DRAINAGE REPORT

Site Redevelopment for Proposed Mixed-Use
19 Dean Ave., Franklin, MA
Parcel ID: 279-169

CHA Project Number: 085087.000

March 01, 2024

Prepared for:
Team Q, LLC
8 Symmes Rd, Franklin, MA 02038

Prepared by:
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141 Longwater Drive, Norwell MA
Phone: (781) 982-5400

Project Narrative

Stormwater Management Report for
Site Redevelopment for Proposed Mixed-Use
19 Dean Ave., Franklin, MA
Parcel ID: 279-169

The purpose of this report is to provide an assessment of the existing conditions and proposed stormwater Best Management Practices (BMPs) for the project referenced above. The Applicant proposes a redevelopment project to raze the existing building and construct a new mixed-use building located at the 3,433 square feet lot. The results of the assessment are summarized below.

A. Project Overview:

The property (3,433 square feet lot) is currently occupied by an existing commercial building, which occupies 2,700 square feet of the lot and other impervious surfaces. The site is located on the south side of Dean Avenue in the Downtown Commercial (DC) zoning district, where a maximum lot coverage of 90% is allowed. The existing lot improvements pre-exist the current zoning requirements for lot coverage and lacks a stormwater management system. The current lot coverage exceeds this zoning district's maximum allowed lot coverage, which has had no stormwater management system. The existing stormwater runoff from the property flows overland to the Dean Avenue right-of-way, abutting properties, and ultimately to the Town of Franklin's drainage system.

The proposed project includes razing the existing building, associated stairs, and utility services. The proposed building is be located within the existing building's footprint. Permeable pavers are utilized in the back area for walkways and stairs to maximize groundwater recharge and prevent stormwater runoff to abutting properties. A new underground retention/recharge concrete chamber system is to be utilized under the slab-on-grade portion of the new building. The recharge system is sized to infiltrate 1 inch of runoff from the entire site area as required by the Town of Franklin. The proposed recharge system is equipped with an overflow and an outlet control structure connected to the Town's existing drainage system located in Dean Avenue right-of-way.

The project proposes to reduce the amount of impervious surfaces to comply with the maximum allowed lot coverage (90%) and reduce the amount of stormwater runoff from the site. The project maximizes the site recharge and infiltration to the maximum extent practicable. Due to space constraints, there are no other practical or feasible drainage solutions for this site.

As a redevelopment project, the project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: MassDEP Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions. However, MassDEP recognizes that site constraints often make it challenging to comply with all the Standards at a redevelopment site. These constraints include lack of space, soil conditions, and underground utilities. Lack of space is the biggest hurdle; there is no space available to install additional stormwater Best Management Practices (BMPs) beyond what is incorporated in the proposed site design.

To the maximum extent, the proposed conditions significantly improve the site conditions and implement a formal stormwater management system where none exists onsite. Roof runoff from the proposed building is directed to the UG-1 underground chambers. UG-1 consists of underground concrete galleys that provide recharge and infiltration. The attached stormwater computations are based on the 24-hour rainfall amounts from NOAA Atlas 14, Volume 10/National Resources Climate Center (NRCC).

The proposed stormwater system provides the required treatment for stormwater runoff from impervious areas to the maximum extent practicable for a redevelopment project. It mitigates any increase in stormwater runoff as the 2008 Massachusetts Stormwater Handbook requires. The site design does not present any adverse impacts downstream. The following section includes an evaluation of the MassDEP Stormwater Standards and the Town of Franklin Stormwater Standards located in The Town's Best Development Practices Guidebook:

B. Stormwater Management Standards:

This section provides an explanation of how the proposed project addresses the 2008 MassDEP Stormwater Management Regulations.

Standard 1: No New Untreated Discharges – No new stormwater system conveyances will discharge untreated runoff or cause erosion in wetlands or waters of the Commonwealth.

The existing site has no stormwater management infrastructure, resulting in the discharge of uncontrolled stormwater runoff to the adjacent Right-of-way. The proposed Stormwater Management System and the reduction of impervious surfaces result in reduced stormwater runoff and enhanced stormwater treatment. No new stormwater system conveyances discharge untreated runoff from the site. The site design meets this Standard.

Standard 2: Peak Rate Attenuation – Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

As a redevelopment project, the project is required to meet this Standard only to the maximum extent practicable. The project reduces impervious surface area and attenuates peak rate and volume using permeable pavers, leaching catch basin, and underground infiltration chambers. The post-development peak discharge rates and volumes do not exceed pre-development peak discharge rates, and Standard 2 is met. Below is a summary of the design point's peak discharge rates and volumes. The Stormwater computations are based on the 24-hour rainfall amounts from NOAA Atlas 14, Volume 10/National Resources Climate Center (NRCC). The pre-and post-development hydrology calculation results are summarized in the following tables. The table below corresponds to the design points indicated in the Hydrology plans and hydrograph routing calculations.

TOTAL RUNOFF PEAK FLOW RATE (CFS)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	0.20	0.19	-0.01
10-YEAR	0.30	0.29	-0.01
25-YEAR	0.39	0.37	-0.02
100-YEAR	0.55	0.53	-0.02

TOTAL RUNOFF VOL. (AC-FT)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	0.017	0.011	-0.006
10-YEAR	0.027	0.021	-0.006
25-YEAR	0.034	0.028	-0.006
100-YEAR	0.049	0.043	-0.006

The project design reduces the peak flow rates and volumes in the post-developed condition in all storms and improves the existing conditions, meeting the requirements for Standard 2.

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

As a redevelopment project without a net increase of impervious area, Standard 3 is to be met to the maximum extent practicable. As explained previously, the reconfiguration of the project site reduces the existing impervious. Since there is no increase in impervious areas, this Standard is met. The Required Recharge Volume calculation is shown below:

- Total Proposed New Impervious Area = 0 sq. ft. = 0 ac.
- Required Recharge Volume = Rv = F x New Impervious Area (where F for C soils = 0.25-inch)
  Rv = 0.60 in x (0 ac.) x 1 ft/12 in
  Rv = 0 ac-ft

However, the Town of Franklin requires onsite infiltration/ recharge for 1 inch over all new impervious areas and 0.8 inch over redeveloped impervious areas to the maximum extent practicable. The underground chambers have been sized for 1-inch all impervious area.

- Required Recharge Volume (Franklin) = (1-inch/12) x 3,000 s.f. = 250 cubic feet
- Provided Recharge Volume (UG-1) = 8 ft x 4 ft x 2ft x 5 chambers = 320 cubic feet > 250 OK

The volume available within the proposed stormwater management system is more than sufficient to support the proposed redevelopment and infiltrate 1 inch of runoff over the impervious surface. The system satisfies Standard 3 of the MassDEP Stormwater Regulations.

Standard 4: Water Quality – Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:

a. *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan and thereafter are implemented and maintained;*
b. *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
c. *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

A redevelopment project is required to meet this Standard only to the maximum extent practicable. This project does not propose any increase in impervious surfaces. No water quality volume is required. However, the design does provide water quality volume via an underground infiltration system (UG-1), permeable paver, and the leaching catch basin. The storage available within the proposed stormwater management system is more than sufficient to support the proposed redevelopment, and the system satisfies Standard 4 of the MassDEP Stormwater Regulations. The proposed stormwater system infiltration chambers, leaching catch basin with sump, and infiltration pervious pavers each provide the required 80% TSS removal.

Standard 5: Land Uses with Higher Potential Pollutant Loads – For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, MGL c. 21, §§ 26-53 and the regulations promulgated there under at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

This Standard does not apply to the project site. The project is not considered a LUHPL (Land Use with Higher Potential Pollutant Load).

Standard 6: Critical Areas - Stormwater Discharges within Zone Is, Zone IIs and Interim Wellhead Protection Areas

There is no untreated stormwater discharge to a "Critical Area." According to MASSGIS, this site is not located within critical areas.

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

The project intends to comply with all applicable Standards to the maximum extent practicable. Additionally, the proposed project significantly upgrades the existing drainage conditions that discharge stormwater runoff to the Right-of-way. The proposed project reduces the impervious surfaces and provides infiltration and recharge. This Standard is met.

Standard 8: Construction Period Pollution Prevention Plan and Erosion and Sedimentation Control – A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

Projects that disturb one acre of land or more must obtain coverage under the NPDES Construction General Permit issued by EPA and prepare a Stormwater Pollution Plan (SWPPP). The project disturbance area is approximately 0.08 acres; therefore, this Standard does not apply.

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

An Operation and Maintenance Plan has been customized to fit the design of the proposed development (See Section C below). Provisions to maintain runoff control devices have been assured through non-structural, structural, and construction management approaches.

Standard 10: Prohibition of Illicit Discharges – All illicit discharges to the stormwater management system are prohibited.

The Operation and Maintenance plan required by Standard 9 includes measures to prevent illicit discharges. An Illicit Discharge Compliance Statement is provided and attached to this report.

Long-Term Pollution Prevention and Operation & Maintenance Plan

C. Long-Term Stormwater Pollution Prevention and Operation & Maintenance Plan to Comply with Stormwater Standards 4, 6, & 9:

This section identifies constituents of concern that can contaminate stormwater runoff from the proposed project site and provides a framework of Best Management Practices (BMPs) for handling stormwater runoff. It also outlines an inspection and maintenance program to ensure the continued effectiveness of the stormwater management system. The used BMPs are shown on the site plans prepared by CHA at 141 Longwater Drive, Suite 104, Norwell, Massachusetts.

1. Owner and Responsible Party:

- *Owner:* Team Q, LLC
  8 Symmons Drive Frankin, MA

- *Day-to-day Operation and Maintenance*: Maintenance Company Hired by Owner

2. Construction Management:

A construction manager with adequate knowledge and experience on projects of similar size and scope shall oversee all site work-related construction. The contractor shall incorporate the appropriate techniques to control sediment and erosion pollution during construction in accordance with the Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas and any conditions of approval from the local conservation commission.

The design incorporates measures to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities. The information contained herein and within the engineering drawings identifies construction period pollution prevention measures, responsible parties, erosion control measures (straw bales and silt fence, etc.), BMPs for collecting and treating runoff and groundwater during construction[1], site stabilization measures (i.e., gravel, seed, pavement, etc.), an operations and maintenance plan & long-term pollution prevention plan contained herein.

Care should be taken when constructing stormwater control structures. Light earthmoving equipment shall be used when operating over top of buried utilities, drains, or chambers.

3. On-Going Maintenance Contract:

The non-structural and structural approaches recommended below in sections 8 & 9, and required BMP maintenance are to be completed by appropriate contractors. Adequate personnel with proper training and access to equipment are to be available. Future responsible parties must be notified of their responsibilities to operate and maintain the system in perpetuity.

[1] Should the need for de-watering arise during construction at the site, groundwater will be pumped directly from the work area into geotextile filter bags, temporary settling basins, or portable fractionation tanks (depending on the nature and volume of water encountered) which will act as sediment traps during construction. Discharge points will be setback outside of all resource areas and buffers monitored by qualified personnel (wetland scientist, licensed site professional, civil engineer, etc.) to ensure no impacts to resource areas and compliance with applicable Federal and state regulations. All discharges will be free from visible floating, suspended, and settleable solids that would impair the functions of the nearby drainage systems, wetlands, or downstream rivers. Refer to the details provided on the drawing set for additional information.

4. Living Document Provisions:

This document shall be updated as necessary to reflect new procedures, technologies, or requirements.

5. Maintenance Log:

The Responsible Party shall develop and maintain a log of inspections, maintenance, repairs, and disposal (including the location of disposal) during the life of the project. Records to be maintained for at least three years are to be made available for viewing to the Massachusetts Department of Environmental Protection per the provisions of the Massachusetts Stormwater Handbook.

6. Good Housekeeping Practices During Construction:

The Responsible Party shall maintain good housekeeping practices by maintaining a clean and orderly facility to prevent potential pollution sources, including debris, from coming into contact with stormwater and degrading water quality. It includes establishing protocols to reduce the possibility of mishandling materials or equipment and training employees in good housekeeping techniques. Common areas where good housekeeping practices should be followed shall include material storage, vehicle and equipment maintenance, and loading areas. Good housekeeping practices must include a designated and secure location for garbage. A schedule for regular pickup and disposal of garbage and waste materials and routine inspections of containers for leaks and structural integrity shall be developed.

Specific good housekeeping practices that are to be implemented include routine removal of the trash. Items include scrap metal, wood, plastic, miscellaneous trash, paper, glass, insulation, and miscellaneous. building materials and packaging. Additional practices include securing and covering any containers, supplies, or equipment that could become sources of stormwater pollution.

7. Minimizing Exposure During Construction:

The Responsible Party is to minimize exposure of potential pollutant sources, including debris, from coming into contact with precipitation and being picked up by stormwater and carried into drains and surface waters using the following steps:

- Storing all containerized materials in a protected, secure location away from drains and plainly labeled.
- Containing all activities that can generate sources of contaminants from reaching the receiving water or the stormwater management system.
- Securing equipment or supplies not to be transported into receiving waters or stormwater management systems during storm events.

8. Best Management Practices Maintenance Post Construction:

A description of the non-structural and structural approaches to be incorporated is indicated below. The following Best Management Practices are proposed to be incorporated into the stormwater management system treatment train design to reduce source runoff and improve stormwater runoff discharge quality. The Responsible Party is to inspect all BMPs to ensure they are operating properly regularly. If any deficiencies are identified during these inspections, action to resolve them are to be initiated and documented on the maintenance log.

9. Non-Structural Best Management Practices (BMPs):

Below is an explanation of the non-structural best management practices. Those practices are essential and required to ensure the effectiveness of the proposed drainage system.

GRADING:

The impervious areas of the site shall be graded as gently as possible to reduce runoff velocities. Steep slopes are to be permanently vegetated to dissipate energy and minimize potential erosion. No constructed vegetated slopes should exceed 2H: 1V without providing additional reinforcement. Steep slopes may require soil reinforcement and additional vegetation.

SNOW STORAGE AND DEICING:

In order to reduce the volume of dissolved salt, the development operator is to rely on sand alone, where traction on snowy surfaces is the primary objective. However, when deicing is necessary for safety reasons during winter, paved surfaces are typically treated with a mixture of 90% sand and 10% road salt (NaCl).

FERTILIZER:

Slow-release organic fertilizers are recommended to be used in landscape areas to limit nutrient transport to groundwater and the wetland area. It is recommended that the application be limited to a rate of 5 lbs. per 1000 square feet of lawn area.

WASTE MANAGEMENT:

Solid waste is to be contained within dumpsters. Waste deposition in these receptacles is to be consistent with state and local permits.

10. Structural Best Management Practices:

Prior to completion and full occupancy of the development, it is recommended that a representative of the Contractor, Manufacturer, and/or Engineer either designing or building the facility for the Owner properly instruct the Responsible Party as to the maintenance practices required to maintain the effectiveness of the drainage system responsibly. These frequencies and requirements are recommendations to maintain minimum effectiveness in most typical environments. Ultimately, the Responsible Party is to implement the procedures and frequencies as they see fit under their current plan and inspect the systems as needed to maintain minimum effectiveness as the manufacturer recommends. The following maintenance of structural BMPs is to be implemented:

ROOF DRAIN GUTTERS AND DOWNSPOUTS:

Roof drain gutters and downspouts should be inspected and cleaned twice a year, once in the fall after leaf drop and in the spring after snow melt. Cleaning occurs at the completion of construction and in early spring after the snow melts. Any obstructions, sediment, and debris that could cause clogging shall be removed within the roof drain gutter and downspout system as necessary.

DEEP SUMP CATCH BASINS AND MANHOLE STRUCTURES:

Catch basins shall be cleaned in dry weather when half of the sump capacity is filled or at a minimum once a year or as required through periodic inspection. Cleaning is to occur after construction and in early spring after the sanding of roadways has ceased. All manholes shall be inspected at least once annually or as the Responsible Party dictates. Any obstructions, sediment, and debris that could potentially cause clogs shall be removed within the conveyance system as necessary. Inverts, grates, and hoods shall be checked and replaced as required to maintain hydraulic effectiveness.

Essential items to check include differential settlement, cracking, breakout, clogging of outlets and vents, and root infestation. Water levels should be checked and recorded against rainfall amounts to verify that the drainage system is working properly and draining within 72 hours. Corrective action should be taken if they do not drain within 72 hours.

11. General Construction Sequencing

The following section provides construction details and highlights earthmoving activities' construction sequence and timing. The overall project is broken down into the following four phases:

- Establish Erosion and Sediment Controls around the project site.
- Demolition (structures, driveways).
- Grading, utility, and roadway installation.
- Building Construction.
- Final utility connections and permanent stabilization.

a. Pre-Construction Meeting

The Owner's Representative is to conduct an onsite meeting before the start of construction activity. A copy of the Erosion & Sedimentation Control Plan and Operation & Maintenance Plan can be provided to applicable parties, Authorities, and Town Departments.

b. Installation of Erosion Controls

Erosion and sedimentation controls (i.e., filter sock, silt fence, and inlet protection) are installed at the limits of work and within the existing catch basins, as applicable. Tree protection is installed around trees specified to remain within the limit of work. Structures to remain shall also be visibly flagged/protected.

c. Demolition

Existing building, utility services, and pavement within the project are to be demolished as needed per the Construction Plans. Those utilities affected by construction shall be coordinated with the utility purveyors, and Dig Safe procedures shall be taken before implementing agreed-

upon connections/disconnections/abandonment of services. According to Federal, State, and Local guidelines, materials removed from the site is to be transported to an appropriate facility or disposed of elsewhere. Inactive stockpiles or areas of granular material or topsoil shall be temporarily secured according to the erosion and sedimentation control notes on the construction Plans to control sediment-laden runoff.

d. Building Construction

This phase involves the construction of the building foundations and pads and then the vertical structures. All building waste is to be properly disposed of in dumpsters. While this phase commences, other site construction activities are to take place.

e. Installation of Drainage and Utilities

Utility relocations, modifications, and new services, including water, sewer, gas, and electricity, are anticipated to occur in conjunction with the drainage work. Temporary sediment basins are to be constructed at this time on an as-needed basis to collect stormwater runoff during construction. Stockpiles ware to be established in designated areas. All temporary/inactive stockpile areas are to be encompassed by straw bales or other approved erosion control devices to control sediment-laden runoff as necessary and be temporarily seeded, mulched, or covered with plastic, as required. Material stabilization is to be in accordance with the erosion and sedimentation control notes on the Construction Plans.

f. Fine Grading, Paving, Etc.

The fine grading and shaping are to commence along with the installation of curbing. Areas outside of impervious surfaces are to be shaped and prepared for loam, seed, or other treatments. Paving operations are to begin with the installation of both binder and finish course layers.

g. Permanent / Final Site Stabilization

The project's final phase consists of landscaping and restoration and stabilization of all exposed surfaces. Final landscaping is to be performed upon completion of earthwork and completion of all curbing and sidewalk construction.

Disturbed areas are to be landscaped, mulched, or seeded in accordance with the landscape requirements. Permanent restoration and revegetation measures serve to control erosion and sedimentation by establishing a vegetative cover. If weather conditions prevent final restoration, temporary erosion and sedimentation measures are to be employed until the weather is suitable for final cleanup. A final inspection ensures that the project site is cleared of all project debris and that erosion and sedimentation controls are functioning properly. Once the site has been stabilized, newly installed catch basins, subsurface infiltration systems, and sediment deposits are to be inspected and cleaned as necessary.

ILLICIT DISCHARGE COMPLIANCE STATEMENT

Standard 10: Massachusetts Stormwater Standards Handbook

Illicit discharges are defined as discharges into waters of the State or municipal separate stormwater system (MS4) that are not entirely comprised of stormwater. Exclusions for non-stormwater discharges into drainage systems include activities or facilities for firefighting, water line flushing, landscape irrigation, uncontaminated groundwater discharge, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, water used to clean residential buildings without detergents, water used for street washing, and flows from riparian habitats/wetlands. These exclusions are subject to change and are under the discretion of the local governing authority.

To the best of our knowledge and professional belief no illicit discharges to the stormwater system, surface waters, or wetland resource areas will remain on the site after construction. We will agree to implement a pollution prevention plan to prevent illicit discharges into the stormwater management system. The design of the site based on the plans and specifications entitled "Reconstruction and Related Work on Route 143" prepared by CHA Consulting, Inc., 141 Longwater Drive, Suite 104, Norwell, Massachusetts show a separation and no direct connection between the stormwater management systems and the wastewater and/ or groundwater on the site. To the maximum extent practicable, the design prevents entry of illicit discharges into the stormwater management system.

Engineer's Name: ___Kelly Killeen_____
(please print)

Engineer's Signature: _____ Date: ____03/01/2024_____

Company: CHA Consulting, Inc.

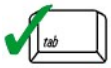
Stormwater Management Checklist

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.

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

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.

CHECKLIST FOR DESIGNERS

GOALS and NEEDS addressed:

1. Create a visually appealing community
2. Stabilize and increase property values
3. Encourage low impact development
4. Preserve the Town's historic and cultural heritage
5. Protect Franklin's natural environment, including habitat, water resources, and ecosystem services

FRANKLIN POLICY:
Subdivision plans and site plans for all forms of development shall adhere to the principles of environmental and aesthetic compatibility and energy-efficient design.

BEST DEVELOPMENT PRACTICES The site plan should be designed to address the following to the maximum extent practicable	Incorporated into Project?
Unique natural features have been preserved *(the development program should either avoid altering or showcase significant natural features)*	☐ N/A
Native vegetation planted in disturbed areas as needed to enhance or restore habitat	☐ N/A
Historic and cultural resources have been preserved *(the development program should either avoid altering or showcase significant historic and cultural features)*	☐ N/A
Clearing, grading, and building placement consider viewsheds	☒
Cut and fill have been minimized	☒
Buildings blend into the natural topography	☒
Buildings are oriented to the sun and wind for maximum energy efficiency *Vegetated protection from northwest (winter) winds is provided* *Deciduous species planted or retained close to the East, South and West building edges*	☐ N/A
Conforms to §185-31 of the Town of Franklin Zoning Code and/ or Chapter 300 of the Town of Franklin Subdivision Regulations	☒ w/ Waivers Requested.

Stormwater Management

Checklist for Designers

GOALS and NEEDS addressed:

1. Protect local and regional wetlands and water bodies
2. Maximize groundwater recharge to retain a viable local groundwater supply
3. Minimize pollutants in stormwater runoff

FRANKLIN POLICIES:

(A) All new development and redevelopment projects in Franklin shall meet the following stormwater management performance standards.

i. Post-development peak discharge rates and volumes from the site shall not exceed pre-development peak discharge rates and volumes from the site.

ii. The stormwater management system shall remove at least 80% of the average annual load of total suspended solids (TSS), at least 80% of the phosphorus loading, and at least 60% of nitrogen loading from the post-development stormwater created on site.

iii. All drainage facilities proposed shall utilize best management practices as outlined in the Massachusetts Stormwater Management Standards.

iv. All sites will have an Operation and Maintenance plan to insure future compliance.

(B) Non-structural stormwater management systems should be used wherever site conditions allow.

BEST DEVELOPMENT PRACTICES The site plan should be designed to address the following to the maximum extent practicable	Incorporated into Project?
Vegetated swales *(recommended to convey runoff from roadways & parking lots)*	☐
Vegetated filter strips *(recommended to filter and infiltrate runoff from roadways, parking lots, and driveways; use along roadsides and parking lots)*	☐
Constructed wetlands *(preferred method for stormwater retention & pollutant removal)*	☐
Bioretention cells *(rain gardens) (recommended on residential lots and parking lot islands)*	☐
Pervious paving surfaces *(recommended in overflow parking and low-traffic areas)*	☒
Sediment Forebays *(use in combination with other BDP)*	☐
Roof gardens *(encouraged on flat or gently sloped commercial and industrial rooftops)*	☐
Retention/Detention basins *(may be used in series with other practices to provide pre-treatment)*	☐
Recharge Systems *(suitable for all areas of development)*	☒
Drain pipe/catch basin systems *(as required to collect runoff when other systems are not practical)*	☒
If utilizing drain pipe and/or catch basin systems, have you documented that other systems are infeasible?	☒

Erosion and Sedimentation Control

Checklist for Designers

GOALS and NEEDS addressed:

1. Minimize clearing and regrading;
2. Prevent erosion and sedimentation.

FRANKLIN POLICIES:

(A) Any proposed project on a previously undeveloped site shall accommodate the development program in a way that minimizes clearing and re-grading, especially in areas of steep slopes, erosion-prone soils, or sensitive vegetation. For redevelopment projects, the site plan shall concentrate development in previously-disturbed areas to the extent possible.

(B) As a condition of approval, every proposed project shall submit and adhere to an erosion control plan that addresses soil stabilization, sediment retention, perimeter protection, construction scheduling, traffic area stabilization and dust control.

(C) If the proposed project is in an area under conservation jurisdiction, the project will require permitting deemed appropriate by the Conservation Commission.

BEST DEVELOPMENT PRACTICES The site plan should be designed to address the following to the maximum extent practicable.	Incorporated into Project?
Clearing and re-grading have been minimized	☐ N/A
Plan identifies sensitive areas to be protected and areas that are suitable for development	☐ N/A
Conservation Permits have been obtained *(when applicable)*	☐ N/A
The erosion and sedimentation control plan addresses:	
• **Soil stabilization** *(cover or stabilize erodible surfaces not in immediate use)*	☒
• **Sediment retention** *(runoff interceptors and sediment traps/ponds)*	☒
• **Perimeter protection** *(vegetated buffers, compost socks or straw wattles at limit of work)*	☐
• **Construction scheduling** *(minimize disturbed area at any given time)*	☒
• **Traffic area stabilization** *(crushed rock or similar at construction vehicle entrance and parking areas)*	☒
• **Dust control** *(plan for stabilizing dry, dust-prone surfaces when necessary)*	☐ N/A
• **Vegetation** *(preserve existing vegetation and/or identify areas to be revegetated including proposed planting species, quantity and planting specifications)*	☒

Landscape Design

Checklist for Designers

GOALS and NEEDS addressed:

1. Stabilize water use at a sustainable level
2. Create landscapes that minimize habitat destruction and maximize habitat value
3. Encourage the development of landscapes that provide environmental quality and visual relief through the planting of native or naturalized species

FRANKLIN POLICIES:

(A) Site plans and landscape plans for all proposed projects shall take appropriate steps, as outlined in the Guidebook, to minimize water use for irrigation and to allow for natural recharge of groundwater. Landscape plans shall follow the guidelines in the Guidebook for selecting species that are most appropriate to the site conditions.

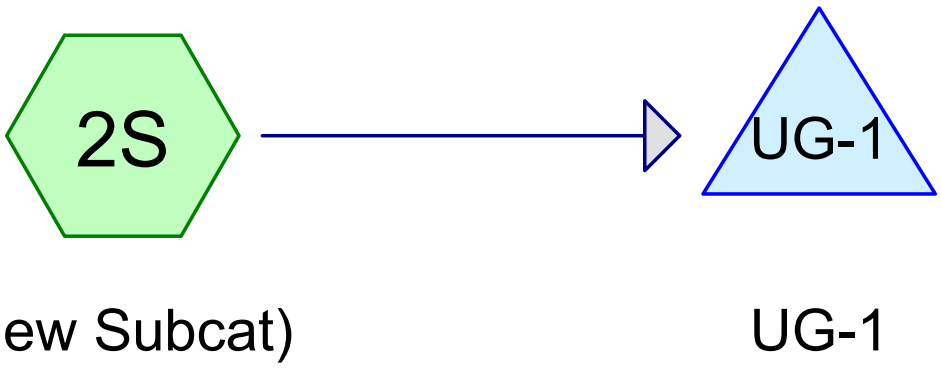
(B) Native and habitat-creating species shall be used in all landscape plans to the maximum extent possible while still meeting the site's landscaping needs. Invasive species may not be planted in Franklin under any condition. Refer to the Massachusetts Prohibited Plant list for more information.

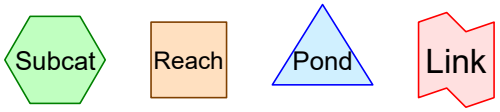
(C) Actively promote the Town of Franklin's Water Conservation Measures.

BEST DEVELOPMENT PRACTICES The site plan must address all of the following principles.	Incorporated into Project?
Retain and Recharge water on site *(install bio-retention cells, vegetated filter strips and minimize lawn areas where feasible)*	☒ Recharge System under Building.
Preserve natural vegetation to the maximum extent practicable	☐ N/A
Irrigation system is water efficient *(if an in-ground irrigation system is proposed, it is a water efficient system with timers and automatic sensors to prevent overwatering)*	☐ N/A
Preserve soil permeability *(minimize disturbing existing landscapes. Prepare new planting beds in accordance to the Planting Bed Guidelines on p. 13, and install 1-2" of shredded pine bark mulch on new planting areas)*	☐ N/A
Minimize the use of turf grass *(when applicable, reduce the size of the lawn area; instead, plant a bio-retention cell, use alternative, drought tolerant groundcover)*	☐ N/A
Specify variety of native and naturalized species *(species from the plant list have been incorporated into the landscape design, and no invasive species are used. Refer to the Plant Species Section and the Massachusetts Prohibited Plant List)*	☐ N/A
Species are appropriate to the soil, site, and microclimate conditions *(select appropriate species from the plant list in this guidebook)*	☐ N/A

Appendix A

Hydrology Calculations





Routing Diagram for 19 Dean Ave_Proposed Conditions
Prepared by CHA Consulting, Inc, Printed 2/29/2024

Summary for Subcatchment 2S: (new Subcat)

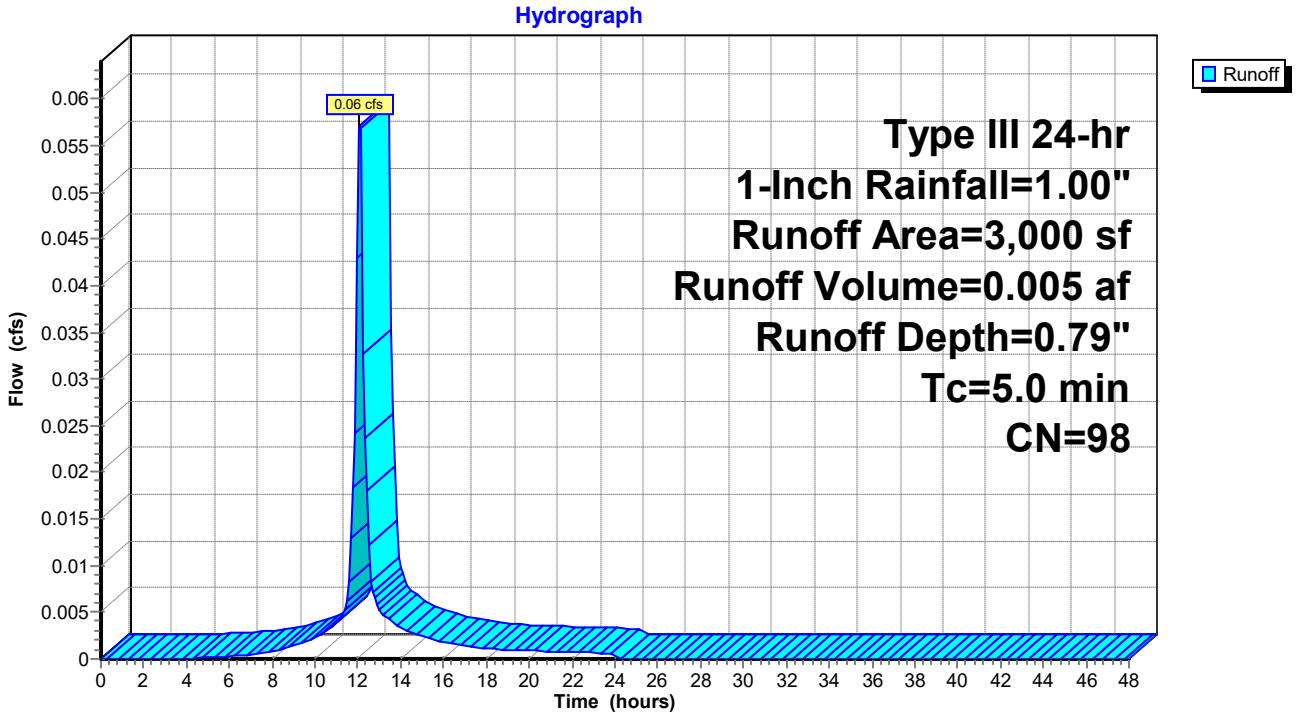
Runoff = 0.06 cfs @ 12.09 hrs, Volume= 0.005 af, Depth= 0.79"
Routed to Pond UG-1 : UG-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Type III 24-hr 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
*	3,000	98	
	3,000		100.00% Impervious Area

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

Subcatchment 2S: (new Subcat)



Summary for Pond UG-1: UG-1

Inflow Area = 0.069 ac,100.00% Impervious, Inflow Depth = 0.79" for 1-Inch event
Inflow = 0.06 cfs @ 12.09 hrs, Volume= 0.005 af
Outflow = 0.00 cfs @ 9.70 hrs, Volume= 0.005 af, Atten= 97%, Lag= 0.0 min
Discarded = 0.00 cfs @ 9.70 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 302.94' @ 16.55 hrs Surf.Area= 131 sf Storage= 124 cf

Plug-Flow detention time= 730.5 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 730.3 min (1,517.3 - 786.9)

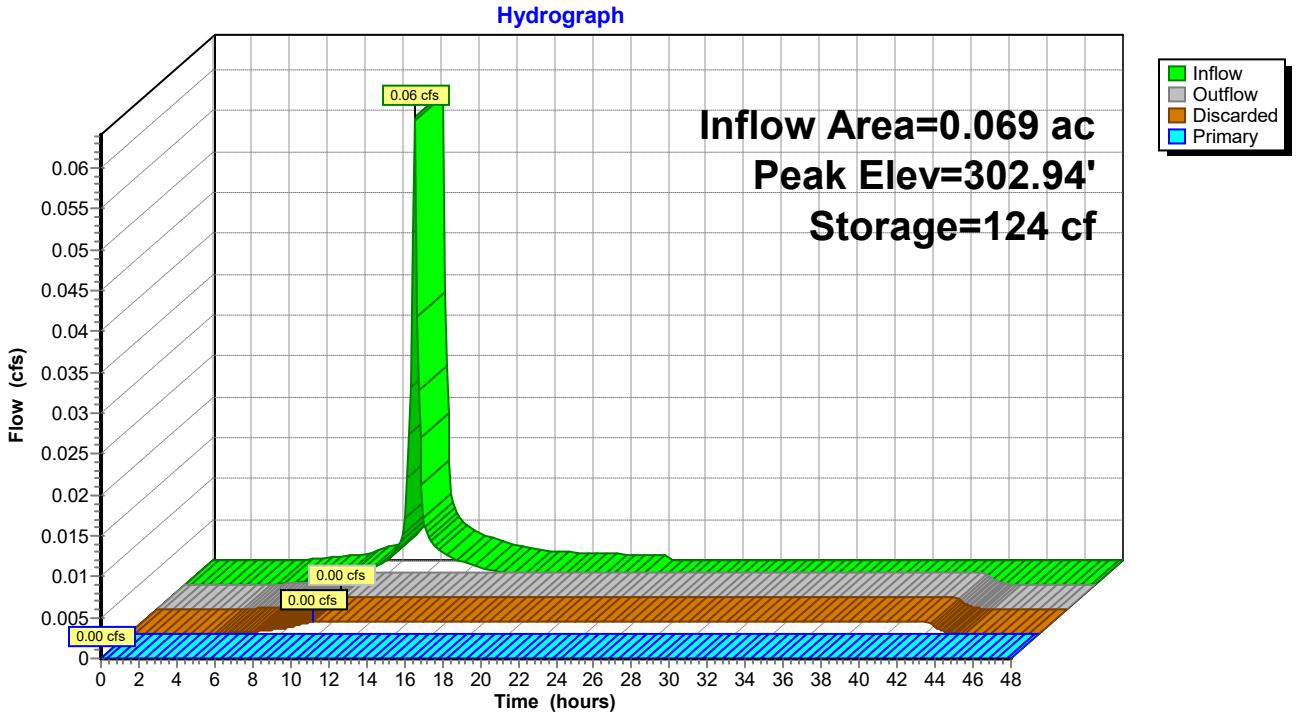
Volume	Invert	Avail.Storage	Storage Description
#1	302.00'	227 cf	**Concrete Galley 4x8x2** x 5 Inside= 42.0"W x 21.0"H => 6.04 sf x 7.50'L = 45.3 cf Outside= 48.0"W x 24.0"H => 7.92 sf x 8.00'L = 63.4 cf

Device	Routing	Invert	Outlet Devices
#1	Discarded	302.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	303.00'	**8.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 303.00' / 302.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Cast iron, coated, Flow Area= 0.35 sf

Discarded OutFlow Max=0.00 cfs @ 9.70 hrs HW=302.02' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=302.00' (Free Discharge)
↑**2=Culvert** (Controls 0.00 cfs)

Pond UG-1: UG-1


Hydrograph
Inflow
Outflow
Discarded
Primary
Inflow Area=0.069 ac
Peak Elev=302.94'
Storage=124 cf
0.06 cfs
0.00 cfs
0.00 cfs
0.00 cfs
Flow (cfs)
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045
0.05
0.055
0.06
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
Time (hours)

Summary for Subcatchment 2S: (new Subcat)

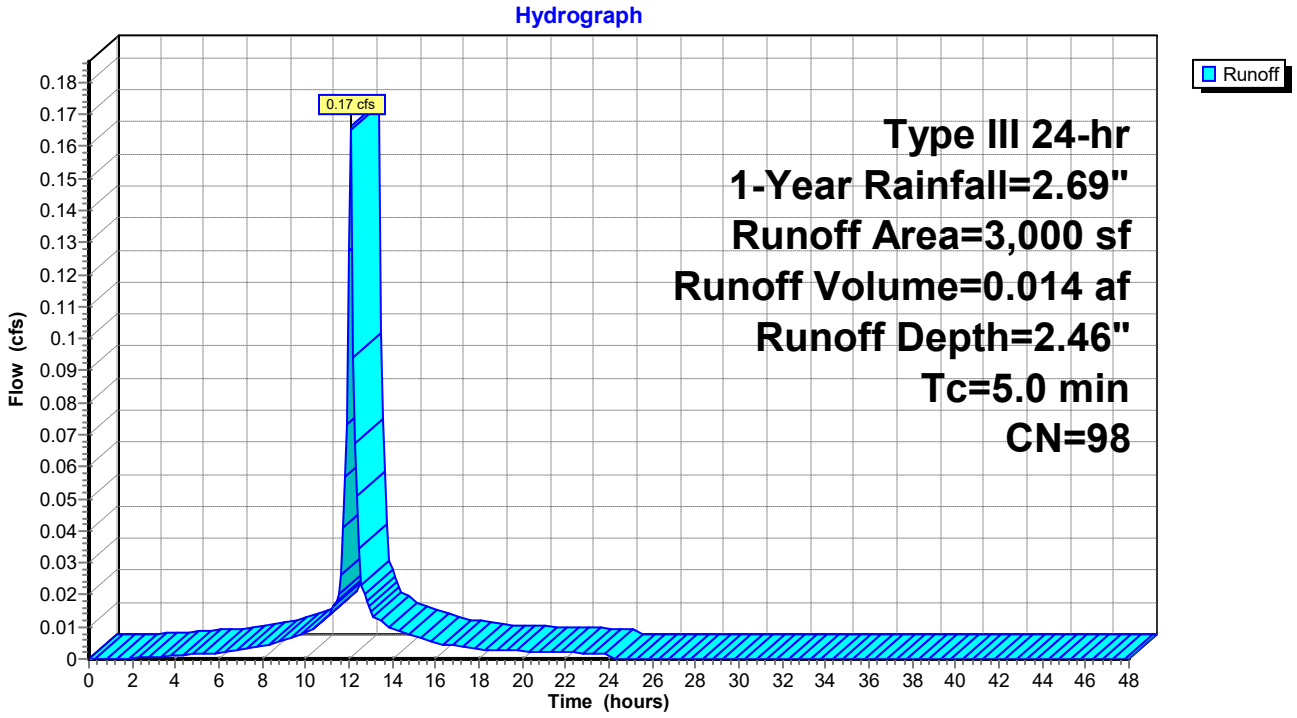
Runoff = 0.17 cfs @ 12.08 hrs, Volume= 0.014 af, Depth= 2.46"
Routed to Pond UG-1 : UG-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Type III 24-hr 1-Year Rainfall=2.69"

	Area (sf)	CN	Description
*	3,000	98	
	3,000		100.00% Impervious Area

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

Subcatchment 2S: (new Subcat)



Summary for Pond UG-1: UG-1

Inflow Area = 0.069 ac,100.00% Impervious, Inflow Depth = 2.46" for 1-Year event
Inflow = 0.17 cfs @ 12.08 hrs, Volume= 0.014 af
Outflow = 0.16 cfs @ 12.11 hrs, Volume= 0.014 af, Atten= 7%, Lag= 1.7 min
Discarded = 0.00 cfs @ 5.60 hrs, Volume= 0.006 af
Primary = 0.15 cfs @ 12.11 hrs, Volume= 0.008 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 303.24' @ 12.11 hrs Surf.Area= 131 sf Storage= 163 cf

Plug-Flow detention time= 329.0 min calculated for 0.014 af (100% of inflow)
Center-of-Mass det. time= 331.1 min (1,090.4 - 759.3)

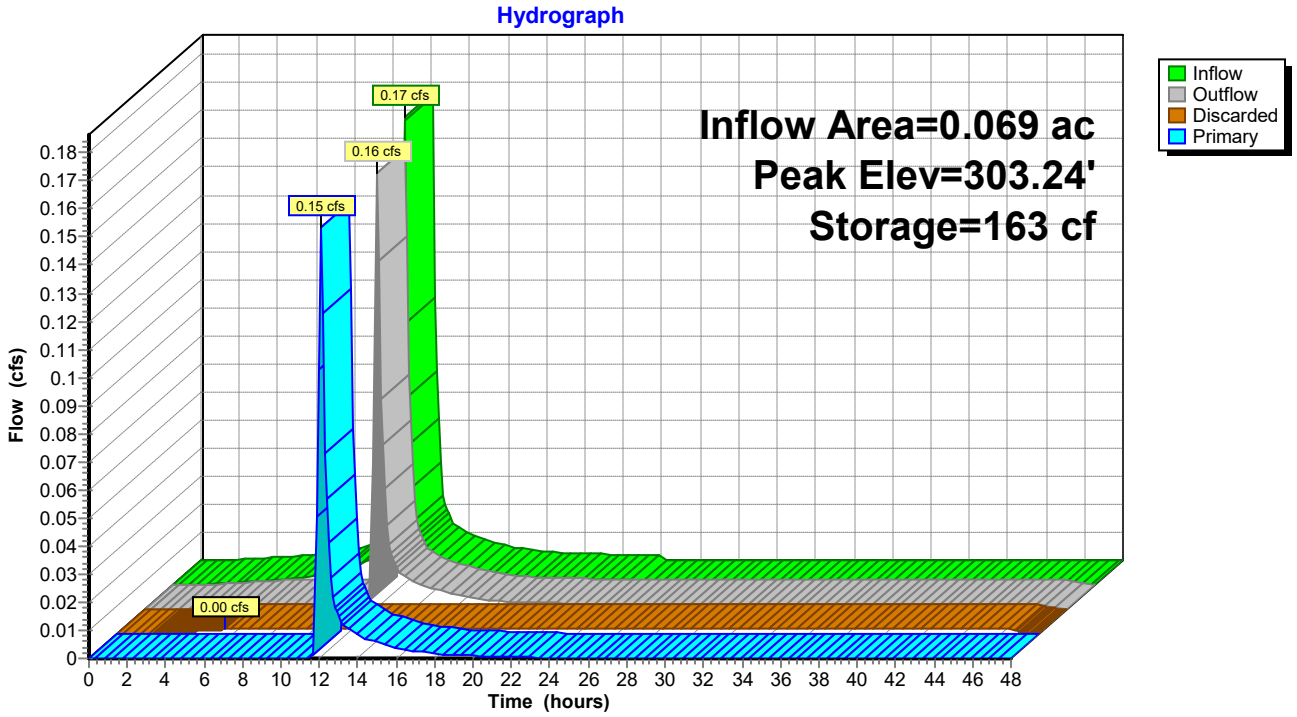
Volume	Invert	Avail.Storage	Storage Description
#1	302.00'	227 cf	**Concrete Galley 4x8x2** x 5 Inside= 42.0"W x 21.0"H => 6.04 sf x 7.50'L = 45.3 cf Outside= 48.0"W x 24.0"H => 7.92 sf x 8.00'L = 63.4 cf

Device	Routing	Invert	Outlet Devices
#1	Discarded	302.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	303.00'	**8.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 303.00' / 302.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Cast iron, coated, Flow Area= 0.35 sf

Discarded OutFlow Max=0.00 cfs @ 5.60 hrs HW=302.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.15 cfs @ 12.11 hrs HW=303.24' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.15 cfs @ 1.32 fps)

Pond UG-1: UG-1


Hydrograph
Inflow Area=0.069 ac
Peak Elev=303.24'
Storage=163 cf
0.17 cfs
0.16 cfs
0.15 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)

Summary for Subcatchment 2S: (new Subcat)

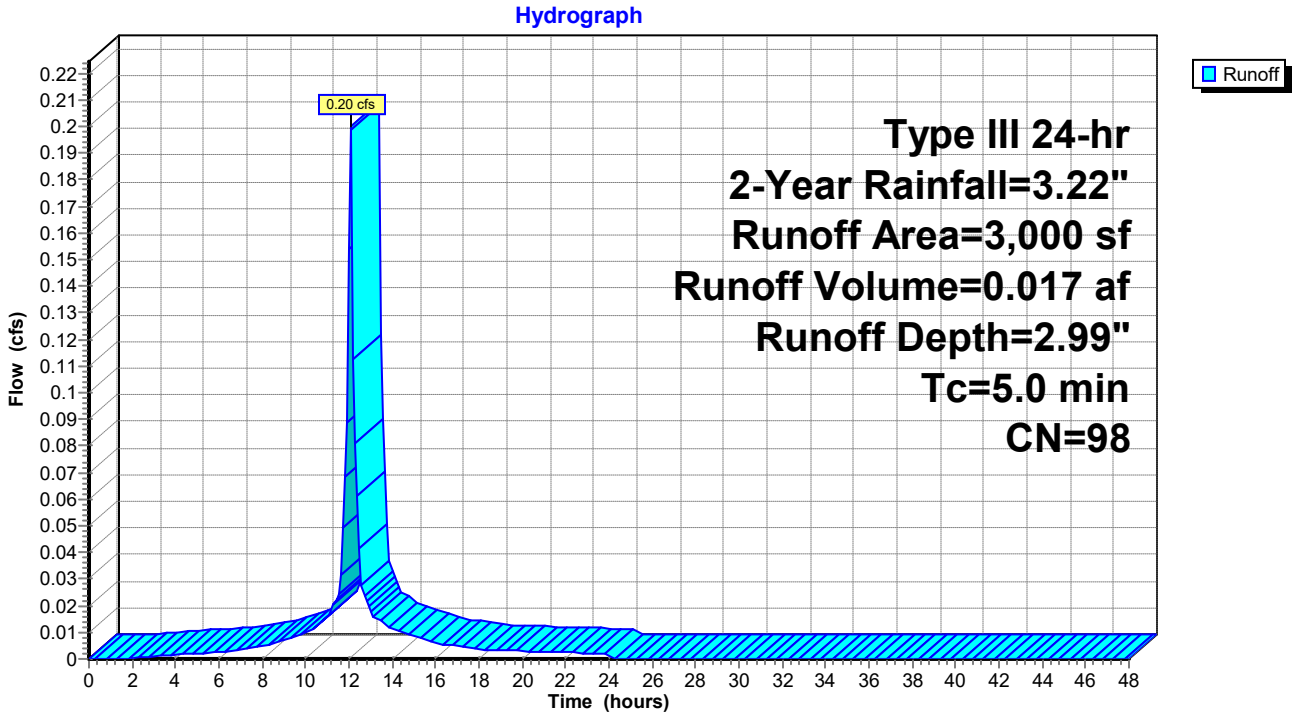
Runoff = 0.20 cfs @ 12.08 hrs, Volume= 0.017 af, Depth= 2.99"
Routed to Pond UG-1 : UG-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Type III 24-hr 2-Year Rainfall=3.22"

	Area (sf)	CN	Description
*	3,000	98	
	3,000		100.00% Impervious Area

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

Subcatchment 2S: (new Subcat)



Summary for Pond UG-1: UG-1

Inflow Area = 0.069 ac,100.00% Impervious, Inflow Depth = 2.99" for 2-Year event
Inflow = 0.20 cfs @ 12.08 hrs, Volume= 0.017 af
Outflow = 0.19 cfs @ 12.11 hrs, Volume= 0.017 af, Atten= 6%, Lag= 1.6 min
Discarded = 0.00 cfs @ 4.60 hrs, Volume= 0.006 af
Primary = 0.19 cfs @ 12.11 hrs, Volume= 0.011 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 303.27' @ 12.11 hrs Surf.Area= 131 sf Storage= 167 cf

Plug-Flow detention time= 281.7 min calculated for 0.017 af (100% of inflow)
Center-of-Mass det. time= 281.5 min (1,036.9 - 755.3)

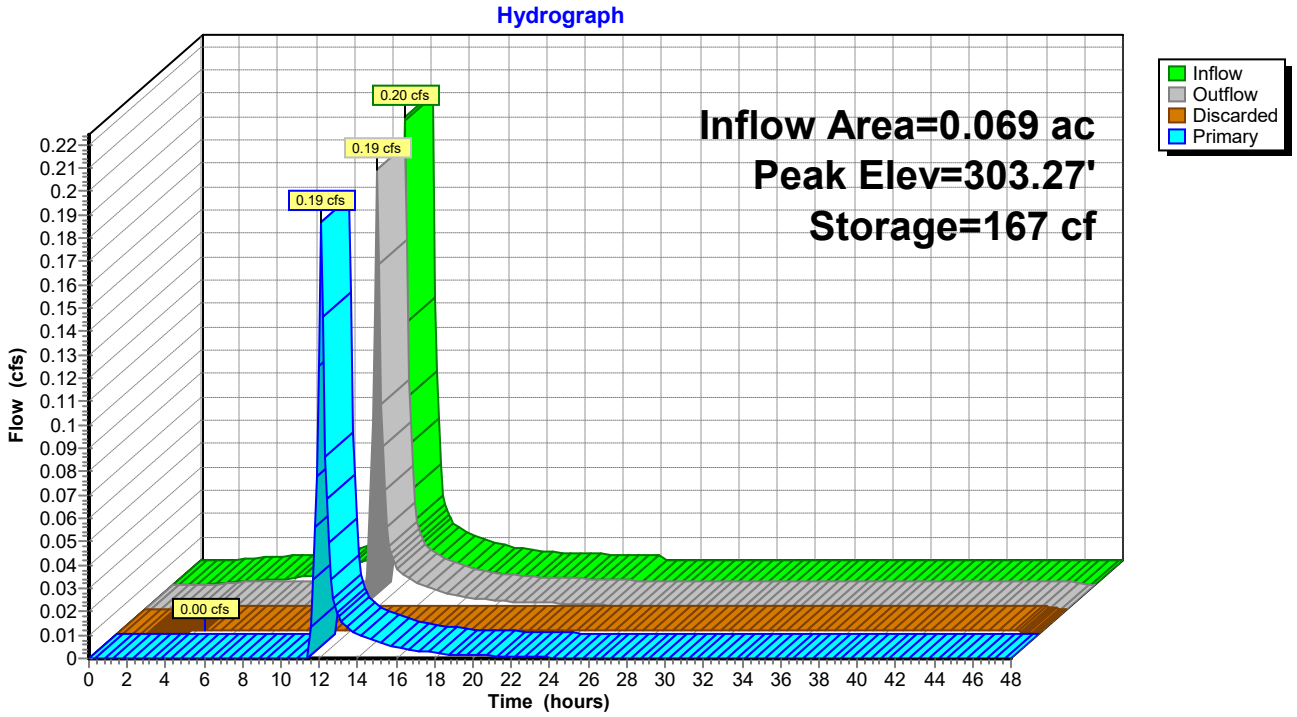
Volume	Invert	Avail.Storage	Storage Description
#1	302.00'	227 cf	**Concrete Galley 4x8x2** x 5 Inside= 42.0"W x 21.0"H => 6.04 sf x 7.50'L = 45.3 cf Outside= 48.0"W x 24.0"H => 7.92 sf x 8.00'L = 63.4 cf

Device	Routing	Invert	Outlet Devices
#1	Discarded	302.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	303.00'	**8.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 303.00' / 302.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Cast iron, coated, Flow Area= 0.35 sf

Discarded OutFlow Max=0.00 cfs @ 4.60 hrs HW=302.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.18 cfs @ 12.11 hrs HW=303.27' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.18 cfs @ 1.39 fps)

Pond UG-1: UG-1


Hydrograph
Inflow Area=0.069 ac
Peak Elev=303.27'
Storage=167 cf
Inflow
Outflow
Discarded
Primary
0.20 cfs
0.19 cfs
0.19 cfs
0.00 cfs
Flow (cfs)
Time (hours)

Summary for Subcatchment 2S: (new Subcat)

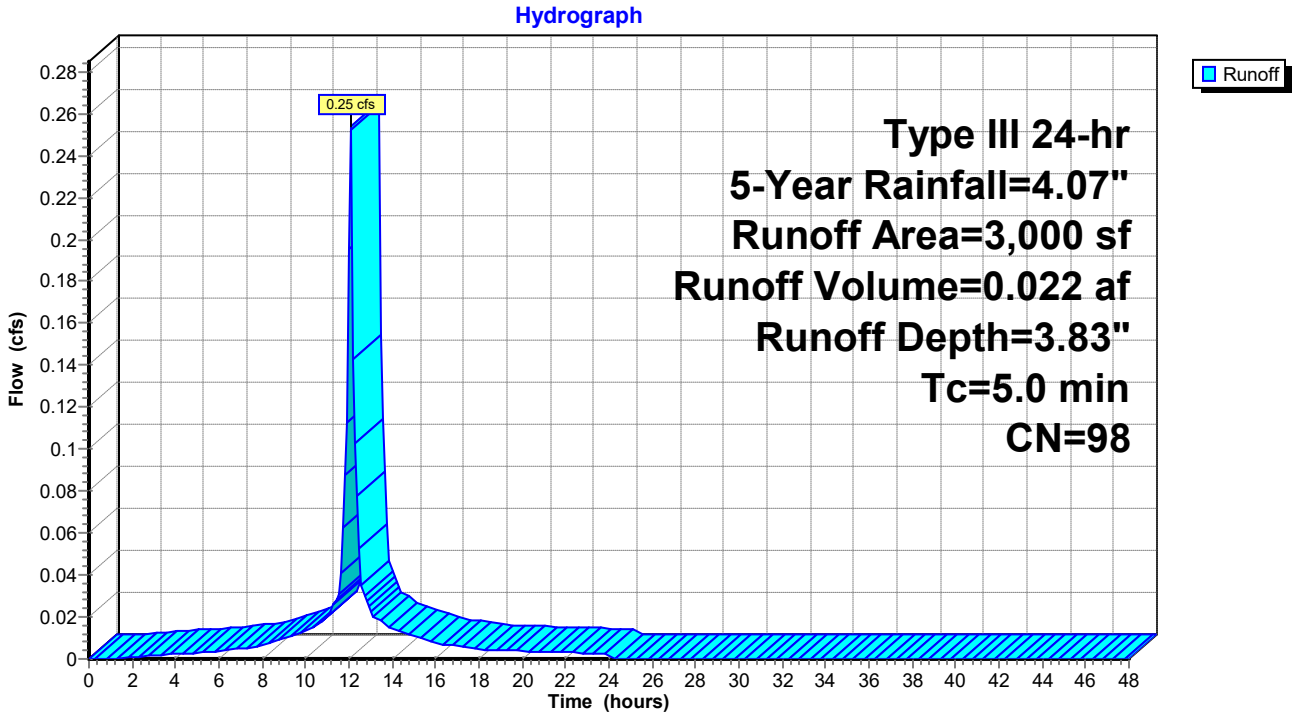
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.022 af, Depth= 3.83"
Routed to Pond UG-1 : UG-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Type III 24-hr 5-Year Rainfall=4.07"

	Area (sf)	CN	Description
*	3,000	98	
	3,000		100.00% Impervious Area

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

Subcatchment 2S: (new Subcat)



Summary for Pond UG-1: UG-1

Inflow Area = 0.069 ac,100.00% Impervious, Inflow Depth = 3.83" for 5-Year event
Inflow = 0.25 cfs @ 12.08 hrs, Volume= 0.022 af
Outflow = 0.24 cfs @ 12.11 hrs, Volume= 0.022 af, Atten= 5%, Lag= 1.4 min
Discarded = 0.00 cfs @ 3.50 hrs, Volume= 0.006 af
Primary = 0.24 cfs @ 12.11 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 303.31' @ 12.11 hrs Surf.Area= 131 sf Storage= 172 cf

Plug-Flow detention time= 227.3 min calculated for 0.022 af (100% of inflow)
Center-of-Mass det. time= 229.6 min (980.3 - 750.7)

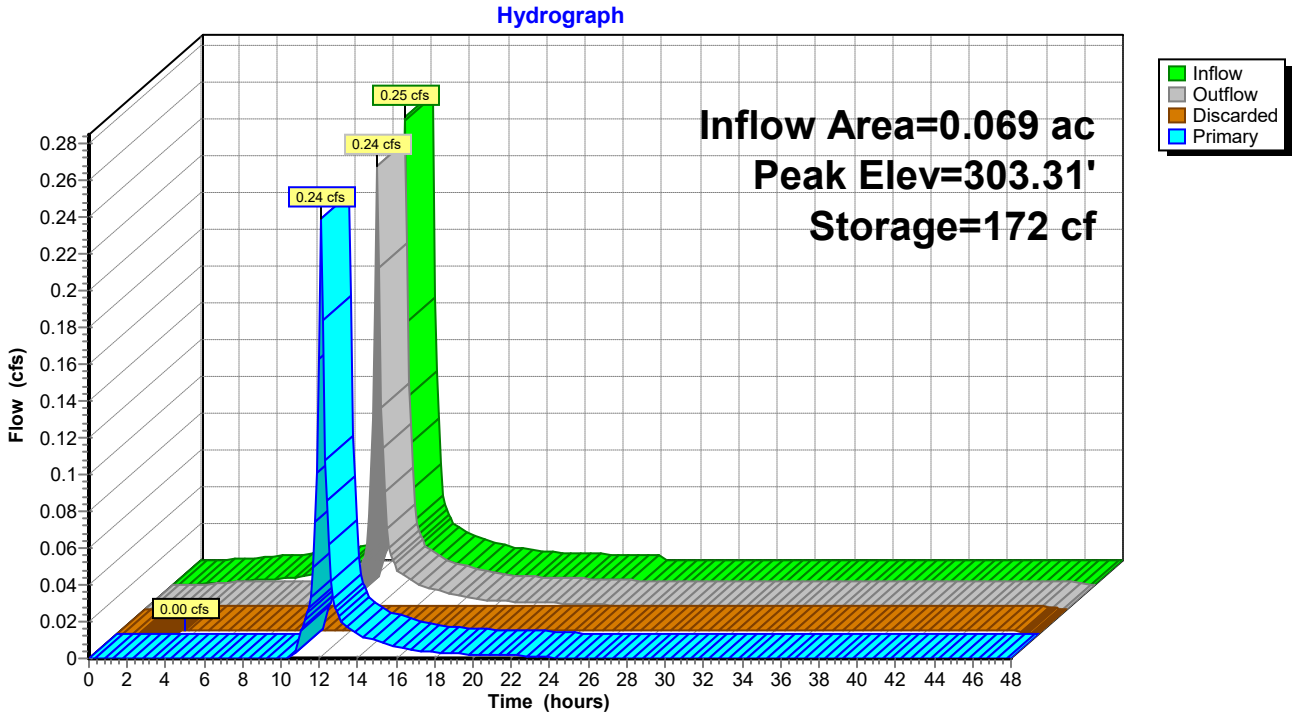
Volume	Invert	Avail.Storage	Storage Description
#1	302.00'	227 cf	**Concrete Galley 4x8x2** x 5 Inside= 42.0"W x 21.0"H => 6.04 sf x 7.50'L = 45.3 cf Outside= 48.0"W x 24.0"H => 7.92 sf x 8.00'L = 63.4 cf

Device	Routing	Invert	Outlet Devices
#1	Discarded	302.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	303.00'	**8.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 303.00' / 302.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Cast iron, coated, Flow Area= 0.35 sf

Discarded OutFlow Max=0.00 cfs @ 3.50 hrs HW=302.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.23 cfs @ 12.11 hrs HW=303.31' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.23 cfs @ 1.49 fps)

Pond UG-1: UG-1


Hydrograph
Inflow Area=0.069 ac
Peak Elev=303.31'
Storage=172 cf
0.25 cfs
0.24 cfs
0.24 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0.28
0.26
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
Time (hours)

Summary for Subcatchment 2S: (new Subcat)

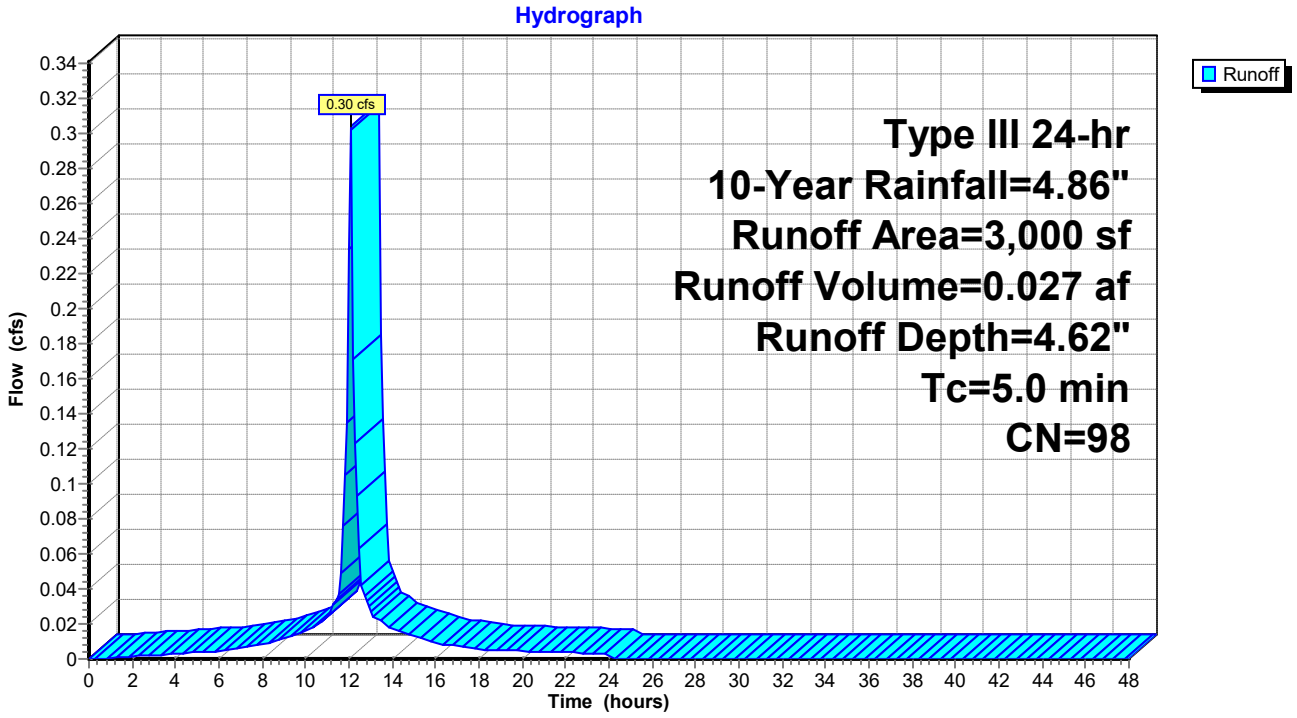
Runoff = 0.30 cfs @ 12.08 hrs, Volume= 0.027 af, Depth= 4.62"
Routed to Pond UG-1 : UG-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Type III 24-hr 10-Year Rainfall=4.86"

	Area (sf)	CN	Description
*	3,000	98	
	3,000		100.00% Impervious Area

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

Subcatchment 2S: (new Subcat)



Summary for Pond UG-1: UG-1

Inflow Area = 0.069 ac,100.00% Impervious, Inflow Depth = 4.62" for 10-Year event
Inflow = 0.30 cfs @ 12.08 hrs, Volume= 0.027 af
Outflow = 0.29 cfs @ 12.11 hrs, Volume= 0.027 af, Atten= 5%, Lag= 1.3 min
Discarded = 0.00 cfs @ 2.90 hrs, Volume= 0.006 af
Primary = 0.29 cfs @ 12.11 hrs, Volume= 0.021 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 303.35' @ 12.11 hrs Surf.Area= 131 sf Storage= 177 cf

Plug-Flow detention time= 197.2 min calculated for 0.027 af (100% of inflow)
Center-of-Mass det. time= 197.0 min (944.6 - 747.6)

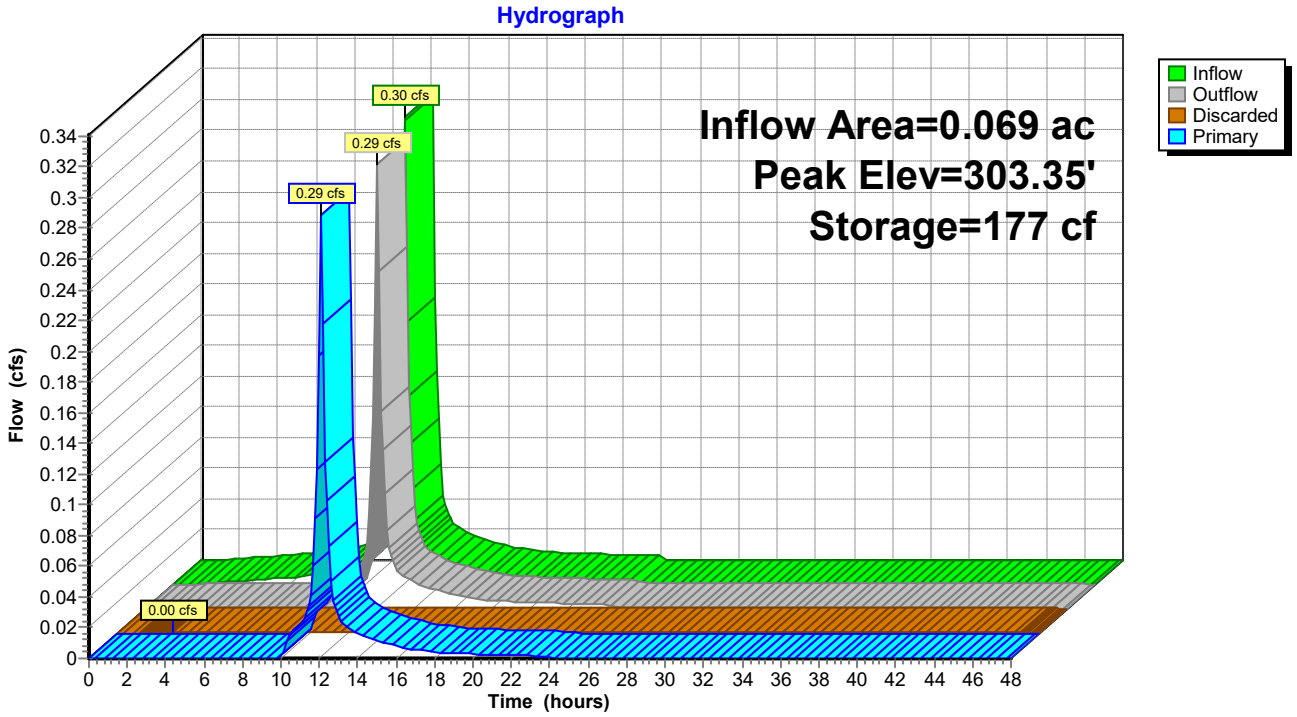
Volume	Invert	Avail.Storage	Storage Description
#1	302.00'	227 cf	**Concrete Galley 4x8x2** x 5 Inside= 42.0"W x 21.0"H => 6.04 sf x 7.50'L = 45.3 cf Outside= 48.0"W x 24.0"H => 7.92 sf x 8.00'L = 63.4 cf

Device	Routing	Invert	Outlet Devices
#1	Discarded	302.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	303.00'	**8.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 303.00' / 302.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Cast iron, coated, Flow Area= 0.35 sf

Discarded OutFlow Max=0.00 cfs @ 2.90 hrs HW=302.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.28 cfs @ 12.11 hrs HW=303.34' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.28 cfs @ 1.57 fps)

Pond UG-1: UG-1


Hydrograph
Inflow Area=0.069 ac
Peak Elev=303.35'
Storage=177 cf
0.30 cfs
0.29 cfs
0.29 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0 0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16 0.18 0.2 0.22 0.24 0.26 0.28 0.3 0.32 0.34
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48

Summary for Subcatchment 2S: (new Subcat)

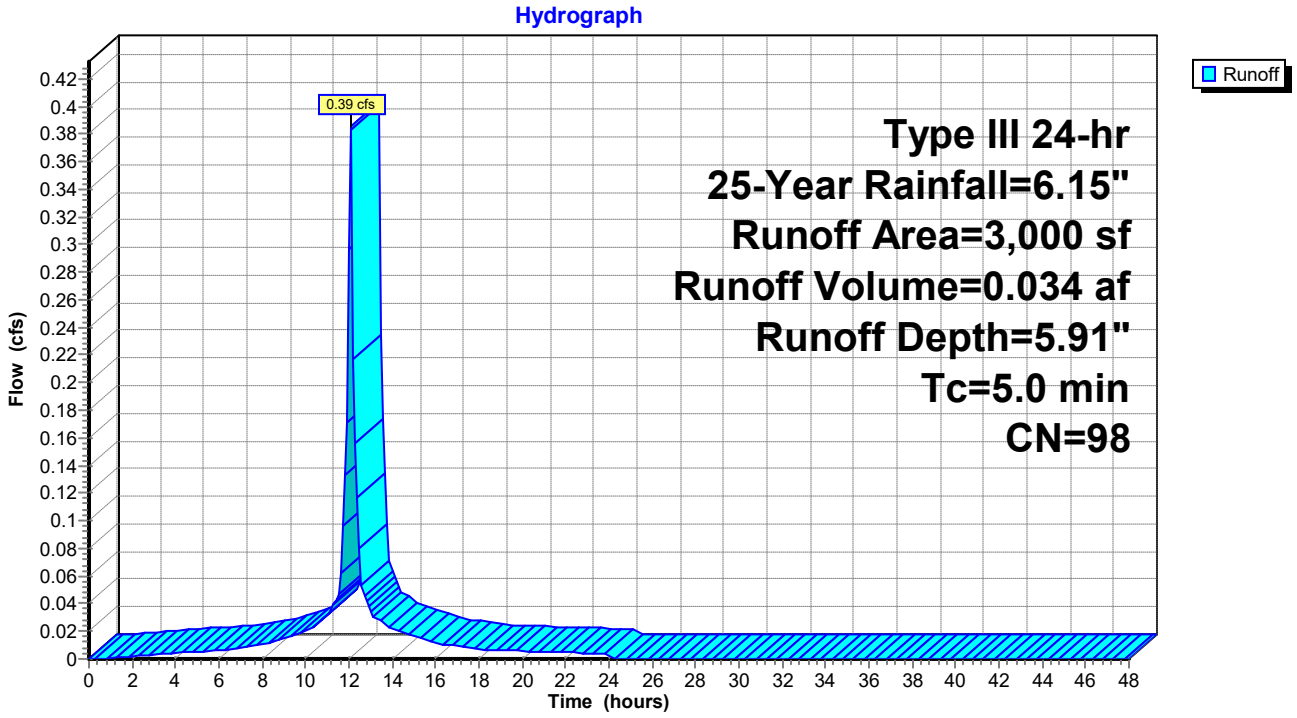
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.034 af, Depth= 5.91"
Routed to Pond UG-1 : UG-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Type III 24-hr 25-Year Rainfall=6.15"

	Area (sf)	CN	Description
*	3,000	98	
	3,000		100.00% Impervious Area

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

Subcatchment 2S: (new Subcat)



Summary for Pond UG-1: UG-1

Inflow Area = 0.069 ac,100.00% Impervious, Inflow Depth = 5.91" for 25-Year event
Inflow = 0.39 cfs @ 12.08 hrs, Volume= 0.034 af
Outflow = 0.37 cfs @ 12.10 hrs, Volume= 0.034 af, Atten= 4%, Lag= 1.2 min
Discarded = 0.00 cfs @ 2.10 hrs, Volume= 0.006 af
Primary = 0.37 cfs @ 12.10 hrs, Volume= 0.028 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 303.40' @ 12.11 hrs Surf.Area= 131 sf Storage= 183 cf

Plug-Flow detention time= 158.7 min calculated for 0.034 af (100% of inflow)
Center-of-Mass det. time= 161.1 min (905.0 - 743.9)

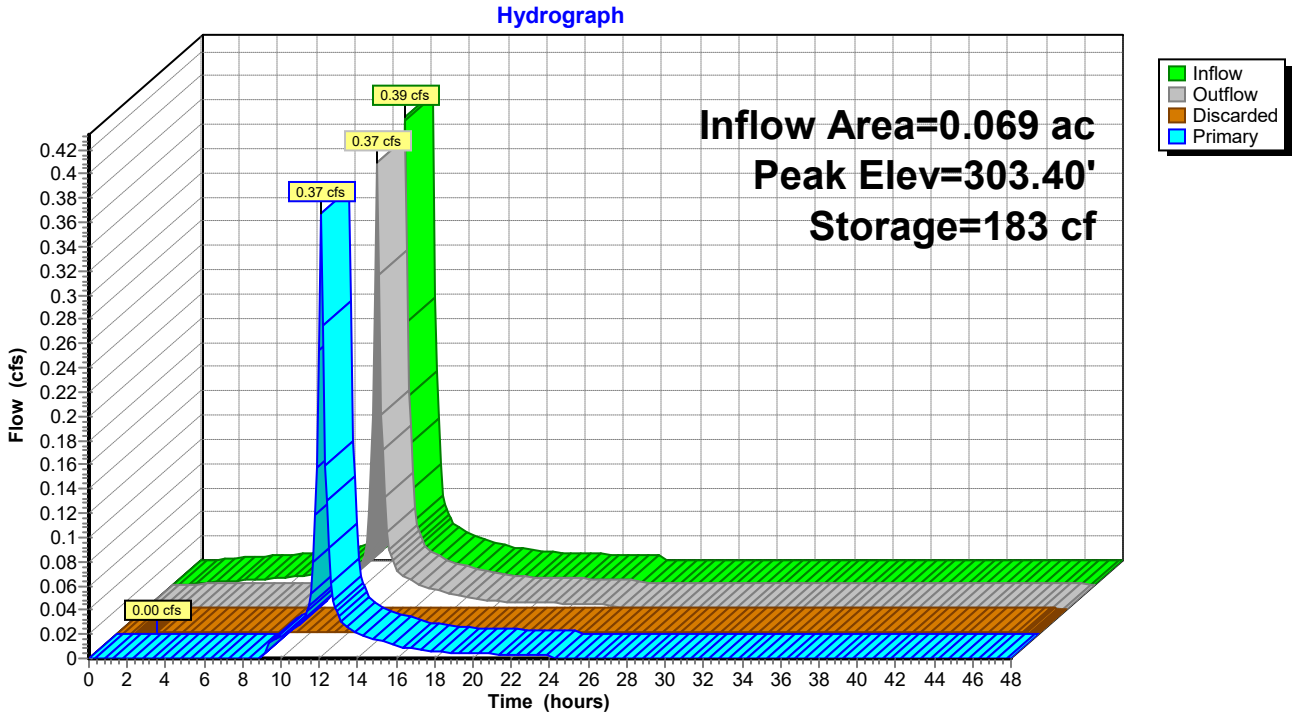
Volume	Invert	Avail.Storage	Storage Description
#1	302.00'	227 cf	**Concrete Galley 4x8x2** x 5 Inside= 42.0"W x 21.0"H => 6.04 sf x 7.50'L = 45.3 cf Outside= 48.0"W x 24.0"H => 7.92 sf x 8.00'L = 63.4 cf

Device	Routing	Invert	Outlet Devices
#1	Discarded	302.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	303.00'	**8.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 303.00' / 302.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Cast iron, coated, Flow Area= 0.35 sf

Discarded OutFlow Max=0.00 cfs @ 2.10 hrs HW=302.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.36 cfs @ 12.10 hrs HW=303.39' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.36 cfs @ 1.69 fps)

Pond UG-1: UG-1


Hydrograph
Inflow Area=0.069 ac
Peak Elev=303.40'
Storage=183 cf
0.39 cfs
0.37 cfs
0.37 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0 0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16 0.18 0.2 0.22 0.24 0.26 0.28 0.3 0.32 0.34 0.36 0.38 0.4 0.42
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48

Summary for Subcatchment 2S: (new Subcat)

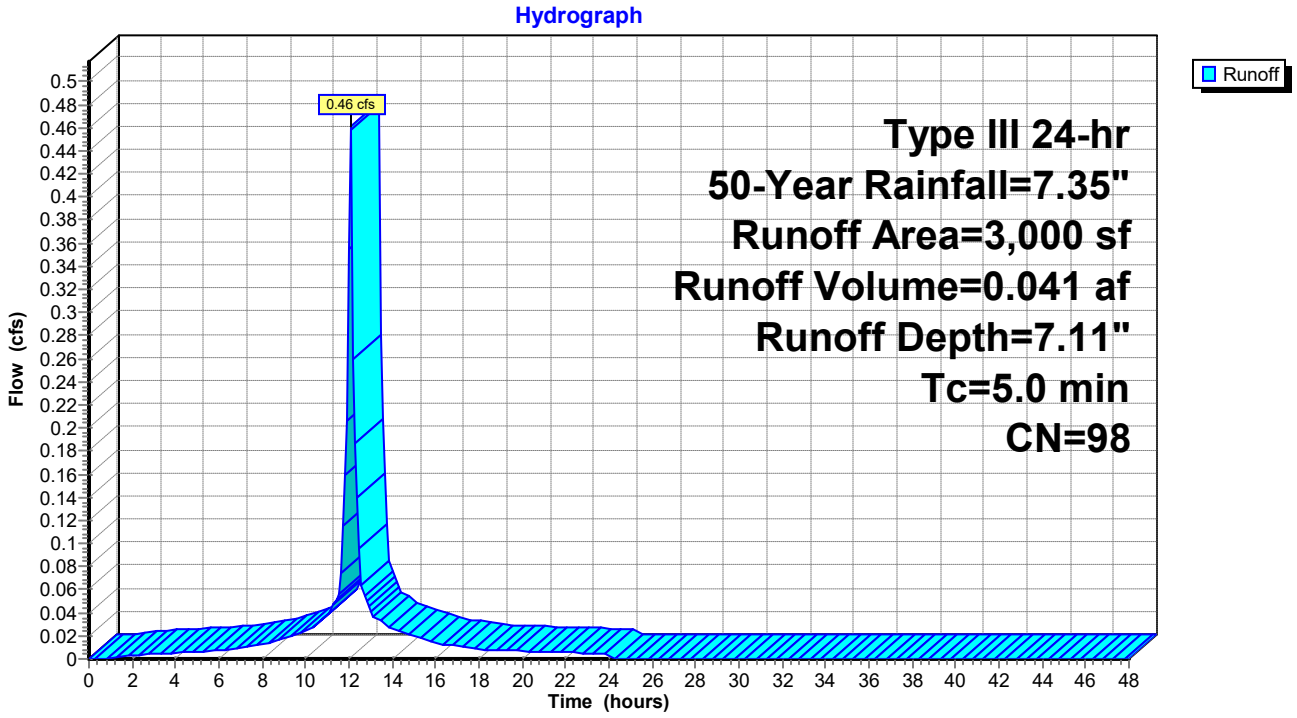
Runoff = 0.46 cfs @ 12.08 hrs, Volume= 0.041 af, Depth= 7.11"
Routed to Pond UG-1 : UG-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Type III 24-hr 50-Year Rainfall=7.35"

	Area (sf)	CN	Description
*	3,000	98	
	3,000		100.00% Impervious Area

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

Subcatchment 2S: (new Subcat)



Summary for Pond UG-1: UG-1

Inflow Area = 0.069 ac,100.00% Impervious, Inflow Depth = 7.11" for 50-Year event
Inflow = 0.46 cfs @ 12.08 hrs, Volume= 0.041 af
Outflow = 0.44 cfs @ 12.10 hrs, Volume= 0.041 af, Atten= 4%, Lag= 1.2 min
Discarded = 0.00 cfs @ 1.70 hrs, Volume= 0.006 af
Primary = 0.44 cfs @ 12.10 hrs, Volume= 0.035 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 303.44' @ 12.10 hrs Surf.Area= 131 sf Storage= 189 cf

Plug-Flow detention time= 136.0 min calculated for 0.041 af (100% of inflow)
Center-of-Mass det. time= 138.5 min (879.9 - 741.4)

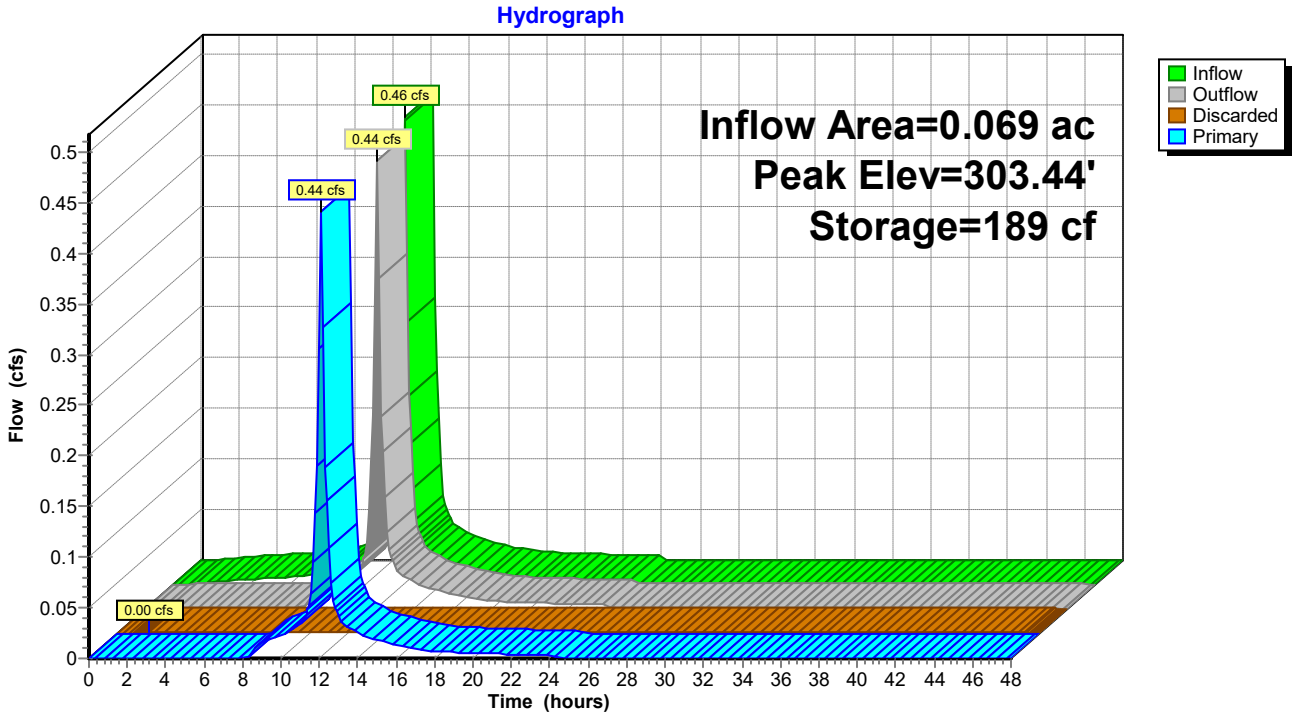
Volume	Invert	Avail.Storage	Storage Description
#1	302.00'	227 cf	**Concrete Galley 4x8x2** x 5 Inside= 42.0"W x 21.0"H => 6.04 sf x 7.50'L = 45.3 cf Outside= 48.0"W x 24.0"H => 7.92 sf x 8.00'L = 63.4 cf

Device	Routing	Invert	Outlet Devices
#1	Discarded	302.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	303.00'	**8.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 303.00' / 302.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Cast iron, coated, Flow Area= 0.35 sf

Discarded OutFlow Max=0.00 cfs @ 1.70 hrs HW=302.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.44 cfs @ 12.10 hrs HW=303.44' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.44 cfs @ 1.78 fps)

Pond UG-1: UG-1


Hydrograph
Inflow Area=0.069 ac
Peak Elev=303.44'
Storage=189 cf
0.46 cfs
0.44 cfs
0.44 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48

Summary for Subcatchment 2S: (new Subcat)

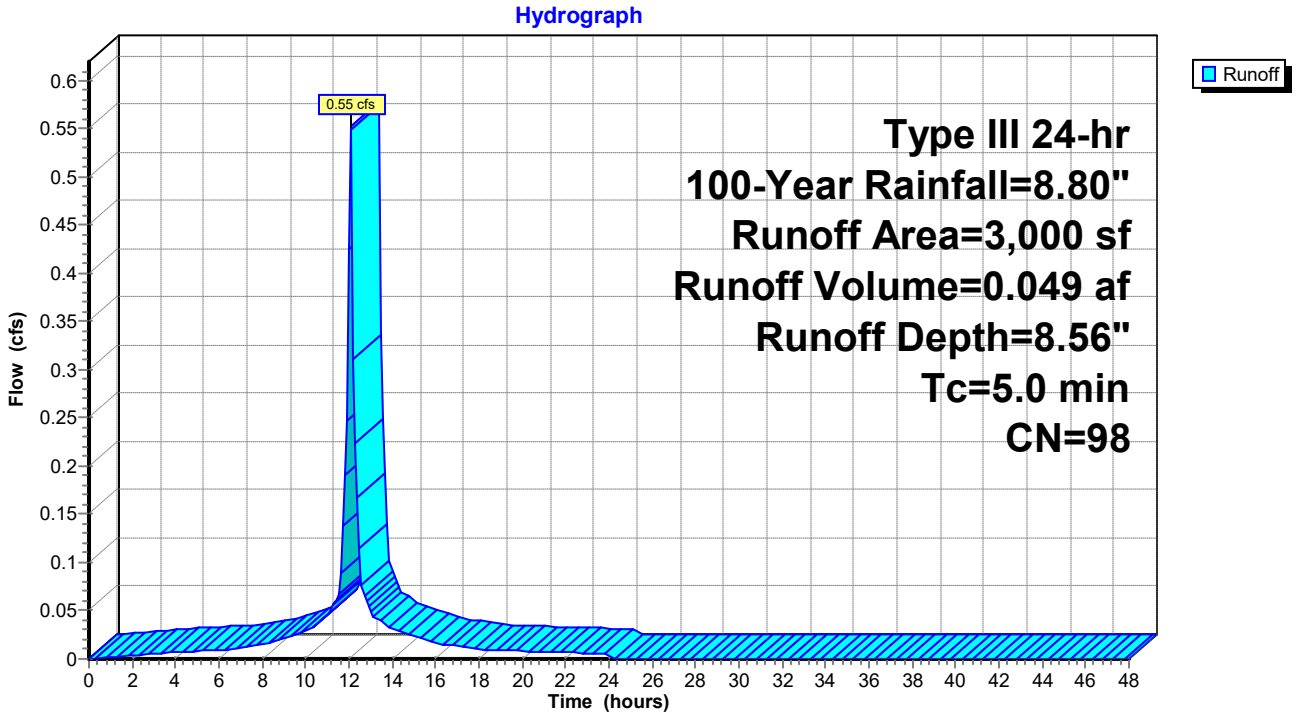
Runoff = 0.55 cfs @ 12.08 hrs, Volume= 0.049 af, Depth= 8.56"
Routed to Pond UG-1 : UG-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Type III 24-hr 100-Year Rainfall=8.80"

	Area (sf)	CN	Description
*	3,000	98	
	3,000		100.00% Impervious Area

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

Subcatchment 2S: (new Subcat)



Summary for Pond UG-1: UG-1

Inflow Area = 0.069 ac,100.00% Impervious, Inflow Depth = 8.56" for 100-Year event
Inflow = 0.55 cfs @ 12.08 hrs, Volume= 0.049 af
Outflow = 0.53 cfs @ 12.10 hrs, Volume= 0.049 af, Atten= 4%, Lag= 1.2 min
Discarded = 0.00 cfs @ 1.40 hrs, Volume= 0.006 af
Primary = 0.53 cfs @ 12.10 hrs, Volume= 0.043 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 303.50' @ 12.10 hrs Surf.Area= 131 sf Storage= 197 cf

Plug-Flow detention time= 116.3 min calculated for 0.049 af (100% of inflow)
Center-of-Mass det. time= 118.8 min (858.0 - 739.1)

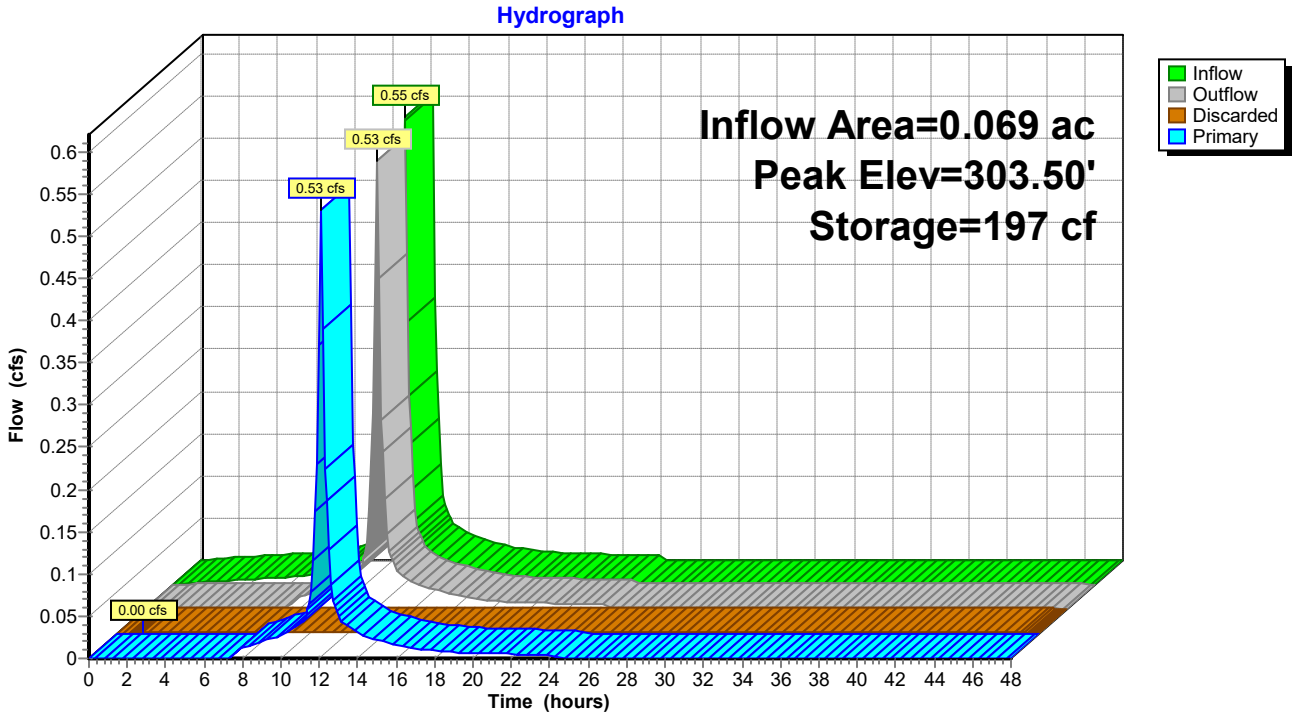
Volume	Invert	Avail.Storage	Storage Description
#1	302.00'	227 cf	**Concrete Galley 4x8x2** x 5 Inside= 42.0"W x 21.0"H => 6.04 sf x 7.50'L = 45.3 cf Outside= 48.0"W x 24.0"H => 7.92 sf x 8.00'L = 63.4 cf

Device	Routing	Invert	Outlet Devices
#1	Discarded	302.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	303.00'	**8.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 303.00' / 302.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Cast iron, coated, Flow Area= 0.35 sf

Discarded OutFlow Max=0.00 cfs @ 1.40 hrs HW=302.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.53 cfs @ 12.10 hrs HW=303.49' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.53 cfs @ 1.89 fps)

Pond UG-1: UG-1


Hydrograph
Inflow Area=0.069 ac
Peak Elev=303.50'
Storage=197 cf
Inflow
Outflow
Discarded
Primary
0.55 cfs
0.53 cfs
0.53 cfs
0.00 cfs
Flow (cfs)
Time (hours)

Appendix B

NRCS Soil Report

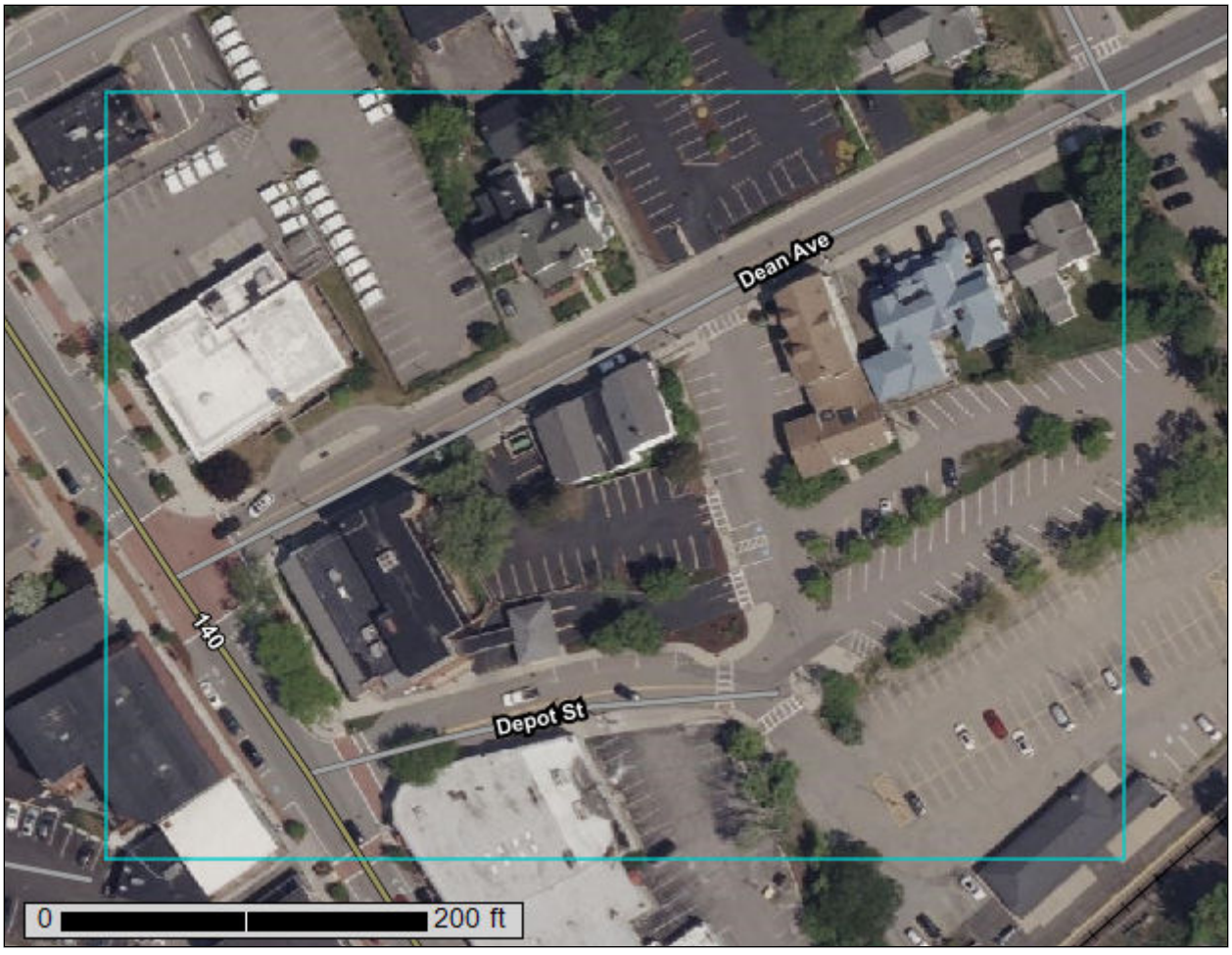
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Norfolk and Suffolk Counties, Massachusetts



February 26, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

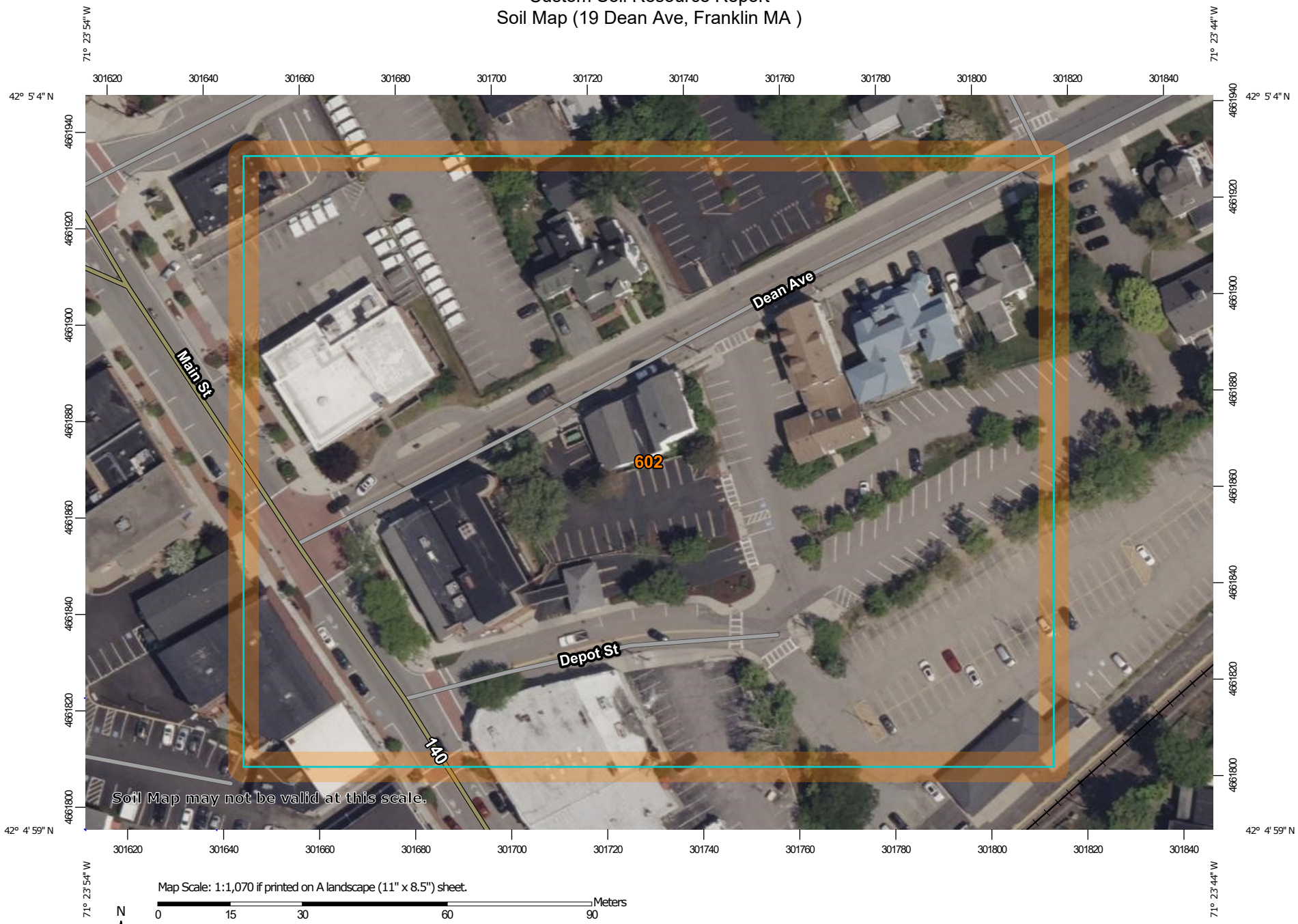
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (19 Dean Ave, Franklin MA)



Map Scale: 1:1,070 if printed on A landscape (11" x 8.5") sheet.

N

0 15 30 60 90 Meters

0 50 100 200 300 Feet

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 1:25,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

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

Map Unit Legend (19 Dean Ave, Franklin MA)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
602	Urban land, 0 to 15 percent slopes	5.3	100.0%
Totals for Area of Interest		**5.3**	**100.0%**

Map Unit Descriptions (19 Dean Ave, Franklin MA)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The

delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Norfolk and Suffolk Counties, Massachusetts

602—Urban land, 0 to 15 percent slopes

Map Unit Setting

National map unit symbol: vkyj
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 120 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 99 percent
Minor components: 1 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Excavated and filled land

Minor Components

Rock outcrops

Percent of map unit: 1 percent
Hydric soil rating: Unranked

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