Stormwater Permit Application

Littleton, Massachusetts

Taylor Street Well and Raw Water Main

October 16, 2023
Revised: December 14, 2023

JOB NO: ENG23-0679

Weston & Sampson
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
www.westonandsampson.com
Tel: 978-532-1900 Fax: 978-977-0100

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PLANNING BOARD
P.O. Box 1305
Littleton, Massachusetts 01460

STORMWATER PERMIT APPLICATION

1. Property Information

Street Address 153 Taylor Street

Assessor's Map R10 Parcel 14

Deed Reference (Registry Book and Page or Land Court Certificate of Title No.):

BK 79319 PG 596

2. Project Title or Brief Description: Taylor Street Well and Raw Water Main

3. Property Owners: List all property owners and their mailing addresses; for any owner that is an entity (e.g. LLC or corporation), provide the name and title of the individual authorized to sign for the entity.

Littleton Water Department, 39 Ayer Road, Littleton, MA 01460

4. Applicant Information (Individual or Entity to Whom Permit Will Be Issued)

Name: Corey Godfrey

Company (if applicable): Littleton Electric Light & Water Department

Mailing Address: 39 Ayer Road, Littleton, MA 01460

Tel: 978-540-2222 Fax: _____ E-Mail: cgodfrey@lelwd.com

5. Applicant's Authorized Representative to Planning Board (if any):

Name: James Pearson, P.E.

Company (if applicable): Weston & Sampson

Mailing Address: 55 Walkers Brook Drive, Suite 100, Reading, MA 01867

Tel: 978-532-1900 Fax: _____ E-Mail: Pearsonj@wseinc.com

PLANNING BOARD
P.O. Box 1305
Littleton, Massachusetts 01460

6. Other Planning Board Permits or Approvals Required for This Project:

_____

_____

7. Applicant's Certification:

I hereby certify that the information contained in this application (including all required documents submitted herewith) is correct to the best of my knowledge. If I have identified an Authorized Representative above, I authorize that person to serve as my representative to the Planning Board.

Signature of Applicant: _____ Date: 10-27-23

Printed Name: Corey Godfrey

8. Property Owner's Authorization:

I am the owner of the parcel identified as Littleton Assessor's Map R10, Parcel 14, or the authorized signatory for the entity that is the owner of that parcel. I hereby attest that I have knowledge of, and give my consent to, this application. I authorize the Littleton Planning Board and its authorized agents to enter the aforementioned parcel to verify the information contained in this application and associated documents and, if a permit is granted, to inspect for compliance with permit conditions.

Signature of Owner: _____ Date: 10-27-23

Printed Name: Corey Godfrey

Signature of Owner: _____ Date: _____

Printed Name: _____

9. Checklist of Materials to Be Submitted with Application:

X Erosion and Sediment Control Plan

X Certified List of Abutters

X Stormwater Management Plan

X Permit Application Fee

X Operation and Maintenance Plan

****Communications from the Planning Department will be sent to the e-mail addresses provided for the Applicant and the Applicant's Authorized Representative.****

MToohill@littletonma.org

TOWN OF LITTLETON
BOARD OF ASSESSORS
P.O. BOX 1305
LITTLETON, MA 01460
(978) 540-2410
FAX: (978) 952-2321

DATE: October 27, 2023

RE: Certified List of Abutters

APPLICANT: Littleton Electric Light & Water Departments
NAME OF FIRM: Weston & Sampson
MAILING ADDRESS: 39 Ayer Road P.O Box 2406, Littleton MA

SUBJECT PARCEL OWNER: Littleton Water Department
SUBJECT PARCEL LOCATION 153 Taylor St.
SUBJECT PARCEL MAP &PARCEL NO: R10-14-0

This list of abutters is per your request of October 27, 2023 for 300 feet around 153 Taylor St. for the Planning Board, Chapter 38, Storm Water Management and Erosion Control Regulations.

I hereby certify the attached list of abutter (s)

Number of Abutters 14 + 1 for the Applicant requesting the list.

Certified by:

Hanna Axon, Office Assistant

215 TAYLOR ST — R10 10 0

LUC: 104

CHB LITTLETON LLC
20 GARDEN ST
DANVERS, MA 01923

205 TAYLOR ST — R10 11 0

LUC: 316

CMH LITTLETON LLC
20 GARDEN ST
DANVERS, MA 01923

153 TAYLOR ST — R10 14 0

LUC: 930

LITTLETON WATER DEPARTMENT
39 AYER RD
LITTLETON, MA 01460

151 TAYLOR ST — R10 14 1

LUC: 401

LML LITTLETON LLC
401 EDGEWATER PLACE, SUITE 265
WAKEFIELD, MA 01880

1 MONARCH DR — R10 16 0

LUC: 402

CDK REALTY VENTURE ONE LLC
410 BOSTON POST RD STE 28
SUDBURY, MA 01776-3034

2 MONARCH DR — R10 16 A

LUC: 440

VMD INDUSTRIAL V LLC
733 TURNPIKE ST, ROUTE 114
NORTH ANDOVER, MA 01845

MONARCH DR — R10 16 B

LUC: 440

VMD INDUSTRIAL V LLC
733 TURNPIKE ST, ROUTE 114
NORTH ANDOVER, MA 01845

305 FOSTER ST — R10 2 1

LUC: 404

2641-2651 SANTA ANNA AVE LLC
80 ERDMAN WAY SUITE 301
LEOMINSTER, MA 01453

MONARCH DR — R10 4 0

LUC: 601

HARVARD SPORTSMENS CLUB INC
P.O.BOX 114
HARVARD, MA 01451

TAYLOR ST — R10 6 0

LUC: 440

GUTIERREZ ARTURO+CATALDO CLASS
B TRS, SWEENEY D CLASS A TR
C/O THE GUTIERREZ COMPANY
200 WHEELER ROAD
BURLINGTON, MA 01803

219 TAYLOR ST — R10 8 0

LUC: 101

FOSS WILLIAM R, FOSS JANICE M
CHARLTON ELIZABETH A
219 TAYLOR ST
LITTLETON, MA 01460

OFF WHITCOMB AV — R13 13 0

LUC: 601

HARVARD SPORTSMENS CLUB INC
P.O. BOX 114
HARVARD, MA 01451

OFF WHITCOMB AV — R13 3 15

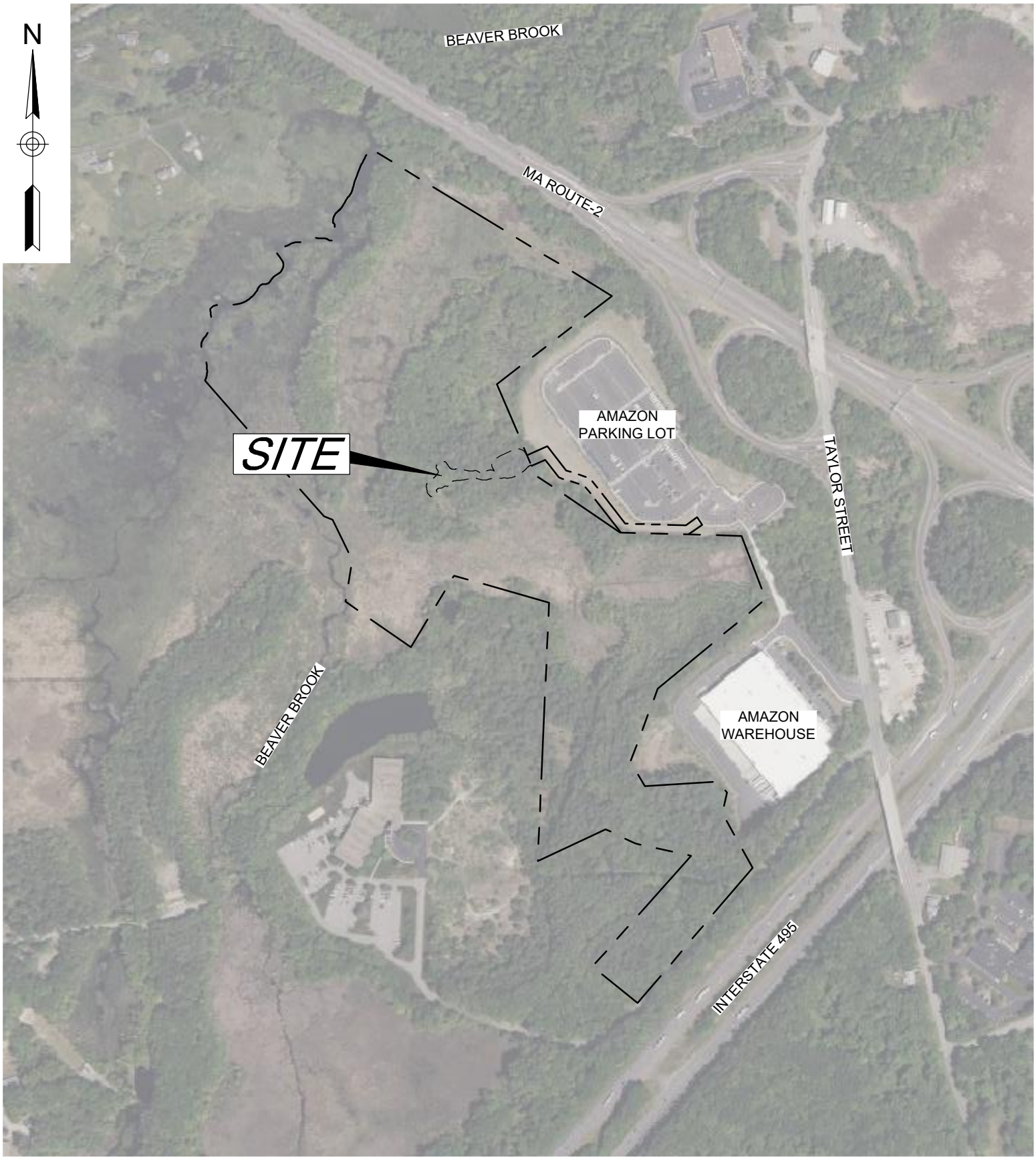
LUC: 930

LITTLETON TOWN OF
P O BOX 1305
LITTLETON, MA 01460

OFF WHITCOMB AV — R13 5 A

LUC: 950

LITTLETON CONSERVATION TRUST
P O BOX 594
LITTLETON, MA 01460



500 250 0 500

SCALE 1"= 500

LOCUS MAP

Weston & Sampson℠

Weston & Sampson Engineers, Inc.

55 Walkers Brook Drive, Suite 100, Reading MA 01867

Erosion and Sediment Control Plan

Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan

SECTION 1: Introduction

The Littleton Electric Light & Water Department proposes to develop a new drinking water well at a Town owned parcel located off Taylor Street to augment the Town's active water supply sources. Access to the site will be provided through an easement located on abutting property owned by Amazon. Work involved with this project will include the construction of a 1,200-foot± access road, with approximately 800-feet constructed of gravel and 400-feet of asphalt, a well building, a raw water main, and stormwater management infrastructure. Other work will include grading, landscaping, and utilities in support of the well building.

As part of this project, this "Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan" has been created to ensure that onsite erosion is prevented and sediment is controlled to prevent it from leaving the site.

SECTION 2: Construction Period Pollution Prevention Measures

Best Management Practices (BMPs) will be utilized as Construction Period Pollution Prevention Measures to reduce potential pollutants and prevent any off-site discharge. The objectives of the BMPs for construction activity are to minimize the disturbed areas, stabilize any disturbed areas, control the site perimeter and retain sediment. Both erosion and sedimentation controls and non-stormwater best management measures will be used to minimize site disturbance and ensure compliance with the performance standards of the WPA and Stormwater Standards. Measures will be taken to minimize the area disturbed by construction activities to reduce the potential for soil erosion and stormwater pollution problems. All pollution prevention and erosion control measures which are required on the site plans and in the SWPPP shall be followed along with the guidance in this document. In addition, good housekeeping measures will be followed for the day-to-day operation of the construction site under the control of the contractor to minimize the impact of construction. This section describes the control practices that will be in place during construction activities. All recommended control practices will comply with the standards set in the MA DEP Stormwater Policy Handbook.

2.1 Minimize Disturbed Area and Protect Natural Features and Soil

In order to minimize disturbed areas all work will be completed within well-defined work limits. These work limits are shown on the construction plans. The Contractor shall not disturb native vegetation in the undisturbed wooded area without prior

approval from the Engineer. The Contractor will be responsible to make sure that all workers know the proper work limits and do not extend their work into the undisturbed areas. The protective measures are described in more detail in the following sections.

2.2 Control Stormwater Flowing onto and through the project

All construction areas adjacent to drainage features will be lined with compost filter tubes and silt fence. The tubes and silt fence will be inspected daily and accumulated silt will be removed as appropriate. In addition, any storage of material will require a second level of protection by surrounding the areas with another row of compost filter tubes. A stabilized construction entrance/exit is proposed so that equipment visiting the site can remove any accumulated dirt and mud from vehicles to prevent tracking the mud onto public roads.

2.3 Stabilize Soils

The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) months, mulching, the use of erosion control mats, or other protective measures shall be provided as specified.

The Contractor shall take account of the conditions of the soil where erosion control seeding will take place to ensure that materials used for re-vegetation are adaptive to the sediment control.

Following the completion of construction, embankment areas will be finished with topsoil and seed. Slopes in excess of 3H:1V will be stabilized with erosion matting to prevent erosion during the interim period in which vegetation is being established. The overland areas of the proposed construction staging areas will also be re-seeded.

2.4 Proper storage and cover of any stockpiles

The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project and shall require written approval of the Engineer.

Adequate measures for erosion and sediment control such as the placement of compost filter tubes around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

2.5 Perimeter Controls and Sediment Barriers

Erosion control lines as described in Section 5 will be utilized to ensure that no

sedimentation occurs outside the perimeter of the work area.

2.6 Storm Drain Inlet Protection

Storm drain inlets will be protected from sediment.

2.7 Retain Sediment On-Site

The Contractor will be responsible to monitor all erosion control measures. Whenever necessary the Contractor will clear all sediment from the compost filter tubes and silt fence that have been silted up during construction. Daily monitoring should be conducted using the attached Monitoring Form.

The following good housekeeping practices will be followed on-site during the construction project.

2.8 Material Handling and Waste Management

All materials stored on-site will be stored in a neat, orderly manner in appropriate containers. All materials will be kept in their original containers with the original manufacturer's label. Substances will not be mixed with one another unless recommended by the manufacturer.

All waste materials will be collected and stored in a securely lidded metal container from a licensed management company. The waste and any construction debris from the site will be hauled off-site daily and disposed of properly. The contractor will be responsible for all waste removal. Manufacturer's recommendations for proper use and disposal will be followed for all materials. Sanitary waste will be collected from the portable units a minimum of once a week, by a licensed sanitary waste management contractor.

2.9 Designated Washout Areas

The Contractor shall perform washout into contained areas designated for that purpose to prevent cement-laden water from leaving the site.

2.10 Proper Equipment/Vehicle Fueling and Maintenance Practices

On-site vehicles will be monitored for leaks and receive regular preventative maintenance to reduce the risk of leakage. To ensure that leaks on stored equipment do not contaminate the site, oil-absorbing mats will be placed under all equipment during storage. Regular fueling and service of the equipment may be performed using approved methods and with care taken to minimize chance of spills. Any petroleum products will be stored in tightly sealed containers that are clearly labeled.

2.11 Equipment/Vehicle Washing

The Contractor will be responsible to ensure that no equipment is washed on-site.

SECTION 3: Spill Prevention and Control Plan

The Contractor will be responsible for preventing spills in accordance with the project specifications and applicable federal, state, and local regulations. The Contractor will identify a properly trained site employee, involved with the day-to-day site operations to be the spill prevention and cleanup coordinator. The name(s) of the responsible spill personnel will be posted on-site. Each employee will be instructed that all spills are to be reported to the spill prevention and cleanup coordinator.

3.1 Spill Control Equipment

Spill control/containment equipment will be kept in the Work Area. Materials and equipment necessary for spill cleanup will be kept either in the Work Area or in an otherwise accessible on-site location. Equipment and materials will include, but not be limited to, absorbent booms/mats, brooms, dust pans, mops, rags, gloves, goggles, sand, plastic and metal containers specifically for this purpose. It is the responsibility of the Contractor to ensure the inventory will be readily accessible and maintained.

3.2 Notification

All workers will be directed to inform the on-site supervisor of a spill event. The supervisor will assess the incident and initiate proper containment and response procedures immediately upon notification. Workers should avoid direct contact with spilled materials during the containment procedures. Primary notification of a spill should be made to the local Fire Department and Police Departments. Secondary Notification will be to the certified cleanup contractor if deemed necessary by Fire and/or Police personnel. The third level of notification is to the DEP. The specific cleanup contractor to be used will be identified by the Contractor prior to commencement of construction activities.

3.3 Spill Containment and Clean-Up Measures

Spills will be contained with granular sorbent material, sand, sorbent pads, booms or all of the above to prevent spreading. Certified cleanup contractors should complete spill cleanup. The material manufacturer's recommended methods for spill cleanup will be clearly posted and on-site personnel will be made aware of the procedures and the location of the information and cleanup supplies.

3.4 Hazardous Materials Spill Report

The Contractor will report and record any spill. The spill report will present a description of the release, including the quantity and type of material, date of the spill, circumstances leading to the release, location of spill, response actions and personnel, documentation of notifications and corrective measures implemented

to prevent reoccurrence.

This document does not relieve the Contractor of the Federal reporting requirements of 40 CFR Part 110, 40 CFR Part 117, 40 CFR Part 302 and the State requirements specified under the Massachusetts Contingency Plan (M.C.P) relating to spills or other releases of oils or hazardous substances. Where a release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part 117 or 40 CFR Part 302, occurs during a twenty-four (24) hour period, the Contractor is required to comply with the response requirements of the above mentioned regulations. Spills of oil or hazardous material in excess of the reportable quantity will be reported to the National Response Center (NRC).

SECTION 4: Contact Information/Responsible Parties

Owner/Operator:
Littleton Water Department
Corey Godfrey
Water & Sewer Superintendent
39 Ayer Road, Littleton, MA 01460
cgodfrey@lelwd.com
978-540-2222

Engineer:
James Pearson, P.E.
Weston & Sampson, Inc.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
978-532-1900

Site Inspector:
TBD

Contractor:
TBD

SECTION 5: Erosion and Sedimentation Control

Erosion and Sedimentation Controls are shown on the project plans. A Stormwater Pollution Prevention Plan (SWPPP) will be required for this project in accordance with EPA regulations. The contractor shall refer to the SWPPP for additional requirements.

SECTION 6: Site Development Plans

A full set of site development plans are included with this submittal.

SECTION 7: Operation and Maintenance of Erosion Control

If there is a failure to the controls the Contractor, under the supervision of the Engineer, will be required to stop work until the failure is repaired.

Periodically throughout the work, whenever the Engineer deems it necessary, the sediment that has been deposited against the controls will be removed to ensure that the controls are working properly.

SECTION 8: Inspection Schedule

During construction the erosion and sedimentation controls will be inspected daily. Once the Contractor is selected, an on-site inspector will be selected to work closely with the Engineer to insure that all erosion and sedimentation controls are in place and working properly. An Inspection Form is included.

Inspection Form

Inspected By: _____ Date: _____ Time: _____

YES	NO	DOES NOT APPLY	ITEM
			Do any erosion/siltation control measures require repair or clean out to maintain adequate function?
			Is there any evidence that sediment is leaving the site and entering the wetlands?
			Are any temporary soil stockpiles or construction materials located in non-approved areas?
			Are on-site construction traffic routes, parking, and storage of equipment and supplies located in areas not specifically designed for them?
			Is there any evidence that sediment is entering stormwater management systems?

Specific location, current weather conditions, and action to be taken:

_____

_____

_____

_____

_____

_____

Other Comments:

_____

_____

_____

Pending the actions noted above I certify that the site is in compliance with the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan.

Signature: _____ Date: _____

Stormwater Management Plan

Stormwater Management Plan Summary

December 14, 2023

Applicant/Project Name: Littleton Electric Light & Water Department
Taylor Street Well and Raw Water Main

Project Address: 151 & 153 Taylor Street, Littleton, MA

Application Prepared by:
Firm: Weston & Sampson, Inc.
Registered PE: James Pearson, P.E.

Below is an explanation regarding MassDEP Standards 1-10 as they apply to the Taylor Street Well and Raw Water Main project:

Project Information

The Littleton Electric Light & Water Department proposes to develop a new drinking water well at a Town owned parcel located off Taylor Street to augment the Town's active water supply sources. Access to the site will be provided through an easement located on abutting property owned by Amazon. Work involved with this project will include the construction of a 1,200-foot± access road, with approximately 800-feet constructed of gravel and 400-feet of asphalt, a well building, a raw water main, and stormwater management infrastructure. Other work will include grading, landscaping, and utilities in support of the well building.

The existing site is predominantly wooded and surrounded by a large wetland complex. Terrain is complex, with flat upland grassed areas, and undulating rolling hills located within wooded areas. Elevations range from 237-feet to 233-feet on the grassed portion of the Amazon site, and from 244-feet to 223-feet on the wooded portion located on Town owned property. Resource areas include bordering vegetated wetland, the 100-foot wetland buffer, and a Zone II wellhead protection area. NRCS soil mapping shows the site being comprised primarily of Quonset sandy loam and sandy Udorthents. Numerous well borings throughout the area generally confirm the subsurface conditions and can be found in Attachment C of this report.

Standard 1: No New Untreated Discharges

The proposed project will create no new untreated discharges. Runoff from pollutant generating impervious areas will be captured in the stormwater management system and treated prior to discharge. All outlets have been designed to prevent scour and erosion to receiving waterbodies.

Standard 2: Peak Rate Attenuation

Existing and proposed conditions were modeled using HydroCAD computer software. A table, summarizing peak discharges for the 2-Yr, 10-Yr, 25-Yr, 50-Yr, and 100-Yr storm events can be found in Attachment D of this report. The proposed design is such that peak discharge rates do not exceed pre-development rates, even in the 100-year storm scenario.

To ensure that the work incorporates the performance standards recommended in the DEP's Stormwater Management Policy, necessary erosion and sedimentation control measures will be utilized during construction, as depicted on the site plans.

Standard 3: Recharge

Standard 3 has been met. The required recharge volume has been provided within the proposed stormwater BMPs. Supporting calculations can be found in Attachment E of this report.

Standard 4: Water Quality

Standard 4 has been met to the maximum extent practicable. Treatment practices have been designed to capture the required water quality volume and remove greater than 80% of TSS overall, based upon 1-IN of runoff volume due to the location of the project within a Zone II. The proposed stormwater management system has also been designed to remove greater than 44% of TSS prior to entering the infiltration basin by providing grassed channels which discharge to a sediment forebay.

At the location of the well building, due to site constraints such as existing topography, proximity to the bordering vegetated wetland, and shallow groundwater elevations, we propose a stormwater management design to the maximum extent practicable. To maintain minimum separation to groundwater, the proposed infiltration trench is only 18-inches deep and all available space at this location was needed to provide the required water quality volume. We investigated several options to provide a vegetated filter strip for pre-treatment in this area, however neither option proved feasible as we are unable to change the geometry of the proposed infiltration trench by raising the road without directly impacting the wetland resource area or by moving the trench further inland without producing a significant cut into the adjacent hillside where topography sharply rises, and concerns of higher groundwater elevations exist. A non-structural BMP will also be implemented at the well building location as access to the site will be restricted, and pollutant generation will be limited. Supporting calculations can be found in Attachment E of this report.

During the project, appropriate BMPs will be used to minimize sedimentation and soil erosion.

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

This site is not considered a LUHPPL, Standard 5 does not apply.

Standard 6: Critical Areas

This project is located within a Zone II of a public water supply.

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

This is not a redevelopment project, Standard 7 does not apply.

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

A detailed Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is included in Attachment G of this report. To ensure that the work incorporates the performance standards recommended in the DEP's Stormwater Management Policy, necessary erosion and sedimentation control measures will be utilized during construction.

Standard 9: Operation and Maintenance Plan

An operations and maintenance plan is included in Attachment H of this report.

Standard 10: Prohibition of Illicit Discharges

An illicit discharge compliance statement has been included in Attachment I of this report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including any relevant soil evaluations, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan, the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement 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

12/14/2023

Signature and Date

Stormwater Checklist

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

Checklist for Stormwater Report

A. Introduction

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

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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

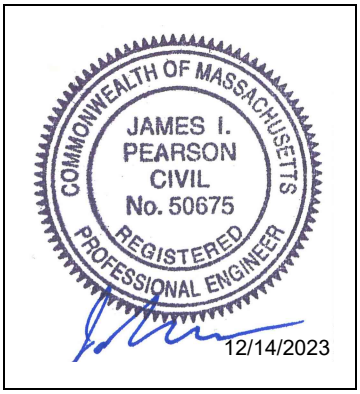
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



12/14/2023
Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

---

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

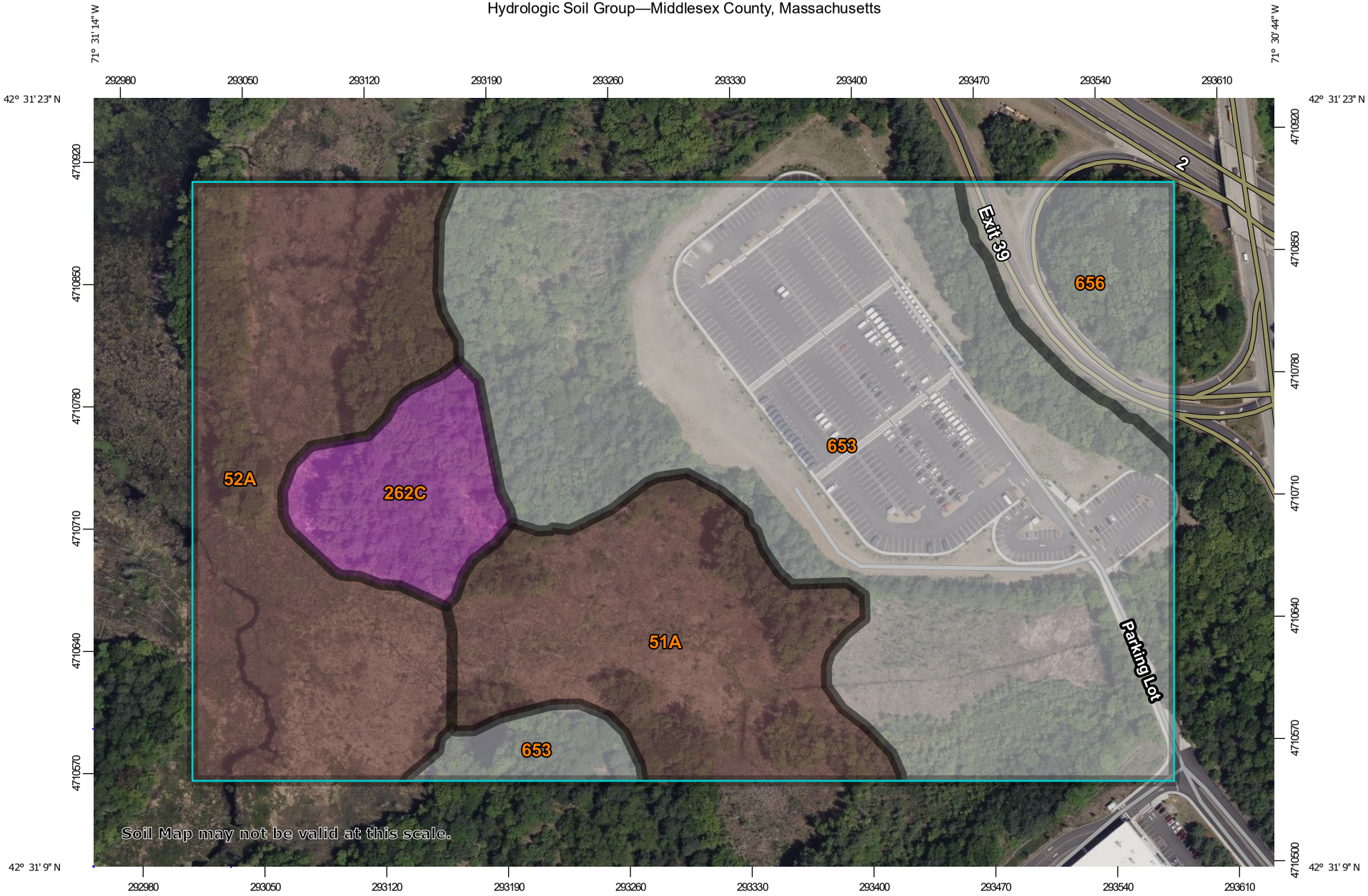
Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

NRCS Soils Map, Soils Report, and HSG Classifications



Map Scale: 1:3,100 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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: Middlesex County, Massachusetts
Survey Area Data: Version 23, Sep 12, 2023

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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
51A	Swansea muck, 0 to 1 percent slopes	B/D	7.3	15.3%
52A	Freetown muck, 0 to 1 percent slopes	B/D	10.4	21.6%
262C	Quonset sandy loam, 8 to 15 percent slopes	A	2.8	5.8%
653	Udorthents, sandy		24.4	50.9%
656	Udorthents-Urban land complex		3.1	6.4%
Totals for Area of Interest			**48.0**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Groundwater Memorandums & Boring Logs

Groundwater Analysis Summary

December 14, 2023

To support the design of two proposed infiltration practices at the location of the Taylor Street Well site, Hydrogeologists from Weston & Sampson performed two analyses to determine probable groundwater elevations at the site.

At the location of the proposed infiltration basin, a Frimpter Analysis was performed. The Frimpter method entails using statistical analysis of long-term groundwater measurements from a network of established groundwater observation wells located within similar geologic and topographic settings to establish probable high groundwater elevations. Generally, the Frimpter method is more conservative and predicts higher groundwater elevations than what is present on site.

For estimating probable high groundwater elevations at the location of the proposed infiltration trench, groundwater monitoring data from observation wells located around the proposed well site was analyzed. Although readings taken from the observation wells occurred during a period of extreme drought, elevations recorded from survey data at the nearby vegetated wetlands correspond closely to the groundwater elevations observed in the wells. While groundwater elevations fluctuate based upon climate conditions and typically present at lower elevations during periods of drought, wetland delineations are primarily determined by analyzing the types of wetland vegetation present. Wetland vegetation growth is typically supported by groundwater and grows within 1-foot of the groundwater table, if the groundwater elevations were significantly higher at this location than what was shown in the well observations, evidence of wetland vegetation would be found at higher elevations than what the current delineation demonstrates. For a preliminary analysis of groundwater elevation at this location, we feel that this analysis provides a reasonably accurate estimate of probable high groundwater elevations.

Stormwater test pits will be conducted at both locations prior to the start of construction to verify soil conditions and estimated seasonal high groundwater elevations.

712 Brook Street, Suite 103, Rocky Hill, CT 06067
Tel: 860.513.1473

M E M O R A N D U M

TO:	File
FROM:	Jill Getchell
DATE:	September 29, 2023
SUBJECT:	Seasonal High Groundwater Estimations

Weston & Sampson has evaluated probable high groundwater elevations at the proposed Taylor Street Well Site in Littleton, Massachusetts. Using the data set from the pumping test conducted in September 2022, the Frimpter Method (USGS OFR 80-1205), a method for estimating the seasonal high groundwater elevation for a single point, was conducted on the 200-ft Observation Well located near the proposed Taylor Street Well. The Frimpter method for estimation of probable high groundwater levels (S_h) at unmonitored sites and is represented by the following relationship:

$$S_h = S_c - \frac{S_r}{OW_r}(OW_c - OW_{max})$$

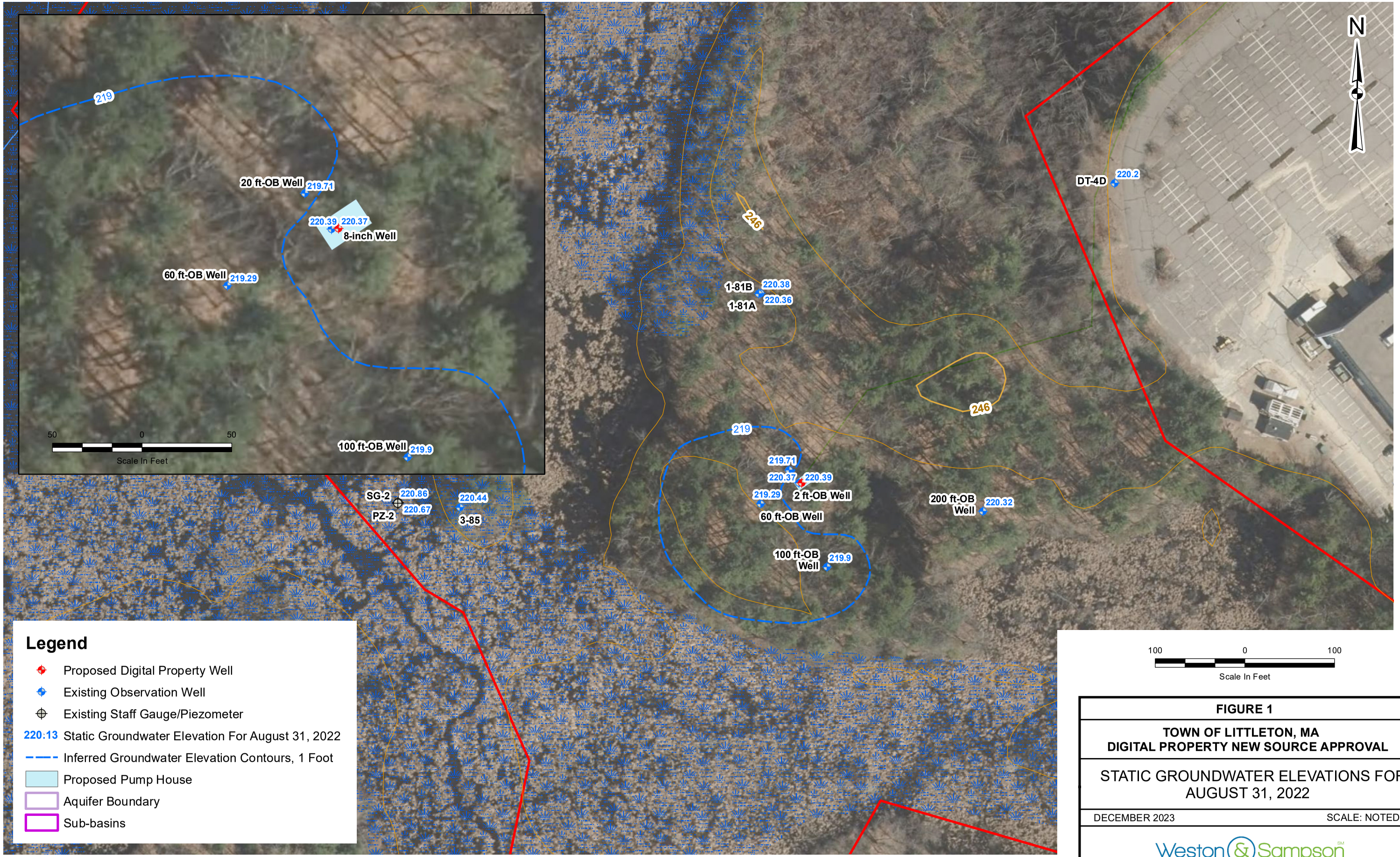
where,

S_c = measured depth to water at site (feet)
S_r = range of water level where the site is located (feet)
OW_r = measured depth to water in well which is used to correlate with the water levels at the site (feet)
OW_c = depth to recorded maximum water level at the observation well which is used to correlate with the water levels at the site (feet)
OW_{max} = recorded upper limit of annual range of water level at the observation well that is used to correlate with the water levels at the site (feet)

The measured depth to water at the site on September 23, 2022 (highest observed static elevation) was used as the basis for the calculation. The site was assumed to be equivalent to a valley flat composed of sand and gravel due to the site's topography. An appropriate range of water levels (S_r) was assumed to be 4.2 feet (Frimpter, 1980). OW_r, OW_c and OW_{max} were each extracted from the nearby USGS monitoring wells (MA-WWW 160 WESTFORD, MA and MA-ACW 158 ACTON, MA). These USGS wells were used for the evaluation based on the distance from the 200-ft observation well and aquifer characteristics. Probable High Groundwater Elevations are summarized in the table below:

	MA-ACW 158 ACTON, MA	MA-WWW 160 WESTFORD, MA
200-ft OB Well DTW (ft btoc)	9.31	
200-ft OB Well Stickup Height (ft)	0.92	
200-ft OB Well TOC Elevation (ft NAVD 88)	230.88	
S_c (ft bg)	8.39	8.39
S_r (ft)	4.2	4.2
OW_c (ft bg)	19.94	12.66
OW_{max} (ft)	13.34	9.56
OW_r (ft bg)	6.35	3.51
S_h (ft bg)	4.03	4.68
S_h Elevation (ft NAVD 88)	225.94	225.28

Therefore, the estimated range of probable high groundwater levels at the site range from 4.03 to 4.68 ft bg (225.28 to 225.94 ft NAVD 88).



Legend

- Proposed Digital Property Well
- Existing Observation Well
- Existing Staff Gauge/Piezometer
- 220.13 Static Groundwater Elevation For August 31, 2022
- Inferred Groundwater Elevation Contours, 1 Foot
- Proposed Pump House
- Aquifer Boundary
- Sub-basins

FIGURE 1

TOWN OF LITTLETON, MA
DIGITAL PROPERTY NEW SOURCE APPROVAL

STATIC GROUNDWATER ELEVATIONS FOR AUGUST 31, 2022

DECEMBER 2023 SCALE: NOTED

Weston & Sampson

Path: P:\MA\Littleton MA\Digital Property New Source Approval\007 GIS\Mapfiles\WS 19111 - Static Contour Map.mxd User: Getchell Saved: 11/2/2022 5:16:09 PM Opened: 12/5/2023 11:53:55 AM

Weston & Sampson SM

55 Walkers Brook Drive, Suite 100, Reading, MA 01867
Tel: 978.532.1900

MEMORANDUM

TO: Aaron Guazzaloca

FROM: Jill Getchell

DATE: December 12, 2023

SUBJECT: Groundwater Elevation Estimations

Weston & Sampson has evaluated groundwater and surface water elevations near the proposed Taylor Street Well Site in Littleton, Massachusetts. Using the water level data set collected prior to the pumping test conducted in September 2022, groundwater elevations were plotted adjacent to the observation wells surrounding the proposed Taylor Street Well pump house (Figure 1). This dataset was compared to 2012 LiDAR data from MassGIS to assess the surface water elevations in the surrounding wetlands.

Based on the 2012 LiDAR data, the surface-water elevations in the surrounding wetlands can vary between 220 to 221 ft msl (no corresponding date) close to the proposed pump house area. Since measurements of surface water and groundwater were not made on the same day, a comparison of the wetlands surface water elevations to the groundwater elevations from the September 2022 pumping test cannot be completed accurately. It should be assumed that there may be some error associated with the wetland elevations derived from the LiDAR data and additional variability depending on the corresponding wetland location. The groundwater elevations near the pump house that were established in August 2022 during a period of extreme drought range between 219.5 and 220.5 ft msl. Based on the distributions of these elevations relative to the local topography, the expected groundwater flow direction under non-pumping conditions should be towards the wetlands which then discharges into Beaver Brook. The corresponding natural hydraulic gradient between the upland areas (the pump house area) and the wetlands should be relatively flat given the 1) observed hydraulic gradient throughout the aquifer and 2) the homogeneity of the aquifer materials in the vicinity.

Observation Well ID	Status	Distance from Pumping Well (ft)	Direction (Upgradient, Downgradient, Cross-gradient)
8-inch Well	Existing	0.33	–
2-ft OB Well	Existing	2	Cross-gradient
20-ft OB Well	Existing	16	Cross-gradient
60-ft OB Well	Existing	54	Upgradient
100-ft OB Well	Existing	122	Upgradient
200-ft OB Well	Existing	205	Cross-gradient
1-81A	Existing	225	Downgradient
OBS C	Existing	265	Downgradient
3-85	Existing	442	Upgradient
12-85	Existing	561	Upgradient
4-85	Existing	793	Downgradient
GZ-1	Existing	809	Downgradient
1-85	Existing	1020	Upgradient
SG-5	Proposed	1048	Cross-gradient
GZ-2	Existing	1250	Downgradient
10-85	Existing	1269	Downgradient
GZ-3	Existing	1275	Upgradient
SG-4	Proposed	1334	Upgradient
11-85	Existing	1455	Upgradient
PZ/SG-3	Proposed	1512	Downgradient
OBS B	Existing	1530	Upgradient
9-85	Existing	1740	Upgradient
GZ-4	Existing	1908	Upgradient
PZ/SG-2	Proposed	2098	Upgradient
2-85	Existing	2269	Upgradient
OBS A	Existing	3350	Upgradient
PZ/SG-1	Proposed	3365	Upgradient

Legend

- Proposed Digital Property Well (Existing 8-inch Well)
- Existing Observation Well
- Existing Observation Well (Owned by Amazon)
- Proposed Piezometer/Staff Gauge Pair
- Proposed Discharge Line
- Digital Property
- USGS Sub-basins

100 0 100
Scale In Feet

600 0 600
Scale In Feet

FIGURE 11

TOWN OF LITTLETON, MA
DIGITAL PROPERTY NEW SOURCE

PROPOSED OBSERVATION NETWORK

MAY 2022 SCALE: NOTED

Weston & Sampson

Path: P:\MA\Littleton MA\Digital Property New Source Approval\007 GIS\Mapfiles\WS 17\11 - PROPOSED OBSERVATION NETWORK.mxd User: GetchellJ Saved: 5/26/2022 10:00:20 AM Opened: 5/26/2022 10:25:23 AM

D.L. MAHER CO.

GROUND WATER DEVELOPMENT

P.O. BOX 127 — 71 CONCORD STREET

NORTH READING • MA. 01864 • 617/933-3210

Test Well No. 8" well — D.L.M. Job No. 85-086-HG

Driller S. Kelly — Helper P. Finn

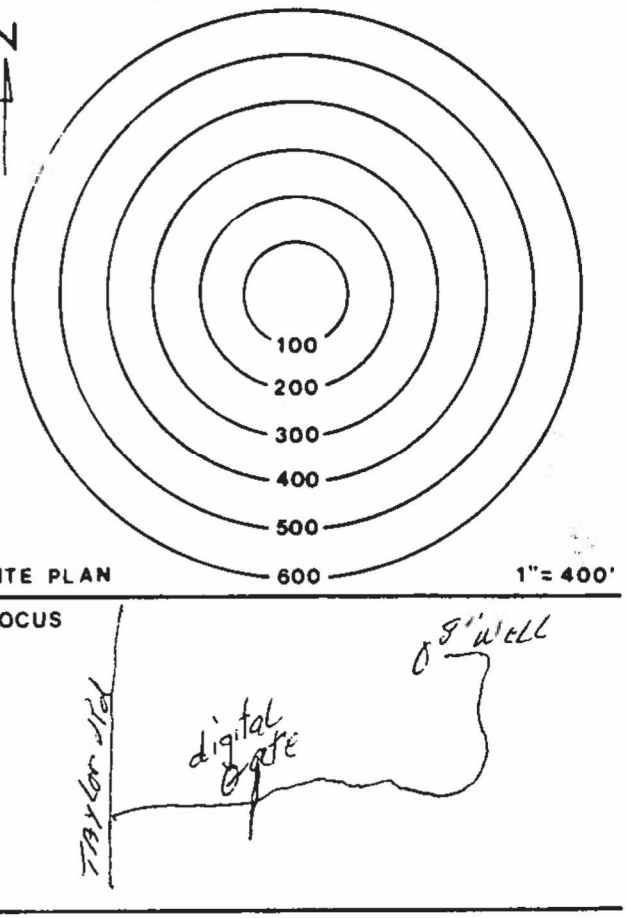
Client Littleton

Location Digital Well Site

Owner's Representative

Date Started: 1/7/86 — Date Finished: 1/13/86

DEPTH From	DEPTH To	Soil Classification	Loss of Wash Water
0	24	Fine to Course Brown Sand + Large Rocks	
24	39	Fine to Course Brown Sand + M. Gravel	
39	49	Fine to Course Brown Sand + Small Gravel	
49	51	Fine to Medium Brown Sand	



TIME AND MATERIALS

Test Well No.	Diam.	Total Depth	Comp. Depth	Casing Left	Screen Length	Screen Exposed	Screen Material	Screen Slot Size	Screen Riser	Hours Dev.	Hours Pumped
	8"	51FT		41FT	10FT	10FT	S.S.	40	8" R. Packer	10	10

REMARKS:

Pump Test on Hole No. — Date

Time	G.P.M.	Water Levels Vac	Obs. No.	Obs. No.	Obs. No.
Static	8"	125	DD 12 - GPF 10.4		
	obs	125	- DD 9.5 - GPF 16.6		

Water Sample

Date _____ Time _____

Sent To:

Field Quality

CO_2 _____ Taste _____

Fe _____ Odor _____

Mn _____ Hardness _____

D. L. MAHER CO.

LOG OF TEST WELL

Log of Well for Littleton Test No. #81-2

Address

Well located at OFF OF Taylor Rd in Littleton County, State of MASS

Date Drilling started JAN 26, 81 Date Test Hole Completed JAN 28, 81

Total depth to bottom of Well 54'-3" Diameter Test Hole 2½"

Water stands when not pumping 5' feet 2" inches from the surface of the grour

EACH STRATUM	DEPTH OF STRATA	FORMATION FOUND EACH STRATUM
0'	21'	med coarse BRN SAND & GRAVEL
21'	28'	" "
28'	35'	" "
35'	42'	" "
42'	50'	" "
50	54'	BRN to Grey Fine SAND & GRAVEL
	54'-3"	REFUSAL
		Set Screen at 50'

Did Well Clear Up? Yes

How Long? 3/4 hr

Time Pumped? 4 hr

Drawdown 2' Ft. 0" In.

Capacity 60 GPM VAC 15"

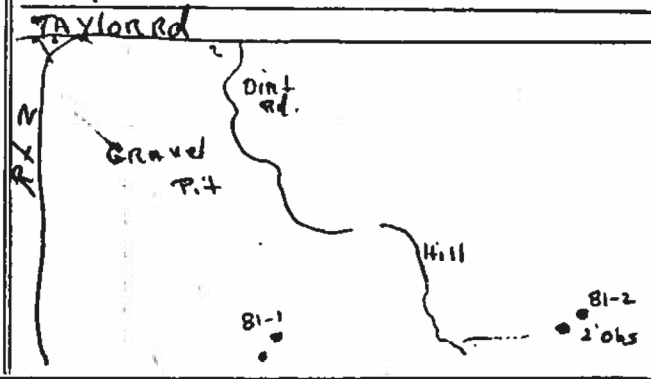
Time Required for Recovery?

Was Well Pulled? No

Observation Yes What Depth? 50'

Was Observation Well Pulled? No

Map of Location



Remarks and opinion of Test Set 50 S/O T SCREEN IN test well
Set 30 S/O T SCREEN IN 2' obs well . Both Pumped 60 GPM.
2' obs well had 16" VAC
Test well had - 19" VAC.

Driller T. Pelczar

Helpers P. Bishop

D.L. MAHER CO.

GROUND WATER DEVELOPMENT

P.O. BOX 127 — 71 CONCORD STREET

NORTH READING • MA. 01864 • 617/933-3210

Test Well No. #1-85 — D.L.M. Job No. 85-086-T

Driller John Graglia — Helper David Maher

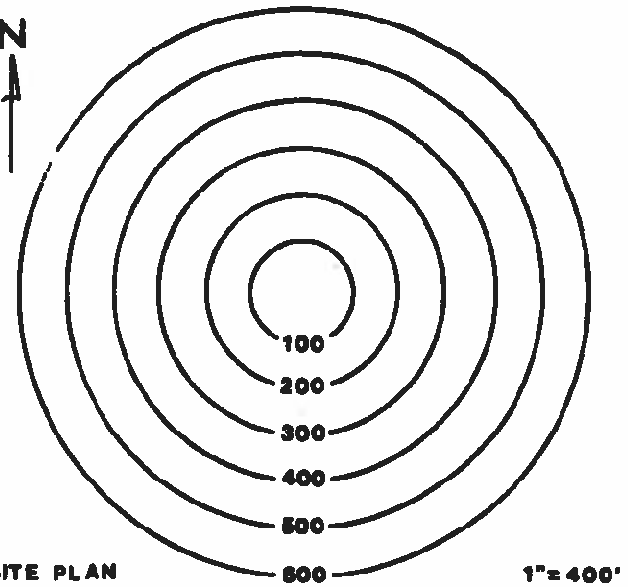
Client Littleton Water Dept

Location off Taylor Rd.

Owner's Representative Savas Arnos

Date Started: 7-22-85 — Date Finished: 7-22-85

DEPTH From	DEPTH To	Soil Classification	Loss of Wash Water
0	21'	Large Broken gravel	
		Fine to Medium Brown	
		Sand	
21'	28'	Fine to med. um Brown	
		Sand And Sharp gravel	
28'	35'	Sharp Gray gravel	
		And Fine to Medium	
		Gray Sand	
35'	56'	Sharp Broken Gray	
		Gravel And Fine to	
		medium Gray Sand	
	60'	Refusal	



LOCUS See MAP ATTACHED For wells #1 To #11

TIME AND MATERIALS

Test Well No.	Diam.	Total Depth	Comp. Depth	Casing Left	Screen Length	Screen Exposed	Screen Material	Screen Slot Size	Riser	Hours Dev.	Hours Pumped
#1-85	22"	60	56'	49'	6'	6'	14" Armco	60	5'	½hr	

REMARKS: well pumps 30gpm vac 17"

Pump Test on Hole No. — Date

Time	G.P.M.	Water Levels Vac	Obs. No.	Obs. No.	Obs. No.
Static					

Water Sample

Date _____ Time _____

Sent To:

Field Quality

CO_2 _____ Taste _____

Fe _____ Odor _____

Mn _____ Hardness _____

Ph _____ Color _____

D.L.MAHER CO.

GROUND WATER DEVELOPMENT

P.O. BOX 127 — 71 CONCORD STREET

NORTH READING • MA. 01864 • 617/933-3210

Test Well No. #2-85 D.L.M. Job No. 85-096-T

Driller John Braglia Helper David Maher

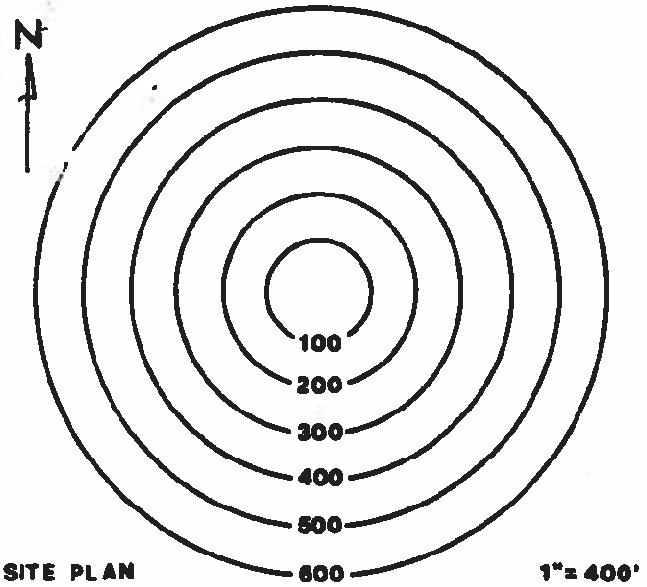
Client Littleton Water Dept

Location off Taylor Rd.

Owner's Representative Savas Danis

Date Started: 7-23-85 Date Finished: 7-23-85

DEPTH From	To	Soil Classification	Loss of Wash Water
0	6'	well going crooked	
0	21'	fine to medium brown sand and sharp gravel	
21'	28'	sharp broken gray gravel fine gray sand	
28'	35'	fine to medium gray sand and sharp broken gravel	YES
35'	40'	sharp broken gray gravel with gray clay	
	40'	Refusal	



SITE PLAN 1"= 400'

LOCUS

TIME AND MATERIALS

Test Well No.	Diam.	Total Depth	Comp. Depth	Casing Left	Screen Length	Screen Exposed	Screen Material	Screen Slot Size	Screen Riser	Hours Dev.	Hours Pumped
#2-85	2½"	40'	35'	28'	6'	6'	1¼" Aprice	60	5'	½hr	
2A-85		6'		0							

REMARKS: well pumps 40 GPM vac 14" "Trial Pipe Driven 40')"

Pump Test on Hole No. Date

Time	G.P.M.	Water Levels Vac	Obs. No.	Obs. No.	Obs. No.
Static					

Water Sample

Date _____ Time _____

Sent To:

Field Quality

CO_2 _____ Taste _____

Fe _____ Odor _____

Mn _____ Hardness _____

Ph _____ Color _____

D.L.MAHER CO.

GROUND WATER DEVELOPMENT

P.O. BOX 127 — 71 CONCORD STREET

NORTH READING • MA. 01864 • 617/933-3210

Test Well No. #3-85 D.L.M. Job No. 85-056-T

Driller JOHN GRAGLIA Helper DAVID MAHER

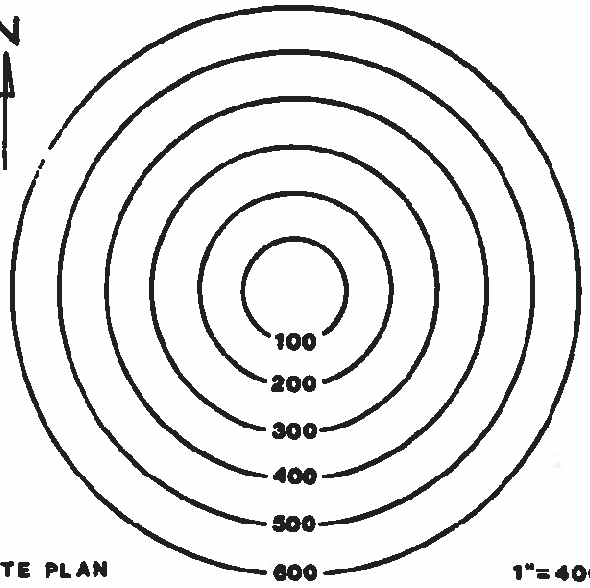
Client LITTLETON WATER DEPT.

Location OFF TAYLER RD.

Owner's Representative SAVAS DANOS

Date Started: 7-24-85 Date Finished: 7-25-85

DEPTH From	DEPTH To	Soil Classification	Loss of Wash Water
0	4'	HIT ROCK	
0	5'	GOING CROOKED	
0	21'	GRAYISH BROWN SAND	
		AND SHARP GRAVEL	
21'	28'	SHARP GRAY GRAVEL	
		AND FINE TO MEDIUM GRAY	
		SAND	
28'	49'	SHARP BROKEN GRAY	
		GRAVEL FINE TO MEDIUM	
		GRAY SAND	
	53'	REFUSAL	



SITE PLAN 1"=400'

LOCUS

TIME AND MATERIALS

Test Well No.	Diam.	Total Depth	Comp. Depth	Casing Left	Screen Length	Screen Exposed	Screen Material	Screen Slot Size	Riser	Hours Dev.	Hours Pumped
#3-85	2½"	53'	49'	42'	6'	6'	1½" Areo	80	5'	½ hr	1 hr Tester
3A	1"	footed	3B	5'	footed						

REMARKS: WELL PUMPS 60 GPM VAC 8" STATIC 8'9½" (TOTAL P. PO DRIVEN 42')

Pump Test on Hole No. Date

Time	G.P.M.	Water Levels Vac	Obs. No.	Obs. No.	Obs. No.
Static					

Water Sample

Date _____ Time _____

Sent To:

Field Quality

CO_2 _____ Taste _____

Fe _____ Odor _____

Mn _____ Hardness _____

Ph _____ Color _____

D.L. MAHER CO.

GROUND WATER DEVELOPMENT

P.O. BOX 127 — 71 CONCORD STREET

NORTH READING • MA. 01864 • 617/933-3210

Test Well No. #4-85 D.L.M. Job No. 85-086-T

Driller JOHN GRAGLIA Helper DAVID MAHER

Client LITTLETON WATER DEPT.

Location OFF TAYLOR RD.

Owner's Representative SAVAS ANGES

Date Started: 7-25-85 Date Finished: 7-26-85

DEPTH From	DEPTH To	Soil Classification
0	14'	PIPE being CRACKED
0	21'	SHARP BROWN GRAVEL
		FINE BROWN SAND.
	23'	REFUSAL.

Loss of Wash Water

1" ↕

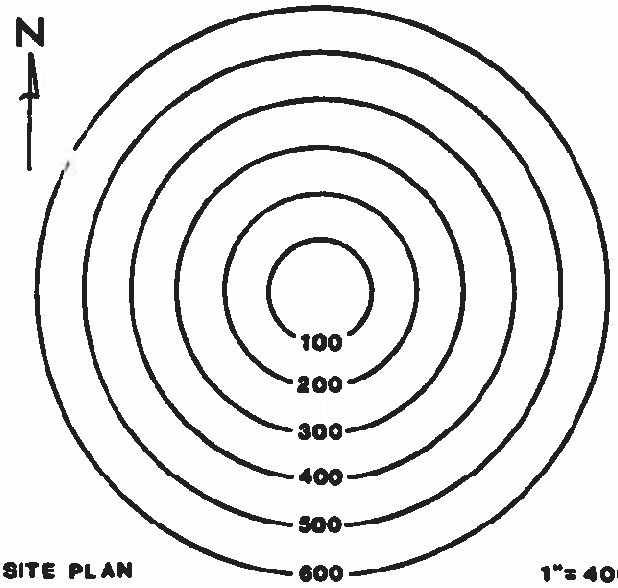
2½" → Static

DEPTH

DEPTH

COMPLETED 21'

TOTAL 23'



SITE PLAN 1"= 400'

LOCUS

TIME AND MATERIALS

Test Well No.	Diam.	Total Depth	Comp. Depth	Casing Left	Screen Length	Screen Exposed	Screen Material	Screen Slot Size	Riser	Hours Dev.	Hours Pumped
#4-85	2½"	23'	21'	21'	6'	2½'	1½" Aprox	60	5'	1½ MIN	½ hr
4A	14'	pulled									

REMARKS: well pumps 10GPM VAC 25" (TOTAL PIPE DRIVEN 27')

Pump Test on Hole No. Date

Time	G.P.M.	Water Levels Vac	Obs. No.	Obs. No.	Obs. No.
Static					

Water Sample

Date _____ Time _____

Sent To:

Field Quality

CO_2 _____ Taste _____

Fe _____ Odor _____

Mn _____ Hardness _____

Ph _____ Color _____

D.L.MAHER CO.

GROUND WATER DEVELOPMENT

P.O. BOX 127 — 71 CONCORD STREET

NORTH READING • MA. 01864 • 617/933-3210

Test Well No. #5-85 2a'cb D.L.M. Job No. 85-056-T

Driller John BRAGLIA Helper David MAHER

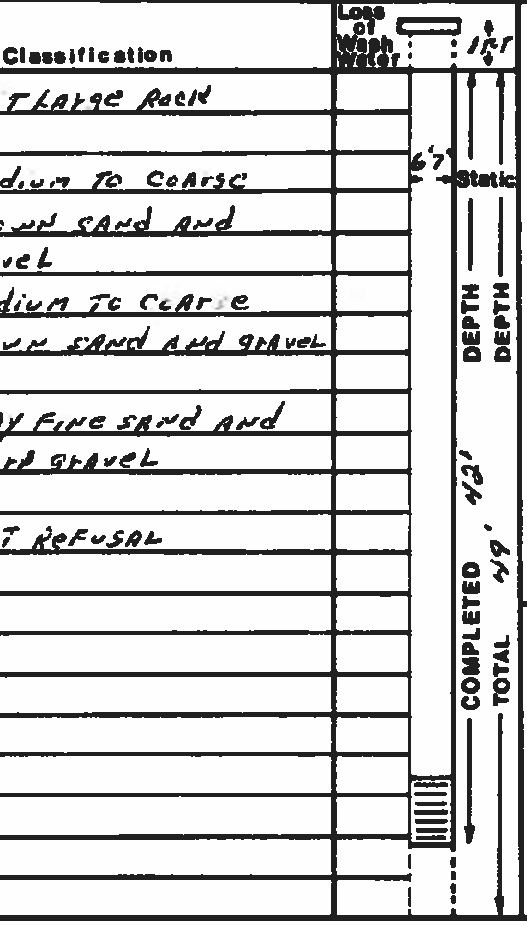
Client LITTLETON WATER DEPT

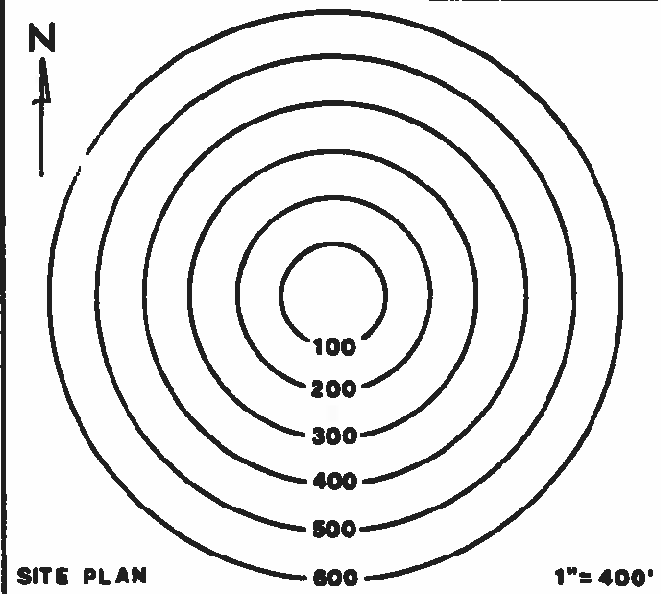
Location OFF OF TAYLOR RD.

Owner's Representative SAVAS BANOS

Date Started: 7-29-85 Date Finished: 7-29-85

DEPTH From	DEPTH To	Soil Classification	Loss of Wash Water
0	2'	FILL Large Rock	
0	21'	medium to coarse	
		Brown SAND and	
		gravel	
21'	46'	medium to coarse	
		Brown SAND and gravel	
46'	49'	gray fine sand and	
		shard gravel	
	49'	NOT REFUSAL	





SITE PLAN 1"= 400'

LOCUS

TIME AND MATERIALS

Test Well No.	Diam.	Total Depth	Comp. Depth	Casing Left	Screen Length	Screen Exposed	Screen Material	Screen Slot Size	Riser	Hours Dev.	Hours Pumped
#5-85	2½"	49'	42'	35'	6'	6'	1½" Aroco	40	5'	½ hr	

REMARKS: WELL PUMPS 35 GPM VAC 15" (TOTAL PIPE DRIVEN 56')

Pump Test on Hole No. Date

Time	G.P.M.	Water Levels Vac	Obs. No.	Obs. No.	Obs. No.
Static					

Water Sample

Date _____ Time _____

Sent To:

Field Quality

CO_2 _____ Taste _____

Fe _____ Odor _____

Mn _____ Hardness _____

Ph _____ Color _____

D.L.MAHER CO.

GROUND WATER DEVELOPMENT

P.O. BOX 127 — 71 CONCORD STREET

NORTH READING • MA. 01864 • 617/933-3210

Test Well No. #6-85 100'm D.L.M. Job No. 85-086-T

Driller JOHN GRAGLIA Helper DAVID MAHER

Client LITTLETON WATER DEPT.

Location OFF TAYLOR RD.

Owner's Representative SAVAS DANOS

Date Started: 7-30-85 Date Finished: 7-30-85

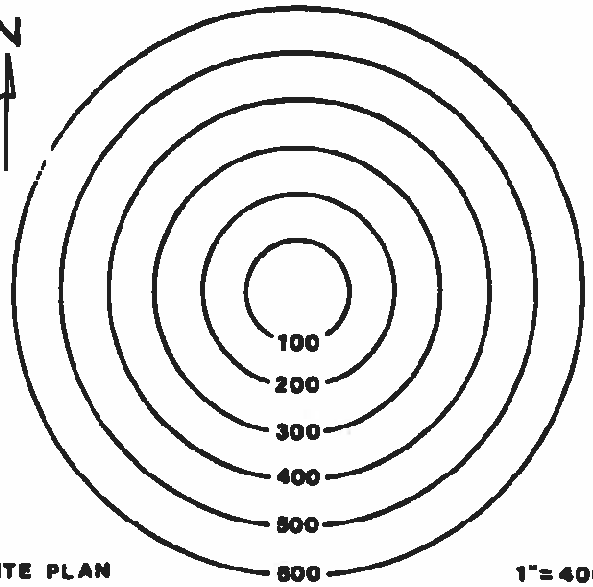
DEPTH From	DEPTH To	Soil Classification
0	29'	Fine to medium
		Brown SAND and gravel
29'	49'	medium to coarse
		Brown SAND and gravel
	51'	Refusal

Loss of Wash Water

1 1/2" Static 6'7"

DEPTH COMPLETED 49'

DEPTH TOTAL 51'



SITE PLAN 1"=400'

LOCUS

TIME AND MATERIALS

Test Well No.	Diam.	Total Depth	Comp. Depth	Casing Left	Screen Length	Screen Exposed	Screen Material	Screen Slot Size	Screen Riser	Hours Dev.	Hours Pumped
#6-85	2½"	51'	49'	42'	6'	6'	1½" Armco	#40	5'	½ hr	

REMARKS: well pumps 60gpm vac 11"

Pump Test on Hole No. Date

Time	G.P.M.	Water Levels Vac	Obs. No.	Obs. No.	Obs. No.
Static					

Water Sample

Date _____ Time _____

Sent To:

Field Quality

CO_2 _____ Taste _____

Fe _____ Odor _____

Mn _____ Hardness _____

Ph _____ Color _____

D.L. MAHER CO.

GROUND WATER DEVELOPMENT

P.O. BOX 127 — 71 CONCORD STREET

NORTH READING • MA. 01864 • 617/933-3210

Test Well No. #7-85 56'ob D.L.M. Job No. 85-096-T

Driller John Grashia Helper David Maher

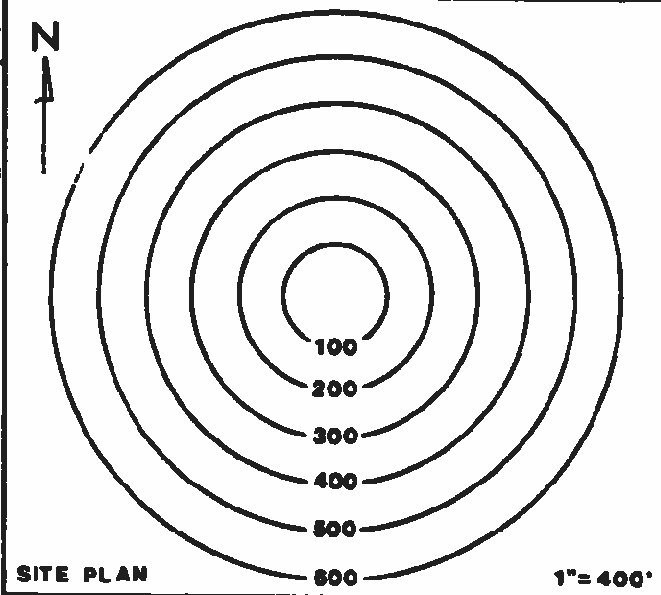
Client Littleton Water Dept

Location OFF TAYLOR RD.

Owner's Representative SAVAS DANOS

Date Started: 7-30-85 Date Finished: 7-31-85

DEPTH From	DEPTH To	Soil Classification	Loss of Wash Water
0	28'	FINE TO MEDIUM BROWN	
		SAND AND GRAVEL	
28'	49'	MEDIUM TO COARSE BROWN	
		SAND AND GRAVEL	
49'	56	FINE BROWN SAND SOME	
		SHARP GRAVEL	
	58'	REFUSAL	



SITE PLAN 1"= 400'

LOCUS

TIME AND MATERIALS

Test Well No.	Diam.	Total Depth	Comp. Depth	Casing Left	Screen Length	Screen Exposed	Screen Material	Screen Slot Size	Screen Riser	Hours Dev.	Hours Pumped
#7-85	2½"	58'	49'	42'	6'	6'	1½" Areo	40	5'	½hr	

REMARKS: SET 30 SLOT SCREEN AT 56' WELL TIGHT PULLED SCREEN RESET 40 SLOT AT 49' WELL PUMPS 50GPM VAC 15"

Pump Test on Hole No. Date

Time	G.P.M.	Water Levels Vac	Obs. No.	Obs. No.	Obs. No.
Static					

Water Sample

Date _____ Time _____

Sent To:

Field Quality

CO_2 _____ Taste _____

Fe _____ Odor _____

Mn _____ Hardness _____

Ph _____ Color _____

D.L. MAHER CO.

GROUND WATER DEVELOPMENT

P.O. BOX 127 — 71 CONCORD STREET

NORTH READING • MA. 01864 • 617/933-3210

Test Well No. #9-85 200' @ D.L.M. Job No. 85-086-T

Driller John Graglia Helper David Maher

Client Littleton Water Dept

Location off Taylor Rd.

Owner's Representative Savas Danos

Date Started: 7-31-85 Date Finished: 8-1-85

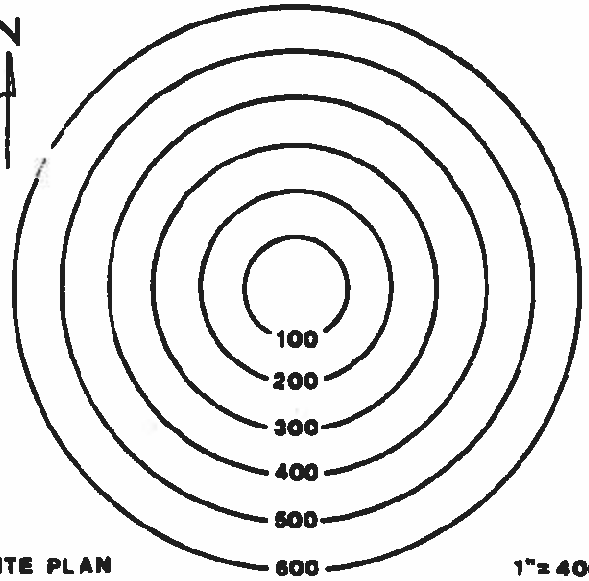
DEPTH From	DEPTH To	Soil Classification
0	28'	Fine to medium Brown
		sand and gravel
28'	35'	medium to coarse Brown
		sand and gravel
35'	42'	Fine Brown sand
		changing to gray fine
		sand.
42'	49'	Fine gray sand some
		sharp gravel.
49'	56'	Fine gray sand some
		sharp gravel
	55'	Refusal

Loss of Wash Water

11'-1" Static

DEPTH COMPLETED 56'

DEPTH TOTAL 58'



SITE PLAN 1"= 400'

LOCUS

TIME AND MATERIALS

Test Well No.	Diam.	Total Depth	Comp. Depth	Casing Left	Screen Length	Screen Exposed	Screen Material	Screen Slot Size	Screen Riser	Hours Dev.	Hours Pumped
#9-85	2½"	55'	56'	49'	6'	6'	1½" Armco	20	5'	2hr	

REMARKS: well pumps 59gpm vac 24"

Pump Test on Hole No. Date

Time	G.P.M.	Water Levels Vac	Obs. No.	Obs. No.	Obs. No.
Static					

Water Sample

Date _____ Time _____

Sent To:

Field Quality

CO_2 _____ Taste _____

Fe _____ Odor _____

Mn _____ Hardness _____

Ph _____ Color _____

D.L.MAHER CO.

GROUND WATER DEVELOPMENT

P.O. BOX 127 — 71 CONCORD STREET

NORTH READING • MA. 01864 • 617/933-3210

Test Well No. PW-85 — D.L.M. Job No. 85-086-T

Driller JOHN GRASLIA — Helper DAVID MAHER

Client LITTLETON WATER DEPT

Location OFF TAYLOR RD.

Owner's Representative SAVAS DANOS

Date Started: 8-1-85 — Date Finished: 8-1-85

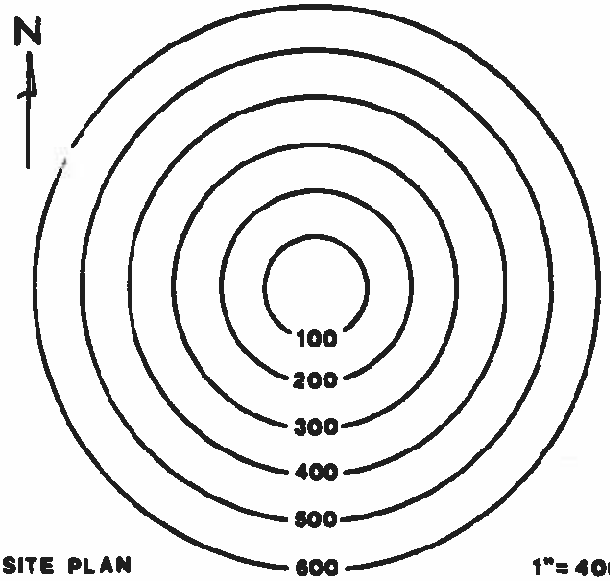
DEPTH From	DEPTH To	Soil Classification	Loss of Wash Water
0	21'	Fine to medium Brown sand and sharp gravel	
21'	28'	Fine Brown sand some sharp gravel	
28'	35'	Fine Brown sand changing to sharp gray gravel some clay	
35'	40'	sharp gray gravel and clay	
	40'	Refusal	

3 GPM

Static

DEPTH COMPLETED 21'

DEPTH TOTAL 40'



SITE PLAN — 1"= 400'

LOCUS

TIME AND MATERIALS

Test Well No.	Diam.	Total Depth	Comp. Depth	Casing Left	Screen Length	Screen Exposed	Screen Material	Screen Slot Size	Screen Riser	Hours Dev.	Hours Pumped
PW-85	2½"	40'	21'	21'	6'	3'	1¼" Armco	40	5	½hr	

REMARKS: well pumps 30 GPM VAC 26"

Pump Test on Hole No. — Date

Time	G.P.M.	Water Levels Vac	Obs. No.	Obs. No.	Obs. No.
Static					

Water Sample

Date _____ Time _____

Sent To:

Field Quality

CO_2 _____ Taste _____

Fe _____ Odor _____

Mn _____ Hardness _____

Ph _____ Color _____

D.L.MAHER CO.

GROUND WATER DEVELOPMENT

P.O. BOX 127 — 71 CONCORD STREET

NORTH READING • MA. 01864 • 617/933-3210

Test Well No. #0-85 D.L.M. Job No. 85-056-T

Driller John Graglia Helper David Maher

Client Littleton Water Dept

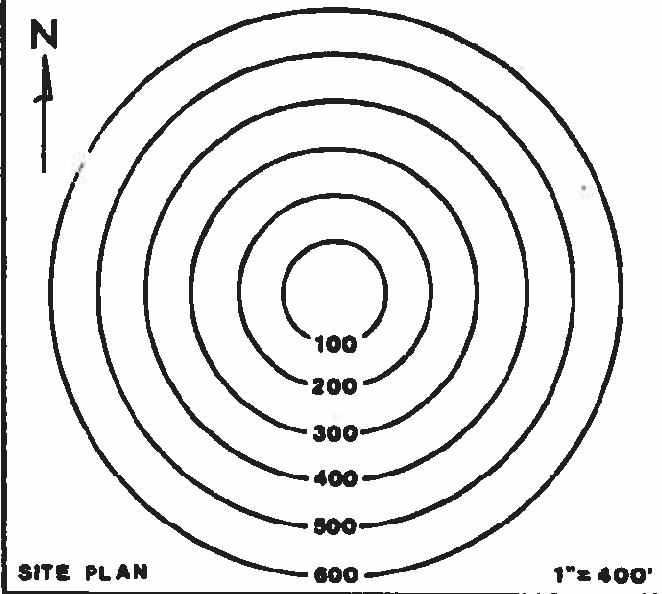
Location Off Taylor Rd.

Owner's Representative Savas Danos

Date Started: 8-1-85 Date Finished: 8-2-85

DEPTH From	DEPTH To	Soil Classification
0	21'	Fine to medium Brown
		Sand and Gravel
21'	28'	Fine Brown Sand
28'	34'	Fine Brown Sand
		Changing to Sharp Gray
		Gravel and Clay
	34'	Refusal

Loss of Wash Water



SITE PLAN 1"= 400'

LOCUS

TIME AND MATERIALS

Test Well No.	Diam.	Total Depth	Comp. Depth	Casing Left	Screen Length	Screen Exposed	Screen Material	Screen Slot Size	Screen Riser	Hours Dev.	Hours Pumped
#0-85	2½"	34'	21'	21'	6'	3'	1½" Atmec	40	5'		

REMARKS: set 40 slot screen at 28' exposed 6' well tight, pulled and reset at 21' exposed 3ft well pumps 35 gpm vac 18"

Pump Test on Hole No. Date

Time	G.P.M.	Water Levels Vac	Obs. No.	Obs. No.	Obs. No.
Static					

Water Sample

Date _____ Time _____

Sent To:

Field Quality

CO_2 _____ Taste _____

Fe _____ Odor _____

Mn _____ Hardness _____

Ph _____ Color _____

D.L.MAHER CO.

GROUND WATER DEVELOPMENT

P.O. BOX 127 71 CONCORD STREET

NORTH READING • MA. 01864 • 617/933-3210

Test Well No. #1-85 D.L.M. Job No. 85-086-T

Driller JOHN GRAGLIA Helper DAVID MAHER

Client LITTLETON WATER DEPT

Location OFF TAYLOR RD.

Owner's Representative SAVAS DANOS

Date Started: 8-2-85 Date Finished: 8-2-85

DEPTH From	DEPTH To	Soil Classification
0	21'	SHARP BROWN GRAVEL
		FINE BROWN SAND.
	23'	REFUSAL

Loss of Wash Water

3FT

8'2" Static

DEPTH

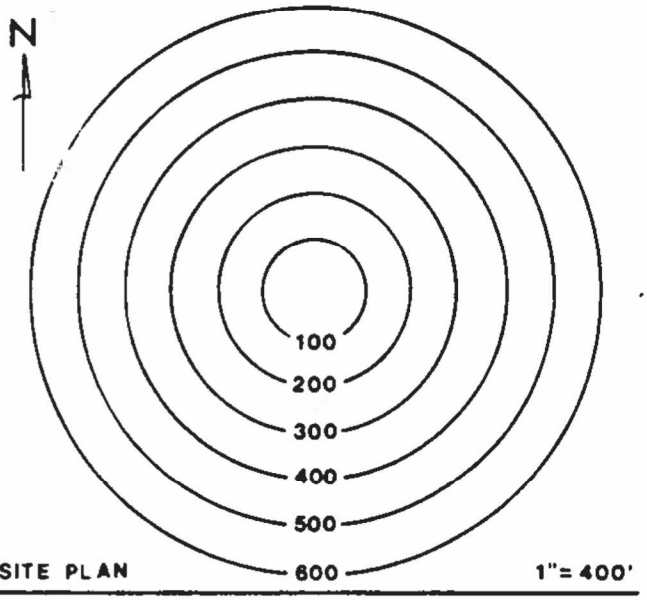
DEPTH

21'

23'

COMPLETED

TOTAL



SITE PLAN 1"= 400'

LOCUS

TIME AND MATERIALS

Test Well No.	Diam.	Total Depth	Comp. Depth	Casing Left	Screen Length	Screen Exposed	Screen Material	Screen Slot Size	Screen Riser	Hours Dev.	Hours Pumped
#1-85	2½"	23'	21'	21'	6'	3'	1½" Armco	10	5'		

REMARKS: did not pump well. well does TAKE water

Pump Test on Hole No. Date

Time	G.P.M.	Water Levels Vac	Obs. No.	Obs. No.	Obs. No.
Static					

Water Sample

Date _____ Time _____

Sent To:

Field Quality

CO_2 _____ Taste _____

Fe _____ Odor _____

Mn _____ Hardness _____

Ph _____ Color _____

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Well Design and Installation
151 & 153 Taylor Street
Littleton, Massachusetts

BORING NO.: GZ-1
SHEET: 1 of 1
PROJECT NO: 01.0175200.00
REVIEWED BY: JRP

Drilling Co.: Drilex Environmental, Inc.
Foreman: Jamie
Logged By: Matthew McGavick

Type of Rig: Track Mounted
Rig Model: CME-55
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.):
Final Boring Depth (ft.): 24
Date Start - Finish: 6/2/2021 - 6/2/2021

H. Datum:
V. Datum:

Auger/Casing Type: HSA
I.D./O.D.: 4.5"/8.5"
Hmr Weight (lb.):
Hmr Fall (in.):
Other:

Sampler Type: Split Spoon
I.D./O.D (in.): 1.375"/2"
Sampler Hmr Wt: 140
Sampler Hmr Fall: 30
Other:

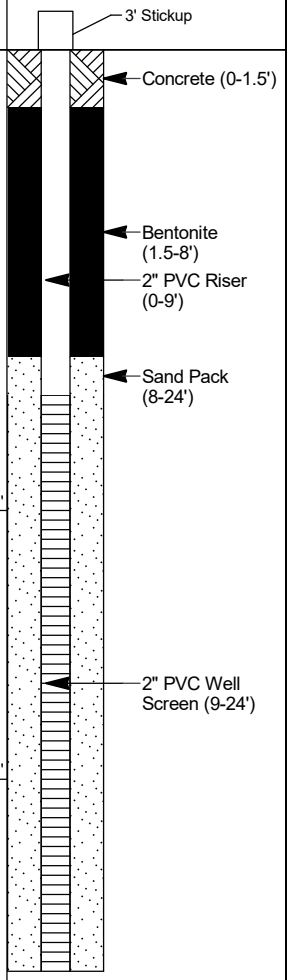
Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
6/4/21	1235	16.98		

Depth (ft)	Casing Blows/ Core Rate Min/ft	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data
0		S-1	0-2					S-1: Tan, fine to medium SAND, some Gravel, little Silt (Fill).	1	
5		S-2	5-7	24	7	7 3 2 7	5	S-2: Very loose brown, fine to medium SANd, some Gravel, little Silt.		
10		S-3	10-12	24	7	2 3 2 3	5	S-3: Very loose, GRAVEL and fine to medium SAND, little Silt.		
		S-4	12-14	24	15	3 5 6 5	11	S-4: (Top 10") Loose, tan-orange, fine to coarse SAND, little Silt, little Gravel. S-4: (Bottom 5") Loose, tan, fine to coarse SAND, little Gravel, trace Silt, wet/moist.		
15		S-5	17-19	24	15	7 6 7 7	13	S-5: Brown, fine to very coarse SAND, little Gravel, little Silt, wet.		
20									2	
25								Bottom of boring at 24 feet.		
30										

Depth (ft)	Stratum Description	Elev. (ft)
0	FINE TO MEDIUM SAND	
12'	FINE TO VERY COARSE SAND	
19'		

Equipment Installed



REMARKS

1. Manually excavated to 30 to 36 inches below ground surface (bgs) to pre-clear location.
2. No samples collected between 19 and 24 feet bgs. Augered to final depth to install well.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-1

175200.00 151_153 TAYLOR STREET_LITTLETON.GPJ; STANDARD BORING W/E W/O SMP 2PG2; 7/13/2021

TEST BORING LOG

GZA GeoEnvironmental, Inc. *Engineers and Scientists*	**Well Design and Installation 151 & 153 Taylor Street Littleton, Massachusetts**	**BORING NO.: GZ-2** **SHEET: 1 of 1** **PROJECT NO: 01.0175200.00** **REVIEWED BY: JRP**

Drilling Co.: Drilex Environmental, Inc.	**Type of Rig:** Track Mounted	**Boring Location:** See Plan	**H. Datum:**
Foreman: Jamie	**Rig Model:** CME-55	**Ground Surface Elev. (ft.):**	
Logged By: Matthew McGavick	**Drilling Method:** HSA	**Final Boring Depth (ft.):** 23	**V. Datum:**
		Date Start - Finish: 6/2/2021 - 6/2/2021	

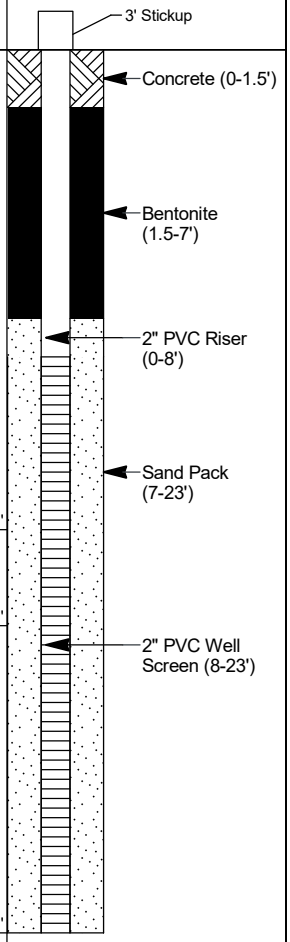
Auger/Casing Type: HSA	**Sampler Type:** Split Spoon	
I.D./O.D.: 4.5"/8.5"	**I.D./O.D (in.):** 1.375"/2"	
Hmr Weight (lb.):	**Sampler Hmr Wt:** 140	
Hmr Fall (in.):	**Sampler Hmr Fall:** 30	
Other:	**Other:**	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
6/4/21	1350	19.02		

Depth (ft)	Casing Blows/ Core Rate Min/ft	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Depth (ft)	Stratum Description	Stratum Elev. (ft)
								S-1: Tan, fine to medium SAND, some Gravel, little Silt (Fill).	1				
5		S-2	5-7	24	8	6 7 7 7	14	S-2: Loose, tan-brown, fine to coarse SAND, little Silt, little Gravel.				FINE TO COARSE SAND	
		S-3	7-9	24	13	7 6 8 10	14	S-3: (Top 8") Loose, tan-brown, fine to coarse SAND, little Silt, little Gravel. S-3: (Bottom 5") Tan, fine to coarse SAND, little Gravel, trace Silt.					
10		S-4	10-12	24	15	4 5 8 9	13	S-4: Loose, tan, fine to coarse SAND, little Gravel, trace Silt.					
		S-5	12-14	24	20	7 5 5 10	10	S-5: (Top 7") Tan, fine to coarse SAND, little Gravel, trace Silt. S-5: (Bottom 13") Loose, tan, fine SAND, little Silt, bottom half wet.			12.5'	FINE SAND	
15											15'		
		S-6	17-19	24	24	4 5 3 3	8	S-6: Loose, tan, fine to medium SAND, little Silt, wet.	2			FINE TO MEDIUM SAND	
20											23'		
								Bottom of boring at 23 feet.					
25													
30													

Equipment Installed



REMARKS

1. Manually excavated to 30 to 36 inches below ground surface (bgs) to pre-clear location.
2. No samples collected between 19 and 23 feet bgs. Augered to final depth to install well.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-2

175200.00 151_153 TAYLOR STREET_LITTLETON.GPJ; STANDARD BORING W/E W/O SMP 2PG2; 7/13/2021

TEST BORING LOG

GZA GeoEnvironmental, Inc. *Engineers and Scientists*	**Well Design and Installation 151 & 153 Taylor Street Littleton, Massachusetts**	**BORING NO.: GZ-3** **SHEET: 1 of 1** **PROJECT NO: 01.0175200.00** **REVIEWED BY: JRP**

Drilling Co.: Drilex Environmental, Inc.	**Type of Rig:** Track Mounted	**Boring Location:** See Plan	**H. Datum:**
Foreman: Jamie	**Rig Model:** CME-55	**Ground Surface Elev. (ft.):**	
Logged By: Matthew McGavick	**Drilling Method:** HSA	**Final Boring Depth (ft.):** 14	**V. Datum:**
		Date Start - Finish: 6/2/2021 - 6/2/2021	

Auger/Casing Type: HSA	**Sampler Type:** Split Spoon	
I.D./O.D.: 4.5"/8.5"	**I.D./O.D (in.):** 1.375"/2"	
Hmr Weight (lb.):	**Sampler Hmr Wt:** 140	
Hmr Fall (in.):	**Sampler Hmr Fall:** 30	
Other:	**Other:**	

Groundwater Depth (ft.)

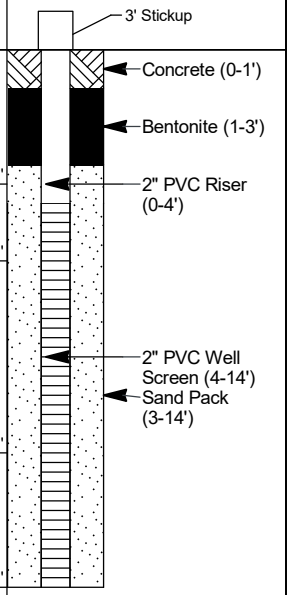
Date	Time	Water Depth	Casing	Stab. Time
6/4/21	1500	9.21		

Depth (ft)	Casing Blows/ Core Rate Min/ft	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data
0		S-1	1-3	24	15	2 3 4 4	7	S-1: (Top 13") Loose, dark brown, fine to medium SAND, some Silt, trace Gravel.	1	
		S-2	3-5	24	14	4 10 7 5	17	S-1: (Bottom 2") Loose, tan-orange, fine to medium SAND, little Silt, little Gravel.		
5		S-3	5-7	24	16	3 4 5 5	9	S-2: (Top 8") Loose, tan-orange, fine to medium SAND, little Silt, little Gravel.		
								S-2: (Bottom 6") Loose, tan, fine to coarse SAND, little Gravel, trace Silt.		
								S-3: (Top 5") Loose, tan, fine to coarse SAND, little Gravel, trace Silt, moist.		
10		S-4	10-12	24	24	4 5 4 2	9	S-3: (Bottom 11") Loose, tan, fine SAND, little Silt, wet.		
								S-4: (Top 4") Loose, tan, SILT, little fine Sand, wet.		
								S-4: (Bottom 20") Loose, tan, fine to medium SAND, trace Silt, wet.	2	
15								Bottom of boring at 14 feet.		
20										
25										
30										

Stratum Description

Depth (ft)	Description	Elev. (ft)
0	FINE TO MEDIUM SAND	
3.5'	FINE TO COARSE SAND	
5.5'	FINE SAND	
10.5'	FINE TO MEDIUM SAND	
14'		

Equipment Installed



REMARKS

1. Manually excavated to 14 inches below ground surface (bgs); found large root.
2. No samples collected between 12 and 14 feet bgs. Augered to final depth to install well.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-3

TEST BORING LOG

GZA GeoEnvironmental, Inc. *Engineers and Scientists*	**Well Design and Installation 151 & 153 Taylor Street Littleton, Massachusetts**	**BORING NO.: GZ-4** **SHEET: 1 of 1** **PROJECT NO: 01.0175200.00** **REVIEWED BY: JRP**

Drilling Co.: Drilex Environmental, Inc.	**Type of Rig:** Track Mounted	**Boring Location:** See Plan	**H. Datum:**
Foreman: Jamie	**Rig Model:** CME-55	**Ground Surface Elev. (ft.):**	
Logged By: Matthew McGavick	**Drilling Method:** HSA	**Final Boring Depth (ft.):** 21	**V. Datum:**
		Date Start - Finish: 6/2/2021 - 6/2/2021	

Auger/Casing Type: HSA	**Sampler Type:** Split Spoon	
I.D./O.D.: 4.5"/8.5"	**I.D./O.D (in.):** 1.375"/2"	
Hmr Weight (lb.):	**Sampler Hmr Wt:** 140	
Hmr Fall (in.):	**Sampler Hmr Fall:** 30	
Other:	**Other:**	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
6/4/21	1120	15.48		

Depth (ft)	Casing Blows/ Core Rate Min/ft	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data
5		S-1	5-7	24	6	7 11 6 7	17	S-1: Loose, brown, fine to medium SAND, some Gravel, little Silt.	1 2	
10		S-2	10-12	24	0	8 16 16 20	32	S-2: No recovery. Bottom half of spoon wet.		
		S-3	12-14	24	15	33 46 46 36	92	S-3: Dense, tan-gray, fine to medium SAND, some Silt, some Gravel, wet.		
15										
20		S-4	17-19	24	18	24 30 32 33	62	S-4: Dense, tan, fine to medium SAND and SILT, little Gravel. Till-like material.	3	
								Bottom of boring at 21 feet.		
25										
30										

Stratum Description (Depth (ft) / Elev. (ft))

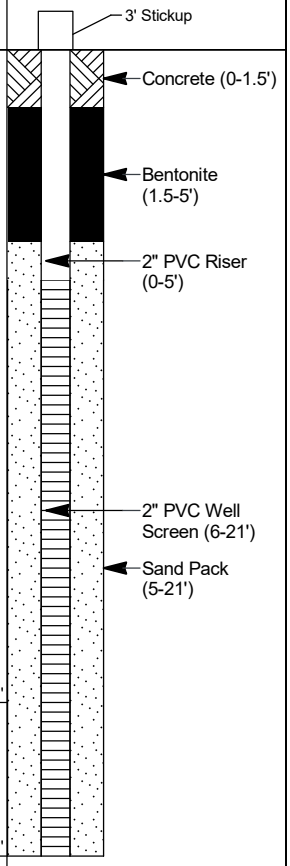
FINE TO MEDIUM SAND

17'

FINE TO MEDIUM SAND AND SILT

21'

Equipment Installed



REMARKS

1. Manually excavated to 30 to 34 inches below ground surface to pre-clear location.
2. The drilling auger encountered an apparent boulder at approximately 9 feet and shifted laterally. This shift caused the augers to encounter and damage a small gauge electrical line serving the adjacent street lights.
3. No samples collected between 19 and 21 feet bgs. Augered to final depth to install well.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-4

HydroCAD Reports

Stormwater Discharge Summary Table

Taylor Street Well and Raw Water Main
Littleton, MA
December 14, 2023

		Peak Discharge (CFS)	
Analysis Point	**24-Hr Storm Event**	**Pre-Development**	**Post-Development**
A	2-YR	0.00	0.00
	10-YR	0.18	0.13
	25-YR	1.08	0.81
	50-YR	2.27	2.01
	100-YR	4.07	3.59

REVISED 12/14/23

NOAA Atlas 14, Volume 10, Version 3
Location name: Littleton, Massachusetts, USA*
Latitude: 42.5185°, Longitude: -71.5132°
Elevation: 243 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_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.326** (0.254-0.411)	**0.388** (0.302-0.490)	**0.489** (0.381-0.620)	**0.572** (0.442-0.729)	**0.687** (0.515-0.912)	**0.773** (0.568-1.05)	**0.865** (0.617-1.21)	**0.970** (0.654-1.38)	**1.12** (0.729-1.66)	**1.25** (0.792-1.88)
10-min	**0.462** (0.360-0.583)	**0.549** (0.428-0.694)	**0.692** (0.538-0.877)	**0.811** (0.626-1.03)	**0.974** (0.729-1.29)	**1.10** (0.805-1.48)	**1.23** (0.874-1.72)	**1.38** (0.927-1.96)	**1.59** (1.03-2.34)	**1.77** (1.12-2.66)
15-min	**0.543** (0.424-0.686)	**0.646** (0.504-0.816)	**0.814** (0.633-1.03)	**0.954** (0.737-1.22)	**1.15** (0.858-1.52)	**1.29** (0.947-1.75)	**1.44** (1.03-2.02)	**1.62** (1.09-2.31)	**1.87** (1.21-2.76)	**2.09** (1.32-3.13)
30-min	**0.737** (0.576-0.931)	**0.878** (0.685-1.11)	**1.11** (0.861-1.40)	**1.30** (1.00-1.65)	**1.56** (1.17-2.07)	**1.76** (1.29-2.38)	**1.96** (1.40-2.75)	**2.20** (1.48-3.14)	**2.55** (1.65-3.76)	**2.84** (1.80-4.26)
60-min	**0.932** (0.727-1.18)	**1.11** (0.865-1.40)	**1.40** (1.09-1.77)	**1.64** (1.27-2.09)	**1.97** (1.48-2.62)	**2.22** (1.63-3.01)	**2.48** (1.77-3.49)	**2.79** (1.88-3.98)	**3.23** (2.09-4.76)	**3.60** (2.28-5.40)
2-hr	**1.18** (0.926-1.47)	**1.42** (1.12-1.78)	**1.82** (1.43-2.29)	**2.15** (1.68-2.72)	**2.61** (1.97-3.45)	**2.95** (2.18-3.98)	**3.31** (2.39-4.64)	**3.75** (2.54-5.31)	**4.42** (2.87-6.45)	**4.98** (3.16-7.41)
3-hr	**1.35** (1.07-1.68)	**1.64** (1.30-2.05)	**2.12** (1.67-2.65)	**2.51** (1.96-3.16)	**3.05** (2.32-4.02)	**3.45** (2.57-4.64)	**3.89** (2.82-5.44)	**4.42** (3.00-6.23)	**5.23** (3.41-7.61)	**5.93** (3.77-8.78)
6-hr	**1.72** (1.38-2.13)	**2.10** (1.67-2.60)	**2.72** (2.16-3.37)	**3.23** (2.55-4.02)	**3.93** (3.01-5.13)	**4.45** (3.34-5.94)	**5.02** (3.66-6.97)	**5.71** (3.89-7.98)	**6.78** (4.43-9.77)	**7.70** (4.91-11.3)
12-hr	**2.19** (1.76-2.68)	**2.66** (2.14-3.26)	**3.43** (2.74-4.22)	**4.07** (3.24-5.03)	**4.95** (3.81-6.40)	**5.60** (4.22-7.40)	**6.31** (4.63-8.67)	**7.16** (4.90-9.92)	**8.48** (5.56-12.1)	**9.60** (6.15-14.0)
24-hr	**2.62** (2.13-3.18)	**3.20** (2.59-3.89)	**4.14** (3.35-5.05)	**4.93** (3.95-6.04)	**6.01** (4.66-7.71)	**6.81** (5.17-8.92)	**7.68** (5.67-10.5)	**8.73** (6.00-12.0)	**10.3** (6.82-14.7)	**11.7** (7.54-16.9)
2-day	**2.97** (2.43-3.58)	**3.66** (2.99-4.41)	**4.79** (3.90-5.79)	**5.73** (4.63-6.96)	**7.02** (5.49-8.94)	**7.97** (6.10-10.4)	**9.01** (6.70-12.2)	**10.3** (7.10-14.0)	**12.3** (8.12-17.2)	**14.0** (9.02-20.0)
3-day	**3.24** (2.67-3.88)	**3.98** (3.27-4.78)	**5.20** (4.25-6.25)	**6.20** (5.04-7.50)	**7.58** (5.96-9.61)	**8.60** (6.61-11.1)	**9.72** (7.26-13.1)	**11.1** (7.68-15.0)	**13.2** (8.76-18.5)	**15.1** (9.72-21.4)
4-day	**3.50** (2.89-4.18)	**4.27** (3.52-5.10)	**5.52** (4.53-6.62)	**6.56** (5.35-7.91)	**8.00** (6.30-10.1)	**9.06** (6.98-11.7)	**10.2** (7.63-13.7)	**11.6** (8.07-15.7)	**13.8** (9.16-19.2)	**15.7** (10.1-22.2)
7-day	**4.21** (3.50-4.99)	**5.02** (4.17-5.96)	**6.34** (5.24-7.55)	**7.44** (6.11-8.90)	**8.95** (7.08-11.2)	**10.1** (7.79-12.8)	**11.3** (8.44-14.9)	**12.7** (8.87-17.0)	**14.9** (9.93-20.6)	**16.8** (10.9-23.6)
10-day	**4.89** (4.08-5.77)	**5.72** (4.77-6.76)	**7.08** (5.89-8.40)	**8.21** (6.78-9.78)	**9.77** (7.76-12.1)	**10.9** (8.47-13.8)	**12.2** (9.10-16.0)	**13.6** (9.52-18.1)	**15.7** (10.5-21.6)	**17.5** (11.4-24.5)
20-day	**6.90** (5.81-8.07)	**7.79** (6.56-9.13)	**9.26** (7.76-10.9)	**10.5** (8.71-12.4)	**12.1** (9.69-14.8)	**13.4** (10.4-16.7)	**14.7** (11.0-18.9)	**16.1** (11.3-21.2)	**18.0** (12.1-24.5)	**19.5** (12.7-27.0)
30-day	**8.57** (7.26-9.97)	**9.51** (8.05-11.1)	**11.1** (9.32-12.9)	**12.3** (10.3-14.5)	**14.1** (11.3-17.1)	**15.5** (12.0-19.1)	**16.8** (12.5-21.3)	**18.2** (12.9-23.8)	**19.9** (13.4-26.9)	**21.2** (13.8-29.3)
45-day	**10.6** (9.06-12.3)	**11.7** (9.91-13.5)	**13.3** (11.3-15.5)	**14.7** (12.3-17.1)	**16.6** (13.3-19.9)	**18.0** (14.1-22.0)	**19.5** (14.5-24.4)	**20.8** (14.8-27.0)	**22.4** (15.1-30.1)	**23.5** (15.4-32.2)
60-day	**12.4** (10.6-14.3)	**13.5** (11.5-15.5)	**15.2** (12.9-17.6)	**16.6** (14.0-19.4)	**18.6** (15.0-22.3)	**20.2** (15.8-24.5)	**21.7** (16.1-27.0)	**23.0** (16.4-29.8)	**24.5** (16.6-32.8)	**25.6** (16.7-34.9)

[1] 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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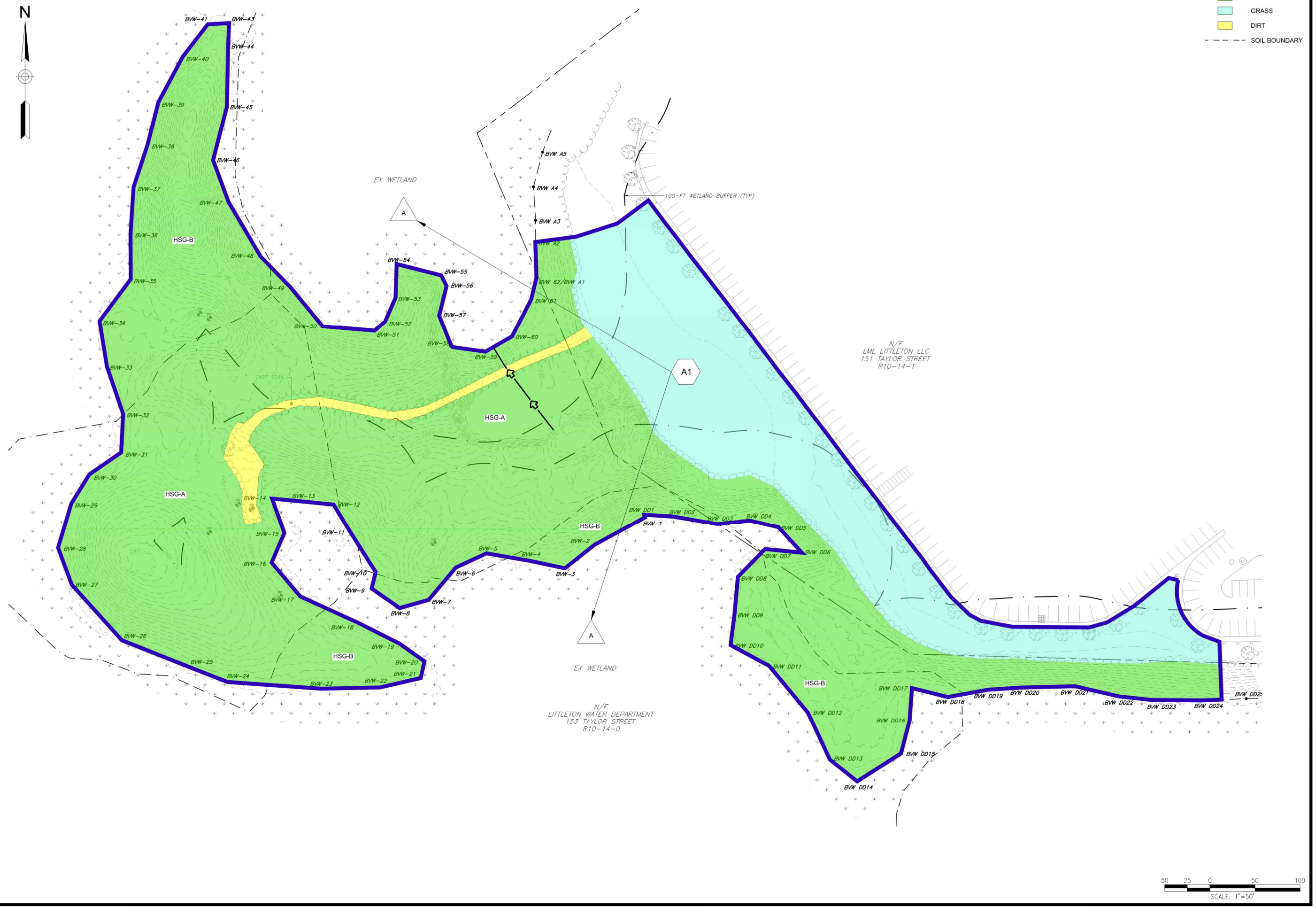
PF graphical



Project:

LITTLETON WATER DEPARTMENT

TAYLOR STREET WELL AND RAW WATER MAIN

151 & 153 TAYLOR STREET, LITTLETON, MA 01460

Weston & Sampson

Weston & Sampson Engineers, Inc.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
978.532.1900 800.SAMPSON
www.westonandsampson.com

Consultants:

Revisions:

No.	Date	Description
1	12/14/23	PER PEER REVIEW

Seal:

Issued For:

PERMITTING - NOT FOR CONSTRUCTION

Scale:	AS SHOWN
Date:	OCTOBER 16, 2023
Drawn By:	AKG
Reviewed By:	JIP
Approved By:	JIP
W&S Project No.:	ENG23-0679
W&S File No.:	

Drawing Title:

EXISTING HYDROLOGIC MAP

Sheet Number:

FIG-1

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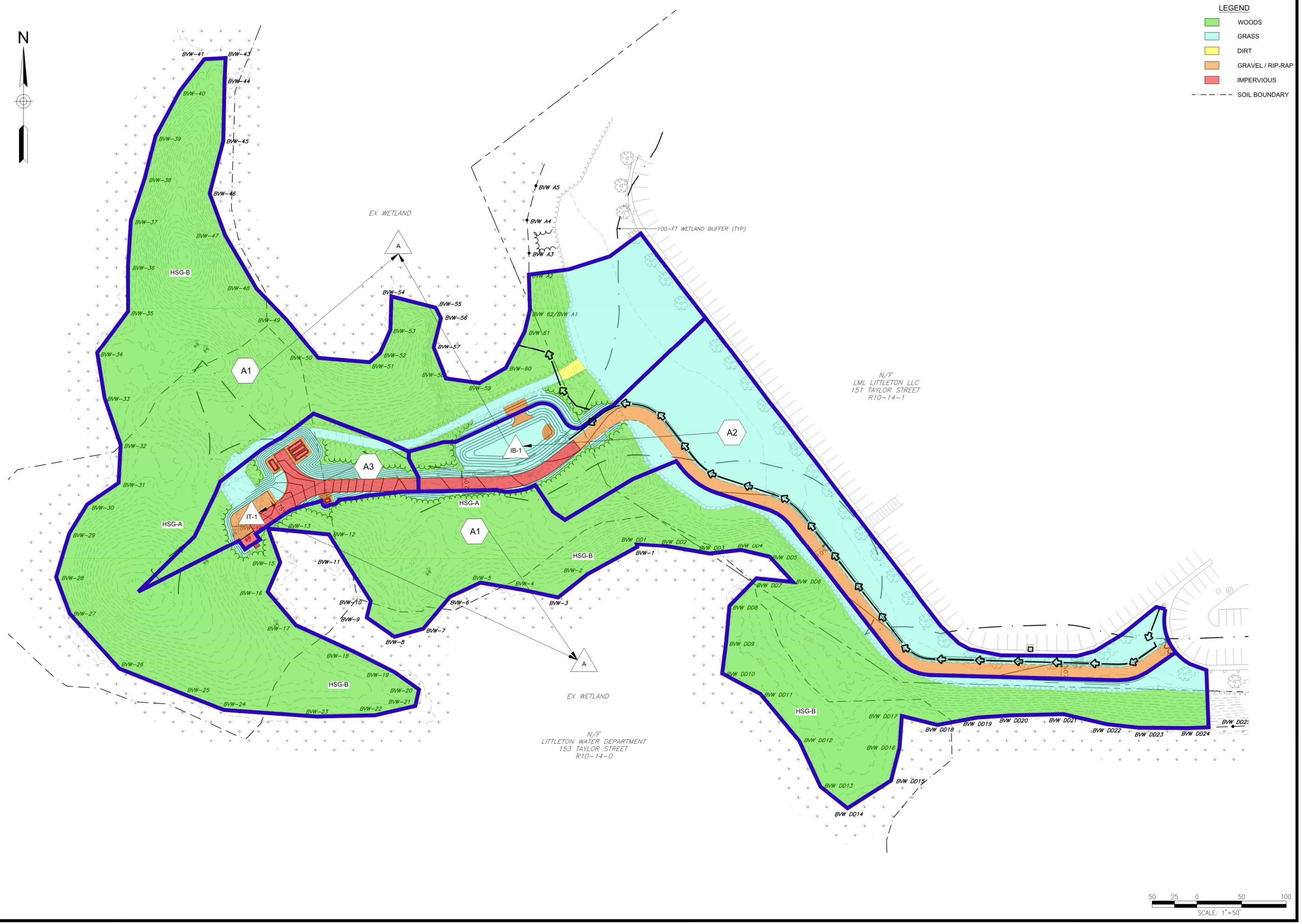
Rev: 1.8 Date: 10/24/2019



Project:

LITTLETON WATER DEPARTMENT

TAYLOR STREET WELL AND RAW WATER MAIN

151 & 153 TAYLOR STREET, LITTLETON, MA 01460

Weston & Sampson

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Consultants:

Revisions:

No.	Date	Description
1	12/14/23	PER PEER REVIEW

Seal:

Issued For:

PERMITTING - NOT FOR CONSTRUCTION

Scale:	AS SHOWN
Date:	OCTOBER 16, 2023
Drawn By:	AKG
Reviewed By:	JIP
Approved By:	JIP
W&S Project No.:	ENG23-0679
W&S File No.:	

Drawing Title:

PROPOSED HYDROLOGIC MAP

Sheet Number:

FIG-2

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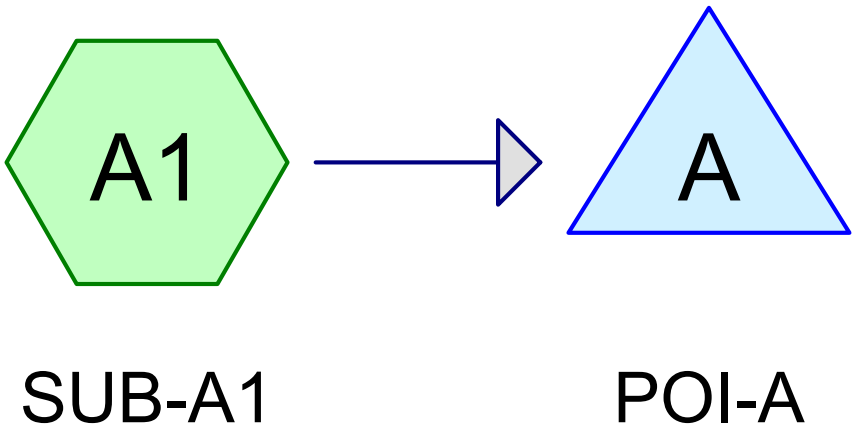
Rev: 1.8 Date: 10/24/2019



Subcat Reach Pond Link

Routing Diagram for EX-HydroCAD
Prepared by Weston & Sampson Engineers, Inc, Printed 12/7/2023

REVISED 12/14/23

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Yr	Type III 24-hr		Default	24.00	1	3.20	2
2	10-Yr	Type III 24-hr		Default	24.00	1	4.93	2
3	25-Yr	Type III 24-hr		Default	24.00	1	6.01	2
4	50-Yr	Type III 24-hr		Default	24.00	1	6.81	2
5	100-Yr	Type III 24-hr		Default	24.00	1	7.68	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
77,738	39	>75% Grass cover, Good, HSG A (A1)
6,735	72	Bare soil, HSG A (A1)
200,417	30	Woods, Good, HSG A (A1)
78,748	55	Woods, Good, HSG B (A1)
363,638	**38**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
284,890	HSG A	A1
78,748	HSG B	A1
0	HSG C	
0	HSG D	
0	Other	
363,638		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
77,738	0	0	0	0	77,738	>75% Grass cover, Good	
6,735	0	0	0	0	6,735	Bare soil	
200,417	78,748	0	0	0	279,165	Woods, Good	
284,890	**78,748**	**0**	**0**	**0**	**363,638**	**TOTAL AREA**	

Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=363,638 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=114' Tc=14.0 min CN=38 Runoff=0.00 cfs 0 cf

Pond A: POI-A Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 363,638 sf Runoff Volume = 0 cf Average Runoff Depth = 0.00"
100.00% Pervious = 363,638 sf 0.00% Impervious = 0 sf

Summary for Subcatchment A1: SUB-A1

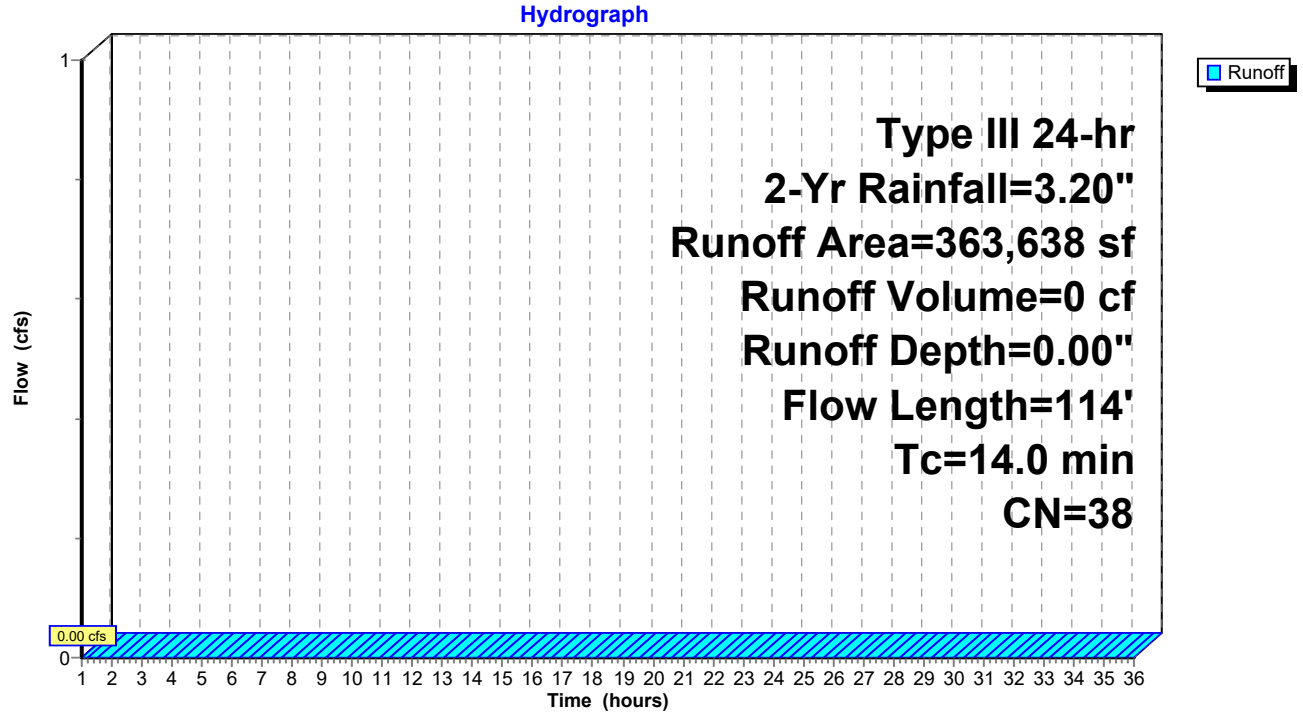
Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Pond A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

	Area (sf)	CN	Description
	200,417	30	Woods, Good, HSG A
	78,748	55	Woods, Good, HSG B
	77,738	39	>75% Grass cover, Good, HSG A
*	6,735	72	Bare soil, HSG A
	363,638	38	Weighted Average
	363,638		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	50	0.0175	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.1	43	0.0175	0.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	21	0.2850	2.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	114	Total			

Subcatchment A1: SUB-A1



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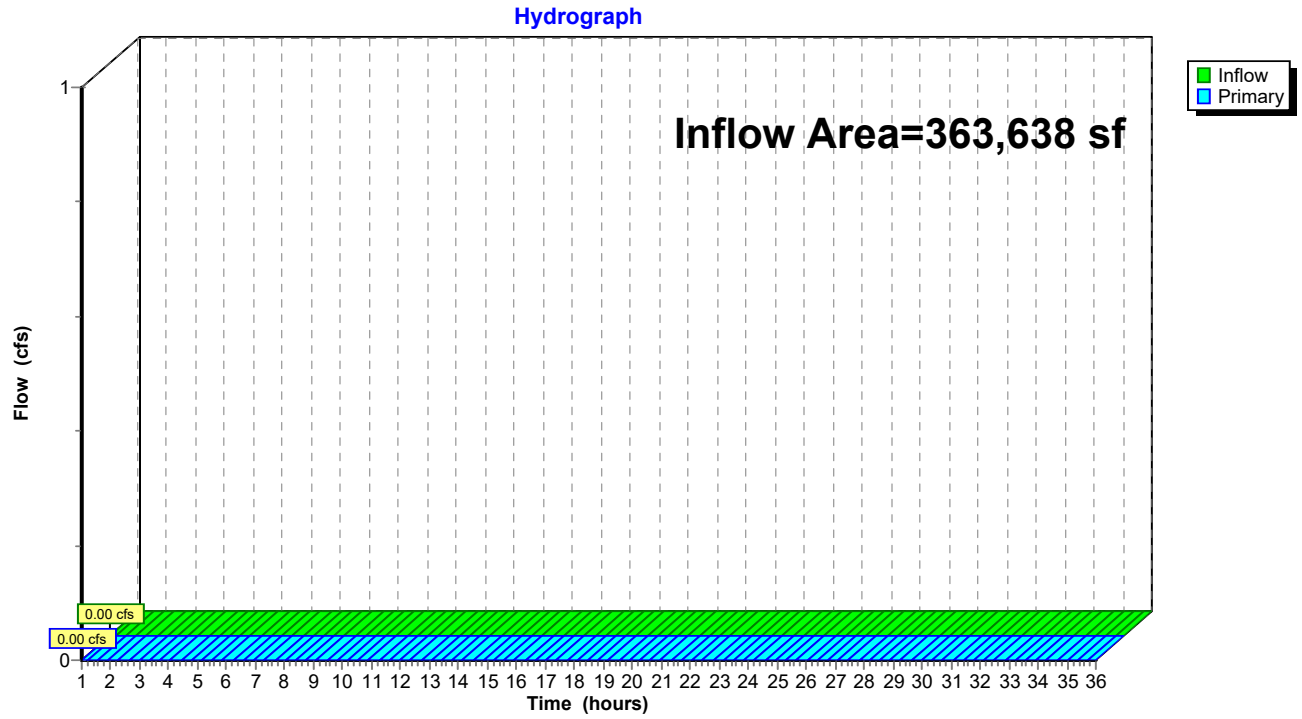
Summary for Pond A: POI-A

Inflow Area = 363,638 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Yr event
Inflow = 0.00 cfs @ 1.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2

Pond A: POI-A



Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=363,638 sf 0.00% Impervious Runoff Depth=0.15"
Flow Length=114' Tc=14.0 min CN=38 Runoff=0.18 cfs 4,682 cf

Pond A: POI-A Inflow=0.18 cfs 4,682 cf
Primary=0.18 cfs 4,682 cf

Total Runoff Area = 363,638 sf Runoff Volume = 4,682 cf Average Runoff Depth = 0.15"
100.00% Pervious = 363,638 sf 0.00% Impervious = 0 sf

Summary for Subcatchment A1: SUB-A1

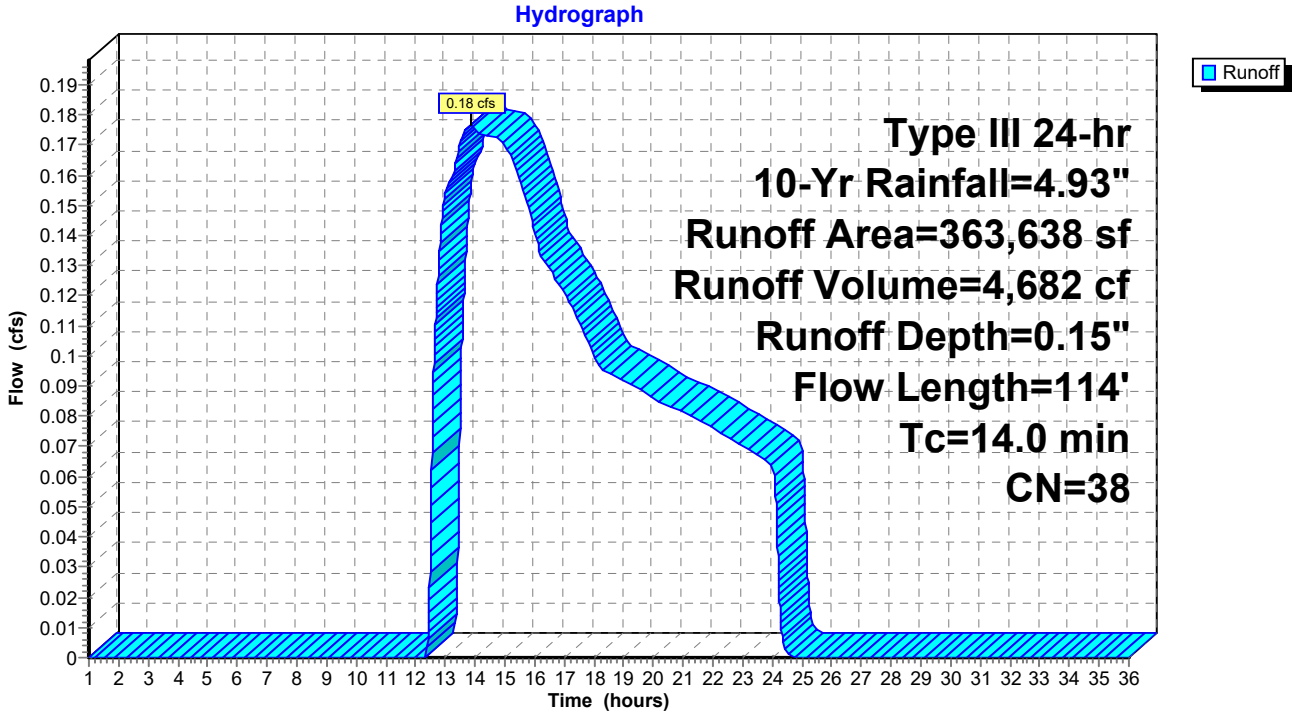
Runoff = 0.18 cfs @ 13.86 hrs, Volume= 4,682 cf, Depth= 0.15"
Routed to Pond A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.93"

	Area (sf)	CN	Description
	200,417	30	Woods, Good, HSG A
	78,748	55	Woods, Good, HSG B
	77,738	39	>75% Grass cover, Good, HSG A
*	6,735	72	Bare soil, HSG A
	363,638	38	Weighted Average
	363,638		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	50	0.0175	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.1	43	0.0175	0.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	21	0.2850	2.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	114	Total			

Subcatchment A1: SUB-A1



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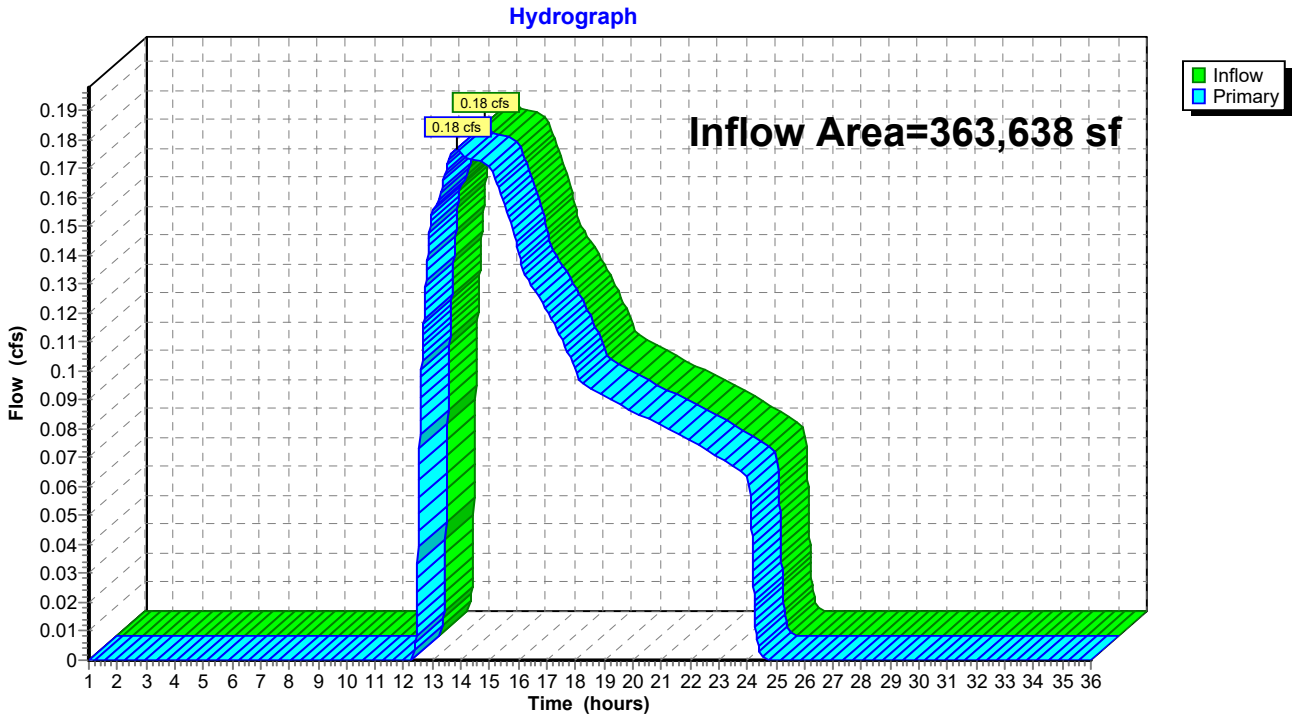
Summary for Pond A: POI-A

Inflow Area = 363,638 sf, 0.00% Impervious, Inflow Depth = 0.15" for 10-Yr event
Inflow = 0.18 cfs @ 13.86 hrs, Volume= 4,682 cf
Primary = 0.18 cfs @ 13.86 hrs, Volume= 4,682 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2

Pond A: POI-A



Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=363,638 sf 0.00% Impervious Runoff Depth=0.40"
Flow Length=114' Tc=14.0 min CN=38 Runoff=1.08 cfs 11,994 cf

Pond A: POI-A Inflow=1.08 cfs 11,994 cf
Primary=1.08 cfs 11,994 cf

Total Runoff Area = 363,638 sf Runoff Volume = 11,994 cf Average Runoff Depth = 0.40"
100.00% Pervious = 363,638 sf 0.00% Impervious = 0 sf

Summary for Subcatchment A1: SUB-A1

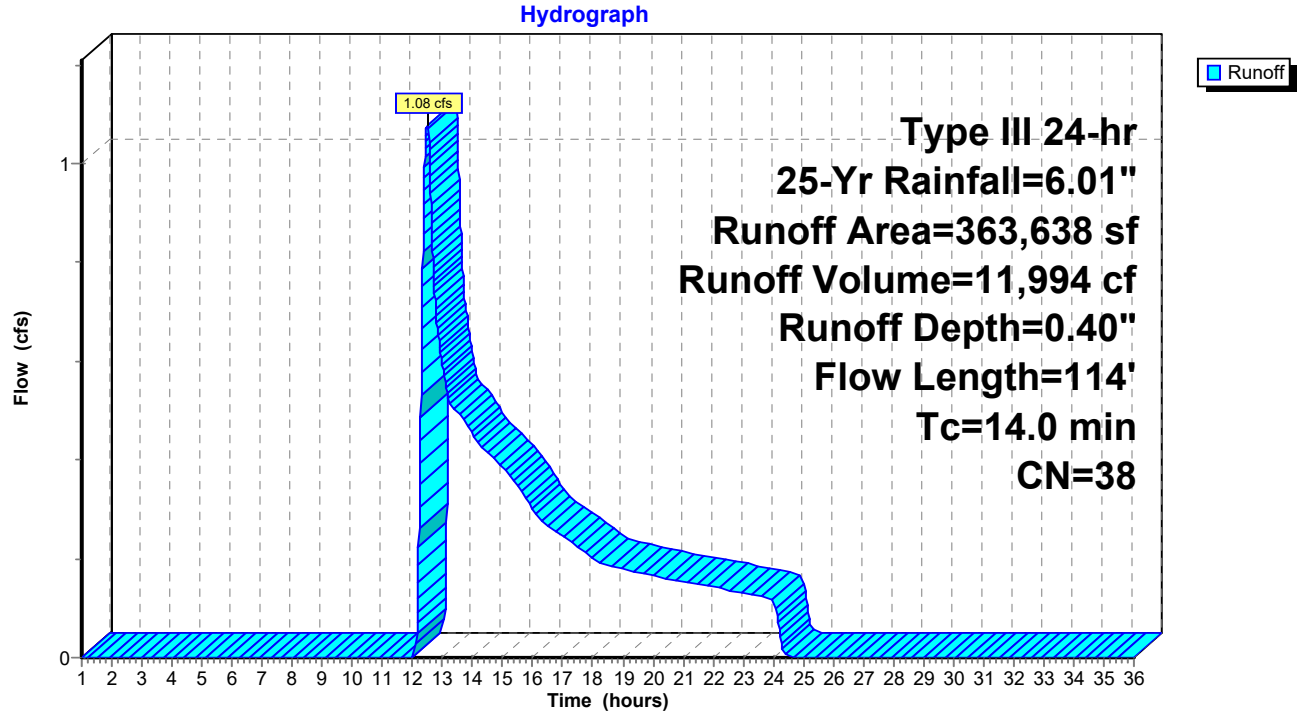
Runoff = 1.08 cfs @ 12.49 hrs, Volume= 11,994 cf, Depth= 0.40"
Routed to Pond A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.01"

	Area (sf)	CN	Description
	200,417	30	Woods, Good, HSG A
	78,748	55	Woods, Good, HSG B
	77,738	39	>75% Grass cover, Good, HSG A
*	6,735	72	Bare soil, HSG A
	363,638	38	Weighted Average
	363,638		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	50	0.0175	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.1	43	0.0175	0.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	21	0.2850	2.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	114	Total			

Subcatchment A1: SUB-A1



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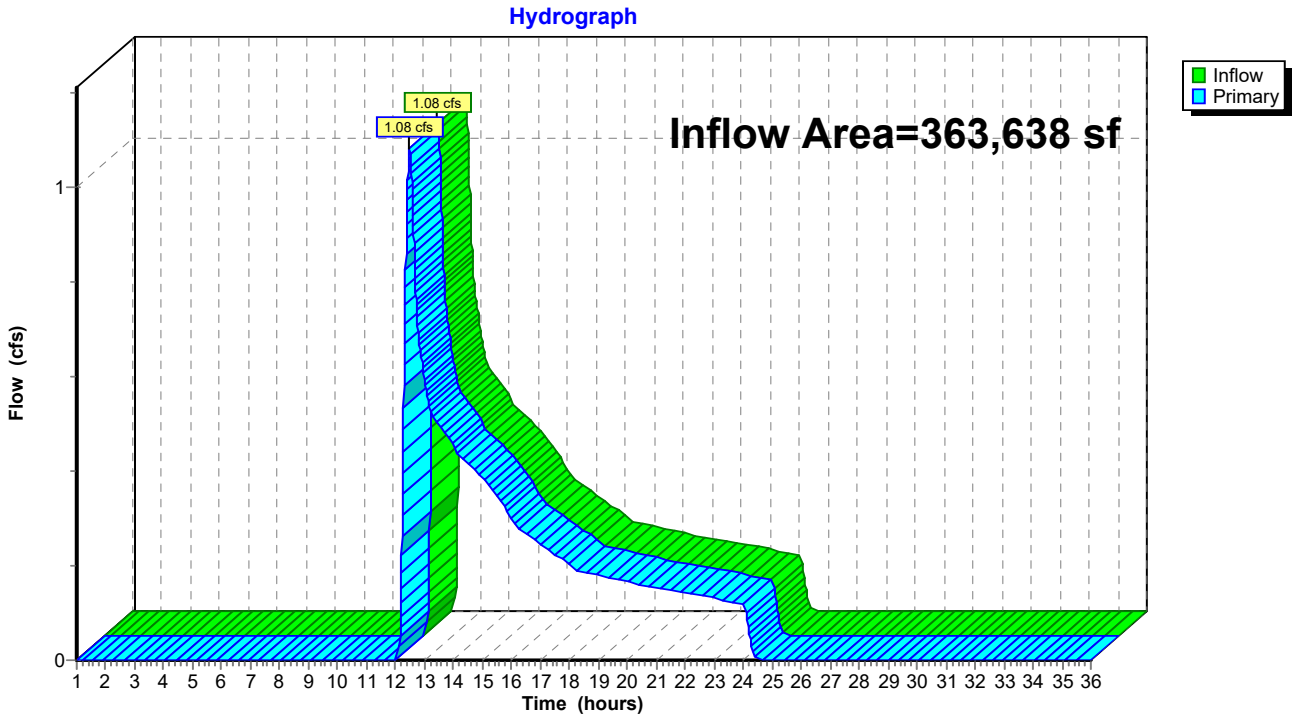
Summary for Pond A: POI-A

Inflow Area = 363,638 sf, 0.00% Impervious, Inflow Depth = 0.40" for 25-Yr event
Inflow = 1.08 cfs @ 12.49 hrs, Volume= 11,994 cf
Primary = 1.08 cfs @ 12.49 hrs, Volume= 11,994 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2

Pond A: POI-A



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Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=363,638 sf 0.00% Impervious Runoff Depth=0.63"
Flow Length=114' Tc=14.0 min CN=38 Runoff=2.27 cfs 19,193 cf

Pond A: POI-A Inflow=2.27 cfs 19,193 cf
Primary=2.27 cfs 19,193 cf

Total Runoff Area = 363,638 sf Runoff Volume = 19,193 cf Average Runoff Depth = 0.63"
100.00% Pervious = 363,638 sf 0.00% Impervious = 0 sf

Summary for Subcatchment A1: SUB-A1

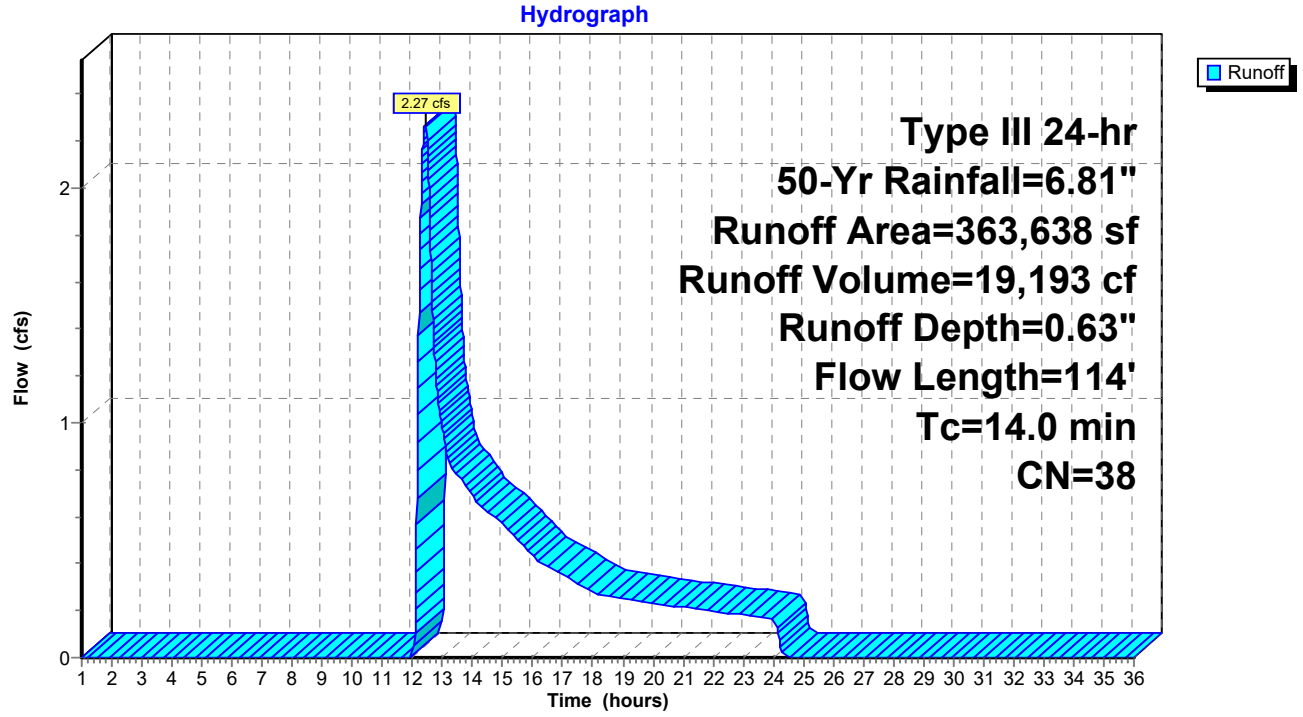
Runoff = 2.27 cfs @ 12.42 hrs, Volume= 19,193 cf, Depth= 0.63"
Routed to Pond A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Yr Rainfall=6.81"

	Area (sf)	CN	Description
	200,417	30	Woods, Good, HSG A
	78,748	55	Woods, Good, HSG B
	77,738	39	>75% Grass cover, Good, HSG A
*	6,735	72	Bare soil, HSG A
	363,638	38	Weighted Average
	363,638		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	50	0.0175	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.1	43	0.0175	0.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	21	0.2850	2.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	114	Total			

Subcatchment A1: SUB-A1



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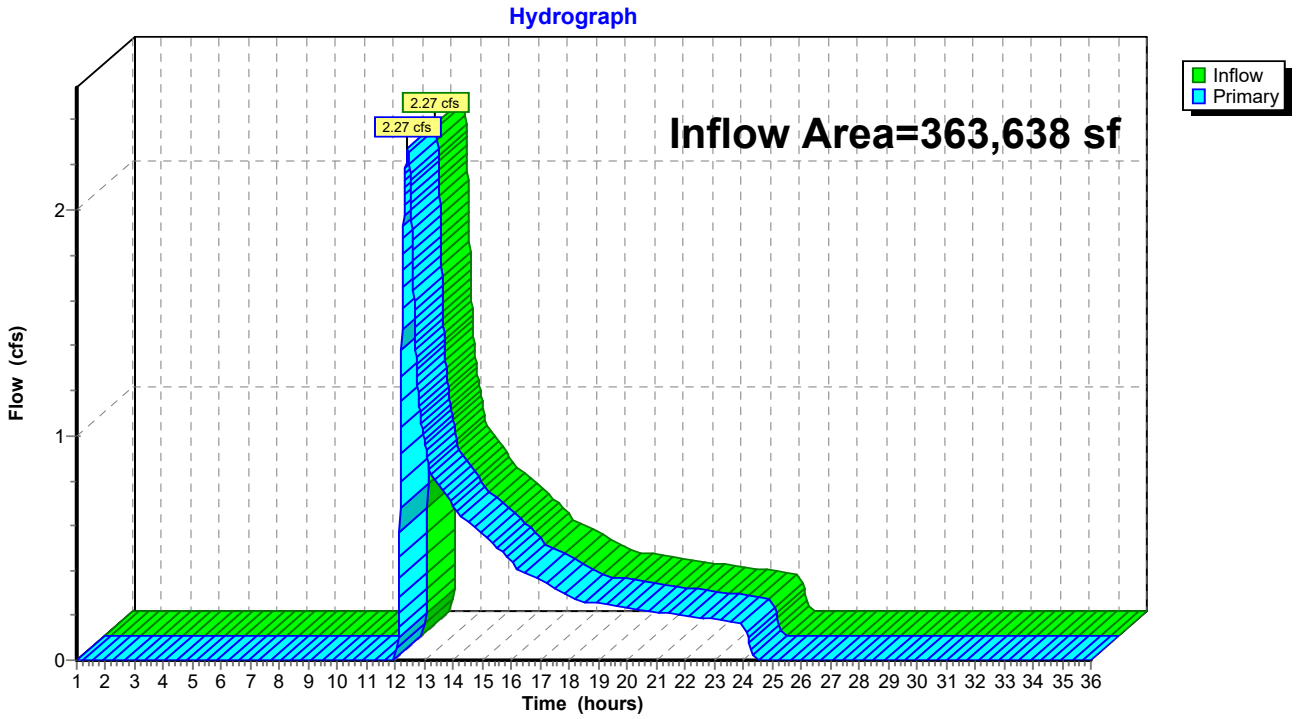
Summary for Pond A: POI-A

Inflow Area = 363,638 sf, 0.00% Impervious, Inflow Depth = 0.63" for 50-Yr event
Inflow = 2.27 cfs @ 12.42 hrs, Volume= 19,193 cf
Primary = 2.27 cfs @ 12.42 hrs, Volume= 19,193 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2

Pond A: POI-A



Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=363,638 sf 0.00% Impervious Runoff Depth=0.94"
Flow Length=114' Tc=14.0 min CN=38 Runoff=4.07 cfs 28,514 cf

Pond A: POI-A Inflow=4.07 cfs 28,514 cf
Primary=4.07 cfs 28,514 cf

Total Runoff Area = 363,638 sf Runoff Volume = 28,514 cf Average Runoff Depth = 0.94"
100.00% Pervious = 363,638 sf 0.00% Impervious = 0 sf

Summary for Subcatchment A1: SUB-A1

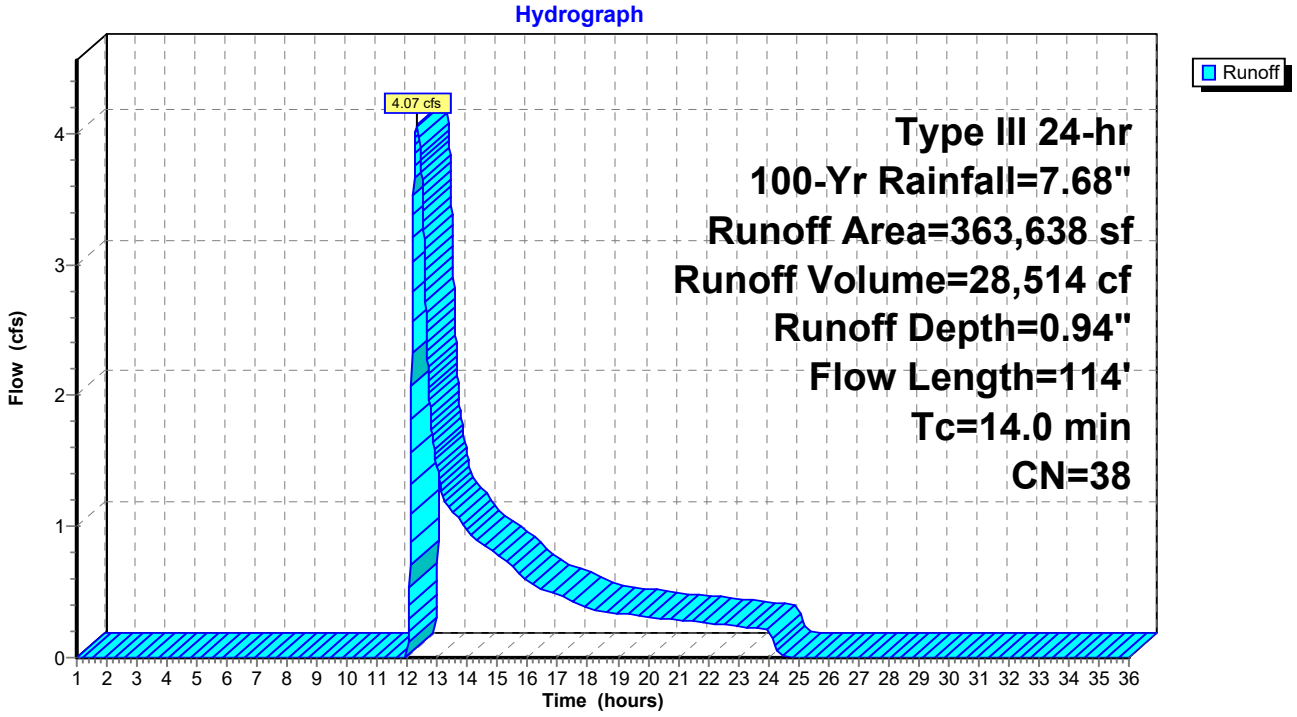
Runoff = 4.07 cfs @ 12.31 hrs, Volume= 28,514 cf, Depth= 0.94"
Routed to Pond A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=7.68"

	Area (sf)	CN	Description
	200,417	30	Woods, Good, HSG A
	78,748	55	Woods, Good, HSG B
	77,738	39	>75% Grass cover, Good, HSG A
*	6,735	72	Bare soil, HSG A
	363,638	38	Weighted Average
	363,638		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	50	0.0175	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.1	43	0.0175	0.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	21	0.2850	2.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	114	Total			

Subcatchment A1: SUB-A1



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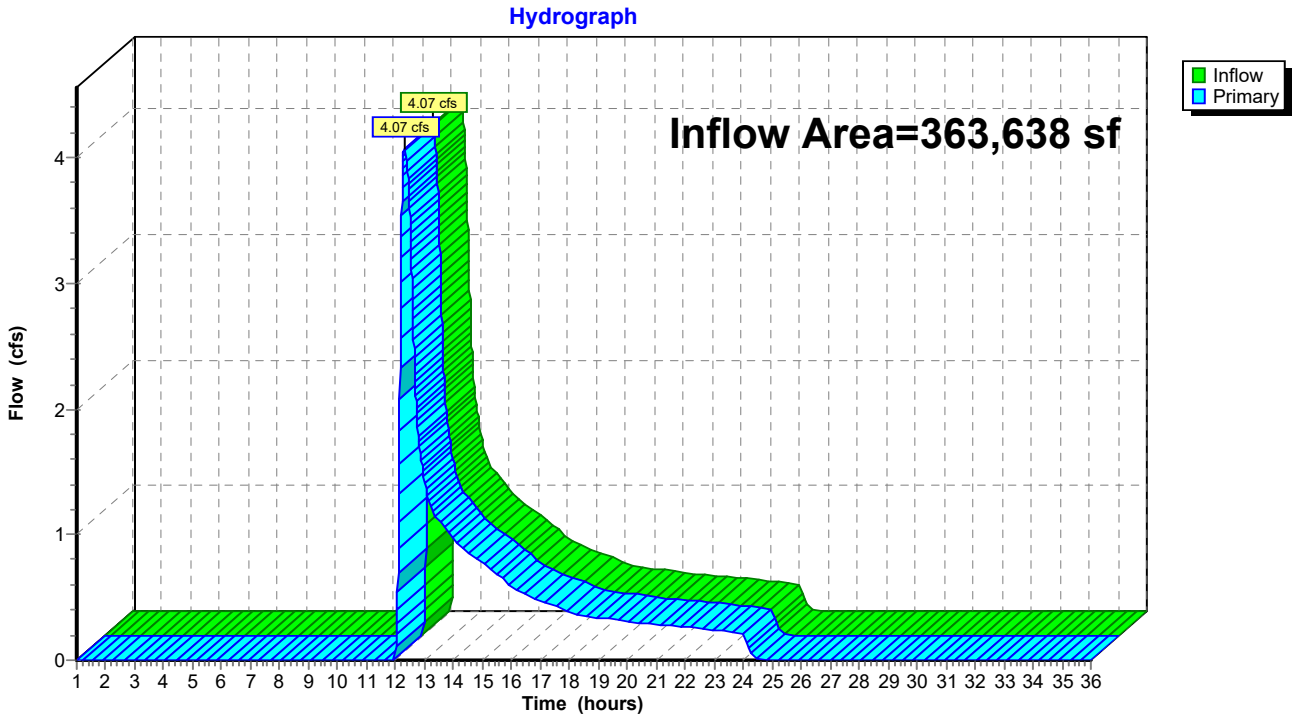
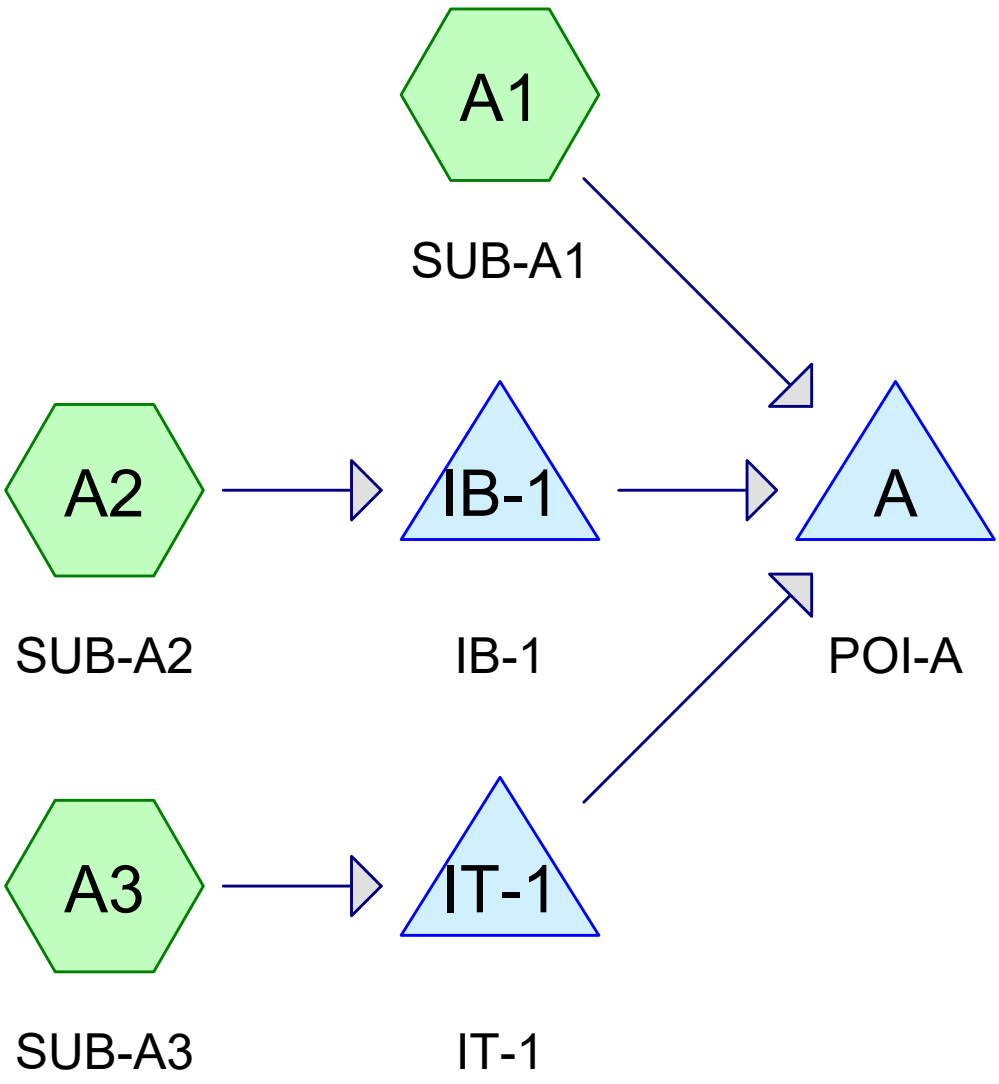
Summary for Pond A: POI-A

Inflow Area = 363,638 sf, 0.00% Impervious, Inflow Depth = 0.94" for 100-Yr event
Inflow = 4.07 cfs @ 12.31 hrs, Volume= 28,514 cf
Primary = 4.07 cfs @ 12.31 hrs, Volume= 28,514 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2

Pond A: POI-A





Subcat Reach Pond Link

Routing Diagram for PR-HydroCAD
Prepared by Weston & Sampson Engineers, Inc, Printed 12/8/2023

REVISED 12/14/23

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Yr	Type III 24-hr		Default	24.00	1	3.20	2
2	10-Yr	Type III 24-hr		Default	24.00	1	4.93	2
3	25-Yr	Type III 24-hr		Default	24.00	1	6.01	2
4	50-Yr	Type III 24-hr		Default	24.00	1	6.81	2
5	100-Yr	Type III 24-hr		Default	24.00	1	7.68	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
87,828	39	>75% Grass cover, Good, HSG A (A1, A2, A3)
367	77	Bare soil, HSG A (A1)
11,455	76	Gravel driveway, HSG A (A2)
6,508	98	Paved driveway, HSG A (A2, A3)
2,335	76	Rip-rap / Crushed stone, HSG A (A2, A3)
289	76	Rip-rap, HSG A (A1)
240	98	Roofs, HSG A (A3)
419	98	Unconnected impervious, HSG A (A1, A3)
175,449	30	Woods, Good, HSG A (A1, A2, A3)
78,748	55	Woods, Good, HSG B (A1)
363,638	**41**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
284,890	HSG A	A1, A2, A3
78,748	HSG B	A1
0	HSG C	
0	HSG D	
0	Other	
363,638		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
87,828	0	0	0	0	87,828	>75% Grass cover, Good	
367	0	0	0	0	367	Bare soil	
11,455	0	0	0	0	11,455	Gravel driveway	
6,508	0	0	0	0	6,508	Paved driveway	
289	0	0	0	0	289	Rip-rap	
2,335	0	0	0	0	2,335	Rip-rap / Crushed stone	
240	0	0	0	0	240	Roofs	
419	0	0	0	0	419	Unconnected impervious	
175,449	78,748	0	0	0	254,197	Woods, Good	
284,890	**78,748**	**0**	**0**	**0**	**363,638**	**TOTAL AREA**	

Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=272,685 sf 0.01% Impervious Runoff Depth=0.00"
Flow Length=116' Tc=13.8 min CN=38 Runoff=0.00 cfs 0 cf

SubcatchmentA2: SUB-A2 Runoff Area=71,036 sf 3.73% Impervious Runoff Depth=0.06"
Flow Length=840' Tc=15.9 min CN=46 Runoff=0.01 cfs 341 cf

SubcatchmentA3: SUB-A3 Runoff Area=19,917 sf 22.48% Impervious Runoff Depth=0.17"
Tc=6.0 min UI Adjusted CN=52 Runoff=0.02 cfs 287 cf

Pond A: POI-A Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Pond IB-1: IB-1 Peak Elev=229.00' Storage=2 cf Inflow=0.01 cfs 341 cf
Discarded=0.01 cfs 341 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 341 cf

Pond IT-1: IT-1 Peak Elev=222.49' Storage=2 cf Inflow=0.02 cfs 287 cf
Discarded=0.02 cfs 287 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 287 cf

Total Runoff Area = 363,638 sf Runoff Volume = 629 cf Average Runoff Depth = 0.02"
98.03% Pervious = 356,471 sf 1.97% Impervious = 7,167 sf

Summary for Subcatchment A1: SUB-A1

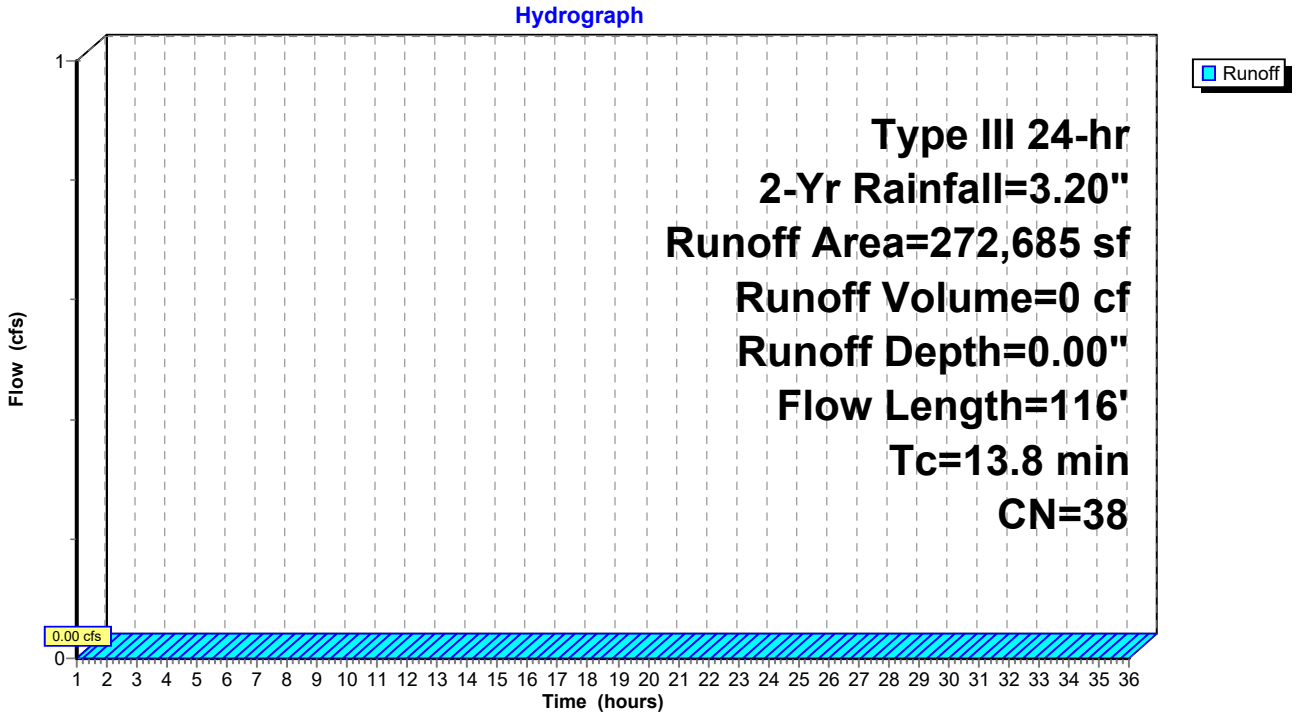
Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Pond A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

	Area (sf)	CN	Description
	160,924	30	Woods, Good, HSG A
	78,748	55	Woods, Good, HSG B
	32,321	39	>75% Grass cover, Good, HSG A
*	289	76	Rip-rap, HSG A
*	367	77	Bare soil, HSG A
*	36	98	Unconnected impervious, HSG A
	272,685	38	Weighted Average
	272,649		99.99% Pervious Area
	36		0.01% Impervious Area
	36		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	50	0.0175	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
0.9	42	0.0240	0.77		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	24	0.3400	2.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.8	116	Total			

Subcatchment A1: SUB-A1



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Summary for Subcatchment A2: SUB-A2

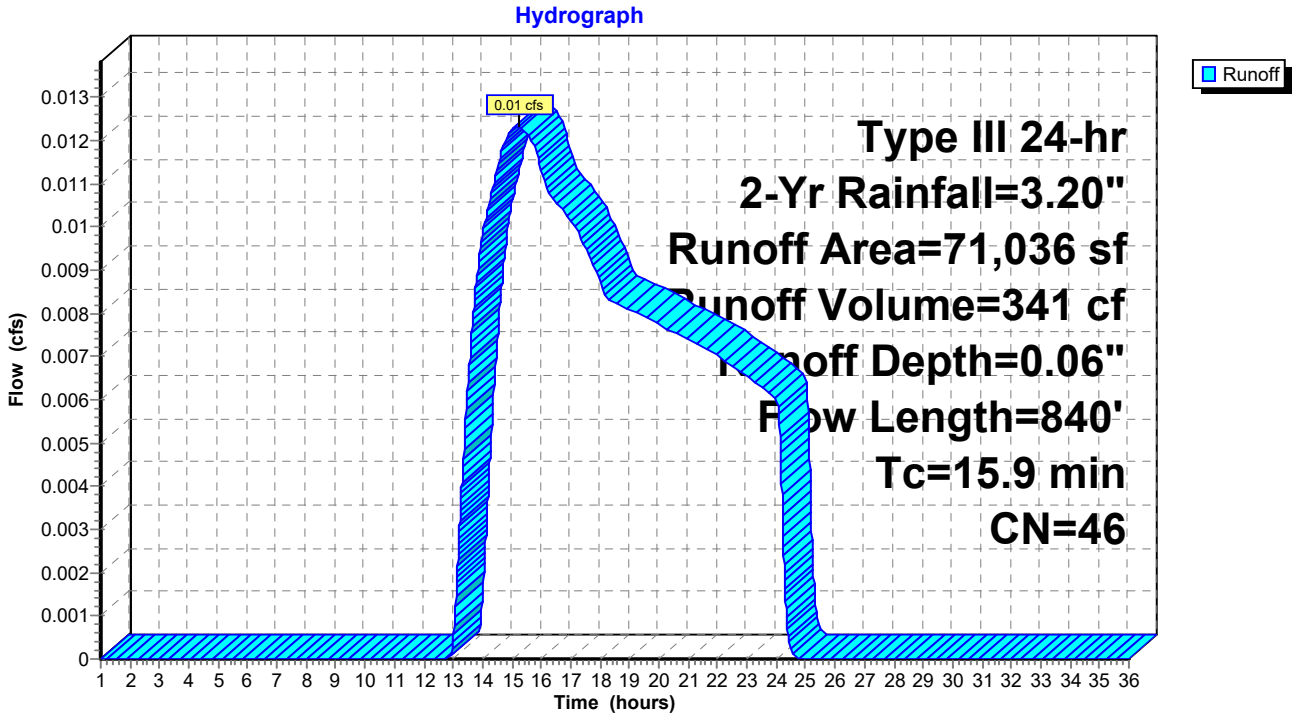
Runoff = 0.01 cfs @ 15.21 hrs, Volume= 341 cf, Depth= 0.06"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

	Area (sf)	CN	Description
	48,567	39	>75% Grass cover, Good, HSG A
*	11,455	76	Gravel driveway, HSG A
	7,961	30	Woods, Good, HSG A
*	2,653	98	Paved driveway, HSG A
*	400	76	Rip-rap / Crushed stone, HSG A
	71,036	46	Weighted Average
	68,383		96.27% Pervious Area
	2,653		3.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	45	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
10.8	795	0.0050	1.23	1.23	**Channel Flow,** Area= 1.0 sf Perim= 4.8' r= 0.21' n= 0.030 Earth, grassed & winding
15.9	840	Total			

Subcatchment A2: SUB-A2



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Summary for Subcatchment A3: SUB-A3

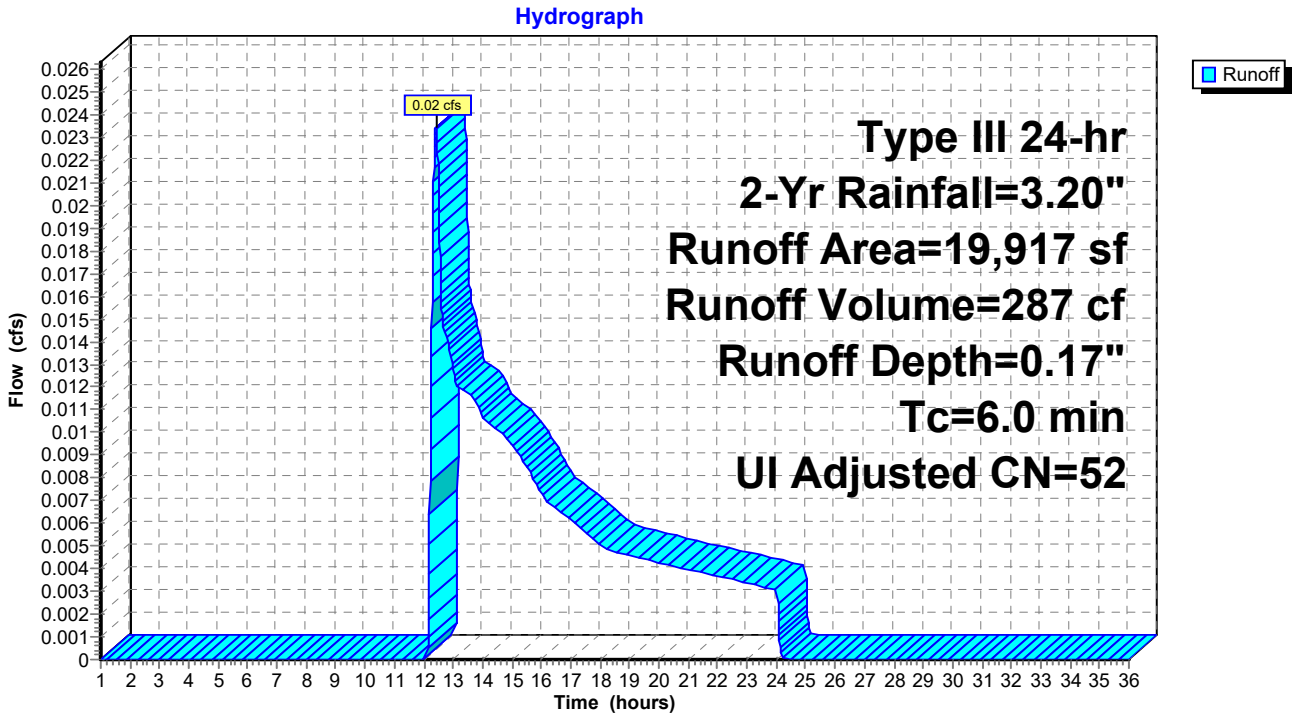
Runoff = 0.02 cfs @ 12.41 hrs, Volume= 287 cf, Depth= 0.17"
Routed to Pond IT-1 : IT-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

	Area (sf)	CN	Adj	Description
	6,564	30		Woods, Good, HSG A
	6,940	39		>75% Grass cover, Good, HSG A
*	3,855	98		Paved driveway, HSG A
*	1,935	76		Rip-rap / Crushed stone, HSG A
*	383	98		Unconnected impervious, HSG A
	240	98		Roofs, HSG A
	19,917	53	52	Weighted Average, UI Adjusted
	15,439			77.52% Pervious Area
	4,478			22.48% Impervious Area
	383			8.55% Unconnected

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

Subcatchment A3: SUB-A3

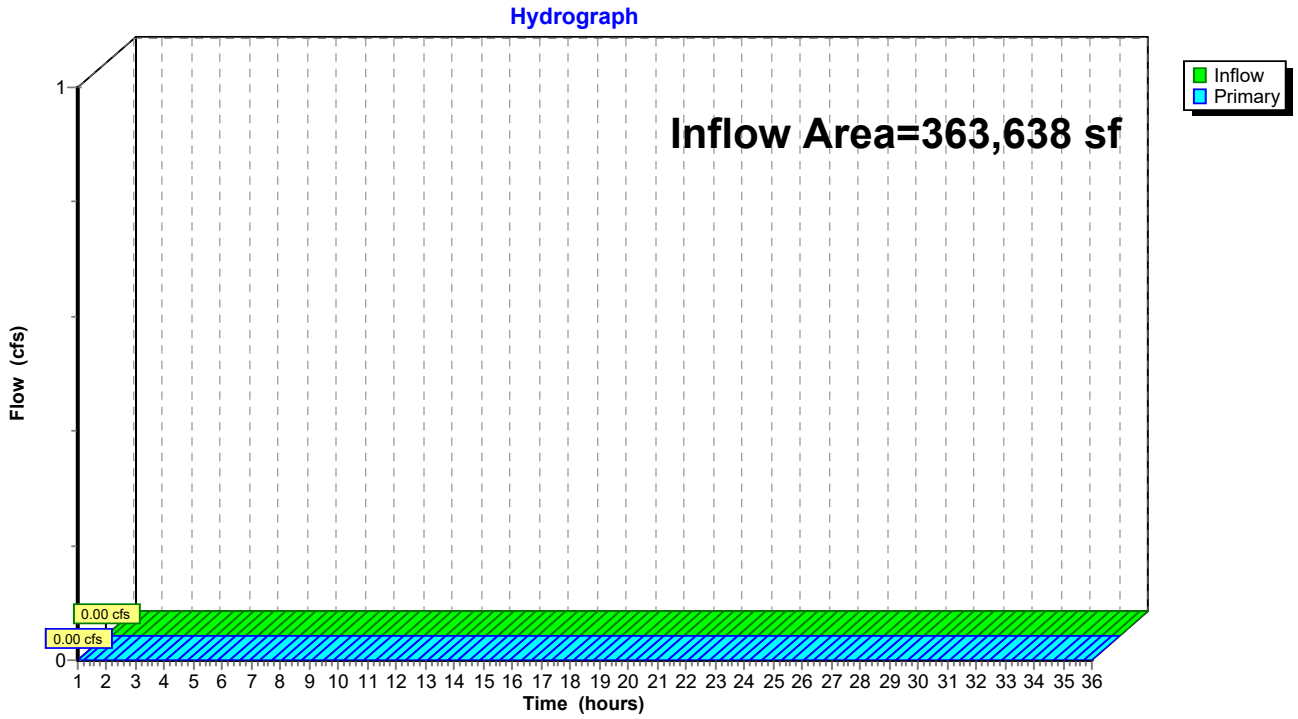


Summary for Pond A: POI-A

Inflow Area = 363,638 sf, 1.97% Impervious, Inflow Depth = 0.00" for 2-Yr event
Inflow = 0.00 cfs @ 1.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2

Pond A: POI-A



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Summary for Pond IB-1: IB-1

Inflow Area = 71,036 sf, 3.73% Impervious, Inflow Depth = 0.06" for 2-Yr event
Inflow = 0.01 cfs @ 15.21 hrs, Volume= 341 cf
Outflow = 0.01 cfs @ 15.26 hrs, Volume= 341 cf, Atten= 0%, Lag= 2.8 min
Discarded = 0.01 cfs @ 15.26 hrs, Volume= 341 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf
Routed to Pond A : POI-A

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 229.00' @ 15.26 hrs Surf.Area= 1,711 sf Storage= 2 cf

Plug-Flow detention time= 3.0 min calculated for 341 cf (100% of inflow)
Center-of-Mass det. time= 3.0 min (1,094.4 - 1,091.4)

Volume	Invert	Avail.Storage	Storage Description
#1	229.00'	12,733 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
229.00	1,710	0	0
230.00	2,407	2,059	2,059
231.00	3,141	2,774	4,833
232.00	3,935	3,538	8,371
233.00	4,789	4,362	12,733

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	231.90'	**20.0' long x 6.0' 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) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.01 cfs @ 15.26 hrs HW=229.00' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=229.00' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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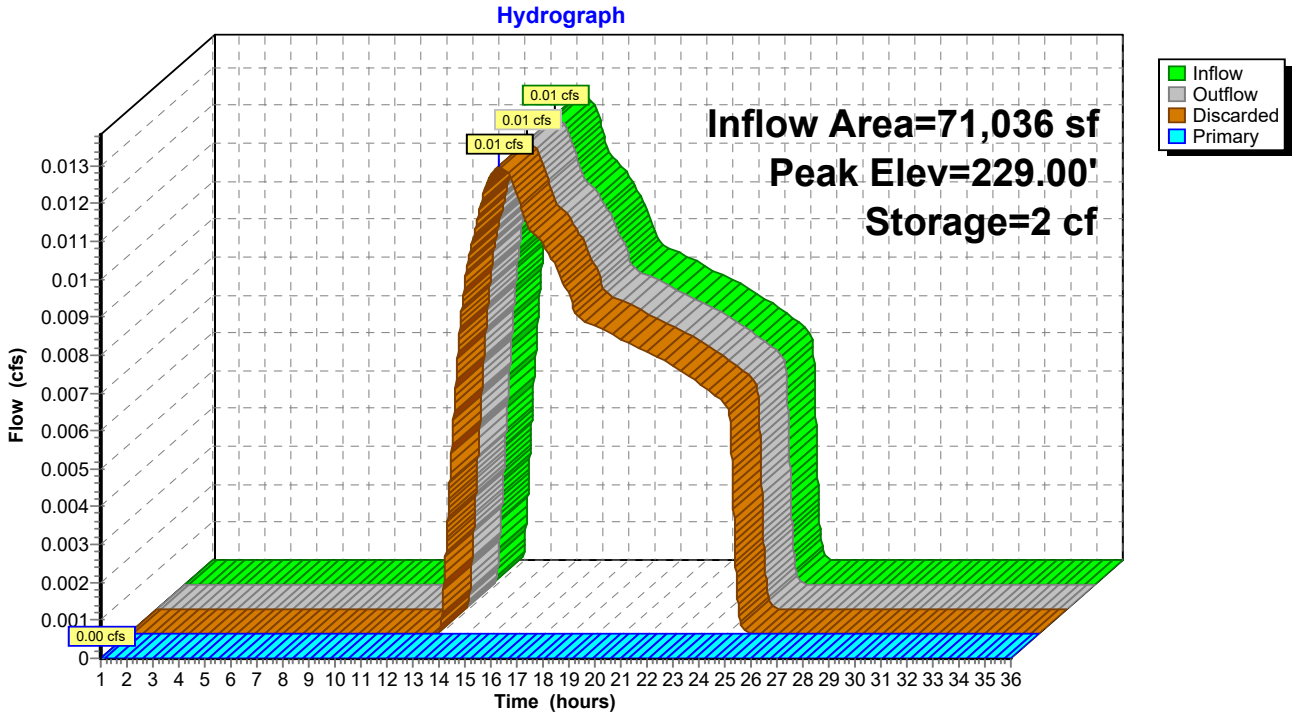
Pond IB-1: IB-1


Hydrograph
Inflow Area=71,036 sf
Peak Elev=229.00'
Storage=2 cf
Inflow
Outflow
Discarded
Primary
0.01 cfs
0.01 cfs
0.01 cfs
0.00 cfs
Flow (cfs)
0 0.001 0.002 0.003 0.004 0.005 0.006 0.007 0.008 0.009 0.01 0.011 0.012 0.013
Time (hours)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

Summary for Pond IT-1: IT-1

Inflow Area = 19,917 sf, 22.48% Impervious, Inflow Depth = 0.17" for 2-Yr event
Inflow = 0.02 cfs @ 12.41 hrs, Volume= 287 cf
Outflow = 0.02 cfs @ 12.43 hrs, Volume= 287 cf, Atten= 1%, Lag= 1.2 min
Discarded = 0.02 cfs @ 12.43 hrs, Volume= 287 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf
Routed to Pond A : POI-A

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 222.49' @ 12.43 hrs Surf.Area= 912 sf Storage= 2 cf

Plug-Flow detention time= 1.2 min calculated for 287 cf (100% of inflow)
Center-of-Mass det. time= 1.2 min (986.0 - 984.8)

Volume	Invert	Avail.Storage	Storage Description
#1	222.49'	1,234 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
222.49	912	0.0	0	0
222.50	912	40.0	4	4
224.00	912	40.0	547	551
224.01	912	100.0	9	560
224.50	1,839	100.0	674	1,234

Device	Routing	Invert	Outlet Devices
#1	Discarded	222.49'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	224.14'	**42.0' long x 16.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.02 cfs @ 12.43 hrs HW=222.49' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=222.49' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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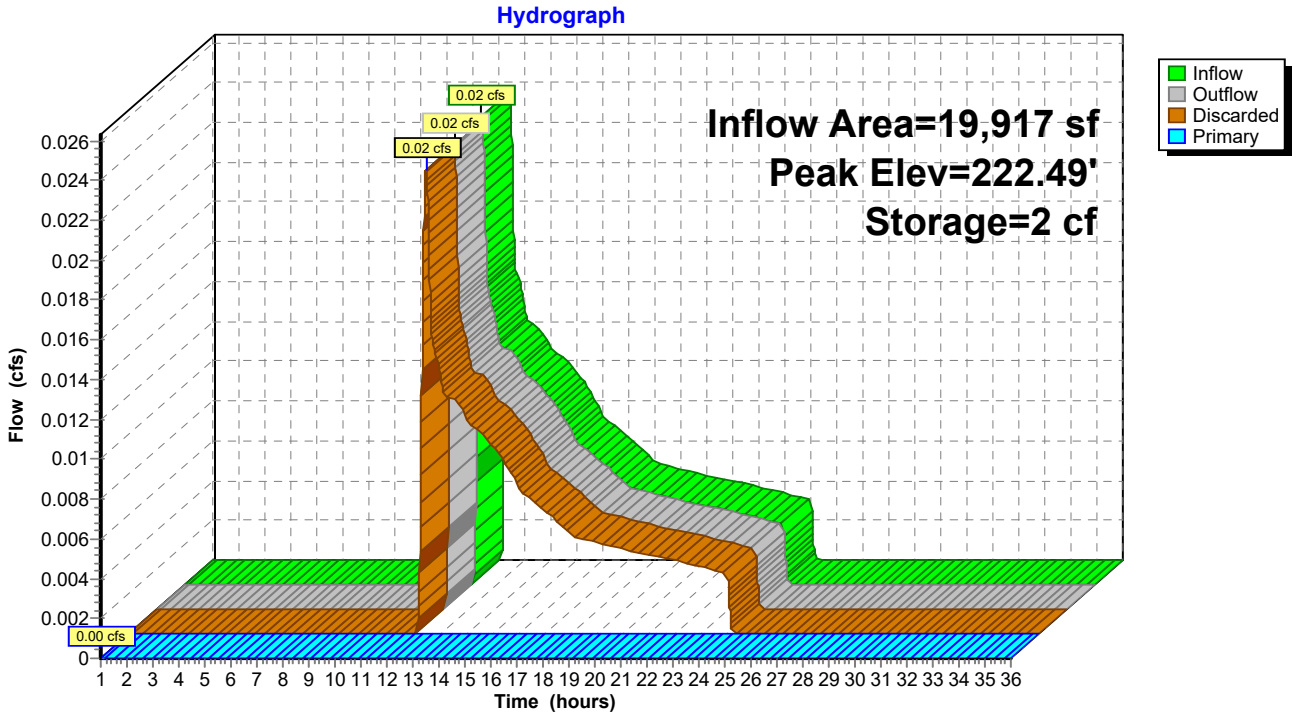
Pond IT-1: IT-1


Hydrograph
Inflow Area=19,917 sf
Peak Elev=222.49'
Storage=2 cf
Inflow
Outflow
Discarded
Primary
0.02 cfs
0.02 cfs
0.02 cfs
0.00 cfs
Flow (cfs)
0.026
0.024
0.022
0.02
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Time (hours)

Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=272,685 sf 0.01% Impervious Runoff Depth=0.15"
Flow Length=116' Tc=13.8 min CN=38 Runoff=0.13 cfs 3,511 cf

SubcatchmentA2: SUB-A2 Runoff Area=71,036 sf 3.73% Impervious Runoff Depth=0.47"
Flow Length=840' Tc=15.9 min CN=46 Runoff=0.32 cfs 2,756 cf

SubcatchmentA3: SUB-A3 Runoff Area=19,917 sf 22.48% Impervious Runoff Depth=0.77"
Tc=6.0 min UI Adjusted CN=52 Runoff=0.29 cfs 1,282 cf

Pond A: POI-A Inflow=0.13 cfs 3,511 cf
Primary=0.13 cfs 3,511 cf

Pond IB-1: IB-1 Peak Elev=229.24' Storage=439 cf Inflow=0.32 cfs 2,756 cf
Discarded=0.10 cfs 2,756 cf Primary=0.00 cfs 0 cf Outflow=0.10 cfs 2,756 cf

Pond IT-1: IT-1 Peak Elev=223.33' Storage=305 cf Inflow=0.29 cfs 1,282 cf
Discarded=0.05 cfs 1,282 cf Primary=0.00 cfs 0 cf Outflow=0.05 cfs 1,282 cf

Total Runoff Area = 363,638 sf Runoff Volume = 7,549 cf Average Runoff Depth = 0.25"
98.03% Pervious = 356,471 sf 1.97% Impervious = 7,167 sf

Summary for Subcatchment A1: SUB-A1

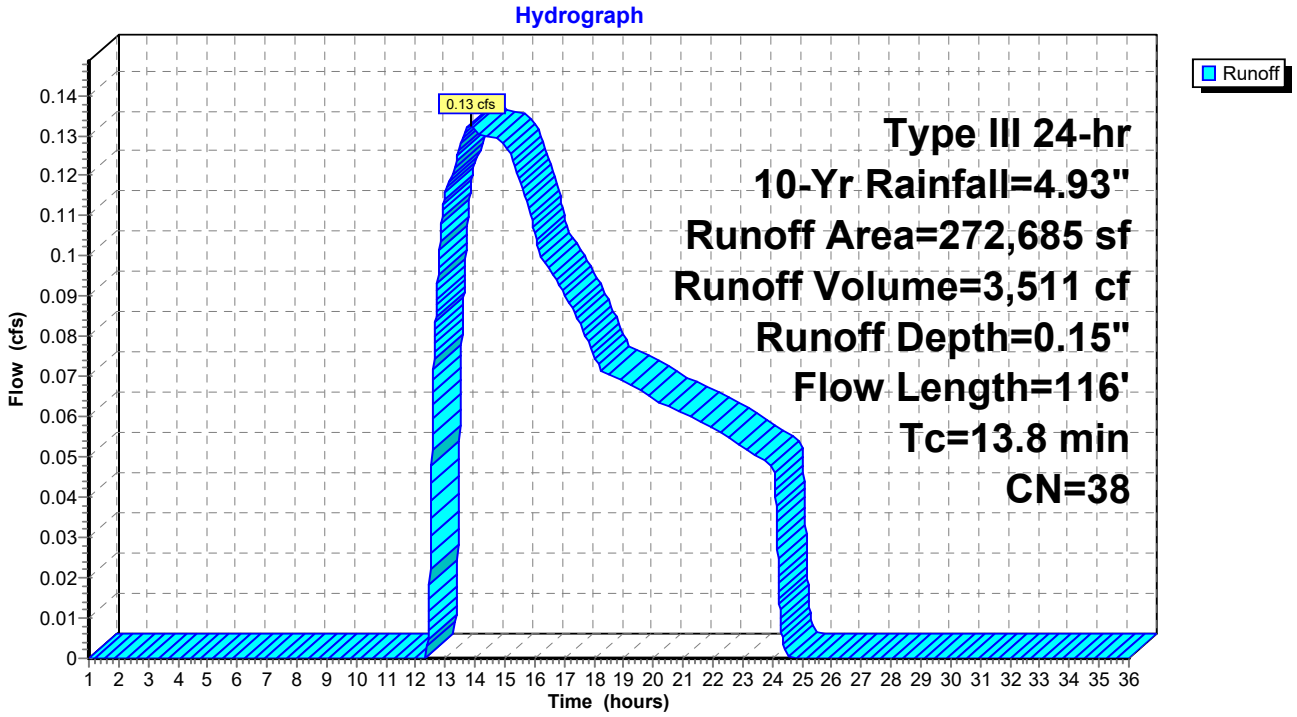
Runoff = 0.13 cfs @ 13.85 hrs, Volume= 3,511 cf, Depth= 0.15"
Routed to Pond A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.93"

	Area (sf)	CN	Description
	160,924	30	Woods, Good, HSG A
	78,748	55	Woods, Good, HSG B
	32,321	39	>75% Grass cover, Good, HSG A
*	289	76	Rip-rap, HSG A
*	367	77	Bare soil, HSG A
*	36	98	Unconnected impervious, HSG A
	272,685	38	Weighted Average
	272,649		99.99% Pervious Area
	36		0.01% Impervious Area
	36		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	50	0.0175	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
0.9	42	0.0240	0.77		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	24	0.3400	2.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.8	116	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

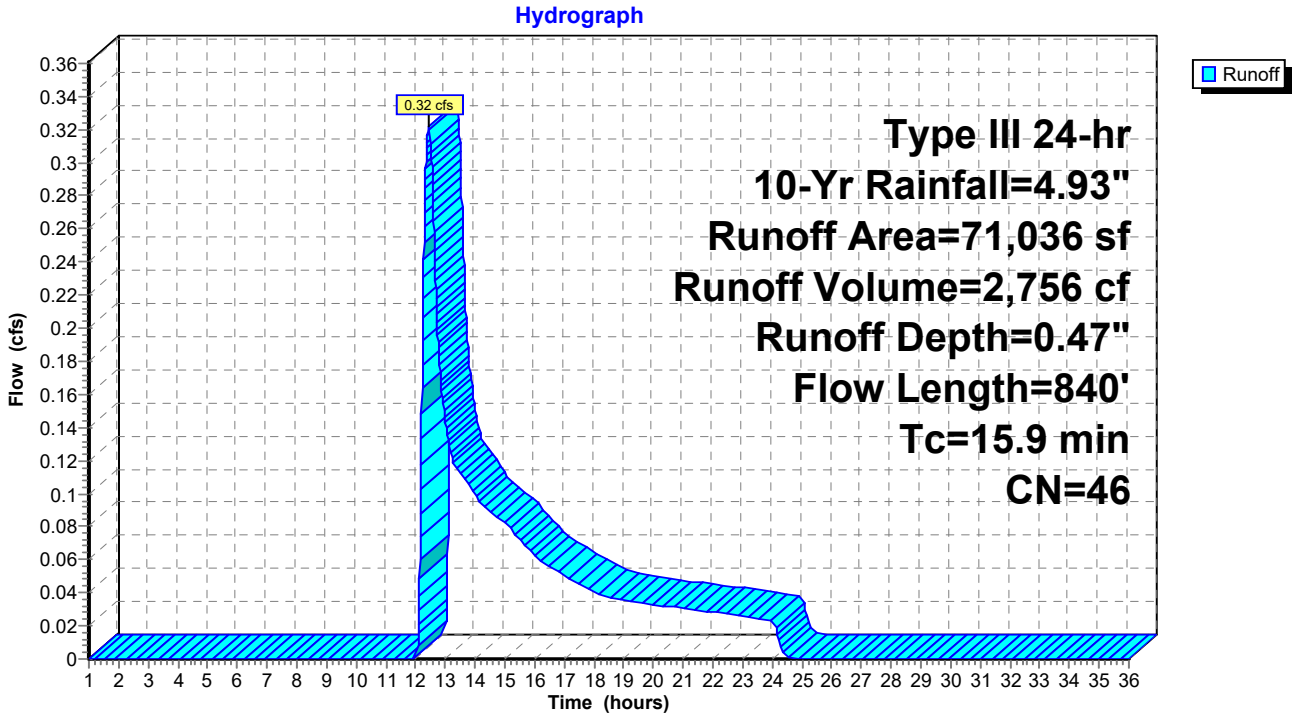
Runoff = 0.32 cfs @ 12.45 hrs, Volume= 2,756 cf, Depth= 0.47"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.93"

	Area (sf)	CN	Description
	48,567	39	>75% Grass cover, Good, HSG A
*	11,455	76	Gravel driveway, HSG A
	7,961	30	Woods, Good, HSG A
*	2,653	98	Paved driveway, HSG A
*	400	76	Rip-rap / Crushed stone, HSG A
	71,036	46	Weighted Average
	68,383		96.27% Pervious Area
	2,653		3.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	45	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
10.8	795	0.0050	1.23	1.23	**Channel Flow,** Area= 1.0 sf Perim= 4.8' r= 0.21' n= 0.030 Earth, grassed & winding
15.9	840	Total			

Subcatchment A2: SUB-A2



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Summary for Subcatchment A3: SUB-A3

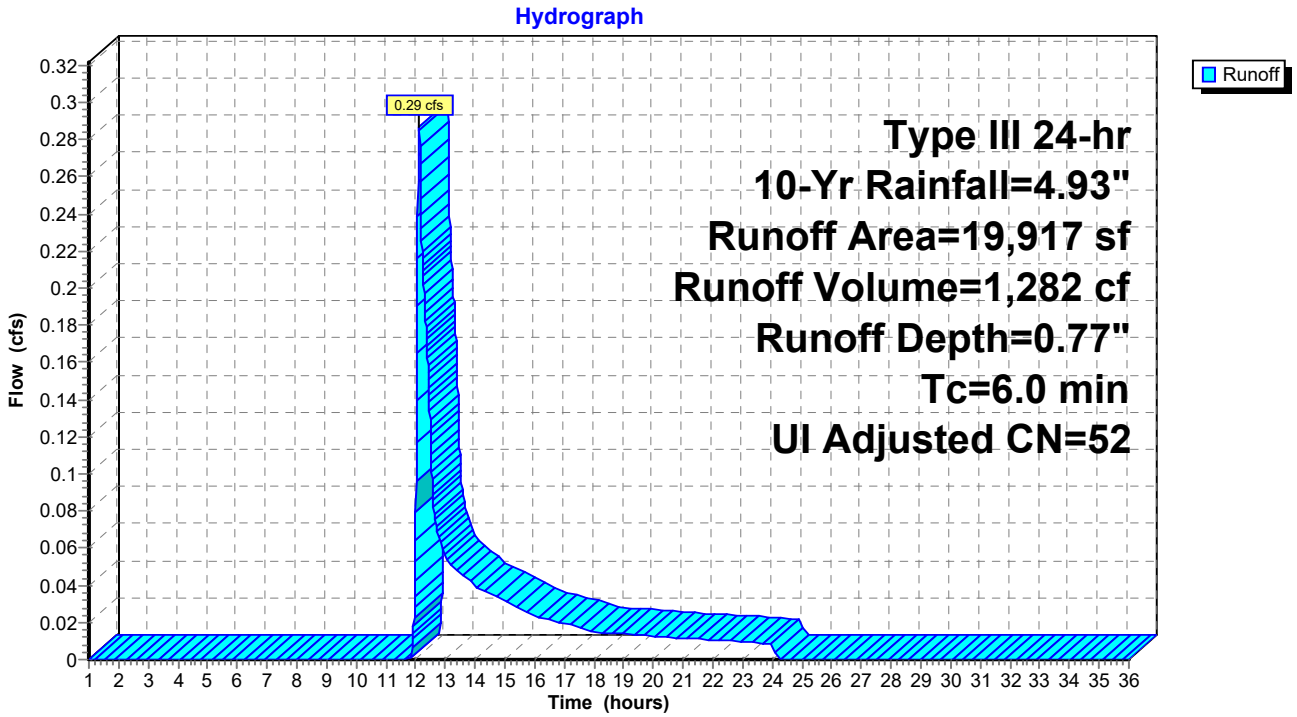
Runoff = 0.29 cfs @ 12.12 hrs, Volume= 1,282 cf, Depth= 0.77"
Routed to Pond IT-1 : IT-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.93"

	Area (sf)	CN	Adj	Description
	6,564	30		Woods, Good, HSG A
	6,940	39		>75% Grass cover, Good, HSG A
*	3,855	98		Paved driveway, HSG A
*	1,935	76		Rip-rap / Crushed stone, HSG A
*	383	98		Unconnected impervious, HSG A
	240	98		Roofs, HSG A
	19,917	53	52	Weighted Average, UI Adjusted
	15,439			77.52% Pervious Area
	4,478			22.48% Impervious Area
	383			8.55% Unconnected

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

Subcatchment A3: SUB-A3



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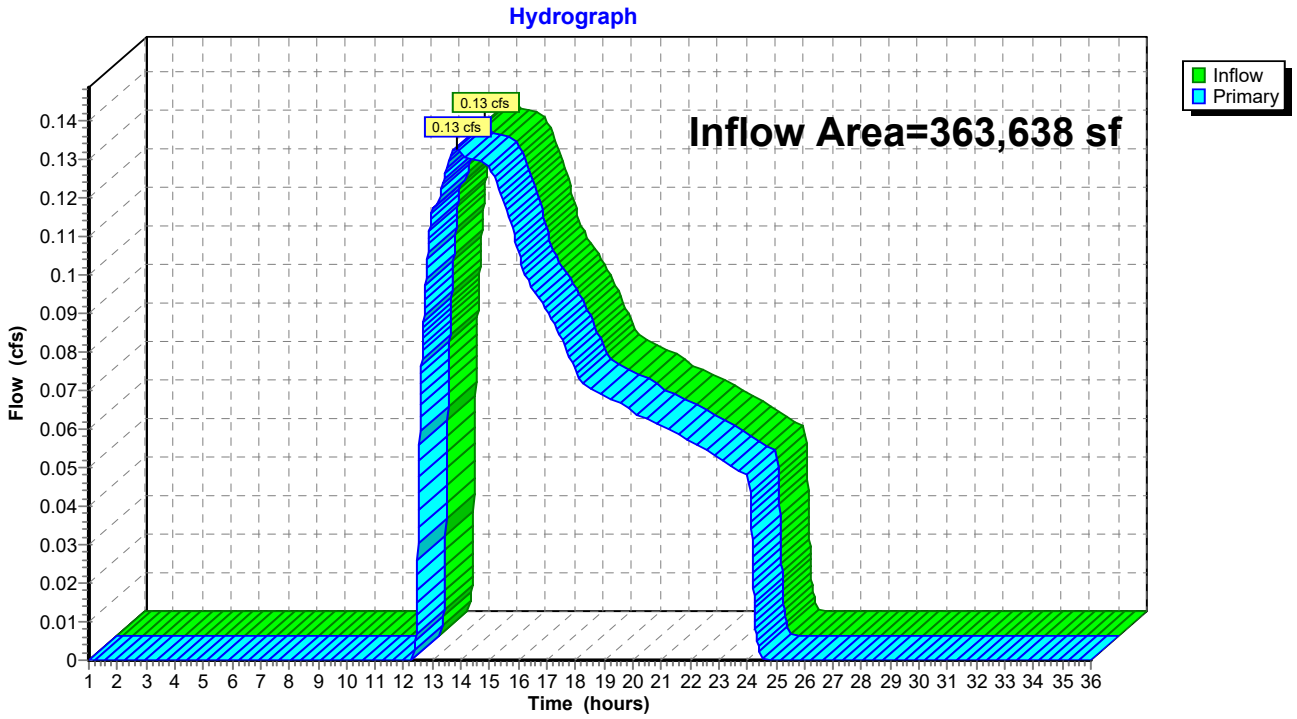
Summary for Pond A: POI-A

Inflow Area = 363,638 sf, 1.97% Impervious, Inflow Depth = 0.12" for 10-Yr event
Inflow = 0.13 cfs @ 13.85 hrs, Volume= 3,511 cf
Primary = 0.13 cfs @ 13.85 hrs, Volume= 3,511 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2

Pond A: POI-A



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Summary for Pond IB-1: IB-1

Inflow Area = 71,036 sf, 3.73% Impervious, Inflow Depth = 0.47" for 10-Yr event
Inflow = 0.32 cfs @ 12.45 hrs, Volume= 2,756 cf
Outflow = 0.10 cfs @ 13.81 hrs, Volume= 2,756 cf, Atten= 67%, Lag= 81.5 min
Discarded = 0.10 cfs @ 13.81 hrs, Volume= 2,756 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf
Routed to Pond A : POI-A

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 229.24' @ 13.81 hrs Surf.Area= 1,880 sf Storage= 439 cf

Plug-Flow detention time= 35.9 min calculated for 2,755 cf (100% of inflow)
Center-of-Mass det. time= 35.9 min (986.6 - 950.7)

Volume	Invert	Avail.Storage	Storage Description
#1	229.00'	12,733 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
229.00	1,710	0	0
230.00	2,407	2,059	2,059
231.00	3,141	2,774	4,833
232.00	3,935	3,538	8,371
233.00	4,789	4,362	12,733

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	231.90'	**20.0' long x 6.0' 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) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.10 cfs @ 13.81 hrs HW=229.24' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=229.00' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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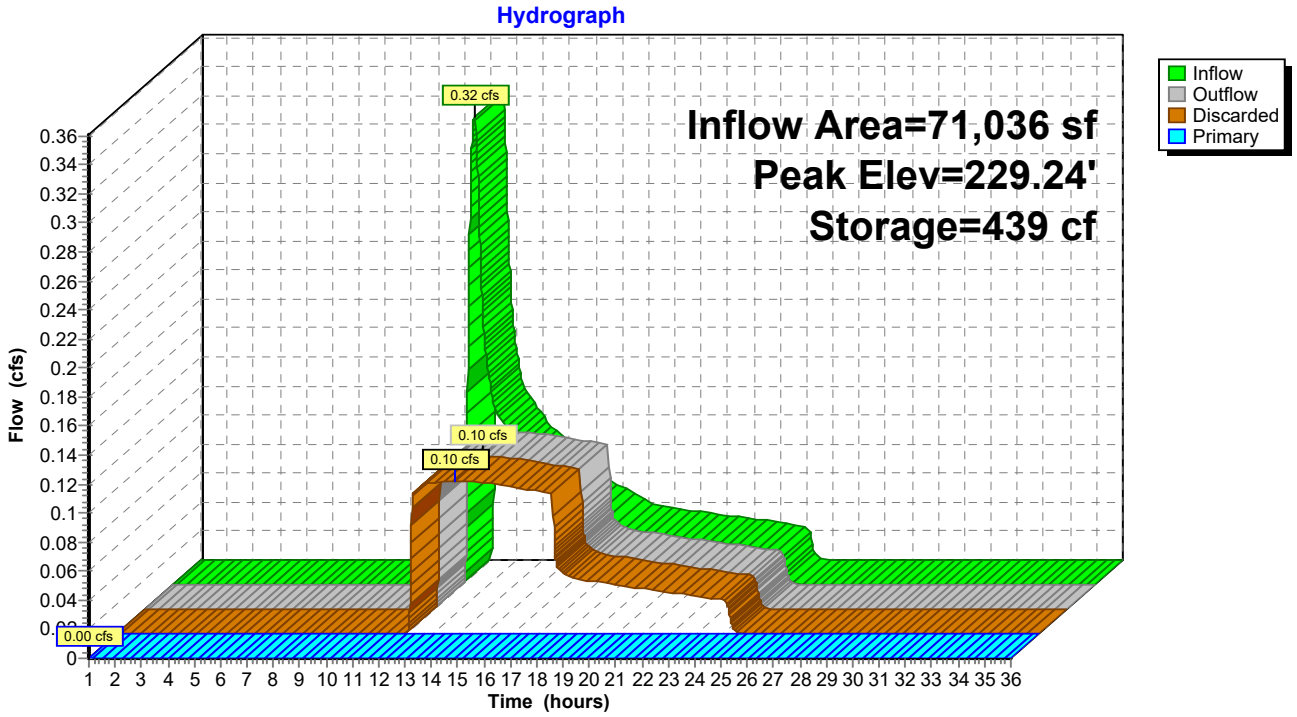
Pond IB-1: IB-1


Hydrograph
Inflow Area=71,036 sf
Peak Elev=229.24'
Storage=439 cf
Inflow
Outflow
Discarded
Primary
0.32 cfs
0.10 cfs
0.10 cfs
0.00 cfs
Flow (cfs)
Time (hours)

Summary for Pond IT-1: IT-1

Inflow Area = 19,917 sf, 22.48% Impervious, Inflow Depth = 0.77" for 10-Yr event
Inflow = 0.29 cfs @ 12.12 hrs, Volume= 1,282 cf
Outflow = 0.05 cfs @ 12.02 hrs, Volume= 1,282 cf, Atten= 82%, Lag= 0.0 min
Discarded = 0.05 cfs @ 12.02 hrs, Volume= 1,282 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf
Routed to Pond A : POI-A

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 223.33' @ 13.12 hrs Surf.Area= 912 sf Storage= 305 cf

Plug-Flow detention time= 50.8 min calculated for 1,282 cf (100% of inflow)
Center-of-Mass det. time= 50.8 min (957.6 - 906.8)

Volume	Invert	Avail.Storage	Storage Description
#1	222.49'	1,234 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
222.49	912	0.0	0	0
222.50	912	40.0	4	4
224.00	912	40.0	547	551
224.01	912	100.0	9	560
224.50	1,839	100.0	674	1,234

Device	Routing	Invert	Outlet Devices
#1	Discarded	222.49'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	224.14'	**42.0' long x 16.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.05 cfs @ 12.02 hrs HW=222.51' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=222.49' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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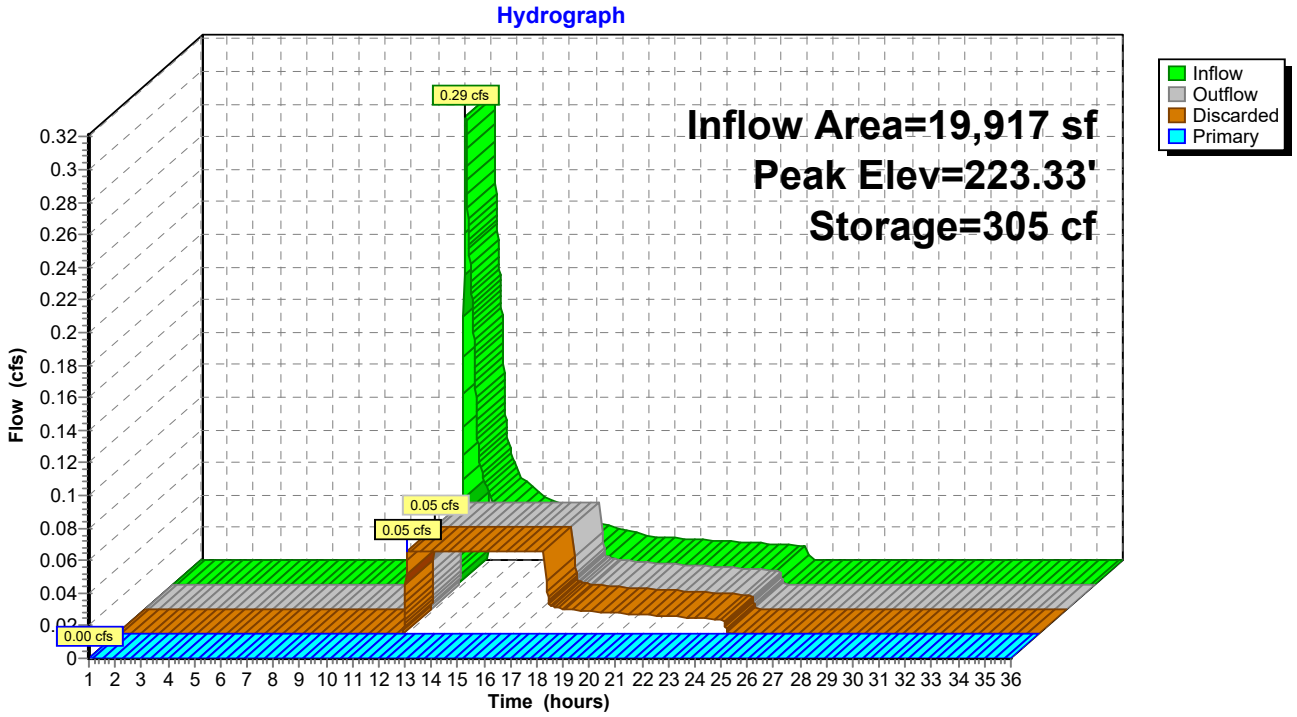
Pond IT-1: IT-1


Hydrograph
Inflow Area=19,917 sf
Peak Elev=223.33'
Storage=305 cf
Inflow
Outflow
Discarded
Primary
0.29 cfs
0.05 cfs
0.05 cfs
0.00 cfs
Flow (cfs)
Time (hours)

Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=272,685 sf 0.01% Impervious Runoff Depth=0.40"
Flow Length=116' Tc=13.8 min CN=38 Runoff=0.81 cfs 8,994 cf

SubcatchmentA2: SUB-A2 Runoff Area=71,036 sf 3.73% Impervious Runoff Depth=0.87"
Flow Length=840' Tc=15.9 min CN=46 Runoff=0.81 cfs 5,155 cf

SubcatchmentA3: SUB-A3 Runoff Area=19,917 sf 22.48% Impervious Runoff Depth=1.29"
Tc=6.0 min UI Adjusted CN=52 Runoff=0.58 cfs 2,148 cf

Pond A: POI-A Inflow=0.81 cfs 9,041 cf
Primary=0.81 cfs 9,041 cf

Pond IB-1: IB-1 Peak Elev=229.87' Storage=1,750 cf Inflow=0.81 cfs 5,155 cf
Discarded=0.13 cfs 5,155 cf Primary=0.00 cfs 0 cf Outflow=0.13 cfs 5,155 cf

Pond IT-1: IT-1 Peak Elev=224.14' Storage=699 cf Inflow=0.58 cfs 2,148 cf
Discarded=0.07 cfs 2,101 cf Primary=0.03 cfs 47 cf Outflow=0.09 cfs 2,148 cf

Total Runoff Area = 363,638 sf Runoff Volume = 16,297 cf Average Runoff Depth = 0.54"
98.03% Pervious = 356,471 sf 1.97% Impervious = 7,167 sf

Summary for Subcatchment A1: SUB-A1

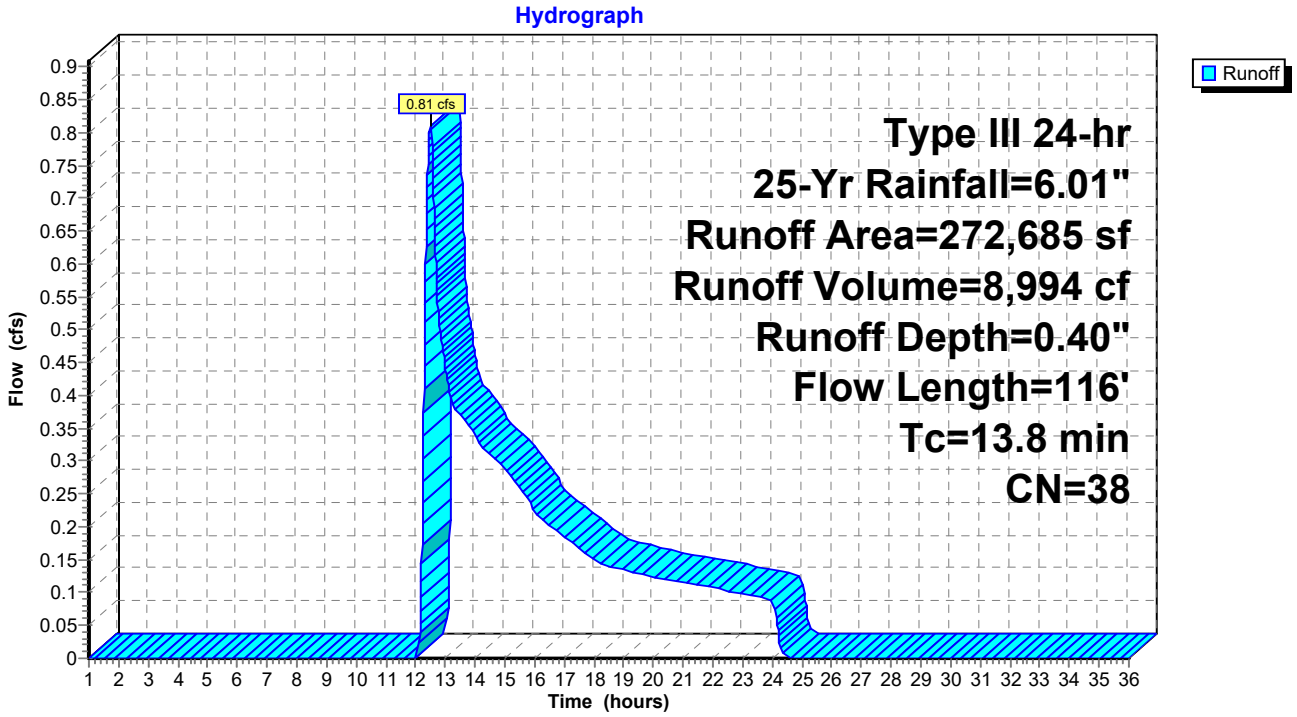
Runoff = 0.81 cfs @ 12.49 hrs, Volume= 8,994 cf, Depth= 0.40"
Routed to Pond A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.01"

	Area (sf)	CN	Description
	160,924	30	Woods, Good, HSG A
	78,748	55	Woods, Good, HSG B
	32,321	39	>75% Grass cover, Good, HSG A
*	289	76	Rip-rap, HSG A
*	367	77	Bare soil, HSG A
*	36	98	Unconnected impervious, HSG A
	272,685	38	Weighted Average
	272,649		99.99% Pervious Area
	36		0.01% Impervious Area
	36		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	50	0.0175	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
0.9	42	0.0240	0.77		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	24	0.3400	2.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.8	116	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

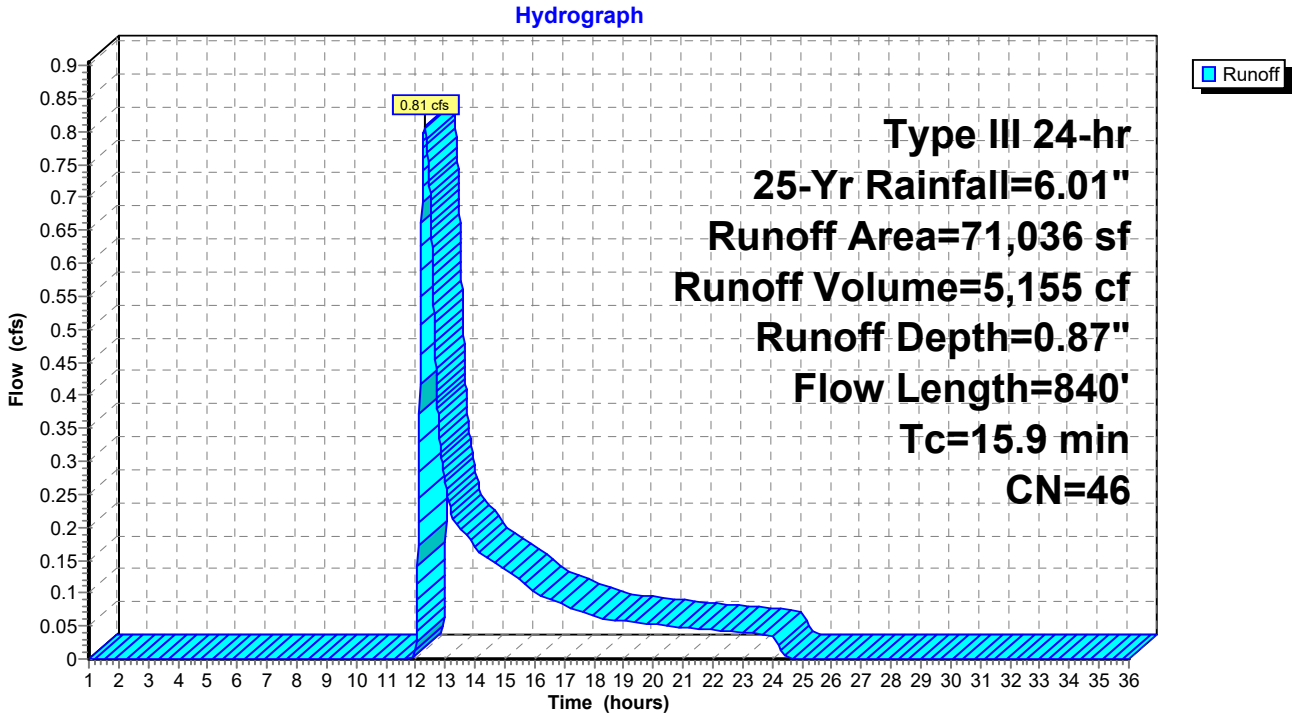
Runoff = 0.81 cfs @ 12.31 hrs, Volume= 5,155 cf, Depth= 0.87"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.01"

	Area (sf)	CN	Description
	48,567	39	>75% Grass cover, Good, HSG A
*	11,455	76	Gravel driveway, HSG A
	7,961	30	Woods, Good, HSG A
*	2,653	98	Paved driveway, HSG A
*	400	76	Rip-rap / Crushed stone, HSG A
	71,036	46	Weighted Average
	68,383		96.27% Pervious Area
	2,653		3.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	45	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
10.8	795	0.0050	1.23	1.23	**Channel Flow,** Area= 1.0 sf Perim= 4.8' r= 0.21' n= 0.030 Earth, grassed & winding
15.9	840	Total			

Subcatchment A2: SUB-A2



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Summary for Subcatchment A3: SUB-A3

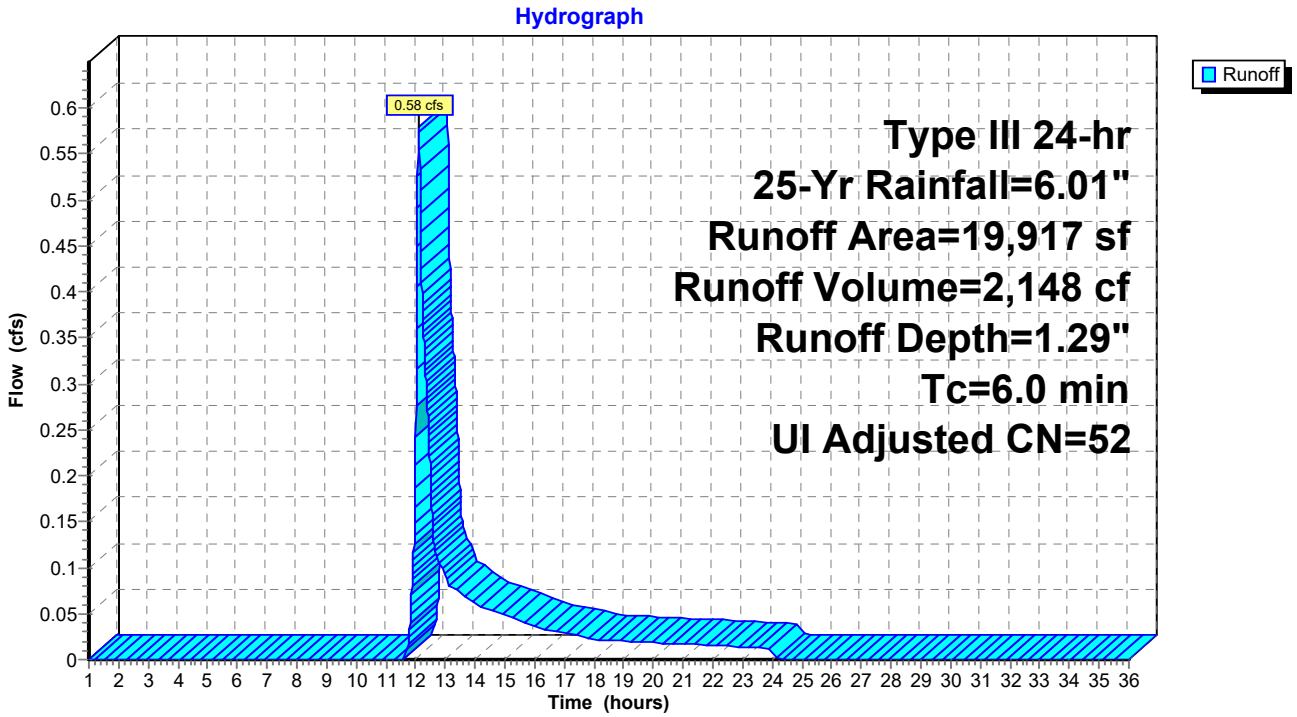
Runoff = 0.58 cfs @ 12.10 hrs, Volume= 2,148 cf, Depth= 1.29"
Routed to Pond IT-1 : IT-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.01"

	Area (sf)	CN	Adj	Description
	6,564	30		Woods, Good, HSG A
	6,940	39		>75% Grass cover, Good, HSG A
*	3,855	98		Paved driveway, HSG A
*	1,935	76		Rip-rap / Crushed stone, HSG A
*	383	98		Unconnected impervious, HSG A
	240	98		Roofs, HSG A
	19,917	53	52	Weighted Average, UI Adjusted
	15,439			77.52% Pervious Area
	4,478			22.48% Impervious Area
	383			8.55% Unconnected

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

Subcatchment A3: SUB-A3



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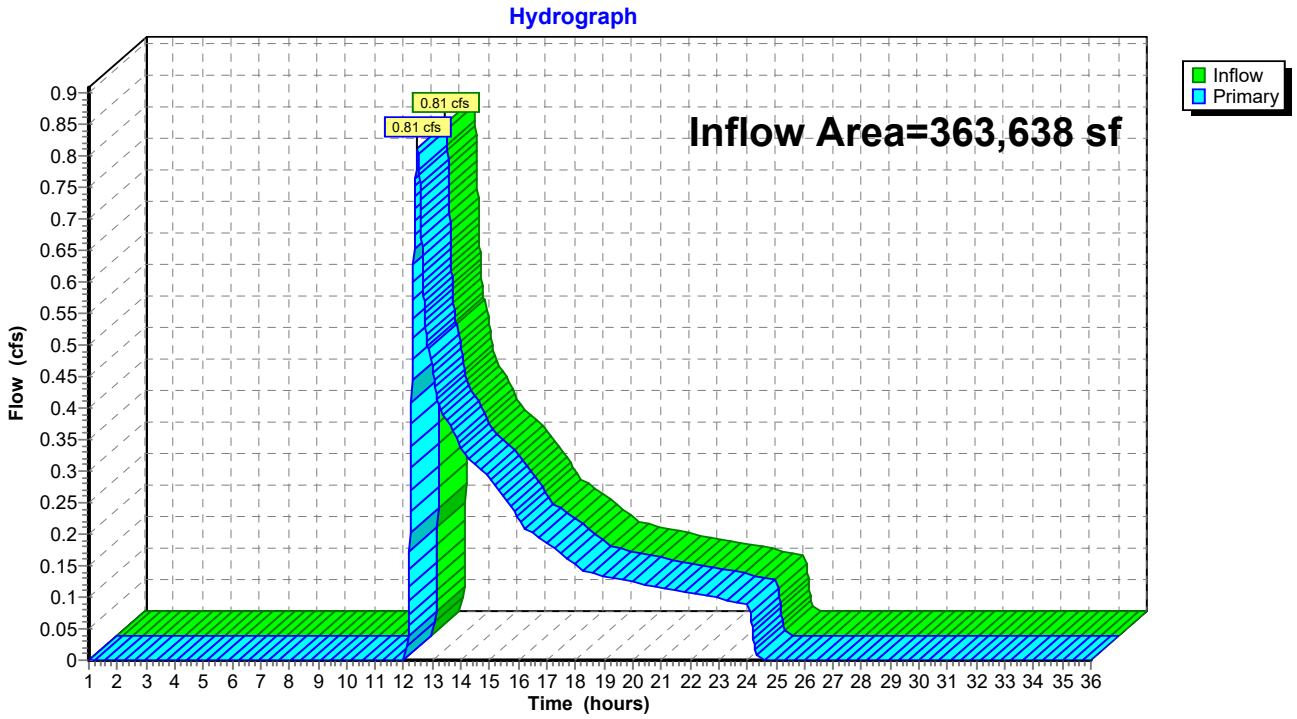
Summary for Pond A: POI-A

Inflow Area = 363,638 sf, 1.97% Impervious, Inflow Depth = 0.30" for 25-Yr event
Inflow = 0.81 cfs @ 12.49 hrs, Volume= 9,041 cf
Primary = 0.81 cfs @ 12.49 hrs, Volume= 9,041 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2

Pond A: POI-A



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Summary for Pond IB-1: IB-1

Inflow Area = 71,036 sf, 3.73% Impervious, Inflow Depth = 0.87" for 25-Yr event
Inflow = 0.81 cfs @ 12.31 hrs, Volume= 5,155 cf
Outflow = 0.13 cfs @ 15.22 hrs, Volume= 5,155 cf, Atten= 84%, Lag= 174.8 min
Discarded = 0.13 cfs @ 15.22 hrs, Volume= 5,155 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf
Routed to Pond A : POI-A

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 229.87' @ 15.22 hrs Surf.Area= 2,316 sf Storage= 1,750 cf

Plug-Flow detention time= 154.9 min calculated for 5,153 cf (100% of inflow)
Center-of-Mass det. time= 154.9 min (1,075.9 - 921.1)

Volume	Invert	Avail.Storage	Storage Description
#1	229.00'	12,733 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
229.00	1,710	0	0
230.00	2,407	2,059	2,059
231.00	3,141	2,774	4,833
232.00	3,935	3,538	8,371
233.00	4,789	4,362	12,733

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	231.90'	**20.0' long x 6.0' 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) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.13 cfs @ 15.22 hrs HW=229.87' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=229.00' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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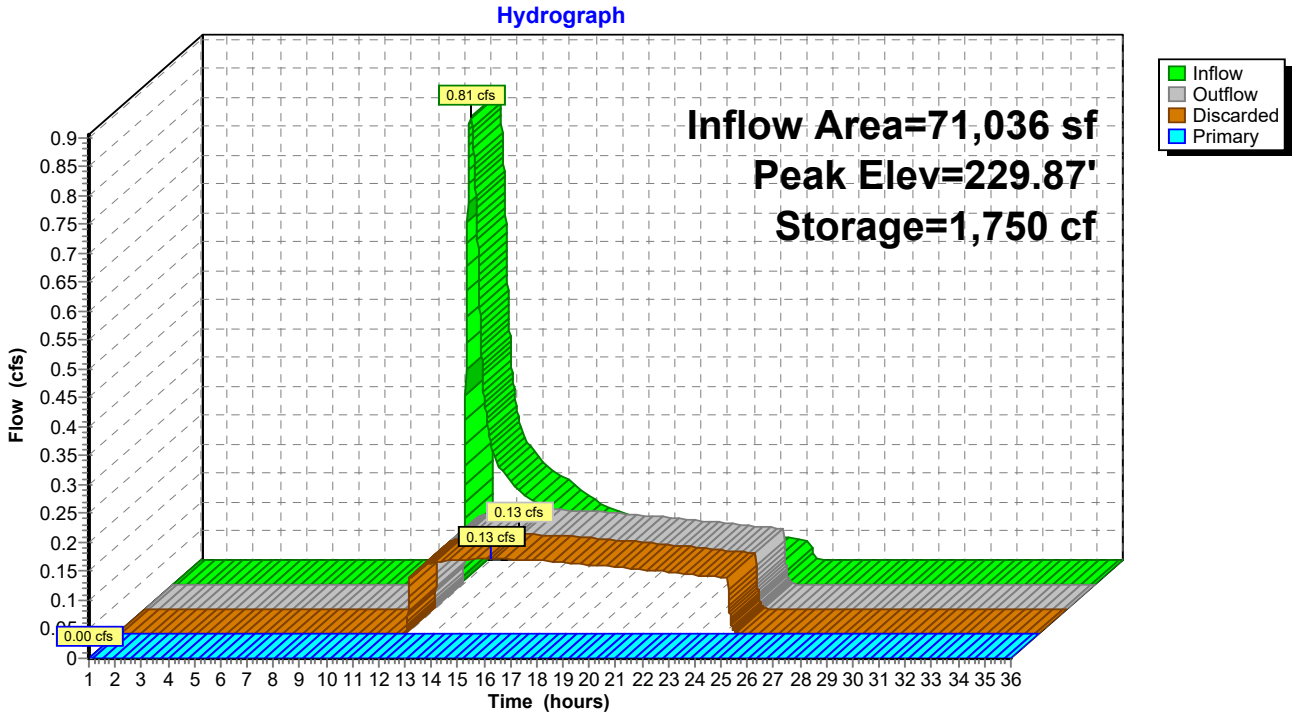
Pond IB-1: IB-1


Hydrograph
Inflow Area=71,036 sf
Peak Elev=229.87'
Storage=1,750 cf
Inflow
Outflow
Discarded
Primary
0.81 cfs
0.13 cfs
0.13 cfs
0.00 cfs
Flow (cfs)
Time (hours)

Summary for Pond IT-1: IT-1

Inflow Area = 19,917 sf, 22.48% Impervious, Inflow Depth = 1.29" for 25-Yr event
Inflow = 0.58 cfs @ 12.10 hrs, Volume= 2,148 cf
Outflow = 0.09 cfs @ 12.93 hrs, Volume= 2,148 cf, Atten= 84%, Lag= 49.7 min
Discarded = 0.07 cfs @ 12.93 hrs, Volume= 2,101 cf
Primary = 0.03 cfs @ 12.93 hrs, Volume= 47 cf
Routed to Pond A : POI-A

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 224.14' @ 12.93 hrs Surf.Area= 1,166 sf Storage= 699 cf

Plug-Flow detention time= 124.1 min calculated for 2,148 cf (100% of inflow)
Center-of-Mass det. time= 124.1 min (1,011.0 - 886.9)

Volume	Invert	Avail.Storage	Storage Description
#1	222.49'	1,234 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

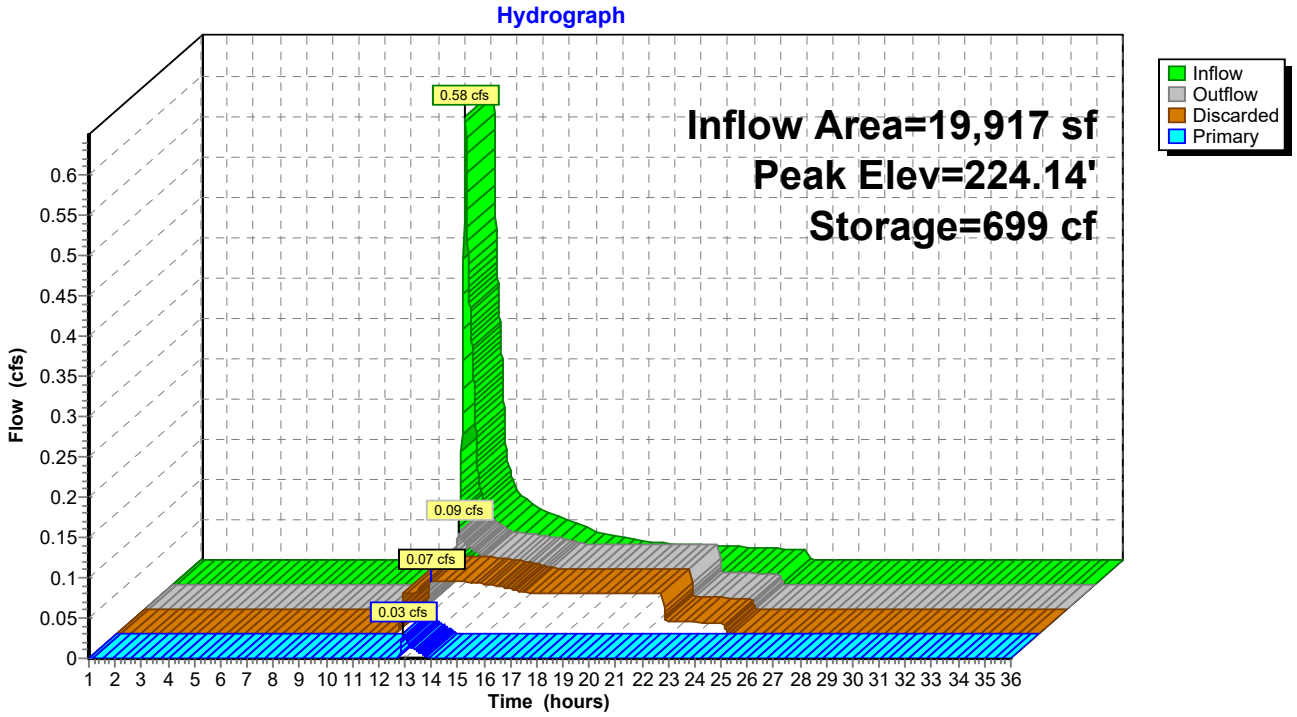
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
222.49	912	0.0	0	0
222.50	912	40.0	4	4
224.00	912	40.0	547	551
224.01	912	100.0	9	560
224.50	1,839	100.0	674	1,234

Device	Routing	Invert	Outlet Devices
#1	Discarded	222.49'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	224.14'	**42.0' long x 16.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.07 cfs @ 12.93 hrs HW=224.14' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.03 cfs @ 12.93 hrs HW=224.14' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.03 cfs @ 0.17 fps)

Pond IT-1: IT-1



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Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=272,685 sf 0.01% Impervious Runoff Depth=0.63"
Flow Length=116' Tc=13.8 min CN=38 Runoff=1.71 cfs 14,392 cf

SubcatchmentA2: SUB-A2 Runoff Area=71,036 sf 3.73% Impervious Runoff Depth=1.23"
Flow Length=840' Tc=15.9 min CN=46 Runoff=1.31 cfs 7,275 cf

SubcatchmentA3: SUB-A3 Runoff Area=19,917 sf 22.48% Impervious Runoff Depth=1.74"
Tc=6.0 min UI Adjusted CN=52 Runoff=0.83 cfs 2,881 cf

Pond A: POI-A Inflow=2.01 cfs 14,901 cf
Primary=2.01 cfs 14,901 cf

Pond IB-1: IB-1 Peak Elev=230.39' Storage=3,063 cf Inflow=1.31 cfs 7,275 cf
Discarded=0.15 cfs 7,275 cf Primary=0.00 cfs 0 cf Outflow=0.15 cfs 7,275 cf

Pond IT-1: IT-1 Peak Elev=224.16' Storage=719 cf Inflow=0.83 cfs 2,881 cf
Discarded=0.07 cfs 2,372 cf Primary=0.35 cfs 509 cf Outflow=0.41 cfs 2,881 cf

Total Runoff Area = 363,638 sf Runoff Volume = 24,548 cf Average Runoff Depth = 0.81"
98.03% Pervious = 356,471 sf 1.97% Impervious = 7,167 sf

Summary for Subcatchment A1: SUB-A1

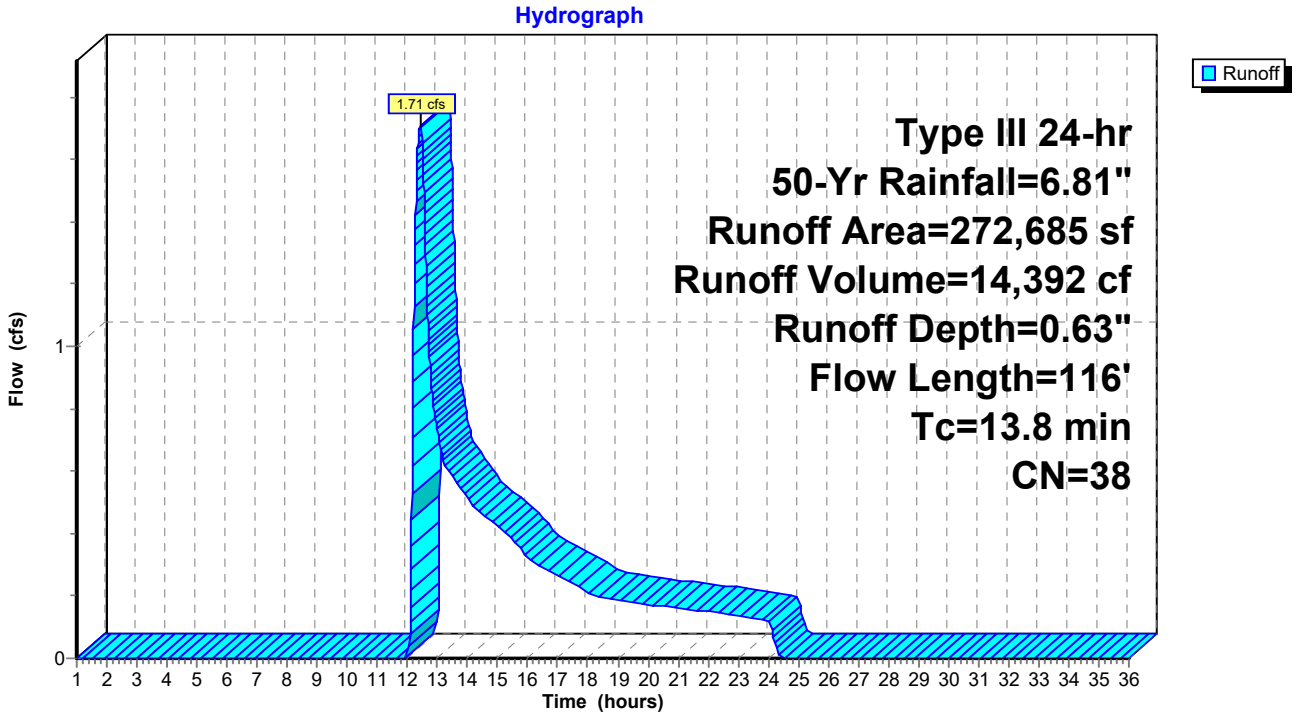
Runoff = 1.71 cfs @ 12.41 hrs, Volume= 14,392 cf, Depth= 0.63"
Routed to Pond A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Yr Rainfall=6.81"

	Area (sf)	CN	Description
	160,924	30	Woods, Good, HSG A
	78,748	55	Woods, Good, HSG B
	32,321	39	>75% Grass cover, Good, HSG A
*	289	76	Rip-rap, HSG A
*	367	77	Bare soil, HSG A
*	36	98	Unconnected impervious, HSG A
	272,685	38	Weighted Average
	272,649		99.99% Pervious Area
	36		0.01% Impervious Area
	36		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	50	0.0175	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
0.9	42	0.0240	0.77		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	24	0.3400	2.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.8	116	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

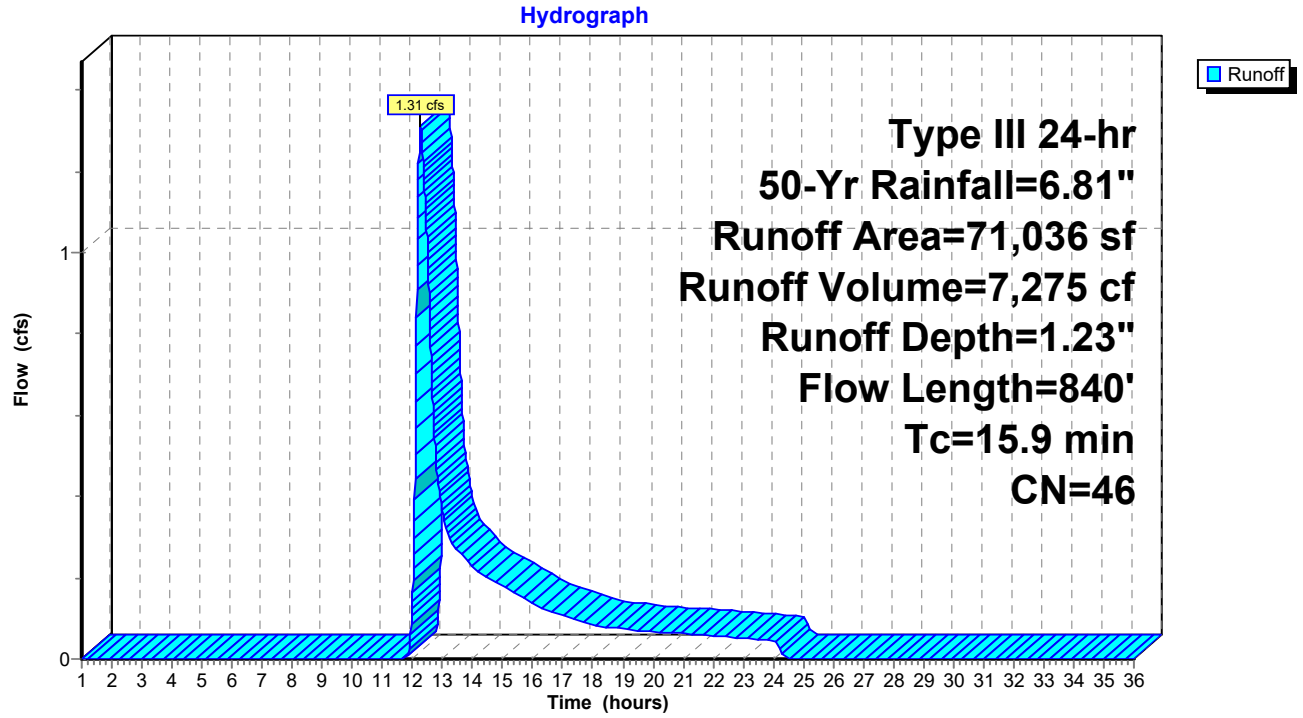
Runoff = 1.31 cfs @ 12.28 hrs, Volume= 7,275 cf, Depth= 1.23"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Yr Rainfall=6.81"

	Area (sf)	CN	Description
	48,567	39	>75% Grass cover, Good, HSG A
*	11,455	76	Gravel driveway, HSG A
	7,961	30	Woods, Good, HSG A
*	2,653	98	Paved driveway, HSG A
*	400	76	Rip-rap / Crushed stone, HSG A
	71,036	46	Weighted Average
	68,383		96.27% Pervious Area
	2,653		3.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	45	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
10.8	795	0.0050	1.23	1.23	**Channel Flow,** Area= 1.0 sf Perim= 4.8' r= 0.21' n= 0.030 Earth, grassed & winding
15.9	840	Total			

Subcatchment A2: SUB-A2



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Summary for Subcatchment A3: SUB-A3

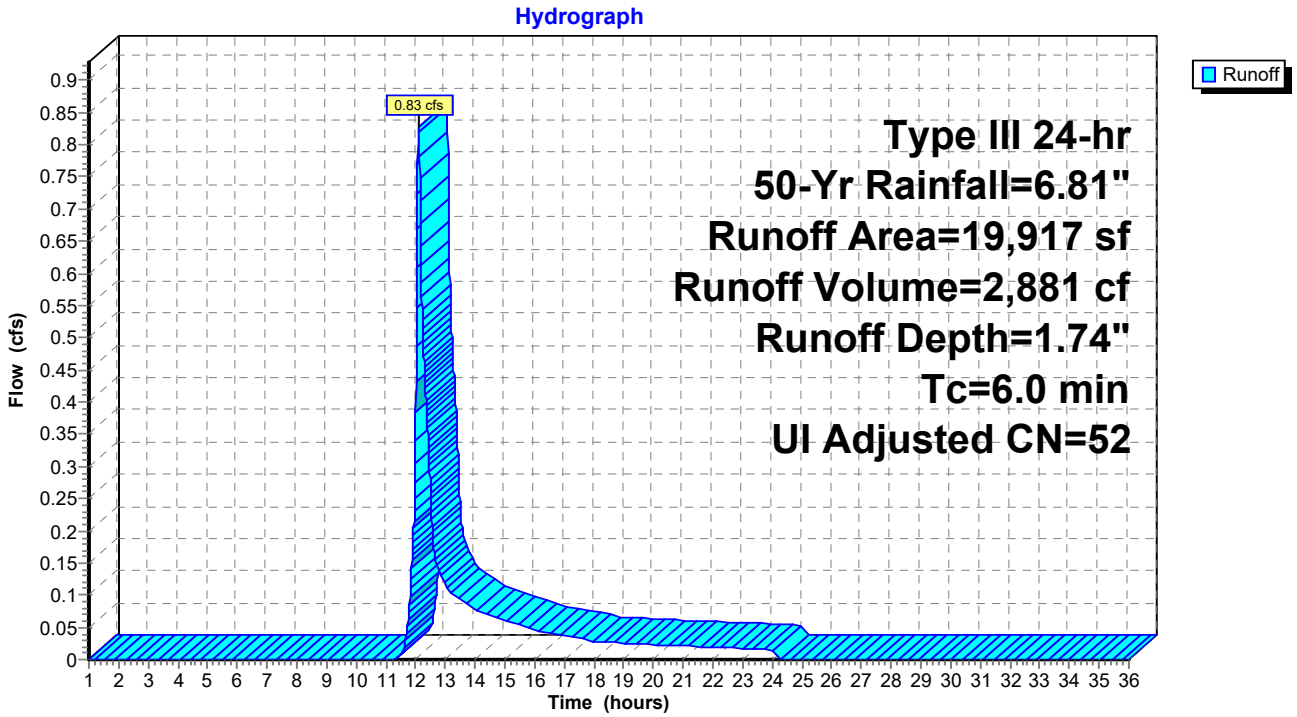
Runoff = 0.83 cfs @ 12.10 hrs, Volume= 2,881 cf, Depth= 1.74"
Routed to Pond IT-1 : IT-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Yr Rainfall=6.81"

	Area (sf)	CN	Adj	Description
	6,564	30		Woods, Good, HSG A
	6,940	39		>75% Grass cover, Good, HSG A
*	3,855	98		Paved driveway, HSG A
*	1,935	76		Rip-rap / Crushed stone, HSG A
*	383	98		Unconnected impervious, HSG A
	240	98		Roofs, HSG A
	19,917	53	52	Weighted Average, UI Adjusted
	15,439			77.52% Pervious Area
	4,478			22.48% Impervious Area
	383			8.55% Unconnected

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

Subcatchment A3: SUB-A3



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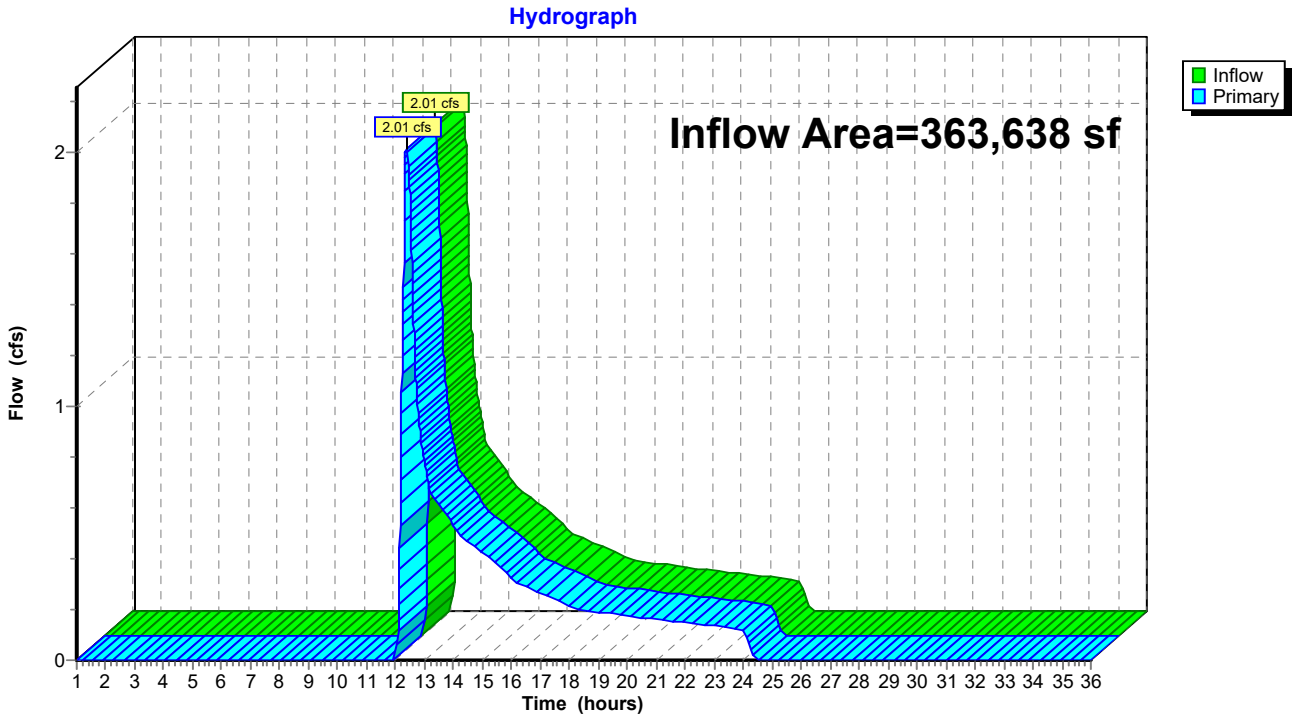
Summary for Pond A: POI-A

Inflow Area = 363,638 sf, 1.97% Impervious, Inflow Depth = 0.49" for 50-Yr event
Inflow = 2.01 cfs @ 12.38 hrs, Volume= 14,901 cf
Primary = 2.01 cfs @ 12.38 hrs, Volume= 14,901 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2

Pond A: POI-A



Summary for Pond IB-1: IB-1

Inflow Area = 71,036 sf, 3.73% Impervious, Inflow Depth = 1.23" for 50-Yr event
Inflow = 1.31 cfs @ 12.28 hrs, Volume= 7,275 cf
Outflow = 0.15 cfs @ 15.67 hrs, Volume= 7,275 cf, Atten= 89%, Lag= 203.8 min
Discarded = 0.15 cfs @ 15.67 hrs, Volume= 7,275 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf
Routed to Pond A : POI-A

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 230.39' @ 15.67 hrs Surf.Area= 2,696 sf Storage= 3,063 cf

Plug-Flow detention time= 246.9 min calculated for 7,273 cf (100% of inflow)
Center-of-Mass det. time= 246.9 min (1,153.9 - 907.0)

Volume	Invert	Avail.Storage	Storage Description
#1	229.00'	12,733 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
229.00	1,710	0	0
230.00	2,407	2,059	2,059
231.00	3,141	2,774	4,833
232.00	3,935	3,538	8,371
233.00	4,789	4,362	12,733

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	231.90'	**20.0' long x 6.0' 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) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.15 cfs @ 15.67 hrs HW=230.39' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=229.00' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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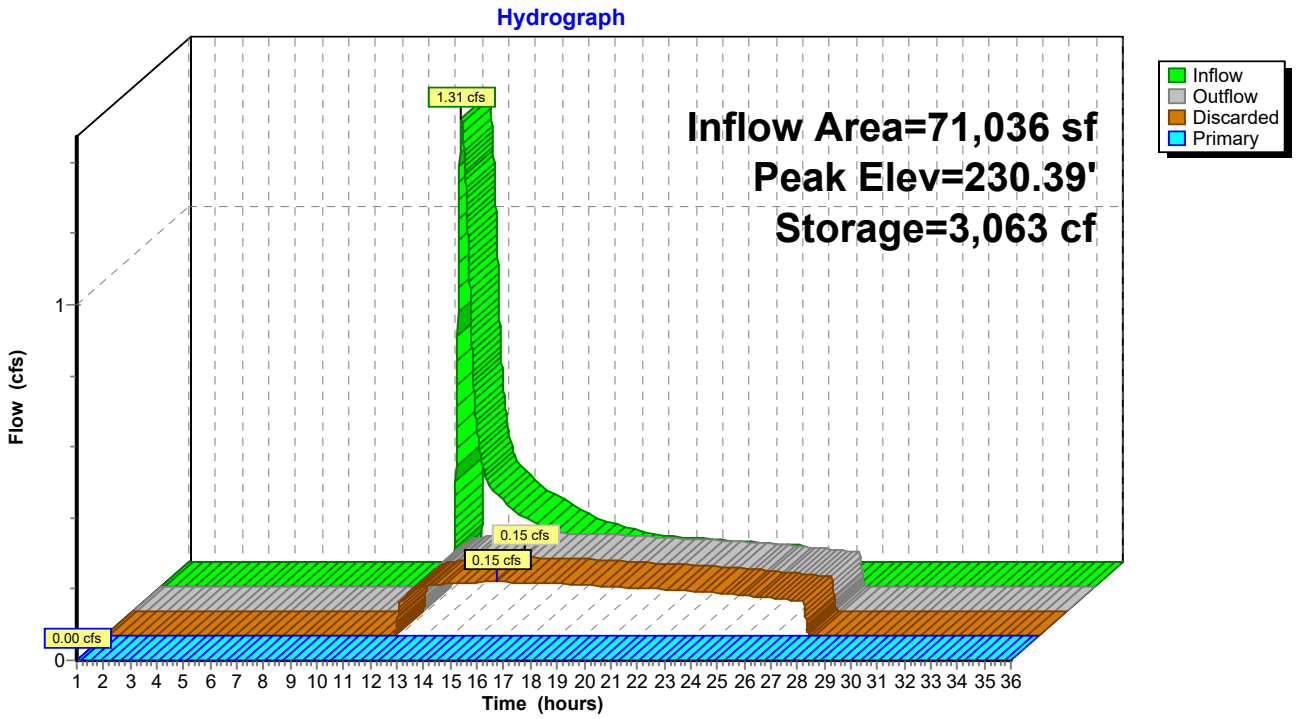
Pond IB-1: IB-1


Hydrograph
Inflow Area=71,036 sf
Peak Elev=230.39'
Storage=3,063 cf
Inflow
Outflow
Discarded
Primary
1.31 cfs
0.15 cfs
0.15 cfs
0.00 cfs
Flow (cfs)
0
1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Time (hours)

Summary for Pond IT-1: IT-1

Inflow Area = 19,917 sf, 22.48% Impervious, Inflow Depth = 1.74" for 50-Yr event
Inflow = 0.83 cfs @ 12.10 hrs, Volume= 2,881 cf
Outflow = 0.41 cfs @ 12.34 hrs, Volume= 2,881 cf, Atten= 50%, Lag= 14.4 min
Discarded = 0.07 cfs @ 12.34 hrs, Volume= 2,372 cf
Primary = 0.35 cfs @ 12.34 hrs, Volume= 509 cf
Routed to Pond A : POI-A

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 224.16' @ 12.34 hrs Surf.Area= 1,198 sf Storage= 719 cf

Plug-Flow detention time= 110.5 min calculated for 2,880 cf (100% of inflow)
Center-of-Mass det. time= 110.4 min (987.1 - 876.6)

Volume	Invert	Avail.Storage	Storage Description
#1	222.49'	1,234 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
222.49	912	0.0	0	0
222.50	912	40.0	4	4
224.00	912	40.0	547	551
224.01	912	100.0	9	560
224.50	1,839	100.0	674	1,234

Device	Routing	Invert	Outlet Devices
#1	Discarded	222.49'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	224.14'	**42.0' long x 16.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.07 cfs @ 12.34 hrs HW=224.16' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.35 cfs @ 12.34 hrs HW=224.16' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.35 cfs @ 0.39 fps)

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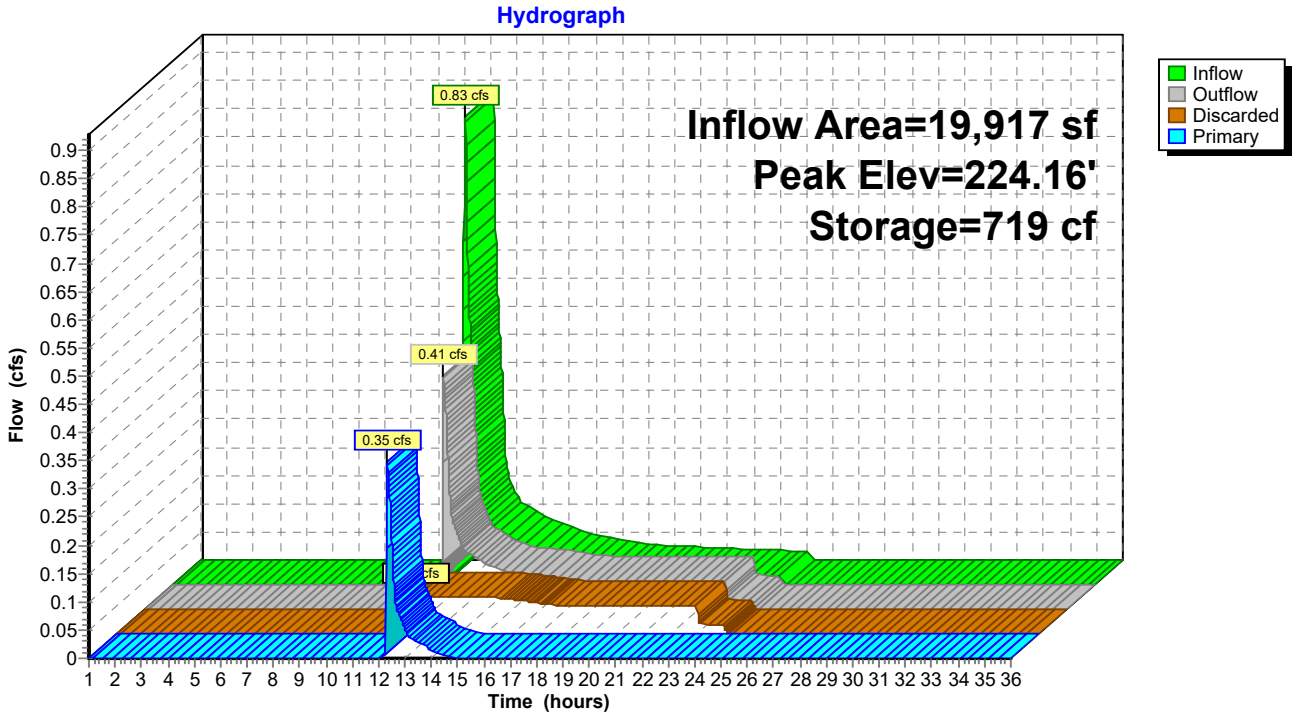
Pond IT-1: IT-1


Hydrograph
Inflow Area=19,917 sf
Peak Elev=224.16'
Storage=719 cf
0.83 cfs
0.41 cfs
0.35 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)

Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=272,685 sf 0.01% Impervious Runoff Depth=0.94"
Flow Length=116' Tc=13.8 min CN=38 Runoff=3.06 cfs 21,382 cf

SubcatchmentA2: SUB-A2 Runoff Area=71,036 sf 3.73% Impervious Runoff Depth=1.67"
Flow Length=840' Tc=15.9 min CN=46 Runoff=1.95 cfs 9,859 cf

SubcatchmentA3: SUB-A3 Runoff Area=19,917 sf 22.48% Impervious Runoff Depth=2.26"
Tc=6.0 min UI Adjusted CN=52 Runoff=1.12 cfs 3,750 cf

Pond A: POI-A Inflow=3.59 cfs 22,514 cf
Primary=3.59 cfs 22,514 cf

Pond IB-1: IB-1 Peak Elev=230.97' Storage=4,740 cf Inflow=1.95 cfs 9,859 cf
Discarded=0.17 cfs 9,859 cf Primary=0.00 cfs 0 cf Outflow=0.17 cfs 9,859 cf

Pond IT-1: IT-1 Peak Elev=224.17' Storage=735 cf Inflow=1.12 cfs 3,750 cf
Discarded=0.07 cfs 2,618 cf Primary=0.71 cfs 1,132 cf Outflow=0.78 cfs 3,750 cf

Total Runoff Area = 363,638 sf Runoff Volume = 34,991 cf Average Runoff Depth = 1.15"
98.03% Pervious = 356,471 sf 1.97% Impervious = 7,167 sf

Summary for Subcatchment A1: SUB-A1

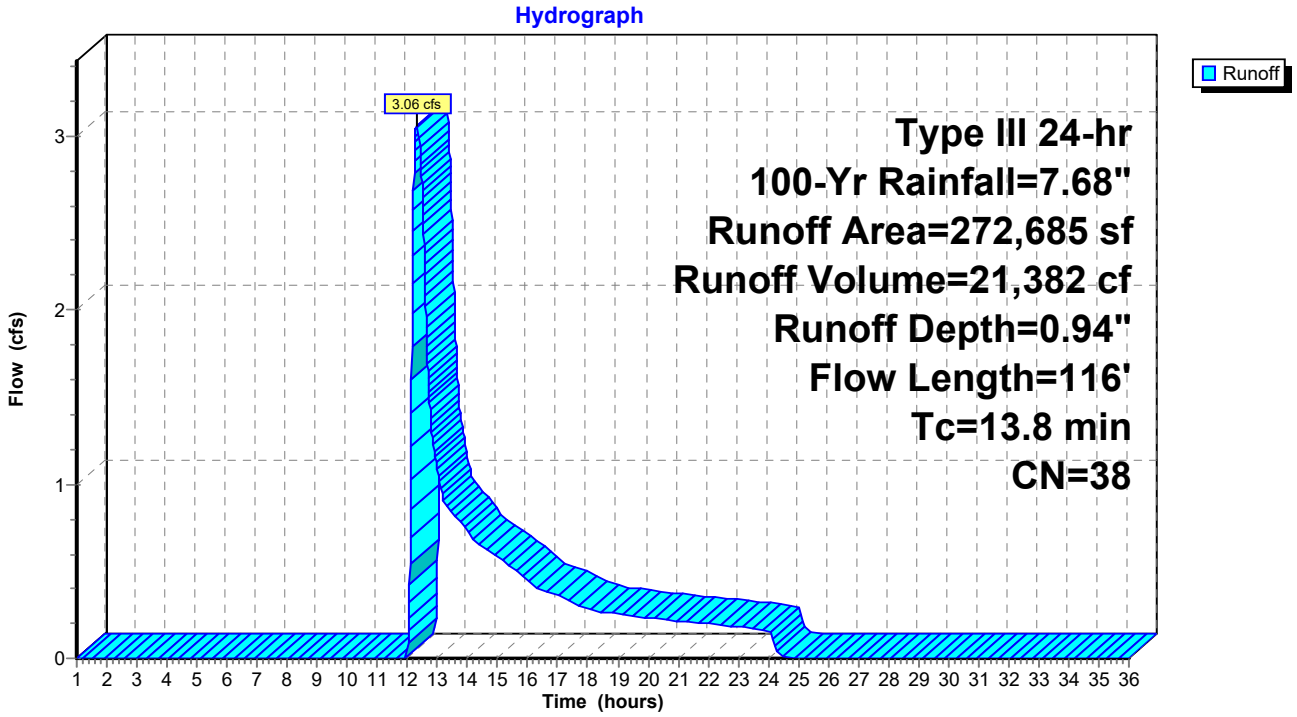
Runoff = 3.06 cfs @ 12.31 hrs, Volume= 21,382 cf, Depth= 0.94"
Routed to Pond A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=7.68"

	Area (sf)	CN	Description
	160,924	30	Woods, Good, HSG A
	78,748	55	Woods, Good, HSG B
	32,321	39	>75% Grass cover, Good, HSG A
*	289	76	Rip-rap, HSG A
*	367	77	Bare soil, HSG A
*	36	98	Unconnected impervious, HSG A
	272,685	38	Weighted Average
	272,649		99.99% Pervious Area
	36		0.01% Impervious Area
	36		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	50	0.0175	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
0.9	42	0.0240	0.77		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	24	0.3400	2.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.8	116	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

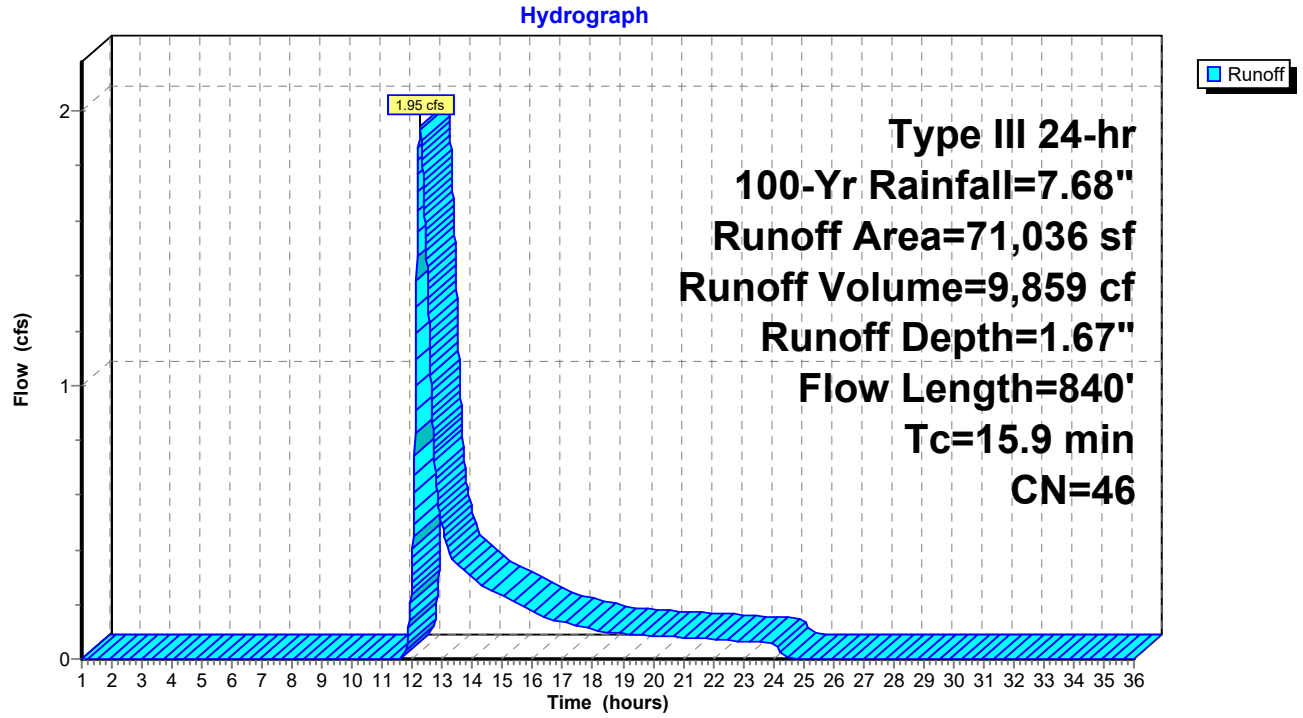
Runoff = 1.95 cfs @ 12.25 hrs, Volume= 9,859 cf, Depth= 1.67"
Routed to Pond IB-1 : IB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=7.68"

	Area (sf)	CN	Description
	48,567	39	>75% Grass cover, Good, HSG A
*	11,455	76	Gravel driveway, HSG A
	7,961	30	Woods, Good, HSG A
*	2,653	98	Paved driveway, HSG A
*	400	76	Rip-rap / Crushed stone, HSG A
	71,036	46	Weighted Average
	68,383		96.27% Pervious Area
	2,653		3.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	45	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
10.8	795	0.0050	1.23	1.23	**Channel Flow,** Area= 1.0 sf Perim= 4.8' r= 0.21' n= 0.030 Earth, grassed & winding
15.9	840	Total			

Subcatchment A2: SUB-A2



REVISED 12/14/23

Summary for Subcatchment A3: SUB-A3

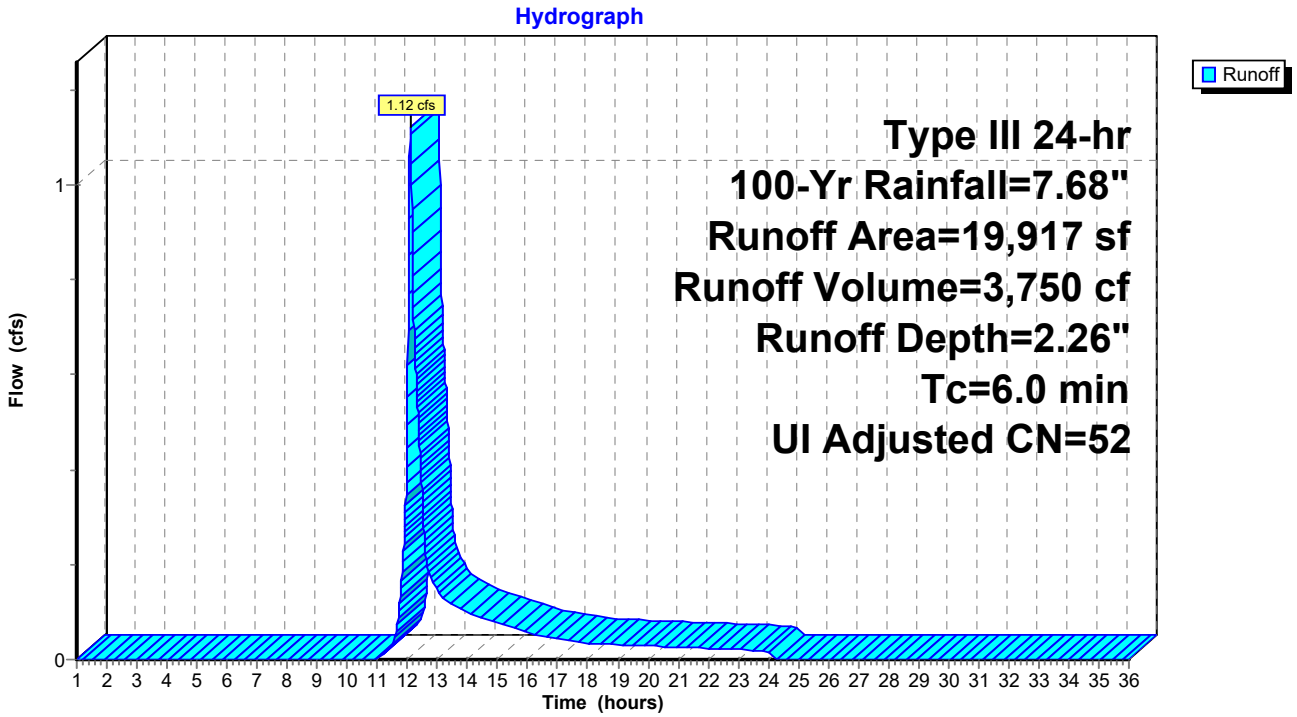
Runoff = 1.12 cfs @ 12.10 hrs, Volume= 3,750 cf, Depth= 2.26"
Routed to Pond IT-1 : IT-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=7.68"

	Area (sf)	CN	Adj	Description
	6,564	30		Woods, Good, HSG A
	6,940	39		>75% Grass cover, Good, HSG A
*	3,855	98		Paved driveway, HSG A
*	1,935	76		Rip-rap / Crushed stone, HSG A
*	383	98		Unconnected impervious, HSG A
	240	98		Roofs, HSG A
	19,917	53	52	Weighted Average, UI Adjusted
	15,439			77.52% Pervious Area
	4,478			22.48% Impervious Area
	383			8.55% Unconnected

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

Subcatchment A3: SUB-A3

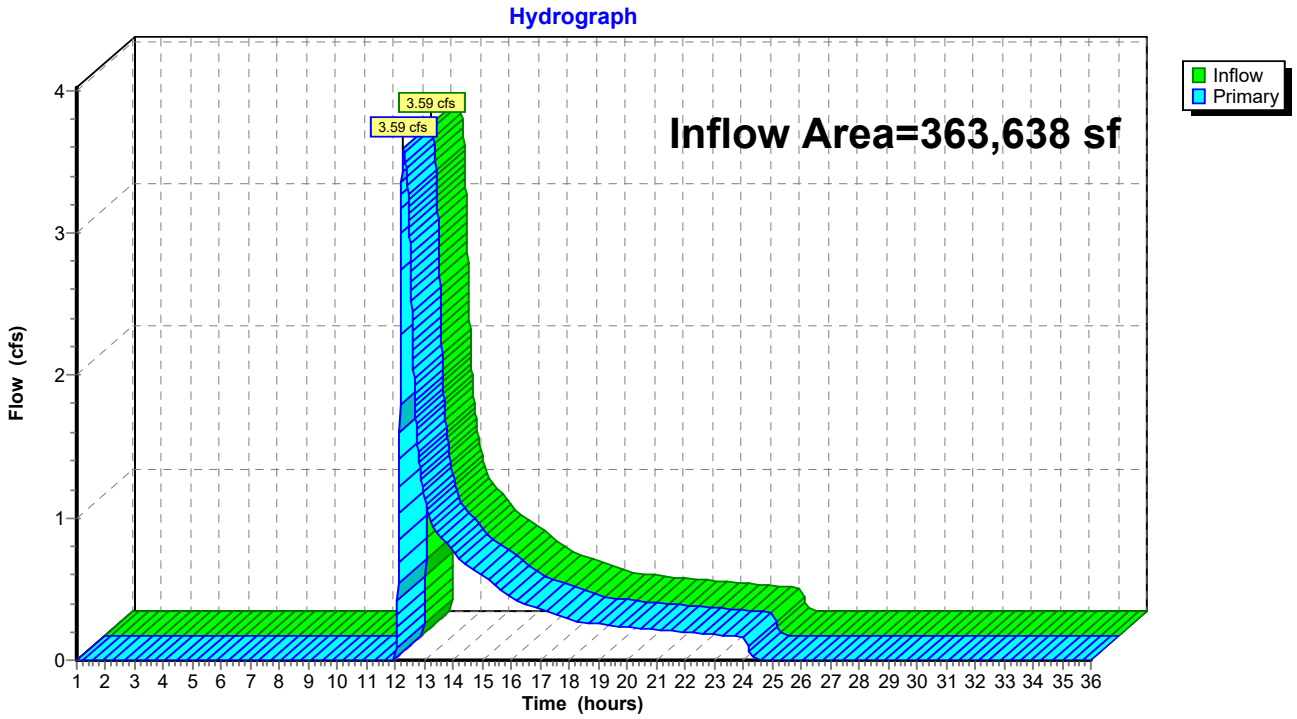


Summary for Pond A: POI-A

Inflow Area = 363,638 sf, 1.97% Impervious, Inflow Depth = 0.74" for 100-Yr event
Inflow = 3.59 cfs @ 12.28 hrs, Volume= 22,514 cf
Primary = 3.59 cfs @ 12.28 hrs, Volume= 22,514 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2

Pond A: POI-A



Summary for Pond IB-1: IB-1

Inflow Area = 71,036 sf, 3.73% Impervious, Inflow Depth = 1.67" for 100-Yr event
Inflow = 1.95 cfs @ 12.25 hrs, Volume= 9,859 cf
Outflow = 0.17 cfs @ 15.96 hrs, Volume= 9,859 cf, Atten= 91%, Lag= 222.4 min
Discarded = 0.17 cfs @ 15.96 hrs, Volume= 9,859 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf
Routed to Pond A : POI-A

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 230.97' @ 15.96 hrs Surf.Area= 3,119 sf Storage= 4,740 cf

Plug-Flow detention time= 334.9 min calculated for 9,856 cf (100% of inflow)
Center-of-Mass det. time= 334.9 min (1,230.5 - 895.6)

Volume	Invert	Avail.Storage	Storage Description
#1	229.00'	12,733 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

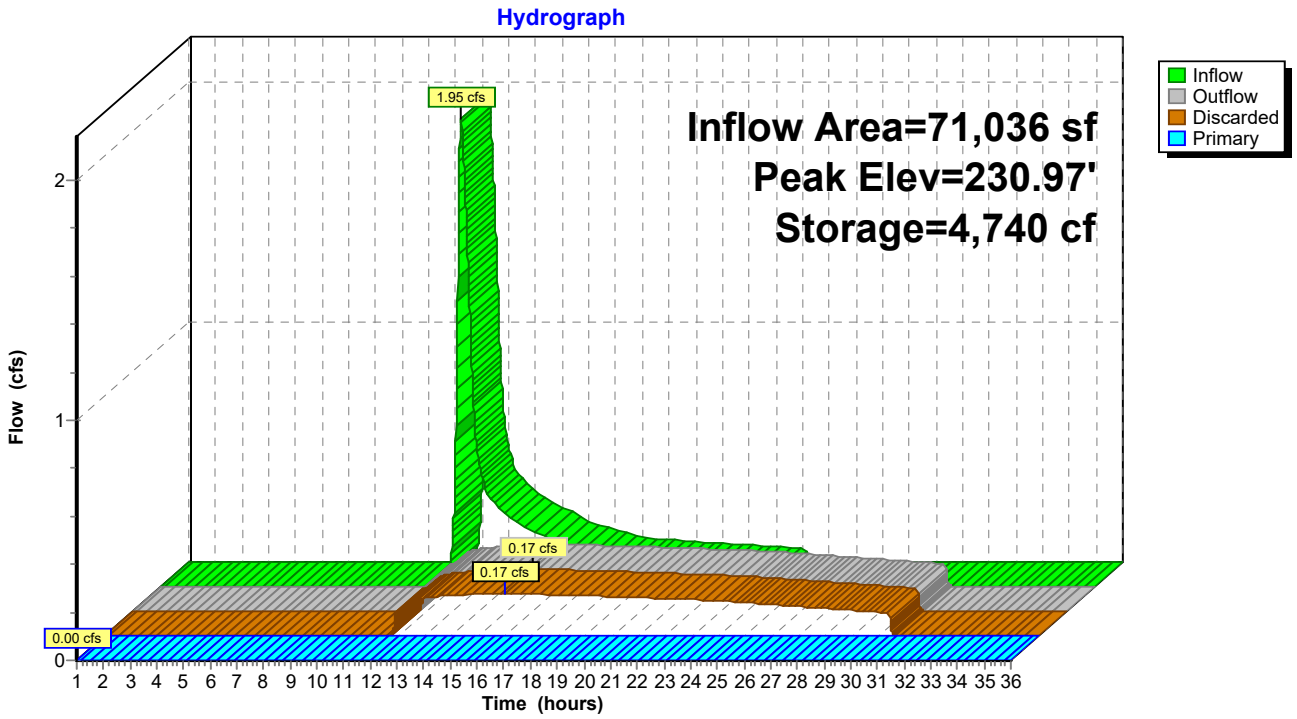
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
229.00	1,710	0	0
230.00	2,407	2,059	2,059
231.00	3,141	2,774	4,833
232.00	3,935	3,538	8,371
233.00	4,789	4,362	12,733

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	231.90'	**20.0' long x 6.0' 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) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.17 cfs @ 15.96 hrs HW=230.97' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=229.00' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond IB-1: IB-1


Hydrograph
Inflow
Outflow
Discarded
Primary
Inflow Area=71,036 sf
Peak Elev=230.97'
Storage=4,740 cf
1.95 cfs
0.17 cfs
0.17 cfs
0.00 cfs
Flow (cfs)
0
1
2
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Time (hours)

Summary for Pond IT-1: IT-1

Inflow Area = 19,917 sf, 22.48% Impervious, Inflow Depth = 2.26" for 100-Yr event
Inflow = 1.12 cfs @ 12.10 hrs, Volume= 3,750 cf
Outflow = 0.78 cfs @ 12.19 hrs, Volume= 3,750 cf, Atten= 30%, Lag= 5.6 min
Discarded = 0.07 cfs @ 12.19 hrs, Volume= 2,618 cf
Primary = 0.71 cfs @ 12.19 hrs, Volume= 1,132 cf
Routed to Pond A : POI-A

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 224.17' @ 12.19 hrs Surf.Area= 1,223 sf Storage= 735 cf

Plug-Flow detention time= 97.8 min calculated for 3,750 cf (100% of inflow)
Center-of-Mass det. time= 97.8 min (965.8 - 868.0)

Volume	Invert	Avail.Storage	Storage Description
#1	222.49'	1,234 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

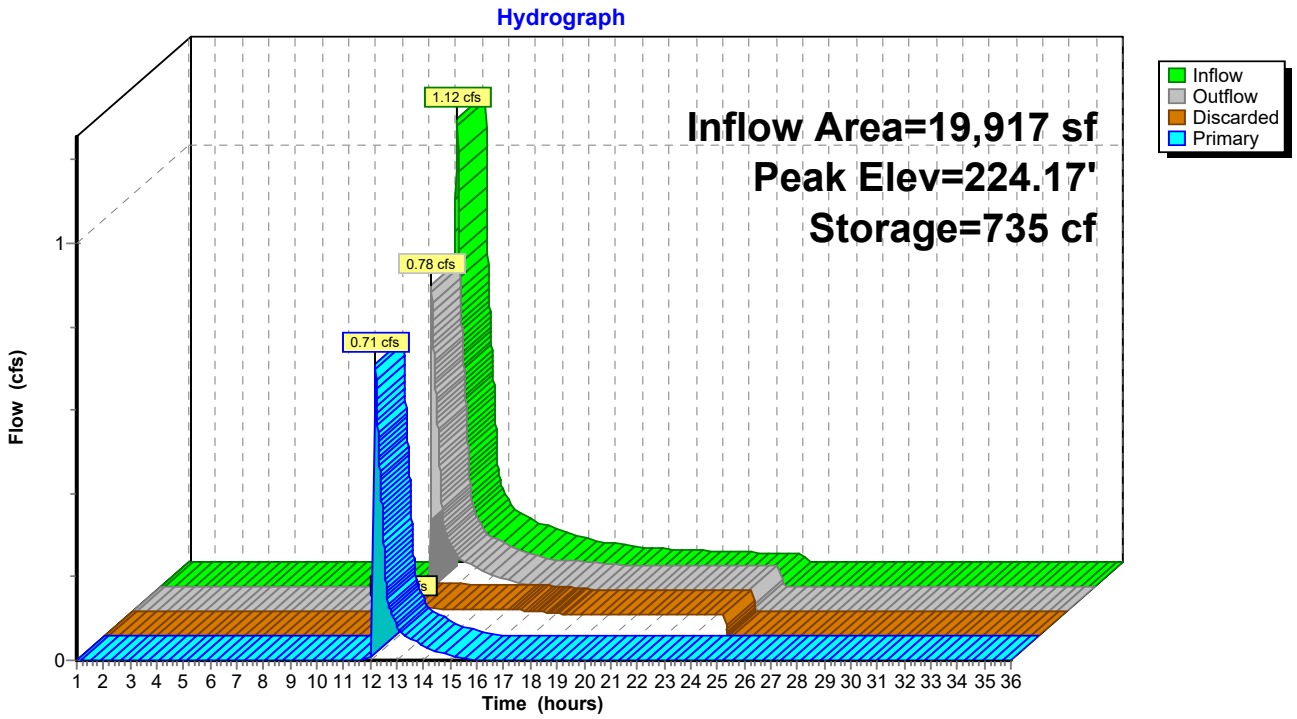
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
222.49	912	0.0	0	0
222.50	912	40.0	4	4
224.00	912	40.0	547	551
224.01	912	100.0	9	560
224.50	1,839	100.0	674	1,234

Device	Routing	Invert	Outlet Devices
#1	Discarded	222.49'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	224.14'	**42.0' long x 16.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.07 cfs @ 12.19 hrs HW=224.17' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.71 cfs @ 12.19 hrs HW=224.17' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.71 cfs @ 0.50 fps)

Pond IT-1: IT-1


Hydrograph
Inflow Area=19,917 sf
Peak Elev=224.17'
Storage=735 cf
1.12 cfs
0.78 cfs
0.71 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Time (hours)

Supplemental Calculations

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

Version 1, Automated: Mar. 4, 2008

Location: Infiltration Basin with Sediment Forebay

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Grass Channel	0.50	1.00	0.50	0.50
Infiltration Basin	0.80	0.50	0.40	0.10
	0.00	0.10	0.00	0.10
	0.00	0.10	0.00	0.10
	0.00	0.10	0.00	0.10

Total TSS Removal = 90%

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

Project: Taylor Street Well and Raw Water Supply, Littleton MA
Prepared By: Aaron Guazzaloca
Date: 10/16/2023

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

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

Version 1, Automated: Mar. 4, 2008

Location: Infiltration Trench

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Trench	**0.80**	**1.00**	**0.80**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**

Total TSS Removal = **80%**

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

Project: **Taylor Street Well and Raw Water Supply, Littleton MA**
Prepared By: **Aaron Guazzaloca**
Date: **12/14/2023**

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

REVISED 12/14/23

Recharge Volume Calculations (Static Method)

Taylor Street Well and Raw Water Main
Littleton, MA
December 14, 2023

Infiltration Basin Required Recharge Volume Hydrologic Soils Group:	A	B	C	D	Total	
Total Proposed Impervious Area:	2,653	0	0	0	2,653	(SF)
Target Factor:	0.60	0.35	0.25	0.10		
Recharge Volume:	133	0	0	0	133	(CF)

Provided Recharge Volume		
Elevation of Lowest Invert:	231.90	(FT)
Volume Below Lowest Outlet:	7,981	(CF)

Drawdown Time		
Saturated Hydraulic Conductivity (Rawls Rate):	2.41	(IN/HR)
Bottom Area of Infiltration Basin:	1,710	(SF)
Drawdown Time:	23.2	(HRS)

Infiltration Trench Required Recharge Volume Hydrologic Soils Group:	A	B	C	D	Total	
Total Proposed Impervious Area:	4,508	0	0	0	4,508	(SF)
Target Factor:	0.60	0.35	0.25	0.10		
Recharge Volume:	225	0	0	0	225	(CF)

Provided Recharge Volume		
Elevation of Lowest Invert:	224.14	(FT)
Volume Below Lowest Outlet:	695	(CF)

Drawdown Time		
Saturated Hydraulic Conductivity (Rawls Rate):	2.41	(IN/HR)
Bottom Area of Infiltration Basin:	912	(SF)
Drawdown Time:	3.8	(HRS)

REVISED 12/14/23

Water Quality Volume Calculations

Taylor Street Well and Raw Water Main
Littleton, MA
December 14, 2023

Required Water Quality Storage Calculation

Proposed Impervious Area (SF) x 1-IN x 1-FT/12-IN = Required WQV

Location	Area (SF)	Required WQV (CF)	Provided WQV (CF)	BMP Description
Roadway Basin	2,653	221	7,981	Infiltration Basin
Well Building	3,855	321	695	Infiltration Trench

REVISED 12/14/23

Stage-Area-Storage for Pond IB-1: IB-1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
229.00	1,710	0
229.05	1,745	86
229.10	1,780	174
229.15	1,815	264
229.20	1,849	356
229.25	1,884	449
229.30	1,919	544
229.35	1,954	641
229.40	1,989	740
229.45	2,024	840
229.50	2,059	942
229.55	2,093	1,046
229.60	2,128	1,151
229.65	2,163	1,259
229.70	2,198	1,368
229.75	2,233	1,479
229.80	2,268	1,591
229.85	2,302	1,705
229.90	2,337	1,821
229.95	2,372	1,939
230.00	2,407	2,059
230.05	2,444	2,180
230.10	2,480	2,303
230.15	2,517	2,428
230.20	2,554	2,555
230.25	2,591	2,683
230.30	2,627	2,814
230.35	2,664	2,946
230.40	2,701	3,080
230.45	2,737	3,216
230.50	2,774	3,354
230.55	2,811	3,493
230.60	2,847	3,635
230.65	2,884	3,778
230.70	2,921	3,923
230.75	2,958	4,070
230.80	2,994	4,219
230.85	3,031	4,370
230.90	3,068	4,522
230.95	3,104	4,676
231.00	3,141	4,833
231.05	3,181	4,991
231.10	3,220	5,151
231.15	3,260	5,313
231.20	3,300	5,477
231.25	3,340	5,643
231.30	3,379	5,811
231.35	3,419	5,980
231.40	3,459	6,152
231.45	3,498	6,326
231.50	3,538	6,502
231.55	3,578	6,680
231.60	3,617	6,860
231.65	3,657	7,042
231.70	3,697	7,226
231.75	3,737	7,412
231.80	3,776	7,599
231.85	3,816	7,789
231.90	3,856	7,981
231.95	3,895	8,175
232.00	3,935	8,371
232.05	3,978	8,568
232.10	4,020	8,768
232.15	4,063	8,970
232.20	4,106	9,175
232.25	4,149	9,381
232.30	4,191	9,589
232.35	4,234	9,800
232.40	4,277	10,013
232.45	4,319	10,228
232.50	4,362	10,445
232.55	4,405	10,664
232.60	4,447	10,885
232.65	4,490	11,109
232.70	4,533	11,334
232.75	4,576	11,562
232.80	4,618	11,792
232.85	4,661	12,024
232.90	4,704	12,258
232.95	4,746	12,494
233.00	**4,789**	**12,733**

VOLUME BELOW LOWEST OUTLET

REVISED 12/14/23

Stage-Area-Storage for Pond IT-1: IT-1 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
223.53	912	379
223.54	912	383
223.55	912	387
223.56	912	390
223.57	912	394
223.58	912	398
223.59	912	401
223.60	912	405
223.61	912	409
223.62	912	412
223.63	912	416
223.64	912	420
223.65	912	423
223.66	912	427
223.67	912	430
223.68	912	434
223.69	912	438
223.70	912	441
223.71	912	445
223.72	912	449
223.73	912	452
223.74	912	456
223.75	912	460
223.76	912	463
223.77	912	467
223.78	912	471
223.79	912	474
223.80	912	478
223.81	912	482
223.82	912	485
223.83	912	489
223.84	912	492
223.85	912	496
223.86	912	500
223.87	912	503
223.88	912	507
223.89	912	511
223.90	912	514
223.91	912	518
223.92	912	522
223.93	912	525
223.94	912	529
223.95	912	533
223.96	912	536
223.97	912	540
223.98	912	544
223.99	912	547
224.00	912	551
224.01	912	560
224.02	931	569
224.03	950	579
224.04	969	588
224.05	988	598
224.06	1,007	608
224.07	1,026	618
224.08	1,044	628
224.09	1,063	639
224.10	1,082	650
224.11	1,101	661
224.12	1,120	672
224.13	1,139	683
224.14	1,158	695
224.15	1,177	706
224.16	1,196	718
224.17	1,215	730
224.18	1,234	742
224.19	1,253	755
224.20	1,271	767
224.21	1,290	780
224.22	1,309	793
224.23	1,328	806
224.24	1,347	820
224.25	1,366	833
224.26	1,385	847
224.27	1,404	861
224.28	1,423	875
224.29	1,442	889
224.30	1,461	904
224.31	1,480	919
224.32	1,498	934
224.33	1,517	949
224.34	1,536	964
224.35	1,555	979
224.36	1,574	995
224.37	1,593	1,011
224.38	1,612	1,027
224.39	1,631	1,043
224.40	1,650	1,060
224.41	1,669	1,076
224.42	1,688	1,093
224.43	1,707	1,110
224.44	1,725	1,127
224.45	1,744	1,144
224.46	1,763	1,162
224.47	1,782	1,180
224.48	1,801	1,198
224.49	1,820	1,216
224.50	**1,839**	**1,234**

VOLUME BELOW LOWEST OUTLET

REVISED 12/14/23

Sediment Forebay Sizing Calculations

Taylor Street Well and Raw Water Main
Littleton, MA
December 14, 2023

Forebay Volume:

Minimum Required Volume = 0.1-IN x Impervious Area

Impervious Area:	2,653	(SF)
Volume Required:	22	(CF)
Volume Provided:	61	(CF)

Volume Calculation			
Elevation (FT)	**Area (SF)**	**Incremental Volume (CF)**	**Cumulative Volume (CF)**
229	25	0	0
230	97	61	**61**

REVISED 12/14/23

INFILTRATION BASIN GROUNDWATER MOUNDING CALCULATIONS

use consistent units (e.g. feet & days **or** inches & hours)

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).

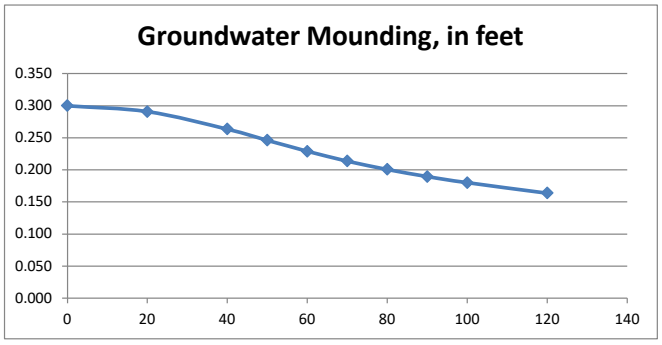
Input Values

4.8200	***R***	**Recharge (infiltration) rate (feet/day)**
0.310	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
382.75	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
43.830	**x**	**1/2 length of basin (x direction, in feet)**
12.500	**y**	**1/2 width of basin (y direction, in feet)**
3.000	**t**	**duration of infiltration period (days)**
51.000	**hi(0)**	**initial thickness of saturated zone (feet)**

51.300	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.300	**Δh(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
0.300	0
0.291	20
0.264	40
0.246	50
0.229	60
0.214	70
0.201	80
0.190	90
0.180	100
0.164	120

Re-Calculate Now



CALCULATION NOTES:

Infiltration rate was calculated using the Rawls rate of 2.41 IN/HR

Hydraulic conductivity was calculated using Ksat data obtained from NRCS (refer to attached NRCS Ksat report)

Initial thickness of the saturated zone was calculated based upon a bedrock depth obtained from the logs for boring 3-85 which is the closest boring with a refusal depth of 53-feet (refer to boring logs in Attachment C)

INFILTRATION TRENCH GROUNDWATER MOUNDING CALCULATIONS

use consistent units (e.g. feet & days **or** inches & hours)

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).

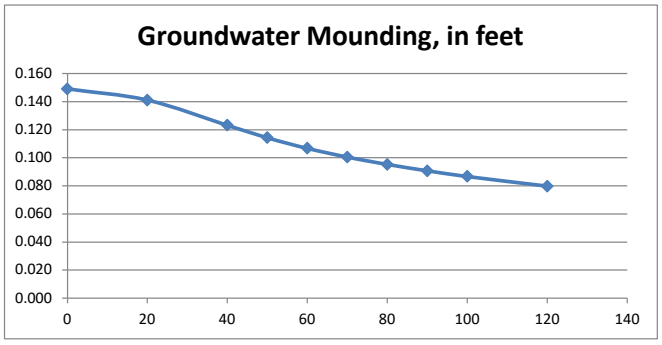
Input Values

4.8200	***R***	**Recharge (infiltration) rate (feet/day)**
0.310	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
382.77	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
29.000	**x**	**1/2 length of basin (x direction, in feet)**
8.250	**y**	**1/2 width of basin (y direction, in feet)**
3.000	**t**	**duration of infiltration period (days)**
51.000	**hi(0)**	**initial thickness of saturated zone (feet)**

51.149	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.149	**Δh(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
0.149	0
0.141	20
0.123	40
0.114	50
0.107	60
0.101	70
0.095	80
0.091	90
0.087	100
0.080	120

Re-Calculate Now



CALCULATION NOTES:

Infiltration rate was calculated using the Rawls rate of 2.41 IN/HR

Hydraulic conductivity was calculated using Ksat data obtained from NRCS (refer to attached NRCS Ksat report)

Initial thickness of the saturated zone was calculated based upon a bedrock depth obtained from the logs for boring 3-85 which is the closest boring with a refusal depth of 53-feet (refer to boring logs in Attachment C)

D.L. MAHER CO.

GROUND WATER DEVELOPMENT

P.O. BOX 127 — 71 CONCORD STREET

NORTH READING • MA. 01864 • 617/933-3210

Test Well No. #3-85 D.L.M. Job No. 85-056-T

Driller John Graglia Helper David Maher

Client Littleton Water Dept.

Location off Tayler Rd.

Owner's Representative Savas Danos

Date Started: 7-24-85 Date Finished: 7-25-85

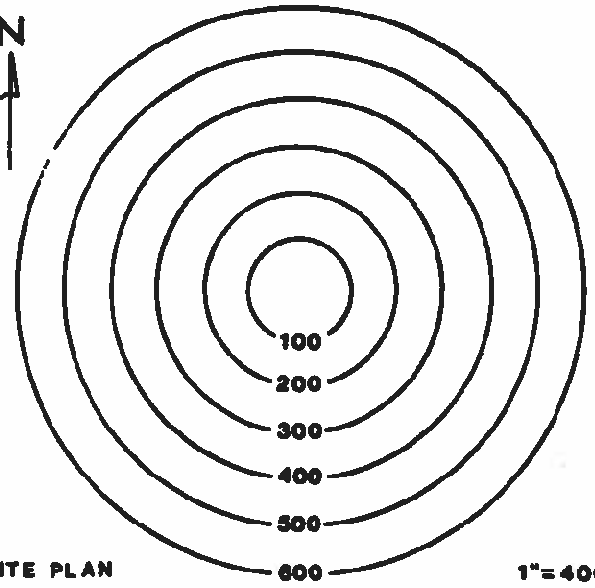
DEPTH From	DEPTH To	Soil Classification
0	4'	hit Rock
0	5'	going Crooked
0	21'	Grayish Brown Sand and sharp Gravel
21'	28'	Sharp Gray Gravel and Fine to Medium Gray Sand
28'	49'	Sharp Broken Gray Gravel Fine to Medium Gray Sand
	53'	Refusal

Loss of Wash Water: 1hr

Static 8'9½"

DEPTH COMPLETED 49'

DEPTH TOTAL 53'



SITE PLAN 1"=400'

LOCUS

TIME AND MATERIALS

Test Well No.	Diam.	Total Depth	Comp. Depth	Casing Left	Screen Length	Screen Exposed	Screen Material	Screen Slot Size	Riser	Hours Dev.	Hours Pumped
#3-85	2½"	53'	49'	42'	6'	6'	1½" Areo	80	5'	½ hr	1 hr Tester
3A	1'	footed	3B	5'	footed						

REMARKS: well pumps 6 GPM VAC 8" STATIC 8'9½" (TOTAL P.P. Driven 42')

Pump Test on Hole No. Date

Time	G.P.M.	Water Levels Vac	Obs. No.	Obs. No.	Obs. No.
Static					

Water Sample

Date _____ Time _____

Sent To:

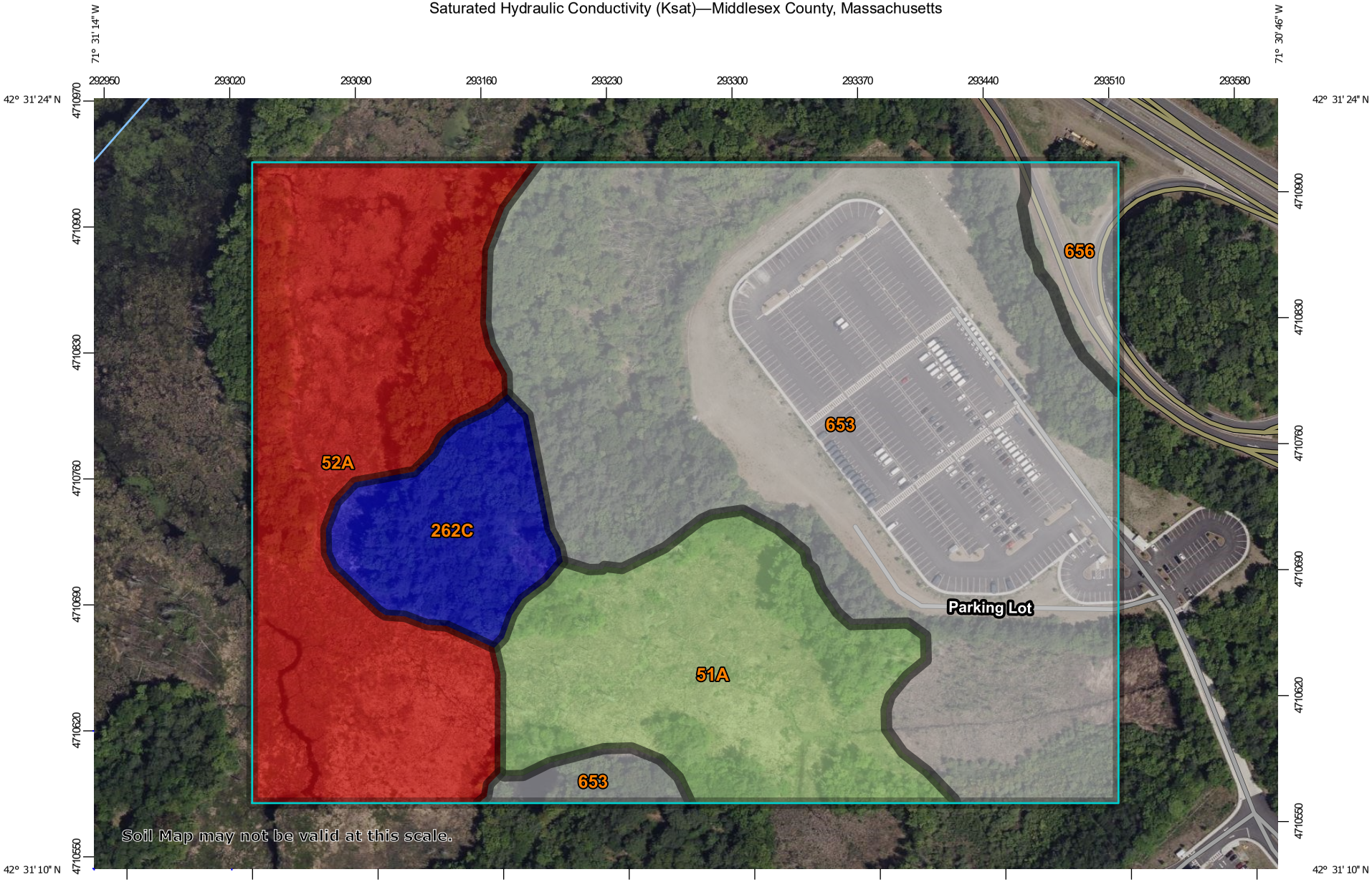
Field Quality

CO_2 _____ Taste _____

Fe _____ Odor _____

Mn _____ Hardness _____

Ph _____ Color _____



Map Scale: 1:3,020 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 40 80 160 240

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

<= 10.0000

> 10.0000 and <= 83.8130

> 83.8130 and <= 135.0333

Not rated or not available

Soil Rating Lines

<= 10.0000

> 10.0000 and <= 83.8130

> 83.8130 and <= 135.0333

Not rated or not available

Soil Rating Points

<= 10.0000

> 10.0000 and <= 83.8130

> 83.8130 and <= 135.0333

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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: Middlesex County, Massachusetts
Survey Area Data: Version 23, Sep 12, 2023

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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.

Saturated Hydraulic Conductivity (Ksat)

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	83.8130	6.9	16.1%
52A	Freetown muck, 0 to 1 percent slopes	10.0000	10.1	23.6%
262C	Quonset sandy loam, 8 to 15 percent slopes	135.0333	2.8	6.5%
653	Udorthents, sandy		21.8	51.1%
656	Udorthents-Urban land complex		1.2	2.7%
Totals for Area of Interest			**42.7**	**100.0%**

Description

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

Rating Options

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): Depth Range (Weighted Average)

Top Depth: 24

Bottom Depth: 636

Units of Measure: Inches

Summary for Reach SW-1: SW-1

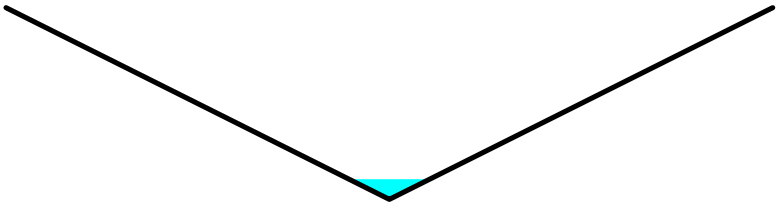
STA 0+00 to STA 8+10

Inflow Area = 71,274 sf, 3.99% Impervious, Inflow Depth = 0.06" for 2-Yr event
Inflow = 0.01 cfs @ 15.06 hrs, Volume= 343 cf
Outflow = 0.01 cfs @ 15.39 hrs, Volume= 343 cf, Atten= 2%, Lag= 19.9 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 0.54 fps, Min. Travel Time= 24.8 min
Avg. Velocity = 0.39 fps, Avg. Travel Time= 35.0 min

Peak Storage= 18 cf @ 15.39 hrs
Average Depth at Peak Storage= 0.11' , Surface Width= 0.42'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 4.85 cfs

0.00' x 1.00' deep channel, n= 0.025 Earth, grassed & winding
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 810.0' Slope= 0.0049 '/'
Inlet Invert= 235.65', Outlet Invert= 231.71'



Summary for Reach SW-1: SW-1

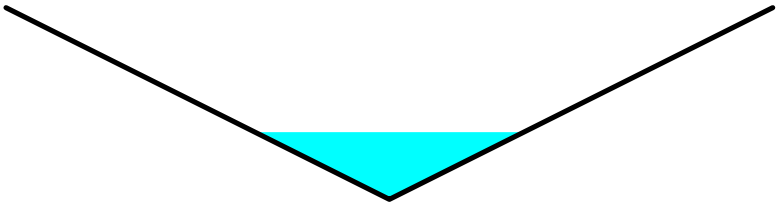
STA 0+00 to STA 8+10

Inflow Area = 71,274 sf, 3.99% Impervious, Inflow Depth = 0.47" for 10-Yr event
Inflow = 0.36 cfs @ 12.29 hrs, Volume= 2,765 cf
Outflow = 0.30 cfs @ 12.44 hrs, Volume= 2,765 cf, Atten= 16%, Lag= 9.3 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 1.21 fps, Min. Travel Time= 11.2 min
Avg. Velocity = 0.59 fps, Avg. Travel Time= 22.8 min

Peak Storage= 199 cf @ 12.44 hrs
Average Depth at Peak Storage= 0.35', Surface Width= 1.40'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 4.85 cfs

0.00' x 1.00' deep channel, n= 0.025 Earth, grassed & winding
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 810.0' Slope= 0.0049 '/'
Inlet Invert= 235.65', Outlet Invert= 231.71'



Summary for Reach SW-2: SW-2

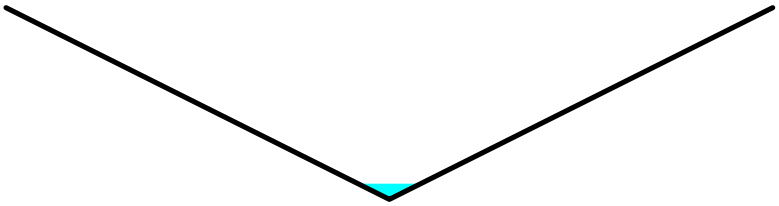
STA 8+10 to STA 10+00

Inflow Area = 71,274 sf, 3.99% Impervious, Inflow Depth = 0.06" for 2-Yr event
Inflow = 0.01 cfs @ 15.06 hrs, Volume= 343 cf
Outflow = 0.01 cfs @ 15.11 hrs, Volume= 343 cf, Atten= 0%, Lag= 2.7 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 0.92 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 0.80 fps, Avg. Travel Time= 3.9 min

Peak Storage= 3 cf @ 15.11 hrs
Average Depth at Peak Storage= 0.08' , Surface Width= 0.33'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 9.74 cfs

0.00' x 1.00' deep channel, n= 0.025 Earth, grassed & straight
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 190.0' Slope= 0.0196 '/'
Inlet Invert= 235.44', Outlet Invert= 231.71'



Summary for Reach SW-2: SW-2

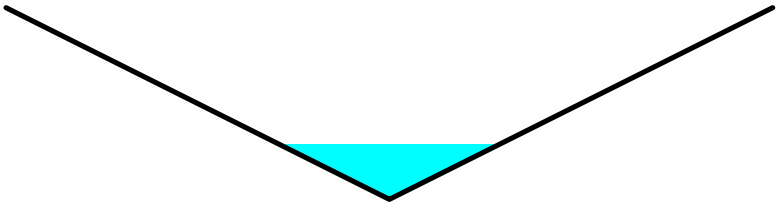
STA 8+10 to STA 10+00

Inflow Area = 71,274 sf, 3.99% Impervious, Inflow Depth = 0.47" for 10-Yr event
Inflow = 0.36 cfs @ 12.29 hrs, Volume= 2,765 cf
Outflow = 0.35 cfs @ 12.31 hrs, Volume= 2,765 cf, Atten= 0%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 2.13 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 1.27 fps, Avg. Travel Time= 2.5 min

Peak Storage= 32 cf @ 12.31 hrs
Average Depth at Peak Storage= 0.29' , Surface Width= 1.15'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 9.74 cfs

0.00' x 1.00' deep channel, n= 0.025 Earth, grassed & straight
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 190.0' Slope= 0.0196 '/'
Inlet Invert= 235.44', Outlet Invert= 231.71'



Long Term Pollution Prevention Plan

Long Term Pollution Prevention Plan

To meet the requirements of Standard 4 of the Massachusetts Stormwater Handbook, this Long Term Pollution Prevention Plan is provided to identify the proper procedures of practices for source control and pollution prevention.

Storage and Handling of Oil and other Hazardous Materials

Any hazardous materials that will be used ancillary to the site will be stored inside, or off site.

Spill Prevention/Response

Spill kits will be kept at a local Town facility, and spills shall be cleaned up immediately. Spills of any hazardous material over 10 gallons will be reported to the Massachusetts Department of Environmental Protection within 24 hours.

Operation and Maintenance of Stormwater Control Structures

Included in this application package is the Operation and Maintenance plan for this site, which includes periodic cleaning of stormwater infrastructure. The Littleton Water Department (LWD) will be responsible for the implementation of the plan.

Landscaping

Maintenance of landscaped areas shall be the responsibility of the LWD. Use of fertilizers, herbicides, and pesticides shall not be allowed on site.

Septic System

There will be no onsite septic facilities.

Vehicle Washing

Vehicle washing shall not be performed on site. Vehicles can be rinsed with a high volume of water at low pressure. This is considered dust water by the DEP and accounts for what may be rinsed off the vehicle when it rains.

Non-Hazardous Waste Management/Good Housekeeping Practices

All non-hazardous waste shall be stored in designated trash or recycling containers onsite for periodic collection by the local trash collector. The LWD shall have maintenance staff who monitor the site for the accumulation of trash. Any trash that is seen onsite shall immediately be collected and placed into designated trash or recycling containers.

Prohibition of Illicit Discharges

Illicit discharges to the onsite stormwater management system shall be strictly prohibited. Illicit discharges are defined as any direct or indirect non-stormwater discharge to the onsite stormwater system. Requirements related to Illicit Discharges are further detailed in the attached Illicit Discharge Compliance Statement of this Stormwater Management Plan.

De-icing & Snow Disposal

Salt and sand shall not be used to treat the existing paved surfaces of the site during snow and ice events. Snow will be temporarily stored within peripheral areas of the site and allowed to melt and drain back to onsite stormwater systems. When needed, snow shall be removed from the site and disposed of in accordance with all local, state, and federal regulations. Snow storage shall be prohibited within all wetlands.

Emergency Contact Information

Owner/Operator:
Littleton Water Department
Corey Godfrey
Water & Sewer Superintendent
39 Ayer Road, Littleton, MA 01460
cgodfrey@lelwd.com
978-540-2222

Engineer:
James Pearson, P.E.
Weston & Sampson, Inc.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
978-532-1900

Illicit Discharge Compliance Statement

Illicit Discharge Compliance Statement

Section I – Purpose/Intent

The purpose of this document is to provide for the health, safety, and general welfare of the citizens of Massachusetts through the regulation of non-stormwater discharges into existing outstanding resource areas near the site to the maximum extent practicable, as required by federal and state law. To the best of our knowledge and belief, there are no illicit discharges occurring under existing conditions on this site within the meaning expressed under Standard 10 of the Massachusetts Stormwater Handbook. This document establishes methods for controlling the introduction of pollutants into existing outstanding resource areas to comply with requirements of the National Pollutant Discharge Elimination System (NPDES) permit process.

Section II - Definitions

For the purposes of this statement, the following shall mean:

Best Management Practices (BMPs): Schedules of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or stormwater conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

Clean Water Act: The federal Water Pollution Control Act (33 U.S.C § 1251 et seq.), and any subsequent amendments thereto.

Construction Activity: Activities subject to the Massachusetts Erosion and Sedimentation Control Act or NPDES Construction Permits. Such activities include but are not limited to clearing and grubbing, grading, excavating, and demolition.

Hazardous Materials: Any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Illegal Connection: An illegal connection is defined as either of the following:

a. Any pipe, open channel, drain or conveyance, whether on the surface or subsurface, which allows an illicit discharge to enter the outstanding resource area including but not limited to any conveyances which allow any non-stormwater

discharge including sewage, process wastewater, and wash water, regardless of whether said drain or connection has been previously allowed, permitted, or approved by an authorized enforcement agency; or

b. Any pipe, open channel, drain or conveyance connected to the Town of Littleton storm water treatment system which has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

Illicit Discharge: Any direct or indirect non-stormwater discharge to the Town of Littleton stormwater treatment system, except as exempted in Section III of this ordinance.

Industrial Activity: Activities subject to NPDES Industrial Permits as defined in 40CFR, Section 122.26 (b) (14).

National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permit: A permit issued by MassDEP under authority delegated pursuant to 33 USC § 1342 (b) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area-wide basis.

Town of Littleton Stormwater Treatment System: Any facility, owned or maintained by the Town of Littleton, designed or used for collecting and/or conveying stormwater, including but not limited to roads with drainage systems, Town of Littleton streets, curbs, gutters, inlets, catch basins, piped storm drains, pumping facilities, infiltration, retention and detention basins, natural and man-made or altered drainage channels, reservoirs, and other drainage structures.

Non-Stormwater Discharge: Any discharge to the storm drain system that is not composed entirely of stormwater.

Person: Any individual, association, organization, partnership, firm, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, city, county or other political subdivision of the State, interstate body, or any other legal entity.

Pollutant: Anything which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; petroleum hydrocarbons; automotive fluids; cooking grease; detergents (biodegradable or otherwise); degreasers; cleaning chemicals; non-hazardous liquid and solid wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; liquid and solid wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; concrete and cement; and noxious or offensive matter of any kind.

Pollution: Contamination or other alteration of any water's physical, chemical, or biological properties by addition of any constituent including but not limited to a change in temperature, taste, color, turbidity, or odor of such waters, or the discharge of any liquid,

gaseous, solid, radioactive, or other substance into any such waters as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety, welfare, or environment, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life.

Premises: Any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

Stormwater: Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation and resulting from such precipitation.

Wastewater: Any water or other liquid discharged from a facility, that has been used, as for washing, flushing, or in a manufacturing process, and so contains waste products.

Section III - Prohibitions

Prohibition of Illicit Discharges:

No person shall throw, drain, or otherwise discharge, cause or allow others under its control to throw, drain, or otherwise discharge into the Town of Littleton stormwater treatment system or watercourses any materials, including but not limited to, any pollutants or waters containing any pollutants, other than stormwater. It is to the best knowledge and belief of the project proponent that no illicit discharges currently exist at the project site. The commencement, conduct or continuance of any illicit discharge to the storm drain system is prohibited except as described as follows:

1. Water line flushing performed by a government agency, other potable water sources, landscape irrigation or lawn watering, diverted stream flows, rising ground water, ground water infiltration to storm drains, uncontaminated pumped ground water, foundation or footing drains (not including active groundwater dewatering systems), crawl space pumps, air conditioning condensation, springs, natural riparian habitat or wetland flows, and any other water source not containing pollutants;

2. Discharges or flows from fire fighting, and other discharges specified in writing by the Town of Littleton as being necessary to protect public health and safety;

3. Dye testing is an allowable discharge, but requires notification to the Town of Littleton prior to the time of the test;

4. Any non-stormwater discharge permitted under an NPDES permit, waiver, or waste discharge order issued to the discharger and administered under the authority of the Federal Environmental Protection Agency, provided that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for a discharge to the Town of Littleton stormwater treatment system.

Section IV - Industrial or Construction Activity Discharges

Any person subject to an industrial or construction activity NPDES stormwater discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the Town of Littleton prior to allowing discharges to the Town of Littleton stormwater treatment system.

Section V - Notification of Spills and Accidental Discharges

Notwithstanding other requirements of law, as soon as any person responsible for a facility, activity or operation, or responsible for emergency response for a facility, activity or operation has information of any known or suspected release of pollutants or non-stormwater discharges from that facility, activity, or operation which are resulting or may result in illicit discharges or pollutants discharging into stormwater, the Town of Littleton stormwater treatment system, State Waters, or Waters of the U.S., said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release so as to minimize the effects of the discharge. In the event of such a release of hazardous materials, said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of non-hazardous materials, said person shall notify the Town of Littleton DPW in person or by phone no later than the next business day, including the nature, quantity and time of occurrence of the discharge. Notifications in person or by phone shall be confirmed by written notice, via certified mail return receipt requested addressed to the Town of Littleton DPW within three (3) business days of the initial notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

IN WITNESS WHEREOF the parties hereto have executed copies of this Agreement on the _____ day of _____, _____.

_____

Operations & Maintenance Plan

Operations & Maintenance Plan

1.0 Introduction

The following document has been written to comply with the stormwater guidelines set forth by the Massachusetts Department of Environmental Protection (MassDEP). The intent of these guidelines is to encourage Low Impact Development techniques to improve the quality of the stormwater runoff. These techniques, also known as Best Management Practices (BMPs) collect, store, and treat the runoff before discharging to adjacent environmental resources.

2.0 Purpose

This Operations & Maintenance Plan (O&M Plan) is intended to provide a mechanism for the consistent inspection and maintenance of each BMP installed on the project site. Included in this O&M Plan is a description of the BMP type and an inspection form for the BMP. The Littleton Water Department (LWD) is the owner and operator of the system and is responsible for its upkeep and maintenance. This work will be funded on an annual basis through the owner's operating budget.

In the event the Owner sells the property, it is the Owner's responsibility to transfer this plan as well as the past operation and maintenance records to the new property owner.

3.0 BMP Descriptions

3.1 Infiltration Basins

Infiltration basins are used to provide stormwater treatment, detention, and groundwater recharge to mitigate peak stormwater discharges and remove total suspended solids from the stormwater runoff.

3.2 Infiltration Trenches

Infiltration trenches are excavated trenches which are backfilled with crushed stone and receive stormwater runoff via either sheet flow or pipe conveyance. They provide stormwater detention and groundwater recharge to mitigate peak discharges and remove total suspended solids.

3.3 Sediment Forebays

Sediment forebays are designed to allow temporary ponding of stormwater runoff which allows sedimentation of total suspended solids. The bay is

typically lined with stone riprap but can also be grassed and contains a stone check dam to release retained water.

3.4 Grassed Swales

Grassed swales treat stormwater runoff by providing long retention times for the water travelling through it so that total suspended solids are allowed to settle. The swales also contain stone check dams to increase retention time.

4.0 Inspection, Maintenance Checklist, and Schedule

4.1 Infiltration Basins

Infiltration basins shall be inspected every three months during the first year, and annually thereafter. Inspection shall include all items noted below.

All accumulated sediment and debris in the stormwater infiltration basins should be removed and disposed of according to local, state, and federal regulations. The basin bottom and side slopes shall be mowed as needed, and at least twice a year at a minimum. Any grassed areas of the basin, which are near any paved areas that use salt in deicing applications should be re-seeded in the spring. Vegetation in infiltration basin bottoms shall likewise be inspected for degradation. Any accumulated sediment shall be removed, and bare spots should be re-seeded as needed.

Pipe inlets and outfalls from stormwater infiltration basins shall be inspected for plugging or damage and cleaned or repaired immediately. Any vegetation, soil or debris that forms a barrier to flow shall be removed. If any soil erosion is noted, erosion shall be repaired, and bare spots shall be armored with stone riprap. Embankments, spillways, and swales that affect the operation of the basin shall likewise be inspected for blockage or damage. Any accumulated debris that may impede stormwater flow shall be removed, and any noted erosion shall be repaired with stone riprap.

4.2 Infiltration Trenches

Infiltration trenches should be inspected at least two times per year, in the fall and spring, to inspect for debris that may be covering the crushed stone at the surface of the trench. Debris should be removed to allow runoff to freely enter the stone at the surface. During the winter, the infiltration trench should be cleared of snow after each snowstorm to guard against excessive snow/ice buildup at the surface of the crushed stone.

4.3 Sediment Forebays

Sediment forebays shall be inspected on a monthly basis and shall be cleaned four times per year. Check the sediment forebay for accumulated trash and debris at least once per month and remove by hand. Sediment shall be removed as needed and at least four times per year by hand or by using a vacuum truck. Check for signs of erosion and rilling in the forebay when removing sediments, and repair with stone riprap, or re-seed as needed.

4.4 Grassed Swales

Grassed swales must be inspected at least once a year for signs of erosion, sediment accumulation, vegetation loss and for the presence of invasive species. Any debris or sedimentation must be removed, and all areas of vegetation loss must be repaired. Periodic mowing of the swales is also required and at least 4-IN of grass must be maintained in the bottom of the swale. Repair check dams with stone as needed.

4.5 Inspections and Record Keeping

- An inspection form should be filled out each, and every time maintenance work is performed.
- A binder should be kept that contains all of the completed inspection forms and any other related materials.
- A review of Operation & Maintenance actions should take place annually such that the Stormwater BMPs are being taken care of in the manner illustrated in this Operation & Maintenance Plan.
- Operation & Maintenance log forms for the last three years, at a minimum, shall be kept on site.
- The inspection and maintenance schedule may be refined in the future based on the findings and results of this Operation & Maintenance program or policy.

5.0 Stormwater Management System Owner/Responsible Party

The stormwater management system shall be owned and maintained by the following party or its future designee/assigns:

Littleton Water Department
Corey Godfrey
Water & Sewer Superintendent
39 Ayer Road, Littleton, MA 01460
cgodfrey@lelwd.com
978-540-2222

This operation and Maintenance Plan will be recorded with the registry of deeds so that current and future owners are aware of the requirement for proper operation and maintenance of the onsite stormwater system.

6.0 General Good Housekeeping Practices

All non-hazardous waste shall be stored in designated trash or recycling containers onsite for periodic collection by the local trash collector. The owner shall have maintenance staff who monitor the site for the accumulation of trash. Any trash that is seen onsite shall immediately be collected and placed into designated trash or recycling containers.

7.0 Estimated Operations and Maintenance Budget

The estimated budget for annual operations and maintenance of this stormwater system is $1,500 per year.

Infiltration Basins

Frequency: Inspect every three months during the first year and annually thereafter. Mow basins at least twice a year at a minimum.

Structure Number: _____

Inspected By: _____ Date: _____

Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Inspect grassed area. Mow grass as needed in infiltration basins. Remove accumulated trash and debris. Remove sediment and re-seed bare spots as needed, including in basin bottom. Inspect pipe inlets/outfalls for damage, erosion, or blockage, remove blockage as needed, repair erosion with riprap. Inspect embankments, spillways and swales for erosion or blockage. Repair erosion with riprap, remove blockage as needed. All trash, debris, and sediments should be disposed of in accordance with local, state, and federal regulations.

Infiltration Trenches

Frequency: Inspect at least twice per year, and after every major storm event. During winter months, inspect after every snow event.

Structure Number: _____

Inspected By: _____ Date: _____

Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Remove any accumulated trash, debris, and sediments which can inhibit stormwater flow into the surface stone of the trench. Remove grass clippings from surface of trench after mowing and remove any tree seedlings before they become established. Check any inlet and outlet pipes for clogging and remove as needed. If any ponding is noted after storm events, the trench may need to be rehabilitated. Remove crushed stone aggregate, filter fabric, and accumulated sediments from the trench then replace with new crushed stone and filter fabric. All trash and debris should be disposed of in accordance with local, state, and federal regulations.

Sediment Forebays

Frequency: Inspect monthly for trash and debris accumulation, remove as needed. Four times a year at a minimum, remove sediments.

Structure Number: _____

Inspected By: _____ Date: _____

Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Check for accumulation of sediment, trash, and debris monthly and remove trash and debris as needed. Every three months, remove sediments from forebay by hand or with a vacuum truck. Remove any vegetative growth or debris that restricts flow through the check dam. Check for signs of erosion and repair or replace any lost stone in the forebay or check dam with 4-6” riprap.

Grassed Swales

Frequency: Inspect quarterly in the first year and then annually during the spring each year after.

Structure Number: _____

Inspected By: _____ Date: _____

Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Check for accumulation of sediment, signs of erosion and loss of vegetation. Remove sediment and debris that restricts flow. Mow as needed to maintain a minimum of 4-IN of grass in the swale and repair any areas of vegetation loss. Repair any check dams with stone as needed. All trash, debris, and sediments should be disposed of in accordance with local, state, and federal regulations.

Site Plans