NOTICE OF INTENT

Mystic River Watershed

Stoneham High School Wetlands

Stoneham, MA

Upper Mystic Stormwater Wetlands Project

February 2024

PREPARED FOR:

Town of Stoneham
35 Central Street
Stoneham, MA 02180

PREPARED BY:

Horsley Witten Group
Sustainable Environmental Solutions
90 Route 6A • Unit 1 • Sandwich, MA 02563
508-833-6600 • horsleywitten.com

Horsley Witten Group
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90 Route 6A • Unit 1 • Sandwich, MA 02563
508-833-6600 • horsleywitten.com

February 12, 2024

Stoneham Conservation Commission
c/o Jennifer DeCourcy, Conservation Agent
35 Central Street, Basement Level
Stoneham, MA 02180

Re: Notice of Intent Application – Stoneham High School Wetlands
149 Franklin Street, Stoneham, Massachusetts

Dear Members of the Conservation Commission:

On behalf of the Applicant, the Town of Stoneham, the Horsley Witten Group, Inc. (HW) is submitting the enclosed Notice of Intent (NOI) application and supporting materials for open space and ecological improvements at the Stoneham High School Wetlands, an approximately 6.6 area within the above referenced property.

The proposed project is part of a larger, grant-funded effort through the Municipal Vulnerability Preparedness grant program (MVP) designed to address current and future flooding within the Mystic River Watershed and improve climate change resiliency and water quality while advancing environmental justice and open space connectivity. The Town of Stoneham's site at the Stoneham High School Wetlands was one of the priority sites originally identified to address the program goals and has been selected for design development and permitting. Proposed project activities involve expanding the capacity of existing wetlands by removing debris previously dumped at the site and creating additional vegetated wetlands with the installation of wetland replacement areas. The project also seeks to enhance existing resource areas through native plantings and invasive species control, as well as develop a formalized accessible trail system, wayfinding kiosks, trail markers, educational signage, and seating areas.

Due to the restorative nature of the project, it will be necessary to conduct work within resource areas protected under the Massachusetts Wetlands Protection Act (WPA) (M.G.L. Ch. 131 § 40) and the Town of Stoneham Wetlands Protection Bylaw (Chapter 11). Proposed activities will unavoidably occur within Bordering Vegetated Wetlands (BVWs), Isolated Vegetated Wetland (IVW), Inland Bank (Bank), and the 100- and 25-foot Buffer Zones associated with each resource area. Project objectives aim to improve the functionality of these resource areas by implementing wetlands restoration to improve water quality and flood storage capacity and invasive species management to improve habitat and biodiversity.

Details of the proposed project are provided in the following subsections and depicted on the attached project plans, entitled "*Stoneham Wetlands Restoration, 75% Design Development Plans, Stoneham, MA*" prepared by HW, and dated February 2024, and described in the attached project narrative.

Enclosed please find 1 copy of the NOI application and supporting documentation for the proposed project*. As this is a municipal project, the state filing fees are exempt, and the Applicant is seeking a waiver for any local filing fees. An electronic copy of all materials has been submitted as well and copied to the Massachusetts Department of Environmental Protection (MassDEP), Northeast Regional Office. HW has also sent notification of the pending public hearing to abutters in accordance with State and local filing regulations and policies.

Thank you in advance for your review of this NOI application. If you have any questions and/or require additional information pertaining to this submittal, please contact me at (508) 833-6600 or at jrelstab@horsleywitten.com.

Sincerely,

Horsley Witten Group, Inc.

Jennifer R. Relstab, P.E.
Project Manager

Enclosures

cc: MassDEP, Northeast Regional Office
Catherine Pedemonti, Mystic River Watershed Association
Patrick Herron, Mystic River Watershed Association

*Additional hard copies will be forwarded to Commission members as requested.

Stoneham High School Wetlands
Stoneham, Massachusetts

Notice of Intent Contents

Notice of Intent Forms

WPA Form 3 (eDEP)
Stormwater Checklist

Abutter Notification

Certified Abutters List
Notice to Abutters
Affidavit of Service

Project Narrative

Attachments

Attachment A – Locus Maps

Figure 1 – USGS Topography
Figure 2 – Aerial Photograph
Figure 3 – Environmental Resources
Figure 4 – NRCS Soils Map
Figure 5 – FEMA Flood Zones
Figure 6 – FEMA FIRMette
Figure 7 – Invasive Species

Attachment B – Wetland Data

1 – StreamStats Report
2 – Wetland Determination Forms

Attachment C – Project Plans [bound separately]

Attachment D – Invasive Species Management Plan

Attachment E – Stormwater Analysis Report

Attachment F – Post Construction Operation and Maintenance Plan

Notice of Intent Forms

WPA Form 3 (eDEP)

Stormwater Checklist

Massachusetts Department of Environmental Protection

eDEP Transaction Copy

Here is the fle you requested for your records.

To retain a copy of this fle you must save and/or print.

Username:	**90ROUTE6AEDEP**
Transaction ID:	**1668369**
Document:	**WPA Form 3 - NOI**
Size of File:	**276.18K**
Status of Transaction:	**In Process**
Date and Time Created:	**2/9/2024:2:17:25 PM**

Note: This fl e only includes forms that were part of your transaction as of the date and time indicated above. If you need a more current copy of your transaction, return to eDEP and select to “Download a Copy” from the Current Submittals page.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 3 - Notice of Intent
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:
eDEP Transaction #:1668369
City/Town:STONEHAM

A.General Information

1. Project Location:

a. Street Address	149 FRANKLIN STREET		
b. City/Town	STONEHAM	c. Zip Code	02180
d. Latitude	42.47018N	e. Longitude	71.09034W
f. Map/Plat #	8	g.Parcel/Lot #	134

2. Applicant:

☐ Individual ☑ Organization

a. First Name	PAULETTE	b.Last Name	GERRY		
c. Organization	TOWN OF STONEHAM				
d. Mailing Address	35 CENTRAL STREET				
e. City/Town	STONEHAM	f. State	MA	g. Zip Code	02180
h. Phone Number	781-279-2696	i. Fax		j. Email	pgerry@stoneham-ma.gov

3.Property Owner:

☐ more than one owner

a. First Name		b. Last Name	
c. Organization			
d. Mailing Address			
e. City/Town	f.State		g. Zip Code
h. Phone Number	i. Fax		j.Email

4.Representative:

a. First Name	JENNIFER	b. Last Name	RELSTAB		
c. Organization	HORSLEY WITTEN GROUP, INC.				
d. Mailing Address	112 WATER ST, 6TH FLOOR				
e. City/Town	BOSTON	f. State	MA	g. Zip Code	02109
h.Phone Number	857-263-8193	i.Fax		j.Email	jrelstab@horsleywitten.com

5.Total WPA Fee Paid (Automatically inserted from NOI Wetland Fee Transmittal Form):

a.Total Fee Paid	0.00	b.State Fee Paid	0.00	c.City/Town Fee Paid	0.00

6.General Project Description:

THE TOWN OF STONEHAM (THE APPLICANT), PROPOSES TO ECOLOGICALLY RESTORE AND RECREATIONALLY ENHANCE AN APPROXIMATELY 6.6 ACRE PORTION OF THE STONEHAM HIGH SCHOOL WETLANDS (PARCEL ID: 8-134). THE PROJECT AREA IS LITTERED WITH LARGE DEBRIS, INVASIVE SPECIES, AND INFORMAL, WELL-WORN PATHS CREATED BY ITS CURRENT USERS. PROPOSED PROJECT ACTIVITIES INVOLVE REMOVING DEBRIS PREVIOUSLY DUMPED AT THE SITE AND CREATING ADDITIONAL VEGETATED WETLANDS IN AREAS THAT WERE PRESUMABLY WETLAND PRIOR TO HISTORIC DISTURBANCES. THE PROJECT ALSO SEEKS TO ENHANCE EXISTING RESOURCE AREAS THROUGH NATIVE PLANTINGS AND INVASIVE SPECIES MANAGEMENT, AS WELL AS DEVELOP A FORMALIZED ACCESSIBLE TRAIL SYSTEM, WAYFINDING KIOSKS, TRAIL MARKERS, EDUCATIONAL SIGNAGE, AND SEATING AREAS.

7a.Project Type:

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 3 - Notice of Intent
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:
eDEP Transaction #:1668369
City/Town:STONEHAM

1. ☐ Single Family Home
2. ☐ Residential Subdivision
3. ☐ Limited Project Driveway Crossing
4. ☐ Commercial/Industrial
5. ☐ Dock/Pier
6. ☐ Utilities
7. ☐ Coastal Engineering Structure
8. ☐ Agriculture (eg., cranberries, forestry)
9. ☐ Transportation
10. ☑ Other

7b.Is any portion of the proposed activity eligible to be treated as a limited project subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1. ☑ Yes ☐ No — If yes, describe which limited project applies to this project:
2. Limited Project — 10.53(3)(J)

8.Property recorded at the Registry of Deeds for:

a.County:	b.Certificate:	c.Book:	d.Page:
SOUTHERN MIDDLESEX		10891	20

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

1.Buffer Zone & Resource Area Impacts (temporary & permanent):

☐ This is a Buffer Zone only project - Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.

2.Inland Resource Areas: (See 310 CMR 10.54 - 10.58, if not applicable, go to Section B.3. Coastal Resource Areas)

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Bank	1. linear feet	2. linear feet
b. ☐ Bordering Vegetated Wetland	1. square feet	2. square feet
c. ☐ Land under Waterbodies and Waterways	1. Square feet	2. square feet
	3. cubic yards dredged	
d. ☐ Bordering Land Subject to Flooding	1. square feet	2. square feet
	3. cubic feet of flood storage lost	4. cubic feet replaced
e. ☐ Isolated Land Subject to Flooding	1. square feet	
	2. cubic feet of flood storage lost	3. cubic feet replaced

f. ☐ Riverfront Area

1. Name of Waterway (if any)

2. Width of Riverfront Area (check one)
☐ 25 ft. - Designated Densely Developed Areas only
☐ 100 ft. - New agricultural projects only
☐ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project

square feet

4. Proposed Alteration of the Riverfront Area:

a. total square feet	b. square feet within 100 ft.	c. square feet between 100 ft. and 200 ft.

5. Has an alternatives analysis been done and is it attached to this NOI? ☐ Yes ☐ No

6. Was the lot where the activity is proposed created prior to August 1, 1996? ☐ Yes ☐ No

3.Coastal Resource Areas: (See 310 CMR 10.25 - 10.35)

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Designated Port Areas	Indicate size under	Land under the ocean below,
b. ☐ Land Under the Ocean	1. square feet 2. cubic yards dredged	
c. ☐ Barrier Beaches	Indicate size under Coastal Beaches and/or Coatstal Dunes, below	
d. ☐ Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. ☐ Coastal Dunes	1. square feet	2. cubic yards dune nourishment
f. ☐ Coastal Banks	1. linear feet	
g. ☐ Rocky Intertidal Shores	1. square feet	
h. ☐ Salt Marshes	1. square feet	2. sq ft restoration, rehab, crea.
i. ☐ Land Under Salt Ponds	1. square feet	
	2. cubic yards dredged	
j. ☐ Land Containing Shellfish	1. square feet	
k. ☐ Fish Runs	Indicate size under Coastal Banks, Inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above	
	1. cubic yards dredged	
l. ☐ Land Subject to Coastal Storm Flowage	1. square feet	

4.Restoration/Enhancement

☐ Restoration/Replacement

If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been

entered in Section B.2.b or B.3.h above, please entered the additional amount here.

a. square feet of BVW b. square feet of Salt Marsh

5.Projects Involves Stream Crossings

☑ Project Involves Streams Crossings

If the project involves Stream Crossings, please enter the number of new stream crossings/number of replacement stream crossings.

1

a. number of new stream crossings b. number of replacement stream crossings

C. Other Applicable Standards and Requirements

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage of Endangered Species program (NHESP)?

a. ☐ Yes ☑ No

If yes, include proof of mailing or hand delivery of NOI to:
Natural Heritage and Endangered Species
Program
Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581

b. Date of map:FROM MAP VIEWER

If yes, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18)....

c. Submit Supplemental Information for Endangered Species Review * (Check boxes as they apply)

1.☐ Percentage/acreage of property to be altered:

(a) within Wetland Resource Area percentage/acreage

(b) outside Resource Area percentage/acreage

2.☐ Assessor's Map or right-of-way plan of site

3.☐ Project plans for entire project site, including wetland resource areas and areas outside of wetland jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **

a.☐ Project description (including description of impacts outside of wetland resource area & buffer zone)

b.☐ Photographs representative of the site

c.☐ MESA filing fee (fee information available at: http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/mass-endangered-species-act-mesa/mesa-fee-schedule.html)
Make check payable to "Natural Heritage & Endangered Species Fund" and **mail to NHESP** at above address

*Projects altering **10 or more acres** of land, also submit:*

d.☐ Vegetation cover type map of site

e.☐ Project plans showing Priority & Estimated Habitat boundaries

d. OR Check One of the following

1.☐ Project is exempt from MESA review. Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, http://www.mass.gov/eea/agencies/dfg/dfw/laws-regulations/cmr/321-cmr-1000-massachusetts-endangered-

species-act.html#10.14; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)

2. ☐ Separate MESA review ongoing.
   a. NHESP Tracking Number
   b. Date submitted to NHESP
3. ☐ Separate MESA review completed.

Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review...

2. For coastal projects only, is any portion of the proposed project located below the mean high waterline or in a fish run?
   a. ☑ Not applicable - project is in inland resource area only
   b. ☐ Yes ☐ No

   If yes, include proof of mailing or hand delivery of NOI to either:

South Shore - Cohasset to Rhode Island, and the Cape & Islands:	North Shore - Hull to New Hampshire:
Division of Marine Fisheries - Southeast Marine Fisheries Station Attn: Environmental Reviewer 836 S. Rodney French Blvd New Bedford, MA 02744	Division of Marine Fisheries - North Shore Office Attn: Environmental Reviewer 30 Emerson Avenue Gloucester, MA 01930

   If yes, it may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP's Boston Office. For coastal towns in the Southeast Region, please contact MassDEP's Southeast Regional office.

3. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?

   a. ☐ Yes ☑ No

   If yes, provide name of ACEC (see instructions to WPA Form 3 or DEP Website for ACEC locations). **Note:** electronic filers click on Website.

   b. ACEC Name

4. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?
   a. ☐ Yes ☑ No

5. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L.c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L.c. 130, § 105)?
   a. ☐ Yes ☑ No

6. Is this project subject to provisions of the MassDEP Stormwater Management Standards?
   a. ☑ Yes, Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:
      1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol.2, Chapter 3)
      2. ☐ A portion of the site constitutes redevelopment
      3. ☐ Proprietary BMPs are included in the Stormwater Management System

b. ☐ No, Explain why the project is exempt:

1. ☐ Single Family Home
2. ☐ Emergency Road Repair
3. ☐ Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department by regular mail delivery.

1. USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the ☑ Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)
2. Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland ☑ [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.
3. Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s). ☑ Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.
4. List the titles and dates for all plans and other materials submitted with this NOI. ☑

a. Plan Title:	b. Plan Prepared By:	c. Plan Signed/Stamped By:	c. Revised Final Date:	e. Scale:
ALL FIGURES	HORSLEY WITTEN GROUP, INC.		2/12/2024	
WETLAND DATA	HORSLEY WITTEN GROUP, INC.		5/1/2023	
STONEHAM WETLANDS RESTORATION, 75% DESIGN DEVELOPMENT PLANS, STONEHAM, MA	HORSLEY WITTEN GROUP, INC.		2/12/2024	
INVASIVE SPECIES MANAGEMENT PLAN	HORSLEY WITTEN GROUP, INC.		June 2023	
STORMWATER REPORT	HORSLEY WITTEN GROUP, INC.		June 2023	

5. If there is more than one property owner, please attach a list of these property owners not listed on this form. ☐
6. Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed. ☐
7. Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed. ☐
8. Attach NOI Wetland Fee Transmittal Form. ☑

9. Attach Stormwater Report, if needed.

☑

E. Fees

1.

Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

2. Municipal Check Number

3. Check date

4. State Check Number

5. Check date

6. Payer name on check: First Name

7. Payer name on check: Last Name

F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

1. Signature of Applicant

2. Date: February 9, 2024

3. Signature of Property Owner(if different)

4. Date

5. Signature of Representative (if any)

6. Date: Febuary 9, 2024

For Conservation Commission:

Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:

One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a copy of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:

If the applicant has checked the "yes" box in Section C, Items 1-3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 3 - Notice of Wetland FeeTransmittal Form
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:
eDEP Transaction #:1668369
City/Town:STONEHAM

A. Applicant Information

1. Applicant:

a. First Name	PAULETTE		b.Last Name	GERRY	
c. Organization	TOWN OF STONEHAM				
d. Mailing Address	35 CENTRAL STREET				
e. City/Town	STONEHAM	f. State	MA	g. Zip Code	02180
h. Phone Number	7812792696	i. Fax		j. Email	pgerry@stoneham-ma.gov

2.Property Owner:(if different)

a. First Name		b. Last Name	
c. Organization			
d. Mailing Address			
e. City/Town	f.State		g. Zip Code
h. Phone Number	i. Fax		j.Email

3. Project Location:

a. Street Address	149 FRANKLIN STREET	b. City/Town	STONEHAM

Are you exempted from Fee? ☐ (YOU HAVE SELECTED 'YES')

Note: Fee will be exempted if you are one of the following:

- City/Town/County/District
- Municipal Housing Authority
- Indian Tribe Housing Authority
- MBTA

State agencies are only exempt if the fee is less than $100

B. Fees

Activity Type	Activity Number	Activity Fee	RF Multiplier	Sub Total

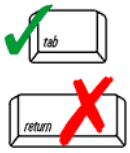
City/Town share of filling fee	State share of filing fee	Total Project Fee
$0.00	$0.00	$0.00

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.

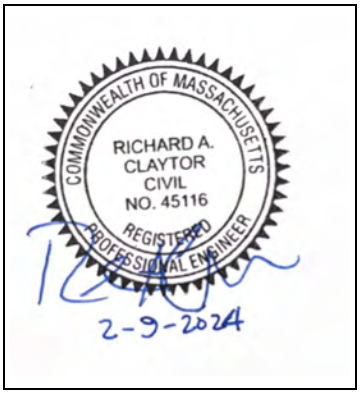
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



2/9/24

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): Restoring historical wetland resource areas

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 Not Applicable

- ☐ 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 Not Applicable

- ☐ 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 Not Applicable

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) Not Applicable

☐ 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 Not Applicable

☐ 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.

See Plans and O&M Plan

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; See O&M Plan
- ☒ 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.

Abutter Notification

Certified Abutters List

Notice to Abutters

Affidavit of Service

TOWN OF STONEHAM
149 FRANKLIN STREET
ABUTTER MAP

0 120240 480 720 960 Feet

N

SAVAGE MARK L.
160 FRANKLIN ST
STONEHAM, MA 02180

LOC: 160 FRANKLIN ST 8-0-101

MCCARTHY TIMOTHY F.
152 FRANKLIN ST
STONEHAM, MA 02180

LOC: 152 FRANKLIN ST 8-0-98

ROTONDI RUDOLPH J
140 1/2 FRANKLIN ST
STONEHAM, MA 02180

LOC: 140 1/2 FRANKLIN ST 8-0-94A

DEMEDEIROS SERGIO L.
148 FRANKLIN ST
STONEHAM, MA 02180

LOC: 148 FRANKLIN ST 8-0-96

BALOGLU ERKAN
8 BENJAMIN TERRACE
STONEHAM, MA 02180

LOC: 8 BENJAMIN TRL 8-0-176A

JOYCE STEVE P
6 EMERALD CT
STONEHAM, MA 02180

LOC: 6 EMERALD CT 8-0-154

DICKINSON LOUIS A
5 EMERALD CT
STONEHAM, MA 02180

LOC: 5 EMERALD CT 8-0-166

WALTERS EDWARD J.
155 FRANKLIN ST
STONEHAM, MA 02180

LOC: 155 FRANKLIN ST 8-0-148

SUTKIN ALEXANDER
12 THOMPSON POND RD
STONEHAM, MA 02180

LOC: 12 THOMPSON POND RD 13-0-533

MCNAMARA MICHAEL J.
10 THOMPSON POND ROAD
STONEHAM, MA 02180

LOC: 10 THOMPSON POND RD 13-0-532

WEISS FARMS APARTMENTS LLC
100 GRANDVIEW RD U203
BRAINTREE, MA 02184

LOC: 170 FRANKLIN ST 8-0-106

RANCOURT MARLENE M.
123 FRANKLIN ST
STONEHAM, MA 02180

LOC: 123 FRANKLIN ST 8-0-179

DOUCET CATHERINE M.
150 FRANKLIN ST
STONEHAM, MA 02180

LOC: 150 FRANKLIN ST 8-0-97

VANI KODELA
4 BENJAMIN TR
STONEHAM, MA 02180

LOC: 4 BENJAMIN TRL 8-0-182

RASO GREGORY C
141 FRANKLIN ST
STONEHAM, MA 02180

LOC: 141 FRANKLIN ST 8-0-168

CAPPELLO JOHN R.
3 EMERALD CT
STONEHAM, MA 02180

LOC: 3 EMERALD CT 8-0-167

DIMARTINO ROSARIO
12 BENJAMIN TERR.
STONEHAM, MA 02180

LOC: 12 BENJAMIN TRL 8-0-176C

MCNAMARA JOHN F
7 EMERALD CT
STONEHAM, MA 02180

LOC: 7 EMERALD CT 8-0-165

RASO JEAN CHRISTOPHE Y BENOIT
9 EMERALD CT
STONEHAM, MA 02180

LOC: 9 EMERALD CT 8-0-164

BROMANDER JOSEPH
11 THOMPSON POND ROAD
STONEHAM, MA 02180

LOC: 11 THOMPSON POND RD 8-0-221

STONEHAM ASSISTED LIVING
200 NORTH MAIN ST STE 204
EAST LONGMEADOW, MA 01028

LOC: 140 FRANKLIN ST 8-0-94

ROTONDI CHARLES S. TRS.
158 FRANKLIN ST
STONEHAM, MA 02180

LOC: 158 FRANKLIN ST 8-0-99

ANDREA FORMOSI
146 FRANKLIN ST
STONEHAM, MA 02180

LOC: 146 FRANKLIN ST 8-0-95

CIPOLLONE KIMBERLY
6 BENJAMIN TERR
STONEHAM, MA 02180

LOC: 6 BENJAMIN TRL 8-0-181

DHROSO VANGJERIS
10 BENJAMIN TERR.
STONEHAM, MA 02180

LOC: 10 BENJAMIN TRL 8-0-176B

SAIA ANTHONY
147 FRANKLIN ST
STONEHAM, MA 02180

LOC: 147 FRANKLIN ST 8-0-153

WEISS DONNA (TR)
170 FRANKLIN ST
STONEHAM, MA 02180

LOC: 162 FRANKLIN ST 8-0-102

MURRAY JOHN F.
14 THOMPSON POND
STONEHAM, MA 02180

LOC: 14 THOMPSON POND RD 8-0-220

DEVLIN ALBERT T. TRS
4 FRANKLIN PLACE
STONEHAM, MA 02180

LOC: 4 FRANKLIN PL 8-0-150

LIN GEN-SHIANG
8 THOMPSON POND ROAD
STONEHAM, MA 02180

LOC: 8 THOMPSON POND RD 13-0-531

SWALLOW JAMES W
14 EMERALD CT
STONEHAM, MA 02180

LOC: 14 EMERALD CT 8-0-155

DOWNS JOHN
42 FRANKLIN RD.
WINCHESTER, MA 01890

LOC: 165 FRANKLIN ST 8-0-144

ROTONDI CHARLES S
6 FRANKLIN PL
STONEHAM, MA 02180

LOC: 6 FRANKLIN PL 8-0-151

ABRAHAMIAN ANDREW
18 EMERALD CT
STONEHAM, MA 02180

LOC: 18 EMERALD CT 8-0-157

VISNICK BURTON S
2 O`GRADY CR
STONEHAM, MA 02180

LOC: 2 O`GRADY CIR 8-0-223

DEMETRIO ROBERT
171 FRANKLIN ST
STONEHAM, MA 02180

LOC: 171 FRANKLIN ST 8-0-130

PENG JAMES LI-WEI
4 O`GRADY CIRCLE
STONEHAM, MA 02180

LOC: 4 O`GRADY CIR 8-0-224

FOLLETTIE MAXIMILLIAN T.
3 O`GRADY CIRCLE
STONEHAM, MA 02180

LOC: 3 O`GRADY CIR 13-0-537

PAJAK KATHRYN
33 SUMMERHILL ST
STONEHAM, MA 02180

LOC: 33 SUMMERHILL ST 13-0-217

DAY VIRGINIA C.
5 EMERY CT
STONEHAM, MA 02180

LOC: 5 EMERY CT 13-0-218

PARMENSI THOMAS
15 EMERALD COURT
STONEHAM, MA 02180

LOC: 15 EMERALD CT 8-0-161

BOLGER PATRICK
16 EMERALD CT
STONEHAM, MA 02180

LOC: 16 EMERALD CT 8-0-156

LEIKAUSKAS RICHARD P (TR)
4 THOMPSON POND ROAD
STONEHAM, MA 02180

LOC: 4 THOMPSON POND RD 13-0-529

FIAMETTI EDILSON
21 EMERALD CT
STONEHAM, MA 02180

LOC: 21 EMERALD CT 8-0-158

CARROLL MITCHELL D (TR)
5 THOMPSON POND ROAD
STONEHAM, MA 02180

LOC: 5 THOMPSON POND RD 13-0-535

BOUTIN CRAIG
1 O`GRADY CIRCLE
STONEHAM, MA 02180

LOC: 1 O`GRADY CIR 13-0-538

MAGEE JOSSHUA
173 FRANKLIN ST
STONEHAM, MA 02180

LOC: 173 FRANKLIN ST 8-0-129

GARAFFO THOMAS
35 SUMMERHILL STREET
STONEHAM, MA 02180

LOC: 35 SUMMERHILL ST 13-0-216

BRANCO ANNA J. (TRS)
29 SUMMERHILL ST
STONEHAM, MA 02180

LOC: 29 SUMMERHILL ST 13-0-221

LELAND ALLEN M
9 EMERY CT
STONEHAM, MA 02180

LOC: 9 EMERY CT 13-0-219

PONZO JOSEPH E
9 THOMPSON POND ROAD
STONEHAM, MA 02180

LOC: 9 THOMPSON POND RD 8-0-222

HAYES FAMILY IRR TRUST
11 STEVENS RD
NORTH READING, MA 01864

LOC: 19 EMERALD CT 8-0-160

PLUSQUELLIC JOHN E.
7 THOMPSON POND RD.
STONEHAM, MA 02180

LOC: 7 THOMPSON POND RD 13-0-534

BROWN SHANE MICHAEL
169 FRANKLIN ST
STONEHAM, MA 02180

LOC: 169 FRANKLIN ST 8-0-132

THAI XIA C.
43 SUMMERHILL ST
STONEHAM, MA 02180

LOC: 43 SUMMERHILL ST 13-0-213

ANGELOSANTO MARIE L (TRS)
22 SUMMERHILL ST
STONEHAM, MA 02180

LOC: 46 SUMMERHILL ST 13-0-244

SACCO ERNEST P.III
1 THOMPSON POND ROAD
STONEHAM, MA 02180

LOC: 1 THOMPSON POND RD 13-0-216A

ANDRADE ANTONIO M.
5 O`GRADY CIRCLE
STONEHAM, MA 02180

LOC: 5 O`GRADY CIR 13-0-536

RITCHIE CRAIG E.
25 SUMMERHILL ST
STONEHAM, MA 02180

LOC: 25 SUMMERHILL ST 13-0-222

VETRANO ANTONIO
5 SUNSET RD
STONEHAM, MA 02180

LOC: 5 SUNSET RD 8-0-122

RICHARDSON RALPH E
5 BARRETT AVE
STONEHAM, MA 02180

LOC: SIBLEY AVE MULTIPLE

KEARNEY WAYNE
20 MIDDLE STREET
STONHAM, MA 02180

LOC: 2 THOMPSON POND RD 13-0-215A

BENNETT ARTHUR S (LT)
7 SUNSET RD
STONEHAM, MA 02180

LOC: 7 SUNSET RD 8-0-121

GUEVARA ORAZIO
4 SUNSET RD
STONEHAM, MA 02180

LOC: 4 SUNSET RD 8-0-116

HADDAD JOHN P.
15 SUNSET RD
STONEHAM, MA 02180

LOC: 15 SUNSET RD 8-0-119

CELLA RICHARD J
19 SUNSET RD
STONEHAM, MA 02180

LOC: 19 SUNSET RD 9-0-71

NOLAN MICHAEL W.
21 SUNSET RD
STONEHAM, MA 02180

LOC: 21 SUNSET RD 9-0-70

WARD BRENDA G.
23 SUNSET RD
STONEHAM, MA 02180

LOC: 23 SUNSET RD 9-0-68

ANSELMI PAUL
48 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 48 FIELDSTONE DR 9-0-50

HEIMAN DAVID I.
50 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 50 FIELDSTONE DR 9-0-67

DEVIN ALBERT T
4 FRANKLIN PL
STONEHAM, MA 01280

LOC: FRANKLIN ST 8-0-148A

WEISS MARVIN TR
37 OLDE COACH RD
SCOTIA, NY 12302

LOC: FRANKLIN ST 8-0-133

DONOVAN JOHN
20 EMERY CT.
STONEHAM, MA 02180

LOC: 20 EMERY CT 13-0-220

BIGGIO BETTE D
16 DAPPER DARBY DR
STONEHAM, MA 02180

LOC: 26 EMERY CT 14-0-33

BENNER WILLIAM K
17 SUNSET RD
STONEHAM, MA 02180

LOC: 17 SUNSET RD 8-0-118

PILLERI SAMANTHA EVE
8 SUNSET RD
STONEHAM, MA 02180

LOC: 8 SUNSET RD 9-0-72

HUME RUSSELL L.
1 BOXWOOD RD
STONEHAM, MA 02180

LOC: 1 BOXWOOD RD 9-0-48

DIPOMPO LISA
46 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 46 FIELDSTONE DR 9-0-49

MAKELA MATTHEW A
14 SUNSET ROAD STONEHAM,
MA 02180

LOC: 14 SUNSET RD 9-0-76

GRIFFIN MATTHEW
16 SUNSET RD
STONEHAM, MA 02180

LOC: 16 SUNSET RD 9-0-77

GEARY WILLIAM J
9 EMERALD CT
STONEHAM, MA 02180

LOC: 9 EMERALD CT 8-0-163

WEISS MARVIN
37 OLDE COACH RD
SCOTIA, NY 12302

LOC: FRANKLIN ST 8-0-128

BORTO CHRISTOPHER
9 SUNSET RD
STONEHAM, MA 02180

LOC: 9 SUNSET RD 8-0-120

THE SOUTHERN N.E. CONF. ASSOC
34 SAWYER ST
LANCASTER, MA 01561

LOC: 169R FRANKLIN ST 8-0-132A

DIMARE MARIA N.
6 SUNSET ROAD
STONEHAM, MA 02180

LOC: 6 SUNSET RD 8-0-117

RENAULT JOHN H
3 BOXWOOD RD
STONEHAM, MA 02180

LOC: 3 BOXWOOD RD 9-0-47

COHEN ROBIN L.
12 SUNSET RD
STONEHAM, MA 02180

LOC: 12 SUNSET RD 9-0-75

FAGONE JOANN M
42 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 42 FIELDSTONE DR 9-0-46

WALKER ERNEST B. TR
40 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 40 FIELDSTONE DR 9-0-45

ANZALONE BETH
ONE OVERLOOK RD
STONEHAM, MA 02180

LOC: 30 DAPPER DARBY DR 14-0-302

BRAGALONE JOSEPH
38 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 38 FIELDSTONE DR 9-0-44

NERING RACHEL C
45 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 45 FIELDSTONE DR 9-0-52

TUTON THOMAS J
18 SUNSET RD
STONEHAM, MA 02180

LOC: 18 SUNSET RD 9-0-78

DAGOSTINO ROBERT F
27 SUNSET RD
STONEHAM, MA 02180

LOC: 27 SUNSET RD 9-0-66

SCHACHTER ELLEN
34 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 34 FIELDSTONE DR 9-0-42

THOMAS ROBERT E.
33 DAPPER DARBY DR
STONEHAM, MA 02180

LOC: 33 DAPPER DARBY DR 14-0-304

SCIAUDONE EMILIO
24 DAPPER DARBY DR.
STONEHAM, MA 02180

LOC: 24 DAPPER DARBY DR 14-0-300

RICCARDELLI ANNE T (TR)
2 KAREN DR
STONEHAM, MA 02180

LOC: 2 KAREN DR 9-0-38

SCIPPA PASQUALE (TR)
28 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 28 FIELDSTONE DR 9-0-37

BOURGEOIS GRACE N (TR)
29 DAPPER DARBY DR
STONEHAM, MA 02180

LOC: 29 DAPPER DARBY DR 14-0-310

PAONESSA KEVIN J.
36 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 36 FIELDSTONE DR 9-0-43

ASHWORTH ROBERT K JR
41 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 41 FIELDSTONE DR 9-0-54

O`BRIEN DANIEL P.
47 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 47 FIELDSTONE DR 9-0-51

SHEEHAN THOMAS P.
37 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 37 FIELDSTONE DR 9-0-56

ZAMBAKIS CHRISAFIDES (TR)
26 DAPPER DARBY DR
STONEHAM, MA 02180

LOC: 26 DAPPER DARBY DR 14-0-301

PALLOTTA ANTHONY J (LT)
32 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 32 FIELDSTONE DR 9-0-41

DELLA PORTA MARIA ASSUNTA TRS.
31 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 31 FIELDSTONE DR 9-0-59

HARUTYUNYAN AVETIK
22 DAPPER DARBY DR
STONEHAM, MA 02180

LOC: 22 DAPPER DARBY DR 14-0-299

BARDASCINO ANTHONY
20 DAPPER DARBY DR
STONEHAM, MA 02180

LOC: 20 DAPPER DARBY DR 14-0-298

CASTANO GREGORY J (TR)
3 ROBERT`S WY
STONEHAM, MA 02180

LOC: 3 ROBERTS WAY 14-0-309

D`ENTREMONT EDWARD H
43 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 43 FIELDSTONE DR 9-0-53

SORABELLA MICHAEL P (TR)
32 DAPPER DARBY DR
STONEHAM, MA 02180

LOC: 32 DAPPER DARBY DR 14-0-303

BALDWIN MICHAEL E.
39 FIELDSTONE DR.
STONEHAM, MA 02180

LOC: 39 FIELDSTONE DR 9-0-55

RICCI KENNETH
20 SUNSET RD
STONEHAM, MA 02180

LOC: 20 SUNSET RD 9-0-79

SHANNON LYNNE
35 FIELDSTONE DR
STONEHAM, MA 02180

LOC: 35 FIELDSTONE DR 9-0-57

GORHAM THOMAS S.
33 FIELDSTONE DRIVE
STONEHAM, MA 02180

LOC: 33 FIELDSTONE DR 9-0-58

SNYDER JOAN A. (TRS)
31 DAPPER DARBY DRIVE
STONEHAM, MA 02180

LOC: 31 DAPPER DARBY DR 14-0-305

BENINATI ENRICO
4 ROBERT`S WAY
STONEHAM, MA 02180

LOC: 4 ROBERTS WAY 14-0-306

ANTENUCCI ANTHONY (TR)
6 ROBERT`S WY
STONEHAM, MA 02180

LOC: 6 ROBERTS WAY 14-0-307

DELFAVERO NINA M.
27 DAPPER DARBY DR.
STONEHAM, MA 02180

LOC: 27 DAPPER DARBY DR 14-0-311

CARDALINO LINDA
8 ROBERT`S WAY
STONEHAM, MA 02180

LOC: 8 ROBERTS WAY 14-0-308

TANSINO PAUL J
6 DANIEL DRIVE
STONEHAM, MA 02180

LOC: 6 DANIEL DR 14-0-315

RAO VISHAL
10 EMERALD COURT
STONEHAM, MA 02180

LOC: 10 EMERALD CT 8-0-152A

SAAD EDWARD (TR)
25 SKYEWOOD DR
STONEHAM, MA 02180

LOC: 25 SKYEWOOD DR 14-0-33A

BEDELL REBECCA
19 SKYEWOOD DRIVE
STONEHAM, MA 02180

LOC: 19 SKYEWOOD DR 14-0-51E

BIGGIO BETTE D
16 DAPPER DARBY DR
STONEHAM, MA 02180

LOC: 28 SKYEWOOD DR 14-0-33B

WEISS FARMS INC
170 FRANKLIN ST
STONEHAM, MA 02180

LOC: 170 FRANKLIN ST 8-0-106A

RUISI GAETANO
25 DAPPER DARBY DR
STONEHAM, MA 02180

LOC: 25 DAPPER DARBY DR 14-0-312

SIEGEL MARCI A.
2 DANIEL DR.
STONEHAM, MA 02180

LOC: 2 DANIEL DR 14-0-313

PECCI DANIEL R
16 SKYEWOOD DR
STONEHAM, MA 02180

LOC: 24 SKYEWOOD DR 14-0-250C

SINHA RANJAN K.
23 SKYEWOOD DR
STONEHAM, MA 02180

LOC: 23 SKYEWOOD DR 14-0-51G

LARIVEE KAREN
4 KAREN DRIVE
STONEHAM, MA 02180

LOC: 4 KAREN DR 9-0-38A

SIME STEPHEN J
16 SKYEWOOD DR
STONEHAM, MA 02180

LOC: 22 SKYEWOOD DR 14-0-250B

VILLA GRANDE CONDO ASS
C/O PMI OF GREATER BOSTON
400 TRADE CENTER STE 5900
WOBURN, MA 01801-0000

SHIPPS GERALD W.JR.
5 DANIEL DR
STONEHAM, MA 02180

LOC: 5 DANIEL DR 14-0-314

CIMINA DOMENICK J. TR.
7 DANIEL DRIVE
STONEHAM, MA 02180

LOC: 7 DANIEL DR 14-0-316

TOLU ROBERT
26 SKYEWOOD DR
STONEHAM, MA 02180

LOC: 26 SKYEWOOD DR 14-0-250D

SCALLY JAMES
21 SKYEWOOD DRIVE
STONEHAM, MA 02180

LOC: 21 SKYEWOOD DR 14-0-51F

DONOVAN JOHN
20 EMERY CT.
STONEHAM, MA 02180

LOC: EMERY CT 13-0-221A

METRO DISTR COMM WATER SYSTEM
20 SOMERSET ST
BOSTON, MA 02108

LOC: POND ST 27-0-2

BROOK MEADOWS CONDO ASS
C/O NORTHEAST E ADVISOR
PO BOX 1968
FRAMINGHAM, MA 01701

NOTICE OF INTENT
ABUTTER NOTIFICATION LETTER

DATE: February 12, 2024

RE: Upcoming Stoneham Conservation Commission Public Hearing

To Whom It May Concern:

As an abutter within 300 feet of the project site, please be advised that a Notice of Intent application was filed with the Stoneham Conservation Commission and the Massachusetts Department of Environmental Protection (MassDEP) regarding the project described below.

APPLICANT:	Town of Stoneham
PROJECT LOCATION:	149 Franklin Street, Stoneham, MA 02180
ASSESSOR'S MAP & PARCEL:	8-134
PROJECT DESCRIPTION:	Project activities are proposed within an approximately 6.6 acre area at the southern end of the parcel and include expanding the capacity of existing wetlands by removing debris previously dumped at the site, improving wildlife habitat and biodiversity by removing invasive species and planting with native species, and enhancing recreational access and connectivity with the Stoneham High School and adjacent residential areas by creating a formal trail system.
APPLICANT'S AGENT:	Horsley Witten Group c/o **Jennifer Relstab** 90 Route 6A, Sandwich, MA 02563 (508) 833-6600
PUBLIC HEARING LOCATION:	Virtual - see the Conservation Commission agenda posted on the Town's website 48 hours prior to the hearing for the meeting link.
DATE:	February 26, 2024
TIME:	beginning at 7 p.m.

NOTE: Plans and application materials describing the project site are on file with the Conservation Commission, located at 35 Central Street, Basement Level, Stoneham, MA 02180 (781-279-2696) and the MassDEP, Northeast Regional Office, 150 Presidential Way, Woburn, MA 01801 (978-694-3200).

AFFIDAVIT OF SERVICE

Under the Massachusetts Wetlands Protection Act, M.G.L., c.131, s.40 and the Stoneham Wetlands Protection Bylaw, Chapter 11

I, Jamie McCarthy, hereby certify under the pains and penalties of perjury that on or before February 12, 2024, the Horsley Witten Group, Inc., gave notification to abutters in compliance with the second paragraph of Massachusetts General Laws'. c.131, s.40, and the *Massachusetts Department of Environmental Protection Guide to Abutter Notification* dated April 8,.1994, and the Stoneham Wetlands Protection Bylaw, Chapter 11, in connection with the following. matter:

> *A Notice of Intent (NOI) application was filed under M.G.L., c.131, s.40 and* the *Stoneham Wetlands Protection Bylaw, Chapter 11, by the Town of Stoneham with the Town of Stoneham Conservation Commission on February 12, 2024, regarding the Stoneham High School Wetlands project located at 149 Franklin Street in Stoneham, Massachusetts (parcel ID: 8-134).*

The form of the notification and list of abutters to whom it was given, and their addresses are attached to this Affidavit of Service.

Jamie McCarthy

Name

February 12, 2024

Date

Project Narrative

TABLE OF CONTENTS

Summary 1
1 Introduction 2
2 General Site Description 3
2.1 State-listed Rare Species Habitat 3
2.2 Wetland Resources 4
2.3 Environmental Due Diligence 10
3 Proposed Project 10
3.1 Debris Removal 10
3.2 Invasive Species Management and Native Species Revegetation 11
3.3 Wetland Expansion 12
3.4 Trail System 13
3.5 Educational Components 14
4 Alternatives Considered 15
4.1 No Build or No Action Alternative 15
4.2 Project Design Alternatives 15
4.3 Preferred Alternative and Proposed Project 16
5 Affected Jurisdictional Areas 16
6 Protection of Resource Area Interests 17
6.1 Massachusetts Wetlands Protection Act 17
6.2 Town of Stoneham Wetlands Protection Bylaw 18
7 Additional Mitigation Measures 24
7.1 Erosion and Sediment Control 24
7.2 Stormwater Management 24
8 References 28

Attachments

Attachment A – Locus Maps

Figure 1 – USGS Topography
Figure 2 – Aerial Photograph
Figure 3 – Environmental Resources
Figure 4 – Soils
Figure 5 – FEMA Flood Zones
Figure 6 – FEMA FIRMette
Figure 7 – Invasive Species

Attachment B – StreamStats Report and Wetland Determination Forms

Attachment C – Project Plans

Attachment D – Invasive Species Management Plan

Attachment E – Stormwater Analysis Report

Attachment F – Post Construction Operation and Maintenance Plan

Stoneham High School Wetlands
Stoneham, Massachusetts

February 2024

Summary

The Town of Stoneham, Massachusetts (the Applicant), proposes to ecologically restore and recreationally enhance the Stoneham High School Wetlands (within Parcel ID: 8-134). The approximately 6.6-acre project area is bound by additional school property to the north and southwest, residential properties to the east and west, and the Department of Conservation and Recreation's (DCR's) Middlesex Fells State Reservation to the southwest.

The project area contains woodlands, vegetated wetlands, an unnamed intermittent stream, habitat for local wildlife, and informal, well-worn paths created by its current users. The northeastern portion of the project area contains large boulders and debris, while the northwestern portion has significant litter and large pieces of trash, including an abandoned car, vehicle parts, and appliances. Proposed project activities involve expanding the capacity of existing wetlands by removing debris and creating additional vegetated wetlands in areas that were presumably wetlands prior to historic disturbances. The project also seeks to enhance existing resource areas through native plantings and invasive species management, as well as develop a formalized accessible trail system, wayfinding kiosks, trail markers, educational signage, and seating areas.

Due to the restorative nature of the project, it will be necessary to conduct work within jurisdictional areas protected under the Massachusetts Wetlands Protection Act (M.G.L. Ch. 131 § 40) and/or the Town of Stoneham Wetlands Protection Bylaw (Chapter 11). Proposed activities will unavoidably occur within Isolated Vegetated Wetland, Inland Bank, Land Under Water Bodies and Waterways, and the 100- and 25-foot Buffer Zones associated with each resource area. Project objectives aim to improve the functionality of these resource areas by implementing wetland expansion to improve water quality and flood storage capacity and managing invasive species and restoring native plant communities to improve habitat and biodiversity.

1 Introduction

The Applicant, the Town of Stoneham (the "Town"), proposes to improve ecosystem function and recreational access within an underutilized portion of the Stoneham High School property, located at 149 Franklin Street (Parcel ID: 8-134). The entire parcel consists of 38.9 acres that were historically used for agricultural purposes, and now includes the high school, recreational areas, driveways, walkways, and parking areas. The southern portion of the parcel (the "Site") is an approximately 6.6-acre area that contains woodlands, vegetated wetlands and an unnamed intermittent stream with informal paths and debris piles at the edges. The site is currently unmaintained.

In 2020, the Site was identified as a priority parcel by the Town of Stoneham Conservation Commission as part of a study conducted in coordination with the Upper Mystic Working Group of the Resilient Mystic Collaborative (RMC) under a Municipal Vulnerability Preparedness (MVP) Action Grant (fiscal year (FY) 2020). This Phase 1 study focused on opportunities for watershed-scale flood management to strengthen community resilience to climate impacts such as increased intensity and duration of storm events and higher groundwater levels. Tasks included desktop assessments, modeling, and prioritization of sites as well as field data collection. Under a Phase 2 study in 2020 and 2021, consultants conducted a limited topographic survey and wetland delineation, assessed the site for wildlife habitat and invasive species, and conducted a preliminary environmental assessment. A conceptual design was developed in June 2021 that included wetland restoration, permeable paths and boardwalks, and formalized entrances.

The Town of Stoneham and Horsley Witten Group, Inc. (HW) have continued work under a Phase 3 MVP Action Grant for fiscal years 2023 and 2024 which has included updated modeling and design development. The project has included public engagement through an online survey, a virtual meeting with the Conservation Commission in June 2023 and an onsite meeting with the public in October 2023. Additional public workshops are scheduled for April 2024 that will incorporate watershed and wetland education, native and invasive plant identification, and trash pickup.

Proposed project activities include:

- Expanding the capacity of existing wetlands by removing debris previously dumped at the Site, including boulders, an old car, appliances, and other trash;
- Removing invasive species and planting native trees and shrubs to improve wildlife habitat and biodiversity; and
- Creating formalized entrances and paths that will connect the new high school campus with the surrounding neighborhoods, providing increased connectivity and opportunity for passive recreation.

While there are limited impacts proposed within the wetland resource areas, the NOI application is being filed as a limited project under the provisions at 310 CMR 10.53(3)(j) to address local concerns. This provision applies to projects that involve "*the construction and maintenance of catwalks, footbridges, wharves, docks, piers, boathouses, boat shelters, duck blinds, skeet and trap shooting decks and observation decks; provided, however, that such structures are*

constructed on pilings or posts so as to permit the reasonably unobstructed flowage of water and adequate light to maintain vegetation."

2 General Site Description

The Site consists of approximately 6.6 acres within the Town-owned 38.9 acre parcel containing Stoneham High School in Stoneham, Massachusetts. It is located at the southern end of the property, south of the school's current football field, surrounding track and bleachers. An additional 2.3 acres of the parcel extends southwest of the Site (Photo 1). All proposed work is within the Town-owned property; however, the Town has discussed possible future connections to the parcel to the south, which is currently owned by the Department of Conservation and Recreation (DCR) and connects to the Middlesex Fells State Reservation. The Town has engaged DCR in discussions about this project and future projects. Both the Town and DCR agree that the extent of invasive species and existing resource areas on both properties will require coordination for feasibility and/or design evaluations.

Photo 1. Project Site within the Stoneham High School Property

The remainder of the parcel (36.6 acres) is developed or maintained as mowed grass or playing fields. Currently a 10-foot high chain link fence separates the Site from the high school and fields and is effectively the northern boundary of the Site. Residential properties border the Site to the east and west, and DCR-owned forested wetlands border the site to the south. A portion of the property on the eastern side is currently being encroached upon by abutters at 32 Fieldstone Drive and 4 Karen Drive, including fences, sheds, debris piles and a driveway. A USGS topographic map and aerial photograph of the Site are provided in **Attachment A,** Figures 1 and 2.

2.1 State-listed Rare Species Habitat

According to the most recent version of the *Massachusetts Natural Heritage Atlas* (15th Edition, August 1, 2021), the project site does not occur within areas of *Estimated Habitat of Rare Wildlife* or *Priority Habitat of Rare Species,* as designated by the Massachusetts Natural Heritage and Endangered Species Program (NHESP) (**Attachment A,** Figure 3).

2.2 Wetland Resources

The Site supports freshwater resource areas, as defined under the Massachusetts *Wetlands Protection Act* (M.G.L. Ch. 131 § 40), and/or the Stoneham Wetlands Protection Bylaw (Chapter 11), as described in the following subsections. Resource areas occurring at or near the project site include:

- 4 areas of Bordering Vegetated Wetland (BVW);
- 1 Isolated Vegetated Wetland (IVW);
- Inland Bank (Bank) associated with an unnamed intermittent stream; and
- Land Under Water Bodies and Waterways (LUWW) associated with the unnamed intermittent stream.

2.2.1 Delineated Wetland Resources

On April 6 and April 14, 2023, HW staff delineated resource areas within the bounds of the Site. Prior to the initial Site visit, HW conducted a desktop review of available source data from MassGIS to gather relevant information pertaining to wetland resources within or in the vicinity of the Site. The results of HW's field visit, desktop reviews and Natural Resource Conservation Service (NRCS) soils data are provided in **Attachment A**, Figures 3 and 4.

To determine the boundaries of resource areas, HW followed procedures consistent with the 2022 Massachusetts Department of Environmental Protection (MassDEP) manual entitled "*Massachusetts Handbook for Delineation of Bordering Vegetated Wetlands"* as well as the Massachusetts Wetland Protection Act Regulations for wetland resource area identification, delineation, and field data collection.

Field methodologies, regulatory definitions and a brief description of each resource area encountered are provided below.

2.2.1.1 Inland Bank

Inland Bank is defined at 310 CMR 10.54(2)(a) as "*the portion of land surface which normally abuts and confines a water body. It occurs between a water body and a vegetated bordering wetland and adjacent floodplain, or, in the absence of these, it occurs between a water body and an upland. A Bank may be partially or totally vegetated, or it may be comprised of exposed soil, gravel, or stone."*

"The upper boundary of a Bank is the first observable break in the slope or the mean annual flood level, whichever is lower. The lower boundary of a Bank is the mean annual low flow level" [310 CMR 10.54(2)(c)].

The WPA also protects a 100-foot buffer zone extending from the boundary of Bank. The local regulations adopt the WPA definition of Bank and afford additional resource protection by requiring a continuous strip of no less than 25 feet of undisturbed buffer zone adjacent to Bank.

An unnamed, presumably historically modified stream channel begins at the northern property boundary, originating through an approximately 48-inch box culvert within the Site that exists about 15 yards east of the bleachers (Photo 2). The banks are steep and well defined as the stream extends south in a straight line through the survey area (Photo 3). The banks become shallower and less defined as the stream begins to diffuse into wetland at the southern edge of the property where it abuts the State Reservation (Photo 4). Vegetation lines both sides of the stream and includes some dense stands of invasive species including multiflora rose (*Rosa multiflora*) and greenbrier (*Smilax rotundifolia*). Several trees grow within the banks as well, primarily native red maples (*Acer rubrum*). Woody debris clutters the mucky streambed.

Photo 2. Culvert from where the stream initiates at the northern end of the survey area.

Photo 3. Well-defined banks of the unnamed intermittent stream that flows south through the Site.

Photo 4. Banks of the stream become less defined and shallower as it diffuses into wetland at the southern property boundary.

The stream is not mapped by the MassGIS MassDEP Wetlands Layer, but a MassDEP Wetland Hydrologic Connection overlaps the portion of the stream that flows between the two mapped MassDEP wetlands. StreamStats indicates that the stream is hydrologically connected with Doleful Pond and Spot Pond south of the Site. The characteristics of its watershed as defined by StreamStats (in accordance with the WPA [310 CMR 10.58(2)(a)1]) are indicative of an intermittent stream. In preparation to develop the Stormwater Report for this site (**Attachment E**), HW conducted additional on-site field surveys and determined that the drainage area is larger than the StreamStats calculation; however, it still falls well below the threshold to be classified as a perennial stream according to the WPA regulations. The StreamStats report is provided in **Attachment B**.

The banks of the stream were demarcated with blue flagging, marked with the stream name, HW-S1, and numbered in each indicated location as follows:

- Eastern bank: 100-114; and
- Western bank: 200-213.

Flags HW-S1-100 and HW-S1-213 are located at the southern end of the Site where it abuts the State Reservation and diffuses into wetland. Flags HW-S1-114 and HW-S1-200 are located at the northern end of the Site and connect to the culvert from which the stream originates.

2.2.1.2 Bordering Vegetated Wetland

Bordering Vegetated Wetlands (BVWs) are defined under Massachusetts WPA Regulations at 310 CMR 10.55(2)(a) as "*freshwater wetlands that border on creeks, rivers, streams, ponds, and lakes. The types of freshwater wetlands are wet meadows, marshes, swamps, and bogs. Bordering Vegetated Wetlands are areas where the soils are saturated and/or inundated such that they support a predominance of wetland indicator plants.*"

"The boundary of Bordering Vegetated Wetland is the line within which 50% or more of the vegetational community consists of wetland indicator plants and saturated or inundated conditions exist" [310 CMR 10.55 (2)(c)].

The WPA also protects a 100-foot buffer zone extending from the boundaries of BVW. The local regulations adopt the WPA definition of BVW and afford additional resource protection by requiring a continuous strip of no less than 25 feet of undisturbed buffer zone adjacent to BVW.

BVW was found throughout the Site adjacent to the stream. HW marked the boundary of BVW as one hydrologically connected system with pink flagging tape. Each flag was labeled with the wetland name, HW-W1, and numbered sequentially in each indicated location as follows:

- Adjacent to the southern end of the eastern bank: 100-106 (Photo 5);
- Adjacent to the northern end of the eastern bank: 200-221 (Photo 6);
- Adjacent to the northern end of the western bank: 300-312 (Photo 7); and
- Adjacent to the southern end of the western bank: 400-418 (Photo 8).

BVW flags HW-W1-221 and HW-W1-300 connect to the culvert at the northern end of the Site. All other beginning and ending flags connect to the bank of the stream itself in the location indicated above, with the exception of BVW flag HW-W1-418. The 400-series of BVW begins along the Bank, opposite the 100-series of BVW, and then extends away from the stream to the west, eventually reaching the western edge of the Site. The BVW continues south outside of the Site.

Dominant tree species within the BVW include red maple and hop-hornbeam (*Ostrya virginiana*). Apple trees (*Malus* spp.) were also found at the boundaries of BVW. Many trees throughout the Site, including those within BVW, are host to invasive Asiatic bittersweet (*Celastrus orbiculatus*) and porcelain berry (*Ampelopsis glandulosa*) vines. Greenbrier vines were found within BVW to a lesser extent. The shrub/sapling layer is limited to saplings of the associated tree species and a few patches of invasive multiflora rose. The herbaceous layer

consists primarily of skunk cabbage (*Symplocarpus foetidus*), jewelweed (*Impatiens capensis*), soft rush (*Juncus effusus*), wrinkle-leaf goldenrod (*Solidago rugosa*), white avens (*Geum canadense),* sensitive fern (*Onoclea sensibilis*), and long-stalked sedge (*Carex pedenculata*).

Photo 5. BVW HW-W1, 100 flagging series

Photo 6. BVW HW-W1, 200 flagging series

Photo 7. BVW HW-W1, 300 flagging series, showing abandoned vehicle present in wetland

Photo 8. BVW HW-W1, 400 flagging series

Soils underlying the BVW adjacent to the stream are classified by the National Resources Conservation Service (NRCS) as very poorly drained Swansea muck, 0-1 percent slopes. These soils are designated as hydrologic soil group B/D, indicating that drained areas have moderate infiltration when thoroughly wet (hydrologic soil group B) and undrained areas have a very slow infiltration rate (hydrologic soil group D). The portion of the 400-series of BVW that extends west away from the stream is underlain by moderately well drained Sudbury fine sandy loam, 3 to 8 percent slopes. These are classified as prime farmland and designated as hydrologic soil group B.

Two representative sites were selected to collect vegetation, soil, and hydrologic data required to document the presence and/or absence of wetlands and delineate wetland boundaries. Data was collected within BVW and within upland areas in close proximity to the wetland boundary.

Documentation of the data is provided on the Bordering Vegetated Wetland Determination Forms provided in **Attachment B**.

2.2.1.3 Isolated Vegetated Wetland

One area of isolated vegetated wetland (IVW) was identified in northwest corner of the Site (Photo 9). The IVW was demarcated with pink flagging marked with the identifier HW-W2 and numbered from 100-111. Plant species in this area were similar to those found within the nearby BVW. Soils that underlie this area are identified as Rock outcrop-Hollis complex, 3 to 35 percent slopes, and are not rated for drainage capability or hydrologic soil group. The local bylaw defines IVW based on the WPA definition for vegetated wetlands that applies to BVW. IVW is a locally protected resource area and is afforded a 100-foot buffer zone and a minimum 25 foot no-disturb buffer zone.

Photo 9. IVW HW-W2 is located in the northwest corner of the Site

2.2.2 Additional Wetland Resources

HW completed a desktop review of the Site to determine if additional WPA or local regulations were applicable. Regulatory definitions and a brief description of each additional wetland resource area evaluated are provided in the following subsections. The Environmental Resources map provided in **Attachment A**, Figure 3, includes the resource areas referenced below, as applicable.

2.2.2.1 Bordering Land Subject to Flooding

Bordering Land Subject to Flooding (BLSF) is defined at 310 CMR 10.57(2)(a) as: "*an area with low, flat topography adjacent to and inundated by flood waters rising from creeks, rivers, streams, ponds, or lakes. It extends from the banks of these waterways and water bodies; where a bordering vegetated wetland occurs, it extends from said wetland*."

"*The boundary of Bordering Land Subject to Flooding is the estimated maximum lateral extent of flood water which will theoretically result from the statistical 100-year frequency storm. Said boundary shall be that determined by reference to the most recently available flood profile data prepared for the community within which the work is proposed under the National Flood Insurance Program (NFIP, currently administered by the Federal Emergency Management Agency, successor to the U.S. Department of Housing and Urban Development)"* [310 CMR 10.57(2)(a)(3)]. The local regulations adopt this WPA definition of BLSF and apply a 100 foot buffer zone to BLSF boundaries.

The current Federal Emergency Management Agency Flood Insurance Rate Map (FEMA FIRM) for Middlesex County (Community Panel 25017C0427E, effective on June 4, 2010), shows that

the entire Site is within Zone X: *Area of Minimal Flood Hazard*. No flood hazard areas subject to flooding by the 1% annual chance of flood are within 1 mile of the Site. The 1% annual chance flood is also referred to as the 100-year flood and is consistent with BLSF in this area. A map of the FEMA Flood Zones and a copy of the FEMA FIRMette map are provided in **Attachment A,** Figures 5 and 6.

2.2.2.2 Isolated Land Subject to Flooding

Although IVWs are not jurisdictional resource areas under the WPA, IVWs can sometimes meet the criteria to be designated as Isolated Land Subject to Flooding (ILSF), defined at 310 CMR 10.57(2)(b)1 as: "*an isolated depression or closed basin without an inlet or an outlet. It is an area which at least once a year confines standing water to a volume of at least ¼ acre-feet and to an average depth of at least six inches."* The local regulations adopt the WPA ILSF definition and apply a 100-foot buffer zone to ILSF boundaries.

The relatively flat topography, as depicted in the MassGIS USGS map and observed in the field, indicates that HW-W2 lacks the potential to meet the minimum depth required to be ILSF. Additionally, no standing water was observed in this area at the time of the delineation.

2.2.2.3 Vernal Pools

Certified Vernal Pools (CVPs) are defined under Massachusetts WPA Regulations at 310 CMR 10.57(2)(a)5 as "*those that have been certified as such by the Massachusetts Division of Fisheries and Wildlife, where said Division has forwarded maps and other information needed to identify the location of such habitat to the Conservation Commission and DEP prior to the filing of each Notice of Intent or Abbreviated Notice of Intent regarding that portion."*

The local bylaw offers protection for vernal pools regardless of whether they have been certified by the Massachusetts Division of Fisheries and Wildlife (DFW). Stoneham Wetland Regulations adopt the WPA vernal pool definition with the following addition: "*The term 'vernal pool' shall include any confined basin or depression not occurring in existing lawns, gardens, landscaped areas, or driveways which, at least in most years, holds water for a minimum of two continuous months during the spring and/or summer, contains at least 200 cubic feet of water at some time during most years, is free of adult predatory fish populations, and provides essential breeding and rearing habitat functions for amphibian, reptile, or vernal pool community species"* [Section 18.1.(c)].

HW reviewed NHESP Certified Vernal Pools (CVPs) MassGIS data and found that none were mapped within or near the Site. Additionally, no MassGIS mapped Potential Vernal Pools (PVPs) were present within or near the Site. HW confirmed that the were no vernal pools at the Site during field efforts described in Section 2.2.1.

2.2.2.4 Land Under Water Bodies and Waterways

Land Under Water Bodies and Waterways (LUWW) is defined at 310 CMR 10.56(2)(a) as "*the land beneath any creek, river, stream, pond, or lake. Said land may be composed of organic muck or peat, fine sediments, rocks, or bedrock."*

"The boundary of Land under Water Bodies and Waterways is the mean annual low water level" [310 CMR 10.56(2)(c)]. The local regulations adopt the WPA definition of LUWW. LUWW is

present at this Site within the delineated Banks of the intermittent stream and consists of a mucky bottom cluttered with woody debris.

2.3 Environmental Due Diligence

Due to the evidence of historic dumping at the Site, HW conducted an on-site evaluation on March 9, 2021 in addition to a desktop evaluation to identify potential environmental concerns. Two potential environmental concerns were identified at the Site:

1) The potential for fill material from unknown origin to have been used at the site. Historical topographical maps dated 1893 and 1903 indicate that an unnamed stream historically transected the Site centrally in a north/south direction. Subsequent topographical maps did not indicate the stream. Additionally, aerial photographs indicate wet areas and streams located at the project area in 1969. These areas are not obvious in the subsequent aerial photographs.
2) The potential for soil impacts related to the historical application of pesticides. The Site appears to have been historically utilized for agricultural purposes.

Proposed geotechnical borings (see Section 3.4) will help to identify and profile additional subsurface soil characteristics beyond the hand auger borings conducted as part of the wetland delineation in 2021. Following the review of any boring data, and prior to construction, soil sampling may be required to confirm the presence and/or extent of contamination onsite. Samples would be collected for laboratory analysis to determine the extent of oil and/or hazardous materials (OHM) (if any) in the areas of proposed excavation. This information will be important to determine if stormwater infiltration will mobilize any potential OHM and how excavated soils may need to be managed. More extensive sampling, if needed, will be feasible once construction activities commence, as some areas may require debris removal for access.

3 Proposed Project

Primary project goals include:

- Expanding the capacity of existing wetlands by removing debris previously dumped at the Site, including boulders, an old car, appliances and other trash;
- Removing invasive species and planting native trees and shrubs to improve wildlife habitat and biodiversity; and
- Creating formalized entrances and paths that will connect the new high school campus with the surrounding neighborhoods, providing increased connectivity and opportunity for passive recreation.

Details of the proposed project are provided in the following subsections and depicted on the attached project plans, entitled "*Stoneham Wetlands Restoration, 75% Design Development Permit Plans, Stoneham, MA*" prepared by HW, and dated February 2024, (**Attachment C**).

3.1 Debris Removal

Following installation of Erosion and Sediment Controls (ESCs), as described in Section 7.1, preconstruction activities will involve the removal of large debris items that have been dumped

at the Site. Debris items identified for removal include an abandoned car, appliances, yard waste, and piles of boulders, likely remnants of blasting and boulder removal during adjacent school or residential developments (see Photos in the following sections). Some larger items (e.g., the car) may not be accessible until later stages of construction. All debris collected from the Site within the limit of work will be disposed of properly.

3.2 Invasive Species Management and Native Species Revegetation

Preconstruction invasive species removal is recommended for this site due to the density and type of invasive species as well as the significant impact the species are having on existing native plants and trees. The Town is seeking early action in key areas of target species as noted below. This is tentatively scheduled to occur in April 2024 with volunteers as part of two planned community workshops under the FY24 MVP grant. Additional invasives management support from a contractor is recommended after the workshops and prior to construction to open up the understory to sunlight and give opportunities for native plants to begin to return. Hand pulling and limited mechanical removal methods will be employed during volunteer efforts. Contractor led efforts may require the use of mechanical and/or chemical means to ensure effective management of more problematic and/or woody species, including the cut and drip method and/or foliar spray application. A comprehensive invasive species management plan has been developed for this Site and will be implemented during preconstruction management efforts, as well as throughout construction and after to ensure the success of invasives management.

The proposed overall invasive species management approach is a Site-based management strategy that focuses on core priority areas identified during HW's Site survey efforts, as well as overall Site invasive species removal for priority species that may continue to spread if not actively managed early on. Core priority areas for the most prevalent invasive species observed at the Site, consisting of upland species including Japanese knotweed (*Fallopia japonica*), porcelain berry (*Ampelopsis glandulosa*), and Asiatic bittersweet (*Celastrus orbiculatus*) (see Photos 10 – 12), are depicted in Figure 7 of **Attachment A**. Portions of some areas overlap with wetland areas; however invasive species present are upland species and management will be limited to upland areas.

The primary goal is to improve the ecological health of the Site by maximizing the native biodiversity present through rehabilitation of native plant communities. The secondary goal is to provide education and public awareness of invasive management on site as well as the ongoing vegetation strategy. The plan details the phased approach that will be implemented and provides additional recommendations for monitoring and ongoing management beyond that time frame. Management approaches are

Photo 10. Japanese knotweed stand at the Site.

Photo 11. Porcelain berry carpeting the Site.

Photo 12. Asiatic bittersweet surrounds old car on Site.

catered for individual species and anticipated tasks are laid out sequentially. Best management practices according to the Massachusetts Invasive Plant Advisory Group (MIPAG) and the University of Massachusetts Invasive Plant Certification Program will be followed. The proposed Stoneham High School Wetlands Invasive Species Management Plan is provided in **Attachment D**.

3.3 Wetland Expansion

Wetland expansion areas are proposed in locations with one or more wetland indicators (soils, hydrology, and/or vegetation), presumably where existing wetlands once extended prior to historic disturbances. The existing wetlands' hydrologic connection with the stream will be maintained with the proposed wetland expansions, further detailed in the project plans provided in **Attachment C.** Based on HW's observations, the deposition of piles of boulders in the northeast corner of the Site (Photo 13) and debris dumping and invasive species domination in the region between the IVW and BVW (Photo 14) has significantly impacted historic wetland coverage and connectivity to the stream at the Site. The proposed minor grading will help restore wetland hydrology and revegetating with native species will support wildlife habitat and align with proposed flow regimes (i.e., to be tolerant of flooding and saturation). The expansion area planned to connect the IVW to BVW will encompass approximately 6,389 SF, and the expansion where the boulders will be removed encompasses approximately 3,150 SF.

Photo 13. Piles of boulders in the northeast corner of the Site.

Photo 14. Debris and invasive species between the IVW and BVW.

The selection of native plantings include species of trees, shrubs, and plugs that are present onsite already, including red maple, yellow birch (*Betula alleghaniensis*), jewelweed (*Impatiens capensis*), sensitive fern (*Onoclea sensibilis*), and shallow sedge (*Carex lurida*). Additional ferns and sedges along with complementary species like swamp milkweed (*Asclepias incamata*), wrinkleleaf goldenrod (*Solidago rugosa*), and Joe-Pye weed (*Eupatorium maculatum*) will support diversity for wildlife and/or pollinators. Additionally, a native wetland seed mix will be applied to help establish the required vegetative cover and achieve maximum coverage of herbaceous species. The full plant list is provided in the project plans in **Attachment C**.

These areas will be monitored during post-construction for a minimum of two growing seasons to ensure proper growth and establishment native plant community. A full monitoring plan will be developed during the next phase of the project. The plan will include:

- Identification of monitoring goals and objectives and core indicators to evaluate wetland conditions.
- Drafting a Quality Assurrance Project Plan (QAPP)
- Outlining field operations, monitoring tasks and schedule
- Identifying a baseline/reference area
- Decision-making/adaptive management strategies

Monitoring will be coordinated with volunteers, such as high school students, the Conservation Commission members and community groups, including MyRWA, to ensure the long-term viability and success of the project.

3.4 Trail System

The proposed trail has been designed to meet the U.S. Forest Services' Trail Accessibility Guidelines (FSTAG) and the Americans with Disabilities Act (ADA) requirements.

3.4.1 At-grade Path Installation

The 6-ft wide at-grade trail sections will utilize a trail surface material that is similar to a dense graded aggregate. This surface is compliant with FSTAG standards and maintains the natural aesthetic of the site. Improved areas will generally follow the existing grade with minor modifications as needed to ensure that water will shed off the surface and tree root disturbance is kept to a minimum. Twenty four trees are proposed for removal to accommodate trail installation, including some invasive Norway maples (*Acer platanoides*), which are prominent at

the Site. Sixty two trees are proposed for planting, as detailed on the landscape plan provided in **Attachment C**. Trail maintenance will include trimming vegetation along the edges and repairing gullies or wash outs as needed. Currently three benches are proposed along the trail to provide adequate seating and resting areas for the elderly and those with disabilities. The path surface material will surround these seating areas to allow for a continuous connection for wheelchairs and strollers.

3.4.2 Boardwalk Installation

Raised boardwalk sections are proposed at the stream crossing and within wetland areas to prevent flooding of the trail. Proposed boardwalk material is timber (e.g., pressure treated or local hardwood, such as black locust) and anchored with screw/auger piles to minimize impact and preserve existing vegetation and habitat. The intent is for the boardwalks to be placed at a height that will not require railings and will allow for a short curb instead.

Further geotechnical investigations are anticipated to support the design of the foundations of the boardwalks and/or the design of the path at the existing culvert outlet to the stream. We anticipate that approximately 4 to 6 borings will be needed within the resource areas (BVW and IVW) and/or the resource buffers. While the proposed borings would be considered a minor activity and except from regulation within resource area buffers, in accordance with the WPA regulations at 310 CMR 10.02(2)(b)2.g. proposed geotechnical work will require further review and approval from the Stoneham Conservation Commission. In the event that the geotechnical findings require a modification to the boardwalk designs, the Town will seek additional review from the Conservation Commission prior to project implementation.

3.4.3 Connectivity Improvements

In addition to creating internal connectivity for users throughout the site, the proposed trail system includes formalized access points at Dapper Darby Drive, Karen Drive, and along the northern boundary leading to the school grounds. The intent is to increase visibility to the site to the public, particularly high school students, while limiting unauthorized uses of the site. While not proposed as a part of this project, the Town hopes to create additional connections to public lands south of the property in the future (i.e., Doleful Pond Trail within the Department of Conservation and Recreation's (DCR's) Middlesex Fells Reservation).

3.5 Educational Components

The project includes kiosks that will be placed at project entrances that will have wayfinding signage and key information about the wetlands expansion. The Town has been coordinating with staff at Stoneham High School as part of the current grant project to identify educational projects (e.g., native plant monitoring, invasive species management) and/or signage that may be incorporated post-construction. There is a workshop planned with students in April 2024 that is being coordinated with the Mystic River Watershed Association (MyRWA) that is intended to initiate educational programming.

4 Alternatives Considered

As a limited project under the provisions at 310 CMR 10.53(3)(j), the Applicant is required to demonstrate that there are no practicable alternatives to the response action that would be less damaging to the resource areas, and the project is required to be designed to minimize resource area impacts. Advantages and disadvantages of the following project alternatives were considered by the project design team, including a "No Build" alternative, alternative trail locations, and additional Site features.

4.1 No Build or No Action Alternative

While the No Build Alternative would not incur the costs or minor resource area impacts associated with the proposed project, the No Build alternative would result in none of the project benefits including removing historically dumped materials from the Site or other public and social benefits realized with the proposed project. Leaving informal trails in their existing condition will subject both the trails and the adjacent resource areas to continued degradation and erosive forces. Flooded conditions also currently limit public access to the Site.

The current conditions do not provide safe access to the Site and exclude people with disabilities or more limited mobility. Dense invasive vegetation growth hinders access throughout the Site and diminishes its potential to provide wildlife habitat. The No Build Alternative would fail to achieve the objectives of the community's stakeholder design efforts for this grant-funded project initiated to address the degraded condition of the Site and enhance accessible recreational access to this underutilized Town owned open space.

4.2 Project Design Alternatives

The project has been designed with consideration to existing Site conditions and in collaboration with stakeholders to garner feedback on the project as a whole and on the various individual elements. Alternative project components that were considered during the design development phase include various alternative trail designs and additional features as described in the following subsections.

Alternative Trail Designs

The trail has been located outside of resource areas to the maximum extent practicable, with only one small area within the locally protected IVW due to topographical limitations. After reviewing numerous trail alignment alternatives, it was decided this least impactful approach would limit additional disturbance and restoration required, which could be both cost prohibitive and problematic for the sensitive resource areas at the Site. Boardwalks on raised pilings would result in the least disturbance, be more cost effective, and provide the desired connectivity throughout the Site, as sought by the many stakeholders. Extensive field review resulted in the determination of the most suitable, least impactful, locations to install the trail, as discussed in Section 3.4.

Additional Features Considered but Eliminated

More intensive design features were eliminated from the proposed project because they would require significantly more funding, permitting, and environmental impacts within jurisdictional resource areas. Elements that were considered include:

- Renaturalizing the stream channel to create sinuosity and improve wildlife habitat and flood storage capacity;
- Creating parking spaces at park entrances/exits;
- Extending invasive species management to the southernmost extent of the property; and
- Providing a connection with the DCR property to the south.

4.3 Preferred Alternative and Proposed Project

The project team evaluated trail relocation and vegetation management options that would balance protecting resource area values while enhancing recreational values. The proposed trail design will provide ADA accessibility and connectivity throughout the Site, while discouraging visitors from disrupting the vegetation while attempting to access the river or wetlands from non-constructed areas.

Elements included in the proposed design were selected with consideration given to limiting disturbance to the maximum extent practicable as described below:

- General trail improvements:
  - Any proposed improvements should attempt to remain outside of resource areas to the maximum extent practicable to minimize disturbance;
  - Boardwalks on raised pilings should be utilized where necessary to further limit disturbance; and
  - The trail should be universally accessible.
- Accessibility and connectivity improvements for the following areas:
  - From Karen Drive to the east;
  - From Dapper Darby Drive to the west; and
  - From the High School to the north.

5 Affected Jurisdictional Areas

The proposed project will occur within jurisdictional areas which are protected and regulated by the WPA and the local wetlands bylaw. The anticipated extent of alteration due to construction of the project to each resource area is summarized in Table 1. Site preparation will involve the removal of large debris and initiation of the Invasive Species Management Plan (**Attachment D**). All areas where debris or invasive vegetation is removed will be revegetated, as described in the Landscape Plan provided in **Attachment C.**

- Temporary Impacts. During construction, some temporary impacts to resource areas will be necessary to complete the work required. Temporary impacts include equipment staging, material stockpiling, and clearing and grubbing of vegetation where grading and invasive species management will occur. All areas where temporary impacts are

proposed will be restored to their pre-construction conditions. Construction entrances will be removed, and all disturbed areas will be revegetated once machine access to the Site is no longer necessary. Cleared and grubbed areas will be revegetated once grading activities have finished.

- Permanent Impacts are associated with installation of the raised boardwalks and trail. Proposed conditions indicate the final change in cover of each resource area as a result of the project.

Table 1. Resource Area Impacts

Resource Area	Existing Conditions[1] (SF)	Limit of Disturbance[2] (SF)	Permanent Changes[3] (SF)	Jurisdiction
Bordering Vegetated Wetland	45,462	0	0	Local and state
Isolated Vegetated Wetland	6,654	475	4	Local only
Inland Bank	1,086 LF	12 LF	12 LF	Local only
Land Under Water Bodies and Waterways	8,846	68	68	Local only
0-25 foot No-Disturb Zone	66,175	11,449	1,626	Local only
0-100 foot Buffer Zone	237,902	51,065	10,101	Local and state

Notes: SF = square feet; LF = linear feet; resource areas overlap and are not additive
[1]Total SF within the Site
[2]Includes temporary impacts (i.e., construction access and grading) and permanent impacts (i.e., trail and boardwalk installation)
[3]Includes permanent impacts only

6 Protection of Resource Area Interests

The proposed project is designed to benefit the interests identified in the WPA and the local bylaw by improving water quality and biodiversity and thereby ecosystem function, aesthetics, and habitat value. A discussion of how the proposed project is designed to meet the performance standards under the WPA and the local bylaw for unavoidable activities within jurisdictional resource areas is provided in the following subsections.

6.1 Massachusetts Wetlands Protection Act

The NOI application was filed as a limited project under the provisions at 310 CMR 10.53(3)(j) which applies to projects that involve

> "*the construction and maintenance of catwalks, footbridges, wharves, docks, piers, boathouses, boat shelters, duck blinds, skeet and trap shooting decks and observation decks; provided, however, that such structures are constructed on pilings or posts so as to permit the reasonably unobstructed flowage of water and adequate light to maintain vegetation*."

As a limited project, the project is not required to meet the WPA performance standards, as stated in 310 CMR 10.53(3):

"Notwithstanding the provisions of 310 CMR 10.54 through 10.58 and 10.60, the Issuing Authority may issue an Order of Conditions and impose such conditions as will contribute to the interests identified in M.G.L. c. 131, § 40 permitting the following limited projects…In determining whether to exercise its discretion to approve the limited projects listed in 310 CMR 10.53(3), the Issuing Authority shall consider the following factors: the magnitude of the alteration and the significance of the project site to the interests identified in M.G.L. c. 131, § 40, the availability of reasonable alternatives to the proposed activity, the extent to which adverse impacts are minimized, and the extent to which mitigation measures, including replication or restoration, are provided to contribute to the protection of the interests identified in M.G.L. c. 131, § 40."

However, construction related impacts to WPA regulated resource areas are limited to Buffer Zone impacts, for which no specified performance standards exist. However, the proposed project will minimize disturbance to vegetation throughout the Site, including within the 100-foot buffer zones to BVW and Bank. The existing tree canopy will be retained as much as possible to allow the Site to remain hospitable for existing wildlife. Invasive species management and native revegetation is proposed to improve biodiversity and therefore ecological function throughout the Site, including within the buffer zone. All disturbed areas will be permanently stabilized upon completion of the project.

6.2 Town of Stoneham Wetlands Protection Bylaw

To demonstrate the extent to which adverse impacts have been minimized and mitigated with the proposed project design, a review of the project's compliance with local performance standards for each impacted locally jurisdictional resource area is provided in the following subsections, followed by a waiver request for unavoidable impacts to resources areas.

6.2.1 Vegetated Wetland

Proposed activities in vegetated wetlands are designed to meet the performance standards, as defined in Section 18.3 of the local regulations:

1) *A proposed project shall not cause any adverse effect or cumulative adverse effect upon the wetland values of a Vegetated Wetland.*

Proposed impacts that will result in a loss of vegetated wetland are confined to a small length boardwalk where topography limits other options for the trail's alignment within the locally protected IVW. These IVW impacts total 4 SF. Project objectives aim to improve the functionality of all resource areas by expanding existing wetlands on Site to improve water quality and flood storage capacity and invasive species management to improve habitat and biodiversity.

2) *Where an Isolated Vegetated Wetland meets the criteria for a vernal pool, whether or not it has been certified, as described in SWR 18.1, a proposed project shall not cause any adverse effect or cumulate adverse effect upon the wetland values of vernal pool habitat. The Commission may require more than the minimum protective undisturbed buffer strip (i.e., a buffer strip setback greater than the 50' minimum, up to the limit specified by the Bylaw) in order to protect the values.*

Not applicable. See Section 2.2.2.

3) *Notwithstanding the above provisions, no project may be permitted which will have any adverse effect on specified habitat of rare vertebrate or invertebrate and rare plant species, as identified by procedures established under 310 CMR 10.59.*

Not applicable. See Section 2.1.

4) *Performance standards for activities or work proposed in the buffer zone to a Vegetated Wetland are specified in SWR 20.0.*

See Section 6.2.4.

5) *The Commission may impose such additional requirements as are necessary to protect the wetland values protected under the Bylaw.*

The Town acknowledges this standard.

6.2.2 Inland Bank

Section 21.4(3) of the local regulations specify that "*a bridge covering a Resource Area shall be considered fill.*" Proposed activities that will result in impacts to Bank are limited to installation of the boardwalk crossing over the stream and are designed to meet the performance standards, as defined in Section 18.2 of the local regulations:

(1) A proposed project shall not cause any adverse effect or cumulative adverse effect upon the wetland values of an Inland Bank.

Impacts to Bank will occur where the intermittent stream boardwalk crossing is proposed. In accordance with the above referenced local definition of fill, a total of 12 LF of Bank will be impacted with the proposed project. Impacts to Bank have been avoided and minimized to the extent practicable by locating one stream crossing at the existing culvert, thereby negating any new impacts to Bank in that location. Additionally, by locating the other stream crossing at the narrowest point of the channel and spanning beyond the Banks, the raised boardwalk avoids any direct contact with the Banks. Formalizing paths to the two stream crossings and creating a formalized trail system will direct users and discourage alternative access (e.g., footpaths) that may contribute to Bank destabilization.

(2) A proposed project shall be permitted only if there is no adverse effect on bank stability, bank height, ground water and surface water quality, the water carrying capacity of an existing channel within a bank, and the capacity of the bank to provide habitat for fisheries and/or wildlife.

Disturbance caused during construction activities will be restored and stabilized with vegetation. The new stream crossing abutments will be placed beyond the width of the Bank. The boardwalks have been sized to maintain the carrying capacity of the existing intermittent stream channel. No impacts to natural surface and groundwater flows or water quality are anticipated as a result of the project, and the crossing will be raised to enable the Banks to maintain their existing vegetation and continue to provide wildlife benefits.

Additionally, the proposed boardwalk will meet the intent of the Massachusetts Stream Crossing Standards (MASCS) Handbook (2nd Edition, June 2012, reprinted May 2018). The proposed

crossing will provide a provide a greater than 1.2 bankfull width as required in the regulations at 310 CMR 10.54(4)(a)6:

> *6. Work on a stream crossing shall be presumed to meet the performance standard set forth in 310 CMR 10.54(4)(a) provided the work is performed in compliance with the Massachusetts Stream Crossing Standards by consisting of a span or embedded culvert in which, at a minimum, the bottom of a span structure or the upper surface of an embedded culvert is above the elevation of the top of the bank, and the structure spans the channel width by a minimum of 1.2 times the bankfull width. This presumption is rebuttable and may be overcome by the submittal of credible evidence from a competent source. Notwithstanding the requirement of 310 CMR 10.54(4)(a)5., the impact on bank caused by the installation of a stream crossing is exempt from the requirement to perform a habitat evaluation in accordance with the procedures contained in 310 CMR 10.60.*

The stream channel bankfull width at the crossing is 11.76 feet. The proposed span for the boardwalk crossing is 20 feet between helical piles, with additional open space beyond the piles to allow uninterrupted water flow and movement for wildlife. The crossing will consist of open spans (boardwalk on helical pile abutments) that will eliminate the need for placement of pilings within the stream Banks. The table and associated calculations below demonstrate how the proposed crossing will meet the MA Stream Crossing Standards to the maximum extent practicable.

Table 2. Stream Crossing Standards

Embedment	**Bankfull Width** (min. 1.2 ratio)	**Openness Ratio** (min. 0.82)	**Substrate**	**Water Depth and Velocity**
N/A (span)	1.7	12.67	Natural	No change

Bankfull width = 11.76 LF, Crossing span = 15 LF
Bankfull ratio: 20 LF / 11.76 LF = 1.7
Cross-sectional area = 76 SF, Length = 6 LF
Openness ratio: 76 / 6 = 12.67

> *(3) Notwithstanding the above provisions, no project may be permitted which will have any adverse effect on specified habitat of rare vertebrate or invertebrate and rare plant species, as identified by procedures established under 310 CMR 10.59.*

Not applicable. See Section 2.1.

> *(4) Performance standards for activities or work proposed in the buffer zone to an Inland Bank are specified in SWR 20.0. The Commission may impose such additional requirements as are necessary to protect the wetland values protected under the Bylaw.*

The Town acknowledges this standard.

6.2.3 Land Under Water Bodies and Waterways

Section 21.4(3) of the local regulations specify that "*a bridge covering a Resource Area shall be considered fill.*" Two boardwalk crossings over the intermittent stream are proposed as part of

this project to allow for connectivity throughout the Site. Impacts have been minimized by utilizing the existing culvert for one of the crossings.

(1) Proposed work shall not cause a significant adverse effect or cumulative adverse effect upon the wetland values of Land Under an Inland Water Body.

In accordance with the above referenced local definition of fill, a total of 68 SF of LUWW will be covered with the proposed stream crossing. As discussed in Section 6.2.2, the crossing has been designed to meet the MASCS to the maximum extent practicable. It will be raised high enough to enable light to penetrate and vegetation to continue to grow within the channel and along its Banks. The location for this crossing was chosen based on its existence within the narrowest point of the channel, shortly before it diffuses into a vegetated wetland, to further avoid and minimize disturbance. No adverse impacts are anticipated as a result of this crossing.

(2) Notwithstanding the above provisions, no project may be permitted which will have any adverse effect on specified habitat of rare vertebrate or invertebrate species, as identified by procedures established under 310 CMR 10.59.

Not applicable. See Section 2.1.

(3) Performance standards for proposed work or activities within the buffer zone to Land Under an Inland Water Body are specified in SWR 20.0.

See Section 6.2.4.

(4) The Commission may impose such additional requirements as are necessary to protect the wetland values protected under the Bylaw.

The Town acknowledges this standard.

6.2.4 Buffer Zone

The local bylaw specifies that:

"*a continuous strip no less than 25 feet in width, untouched and in its natural state, shall be left undisturbed adjacent to those areas meeting the description of a "wetland" as identified in the Wetlands Protection Act, G.L. Ch 131§40, and regulations thereunder (310 CMR 10.00) and areas meeting the description of a "wetland under this Ch. 11 Wetlands Protection bylaw and the regulations thereunder. No person shall remove, fill, dredge, alter or build upon or within this strip."*

A discussion of how the proposed project is designed to meet the local performance standards for the 25 foot and 100-foot Buffer Zones, as defined in the local regulations, Section 20(d)(1-5), follows.

(1) The intent of the Conservation Commission is to move all structures and activities as far away as possible from any Resource Area, in order to protect the wetland values of Resource Areas.

The proposed trail has been designed to avoid interference with existing resource areas and their buffer zones to the maximum extent possible. Because the entire Site is composed almost entirely of resource areas or their buffer zones, working outside of buffer zones was not an

option. However, with the exception of the stream crossings and one area where the boardwalk must cross through the IVW due to existing Site topography, the trail has been designed to exist outside of the 25-foot buffer zone.

(2) Except as otherwise specified, Resource Area buffers shall be retained and maintained in a naturally vegetated condition. Where buffer disturbance has occurred during construction, revegetation with native vegetation may be required.

All areas that are disturbed during construction will be revegetated with native seed mix and plantings, as detailed on the Landscape Plan provided in **Attachment C**. Raised boardwalks will enable vegetation growth to occur beneath the crossings.

(3) The Commission may require that already-altered buffer zone be restored in order to protect or improve Resource Area values. Restoration means planting native vegetation, grading, correcting site drainage, removing debris, or other measures which will improve, restore and protect the wetland values of the Resource Area.

Previous disturbance at the Site has resulted in the deposition of several large items of debris, including piles of boulders, likely remnants of blasting and boulder removal during adjacent school and/or residential developments, in addition to old appliances, a car, and yard waste. Proposed project activities include removal of the debris as well as expansion into areas that were presumably once wetland prior to historic impacts. Further, as invasive species are prevalent throughout the Site, a comprehensive invasive species management plan was developed to improve biodiversity, and thus wildlife habitat and ecosystem function (**Attachment D).**

(4) Notwithstanding the above provisions, no project may be permitted which will have any adverse effect on specified habitat of rare vertebrate or invertebrate and rare plant species, as identified by procedures established pursuant to 310 CMR 10.59.

Not applicable (see Section 2.1).

(5) The Commission may impose such additional requirements as are necessary to protect the wetland values protected under the Bylaw.

The Town acknowledges this standard.

6.2.5 Waiver Request

Due to work within vegetated wetland, the Town requests a waiver under Section 21.4(2) of the local regulations, which states:

"The Commission at its discretion may allow the filling of up to 2,500 SF of Vegetated Wetland for a limited project, if satisfied that mitigation required in the Order of Conditions is sufficient to protect the Resource Area. If filling is allowed, the Commission may require replication of the wetland at a ratio of at least 2:1, in an area that is hydrologically suitable for supporting wetland functions, hydrologically connected to the altered wetland, and must be accomplished by using wetland soils and by using native wetland plant species removed from the area to be filled. The replicated wetland must be established prior to commencing the upland activity. The replicated wetland must be monitored for at least two growing seasons and must be maintained as a functional wetland with wetland values at least

equaling those of the filled wetland for at least five years following the completion of the main project."

Proposed impacts that will result in a loss of vegetated wetland are confined to a small length of boardwalk where topography limits other options for the trail's alignment within the locally protected IVW. These IVW impacts total 4 SF. Project objectives aim to improve the functionality of all resource areas by expanding existing wetlands on Site to improve water quality and flood storage capacity and invasive species management to improve habitat and biodiversity. See Section 3.3 for details on post construction monitoring for these expansion areas, which will significantly exceed the 2:1 minimum ratio that may be required by the Commission.

Additionally, the work proposed to construct the pedestrian trail has been designed in accordance with Conservation Commission priorities, as described under Sections 21.4(1) and 21.5(1) of the local regulations, which state, respectively:

"No fill shall be placed in any Resource Area or any buffer zone so as to alter the flow of surface water in a way that the Conservation Commission reasonably concludes will adversely affect the wetland values of the Resource Area(s)."

"The intent of the Conservation Commission is to move all structures and activities as far away as possible from any Resource Area."

A Waiver of strict adherence to the local regulations is necessary in order to allow the project, led by public initiatives for sustainable recreational access to this Site, to move forward. The Site's proximity to the Stoneham High School and residential neighborhoods as well as DCR property makes this project a key opportunity to increase connectivity for pedestrians in the Town of Stoneham as well as expand education of the Town's natural resources. The existing informal footpaths are highly utilized by students and local community members who want access to the high school. Work within the locally regulated buffer zones will provide controlled access to the Site at designated locations, thereby deterring the public from trampling vegetation in Resource Areas and Buffer Zones, which would ultimately lead to further degradation of wetland resources.

Trail improvements are designed to meet FSTAG and ADA requirements, improving accessibility as the existing informal trails do not provide universal access. Disturbance has been minimized through the use of raised boardwalks, which will prevent soil compaction and enable vegetation to grow beneath them, and by rehabilitating the Site through debris removal, invasive species management, and restoration of the native plant community. The overall restorative nature of the project will result in immediate and long-term benefits to the resource areas and thus, the enhancement of interests protected under the WPA and the local bylaw.

Given the extensive presence of jurisdictional areas within the Site and the goals and objectives of this public project, the Town respectfully requests that the Conservation Commission issue a Waiver to allow the project to move forward as proposed with the planned mitigation.

7 Additional Mitigation Measures

7.1 Erosion and Sediment Control

An erosion and sediment control (ESC) plan is proposed for implementation prior to and throughout construction to prevent migration of sediments or materials, erosion, or other runoff-related impacts to downgradient resource areas. Project construction activities will involve disturbance of one or more acres of land and therefore mitigation measures must be implemented in compliance with the Environmental Protection Agency (EPA) Construction General Permit (CGP). Permit coverage will require the development of a Stormwater Pollution Prevention Plan (SWPPP) and submittal of an electronic NOI (eNOI) through the National Pollutant Discharge Elimination System (NPDES) eReporting Tool. The eNOI must be filed 14 days prior to the start of any earth disturbing activities to allow for the review process to complete. Erosion and sedimentation measures will be implemented as detailed in the SWPPP and as summarized below.

Before any construction activities begin, ESCs will be placed at the limit of work boundary as depicted in the Project Plans (**Attachment C**). ESCs will consist of 12-inch composed silt socks or other measures approved by the Conservation Commission. Water will be applied to exposed areas to control dust as needed.

The limit of clearing, grading, and disturbances will be minimized by phasing site work so only areas which are actively under construction are exposed. Earthmoving or other activities that may leave larger areas temporarily unstabilized will be scheduled to avoid precipitation events that could increase the potential for runoff. Stabilization practices will be initiated on all disturbed areas as soon as possible but not more than 14 days after construction activity in that area has temporarily or permanently ceased. Steep slopes (greater than 4:1) will be reinforced with additional stabilization methods such as erosion control blankets or other approved equivalent practices.

A minimum surplus of 100 feet of ESCs will be kept within the staging area at all times so repairs or replacements can be made immediately as necessary. To prevent sediment tracking onto roadways by construction vehicles, riprap construction entrances will be installed at access points. If any sediment or other debris is tracked from site exits, it will be swept and removed as necessary.

All ESCs will be maintained in good condition until work is complete and all disturbed areas have been stabilized. ESCs will be inspected on a weekly basis and after each rainfall event of 0.25 inches or greater. Any problems identified will be repaired within 24 hours.

7.2 Stormwater Management

HW conducted a Site and associated watershed assessment in April 2023 and determined that the Site accepts runoff from approximately 148 acres of primarily residential, commercial, and open space areas to the north. A large portion of the watershed drains to and through the vegetated wetlands and stream located to the north of Franklin Street, to the north and the west of the former Weiss Farm property. Flows from this system continue through a 30-inch culvert

under Franklin Street and an open channel before being piped under the school grounds and eventually discharging to a 36-inch culvert at the Site's northern boundary, where the unnamed intermittent stream initiates. While the project does not include stream restoration, HW has discussed this with the Town as a potential additional long-term strategy to improve floodplain connectivity and wildlife and aquatic habitat. Details of HW's watershed observations and hydrologic and hydraulic modeling are provided in the Stormwater Management Report provided in **Attachment E**.

The proposed project will not measurably change existing drainage patterns. The existing footpaths and compacted soils due to the dumping of stone and boulders, trash and debris will be restored by aerating soils and revegetating with native seed mix. The proposed path surfacing material, which will be dense graded aggregate or similar product, is intended to be compacted to meet ADA requirements but will have adequate permeability to not generate additional runoff as a result of this project. The proposed design will incorporate grading to direct runoff along the slope on the eastern portion of the site to graded depressions with overland and over path outlets that will be reinforced with sections of granite to limit path erosion and gullying. These depressions will be revegetated with native plants. No formal stormwater management practices are proposed.

The proposed project is designed to meet the Massachusetts Stormwater Management Standards (MASWMS) to the extent practicable, in accordance with 310 CMR 10.05(6)(k)7 and in accordance with the applicability standards outlined in the Massachusetts Stormwater Handbook, as discussed below.

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

No new untreated stormwater will be discharged or cause Stoneham High School Wetlands site located at 149 Franklin Street in Stoneham, Massachusetts erosion to a water of the Commonwealth. Stormwater will be managed and recharged onsite for all storms.

Standard 2. Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

There is no increase in impervious cover and modifications to the site are intended to improve site hydrology and opportunities for infiltration. No formal stormwater practices are proposed to manage runoff volumes.

Standard 3. 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.

Recharge in proposed conditions will be equal or greater than existing conditions with removal of debris and invasive species, the aeration of the existing soil and the creation of shallow depressions that are intended to collect and retain runoff to promote infiltration to groundwater resources.

Standard 4. 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:

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

There are no formal stormwater management systems proposed for the Site. Source controls and pollution prevention will be controlled by the methods outlined in the Operation and Maintenance Plan.

Standard 5. 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, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

Not applicable. No area on the proposed site has been designated as a land use with higher potential pollutant loads.

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

a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

Not applicable. The site is not within a Zone II wellhead protection recharge area for public water supply or any of the State designated critical areas listed above.

Standard 7. 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 is not considered redevelopment.

Standard 8. 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.

The erosion and sediment control devices that will be implemented during construction of the project are shown on the site plans. They include a formal construction entrance, linear barrier (straw waddle, siltation sock, silt fence, or equal) along the perimeter of the work zone, tree protection and silt socks within catch basin inlets. Details are provided on the Project plans in **Attachment C**.

Standard 9. 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 is provided in **Attachment F**, will be implemented by the Owner and designated Site Operator.

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

There will be no illicit discharges to any resource area or stormwater management system/structure as part of this project.

8 References

Federal Emergency Management Agency (FEMA) Flood Map Service Center. Accessed April 2023 via https://msc.fema.gov/portal/home.

Jackson, S.D., et. al., 2022. *Massachusetts Handbook for Delineation of Bordering Vegetated Wetlands, Second Edition*. Massachusetts Department of Environmental Protection. Bureau of Water Resources. Accessed April 2023 via https://www.mass.gov/doc/massachusetts-handbook-for-delineation-of-bordering-vegetated-wetlands/download.

Horsley Witten Group, Inc., June 2023. *Stoneham High School Wetlands Invasive Species Management Plan.*

Horsley Witten Group, Inc., June 27, 2023. *Stormwater Analysis Report, Upper Mystic Watershed, Stoneham High School Wetlands, Stoneham, Massachusetts.*

Massachusetts Office of Geographic and Environmental Information (MassGIS). Accessed April 2023 via http://www.mass.gov/mgis/.

Massachusetts Wetlands Protection Act (WPA). Massachusetts Department of Environmental Protection. 2017. Accessed April 2023 via https://www.mass.gov/doc/310-cmr-1000-the-wetlands-protection-act/download.

Natural Resources Conservation Service Web Soil Survey. Accessed April 2023 via https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx.

Stoneham Wetland Protection Bylaw. 2021. Chapter 11 of the Stoneham Town Code. Accessed April 2023 via https://www.stoneham-ma.gov/DocumentCenter/View/1218/CH11-Wetlands--Protection-Bylaw.

Stoneham Wetland Regulations. 2016. Chapter 23 of the Stoneham Town Code. Accessed April 2023 via https://www.stoneham-ma.gov/DocumentCenter/View/1218/CH11-Wetlands--Protection-Bylaw.

Attachment A – Locus Maps

Figure 1 – USGS Topography

Figure 2 – Aerial Photograph

Figure 3 – Environmental Resources

Figure 4 – NRCS Soils

Figure 5 – FEMA Flood Zones

Figure 6 – FEMA FIRMette

Figure 7 – Invasive Species

Horsley Witten Group
Sustainable Environmental Solutions

Path: H:\Projects\2021\21008 Upper Mystic River Watershed\21008C Stoneham\GIS\Maps\USGS_Locus.mxd

Date: 2/1/2024
Data Sources: Bureau of Geographic Information (MassGIS), ESRI

This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

Stoneham High School Property
Project Site

Stoneham High School Conservation Lands
Stoneham, MA

Figure 1
USGS Locus.

Horsley Witten Group
Sustainable Environmental Solutions

Path: H:\Projects\2021\21008 Upper Mystic River Watershed\21008C Stoneham\GIS\Maps\Aerial.mxd

Date: 2/7/2024
Data Sources: Bureau of Geographic Information (MassGIS), ESRI

This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

Parcels
Stoneham High School Property
Project Site

Stoneham High School Conservation Lands
Stoneham, MA

Figure 2
Aerial.

Horsley Witten Group
Sustainable Environmental Solutions

Path: H:\Projects\2021\21008 Upper Mystic River Watershed\21008C Stoneham\GIS\Maps\Environmental_Resources.mxd

Date: 4/14/2023
Data Sources: Bureau of Geographic Information (MassGIS), ESRI, Field survey conducted by Horsley Witten Scientists.

This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

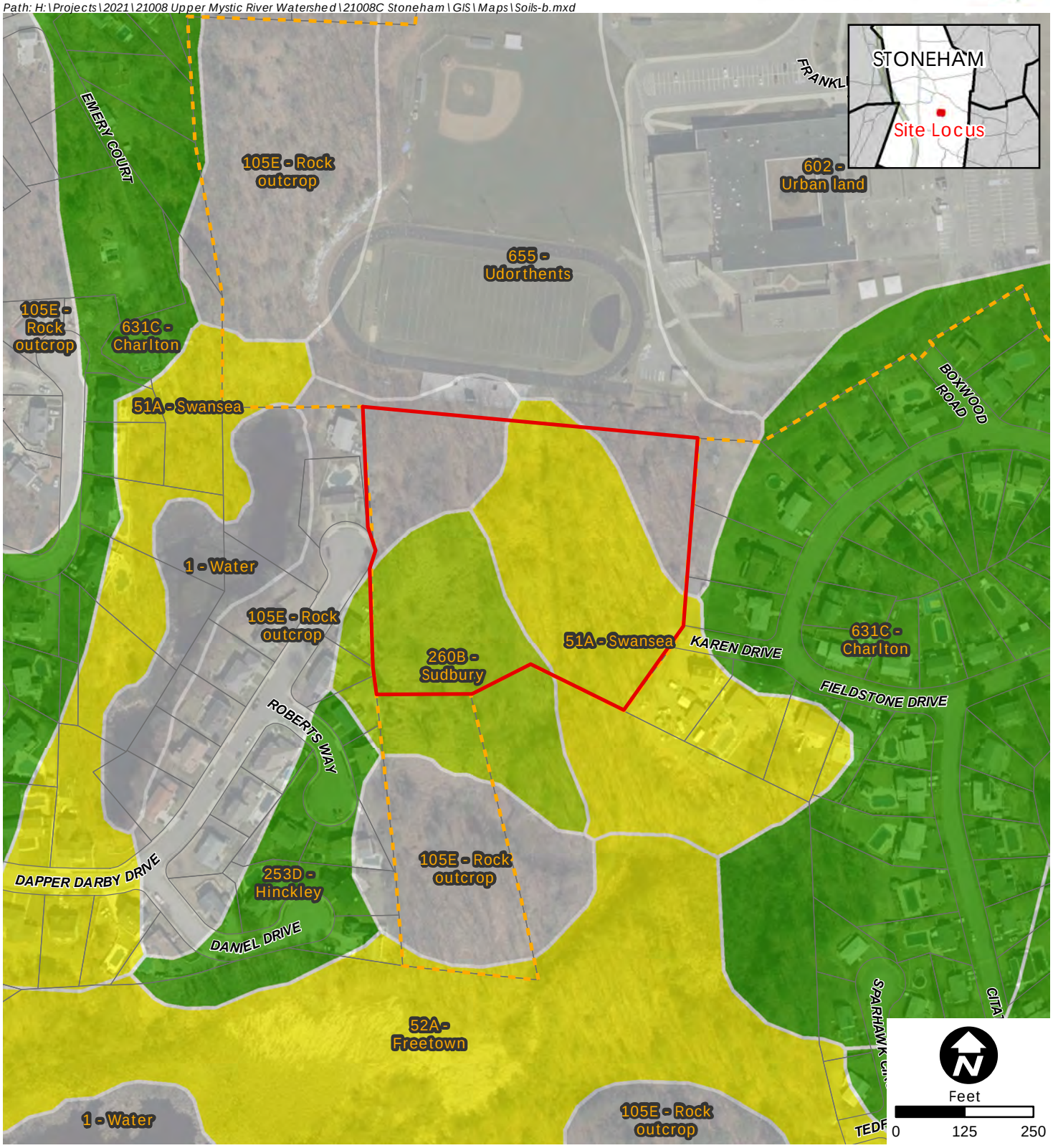
- Project Site
- Stoneham High School Property
- Parcels
- Stream
- 25 Foot Undisturbed Buffer to Stream
- 100 Foot Buffer to Stream
- Vegetated Wetlands
- 25 Foot Undisturbed Buffer to Vegetated Wetlands
- 100 Foot Buffer to Vegetated Wetlands

Stoneham High School Conservation Lands
Stoneham, MA

Figure 3
Environmental Resources

Horsley Witten Group
Sustainable Environmental Solutions

Path: H:\Projects\2021\21008 Upper Mystic River Watershed\21008C Stoneham\GIS\Maps\Soils-b.mxd



Date: 2/1/2024
Data Sources: Bureau of Geographic Information (MassGIS), ESRI

This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

Stoneham High School Property
Project Site
Parcels

Hydrologic Soil Group
null
A
B
B/D

Stoneham High School Conservation Lands
Stoneham, MA

Figure 4
NRCS SSURGO-Certified Soils.

Horsley Witten Group
Sustainable Environmental Solutions

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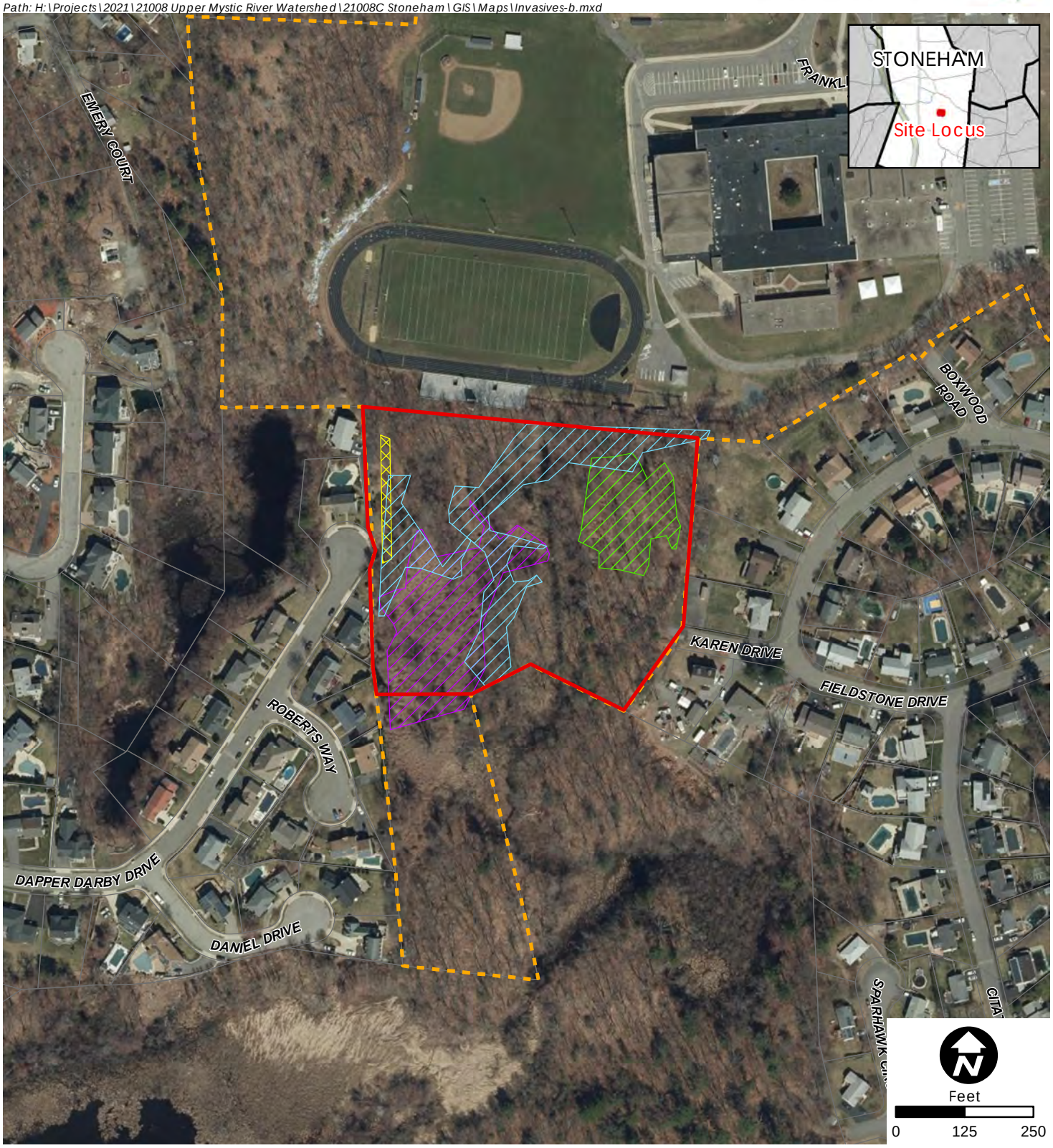

Date:4/14/2023
Data Sources: Bureau of Geographic Information (MassGIS), ESRI, Field survey conducted by Horsley Witten Scientists.

This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

- Stoneham High School Property
- Project Site
- Parcels
- Bittersweet, 25%
- Japanese knotweed, 25%
- Japanese knotweed, 80%
- Porcelain berry, 80%

Stoneham High School Conservation Lands
Stoneham, MA

Figure 5
Invasive Species.

Horsley Witten Group
Sustainable Environmental Solutions

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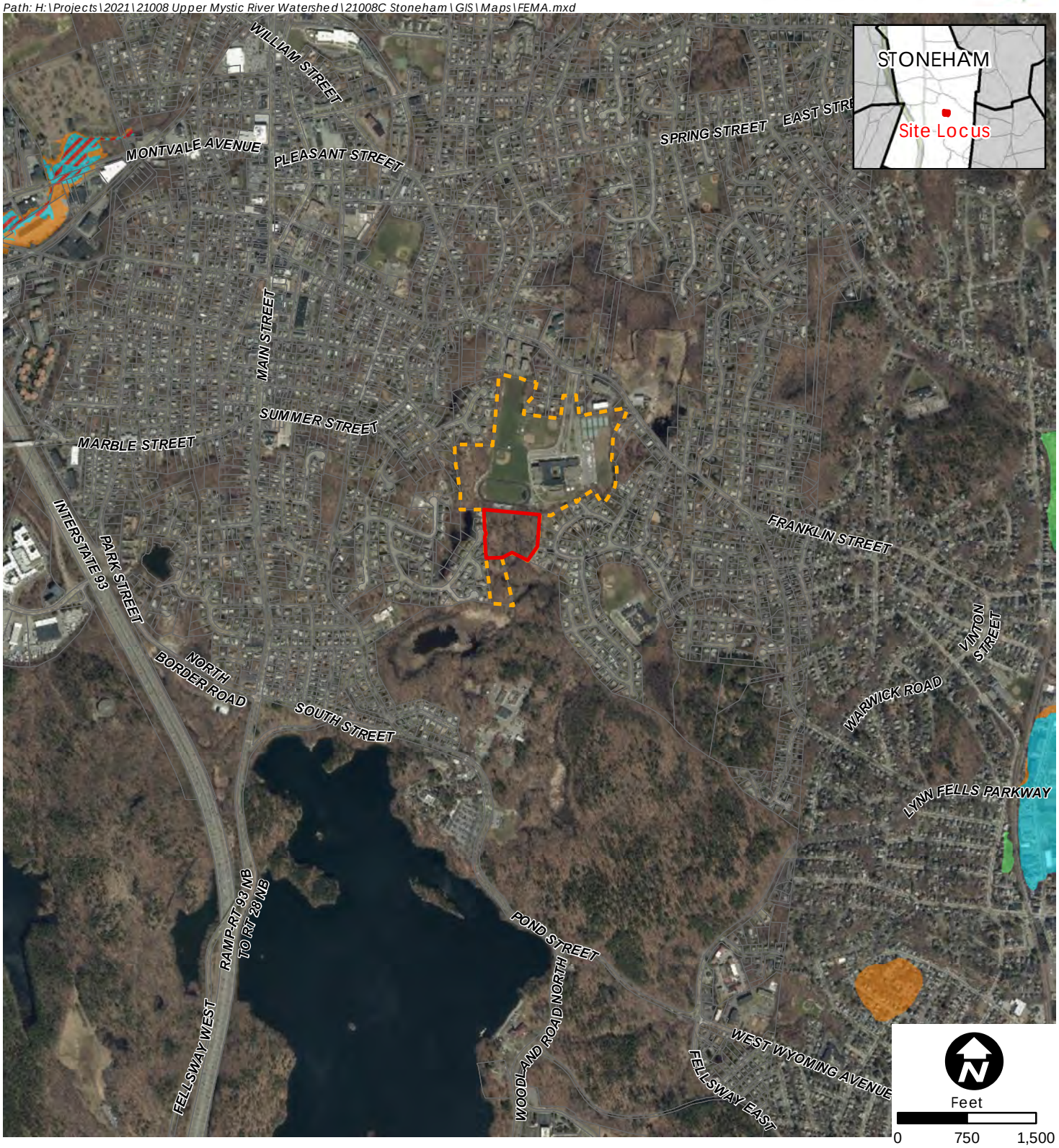


Date: 2/1/2024
Data Sources: Bureau of Geographic Information (MassGIS), ESRI

This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

- Parcels
- StonehamHighschoolPr...
- Current Survey Area

Flood Zone Designations

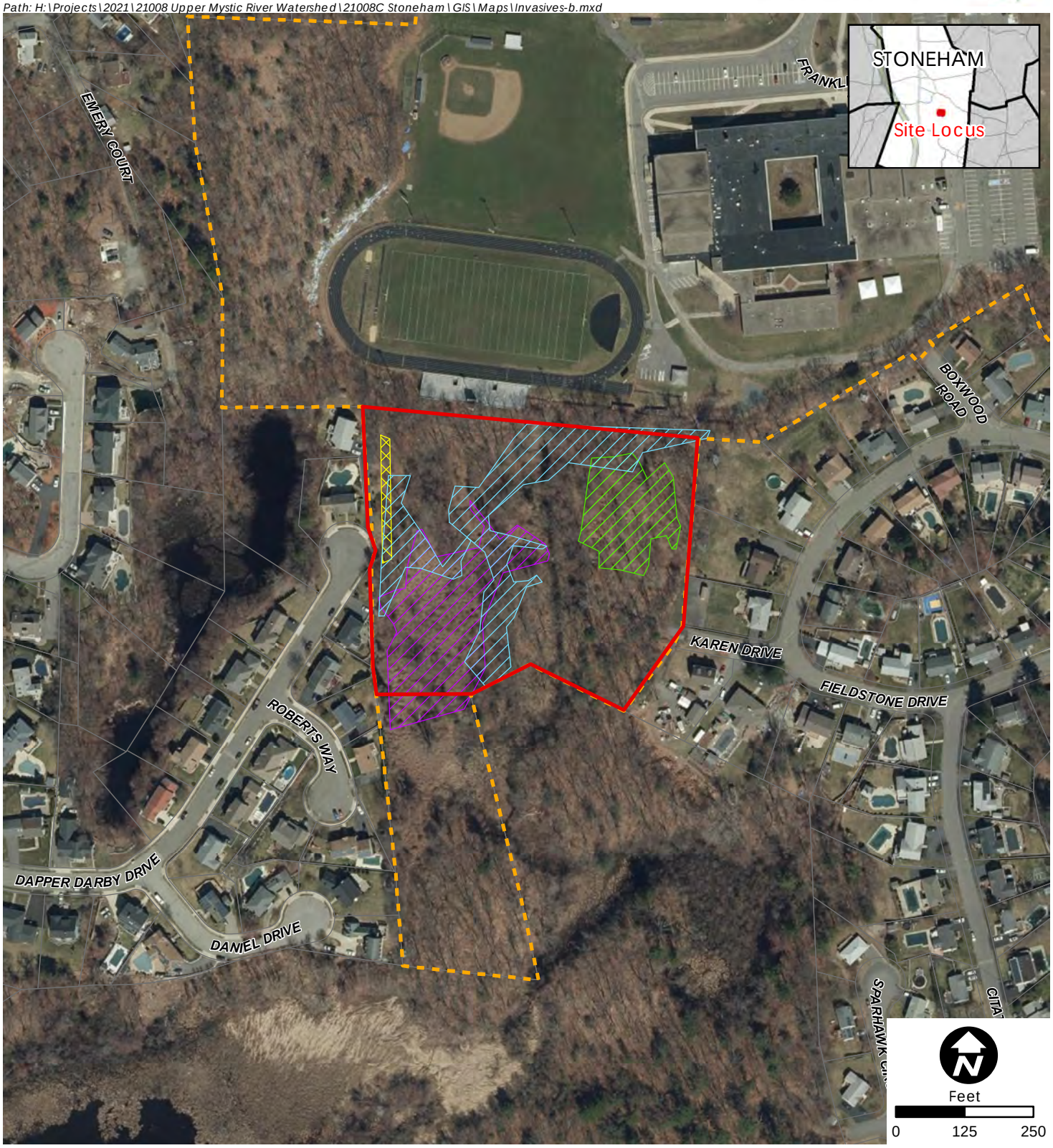
- A: 1% Annual Chance of Flooding, no BFE
- AE: 1% Annual Chance of Flooding, with BFE
- AE: Regulatory Floodway
- X: 0.2% Annual Chance of Flooding

Stoneham High School Conservation Lands
Stoneham, MA

Figure 6
FEMA National Flood Hazard Layer

Horsley Witten Group
Sustainable Environmental Solutions

Path: H:\Projects\2021\21008 Upper Mystic River Watershed\21008C Stoneham\GIS\Maps\Invasives-b.mxd



Date:4/14/2023
Data Sources: Bureau of Geographic Information (MassGIS), ESRI, Field survey conducted by Horsley Witten Scientists.

This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

- Stoneham High School Property
- Project Site
- Parcels
- Bittersweet, 25%
- Japanese knotweed, 25%
- Japanese knotweed, 80%
- Porcelain berry, 80%

Stoneham High School Conservation Lands
Stoneham, MA

Figure 7
Invasive Species.

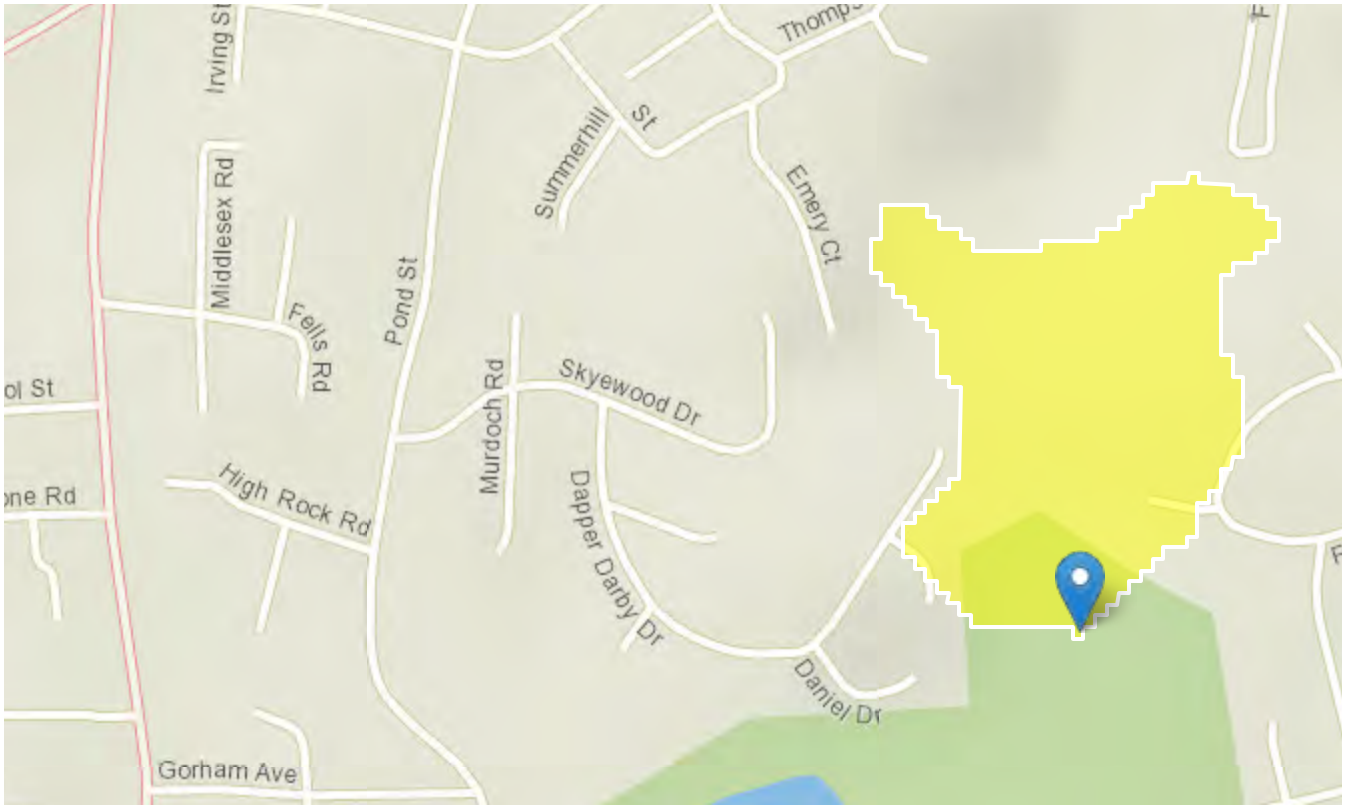
Attachment B – Wetland Data

1 – StreamStats Report

2 – Wetland Determination Forms

StreamStats Report - Stoneham HS_21008C

Region ID: MA
Workspace ID: MA20230501194409140000
Clicked Point (Latitude, Longitude): 42.46912, -71.09042
Time: 2023-05-01 15:44:31 -0400



An unnamed, presumably man-made stream channel flows from culvert at northern end of the project site and continues south across the survey area in the direction of the selected delineated basin point, which exists just south of the survey area.

Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM10M	Mean basin slope computed from 10 m DEM	5.264	percent

Parameter Code	Parameter Description	Value	Unit
BSLDEM250	Mean basin slope computed from 1:250K DEM	5.29	percent
DRFTPERSTR	Area of stratified drift per unit of stream length	-100000	square mile per mile
DRNAREA	Area that drains to a point on a stream	0.0349	square miles
ELEV	Mean Basin Elevation	169	feet
FOREST	Percentage of area covered by forest	51.55	percent
LC06STOR	Percentage of water bodies and wetlands determined from the NLCD 2006	11.95	percent
MAREGION	Region of Massachusetts 0 for Eastern 1 for Western	0	dimensionless
PCTSNDGRV	Percentage of land surface underlain by sand and gravel deposits	73.34	percent

Peak-Flow Statistics

Peak-Flow Statistics Parameters [Peak Statewide 2016 5156]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0349	square miles	0.16	512
ELEV	Mean Basin Elevation	169	feet	80.6	1948
LC06STOR	Percent Storage from NLCD2006	11.95	percent	0	32.3

Peak-Flow Statistics Disclaimers [Peak Statewide 2016 5156]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Peak-Flow Statistics Flow Report [Peak Statewide 2016 5156]

Statistic	Value	Unit

Statistic	Value	Unit
50-percent AEP flood	2.28	ft^3/s
20-percent AEP flood	3.97	ft^3/s
10-percent AEP flood	5.37	ft^3/s
4-percent AEP flood	7.44	ft^3/s
2-percent AEP flood	9.17	ft^3/s
1-percent AEP flood	11	ft^3/s
0.5-percent AEP flood	13.1	ft^3/s
0.2-percent AEP flood	16.1	ft^3/s

Peak-Flow Statistics Citations

Zarriello, P.J.,2017, Magnitude of flood flows at selected annual exceedance probabilities for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2016–5156, 99 p. (https://dx.doi.org/10.3133/sir20165156)

Low-Flow Statistics

Low-Flow Statistics Parameters [Statewide Low Flow WRIR00 4135]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0349	square miles	1.61	149
BSLDEM250	Mean Basin Slope from 250K DEM	5.29	percent	0.32	24.6
DRFTPERSTR	Stratified Drift per Stream Length	-100000	square mile per mile	0	1.29
MAREGION	Massachusetts Region	0	dimensionless	0	1

Low-Flow Statistics Disclaimers [Statewide Low Flow WRIR00 4135]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors. Equation M7D2Y in GC320 could not be calulated due to undefined basin characteristic. Equation M7D10Y in GC320 could not be calulated due to undefined basin characteristic.

Low-Flow Statistics Flow Report [Statewide Low Flow WRIR00 4135]

Statistic	Value	Unit
7 Day 2 Year Low Flow	undefined	ft^3/s
7 Day 10 Year Low Flow	undefined	ft^3/s

Low-Flow Statistics Citations

Ries, K.G., III,2000, Methods for estimating low-flow statistics for Massachusetts streams: U.S. Geological Survey Water Resources Investigations Report 00-4135, 81 p. (http://pubs.usgs.gov/wri/wri004135/)

Flow-Duration Statistics

Flow-Duration Statistics Parameters [Statewide Low Flow WRIR00 4135]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0349	square miles	1.61	149
DRFTPERSTR	Stratified Drift per Stream Length	-100000	square mile per mile	0	1.29
MAREGION	Massachusetts Region	0	dimensionless	0	1
BSLDEM250	Mean Basin Slope from 250K DEM	5.29	percent	0.32	24.6

Flow-Duration Statistics Disclaimers [Statewide Low Flow WRIR00 4135]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors. Equation D60 in GC320 could not be calulated due to undefined basin characteristic. Equation D70 in GC320 could not be calulated due to undefined basin characteristic. Equation D75 in GC320 could not be calulated due to undefined basin characteristic. Equation D80 in GC320 could not be calulated due to undefined basin characteristic. Equation D85 in GC320 could not be calulated due to undefined basin characteristic. Equation D90 in GC320 could not be calulated due to undefined basin characteristic. Equation D95 in GC320 could not be calulated due to undefined basin characteristic. Equation D98 in GC320 could not be calulated due to undefined basin characteristic. Equation D99 in GC320 could not be calulated due to undefined basin characteristic.

Flow-Duration Statistics Flow Report [Statewide Low Flow WRIR00 4135]

Statistic	Value	Unit
50 Percent Duration	0.0312	ft^3/s

Statistic	Value	Unit
60 Percent Duration	undefined	ft^3/s
70 Percent Duration	undefined	ft^3/s
75 Percent Duration	undefined	ft^3/s
80 Percent Duration	undefined	ft^3/s
85 Percent Duration	undefined	ft^3/s
90 Percent Duration	undefined	ft^3/s
95 Percent Duration	undefined	ft^3/s
98 Percent Duration	undefined	ft^3/s
99 Percent Duration	undefined	ft^3/s

Flow-Duration Statistics Citations

Ries, K.G., III,2000, Methods for estimating low-flow statistics for Massachusetts streams: U.S. Geological Survey Water Resources Investigations Report 00-4135, 81 p. (http://pubs.usgs.gov/wri/wri004135/)

August Flow-Duration Statistics

August Flow-Duration Statistics Parameters [Statewide Low Flow WRIR00 4135]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0349	square miles	1.61	149
BSLDEM250	Mean Basin Slope from 250K DEM	5.29	percent	0.32	24.6
DRFTPERSTR	Stratified Drift per Stream Length	-100000	square mile per mile	0	1.29
MAREGION	Massachusetts Region	0	dimensionless	0	1

August Flow-Duration Statistics Disclaimers [Statewide Low Flow WRIR00 4135]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors. Equation AUGD50 in GC320 could not be calulated due to undefined basin characteristic.

August Flow-Duration Statistics Flow Report [Statewide Low Flow WRIR00 4135]

Statistic	Value	Unit
August 50 Percent Duration	undefined	ft^3/s

August Flow-Duration Statistics Citations

Ries, K.G., III,2000, Methods for estimating low-flow statistics for Massachusetts streams: U.S. Geological Survey Water Resources Investigations Report 00-4135, 81 p. (http://pubs.usgs.gov/wri/wri004135/)

Bankfull Statistics

Bankfull Statistics Parameters [Bankfull Statewide SIR2013 5155]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0349	square miles	0.6	329
BSLDEM10M	Mean Basin Slope from 10m DEM	5.264	percent	2.2	23.9

Bankfull Statistics Parameters [Appalachian Highlands D Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0349	square miles	0.07722	940.1535

Bankfull Statistics Parameters [New England P Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0349	square miles	3.799224	138.999861

Bankfull Statistics Parameters [USA Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0349	square miles	0.07722	59927.7393

Bankfull Statistics Disclaimers [Bankfull Statewide SIR2013 5155]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Bankfull Statistics Flow Report [Bankfull Statewide SIR2013 5155]

Statistic	Value	Unit
Bankfull Width	3.81	ft
Bankfull Depth	0.347	ft
Bankfull Area	1.29	ft^2
Bankfull Streamflow	2.34	ft^3/s

Bankfull Statistics Disclaimers [Appalachian Highlands D Bieger 2015]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Bankfull Statistics Flow Report [Appalachian Highlands D Bieger 2015]

Statistic	Value	Unit
Bieger_D_channel_width	3.78	ft
Bieger_D_channel_depth	0.428	ft
Bieger_D_channel_cross_sectional_area	1.62	ft^2

Bankfull Statistics Disclaimers [New England P Bieger 2015]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Bankfull Statistics Flow Report [New England P Bieger 2015]

Statistic	Value	Unit
Bieger_P_channel_width	9.88	ft
Bieger_P_channel_depth	0.657	ft
Bieger_P_channel_cross_sectional_area	6.25	ft^2

Bankfull Statistics Disclaimers [USA Bieger 2015]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with

unknown errors.

Bankfull Statistics Flow Report [USA Bieger 2015]

Statistic	Value	Unit
Bieger_USA_channel_width	3.8	ft
Bieger_USA_channel_depth	0.59	ft
Bieger_USA_channel_cross_sectional_area	2.79	ft^2

Bankfull Statistics Flow Report [Area-Averaged]

Statistic	Value	Unit
Bankfull Width	3.81	ft
Bankfull Depth	0.347	ft
Bankfull Area	1.29	ft^2
Bankfull Streamflow	2.34	ft^3/s
Bieger_D_channel_width	3.78	ft
Bieger_D_channel_depth	0.428	ft
Bieger_D_channel_cross_sectional_area	1.62	ft^2
Bieger_P_channel_width	9.88	ft
Bieger_P_channel_depth	0.657	ft
Bieger_P_channel_cross_sectional_area	6.25	ft^2
Bieger_USA_channel_width	3.8	ft
Bieger_USA_channel_depth	0.59	ft
Bieger_USA_channel_cross_sectional_area	2.79	ft^2

Bankfull Statistics Citations

Bent, G.C., and Waite, A.M.,2013, Equations for estimating bankfull channel geometry and discharge for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2013–5155, 62 p., (http://pubs.usgs.gov/sir/2013/5155/)

Bieger, Katrin; Rathjens, Hendrik; Allen, Peter M.; and Arnold, Jeffrey G.,2015, Development and Evaluation of Bankfull Hydraulic Geometry Relationships for the Physiographic Regions of the United States, Publications from USDA-ARS / UNL Faculty, 17p. (https://digitalcommons.unl.edu/usdaarsfacpub/1515?utm_source=digitalcommons.unl.edu%2Fusdaarsfacpub%2F1515&utm_medium=PDF&utm_campaign=PDFCoverPages)

Probability Statistics

Probability Statistics Parameters [Perennial Flow Probability]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0349	square miles	0.01	1.99
PCTSNDGRV	Percent Underlain By Sand And Gravel	73.34	percent	0	100
FOREST	Percent Forest	51.55	percent	0	100
MAREGION	Massachusetts Region	0	dimensionless	0	1

Probability Statistics Flow Report [Perennial Flow Probability]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PC
Probability Stream Flowing Perennially	0.29	dim	71

Probability Statistics Citations

Bent, G.C., and Steeves, P.A.,2006, A revised logistic regression equation and an automated procedure for mapping the probability of a stream flowing perennially in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2006–5031, 107 p. (http://pubs.usgs.gov/sir/2006/5031/pdfs/SIR_2006-5031rev.pdf)

Maximum Probable Flood Statistics

Maximum Probable Flood Statistics Parameters [Crippen Bue Region 2]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0349	square miles	0.1	3000

Maximum Probable Flood Statistics Disclaimers [Crippen Bue Region 2]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Maximum Probable Flood Statistics Flow Report [Crippen Bue Region 2]

Statistic	Value	Unit
Maximum Flood Crippen Bue Regional	483	ft^3/s

Maximum Probable Flood Statistics Citations

Crippen, J.R. and Bue, Conrad D.1977, Maximum Floodflows in the Conterminous United States, Geological Survey Water-Supply Paper 1887, 52p. (https://pubs.usgs.gov/wsp/1887/report.pdf)

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Application Version: 4.14.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

BORDERING VEGETATED WETLAND DETERMINATION FORM

Project/Site: Stoneham high school conservation lands City/Town: Stoneham Sampling Date: 4/14/2023

Applicant/Owner: Town of Stoneham, Massachusetts Sampling Point or Zone: Wet Plot 1: HW-W1-407

Investigator(s): Jamie McCarthy, Horsley Witten Group, Inc. Latitude / Longitude: 42.470073, -71.091043

Soil Map Unit Name: Sudbury fine sandy loam, non-hydric NWI or DEP Classification: PFO1/SS1Cd

Are climatic/hydrologic conditions on the site typical for this time of year? Yes [✓] No [ ] (If no, explain in Remarks)

Are Vegetation [ ], Soil [ ], or Hydrology [ ] significantly disturbed? (If yes, explain in Remarks)

Are Vegetation [ ], Soil [ ], or Hydrology [ ] naturally problematic? (If yes, explain in Remarks)

SUMMARY OF FINDINGS – Attach site map and photograph log showing sampling locations, transects, etc.

Wetland vegetation criterion met?	Yes [✓] No [ ]	**Is the Sampled Area within a Wetland?**	**Yes [✓] No [ ]**
Hydric Soils criterion met?	Yes [✓] No [ ]		
Wetlands hydrology present?	Yes [✓] No [ ]		

Remarks, Photo Details, Flagging, etc.:

Four series of flags mark the BVW boundaries which exist along the banks of the unnamed stream that flows south across the survey area. Each flag was marked with the wetland name, HW-W1, and numbered in each indicated location as follows:

- 100-106: adjacent to the southern end of the eastern bank
- 200-221: adjacent to the northern end of the eastern bank
- 300-312: adjacent to the northern end of the western bank
- 400-418: adjacent to the southern end of the western bank

This sample plot is located within the wetland area nearest to flag HW-W1-407.

HYDROLOGY

Field Observations:			
Surface Water Present?	Yes [ ]	No [✓]	Depth (inches) _____
Water Table Present?	Yes [ ]	No [✓]	Depth (inches) _____
Saturation Present (including capillary fringe)?	Yes [✓]	No [ ]	Depth (inches) 0.00

Wetland Hydrology Indicators

Reliable Indicators of Wetlands Hydrology	Indicators that can be Reliable with Proper Interpretation	Indicators of the Influence of Water
[✓] Water-stained leaves	[ ] Hydrological records	[ ] Direct observation of inundation
[ ] Evidence of aquatic fauna	[ ] Free water in a soil test hole	[✓] Drainage patterns
[ ] Iron deposits	[✓] Saturated soil	[ ] Drift lines
[ ] Algal mats or crusts	[✓] Water marks	[ ] Scoured areas
[ ] Oxidized rhizospheres/pore linings	[ ] Moss trim lines	[ ] Sediment deposits
[ ] Thin muck surfaces	[✓] Presence of reduced iron	[ ] Surface soil cracks
[ ] Plants with air-filled tissue (aerenchyma)	[ ] Woody plants with adventitious roots	[ ] Sparsely vegetated concave surface
[ ] Plants with polymorphic leaves	[ ] Trees with shallow root systems	[ ] Microtopographic relief
[ ] Plants with floating leaves	[ ] Woody plants with enlarged lenticels	[ ] Geographic position (depression, toe of slope, fringing lowland
[ ] Hydrogen sulfide odor		

Remarks (describe recorded data from stream gauge, monitoring well, aerial photos, previous inspections, if available):

This form is only for BVW delineations. Other wetland resource areas may be present and should be delineated according to the applicable regulatory provisions.

Sampling Point Wet Plot 1: HW-W1-407

VEGETATION – Use both common and scientific names of plants.

Tree Stratum Plot size 30

Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1. Apple trees	Malus spp.		20.0		
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
			20.0 = Total Cover		

Shrub/Sapling Stratum Plot size 15

Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
			0.0 = Total Cover		

Herb Stratum Plot size 5

Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1. sensitive fern	Onoclea sensibilis	FACW	40.0	Yes	Yes
2. skunk cabbage	Symplocarpus foetidus	OBL	30.0	Yes	Yes
3. long-stalk sedge	Carex pendiculata	FAC	5.0	No	Yes
4. wrinkle-leaf goldenrod	Solidago rugosa	FAC	10.0	No	Yes
5. white avens	Geum canadense	FAC	10.0	No	Yes
6.					Yes
7.					Yes
8.					Yes
9.					Yes
10.					Yes
11.					Yes
12.					Yes
			95.0 = Total Cover		

VEGETATION – continued.

Woody Vine Stratum	Plot size 30				
Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1. Asian Bittersweet	Celastrus orbiculatus	FACU	15.0	Yes	No
2. porcelain berry	Ampelopsis glandulosa		15.0		
3.					
4.					
			30.0 = Total Cover		

Rapid Test: Do all dominant species have an indicator status of OBL or FACW?				Yes ☐ No ☑
Dominance Test:	Number of dominant species	Number of dominant species that are wetland indicator plants		Do wetland indicator plants make up ≥ 50% of dominant plant species?
	3	2		Yes ☑ No ☐
Prevalence Index:		Total % Cover (all strata)	Multiply by:	Result
	OBL species		X 1	= 0.00
	FACW species		X 2	= 0.00
	FAC species		X 3	= 0.00
	FACU species		X 4	= 0.00
	UPL species		X 5	= 0.00
	Column Totals	(A) 0		(B) 0
Prevalence Index		B/A = 0.00		Is the Prevalence Index ≤ 3.0? Yes ☐ No ☐
Wetland vegetation criterion met?		**Yes** ☑	**No** ☐	

Definitions of Vegetation Strata

Tree - Woody plants 3 in. (7.62 cm) or more in diameter at breast height (DBH), regardless of height

Shrub / Sapling - Woody plants less than 3 in. (7.62 cm) DBH and greater than or equal to 3.3 ft. (1 m) tall

Herb - All herbaceous (non-woody plants, regardless of size, and woody plants less than 3.3 ft. (1 m) tall

Woody vines - All woody vines greater than 3.3 ft. (1 m) in height

Cover Ranges	
Range	Midpoint
1-5 %	3.0 %
6-15 %	10.5 %
15-25 %	20.5 %
26-50 %	38.0 %
51-75 %	63.0 %
76-95 %	85.5 %
96-100 %	98.0 %

Sampling Point Wet Plot 1: HW-W1-407

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Location[2]		
3.00	10YR 2/1	100.0%		0.0%			mucky peat	
12.00	10YR 2/1	100.0%		0.0%			mucky sand	
18.00	10YR 5/1	80.0%	10YR 3/6	20.0%	C	M	sandy	prominent redox concentrations
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators (Check all that apply)		**Indicators for Problematic Hydric Soils**
☐ Histosol (A1)	☐ Polyvalue Below Surface (S8)	☐ 2 cm Muck (A10)
☐ Histic Epipedon (A2)	☐ Thin Dark Surface (S9)	☐ 5 cm Mucky Peat or Peat (S3)
☐ Black Histic (A3)	☐ Loamy Mucky Mineral (F1)	☐ Dark Surface (S7)
☐ Hydrogen Sulfide (A4)	☐ Loamy Gleyed Matrix (F2)	☐ Polyvalue Below Surface (S8)
☐ Stratified Layers (A5)	☐ Depleted Matrix (F3)	☐ Thin Dark Surface (S9)
☐ Depleted Below Dark Surface (A11)	☐ Redox Dark Surface (F7)	☐ Iron-Manganese Masses (F12)
☐ Thick Dark Surface (A12)	☐ Depleted Dark Surface (F8)	☐ Mesic Spodic (A17)
☑ Sandy Mucky Mineral (S1)		☐ Red Parent Material (F21)
☐ Sandy Gleyed Matrix (S4)		☐ Very Shallow Dark Surface (TF12)
☐ Sandy Redox (S5)		☐ Other (Include Explanation in Remarks)
☐ Stripped Matrix (S6)		
☐ Dark Surface (S7)		

Restrictive Layer (if observed) Type: _____ Depth (inches): _____

Remarks:

Hydric Soils criterion met? Yes ☑ No ☐

BORDERING VEGETATED WETLAND DETERMINATION FORM

Project/Site: Stoneham high school conservation lands City/Town: Stoneham Sampling Date: 4/14/2023

Applicant/Owner: Town of Stoneham, Massachusetts Sampling Point or Zone: Up Plot 1: HW-W1-407

Investigator(s): Jamie McCarthy, Horsley Witten Group, Inc. Latitude / Longitude: 42.470143, -71.091083

Soil Map Unit Name: Sudbury fine sandy loam, non-hydric NWI or DEP Classification: N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes [✓] No [ ] (If no, explain in Remarks)

Are Vegetation [ ], Soil [ ], or Hydrology [ ] significantly disturbed? (If yes, explain in Remarks)

Are Vegetation [ ], Soil [ ], or Hydrology [ ] naturally problematic? (If yes, explain in Remarks)

SUMMARY OF FINDINGS – Attach site map and photograph log showing sampling locations, transects, etc.

Wetland vegetation criterion met?	Yes [ ] No [✓]	**Is the Sampled Area within a Wetland?**	**Yes** [ ] **No** [✓]
Hydric Soils criterion met?	Yes [ ] No [✓]		
Wetlands hydrology present?	Yes [ ] No [✓]		

Remarks, Photo Details, Flagging, etc.:

Four series of flags mark the BVW boundaries which exist along the banks of the unnamed stream that flows south across the survey area. Each flag was marked with the wetland name, HW-W1, and numbered in each indicated location as follows:

- 100-106: adjacent to the southern end of the eastern bank
- 200-221: adjacent to the northern end of the eastern bank
- 300-312: adjacent to the northern end of the western bank
- 400-418: adjacent to the southern end of the western bank

This sample plot is located in the upland area nearest to flag HW-W1-407.

HYDROLOGY

Field Observations:			
Surface Water Present?	Yes [ ]	No [✓]	Depth (inches)_____
Water Table Present?	Yes [ ]	No [✓]	Depth (inches)_____
Saturation Present (including capillary fringe)?	Yes [ ]	No [✓]	Depth (inches)_____

Wetland Hydrology Indicators

Reliable Indicators of Wetlands Hydrology	Indicators that can be Reliable with Proper Interpretation	Indicators of the Influence of Water
[ ] Water-stained leaves	[ ] Hydrological records	[ ] Direct observation of inundation
[ ] Evidence of aquatic fauna	[ ] Free water in a soil test hole	[ ] Drainage patterns
[ ] Iron deposits	[ ] Saturated soil	[ ] Drift lines
[ ] Algal mats or crusts	[ ] Water marks	[ ] Scoured areas
[ ] Oxidized rhizospheres/pore linings	[ ] Moss trim lines	[ ] Sediment deposits
[ ] Thin muck surfaces	[ ] Presence of reduced iron	[ ] Surface soil cracks
[ ] Plants with air-filled tissue (aerenchyma)	[ ] Woody plants with adventitious roots	[ ] Sparsely vegetated concave surface
[ ] Plants with polymorphic leaves	[ ] Trees with shallow root systems	[ ] Microtopographic relief
[ ] Plants with floating leaves	[ ] Woody plants with enlarged lenticels	[ ] Geographic position (depression, toe of slope, fringing lowland
[ ] Hydrogen sulfide odor		

Remarks (describe recorded data from stream gauge, monitoring well, aerial photos, previous inspections, if available):

This form is only for BVW delineations. Other wetland resource areas may be present and should be delineated according to the applicable regulatory provisions.

VEGETATION – Use both common and scientific names of plants.

Tree Stratum Plot size 30

Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1. Apple trees	Malus spp.		50.0		
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

50.0 = Total Cover

Shrub/Sapling Stratum Plot size 15

Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1. allegheny blackberry	Rubus allegheniensis	FACU	5.0	Yes	No
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

5.0 = Total Cover

Herb Stratum Plot size 5

Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1. wrinkle-leaf goldenrod	Solidago rugosa	FAC	5.0	Yes	Yes
2.					Yes
3.					Yes
4.					Yes
5.					Yes
6.					Yes
7.					Yes
8.					Yes
9.					Yes
10.					Yes
11.					Yes
12.					Yes

5.0 = Total Cover

VEGETATION – continued.

Woody Vine Stratum	Plot size 30				
Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1. Asian Bittersweet	Celastrus orbiculatus	FACU	35.0	Yes	No
2. porcelain berry	Ampelopsis glandulosa		35.0		
3.					
4.					
			70.0 = Total Cover		

Rapid Test: Do all dominant species have an indicator status of OBL or FACW?				Yes ☐ No ☑
Dominance Test:	Number of dominant species	Number of dominant species that are wetland indicator plants		Do wetland indicator plants make up ≥ 50% of dominant plant species?
	3	1		Yes ☐ No ☑
Prevalence Index:		Total % Cover (all strata)	Multiply by:	Result
	OBL species		X 1	= 0.00
	FACW species		X 2	= 0.00
	FAC species		X 3	= 0.00
	FACU species		X 4	= 0.00
	UPL species		X 5	= 0.00
	Column Totals	(A) 0		(B) 0
Prevalence Index		B/A = 0.00		Is the Prevalence Index ≤ 3.0? Yes ☐ No ☐
Wetland vegetation criterion met?		**Yes** ☐	**No** ☑	

Definitions of Vegetation Strata

Tree - Woody plants 3 in. (7.62 cm) or more in diameter at breast height (DBH), regardless of height

Shrub / Sapling - Woody plants less than 3 in. (7.62 cm) DBH and greater than or equal to 3.3 ft. (1 m) tall

Herb - All herbaceous (non-woody plants, regardless of size, and woody plants less than 3.3 ft. (1 m) tall

Woody vines - All woody vines greater than 3.3 ft. (1 m) in height

Cover Ranges	
Range	Midpoint
1-5 %	3.0 %
6-15 %	10.5 %
15-25 %	20.5 %
26-50 %	38.0 %
51-75 %	63.0 %
76-95 %	85.5 %
96-100 %	98.0 %

Sampling Point Up Plot 1: HW-W1-407

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Location[2]		
18.00	10YR 3/2	100.0%		0.0%			sandy	
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators (Check all that apply)		**Indicators for Problematic Hydric Soils**
☐ Histosol (A1)	☐ Polyvalue Below Surface (S8)	☐ 2 cm Muck (A10)
☐ Histic Epipedon (A2)	☐ Thin Dark Surface (S9)	☐ 5 cm Mucky Peat or Peat (S3)
☐ Black Histic (A3)	☐ Loamy Mucky Mineral (F1)	☐ Dark Surface (S7)
☐ Hydrogen Sulfide (A4)	☐ Loamy Gleyed Matrix (F2)	☐ Polyvalue Below Surface (S8)
☐ Stratified Layers (A5)	☐ Depleted Matrix (F3)	☐ Thin Dark Surface (S9)
☐ Depleted Below Dark Surface (A11)	☐ Redox Dark Surface (F7)	☐ Iron-Manganese Masses (F12)
☐ Thick Dark Surface (A12)	☐ Depleted Dark Surface (F8)	☐ Mesic Spodic (A17)
☐ Sandy Mucky Mineral (S1)		☐ Red Parent Material (F21)
☐ Sandy Gleyed Matrix (S4)		☐ Very Shallow Dark Surface (TF12)
☐ Sandy Redox (S5)		☐ Other (Include Explanation in Remarks)
☐ Stripped Matrix (S6)		
☐ Dark Surface (S7)		

Restrictive Layer (if observed) Type: _____ Depth (inches): _____

Remarks:

Hydric Soils criterion met? Yes ☐ No ☑

BORDERING VEGETATED WETLAND DETERMINATION FORM

Project/Site: Stoneham high school conservation lands City/Town: Stoneham Sampling Date: 4/14/2023

Applicant/Owner: Town of Stoneham, Massachusetts Sampling Point or Zone: Wet Plot 2: HW-W1-309

Investigator(s): Jamie McCarthy, Horsley Witten Group, Inc. Latitude / Longitude: 42.470759, -71.090534

Soil Map Unit Name: Swansea muck, hydric NWI or DEP Classification: PFO1/SS1Cd

Are climatic/hydrologic conditions on the site typical for this time of year? Yes [✓] No [ ] (If no, explain in Remarks)

Are Vegetation [ ], Soil [ ], or Hydrology [ ] significantly disturbed? (If yes, explain in Remarks)

Are Vegetation [ ], Soil [ ], or Hydrology [ ] naturally problematic? (If yes, explain in Remarks)

SUMMARY OF FINDINGS – Attach site map and photograph log showing sampling locations, transects, etc.

Wetland vegetation criterion met?	Yes [✓] No [ ]	**Is the Sampled Area within a Wetland?**	**Yes [✓] No [ ]**
Hydric Soils criterion met?	Yes [✓] No [ ]		
Wetlands hydrology present?	Yes [✓] No [ ]		

Remarks, Photo Details, Flagging, etc.:

Four series of flags mark the BVW boundaries which exist along the banks of the unnamed stream that flows south across the survey area. Each flag was marked with the wetland name, HW-W1, and numbered in each indicated location as follows:

- 100-106: adjacent to the southern end of the eastern bank
- 200-221: adjacent to the northern end of the eastern bank
- 300-312: adjacent to the northern end of the western bank
- 400-418: adjacent to the southern end of the western bank

This sample plot is located within the wetland area nearest to flag HW-W1-309.

HYDROLOGY

Field Observations:			
Surface Water Present?	Yes [ ]	No [✓]	Depth (inches)
Water Table Present?	Yes [✓]	No [ ]	Depth (inches) 12.00
Saturation Present (including capillary fringe)?	Yes [✓]	No [ ]	Depth (inches) 0.00

Wetland Hydrology Indicators

Reliable Indicators of Wetlands Hydrology	Indicators that can be Reliable with Proper Interpretation	Indicators of the Influence of Water
[✓] Water-stained leaves	[ ] Hydrological records	[ ] Direct observation of inundation
[ ] Evidence of aquatic fauna	[ ] Free water in a soil test hole	[✓] Drainage patterns
[ ] Iron deposits	[✓] Saturated soil	[ ] Drift lines
[ ] Algal mats or crusts	[✓] Water marks	[ ] Scoured areas
[ ] Oxidized rhizospheres/pore linings	[ ] Moss trim lines	[ ] Sediment deposits
[ ] Thin muck surfaces	[✓] Presence of reduced iron	[ ] Surface soil cracks
[ ] Plants with air-filled tissue (aerenchyma)	[ ] Woody plants with adventitious roots	[ ] Sparsely vegetated concave surface
[ ] Plants with polymorphic leaves	[ ] Trees with shallow root systems	[ ] Microtopographic relief
[ ] Plants with floating leaves	[ ] Woody plants with enlarged lenticels	[ ] Geographic position (depression, toe of slope, fringing lowland
[ ] Hydrogen sulfide odor		

Remarks (describe recorded data from stream gauge, monitoring well, aerial photos, previous inspections, if available):

This form is only for BVW delineations. Other wetland resource areas may be present and should be delineated according to the applicable regulatory provisions.

VEGETATION – Use both common and scientific names of plants.

Tree Stratum Plot size 30

Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1. Apple trees	Malus spp.		15.0		
2. red maple	Acer rubrum	FAC	20.0	Yes	Yes
3.					
4.					
5.					
6.					
7.					
8.					
9.					

35.0 = Total Cover

Shrub/Sapling Stratum Plot size 15

Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

0.0 = Total Cover

Herb Stratum Plot size 5

Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1. jewelweed	Impatiens capensis	FACW	10.0	No	Yes
2. skunk cabbage	Symplocarpus foetidus	OBL	35.0	Yes	Yes
3. long-stalk sedge	Carex pendiculata	FAC	10.0	No	Yes
4. wrinkle-leaf goldenrod	Solidago rugosa	FAC	15.0	No	Yes
5. white avens	Geum canadense	FAC	8.0	No	Yes
6. soft rush	Juncus effusus	OBL	20.0	Yes	Yes
7.					Yes
8.					Yes
9.					Yes
10.					Yes
11.					Yes
12.					Yes

98.0 = Total Cover

VEGETATION – continued.

Woody Vine Stratum	Plot size 30				
Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1. Asian Bittersweet	Celastrus orbiculatus	FACU	20.0	Yes	No
2.					
3.					
4.					
		20.0 = Total Cover			

Rapid Test: Do all dominant species have an indicator status of OBL or FACW?				Yes ☐ No ☑
Dominance Test:	Number of dominant species	Number of dominant species that are wetland indicator plants		Do wetland indicator plants make up ≥ 50% of dominant plant species?
	4	3		Yes ☑ No ☐
Prevalence Index:		Total % Cover (all strata)	Multiply by:	Result
	OBL species		X 1	= 0.00
	FACW species		X 2	= 0.00
	FAC species		X 3	= 0.00
	FACU species		X 4	= 0.00
	UPL species		X 5	= 0.00
	Column Totals	(A) 0		(B) 0
Prevalence Index		B/A = 0.00		Is the Prevalence Index ≤ 3.0? Yes ☐ No ☐
Wetland vegetation criterion met?		**Yes** ☑	**No** ☐	

Definitions of Vegetation Strata

Tree - Woody plants 3 in. (7.62 cm) or more in diameter at breast height (DBH), regardless of height

Shrub / Sapling - Woody plants less than 3 in. (7.62 cm) DBH and greater than or equal to 3.3 ft. (1 m) tall

Herb - All herbaceous (non-woody plants, regardless of size, and woody plants less than 3.3 ft. (1 m) tall

Woody vines - All woody vines greater than 3.3 ft. (1 m) in height

Cover Ranges	
Range	Midpoint
1-5 %	3.0 %
6-15 %	10.5 %
15-25 %	20.5 %
26-50 %	38.0 %
51-75 %	63.0 %
76-95 %	85.5 %
96-100 %	98.0 %

Sampling Point Wet Plot 2: HW-W1-309

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Location[2]	Texture	Remarks
4.00	10YR 2/1	100.0%		0.0%			mucky peat	
12.00	10YR 2/1	95.0%	10YR 3/6	5.0%	C	M	sandy	prominent redox concentrations
20.00	10YR 2/1	20.0%	10YR 3/6	15.0%	C	M	sandy	prominent redox concentrations
		0.0%	10YR 4/2	65.0%	D	M	sandy	
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators (Check all that apply)		**Indicators for Problematic Hydric Soils**
☐ Histosol (A1)	☐ Polyvalue Below Surface (S8)	☐ 2 cm Muck (A10)
☐ Histic Epipedon (A2)	☐ Thin Dark Surface (S9)	☐ 5 cm Mucky Peat or Peat (S3)
☐ Black Histic (A3)	☐ Loamy Mucky Mineral (F1)	☐ Dark Surface (S7)
☐ Hydrogen Sulfide (A4)	☐ Loamy Gleyed Matrix (F2)	☐ Polyvalue Below Surface (S8)
☐ Stratified Layers (A5)	☐ Depleted Matrix (F3)	☐ Thin Dark Surface (S9)
☐ Depleted Below Dark Surface (A11)	☐ Redox Dark Surface (F7)	☐ Iron-Manganese Masses (F12)
☐ Thick Dark Surface (A12)	☐ Depleted Dark Surface (F8)	☐ Mesic Spodic (A17)
☐ Sandy Mucky Mineral (S1)		☐ Red Parent Material (F21)
☐ Sandy Gleyed Matrix (S4)		☐ Very Shallow Dark Surface (TF12)
☑ Sandy Redox (S5)		☐ Other (Include Explanation in Remarks)
☐ Stripped Matrix (S6)		
☐ Dark Surface (S7)		

Restrictive Layer (if observed) Type: _____ Depth (inches): _____

Remarks:

Hydric Soils criterion met? Yes ☑ No ☐

BORDERING VEGETATED WETLAND DETERMINATION FORM

Project/Site: Stoneham high school conservation lands City/Town: Stoneham Sampling Date: 4/14/2023

Applicant/Owner: Town of Stoneham, Massachusetts Sampling Point or Zone: Up Plot 2: HW-W1-309

Investigator(s): Jamie McCarthy, Horsley Witten Group, Inc. Latitude / Longitude: 42.470691, -71.090730

Soil Map Unit Name: Swansea muck, hydric NWI or DEP Classification: N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes [✓] No [ ] (If no, explain in Remarks)

Are Vegetation [ ], Soil [ ], or Hydrology [ ] significantly disturbed? (If yes, explain in Remarks)

Are Vegetation [ ], Soil [ ], or Hydrology [ ] naturally problematic? (If yes, explain in Remarks)

SUMMARY OF FINDINGS – Attach site map and photograph log showing sampling locations, transects, etc.

Wetland vegetation criterion met?	Yes [ ] No [✓]	**Is the Sampled Area within a Wetland?** Yes [ ] No [✓]
Hydric Soils criterion met?	Yes [ ] No [✓]	
Wetlands hydrology present?	Yes [ ] No [✓]	

Remarks, Photo Details, Flagging, etc.:

Four series of flags mark the BVW boundaries which exist along the banks of the unnamed stream that flows south across the survey area. Each flag was marked with the wetland name, HW-W1, and numbered in each indicated location as follows:

- 100-106: adjacent to the southern end of the eastern bank
- 200-221: adjacent to the northern end of the eastern bank
- 300-312: adjacent to the northern end of the western bank
- 400-418: adjacent to the southern end of the western bank

This sample plot is located in the upland area nearest to flag HW-W1-309.

HYDROLOGY

Field Observations:			
Surface Water Present?	Yes [ ]	No [✓]	Depth (inches)_____
Water Table Present?	Yes [ ]	No [✓]	Depth (inches)_____
Saturation Present (including capillary fringe)?	Yes [ ]	No [✓]	Depth (inches)_____

Wetland Hydrology Indicators

Reliable Indicators of Wetlands Hydrology	Indicators that can be Reliable with Proper Interpretation	Indicators of the Influence of Water
[ ] Water-stained leaves	[ ] Hydrological records	[ ] Direct observation of inundation
[ ] Evidence of aquatic fauna	[ ] Free water in a soil test hole	[ ] Drainage patterns
[ ] Iron deposits	[ ] Saturated soil	[ ] Drift lines
[ ] Algal mats or crusts	[ ] Water marks	[ ] Scoured areas
[ ] Oxidized rhizospheres/pore linings	[ ] Moss trim lines	[ ] Sediment deposits
[ ] Thin muck surfaces	[ ] Presence of reduced iron	[ ] Surface soil cracks
[ ] Plants with air-filled tissue (aerenchyma)	[ ] Woody plants with adventitious roots	[ ] Sparsely vegetated concave surface
[ ] Plants with polymorphic leaves	[ ] Trees with shallow root systems	[ ] Microtopographic relief
[ ] Plants with floating leaves	[ ] Woody plants with enlarged lenticels	[ ] Geographic position (depression, toe of slope, fringing lowland
[ ] Hydrogen sulfide odor		

Remarks (describe recorded data from stream gauge, monitoring well, aerial photos, previous inspections, if available):

This form is only for BVW delineations. Other wetland resource areas may be present and should be delineated according to the applicable regulatory provisions.

VEGETATION – Use both common and scientific names of plants.

Tree Stratum Plot size 30

Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1. apple trees	Malus spp.		5.0		
2. red maple	Acer rubrum	FAC	3.0	No	
3. Norway maple	Acer plantanoides	UPL	10.0	Yes	No
4.					
5.					
6.					
7.					
8.					
9.					

18.0 = Total Cover

Shrub/Sapling Stratum Plot size 15

Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1. allegheny blackberry	Rubus allegheniensis	FACU	5.0	Yes	No
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

5.0 = Total Cover

Herb Stratum Plot size 5

Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1. white avens	Geum canadense	FAC	10.0	Yes	Yes
2. wrinkle-leaf goldenrod	Solidago rugosa	FAC	10.0	Yes	Yes
3.					Yes
4.					Yes
5.					Yes
6.					Yes
7.					Yes
8.					Yes
9.					Yes
10.					Yes
11.					Yes
12.					Yes

20.0 = Total Cover

VEGETATION – continued.

Woody Vine Stratum	Plot size 30				
Common name	Scientific name	Indicator Status	Absolute % Cover	Dominant? (yes/no)	Wetland Indictor? (yes/no)
1. Asian Bittersweet	Celastrus orbiculatus	FACU	20.0	Yes	No
2. porcelain berry	Ampelopsis glandulosa		50.0		
3.					
4.					
			70.0 = Total Cover		

Rapid Test:	Do all dominant species have an indicator status of OBL or FACW?			Yes ☐ No ☑
Dominance Test:	Number of dominant species	Number of dominant species that are wetland indicator plants		Do wetland indicator plants make up ≥ 50% of dominant plant species?
	5	2		Yes ☐ No ☑
Prevalence Index:		Total % Cover (all strata)	Multiply by:	Result
	OBL species		X 1	= 0.00
	FACW species		X 2	= 0.00
	FAC species		X 3	= 0.00
	FACU species		X 4	= 0.00
	UPL species		X 5	= 0.00
	Column Totals	(A) 0		(B) 0
	Prevalence Index	B/A = 0.00		Is the Prevalence Index ≤ 3.0? Yes ☐ No ☐
Wetland vegetation criterion met?		**Yes** ☐ **No** ☑		

Definitions of Vegetation Strata

Tree - Woody plants 3 in. (7.62 cm) or more in diameter at breast height (DBH), regardless of height

Shrub / Sapling - Woody plants less than 3 in. (7.62 cm) DBH and greater than or equal to 3.3 ft. (1 m) tall

Herb - All herbaceous (non-woody plants, regardless of size, and woody plants less than 3.3 ft. (1 m) tall

Woody vines - All woody vines greater than 3.3 ft. (1 m) in height

Cover Ranges	
Range	Midpoint
1-5 %	3.0 %
6-15 %	10.5 %
15-25 %	20.5 %
26-50 %	38.0 %
51-75 %	63.0 %
76-95 %	85.5 %
96-100 %	98.0 %

Sampling Point Up Plot 2: HW-W1-309

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Location[2]		
14.00	10YR 3/2	100.0%		0.0%			sandy	
18.00	7.5YR 3/3	100.0%		0.0%			sandy	
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				
		0.0%		0.0%				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators (Check all that apply)		**Indicators for Problematic Hydric Soils**
☐ Histosol (A1)	☐ Polyvalue Below Surface (S8)	☐ 2 cm Muck (A10)
☐ Histic Epipedon (A2)	☐ Thin Dark Surface (S9)	☐ 5 cm Mucky Peat or Peat (S3)
☐ Black Histic (A3)	☐ Loamy Mucky Mineral (F1)	☐ Dark Surface (S7)
☐ Hydrogen Sulfide (A4)	☐ Loamy Gleyed Matrix (F2)	☐ Polyvalue Below Surface (S8)
☐ Stratified Layers (A5)	☐ Depleted Matrix (F3)	☐ Thin Dark Surface (S9)
☐ Depleted Below Dark Surface (A11)	☐ Redox Dark Surface (F7)	☐ Iron-Manganese Masses (F12)
☐ Thick Dark Surface (A12)	☐ Depleted Dark Surface (F8)	☐ Mesic Spodic (A17)
☐ Sandy Mucky Mineral (S1)		☐ Red Parent Material (F21)
☐ Sandy Gleyed Matrix (S4)		☐ Very Shallow Dark Surface (TF12)
☐ Sandy Redox (S5)		☐ Other (Include Explanation in Remarks)
☐ Stripped Matrix (S6)		
☐ Dark Surface (S7)		

Restrictive Layer (if observed) Type: _____ Depth (inches): _____

Remarks:

Hydric Soils criterion met? Yes ☐ No ☑

Attachment C – Project Plans

MASS STATE PLANE

SURVEY NOTES

1. THE TOPOGRAPHY AND EXISTING SITE CONDITIONS DEPICTED HEREON ARE THE RESULT OF AN ON THE GROUND FIELD SURVEY CONDUCTED BY THE HORSLEY WITTEN GROUP, INC. MAY 4, 2023.
2. HORIZONTAL DATUM IS MASS STATE PLANE COORDINATE SYSTEM. DATUM ESTABLISHED BY RTK GPS.
3. THE ELEVATIONS DEPICTED HEREON WERE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.
4. THE PROPERTY LINES AND RIGHTS OF WAYS DEPICTED HAVE BEEN ESTABLISHED BY FIELD SURVEY AND DEEDS AND PLANS OF RECORD.
5. PROPERTY LINES FOR ABUTTING PROPERTY OWNERS ARE APPROXIMATE ONLY.
6. BUILDING LOCATIONS ALONG DAPPER DARBY DRIVE AND AT 4 KAREN DRIVE ARE BASED ON AERIAL IMAGERY AND ARE APPROXIMATE ONLY.
7. THE ACCURACY OF MEASURED PIPE INVERTS AND PIPE SIZES IS SUBJECT TO FIELD CONDITIONS, THE ABILITY TO MAKE VISUAL OBSERVATIONS, DIRECT ACCESS TO THE VARIOUS ELEMENTS AND OTHER CONDITIONS.
8. THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AND STRUCTURES AS SHOWN ON THESE PLANS ARE BASED ON RECORDS OF VARIOUS UTILITY COMPANIES, AND WHEREVER POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THIS INFORMATION IS NOT TO BE RELIED UPON AS BEING EXACT OR COMPLETE. THE LOCATION OF ALL UNDERGROUND UTILITIES AND STRUCTURES SHALL BE VERIFIED IN THE FIELD PRIOR TO THE START OF ANY CONSTRUCTION. THE CONTRACTOR MUST CONTACT THE APPROPRIATE UTILITY COMPANY, ANY GOVERNING PERMITTING AUTHORITY IN THE TOWN OF STONEHAM, AND "DIGSAFE" (1-888-344-7233) AT LEAST 72 HOURS PRIOR TO ANY EXCAVATION WORK IN PREVIOUSLY UNALTERED AREAS TO REQUEST EXACT FIELD LOCATION OF UTILITIES.
9. UTILITY PROVIDERS: ELECTRIC - EVERSOURCE TELEPHONE - VERIZON CABLE - COMCAST
   SEWER - MUNICIPAL WATER - MUNICIPAL GAS - NATIONAL GRID DRAINAGE - MUNICIPAL
10. THE PROPERTY IS LOCATED WITHIN F.I.R.M ZONE X AS SHOWN ON COMMUNITY PANEL NO. 25017C0427E AND 25017C0429E DATED JUNE 4, 2010.
11. THE WETLAND DELINEATION SHOWN HEREON WAS CONDUCTED BY THE HORSLEY WITTEN GROUP, INC. ON APRIL 6 AND APRIL 14, 2023.
12. REFERENCE PLANS:
    MIDDLESEX COUNTY SOUTH REGISTRY OF DEEDS
    PLAN BOOK 11593 PAGE 102
    PLAN BOOK 19857 PAGE 502
    PLAN BOOK 28122 PAGE 457
    PLAN BOOK 32746 PAGE 220
    PLAN PREPARED BY NITSCH ENGINEERING, 2 CENTER PLAZA, SUITE 430, BOSTON, MA 02108, TITLED "EXISTING CONDITIONS CONSTRUCTION DOCUMENTS, 60% PRICING SET, DATED MAY 27, 2022, SCALE: 1" = 60'.

LEGEND:

GENERAL

- BUILDING
- CONTOUR - MINOR
- CONTOUR - MAJOR
- EDGE OF GRAVEL
- EDGE OF PAVEMENT
- FENCE - CHAIN LINK
- PATHWAY
- STONE
- WALL - STONE
- DEBRIS AREA

PROPERTY INFORMATION

- PROPERTY LINE
- PROPERTY LINE (GIS)

UTILITIES

- DRAIN PIPE

ENVIRONMENTAL

- ISOLATED VEGETATED WETLAND (IVW)
- BORDERING VEGETATED WETLAND (BVW)
- STREAM BED
- BORDERING VEGETATED WETLAND/ ISOLATED VEGETATED WETLAND (BVW/IVW)
- WETLAND EDGE
- WETLAND 25' NO DISTURB ZONE
- WETLAND 100' BUFFER ZONE
- STREAM/BANK
- BANK 25' NO DISTURB ZONE
- BANK 100' BUFFER ZONE

SYMBOLS

- BOUNDARY
- EXISTING TREE
- DRAIN MANHOLE
- LIGHT POST
- WETLAND FLAG
- ROCK
- SHRUB

GRAPHIC SCALE

30 0 15 30 60 120

(in feet)

1 INCH = 30 FEET

CATCH BASIN, LOCATION TAKEN FROM EXISTING CONDITIONS PLAN BY NITSCH ENGINEERING

RIM = 166.28'

TRACK

BLEACHERS

100' BUFFER ZONE

TOP BOX CULVERT EL 157.44'
2' HIGH & 5' WIDE
(REC 48")
INV = 155.1±
(INV TAKEN FROM EXISTING CONDITIONS PLAN BY NITSCH ENGINEERING

CATCH BASINS, LOCATION TAKEN FROM EXISTING CONDITIONS PLAN BY NITSCH ENGINEERING

PARKING

SHED

STORAGE BIN

DRAIN MANHOLE, LOCATION TAKEN FROM EXISTING CONDITIONS PLAN BY NITSCH ENGINEERING

RIM = 159.79'

RIM = 166.39'

260.44'
S 89°07'23" W

30 DAPPER DARBY DRIVE N/F ANZALONE

N 00°05'54" W 71.06'

ROCK OUTCROP

PATH

DRIVEWAY

32 DAPPER DARBY DRIVE N/F SORABELLA

N 04°32'04" W 126.11'

ISOLATED VEGETATED WETLAND

25' NO DISTURB ZONE

BORDERING VEGETATED WETLAND

STREAM

BORDERING VEGETATED WETLAND

ABANDONED CAR

25' NO DISTURB ZONE

25' NO DISTURB ZONE

BVW 100' BUFFER ZONE

DEBRIS AREA

ENCROACHING SHED

S 65°04'09" E 31.22'

S 05°54'36" W 137.96'

32 FIELDSTONE DRIVE N/F PAONESSA

ENCROACHING GRAVEL PATHS

34 FIELDSTONE DRIVE N/F SCHACTER

S 06°33'26" W 121.59'

N 02°54'08" W 62.66'

N 02°54'08" W 116.22'

DAPPER DARBY DRIVE

149 FRANKLIN STREET
MAP 8 LOT 134
N/F
TOWN OF STONEHAM
49.5 AC

100' BUFFER ZONE

ROCK OUTCROP

25' NO DISTURB ZONE

ROCK OUTCROP

ROCK OUTCROP

33 DAPPER DARBY DRIVE N/F THOMAS

N 02°52'11" W 90.56'

N 02°52'11" W 90.56'

N 03°32'15" W 90.86'

25' NO DISTURB ZONE

BORDERING VEGETATED WETLAND

N 64°14'58" E 143.96'

MAP 27 LOT 2
N/F
TOWN OF STONEHAM

STREAM

31 DAPPER DARBY DRIVE N/F SNYDER

4 ROBERTS WAY N/F BENITATI

N 03°37'31" W 62.00'

S 20°06'11" E 49.64'

BANK 25' NO DISTURB ZONE

100' BUFFER ZONE

ENCROACHMENTS

SHED

KAREN DRIVE

N 06°19'12" E 45.00'

GRAVEL DRIVEWAY

32 FIELDSTONE DRIVE N/F PALLOTTA

N 06°19'12" E 90.00'

S 06°33'26" W 307.15'

4 KAREN DRIVE N/F LARIVEE

N 06°19'12" E 152.11'

Revisions

Rev.	Date	By	Appr.	Description

Horsley Witten Group, Inc.
Sustainable Environmental Solutions
90 Route 6A Sandwich, MA 02563
www.horsleywitten.com
508-833-6600

Checked By: DWM
Drawn By: JJP
Designed By: -
Date: FEBRUARY 2024

Plan Set: STONEHAM WETLANDS RESTORATION
STONEHAM, MA

Plan Title: EXISTING CONDITIONS

Prepared For:
Town of Stoneham
35 Central Street
Stoneham, MA 02180
Phone: (781) 279-2600

Survey Provided By:
Horsley Witten Group, Inc.
90 Route 6A, Unit 1
Sandwich, MA 02563
Phone: (508) 833-6600
Dated: May 4, 2023

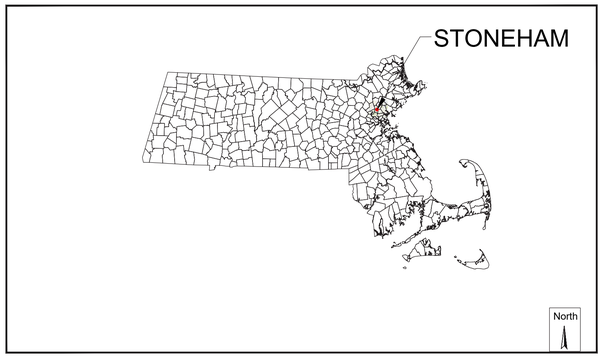
Registration

COMMONWEALTH OF MASSACHUSETTS
DANIEL W. MACKENZIE
No. 47187
REGISTERED PROFESSIONAL LAND SURVEYOR
2-8-24

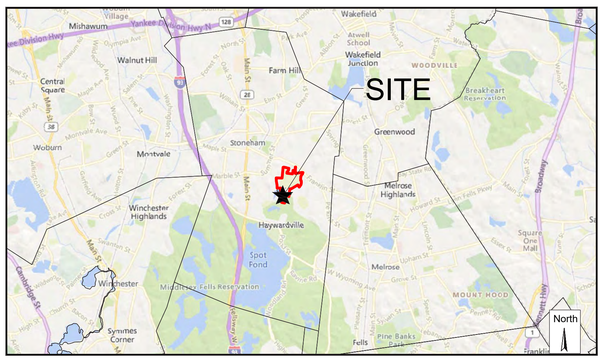
Project Number: 21008C
Sheet : 1 of 1
Sheet Number: SV-1

H:\Projects\2021\21008 Upper Mystic River Watershed\21008C Stoneham\Drawings\21008C EX.dwg
last modified: 02/07/24 printed: 02/07/24 by jk

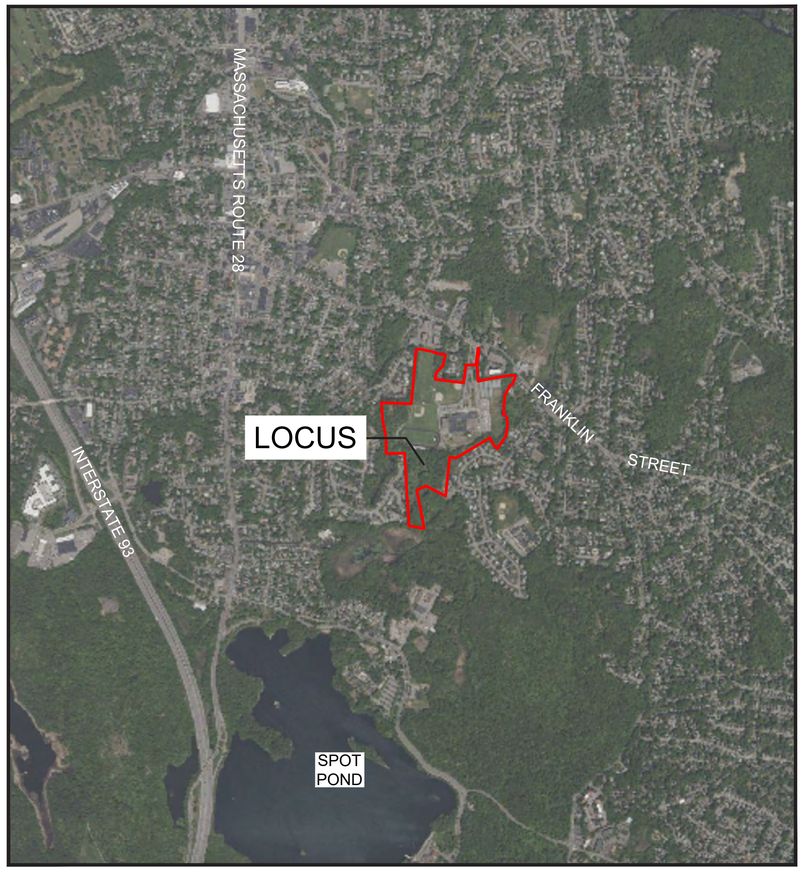
STONEHAM WETLANDS RESTORATION
75% DESIGN DEVELOPMENT PERMIT PLANS
STONEHAM, MA
FEBRUARY 2024



MASSACHUSETTS
SCALE:1"= 200,000'



TOWN OF STONEHAM
SCALE: 1"= 5,000'



VICINITY MAP
SCALE: 1" =1,000'

Sheet List Table	
Sheet Number	Sheet Title
C-1	COVER
C-2	CONSTRUCTION NOTES
C-3	ESC & DEMO PLAN
C-4	SITE PLAN
C-5	GRADING PLAN
C-6	CONSTRUCTION DETAILS-1
C-7	CONSTRUCTION DETAILS-2
L-8	PLANTING PLAN
L-9	PLANTING DETAILS

GENERAL NOTES:
1. THIS PLAN SET IS FOR PERMITTING ONLY AND NOT FOR CONSTRUCTION.
2. SITE INFORMATION:
   - PLAT: 284
   - LOT: 8/25
   - ADDRESS: 149 FRANKLIN STREET
   - ZONING DISTRICT: EDUCATION AND RECREATION & OPEN SPACE

PERMITTING SET ONLY
NOT FOR CONSTRUCTION

Plan Set:
STONEHAM WETLANDS RESTORATION
75% DESIGN DEVELOPMENT PERMIT PLANS
STONEHAM, MA

Prepared For:
Town of Stoneham
35 Central Street
Stoneham, MA 02180
(781) 279-2600

Prepared By:
Horsley Witten Group, Inc.
Sustainable Environmental Solutions
www.horsleywitten.com

Headquarters
90 Route 6A
Sandwich, MA 02563
(508) 833-6600 voice
(508) 833-3150 fax

112 Water Street 6th Floor
Boston, MA 02109
(857) 263-8193 voice
(617) 574-4799 fax

One Turks Head Place Suite 300
Providence, RI 02906
(401) 272-1717 voice
(401) 439-8368 fax

113 R2 Water Street
Exeter, NH 03833
(603) 658-1660 voice

Date Issued: FEBRUARY 2024	Registration: COMMONWEALTH OF MASSACHUSETTS RICHARD A. CLAYTOR CIVIL NO. 45116 REGISTERED PROFESSIONAL ENGINEER 2-9-2024	Revisions	Project Number: 21008C
Designed By: KJK/JMP			Sheet Number: 1 of 9
Drawn By: JMP			Drawing Number: C-1
Checked By: BRK		Rev. Date By Appr. Description	

last modified: 02/08/24 printed: 02/09/24 by me H:\Projects\2021\21008 Upper Mystic River Watershed\21008C Stoneham\Drawings\21008C CN.dwg

GENERAL CONSTRUCTION NOTES:

1. ALL SITE WORK TO COMPLETE THIS PROJECT AS INDICATED ON THE DRAWINGS AND IN THE SPECIFICATIONS IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
2. IMMEDIATELY CONTACT AND COORDINATE WITH THE ENGINEER AND OWNER IF ANY DEVIATION OR ALTERATION OF THE WORK PROPOSED ON THESE DRAWINGS IS REQUIRED.
3. UTILIZE ALL PRECAUTIONS AND MEASURES TO ENSURE THE SAFETY OF THE PUBLIC, ALL PERSONNEL AND PROPERTY DURING CONSTRUCTION IN ACCORDANCE WITH OSHA STANDARDS, INCLUDING THE INSTALLATION OF TEMPORARY FENCING BARRICADES, SAFETY LIGHTING, CONES, POLICE DETAIL AND/OR FLAGMEN AS DETERMINED NECESSARY BY THE TOWN. THE CONTRACTOR IS RESPONSIBLE FOR THE COST OF POLICE DETAIL AND FOR COORDINATING WITH THE LOCAL OR STATE POLICE DEPARTMENT FOR ALL REQUIRED POLICE DETAIL.
4. MAKE ALL NECESSARY CONSTRUCTION NOTIFICATIONS AND APPLY FOR AND OBTAIN ALL NECESSARY CONSTRUCTION PERMITS, PAY ALL FEES INCLUDING POLICE DETAILS AND POST ALL BONDS, IF NECESSARY, ASSOCIATED WITH THE SAME, AND COORDINATE WITH THE OWNER AND THE ENGINEER.
5. ALL EXISTING CONDITIONS SHOWN ARE APPROXIMATE AND ARE BASED ON THE BEST INFORMATION AVAILABLE. PRIOR TO THE START OF CONSTRUCTION VERIFY THAT THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS DO NOT CONFLICT WITH ANY KNOWN EXISTING OR OTHER PROPOSED IMPROVEMENTS. IF ANY CONFLICTS ARE DISCOVERED, NOTIFY THE OWNER AND THE ENGINEER PRIOR TO INSTALLING ANY PORTION OF THE SITE WORK WHICH WOULD BE AFFECTED.
6. THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AND STRUCTURES AS INDICATED ON THE DRAWINGS ARE BASED ON RECORDS OF VARIOUS UTILITY COMPANIES, AND WHEREVER POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THIS INFORMATION IS NOT TO BE RELIED UPON AS BEING EXACT OR COMPLETE. VERIFY THE LOCATION OF ALL UNDERGROUND UTILITIES AND STRUCTURES IN THE FIELD PRIOR TO THE START OF CONSTRUCTION. CONTACT THE APPROPRIATE UTILITY COMPANY, ANY GOVERNING PERMITTING AUTHORITY IN THE TOWN, AND "DIGSAFE" (1-888-344-7233) AT LEAST THREE BUSINESS DAYS PRIOR TO ANY EXCAVATION WORK TO REQUEST EXACT FIELD LOCATION OF UTILITIES. THE CONTRACTOR MUST RESOLVE CONFLICTS BETWEEN THE PROPOSED UTILITIES AND FIELD-LOCATED UTILITIES AND REPORT ANY DISCREPANCIES TO THE ENGINEER IMMEDIATELY. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR DAMAGES INCURRED AS A RESULT OF UTILITIES OMITTED, INCOMPLETELY OR INACCURATELY SHOWN. THE CONTRACTOR MUST MAINTAIN ACCURATE RECORDS OF THE LOCATION AND ELEVATION OF ALL WORK INSTALLED AND EXISTING UTILITIES FOUND DURING CONSTRUCTION FOR THE PREPARATION OF THE AS-BUILT PLAN.
7. THE CONTRACTOR MUST MAINTAIN ALL EXISTING UTILITIES IN WORKING ORDER AND FREE FROM DAMAGE DURING THE ENTIRE DURATION OF THE PROJECT. REPAIR ANY DAMAGE TO EXISTING UTILITY LINES OR STRUCTURES INCURRED DURING CONSTRUCTION OPERATIONS AT NO COST TO THE OWNER. THE CONTRACTOR IS RESPONSIBLE FOR ALL COST RELATED TO THE REPAIR OF UTILITIES. EXCAVATION REQUIRED WITHIN THE PROXIMITY OF EXISTING UTILITY LINES MUST BE DONE BY HAND.
8. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ESTABLISH AND MAINTAIN ALL CONTROL POINTS AND BENCHMARKS DURING CONSTRUCTION INCLUDING BENCHMARK LOCATIONS AND ELEVATIONS AT CRITICAL AREAS. COORDINATE WITH THE ENGINEER THE LOCATION OF ALL CONTROL POINTS AND BENCHMARKS.
9. SITE LAYOUT SURVEY REQUIRED FOR CONSTRUCTION MUST BE PROVIDED BY THE CONTRACTOR AND PERFORMED BY A MASSACHUSETTS' REGISTERED PROFESSIONAL LAND SURVEYOR. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH THE SURVEYOR FOR ALL SITE SURVEY WORK.
10. MAINTAIN ALL GRADE STAKES SET BY THE SURVEYOR. GRADE STAKES ARE TO REMAIN UNTIL A FINAL INSPECTION OF THE ITEM HAS BEEN COMPLETED BY THE ENGINEER. RE-STAKING OF PREVIOUSLY SURVEYED SITE FEATURES IS THE RESPONSIBILITY (INCLUDING COST) OF THE CONTRACTOR.
11. UNLESS OTHERWISE INDICATED ON THE DRAWINGS AND/OR IN THE SPECIFICATIONS, ALL SITE CONSTRUCTION MATERIALS AND METHODOLOGIES ARE TO CONFORM TO THE MOST RECENT VERSION OF THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS (THE COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF TRANSPORTATION SPECIFICATIONS FOR HIGHWAY AND BRIDGES 2020 EDITION, AND THE SUPPLEMENTAL SPECIFICATIONS DATED JUNE 30, 2020)).
12. PROVIDE ALL CONSTRUCTION SERVICE IN ACCORDANCE WITH APPLICABLE LAWS AND REGULATIONS REGARDING NOISE, VIBRATION, DUST, SEDIMENTATION CONTAINMENT, AND TRENCH WORK.
13. COLLECT SOLID WASTES AND STORE IN A SECURED DUMPSTER. THE DUMPSTER MUST MEET ALL LOCAL AND STATE SOLID WASTE MANAGEMENT REGULATIONS.
14. RESTORE ALL SURFACES EQUAL TO THEIR ORIGINAL CONDITION AFTER CONSTRUCTION IS COMPLETE PER SPECIFICATIONS. LEAVE ALL AREAS NOT DISTURBED BY CONSTRUCTION IN THEIR NATURAL STATE. TAKE CARE TO PREVENT DAMAGE TO SHRUBS, TREES, OTHER LANDSCAPING AND/OR NATURAL FEATURES. WHEREAS THE PLANS DO NOT SHOW ALL LANDSCAPE FEATURES, EXISTING CONDITIONS MUST BE VERIFIED BY THE CONTRACTOR IN ADVANCE OF THE WORK.
15. PROVIDE A UNIT PRICE COST IN CUBIC YARD MEASURE FOR LEDGE AND/OR BOULDER REMOVAL. LEDGE AND/OR BOULDERS LESS THAN 1 CUBIC YARD IN SIZE BASED ON THE AVERAGE DIMENSIONS WILL NOT BE CONSIDERED PAYABLE ROCK. PROVIDE UNIT PRICES FOR BOTH ON AND OFF SITE DISPOSAL. IF ADDITIONAL FILL MATERIAL IS REQUIRED INCLUDE THE COST OF ALL FILL MATERIAL.
16. REGULARLY INSPECT THE PERIMETER OF THE PROPERTY TO CLEAN UP AND REMOVE LOOSE CONSTRUCTION DEBRIS BEFORE IT LEAVES THE SITE. PROMPTLY REMOVE ALL DEMOLITION DEBRIS FROM THE SITE TO AN APPROVED DUMP SITE.
17. ALL TRUCKS LEAVING THE SITE MUST BE COVERED.
18. DO NOT WASH ANY CONCRETE TRUCKS ONSITE. REMOVE BY HAND ANY CEMENT OR CONCRETE DEBRIS LEFT IN THE DISTURBED AREA.
19. BURIAL OF ANY STUMPS, SOLID DEBRIS, AND/OR STONES/BOULDERS ONSITE IS PROHIBITED.
20. AT THE END OF CONSTRUCTION, REMOVE ALL CONSTRUCTION DEBRIS AND SURPLUS MATERIALS FROM THE SITE [AS INDICATED IN THE SPECIFICATIONS]. PERFORM A THOROUGH INSPECTION OF THE WORK PERIMETER. COLLECT AND REMOVE ALL MATERIALS AND BLOWN OR WATER CARRIED DEBRIS FROM THE SITE.

BASIC CONSTRUCTION SEQUENCE:

THE FOLLOWING CONSTRUCTION SEQUENCE IS TO BE USED AS A GENERAL GUIDELINE. COORDINATE WITH THE OWNER, ENGINEERS, AND LANDSCAPE ARCHITECT AND SUBMIT A PROPOSED CONSTRUCTION SEQUENCE FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION.

1. SURVEY AND STAKE THE PROPOSED LIMIT OF DISTURBANCE AND LIMIT OF SEDIMENTATION BARRIERS.
2. COORDINATE INVASIVE SPECIES MANAGEMENT WITH THE STONEHAM CONSERVATION COMMISSION RELATED TO CONSTRUCTION SEQUENCING.
3. PLACE SEDIMENTATION BARRIERS AS INDICATED ON DRAWINGS AND STAKED OUT IN THE FIELD. UNDER NO CIRCUMSTANCES IS THE LIMIT OF WORK TO EXTEND BEYOND THE SEDIMENTATION BARRIERS/LIMIT OF DISTURBANCE AS INDICATED ON DRAWINGS AS APPROVED BY THE LOCAL CONSERVATION COMMISSION AND DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP).
4. INSTALL TEMPORARY CONSTRUCTION ENTRANCES IN LOCATIONS INDICATED ON DRAWINGS. NO OTHER ENTRANCES ARE TO BE USED TO GAIN ACCESS TO THE SITE BY ANY CONSTRUCTION OR DELIVERY VEHICLES.
5. BEGIN CLEARING THE SITE AS REQUIRED INCLUDING THE REMOVAL OF DEBRIS, TRASH, AND/OR TREES..
6. SURVEY AND STAKE CENTERLINE OF THE PROPOSED PATHWAYS.
7. BEGIN CLEARING AND GRUBBING THE AREAS OF DEBRIS, INVASIVE TREES, AND PATHWAYS. TOPSOIL IS TO BE STRIPPED FROM THE AREA OF THE PROPOSED PATHS AND STOCKPILED IN AN APPROVED LOCATION. TOPSOIL STOCKPILES MUST BE PROTECTED BY A SEDIMENT BARRIER.
8. INSTALL TEMPORARY CONVEYANCE DEVICES (SWALES, CHECK DAMS, PIPES, ETC.) AS NECESSARY TO PREVENT SEDIMENT FROM ENTERING THE RESOURCE AREAS.
9. BEGIN ROUGH GRADING AREAS FOR PATHS. BRING ROUGH GRADING TO PROPER ELEVATIONS AS SOON AS PRACTICABLE. COORDINATE WORK TO MINIMIZE TIME SOILS ARE UN-STABILIZED.
10. BEGIN ENTRANCES, PATH, AND BOARDWALK CONSTRUCTION PER SITE PLANS AND IN ACCORDANCE WITH APPLICABLE STATE AND LOCAL REGULATIONS.
11. FINISH PERMANENT STABILIZATION. SEED ALL DISTURBED AREAS OUTSIDE OF THE PATH AREA.
12. COMPLETE ALL REMAINING PLANTING AND SEEDING.
13. ENGINEER TO APPROVE THE REMOVAL OF ALL TEMPORARY SOIL EROSION AND SEDIMENTATION CONTROL MEASURES FOLLOWING VEGETATIVE ESTABLISHMENT OF ALL DISTURBED AREAS AND DETERMINE WHEN THE CONTRIBUTING AREA HAS REACHED A MINIMUM OF 80% STABILIZATION.

GENERAL GRADING AND DRAINAGE NOTES:

1. ALL CUT AND FILL SLOPES SHALL BE 4:1 OR FLATTER UNLESS OTHERWISE NOTED.
2. EXISTING GRADE CONTOUR INTERVALS SHOWN AT 1 FOOT.
3. PROPOSED GRADE CONTOUR INTERVALS SHOWN AT 1 FOOT.
4. PROPOSED ELEVATIONS ARE SHOWN TO FINISH GRADE UNLESS NOTED OTHERWISE.

EROSION & SEDIMENT CONTROL NOTES:

1. PRIOR TO THE START OF CONSTRUCTION A NOTICE OF INTENT (NOI) MUST BE FILED WITH NPDES. REFER TO THE STORMWATER AND POLLUTION PREVENTION PLAN (SWPPP) REGARDING ALL EROSION CONTROL MATTERS. MAINTAIN A WORKING COPY OF THE SWPPP ONSITE AT ALL TIMES. FOLLOW THE SWPPP PROTOCOL FOR SITE MAINTENANCE, INSPECTIONS AND PROPER DOCUMENTATION UNTIL THE SITE HAS BEEN ACCEPTED BY THE OWNER. AT THE COMPLETION OF THE PROJECT THE CONTRACTOR OR OWNER MUST FILE A NOTICE OF TERMINATION WITH NPDES. IN ACCORDANCE WITH NPDES REGULATIONS, THE COMPLETED SWPPP MUST INCLUDE ALL OF THE SITE EROSION CONTROL DOCUMENTATION, WEEKLY EROSION INSPECTION REPORTS COMPLETED BY THE DESIGNATED SITE PERSONNEL, AND ANY OTHER PERTINENT SITE DOCUMENTATION MUST BE RETAINED FOR A MINIMUM OF 3 YEARS FROM THE DATE OF TERMINATION.
2. DESIGNATE THE SITE CONSTRUCTION FOREMAN AS THE ON-SITE PERSONNEL RESPONSIBLE FOR THE DAILY INSPECTION AND MAINTENANCE OF ALL SEDIMENT AND EROSION CONTROLS AND IMPLEMENTATION OF ALL NECESSARY MEASURES TO CONTROL EROSION AND PREVENT SEDIMENT FROM LEAVING THE SITE.
3. INSTALL ALL EROSION AND SEDIMENT CONTROL (ESC) MEASURES AS INDICATED ON DRAWINGS IN CONSULTATION WITH THE CONSERVATION AGENT, AND ENGINEER BEFORE ANY CONSTRUCTION ACTIVITIES BEGIN. INSPECT, MAINTAIN REPAIR AND REPLACE EROSION CONTROL MEASURES, AS NECESSARY, DURING THE ENTIRE CONSTRUCTION PERIOD OF THE PROJECT. THE SITE PERIMETER EROSION CONTROLS ARE THE DESIGNATED LIMIT OF WORK. INFORM ALL PERSONNEL WORKING ON THE PROJECT SITE THAT NO CONSTRUCTION ACTIVITY IS TO OCCUR BEYOND THE LIMIT OF WORK AT ANY TIME THROUGHOUT THE CONSTRUCTION PERIOD.
4. MAINTAIN A MINIMUM SURPLUS OF 100 FEET OF EROSION CONTROL BARRIER (SILT FENCE, STRAWBALE, &/OR SILT SOCK) ONSITE AT ALL TIMES.
5. PROTECT THE ADJACENT RESOURCE AREA FROM SEDIMENTATION DURING PROJECT CONSTRUCTION UNTIL ACCEPTANCE BY THE OWNER & IN CONFORMANCE WITH THE ORDER OF CONDITIONS.
6. PROVIDE CONSTRUCTION EXITS AS INDICATED ON DRAWINGS TO SHED DIRT FROM CONSTRUCTION VEHICLE TIRES. CLEAN AND/OR REPLACE THE CRUSHED STONE PAD, AS NECESSARY, TO MAINTAIN ITS EFFECTIVENESS.
7. KEEP THE LIMIT OF CLEARING, GRADING AND DISTURBANCES TO A MINIMUM WITHIN THE PROPOSED AREA OF CONSTRUCTION. PHASE THE SITE WORK IN A MANNER TO MINIMIZE AREAS OF EXPOSED SOIL. IF TREES ARE TO BE CUT ON THE ENTIRE SITE, CLEAR AND GRUB ONLY THOSE AREAS WHICH ARE ACTIVELY UNDER CONSTRUCTION. PROPERLY INSTALL THE SEDIMENTATION CONTROLS PRIOR TO BEGINNING ANY LAND CLEARING ACTIVITY AND/OR OTHER CONSTRUCTION RELATED WORK.
8. MONITOR LOCAL WEATHER REPORTS DURING CONSTRUCTION AND PRIOR TO SCHEDULING EARTHMOVING OR OTHER CONSTRUCTION ACTIVITIES WHICH LEAVE LARGE DISTURBED AREAS UNSTABILIZED. IF INCLEMENT WEATHER IS PREDICTED, USE BEST PROFESSIONAL JUDGEMENT AND GOOD CONSTRUCTION PRACTICES WHEN SCHEDULING CONSTRUCTION ACTIVITIES AND ENSURE THE NECESSARY EROSION CONTROL DEVICES ARE INSTALLED AND FUNCTIONING PROPERLY TO MINIMIZE EROSION FROM ANY IMPENDING WEATHER EVENTS.
9. INSPECT EROSION AND SEDIMENT CONTROL DEVICES AND STABILIZED SLOPES ON A WEEKLY BASIS AND AFTER EACH RAINFALL EVENT OF .25 INCH OR GREATER. REPAIR IDENTIFIED PROBLEMS WITHIN 24 HOURS TO ENSURE EROSION AND SEDIMENT CONTROLS ARE IN GOOD WORKING ORDER. RESET OR REPLACE MATERIALS AS REQUIRED.
10. SURROUND THE PERIMETER OF SOIL STOCKPILES WITH SILT SOCK, SILT FENCE, STRAWBALES, OR A COMBINATION OF SILT FENCE WITH STRAWBALE, AS DETERMINED NECESSARY.
11. DISTURBED AREAS AND SLOPES MUST NOT BE LEFT UNATTENDED OR EXPOSED FOR EXCESSIVE PERIODS OF TIME SUCH AS THE INACTIVE WINTER SEASON. PROVIDE APPROPRIATE STABILIZATION PRACTICES ON ALL DISTURBED AREAS AS SOON AS POSSIBLE BUT NOT MORE THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT AREA HAS TEMPORARILY OR PERMANENTLY CEASED, REINFORCE TEMPORARY AREAS HAVING A SLOPE GREATER THAN 4:1 WITH EROSION BLANKETS OR APPROVED EQUAL UNTIL THE SITE IS PROPERLY STABILIZED. TEMPORARY SWALES MAY ALSO BE REQUIRED IF DETERMINED NECESSARY IN THE FIELD BY THE ENGINEER.
12. CONTAIN ALL SEDIMENT ONSITE. SWEEP ALL EXITS FROM THE SITE AS NECESSARY INCLUDING ANY SEDIMENT TRACKING. SWEEP PAVED AREAS AS NEEDED TO REMOVE SEDIMENT AND POTENTIAL POLLUTANTS ACCUMULATED DURING SITE CONSTRUCTION.
13. REMOVE ACCUMULATED SEDIMENT FROM ALL TEMPORARY PRACTICES AND DISPOSE OF IN A PRE-APPROVED LOCATION.
14. PROVIDE ON SITE OR MAKE READILY AVAILABLE THE NECESSARY EQUIPMENT AND SITE PERSONNEL DURING CONSTRUCTION HOURS FOR THE DURATION OF THE PROJECT TO ENSURE ALL EROSION AND SEDIMENTATION CONTROL DEVICES ARE PROPERLY MAINTAINED AND REPAIRED IN A TIMELY AND RESPONSIBLE MANNER. IF SITE WORK IS SUSPENDED DURING THE WINTER MONTHS THE CONTRACTOR MUST CONTINUE TO PROVIDE PERSONNEL AND EQUIPMENT EITHER ON SITE OR READILY AVAILABLE TO PROPERLY MAINTAIN AND REPAIR ALL EROSION AND SEDIMENTATION CONTROL DEVICES IN A TIMELY AND RESPONSIBLE MANNER
15. CONTROL DUST BY WATERING OR OTHER APPROVED METHODS AS NECESSARY, OR AS DIRECTED BY THE ENGINEER.

INVASIVE SPECIES MANAGEMENT:

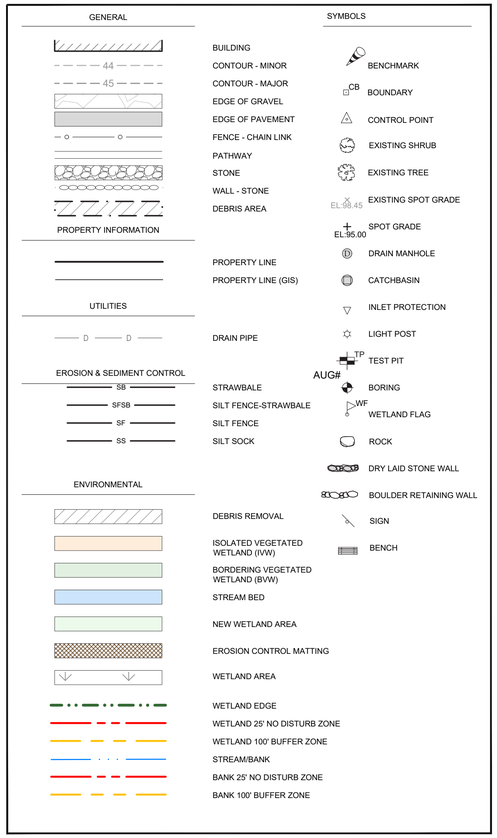
1. INVASIVE SPECIES MANAGEMENT SHOULD BE CUSTOMIZED TO THE INDIVIDUAL SPECIES FOLLOWING THE SPECIFIC MEASURES OUTLINED IN THE SPECIFICATIONS. MANAGERS SHOULD READ AND UNDERSTAND INVASIVE SPECIES CONTROL SPECIFICATIONS FOR THE SITE PRIOR TO COMMENCING ANY INVASIVE SPECIES MANAGEMENT ACTIVES.
2. ALL PESTICIDE APPLICATIONS MUST BE CONDUCTED BY A MASSACHUSETTS LICENSED PESTICIDE APPLICATOR.
3. PRIOR TO ANY WORK ALL INVASIVE SPECIES ARE TO BE IDENTIFIED AND MARKED BY A QUALIFIED PROFESSIONAL. ANY SPECIES IDENTIFIED, OR ANY INVASIVE ON THE MASSACHUSETTS INVASIVE SPECIES LIST, LOCATED WITHIN THE LIMIT OF WORK SHOULD BE REMOVED FOLLOWING THE MEASURES OUTLINED IN THE SPECIFICATIONS.
4. MONITOR ALL INVASIVE SPECIES AT THE SITE THROUGHOUT THE DURATION OF THE CONSTRUCTION PERIOD, AND A MINIMUM OF THREE YEARS FOLLOWING SUBSTANTIAL COMPLETION. NEW GROWTH OF ANY INVASIVE SPECIES SHOULD BE REMOVED AS SOON AS IT IS DETECTED.

ROOT PRUNING:

ALL ROOTS ABOVE 1" IN DIAMETER ENCOUNTERED DURING DEMOLITION OR CONSTRUCTION SHALL BE ROOT PRUNED.

1. CUT ROOT CLEAN WITH A SAW ON THE SURFACE OF THE ROOT, WHICH IS STILL ATTACHED TO THE TREE. DO NOT PAINT THE CUT ROOT END.
2. ROOT PRUNING WORK WILL NOT BE DONE WHEN MORE THAN THE TOP 1 INCH OF SOIL IS FROZEN. ROOT PRUNING WILL NOT BE UNDERTAKEN WHEN THE SOIL IS WET AND CONDITIONS ARE MUDDY.
3. ONCE CUT, BACK FILL SOIL OVER ROOT. DO NOT LEAVE ROOT EXPOSED OVER NIGHT. AFTER ROOT HAS BEEN CUT, AND COVERED WITH SOIL, THOROUGHLY WATER .
4. PRUNE TREE BRANCHES IF ANY DIE AS A RESULT OF ROOT PRUNING.
5. IF MORE THAN 40% OF A TREES DRIP LINE IS DISTURBED, AND IT'S ROOTS DESTROYED OR REMOVED, NOTIFY PROJECT ENGINEER TO DETERMINE IF TREE SHOULD BE REMOVED.

LEGEND:



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Revisions

Rev.	Date	By	Appr.	Description

Horsley Witten Group, Inc.
Sustainable Environmental Solutions
www.horsleywitten.com
90 Route 6A
Sandwich, MA 02563
508-833-6600 voice
508-833-3150 fax

Checked By: BRK
Drawn By: JMP
Designed By: AAK/JMP
Date: FEBRUARY 2024

Plan Set: STONEHAM WETLANDS RESTORATION
75% DESIGN DEVELOPMENT PERMIT PLANS
STONEHAM, MA

Plan Title: CONSTRUCTION NOTES

Prepared For:
Town of Stoneham
35 Central Street
Stoneham, MA 02180
Phone: (781) 279-2600
Fax: ----

Survey Provided By:
Horsley Witten Group, Inc.
90 Route 6A, Unit 1
Sandwich, MA 02563
Phone: (508) 833-6600
Fax: ----
Dated: May 4, 2023

Registration:
COMMONWEALTH OF MASSACHUSETTS
RICHARD A. CLAYTOR
CIVIL
NO. 45116
REGISTERED
PROFESSIONAL ENGINEER
2-9-2024

Project Number: 21008C
Sheet : 2 of 9
Sheet Number: C - 2

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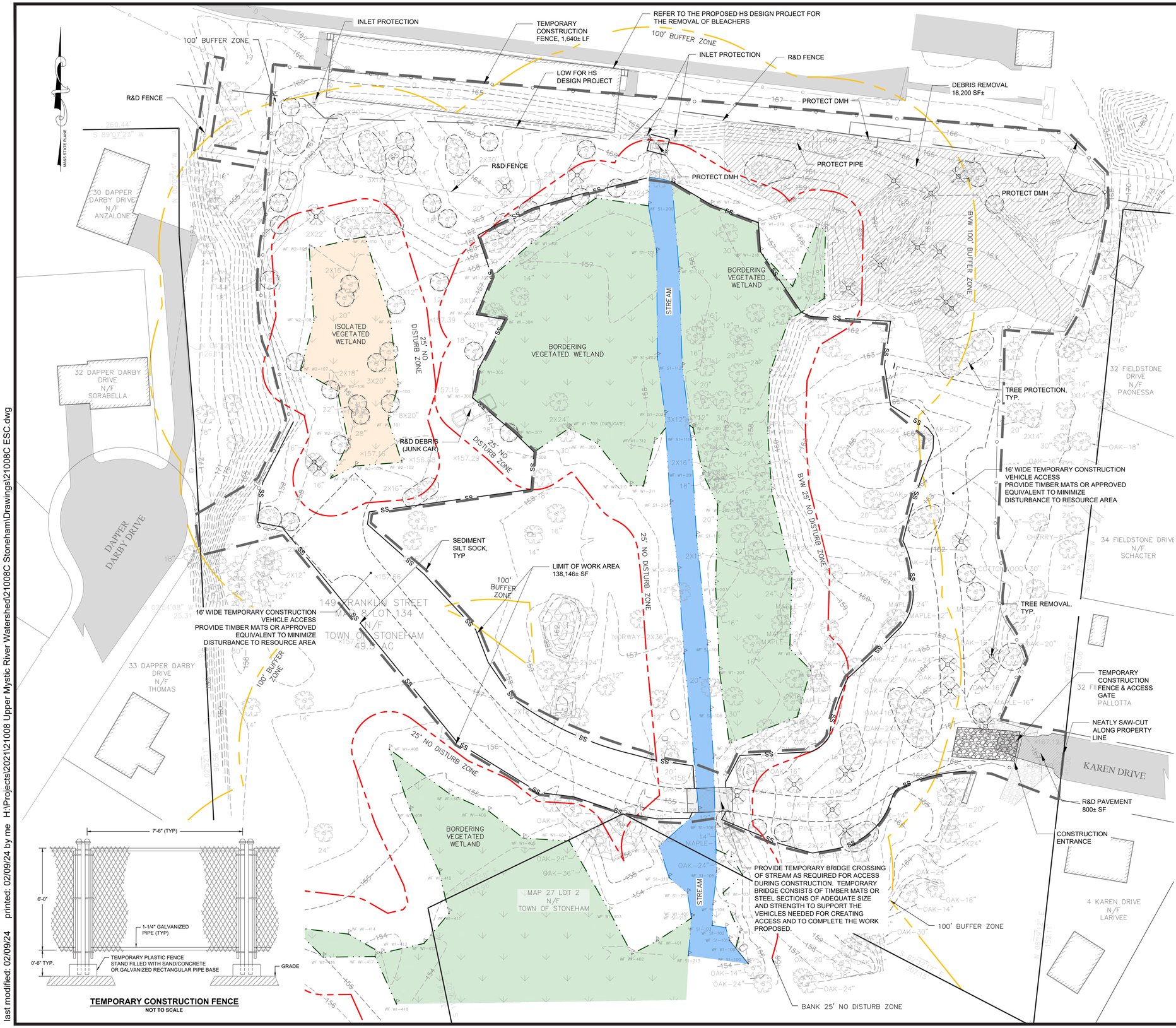

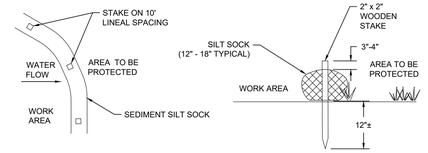

NOTES:
1. SILT SOCK MANUFACTURER TO BE SILT SOXX OR ENGINEER APPROVED EQUAL.
2. ALL MATERIAL TO MEET MANUFACTURER'S SPECIFICATIONS.
3. SEDIMENT SILT SOCK TO BE FILLED WITH LEAF COMPOST AND/OR WOODY MULCH PER MANUFACTURER'S REQUIREMENTS.
4. FOLLOWING CONSTRUCTION AND SITE STABILIZATION, COMPOST MATERIAL TO BE REMOVED OR DISPERSED ON SITE, AS APPROVED BY THE ENGINEER.

SEDIMENT SILT SOCK
NOT TO SCALE

DRAWING NAME: H:\References\AUTOCAD STANDARDS_DETAILS\Erosion Control\SB Sack, Sock & Fence\SILT SOCK SMALL.dwg
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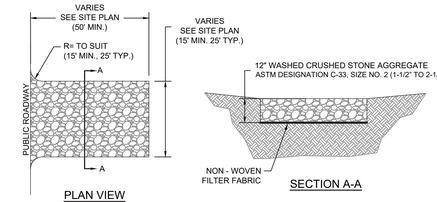
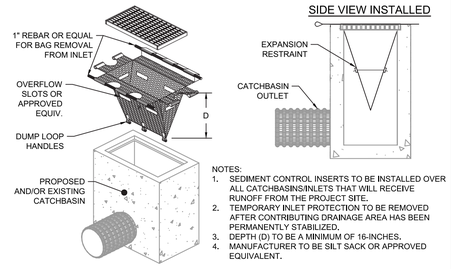


NOTE:
1. STONE CONSTRUCTION ENTRANCE(S) TO REMAIN UNTIL INSTALLATION OF PAVEMENT SUB-BASE IS TO BEGIN.
2. SEE SITE PLAN FOR LOCATION & ACTUAL DIMENSIONS

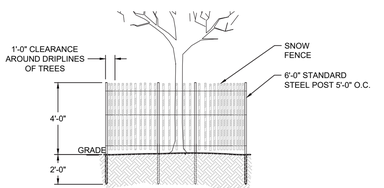
STONE CONSTRUCTION ENTRANCE
NOT TO SCALE



NOTES:
1. SEDIMENT CONTROL INSERTS TO BE INSTALLED OVER ALL CATCHBASINS/INLETS THAT WILL RECEIVE RUNOFF FROM THE PROJECT SITE.
2. TEMPORARY INLET PROTECTION TO BE REMOVED AFTER CONTRIBUTING DRAINAGE AREA HAS BEEN PERMANENTLY STABILIZED.
3. DEPTH (D) TO BE A MINIMUM OF 16-INCHES.
4. MANUFACTURER TO BE SILT SACK OR APPROVED EQUIVALENT.

INLET PROTECTION
NOT TO SCALE

TEMPORARY CONSTRUCTION FENCE
NOT TO SCALE



DECIDUOUS TREE

NOTES:
1. FENCING SHALL BE ORANGE RESINET SM60 BARRIER FENCE "SNOW FENCE" OR APPROVED EQUIVALENT.
2. POST SHALL BE HOT ROLLED RAIL STEEL AND FORMED INTO A "T". DIMENSIONS OF "T" POST SECTION, APPROXIMATELY 1 7/16" X 1 5/16" X 1/8" X 6' (SIX FEET) LONG. THE POST SHALL BE PAINTED GREEN OR GALVANIZED.
3. THE FENCING SHALL REMAIN IN PLACE UNTIL ALL EXCAVATION HAS BEEN COMPLETED AND THE SURFACE HAS BEEN RE-ESTABLISHED

TREE PROTECTION
NOT TO SCALE

GRAPHIC SCALE
30 0 15 30 60 120
(in feet)
1 INCH = 30 FEET

PERMITTING SET ONLY
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Revisions

Rev.	Date	By	Appr.	Description

Horsley Witten Group, Inc.
Sustainable Environmental Solutions
www.horsleywitten.com
90 Route 6A
Sandwich, MA 02563
508-833-6600 voice
508-833-3150 fax

Checked By: BRK
Drawn By: JMP
Designed By: KA/JMP
Date: FEBRUARY 2024

Plan Set: STONEHAM WETLANDS RESTORATION
75% DESIGN DEVELOPMENT PERMIT PLANS
STONEHAM, MA

Plan Title: ESC & DEMO PLAN

Prepared For:
Town of Stoneham
35 Central Street
Stoneham, MA 02180
Phone: (781) 279-2600
Fax: ----

Survey Provided By:
Horsley Witten Group, Inc.
90 Route 6A, Unit 1
Sandwich, MA 02563
Phone: (508) 833-6600
Fax: ----
Dated: May 4, 2023

Registration:
COMMONWEALTH OF MASSACHUSETTS
RICHARD A. CLAYTOR
CIVIL
NO. 45116
REGISTERED PROFESSIONAL ENGINEER
2-9-2024

Project Number: 21008C
Sheet : 3 of 9
Sheet Number: C-3

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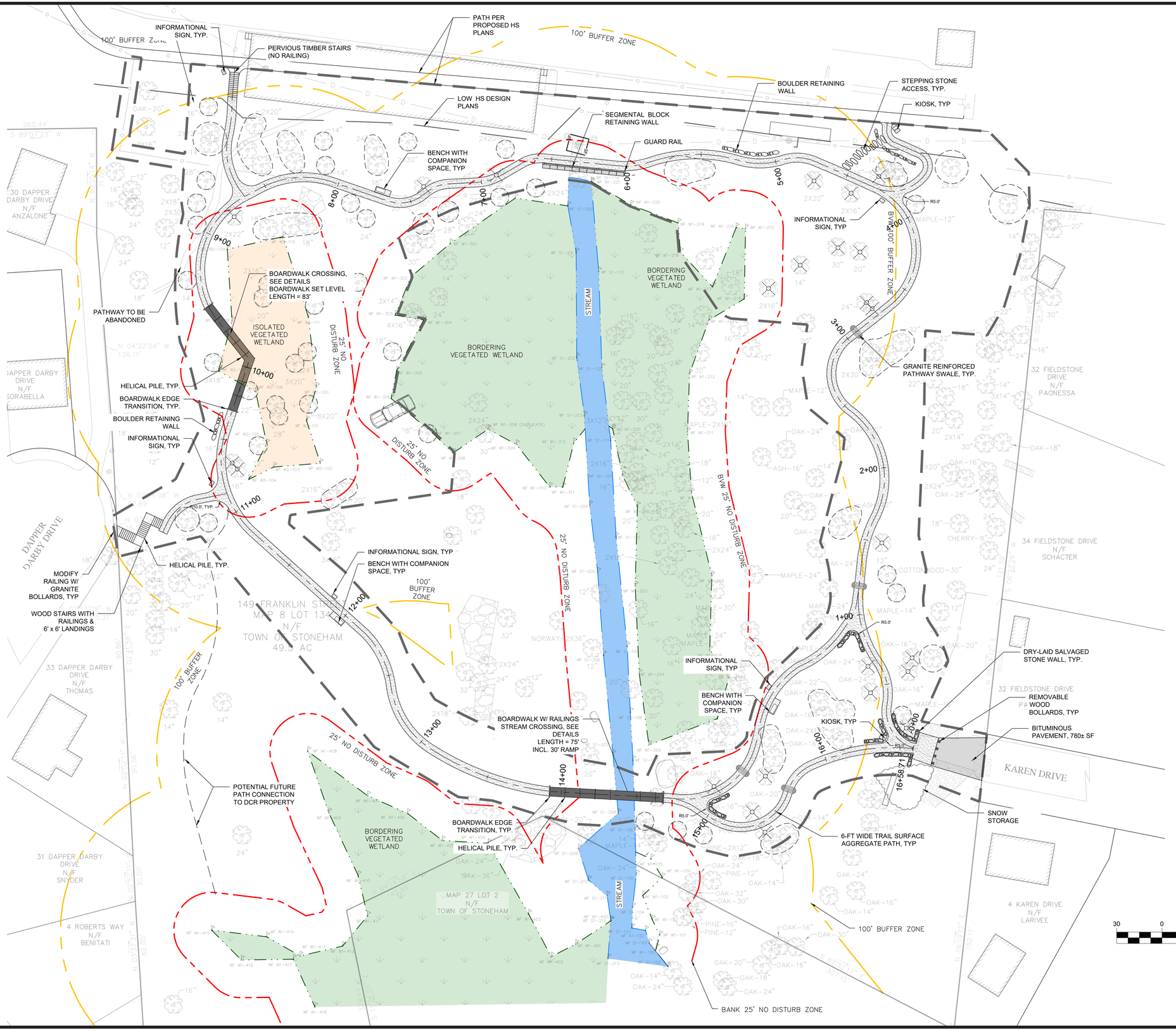

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Revisions

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Horsley Witten Group, Inc.
Sustainable Environmental Solutions
www.horsleywitten.com
90 Route 6A
Sandwich, MA 02563
508-833-6600 voice
508-833-3150 fax

Checked By: BRK
Drawn By: JMP
Designed By: KA/JMP
Date: FEBRUARY 2024

Plan Set: STONEHAM WETLANDS RESTORATION
75% DESIGN DEVELOPMENT PERMIT PLANS
STONEHAM, MA

Plan Title: SITE PLAN

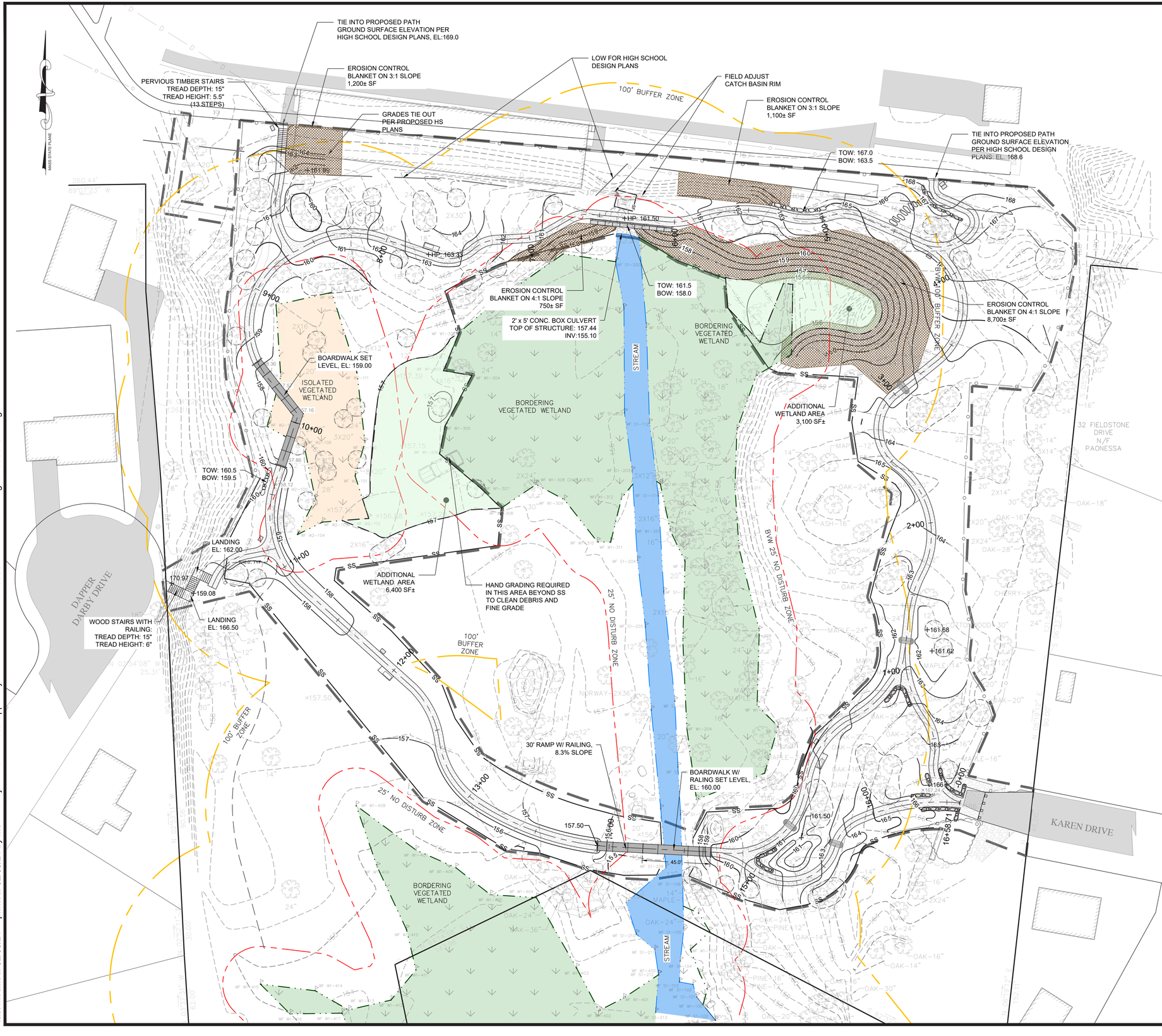
Prepared For:
Town of Stoneham
35 Central Street
Stoneham, MA 02180
Phone: (781) 279-2600
Fax: -----

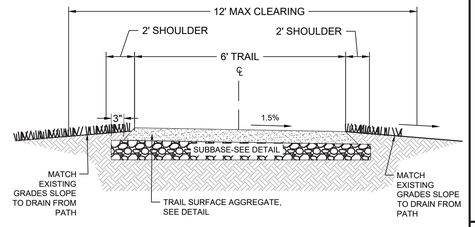
Survey Provided By:
Horsley Witten Group, Inc.
90 Route 6A, Unit 1
Sandwich, MA 02563
Phone: (508) 833-6600
Fax: -----
Dated: May 4, 2023

Registration:
COMMONWEALTH OF MASSACHUSETTS
RICHARD A. CLAYTOR
CIVIL
NO. 45116
REGISTERED PROFESSIONAL ENGINEER
2-9-2024

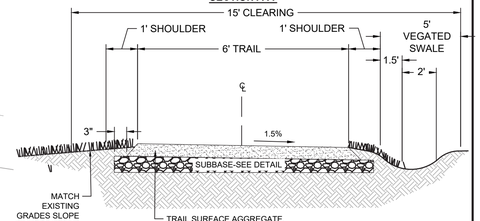
Project Number: 21008C
Sheet : 4 of 9

Sheet Number: C - 4





SECTION A-A'



SECTION B-B'

NOTE:
1. BACKFILL ALONG PATH EDGE TO MATCH EXISTING GRADES AS NECESSARY.
2. ENSURE POSITIVE DRAINAGE OFF PATH.
3. 3% MAXIMUM CROSS SLOPE ON PATH.

PATH SECTIONS
NOT TO SCALE

GRAPHIC SCALE
30 0 15 30 60 120
(in feet)
1 INCH = 30 FEET

PERMITTING SET ONLY
NOT FOR CONSTRUCTION

Revisions

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Horsley Witten Group, Inc.
Sustainable Environmental Solutions
www.horsleywitten.com
90 Route 6A
Sandwich, MA 02563
508-833-6600 voice
508-833-3150 fax

Checked By: BRK
Drawn By: JMP
Designed By: AAC/JMP
Date: FEBRUARY 2024

Plan Set:
STONEHAM WETLANDS RESTORATION
75% DESIGN DEVELOPMENT PERMIT PLANS
STONEHAM, MA

Plan Title:
GRADING PLAN

Prepared For:
Town of Stoneham
35 Central Street
Stoneham, MA 02180
Phone: (781) 279-2600
Fax: —

Survey Provided By:
Horsley Witten Group, Inc.
90 Route 6A, Unit 1
Sandwich, MA 02563
Phone: (508) 833-6600
Fax: —
Dated: May 4, 2023

Registration:
COMMONWEALTH OF MASSACHUSETTS
RICHARD A. CLAYTOR
CIVIL
NO. 45116
REGISTERED PROFESSIONAL ENGINEER
2-9-2024

Project Number: 21008C
Sheet : 5 of 9

Sheet Number: C-5

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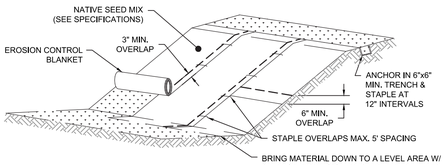
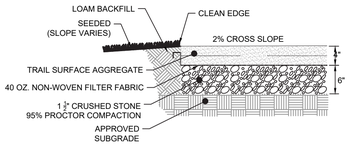


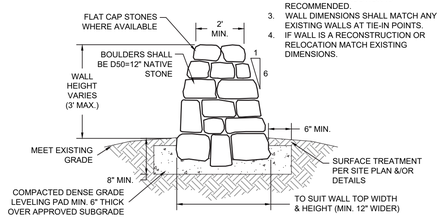
NOTES:
1. EROSION CONTROL BLANKET TO BE ALL NATURAL MATERIAL SUITABLE FOR TEMPORARY STABILIZATION - NORTH AMERICAN GREEN BIONET S150BN OR APPROVED EQUIVALENT.
2. SLOPE SURFACE SHALL BE SMOOTH BEFORE PLACEMENT FOR PROPER SOIL CONTACT.
3. STAPLING PATTERN AS PER MANUFACTURER'S RECOMMENDATIONS.
4. DO NOT STRETCH BLANKETS/MATTINGS TIGHT, ALLOW THE ROLLS TO MOLD TO ANY IRREGULARITIES.
5. FOR SLOPES LESS THAN 3H:1V, ROLLS MAY BE PLACED IN HORIZONTAL STRIPS.
6. LIME, FERTILIZE AND SEED BEFORE INSTALLATION, PLANTING OF SHRUBS, TREES, ETC, SHOULD OCCUR AFTER INSTALLATION.

EROSION CONTROL BLANKET
NOT TO SCALE



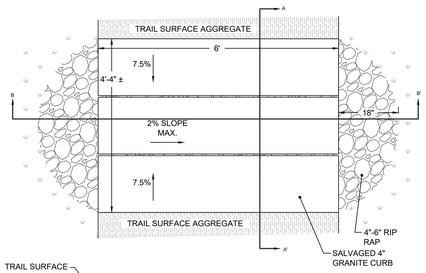
NOTES:
1. REMOVE TOPSOIL AND SUBSOIL PRIOR TO COMPACTED GRAVEL BASE INSTALLATION.
2. SEE PLAN AND APPLICABLE DETAILS FOR PATH LAYOUT.
3. FILTER FABRIC SHALL BE TUCKED INTO SIDE MATERIAL 2-INCHES BELOW FINISH GRADE @ BOTH ENDS.

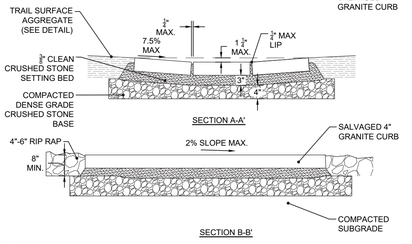
TRAIL SURFACE AGGREGATE
NOT TO SCALE



NOTES:
1. CONTRACTOR TO VERIFY WITH LOCAL CODE PRIOR TO CONSTRUCTION.
2. RE-USE OF EXISTING STONES FOUND DURING CONSTRUCTION IS RECOMMENDED.
3. WALL DIMENSIONS SHALL MATCH ANY EXISTING WALLS AT TIE-IN POINTS.
4. IF WALL IS A RECONSTRUCTION OR RELOCATION MATCH EXISTING DIMENSIONS.

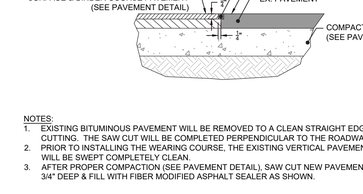
DRY-LAID STONE WALL
NOT TO SCALE





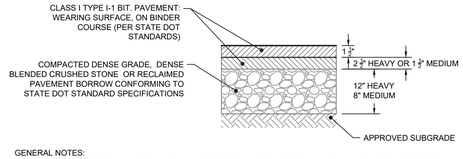
NOTES:
1. THIS SWALE SECTION MUST BE ADA COMPLIANT. SPECIAL CARE SHOULD BE TAKEN DURING INSTALLATION OF GRANITE TO MAINTAIN A MAXIMUM VERTICAL DIFFERENCE BETWEEN ANY STONE OR TRANSITION OF ½". ALL EDGE TRANSITIONS SHOULD BE AS FLUSH AND SMOOTH AS PRACTICABLE. THE SLOPES OF THE SWALE WILL BE 7.5% OR LESS.
2. THE RECLAIMED GRANITE CURB WILL SPAN THE PATH.
3. SEE AGGREGATE BASE COURSE SPECIFICATION FOR GEOGRID.
4. ¾" CLEAN CRUSHED STONE SETTING BED TO BE 3" DEEP.

GRANITE REINFORCED PATHWAY SWALE
NOT TO SCALE



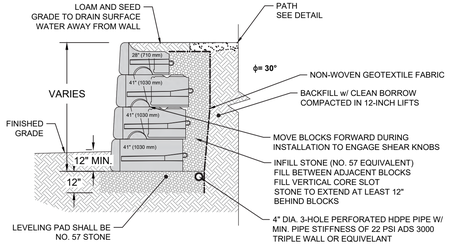
NOTES:
1. EXISTING BITUMINOUS PAVEMENT WILL BE REMOVED TO A CLEAN STRAIGHT EDGE VIA SAW CUTTING. THE SAW CUT WILL BE COMPLETED PERPENDICULAR TO THE ROADWAY/SIDEWALK.
2. PRIOR TO INSTALLING THE WEARING COURSE, THE EXISTING VERTICAL PAVEMENT SURFACE WILL BE SWEPT COMPLETELY CLEAN.
3. AFTER PROPER COMPACTION (SEE PAVEMENT DETAIL), SAW CUT NEW PAVEMENT ABUTMENT 3/4" DEEP & FILL WITH FIBER MODIFIED ASPHALT SEALER AS SHOWN.

PAVEMENT PATCH
NOT TO SCALE



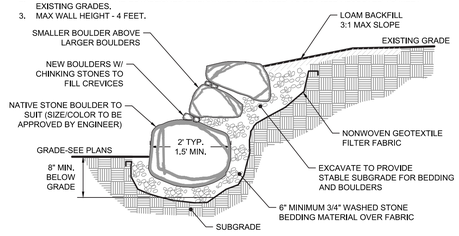
GENERAL NOTES:
1. SUB-GRADE (EXISTING MATERIAL) SHALL CONSIST OF INERT MATERIAL THAT IS HARD, DURABLE STONE AND/OR COARSE SAND, FREE FROM LOAM AND CLAY TO A DEPTH NOT LESS THAN 4-FT BELOW THE FINISH PAVEMENT SURFACE. EXCAVATE SANDY-LOAM AND/OR LOAMY-SAND TOPSOIL MATERIAL FROM ALL PAVED AREAS PRIOR TO SUB-BASE INSTALLATION.
2. PLACE SUB-BASE IN MAXIMUM 8" LIFTS (COMPACTED TO 95%).
3. COMPACT SUB-GRADE FILL TO 95% COMPACTION.
4. SEE SITE LAYOUT PLAN FOR PAVEMENT WIDTH AND LOCATION.
5. SEE GRADING PLANS FOR PAVEMENT SLOPE AND CROSS SLOPE.
6. SWEEP CLEAN THE EXISTING BINDER COURSE SURFACE PRIOR TO INSTALLING THE WEARING COURSE BY A STREET SWEEPING MACHINE.
7. APPLY A TACK COAT PER SPECIFICATIONS.

BITUMINOUS PAVEMENT
NOT TO SCALE

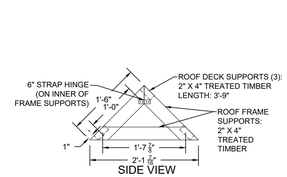


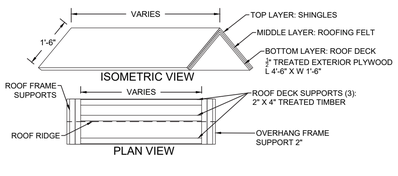
SEGMENTAL BLOCK RETAINING WALL
NOT TO SCALE

NOTES:
1. ADJUST DEPTH OF WALL TO AVOID DISTURBING MAJOR TREE ROOTS
2. EXACT PROFILE OF RE-ESTABLISHED EMBANKMENT WILL NEED TO BE FIELD ADJUSTED TO MEET EXISTING GRADES.
3. MAX WALL HEIGHT - 4 FEET.

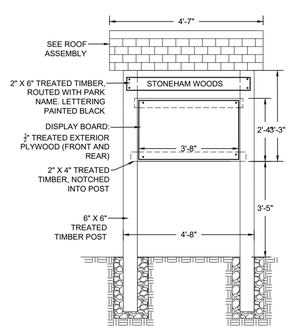


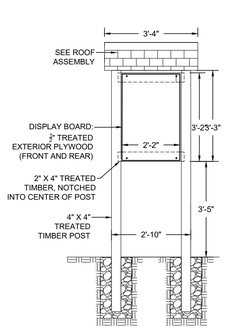
BOULDER RETAINING WALL
NOT TO SCALE

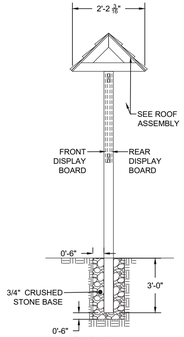




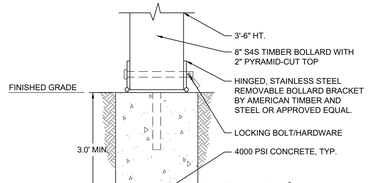
ROOF ASSEMBLY



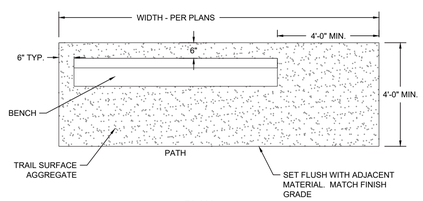




KIOSK
NOT TO SCALE



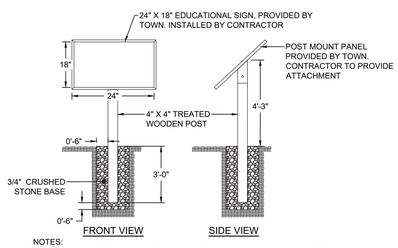
REMOVABLE WOOD BOLLARD
NOT TO SCALE



PLAN

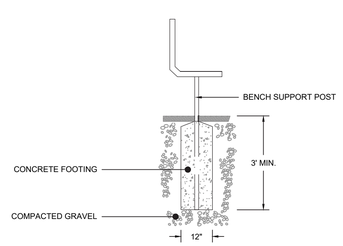
NOTES:
1. ANCHOR PER SITE FURNISHING MANUFACTURER REQUIREMENTS.
2. SEE SPECIFICATIONS FOR SITE FURNISHING TYPE/STYLE.

BENCH WITH COMPANION PAD
NOT TO SCALE



NOTES:
1. FINAL LOCATIONS TO BE FIELD VERIFIED WITH LANDSCAPE ARCHITECT.
2. VERIFY HEIGHT OF SIGN FOR ADA REQUIREMENTS PRIOR TO INSTALLATION.

INFORMATIONAL SIGN
NOT TO SCALE



BENCH FOOTING
NOT TO SCALE

PERMITTING SET ONLY
NOT FOR CONSTRUCTION

Revisions

Rev.	Date	By	Appr.	Description
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Horsley Witten Group, Inc.
Sustainable Environmental Solutions
www.horsleywitten.com
90 Route 6A
Sandwich, MA 02563
508-833-6600 voice
508-833-3150 fax

Checked By: BRK
Drawn By: JMP
Designed By: AK/JMP
Date: FEBRUARY 2024

Plan Set: STONEHAM WETLANDS RESTORATION
75% DESIGN DEVELOPMENT PERMIT PLANS
STONEHAM, MA

Plan Title: CONSTRUCTION DETAILS-1

Prepared For:
Town of Stoneham
35 Central Street
Stoneham, MA 02180
Phone: (781) 279-2600
Fax: —

Survey Provided By:
Horsley Witten Group, Inc.
90 Route 6A, Unit 1
Sandwich, MA 02563
Phone: (508) 833-6600
Fax: —
Dated: May 4, 2023

Registration:
COMMONWEALTH OF MASSACHUSETTS
RICHARD A. CLAYTOR
CIVIL
NO. 45116
REGISTERED PROFESSIONAL ENGINEER
2-9-2024

Project Number: 21008C
Sheet : 6 of 9
Sheet Number: C-6

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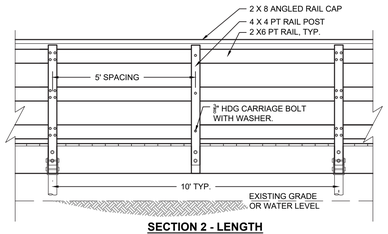
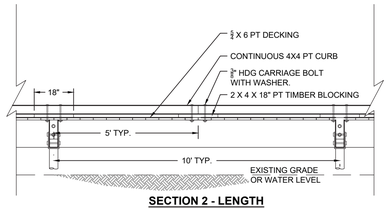


SECTION 2 - LENGTH



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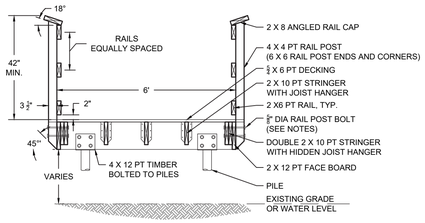
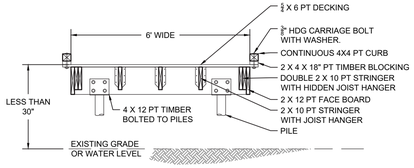


SECTION 1 - WIDTH



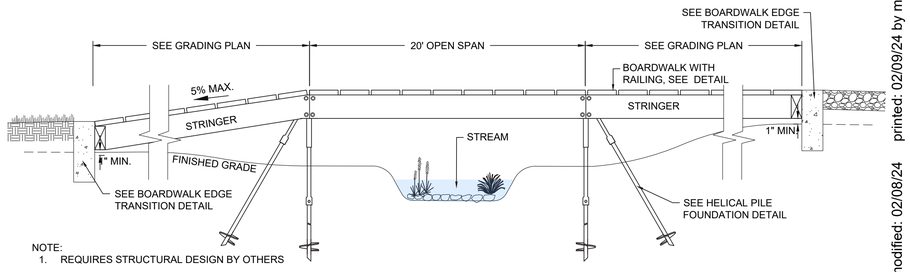
SECTION 1 - WIDTH

NOTE:
1. RAILING TO EXTEND UNTIL BOARDWALK DECKING SURFACE IS WITHIN 30-INCHES OF EXISTING GROUND GRADE.
2. ALL HARDWARE HOT DIPPED GALVANIZED. ALL BOLTS WITH WASHERS AND SCREWS TO SUIT.
3. POST BOLTED THROUGH STRINGER & PILE WHERE APPLICABLE (BOLT LENGTH TO SUIT).
4. POSTS LAG-BOLTED THROUGH TIMBER ENDS WHEN REQUIRED.

BOARDWALK WITH RAILING
NOT TO SCALE

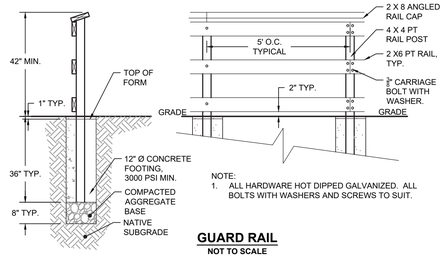
NOTE:
1. RAILING TO EXTEND UNTIL BOARDWALK DECKING SURFACE IS WITHIN 30-INCHES OF EXISTING GROUND GRADE.
2. ALL HARDWARE HOT DIPPED GALVANIZED. ALL BOLTS WITH WASHERS AND SCREWS TO SUIT.
3. POST BOLTED THROUGH STRINGER & PILE WHERE APPLICABLE (BOLT LENGTH TO SUIT).
4. POSTS LAG-BOLTED THROUGH TIMBER ENDS WHEN REQUIRED.

BOARDWALK WITHOUT RAILING
NOT TO SCALE



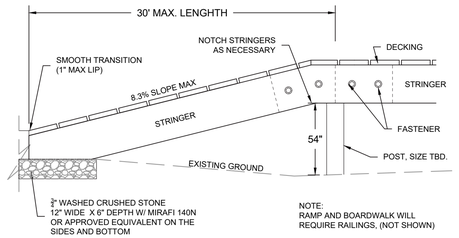
NOTE:
1. REQUIRES STRUCTURAL DESIGN BY OTHERS

BOARDWALK CROSSING
NOT TO SCALE



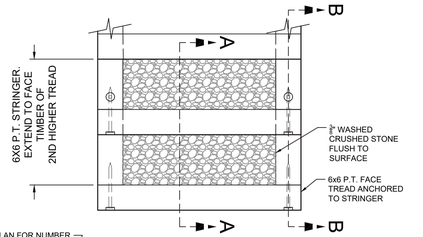
NOTE:
1. ALL HARDWARE HOT DIPPED GALVANIZED. ALL BOLTS WITH WASHERS AND SCREWS TO SUIT.

GUARD RAIL
NOT TO SCALE

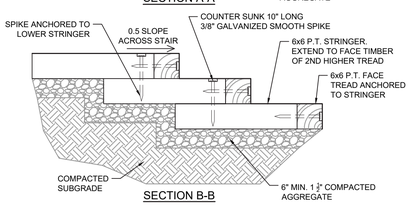


NOTE:
RAMP AND BOARDWALK WILL REQUIRE RAILINGS, (NOT SHOWN)

BOARDWALK RAMP SECTION
NOT TO SCALE

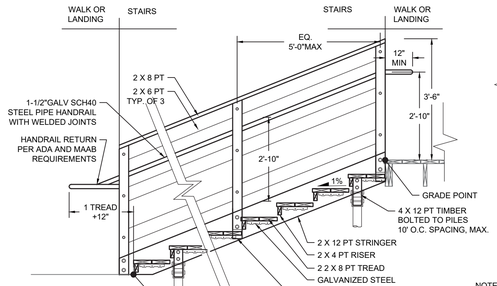


SECTION A-A



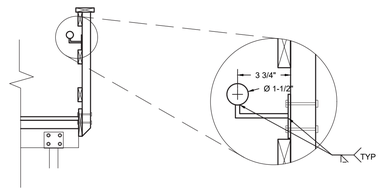
SECTION B-B

PERVIOUS TIMBER STAIRS
NOT TO SCALE

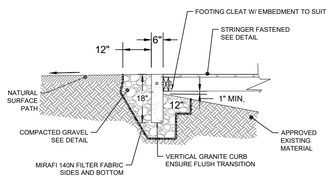


NOTES:
1. FLIGHTS OF STAIRS SHALL BE SHORT AS POSSIBLE (MAX 20 STEPS PER FLIGHT OR 12-FEET IN RISE BEFORE A LANDING IS REQUIRED).
2. AVOID FEWER THAN 2 STEPS PER FLIGHT.
3. STEPS IN FLIGHT MUST HAVE UNIFORM TREAD RUNS AND UNIFORM RISER HEIGHTS WITH TOLERANCE OF ±3/8".
4. TREADS SHALL BE 11" MIN. RISERS SHALL BE 4" MIN, 7" MAX UNLESS OTHERWISE REQUIRED BY LOCAL CODE.
5. NOSING SHALL BE 1/2" MIN. AND ¾" MAX.
6. LANDINGS BETWEEN FLIGHTS OF STEPS MUST HAVE SAME WIDTH AS STEPS AND A MIN LENGTH OF 48" IN DIRECTION OF TRAVEL WITH MAX. 2% CROSS SLOPE.
7. FLIGHTS OF 4 OR MORE STEPS (RISE GREATER THAN 30") SHALL HAVE HANDRAILS ON BOTH SIDES
8. HANDRAILS SHALL BE CONTINUOUS ACROSS LANDINGS BETWEEN FLIGHTS OF STEPS.
9. HANDRAILS ADJACENT TO A WALL SHALL HAVE A SPACE OF NOT LESS THAN 1½ INCHES (38 MM) BETWEEN THE WALL AND THE HANDRAILS.
10. CONCRETE SHALL BE MIN. 3,000 PSI, TYPE II. W/ BROOM FINISH.
11. REQUIRES STRUCTURAL DESIGN BY OTHERS.

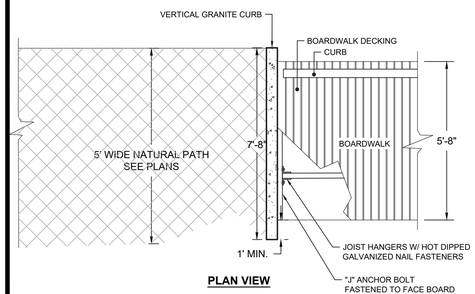
WOOD STAIRS WITH RAILINGS
NOT TO SCALE



NOTES:
1. CROSS SLOPE DIRECTION VARIES. SEE PLANS FOR DIRECTION OF SLOPE.
2. ENSURE TOP OF REINFORCED GRAVEL SYSTEM, GRANITE CURB, AND BOARDWALK DECKING ARE FLUSH.
3. VERTICAL CURB MUST BE GRANITE.
4. GRANITE CURB MUST BE ONE CONTINUOUS PIECE.
5. GRANITE CURB IS TO BE INSTALLED AT BOTH TERMINATION POINTS. SEE PLANS

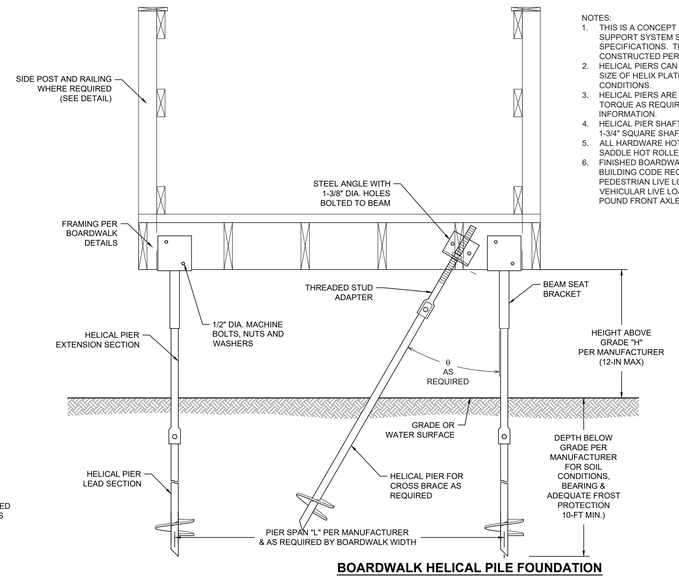


SECTION VIEW



PLAN VIEW

BOARDWALK EDGE TRANSITION
NOT TO SCALE



NOTES:
1. THIS IS A CONCEPT DRAWING ONLY. FINAL DESIGN OF THE HELICAL PIER SUPPORT SYSTEM SHALL BE PROVIDED BY THE MANUFACTURER PER THE SPECIFICATIONS. THE BOARDWALK AND WOOD FRAMING SHALL BE CONSTRUCTED PER THE APPLICABLE BOARDWALK DETAILS.
2. HELICAL PIERS CAN BE EITHER SINGLE OR MULTIHELIX. THE NUMBER AND SIZE OF HELIX PLATES VARY DEPENDING ON PIER LOAD AND SOIL CONDITIONS.
3. HELICAL PIERS ARE INSTALLED (SCREWED) TO A MINIMUM DEPTH AND TORQUE AS REQUIRED BY THE MANUFACTURER WITH THE SOIL INFORMATION.
4. HELICAL PIER SHAFTS FOR WALKWAY SUPPORT ARE TYPICALLY 1-1/2" OR 1-3/4" SQUARE SHAFT OR 2-7/8" O.D. PIPE SHAFT.
5. ALL HARDWARE HOT DIPPED GALVANIZED PER ASTM A-153. MATERIAL FOR SADDLE HOT ROLLED STEEL.
6. FINISHED BOARDWALK STRUCTURE SHALL MEET OR EXCEED INTERNATIONAL BUILDING CODE REQUIREMENTS FOR THE LOADING CAPACITIES BELOW: PEDESTRIAN LIVE LOAD:85 PSF (MIN.) VEHICULAR LIVE LOAD: AASHTO HS (10,000 POUND VEHICLE WITH 2,000 POUND FRONT AXLE AND 8,000 POUND REAR AXLE)

BOARDWALK HELICAL PILE FOUNDATION
NOT TO SCALE

PERMITTING SET ONLY
NOT FOR CONSTRUCTION

last modified: 02/08/24 printed: 02/09/24 by me

Revisions

Rev.	Date	By	Appr	Description
1	---	---	---	---
2	---	---	---	---
3	---	---	---	---
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Horsley Witten Group, Inc.
Sustainable Environmental Solutions
www.horsleywitten.com
90 Route 6A
Sandwich, MA 02563
508-833-6600 voice
508-833-3150 fax

Checked By: BRK
Drawn By: JMP
Designed By: KJK/JMP
Date: FEBRUARY 2024

Plan Set: 75% DESIGN DEVELOPMENT PERMIT PLANS
STONEHAM WETLANDS RESTORATION
STONEHAM, MA

Plan Title: CONSTRUCTION DETAILS-1

Prepared For:
Town of Stoneham
35 Central Street
Stoneham, MA 02180
Phone: (781) 279-2600
Fax: —

Survey Provided By:
Horsley Witten Group, Inc.
90 Route 6A, Unit 1
Sandwich, MA 02563
Phone: (508) 833-6600
Fax: —
Dated: May 4, 2023

Registration:

Project Number: 21008C
Sheet: 7 of 9
Sheet Number: C-7

PROPOSED PLANTING LEGEND

CANOPY TREE

EVERGREEN TREE

LARGE SHRUB

SEED MIX 1 - NEW ENGLAND CONSERVATION/WILDLIFE MIX

WETLAND EXPANSION PLANTS, SEEDED WITH SEED MIX 2 & ALLOWED TO NATURALIZE
SEED MIX 2 - NEW ENGLAND WETMIX (WETLAND SEED MIX)

WETLAND RESTORATION PLANTS, SEEDED WITH SEED MIX 2 & ALLOWED TO NATURALIZE
SEED MIX 2- NEW ENGLAND WETMIX (WETLAND SEED MIX)

TOTAL TREES REMOVED: 25
TOTAL TREES PLANTED: 64

Master Plant List

Key		Botanical Name	Common Name	Size	Spacing
		Canopy Trees			
AR	7	*Acer rubrum*	Red Maple	#15	As Shown
AS	2	*Acer saccharinum*	Silver Maple	#15	As Shown
BA	8	*Betula alleghaniensis*	Yellow Birch	#3	As Shown
CO	3	*Carya ovata*	Shag-Bark Hickory	#2	As Shown
NS	9	*Nyssa sylvatica*	Tupelo	#15	As Shown
OV	9	*Ostrya virginiana*	American Hop Hornbeam	#15	As Shown
PSE	7	*Prunus serotina*	Black Cherry	#2	As Shown
QA	6	*Quercus alba*	White Oak	#10	As Shown
UR	4	*Ulmus rubra*	Slippery Elm	#15	As Shown
Sub:	**55**				
		Evergreen Trees			
PS	9	*Pinus strobus*	Eastern White Pine	#10	As Shown
Sub:	**9**				
		Shrubs			
CA	21	*Clethra alnifolia*	White Summer Sweet	#7	As Shown
HV	21	*Hammamelis virginiana*	Common Witch Hazel	#7	As Shown
IV	13	*Ilex verticillata*	Common Winterberry	#7	As Shown
LB	15	*Lindera benzoin*	Northern Spice Bush	#2	As Shown
RT	21	*Rhus typhina*	Staghorn Sumac	#2	As Shown
SD	9	*Salix discolor*	Pussy Willow	#7	As Shown
SN	11	*Sambucus nigra*	Black Elderberry	#3	As Shown
ST	5	*Spiraea tomentosa*	Hardhack; Steeplebush	#2	As Shown
VA	10	*Vaccinium angustifolium*	Lowbush Blueberry	OPEN	As Shown
VC	15	*Vaccinium corymbosum*	Highbush Blueberry	#5	As Shown
VD	28	*Viburnum dentatum*	Arrowwood Viburnum	#7	As Shown
Sub:	**169**				
		Ground Cover/Grasses/Perennials			
CA	2012	*Carex appalachica*	Appalachina Sedge	plugs	18" O.C.
HF	1145	*Dennstaedtia punctilobula*	Hay Scented Fern	plugs	24" O.C.
DC	573	*Deschampsia flexuosa*	Wavy Hair Grass	plugs	24" O.C.
FER	573	*Eurybia divaricata*	White Wood Aster	plugs	24" O.C.
GM	573	*Geranium maculatum*	Wild Geranium	plugs	24" O.C.
JT	573	*Juncus tenuis*	Slender Rush	plugs	24" O.C.
OSE	573	*Onoclea sensibilis*	Sensitive Fern	plugs	24" O.C.
OC	573	*Osmunda cinnamomea*	Cinnamon Fern	plugs	24" O.C.
Sub:	**6595**				
		Wetland Expansion Plants			
AI	335	*Asclepias incarnata*	Swamp Milkweed	plugs	24" O.C.
CL	589	*Carex lurida*	Shallow Sedge	plugs	18" O.C.
CV	168	*Carex vulpinoida*	Fox Sedge	plugs	24" O.C.
EMA	335	*Eupatorium maculatum*	Joe-Pye Weed	plugs	24" O.C.
IC	168	*Impatiens capemsis*	Jewel Weed	plugs	24" O.C.
IVE	589	*Iris versicolor*	Blue Flag	plugs	18" O.C.
JE	335	*Juncus effusus*	Soft Rush	plugs	24" O.C.
OSE	168	*Onoclea sensibilis*	Sensitive Fern	plugs	24" O.C.
OC	168	*Osmunda cinnamomea*	Cinnamon Fern	plugs	24" O.C.
OR	335	*Osmunda regalis var. spectabilis*	Royal Fern	plugs	24" O.C.
SRF	168	*Solidago rugosa*	Wrinkleleaf Goldenrod	plugs	24" O.C.
SCC	589	*Scirpus cyperinus*	Wool Grass	plugs	18" O.C.
SP	295	*Scirpus pungens*	Three-Square Bulrush	plugs	18" O.C.
Sub:	**4240**				

GRAPHIC SCALE
30 0 15 30 60 120
(in feet)
1 INCH = 30 FEET

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NOT FOR CONSTRUCTION

Revisions

Rev.	Date	By	Appr.	Description

Horsley Witten Group, Inc.
Sustainable Environmental Solutions
www.horsleywitten.com
90 Route 6A
Sandwich, MA 02563
508-833-6600 voice
508-833-3150 fax

Checked By: EEB
Drawn By: MEP/AK
Designed By: MEP/AK
Date: FEBRUARY 2024

Plan Set: STONEHAM WETLANDS RESTORATION
75% DESIGN DEVELOPMENT PERMIT PLANS
STONEHAM, MA

Plan Title: PLANTING PLAN

Prepared For:
Town of Stoneham
35 Central Street
Stoneham, MA 02180
Phone: (781) 279-2600
Fax: —

Survey Provided By:
Horsley Witten Group, Inc.
90 Route 6A, Unit 1
Sandwich, MA 02563
Phone: (508) 833-6600
Fax: —
Dated: May 4, 2023

Registration:
COMMONWEALTH OF MASSACHUSETTS — ADAM R. KURTZ — REGISTERED LANDSCAPE ARCHITECT — NO. 1526
2/12/24

Project Number: 21008C
Sheet : 8 of 9
Sheet Number: L-8

last modified: 02/09/24 printed: 02/09/24 by me H:\Projects\2021\21008 Upper Mystic River Watershed\21008C Stoneham\Drawings\21008C LA.dwg

GENERAL PLANTING NOTES:

1. THE FOLLOWING NOTES ARE PROVIDED AS GENERAL PLANTING GUIDELINES ONLY. THOROUGHLY REVIEW THE PROJECT SPECIFICATIONS FOR ALL LANDSCAPE REQUIREMENTS PRIOR TO THE COMMENCEMENT OF ANY LANDSCAPE WORK. SUBMIT IN WRITING TO THE LANDSCAPE ARCHITECT ANY QUESTIONS OR CLARIFICATIONS REQUIRED AT A MINIMUM OF 30 DAYS PRIOR TO ORDERING ANY MATERIALS OR BEGINNING ANY LANDSCAPE CONSTRUCTION.
2. SUBMIT TO THE LANDSCAPE ARCHITECT FOR REVIEW AND APPROVAL ALL REQUIRED LANDSCAPE SUBMITTALS AS DESCRIBED IN THE SPECIFICATIONS INCLUDING A PLANT LIST WITH PLANT SIZE AND QUANTITIES TO BE ORDERED PRIOR TO DELIVERY TO THE PROJECT SITE.
3. FURNISH AND INSTALL ALL PLANTS AS SHOWN ON THE DRAWINGS AND IN THE SIZE AND QUANTITIES SPECIFIED ON THE PLANTING SCHEDULE. PLANT SUBSTITUTION SELECTION MUST BE APPROVED BY BIOLOGIST OR LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
4. ALL PLANTS TO COMPLY WITH APPLICABLE REQUIREMENTS OF ANSI Z60.1 "AMERICAN STANDARD FOR NURSERY STOCK." LATEST EDITION, PUBLISHED BY THE AMERICAN NURSERY AND LANDSCAPE ASSOCIATION INC.
5. PLANTS TO BE GROWN UNDER CLIMATIC CONDITIONS SIMILAR TO THOSE IN THE LOCALITY OF THE PROJECT FOR AT LEAST TWO (2) YEARS. USE HEALTHY NURSERY GROWN PLANTS THAT HAVE A WELL DEVELOPED ROOT SYSTEM. PLANTS MUST BE FREE OF DISEASE, INSECTS, EGGS OR LARVAE.
6. INSTALL PLANTS WITHIN ONE (1) WEEK OF PURCHASE. IF PLANTS ARE TO BE STORED AT THE SITE PRIOR TO PLANTING, IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THEY ARE PROPERLY MAINTAINED, WATERED, AND REMAIN HEALTHY.
7. PROCEED WITH PLANTING ONLY WHEN EXISTING AND FORECASTED WEATHER CONDITIONS PERMIT. SUBMIT TO THE LANDSCAPE ARCHITECT IN WRITING THE PROPOSED PLANTING SCHEDULE. OBTAIN APPROVAL OF PLANTING SCHEDULE FROM THE LANDSCAPE ARCHITECT PRIOR TO PERFORMING ANY WORK.
8. SEASONS FOR PLANTING:

SPRING:	DECIDUOUS:	APRIL 1 TO JUNE 15
	EVERGREEN:	APRIL 1 TO JUNE 15
	PERENNIALS:	APRIL 15 TO JUNE 1
	GROUNDCOVERS:	APRIL 15 TO JUNE 1
FALL:	DECIDUOUS:	SEPTEMBER 15 TO NOVEMBER 15
	EVERGREEN:	SEPTEMBER 15 TO NOVEMBER 15
	PERENNIALS:	SEPTEMBER 15 TO NOVEMBER 15
	GROUNDCOVERS:	SEPTEMBER 15 TO NOVEMBER 15

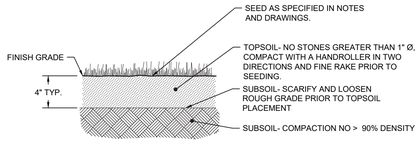
9. PLANTING UNDER FROZEN CONDITIONS WILL NOT BE PERMITTED. PLANTING BEFORE OR AFTER THE ABOVE REFERENCED PLANTING DATES WILL INCREASE THE LIKELIHOOD OF PLANT ESTABLISHMENT FAILURE. ANY DEVIATION FROM THE ABOVE REFERENCED PLANTING DATES IS UNDERTAKEN AT SOLE RISK OF THE CONTRACTOR AND IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE ANY ADDITIONAL MAINTENANCE AND WATERING WHICH MAY BE REQUIRED TO ENSURE SATISFACTORY PLANT ESTABLISHMENT.
10. FURNISH TWO YEAR MANUFACTURER WARRANTY FOR TREES, PLANTS, AND GROUND COVER AGAINST DEFECTS INCLUDING DEATH AND UNSATISFACTORY GROWTH. EXCEPTIONS ARE DEFECTS RESULTING FROM ABNORMAL WEATHER CONDITIONS UNUSUAL FOR WARRANTY PERIOD. THE DATE OF FINAL ACCEPTANCE OF ALL COMPLETED PLANTING WORK ESTABLISHES THE END OF INSTALLATION PERIOD AND THE COMMENCEMENT OF THE ONE YEAR MAINTENANCE AND WARRANTY PERIOD.
11. ALL TREES WITHIN 5'-0" OF WALKWAYS AND SIDEWALKS TO HAVE A 6'-8" STANDARD BRANCHING HEIGHT.
12. INSPECT ALL AREAS TO BE PLANTED OR SEEDED PRIOR TO STARTING ANY LANDSCAPE WORK. REPORT ANY DEFECTS SUCH AS INCORRECT GRADING, INCORRECT SUBGRADE ELEVATIONS OR DRAINAGE PROBLEMS, ETC. TO THE LANDSCAPE ARCHITECT AND ENGINEER PRIOR TO BEGINNING WORK. COMMENCEMENT OF WORK INDICATES ACCEPTANCE OF SUBGRADE AREAS TO BE PLANTED, AND THE LANDSCAPE CONTRACTOR ASSUMES RESPONSIBILITY FOR ALL LANDSCAPE WORK.
13. PROVIDE PROPER PREPARATION OF ALL PROPOSED PLANTED AND SEEDED AREAS PER THE NOTES AND SPECIFICATIONS.
14. ALL PLANT LAYOUT AND ACTUAL PLANTING LOCATIONS ARE TO BE FIELD VERIFIED BY LANDSCAPE ARCHITECT PRIOR TO PLANTING. NOTIFY THE LANDSCAPE ARCHITECT AT A MINIMUM OF 48 HOURS IN ADVANCE PRIOR TO SCHEDULING ANY FIELD INSPECTIONS.
15. BALL AND BURLAP: REMOVE BURLAP AND WIRE BASKETS FROM TOPS OF BALLS AND FROM TOP HALF OF ROOTBALL AS INDICATED ON DRAWINGS. REMOVE PALLETS, IF ANY, BEFORE SETTING.
16. POTTED PLANTS: REMOVE THE PLANT FROM THE POT AND LOOSEN OR SCORE THE ROOTS BEFORE PLANTING TO PROMOTE OUTWARDS ROOT GROWTH INTO THE SOIL.
17. PLUGS: PLANT UPRIGHT AND NOT AT AN ANGLE. DIG PLANTING HOLES LARGE ENOUGH AND DEEP ENOUGH TO ACCOMMODATE THE ENTIRE ROOT MASS. PLANT PLUGS WITH NO TWISTED OR BALLED ROOTS AND WITH NO ROOTS EXPOSED ABOVE THE GRADE LINE. HAND PACK THE SOIL AROUND THE ENTIRE PLUG ROOT MASS.
18. DIG THE THE PLANTING HOLE TO THE SAME DEPTH AS THE ROOT BALL AND TWO TO THREE TIMES WIDER. SCORE ALL SIDES OF THE HOLE, PLACE THE PLANT IN THE HOLE SO THE TOP OF ROOT BALL IS EVEN WITH SOIL SURFACE. FILL THE HOLE HALFWAY AND THEN ADD WATER ALLOWING IT TO SEEP INTO BACK FILLED MATERIAL. BE SURE TO REMOVE ALL AIR POCKETS FROM BACK FILLED SOIL. DO NOT SPREAD SOIL ON TOP OF THE ROOTBALL. IF SOIL IS EXTREMELY POOR, REPLACE BACK FILL WITH GOOD QUALITY TOP SOIL. AMEND THE SOIL, AS NECESSARY.
19. CREATE A 2" TO 4" BERM AROUND THE EDGE OF PLANTING HOLE WITH REMAINING SOIL TO RETAIN WATER.
20. REMOVE ALL PLANT TAGS AND FLAGS FROM THE PLANTS.
21. MULCH ALL PLANTING BEDS AS INDICATED ON DRAWINGS. UNLESS NOTED OTHERWISE, ALL PLANTS TO RECEIVE 2-3 INCHES OF MULCH. DO NOT PILE OR MOUND MULCH AROUND THE PLANT STEMS OR TRUNK.
22. TRIM BROKEN AND DEAD BRANCHES FROM TREES AND SHRUBS AFTER PLANTING. NEVER CUT A LEADER.

GENERAL SEEDING NOTES:

1. SEND A REPRESENTATIVE SAMPLE OF THE TOPSOIL TO A TESTING LABORATORY FOR STANDARD SOIL ANALYSIS AS DESCRIBED IN THE SPECIFICATIONS. SUBMIT TO THE LANDSCAPE ARCHITECT AND ENGINEER TEST RESULTS WITH RECOMMENDED SOIL TREATMENTS TO PROMOTE PLANT AND GRASS GROWTH. CORRECT DEFICIENCIES IN THE LOAM AND STOCKPILED TOPSOIL AS DIRECTED BY THE TESTING AGENCY.
2. ALL AREAS THAT ARE DISTURBED AND/OR GRADED DURING CONSTRUCTION ARE TO BE BROUGHT TO FINISHED GRADE WITH AT LEAST 4" MINIMUM DEPTH OF GOOD QUALITY LOAM AND SEEDED WITH A QUICK GERMINATING GRASS SEED SUCH AS NEW ENGLAND EROSION CONTROL RESTORATION MIX OR AS SPECIFIED ON THE PLANS.
3. PRIOR TO THE PLACEMENT OF TOP SOIL, LOOSEN THE SUBGRADE OF ALL PROPOSED SEEDED AREAS TO A DEPTH OF 6" AND RAKE TO REMOVE STONES LARGER THAN 1 INCH, STICKS, ROOTS, RUBBISH AND OTHER EXTRANEOUS MATTER AND LEGALLY DISPOSE TO AN OFF SITE LOCATION.
4. DO NOT SPREAD TOPSOIL IF THE SUBGRADE IS FROZEN, EXCESSIVELY WET, COMPACTED OR NOT PROPERLY PREPARED PER THE NOTES AND SPECIFICATIONS.
5. SEE SPECIFICATIONS FOR SEASONAL REQUIREMENTS FOR SEEDING.

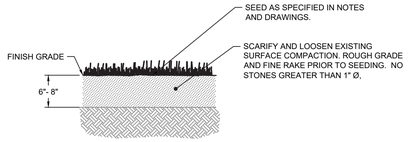
WATERING NOTES:

1. PROVIDE PROPER PLANT CARE, MAINTENANCE AND WATERING ON SITE UNTIL SUCH TIME AS THE LANDSCAPING IS ACCEPTED BY THE PROPERTY OWNER AS SATISFACTORY PER THE SPECIFICATIONS OR AS DETERMINED BY ANY WRITTEN AGREEMENTS BETWEEN THE CONTRACTOR AND PROPERTY OWNER.
2. ESTABLISH AN APPROPRIATE WATERING SCHEDULE FOR ALL PLANT MATERIAL BASED UPON PLANT SPECIES REQUIREMENTS AND SITE CONDITIONS. PROVIDE SCHEDULE IN WRITING TO THE LANDSCAPE ARCHITECT AND OWNER FOR REVIEW AND APPROVAL. ADHERE TO THE APPROVED SCHEDULE UNTIL PLANTS ARE FULLY ESTABLISHED.
3. AT A MINIMUM THE NEWLY SEEDED AND/OR HYDROSEEDED AREAS SHOULD BE WATERED DAILY. SPECIAL CARE SHOULD BE TAKEN TO ENSURE THAT THE SEEDED AREAS ARE NOT SATURATED DURING WATERING. IF AN IRRIGATION SYSTEM IS NOT PROVIDED, A TEMPORARY IRRIGATION SYSTEM OR HANDHELD GARDEN HOSE SHALL BE USED FOR WATERING SEEDED AREAS. THE AREA MUST BE MAINTAINED CONSISTENTLY MOIST FOR THE BEST GERMINATION RESULTS. ADDITIONAL WATERING MAY BE REQUIRED IF PLANTING AND SEEDING OCCUR OUTSIDE OF THE RECOMMENDED PLANTING SEASONS.



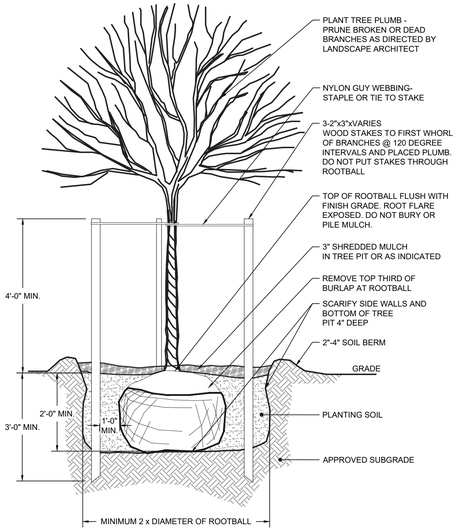
NOTES:
1. SEE LANDSCAPE GRADING SPECIFICATIONS FOR TOPSOIL REQUIREMENTS.
2. CONFIRM SUBGRADES ARE CORRECT AND POSITIVE DRAINAGE IS MAINTAINED PRIOR TO PLACEMENT OF TOPSOIL.
3. NOTIFY ENGINEER/LANDSCAPE ARCHITECT FOR REVIEW OF SUBGRADE PRIOR TO PLACEMENT OF THE TOPSOIL.

LOAM AND SEED
NOT TO SCALE

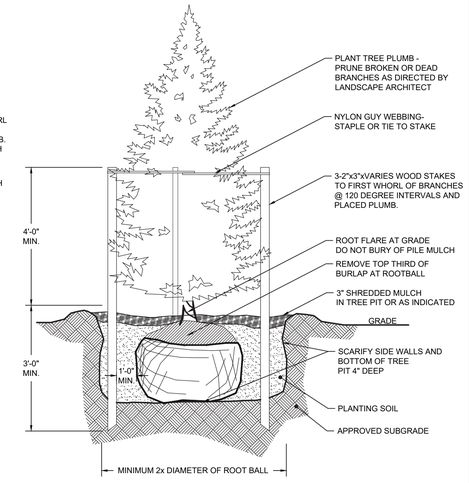


NOTES:
1. NOTIFY ENGINEER/LANDSCAPE ARCHITECT FOR REVIEW PRIOR TO SEEDING.

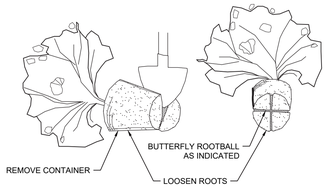
RESTORATION SEEDING
NOT TO SCALE



DECIDUOUS TREE PLANTING
NOT TO SCALE

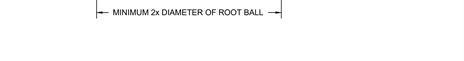


EVERGREEN TREE PLANTING
NOT TO SCALE

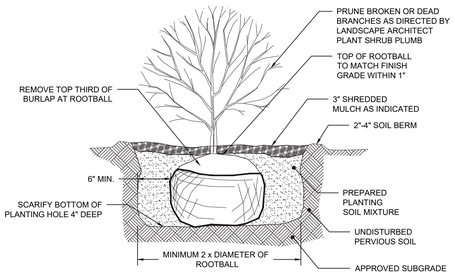


CONTAINER PLANT ROOTBALL TREATMENT
NOT TO SCALE

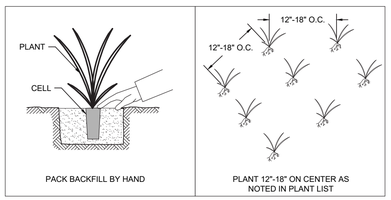
PERENNIAL CONTAINER PLANTING
NOT TO SCALE



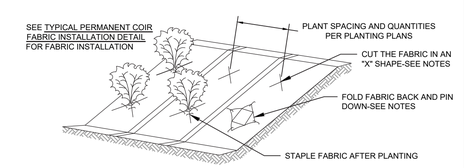
EVERGREEN TREE PLANTING
NOT TO SCALE



SHRUB PLANTING
NOT TO SCALE

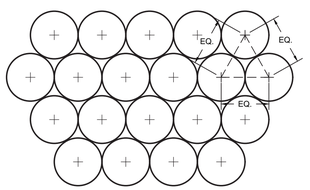


PERENNIAL PLUG PLANTING
NOT TO SCALE



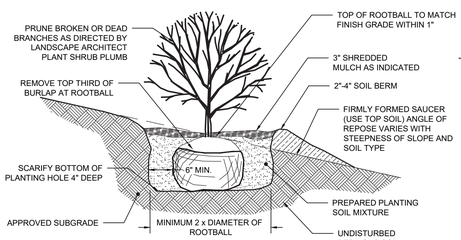
NOTES:
1. CUT THE FABRIC IN AN "X" SHAPE TO ACCOMODATE 2 TIMES THE DIAMETER OF THE ROOTBALL.
2. FOLD FABRIC BACK AND PIN DOWN TO CREATE A HOLE IN THE MAT.
3. DIG THE HOLE PER PLANTING DETAILS.
4. AFTER PLANTING, FOLD FABRIC BACK INTO PLACE AND STAPLE DOWN AS REQUIRED TO SECURE FABRIC IN PLACE.

PLANTING IN EROSION CONTROL BLANKET
NOT TO SCALE



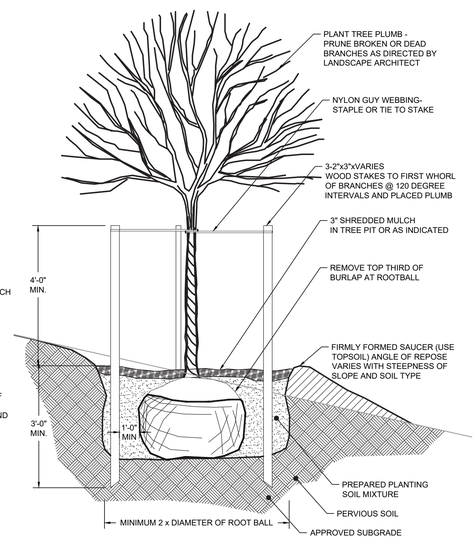
USE EQUIDISTANT TRIANGULAR SPACING FOR PLANTS - FOR ACTUAL SPACING SEE PLANS OR PLANTING SCHEDULE

PLANTING SPACING
NOT TO SCALE



NOTES:
1. PLANTING BACKFILL: 1/3 LOAM, 1/3 SAND, 1/3 PEAT, BY VOLUME.
2. WHEN PLANTING ON SLOPE-MODIFY SLOPE AS SHOWN.

SHRUB PLANTING ON SLOPE
NOT TO SCALE



TREE PLANTING ON SLOPE
NOT TO SCALE

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Revisions

Rev.	Date	By	Appr.	Description

Horsley Witten Group, Inc.
Sustainable Environmental Solutions
www.horsleywitten.com
90 Route 6A
Sandwich, MA 02563
508-833-6600 voice
508-833-3150 fax

Checked By: EEB
Drawn By: MEP,AK
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Date: FEBRUARY 2024

Plan Set: STONEHAM WETLANDS RESTORATION
75% DESIGN DEVELOPMENT PERMIT PLANS
STONEHAM, MA

Plan Title: PLANTING DETAILS

Prepared For:
Town of Stoneham
35 Central Street
Stoneham, MA 02180
Phone: (781) 279-2600
Fax: —

Survey Provided By:
Horsley Witten Group, Inc.
90 Route 6A, Unit 1
Sandwich, MA 02563
Phone: (508) 833-6600
Fax: —
Dated: May 4, 2023

Registration:

Project Number: 21008C
Sheet : 9 of 9
Sheet Number: L-9

last modified: 02/09/24 printed: 02/09/24 by me H:\Projects\2021\21008 Upper Mystic River Watershed\21008C Stoneham\Drawings\21008C LA.dwg

Attachment D – Invasive Species Management Plan

Invasive Species Management Report

Stoneham High School Wetlands

Wetland Restoration and Trails

Stoneham, Ma

Prepared for:
Town of Stoneham
35 Central Street
Stoneham, MA 02180

Prepared by:

Horsley Witten Group
Sustainable Environmental Solutions
112 Water Street • 6th Floor • Boston, MA 02109
857-263-8193 • horsleywitten.com

June 2023

TABLE OF CONTENTS

1.0 Introduction 1
2.0 Site Description 1
3.0 Invasive Species Management 2
3.1 Background on Invasive Species 2
3.2 Goals of Invasives Species Management 2
3.3 Overview of Management Techniques 3
3.4 Notes on Herbicide Use 4
3.5 General Comparison of Glyphosate and Triclopyr 4
3.6 Invasive Species Observed at this Site 5
4.0 Revegetation and Active Restoration 6
5.0 Implementation Plan and Long-Term Management 7
6.0 Summary 9
7.0 References 9

FIGURES

FIGURE 5 – MAP OF TARGETED AREAS FOR PLANT MANAGEMENT

Invasive Species Management Plan
Stoneham High School Wetlands

Stoneham, Massachusetts

1.0 Introduction

The Horsley Witten Group, Inc. (HW) developed this Invasive Species Management Plan (ISMP) as an important component of the wetland restoration project at the Stoneham High School Wetlands. This plan details the results of the site survey performed at the Stoneham High School Wetlands site to identify and assess current conditions relative to invasive plant species on the property. The primary objective of this plan is to provide recommendations for initial and long-term management of the invasive plants that have established and continue to spread at the site. Removal and management of invasive species, in combination with promotion of native species (via planting and natural spread) will increase and fortify the native habitat and ecological health of the site, which will also facilitate improved aesthetics and recreational use at the site.

NOTE: HW recommends that any and all individuals that will be performing invasive plant management activities at the project site read and understand this Invasive Species Management Plan in conjunction with the project plans prior to beginning any work at the site.

2.0 Site Description

The project site is located at 149 Franklin Street, Stoneham, Massachusetts. The majority of the 34.5 acre parcel includes Stoneham High School, recreational areas, driveways, walkways and parking areas (**Attachment A** ,Figures 1 and 2). Residential properties border the project limits to the east and west, and Middlesex Fells State Reservation exists to the south.

The portion of the property surveyed for this report consists of approximately 6.6-acres within the town-owned parcel which supports high school, High School in Stoneham, Massachusetts. It is located at the southern end of the property, behind (south of) the bleachers that face the school's football field and surrounding track. An additional 2.3-acres of the parcel extend southwest of the surveyed area. This additional segment was not included in the surveyed area referenced in this report; although restoration efforts may extend onto this part of the property in the future.

Successful restoration of this smaller segment, which is densely covered with invasive species, will require coordination with the Massachusetts Department of Conservation and Recreation (DCR) because of the way it protrudes onto the DCR-owned Middlesex Fells State Reservation. To differentiate between the two areas, the entire area (i.e., both segments together) is referred to as the "project limit" and the surveyed area referenced in this report is referred to as the "current survey area" This is shown on the attached figures (**Attachment A**).

The combined 8.5 acres on the southern portion of the parcel is a secondary succession woodland with areas of bordering vegetated wetland (BVW) and an intermittent stream. A discussion of the wetland resource areas at this site is provided in the Wetland Delineation Report (June 2023).

3.0 Invasive Species Management

The following sections provide a brief background on invasive species in general, as well as details of the recommendations for management of the invasive species present at this site. These recommendations were developed based on observations by HW during surveys and field reconnaissance visits to the site during the summer of 2021 and spring of 2023. These site visits were performed by HW field ecologists with extensive invasive species management implementation and monitoring experience.

Figure 3 (**Attachment A**) depicts the extent of the most prevalent invasive species observed at the site. Details of the species observed are located in **Attachment B**. The invasive species management recommendations in this plan outline the most effective methods to facilitate improvement, re-establishment, and on-going maintenance of the existing native plant communities at this site, mixed oak woodland/forest and red maple swamp habitats (**Attachment C**).

3.1 Background on Invasive Species

Invasive plants are non-native species that have been introduced to areas outside of their native range, where they often thrive and out-compete/overtake endemic plant communities. These plants are characteristically aggressive, adapted to a wide variety of habitats and climatic conditions, are mostly free of known diseases, parasites, and/or herbivorous predators native to the U.S, and tend to have very effective reproductive abilities. The spread of such plants is a major concern in Massachusetts and the United States as a whole, as they reduce the functions and values of habitats for native flora and fauna within both wetlands and uplands and are a nuisance to manage once they have become established within an area. Adverse economic and environmental impacts are also often incurred by the establishment of invasive species.

Non-native, invasive plants often displace native species over a relatively short period of time, often resulting in a severe reduction of plant community richness, which lacks species diversity. Species diversity is essential to maintaining an ecological balance. As is true with most exotic or non-native species, those found within the site are increasingly common throughout eastern North America, where their spread has led to a decline in species richness and cover of the local native plant communities.

In general, many of the introduced plants were widely cultivated in the past for their ornamental and perceived high wildlife values. Only in more recent years have conservationists and land managers come to realize the importance of preserving native plant communities.

3.2 Goals of Invasives Species Management

While it is possible to exert some control over invasive plant species, they often pose a problem that requires a long-term commitment in terms of vigilance and some level of sustained action in

perpetuity. Despite long-term management requirements, the cost of invasive plant control decreases when invasive plant communities are lower in distribution, density, and abundance. If invasive plants are addressed during the initial stages of establishment when populations are low, the cost of maintaining the area over the long-term will be less than the control effort required to manage a heavily invaded area if the plants are not detected early on. Therefore, it is critical to find ways to identify priority species and populations and to target management efforts to areas of the greatest ecological significance so that available resources are allocated wisely.

In many situations, attaining a final restoration goal of native biodiversity is typically not viable after the initial control methods are performed. Restoring an area to its native condition is often achieved in stages and generally involves multiple removal and restoration cycles. Successful restoration of a minimally managed plant community may occur naturally following removal of invasive plants, but in many cases, communities have been significantly altered and over-taken by invasive plants such that restoration will not occur on its own and may be impractical to attempt. It is important to note that any management activity constitutes a disturbance in and of itself and may provide additional opportunities for invasive plants to become introduced and established after management, as invasive plants often colonize disturbed landscapes at a higher rate than undisturbed landscapes. Care must be taken to monitor all managed and restoration areas.

Those undertaking any management plan should be aware that complete eradication of certain invasive plants may be unlikely. Often, management success is primarily gained through reducing the size of a population and through the prevention of additional spread (i.e., containment). Typically, a management effort lasting between three to five years is required to yield cost-effective, long-term success, where establishment or re-establishment of a diverse and predominantly native plant community is the goal. Complete eradication of invasive species is typically practical only for small-scale populations, generally during the earliest stages of invasion within a new location (e.g., through early detection/rapid response or EDRR). Some land managers have found that eradication efforts within areas less than 2.5 acres have the highest likelihood of success, while only one-third of larger areas were successfully managed (Rejmánek and Pitcairn 2002). This further illustrates the importance of early detection of an invasive species, as the population size can determine the difference between a successful eradication project and implementing a long-term, costly containment strategy.

3.3 Overview of Management Techniques

Selected management techniques are generally based upon the extent of a given species within the vegetation community at a site and employ a strategy that best controls the invasive species, while minimizing the potential for adverse impacts to other desirable (i.e., native) species and the surrounding, integrated environment.

Methods for the management of invasive species fall into three basic categories:

- Physical/Mechanical (cutting, pulling, grubbing, covering, etc.);
- Chemical (use of herbicides); and
- Biological (using living organisms such as insects or domestic grazing animals).

In general, mechanical controls, such as cutting or pulling, have the least adverse impacts on the adjacent, native communities; however, mechanical methods are often not as effective in the control of certain plant species. When warranted and appropriate, chemical controls (through the use of herbicides) are most effective through modest, precisely targeted applications of specific herbicides. Selective application of herbicides also functions to reduce adverse effects on desirable native species from herbicide use.

While not applicable for the Stoneham High School Wetlands site, biological control, or use of living organisms as a control agent, has also been proven effective on certain species. Upon effective removal or control of invasive species, native plant species are then planted and/or promoted (via existing native populations and seed banks) in order to restore a native plant community, which provides a number of ecological benefits, and serves as the primary factor for limiting invasive plant establishment and spread in the future. With establishment of a robust and diverse native plant community, the system becomes more resilient to potential future invasions, and only minor ongoing invasive plant management efforts/interventions are required to maintain the long-term ecological integrity of the site.

3.4 Notes on Herbicide Use

Any all herbicides used for the control of the plant species noted/targeted in this invasive management plan, MUST be an aquatic approved formulation, given the sensitive wetland areas at and/or near the site. Any company, group, or persons applying herbicides to control invasive plant species at the Stoneham High School Wetlands site project MUST possess a valid Massachusetts Commercial Pesticide Applicator License and any required Commercial Certification categories needed to perform the noted invasive plant management work for the designated site areas. For any herbicides used, always read the entire label carefully, follow all mixing and application instructions and wear all recommended personal protective gear and clothing. Contact the Massachusetts Department of Agricultural Resources, Division of Crop and Pest Services for any additional herbicide use requirements, restrictions, or recommendations.

Notice: The recommended chemical control approaches detailed with this invasive plant management plan are based on HW's expertise, experience, and understanding of applicable methodologies and regulations. However, it is the applicator's responsibility to fully understand and comply with all current and applicable Federal, State, and Local pesticide regulations at all times, during the performance of invasive plant management work at Stoneham High School Wetlands site.

3.5 General Comparison of Glyphosate and Triclopyr

Glyphosate

Strongly adsorbs to soil particles, which prevents excessive off-site movement and/or uptake by non-target plants. Degradation occurs primarily via microbial metabolism, but strong adsorption to soil can inhibit microbial metabolism and slow degradation. In soils, the average half-life is 60 days, but ranges from several weeks to years. Degradation rates are slower in soils with high

adsorption rates, and vice versa. Once it touches soil, glyphosate essentially has little or no herbicidal activity. In water, glyphosate is rapidly dissipated through adsorption to suspended and bottom sediments and has a half-life of 12 days to 10 weeks. Relatively low toxicity to terrestrial and aquatic wildlife. Aquatic/wetland use formulations are available (e.g., Rodeo, Aquaneat, etc.).

Triclopyr

Amine salt is the aquatic/wetland-safe formulation (e.g., Garlon 3A), which breaks down to triclopyr acid. Degraded by combination of microbial breakdown, photolysis, and hydrolysis. Average half-life is 30-days, and offsite movement is possible (via ground or surface water) since soil adsorption rates are moderate. Half-life can vary significantly in soils (3.7 to 314 days). Higher soil microbial activity seems to facilitate faster breakdown, so soils that are warm, moist, and have higher organic matter seem to break triclopyr down the fastest. The triclopyr amine salt formulation breaks down rapidly in water (as little as a few hours, with good sunlight) and is relatively non-toxic to terrestrial and aquatic wildlife.

Specific to Knotweed Treatments

Glyphosate treatment demonstrates greater systemic spread to rhizome system overall, particularly for earlier season treatments (prior to second half of summer); however, triclopyr can be highly effective if used later in the growing season, particularly if used in combination with one or more cuttings earlier in the season. The Penn State fact sheet (2005) states that triclopyr treatments injure top growth, but do not injure the root system; however, the TNC factsheet (Controlling Knotweed in the Pacific Northwest, 2004) suggests that using a lower percentage of chemical might allow for better rhizome penetration, as higher percentage mixtures may damage the plants metabolic system too quickly and prevent good translocation, whereas the lower percent mixture may prevent this rapid, acute damage and allow the plant to translocate chemical further into the plant. The SEWISC paper (Herbicide Control of Japanese Knotweed, 2012) has good detail on mixture percentages for both glyphosate and triclopyr.

3.6 Invasive Species Observed at this Site

In Massachusetts, the Massachusetts Invasive Plant Advisory Group (MIPAG) was formed by members representing research institutions, non-profit organizations, the green industry, and state and federal agencies to identify invasive plant species in the Commonwealth of Massachusetts and provide recommendations to the Commonwealth regarding which plants are invasive and what steps should be taken to manage these species.

MIPAG defines invasive plants as "*non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems*." MIPAG adopted this definition and a set of biologically based criteria upon which to objectively evaluate plants suspected to be invasive in the state. MIPAG maintains a list of species determined by MIPAG to be invasive, likely invasive, or potentially invasive, which is presented to the Massachusetts Department of Agricultural Resources (MDAR) on an annual basis and recommended for placement on the state's Prohibited Plant List.

Species of Primary Concern (widespread)

Many invasive species have been identified at this site including trees, shrubs, vines, and herbaceous species, many of which are identified on the MIPAG list. However, the three most highly aggressive species observed to be the most widespread and abundant at this site, are the plants of primary concern. The three species of primary concern include:

- Japanese knotweed (*Fallopia japonica*);
- Asian bittersweet (*Celastrus orbiculatus*); and
- Porcelain-berry (*Ampelopsis brevipedunculata*).

Species of Secondary Concern (sporadic occurrence)

Additional invasive species observed were present at lower densities throughout the site. Although management of these additional invasive species is important to the long-term success of the project, they are of secondary concern relative to the initial removal/management efforts, as their current footprints and densities are not impacting the ecological health of the native communities as significantly as the species of primary concern listed above. Additional species of secondary concern include:

- Norway Maple (*Acer platanoides*);
- European Buckthorn (*Rhamnus cathartica*);
- Glossy Buckthorn (*Frangula alnus*);
- Privet (*Ligustrum* sp.);
- Multiflora Rose (*Rosa multiflora*);
- Japanese Barberry (*Berberis thunbergii*);
- Hairy Willow-Herb (*Epilobium hirsutum*);
- Purple Loosestrife (*Lythrum salicaria*); and
- Garlic Mustard (*Alliaria petiolate*).

While the other identified invasive species will be targeted/included as relatively minor components, the Japanese knotweed, Asian bittersweet, and porcelain-berry will be the primary focus of the overall invasive plant management effort, as achieving control of these species will be a key factor in the long-term success of the restoration at the site.

As invasive plant management moves forward, the site will continue to be monitored for the presence of any existing or newly arriving Massachusetts State-listed invasive species, based on designations from MIPAG. Any newly identified invasive species will be documented and added to the targeted management list.

Attachment B provides a description of the species observed, the extent of the population at this site, and recommended management techniques for each species at this site.

4.0 Revegetation and Active Restoration

Areas that have been designated for invasive plant management will be actively restored with native plantings to discourage invasive regrowth and to bolster the recolonization of native plants, after the initial invasive plant treatments take place. Following the implementation of the

proper management techniques for a species within a given area it is anticipated that some native vegetation will also re-colonize via natural succession, from the existing native populations on site. The active restoration with native species will be implemented through a combination of seeding and planting and will include a mix of site-appropriate herbaceous and woody species.

The seeding and planting components of the native revegetation plan will be implemented in a staggered approach, with seeding to occur immediately after the initial invasive plant management work has been completed in the first year. T

Seeding with Native Seed Mixes

Native seed mixes will be introduced to stabilize disturbed soils within the restoration area and will be compatible with the overall location and anticipated hydrologic regime within the restoration area. Appropriate seed mixes that contain native species suitable for most wetland and forest restoration sites are commercially available. Native seed mixes, such as those supplied by New England Wetland Plants, Inc. (www.newp.com) or acceptable equivalent seed mixes, will be introduced to stabilize the soil surface within the forest and wetland restoration areas and any other areas of temporary disturbance.

All areas designated for seeded with slopes greater than or equal to 2:1 should be secured with an erosion control fabric (NAG SC150BN or equivalent), in order to protect soils (and seed) from erosion while vegetation becomes established.

Introduction of Woody Plant Material

Larger plantings (i.e., trees, shrubs, containers, and plugs) will then be installed only after site invasive plant coverage has been reduced to by at least 80%, which typically requires at least two seasons of effective invasive plant management effort to achieve. This strategy will 1) serve to augment the critically important native revegetation process (with seed), immediately after the initial invasive plant management work, and 2) allow for second-year, follow-up invasive plant management efforts before installing the larger plant material.

The follow-up management efforts in year two will further reduce the invasive plant presence/density at the site, resulting in a less competitive environment for the larger plantings, which are generally be more sensitive and require more initial care for successful establishment. A reduction of the invasive plant coverage by at least 80% before installing the larger plantings improves odds of survival and minimizes excessive plant maintenance actions that may otherwise be needed.

5.0 Implementation Plan and Long-Term Management

Initial implementation of invasive species management efforts will only address the immediate issues. Because of the pervasiveness of invasive species and their ability to aggressively re-colonize through seeds and root fragments, long-term management and monitoring will be necessary. The control methods described above are likely to be successful in controlling many of these species for one to two years without additional action. However, invasive plants often begin to recover within a few years after treatment and will become re-established if follow-up

monitoring and management efforts are not undertaken. Neighboring populations of invasive plants and existing dormant seeds within the soil often reintroduce a species. Annual maintenance is essential to the success of any management plan and should focus on the following:

- Prevention;
- Early detection/rapid response;
- Monitoring managed areas; and
- Preventing the spread of established populations.

Maintenance Plan

Annual maintenance includes monitoring the area and applying recommended treatments as necessary to prevent re-growth. The recommended approaches provided above for the species identified at the site generally apply to both the initial treatments and any follow-up/maintenance treatments. The recommended best practice for invasive plant maintenance, after initial treatments are completed, is to perform follow-up treatments at least two times per year (late-June & late-September are generally recommended) for three to five years after the initial treatments. The exact timing and number of each year's visits and number of years of follow-up maintenance needed to achieve adequate control of the invasive plants is subject to a number of site-specific variables (existing invasive seed bank, effectiveness of initial treatments, etc.) which can be difficult to predict in advance. For the best long-term results, the maintenance phase should be approached in an adaptive manner and utilize site condition feedback from monitoring visits to inform and develop the scope and strategy for each year's maintenance work. Note that the maintenance phase should generally be viewed as an ongoing process, even after successful control has been achieved after a 3-5 year effort, but that the time and cost requirements typically follow a descending trajectory until a modest, minimum annual (or biannual) "bench/floor" level is reached.

Monitoring Plan

Following the implementation of invasive species management and the introduction of native plant species, HW recommends that the site be monitored for a minimum of three growing seasons to ensure successful restoration of the site. Monitoring should occur twice annually (approximately mid-June and mid-September) to assess the relative success of the restored areas. Semi-annual site inspections conducted during late spring and late summer will include an evaluation of the relative health and vigor of the planted vegetation, overall percent of vegetation cover, extent of invasive species regrowth if any, and general compliance with overall restoration plan goals. Additional measures should be taken during construction and monitoring of the restoration area to discourage the invasion of exotic species within the newly disturbed soils. If additional growth of invasive species is encountered, these details will be documented, and recommendations will be provided to the Project Team to facilitate the effectiveness of the adaptive maintenance approach.

6.0 Summary

The native plant and animal communities within the Stoneham High School Wetlands site (and greater watershed) have evolved over time, resulting in unique ecosystems that are particular to the influences of climatic, geologic, and hydrologic processes that have shaped these ecosystems for thousands of years. Human influences have impacted the natural environment with both intentional (e.g., the development of communities, infrastructure, etc.) and unintentional consequences (e.g., the spread of non-native invasive species). This has resulted in the unintentional spread of non-native species that have begun to overtake native plant communities, resulting in a reduced ecological diversity that in turn no longer can effectively support the suite of native wildlife that has co-evolved with the plant community.

Over time, several non-native invasive plant species, which have either colonized or spread within the Stoneham High School Wetlands site. This has resulted in a decline in the native plant communities and its associated wetland resource areas, which in turn, has led to a decline in native habitat that supports native wildlife in the area. Left unchecked, this decline in native species diversity will continue to worsen, and further degradation of ecological functions, values, and integrity of the system can be expected.

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Attachment A

Figures

Figure 1 – USGS Topography

Figure 2 – Proximity to Off-Site Resource Areas

Figure 3 – Invasive Species

Attachment B

Invasive Species at this Site

Attachment C

Targeted Native Plant Communities

Attachment E – Stormwater Analysis Report

STORMWATER ANALYSIS REPORT

STONEHAM HIGH SCHOOL WETLANDS
WETLAND RESTORATION AND TRAILS
STONEHAM, MA

Prepared for:
Town of Stoneham
35 Central Street
Stoneham, MA 02180

Prepared by:

Horsley Witten Group
Sustainable Environmental Solutions
112 Water Street • 6th Floor • Boston, MA 02109
857-263-8193 • horsleywitten.com

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TABLE OF CONTENTS

1.0 STORMWATER AND DRAINAGE NARRATIVE 1
1.1 Existing Conditions 1
Hydrology..... 2
Soils..... 2
1.1.1 Existing Stormwater Management Facilities 3
1.1.2 Drainage Area 3
2.0 DRAINAGE ASSESSMENT METHODOLOGY AND ANALYSIS 4
2.1.1 Conclusions..... 5
REFERENCES..... 5

TABLES

Table 1: Summary of 24 Hour, Type III Design Storms.....2
Table 2: Existing Land Use Coverage.....4
Table 3: Peak Flows and Volumes.....4

APPENDICES

Appendix A: Soil Data

Appendix B: Drainage Area Maps

Appendix C: HydroCAD® Modeling

1.0 STORMWATER AND DRAINAGE NARRATIVE

This Stormwater Analysis Report will provide a summary of the watershed analysis completed for the contributary watershed to the Stoneham High School Wetlands south of Stoneham High School. The Horsley Witten Group (HW) conducted a watershed analysis for multiple evaluation locations (study points) throughout the contributing watershed. The stream and bordering vegetated wetland (BVW) on this property, controlled by the Town of Stoneham Conservation Commission, receives stormwater runoff from a contributary watershed of nearly 150 acres. This runoff can have significant impacts on the stream and wetland within and adjacent to the proposed wetland restoration area. This watershed analysis establishes the baseline for existing watershed characteristics related to stormwater runoff rates and volumes discharging to the subject parcel. The results of this assessment will be used to help evaluate and quantify potential benefits of the wetland restoration relative to flood management, stream channel erosion reduction, and water quality improvements.

HW conducted a site visit on April 4th, 2023, to analyze the existing conditions of the Stoneham High School Wetlands and the surrounding watershed. A full topographic survey and wetland delineation were conducted at Conservation Commission land in April 2023 by Horsley Witten Group. Within the Conservation Commission land there is a bordering vegetated wetland surrounding a stream and a smaller isolated vegetated wetland on the west side of the site. The site is wooded and contains significant debris, invasive species, and the remnants of the channelized stream segment beginning at the outfall of the piped segment under the upstream high school fields. The proposed site improvements will include restoration of the bordering vegetated wetland, removal of debris and invasive plant species, the creation of connecting walking trails and boardwalks, stream bank assessment and stabilization as needed, and increased capacity for the management of stormwater runoff.

The following text and supporting data summarizes the analysis and techniques used to determine stormwater runoff contributing to the Stoneham High School Conservation Commission land.

1.1 Existing Conditions

The goal of this study is to determine the rates and volumes of stormwater runoff draining to the wetland and stream on the Stoneham High School Wetlands, between Upper Darby Road and Karen Drive. Aerial GIS data, obtained from MassGIS, was used to analyze the topographic conditions of the watershed and delineate watershed boundaries. Through this analysis HW determined that runoff from approximately 148.2 acres of land contributed to the stream and wetland at the downgradient property line of the Conservation Commission parcel.

A large portion of residential and commercial land to the north of Franklin Street drained to the wetland and channelized stream located on the Weiss Farm property. This system flows along the small stream, to a 30-inch culvert under Franklin Street and continues as an open channel stream adjacent to the Brookmeadows apartment complex at 135 Franklin Street. Runoff from

the apartment complex and other adjacent residential properties drains to this stream which then travels through a 36-inch culvert beneath the Stoneham High School ball fields. This flow discharges through a large junction box to the wetland and stream to the south of the high school. Runoff from the school building and parking lots is captured through a closed drainage system discharging into the 36-inch culvert. Additional runoff from the neighborhoods to the east and west of the wetlands also discharges overland to the wetlands. The full existing drainage map can be found **Appendix B**.

Stoneham High School is currently under construction, with the new school building and parking lots being constructed on the current ball fields to allow the school to remain operational during construction. HW received the proposed plan set for the high school reconstruction to determine the impact of the construction of stormwater flows to the wetland. The proposed improvements include two sets of large infiltration chambers beneath the new ball fields to treat and infiltrate stormwater runoff. Upon review of the stormwater report and design plans for Stoneham High School, a conservative assumption was made that the stormwater flows would maintain current rates and volumes discharging to the wetland.

Hydrology

Stormwater volume and peak rates were evaluated for the 2-, 10-, 25- and 100-year 24-hour Type III storm events for current conditions. Rainfall depths are based on NOAA Atlas 14 "Plus" precipitation data for the site location. These "Plus" values are obtained by using the 90th percentile confidence intervals and multiplying the upper confidence limit by 0.9. Additionally, a water quality volume (WQV) storm was analyzed. The water quality volume storm event is the required rainfall depth to produce 1-inch of runoff per acre of impervious cover, a rainfall depth of 1.74-inches for this watershed. Rainfall depths are provided in **Table 1**.

Table 1: Summary of 24-hour, Type III Design Storms

Storm Frequency	Depth, in
WQV	1.74
2-Year	3.65
10-Year	5.79
25-Year	7.49
100-Year	10.35

Existing conditions for the contributing drainage area were modeled using HydroCAD software, which combines USDA Soil Conservation Service hydrology and hydraulic techniques (commonly known as SCS TR-55 and TR-20) to generate hydrographs.

Soils

HW conducted a desktop study using the United States Department of Agriculture Natural Resource Conservation Service (USDA NRCS) Web Soil Survey. Soils varied significantly

across the relatively large drainage area. The wetlands north of Franklin Street and south of the high school consisted primarily of Swansea Muck (51A) and Freetown Muck (52A) with some small areas of Udorthents (655). The Stoneham High School property consisted of urban land (602 and 603) and Udorthents (655), these soils are fill and well drained and as such were modeled as NRCS Hydraulic Soil Group (HSG) C. The remainder of the study area consists of a range of soils; however, most are characterized under HSG D with smaller areas of A and B. Soil types for the entire study area are shown in the Drainage Area Map (**Appendix B**).

1.1.1 Existing Stormwater Management Facilities

Small, site specific stormwater management practices are present throughout the study area. Sites such as the assisted living facility at 140 Franklin Street and the apartment complex at 135 Franklin Street have stormwater practices present. However, their effect on the runoff characteristics for larger watersheds is typically negligible and data on their hydraulic performance and storage was not available; therefore, these smaller facilities were not evaluated for this study.

Importantly, the BVW north of Franklin Street was modeled to provide attenuation and storage of the stormwater runoff for the surrounding properties. Stormwater is then conveyed through a series of open channels and culverts before discharging to the BVW.

1.1.2 Drainage Area

The existing drainage area to the Conservation Commission land is 148 acres divided into seven (7) subcatchments. Due to the size of the study area, an average land use approach was used to model the watersheds impervious cover. Under this approach areas are classified by their land use, for example residential, commercial, or pasture. These land uses are assigned average impervious and pervious covers based on NRCS TR-55 documentation for land use type. Residential areas are further classified by lot size, with larger 1/2 acre lots having less impervious cover than smaller 1/8 acre lots. To account for the large recreational fields at Stoneham High School the existing school building, parking lots, and driveways are classified as commercial and the fields are classified as grass. A complete breakdown of the land uses and their corresponding impervious cover is shown in **Table 2** below. Time of concentration is the maximum amount of time it takes for runoff to reach the study point within a subcatchment. For larger subcatchment areas time of concentrations were calculated based on ground cover and flow types; for example, sheet flow was applied to flat slopes, shallow flow applied to steep slopes, channel flow for open channel flow, and direct flow for flows through closed pipes. For smaller subcatchments, DA2, 5a, and 6, flow was classified as a direct entry with a time of concentration of 6 minutes. All time of concentrations can be found in the HydroCAD model in **Appendix C**.

Table 2: Existing Land Use Coverage

Land Use	Area (sq ft)	Area (acres)	%	Impervious Cover (%)
Paved	49,138	1.13	0.8%	100%
Pasture	212,244	4.9	3.3%	0%
Bare Soil	99,720	2.3	1.5%	0%
Water Surface	121,968	2.8	1.9%	100%
1/2 Acre Residential	206,691	4.7	3.2%	25%
1/3 Acre Residential	2,103,855	48.3	32.6%	30%
1/8 Acre Residential	90,861	2.1	1.4%	65%
Commercial	1,007,583	23.1	15.6%	85%
Woods	1,835,291	42.1	28.4%	0%
Grass	730,070	16.8	11.3%	0%
TOTAL	6,457,421	148.2	100%	-

2.0 DRAINAGE ASSESSMENT METHODOLOGY AND ANALYSIS

The drainage assessment was completed by performing the following series of tasks:

- Soils within the watershed are based on NRCS soils data.
- Delineation of existing drainage areas (**Appendix B**)
- Modeling the existing drainage area with HydroCAD® software (**Appendix C**)

The streams and culverts throughout the project area were modeled as reaches and ponds, respectively, in HydroCAD. When available, prior design information for the culverts was used to model this infrastructure. Field observations, MassGIS or field surveyed topography, and photographs were used to model the reaches. The full HydroCAD model is available in **Appendix C.**

Table 3: Peak Flows and Volumes

Event	SP1		SP2		SP3		SP4	
	Flow, *cfs*	Volume, acre-feet (*a-f*)	Flow, *cfs*	Volume, *a-f*	Flow, *cfs*	Volume, *a-f*	Flow, *cfs*	Volume, *a-f*
WQV	3.94	0.384	9.81	1.06	28.24	3.01	29.17	3.20
2-yr	10.16	4.65	36.98	7.13	104.2	13.89	113.3	15.13
10-yr	17.24	15.08	17.10	19.89	199.3	32.95	224.3	35.82
25-yr	23.23	24.69	99.11	31.42	276.9	49.76	316.3	54.09
100-yr	34.28	41.96	146.9	52.01	408.9	79.49	473.6	86.44

2.1.1 Conclusions

The Stoneham High School Wetlands (SP4) receive high volumes of untreated stormwater that impacts the health and function of the stream and bordering vegetative wetland. To restore the wetland measures should be taken to both reduce and treat runoff prior to it reaching the Conservation Commission land. Under existing conditions, the wetland on the Weiss Farm property attenuates a significant amount of runoff. In the 2-, 10-, 25-, and 100-year design storms 9.97, 21.3, 31.1, and 48.2 a-f, respectively, of runoff reaches the wetland from drainage area 1 (DA1). Volumes out of the wetland to study point 1 (SP1) in **Table 3** indicate that the wetland has the capacity to attenuate approximately 6.2 a-f (270,000 cf) of runoff. This significantly reduces flows and volumes throughout the watershed. Implementing green stormwater infrastructure practices within the watershed would mimic the impact the wetland has on the system. Practices such as bioretention areas and infiltration chambers capture and treat stormwater, reducing flows and removing pollutants in runoff. Additionally, reducing impervious cover where feasible would allow stormwater to infiltrate before reaching the drainage system.

HW reviewed the results of the Stormwater Report completed by Nitsch Engineering for the Stoneham High School reconstruction. This study analyzed the impacts of the existing conditions and proposed improvements for the high school reconstruction on the Conservation Commission land. Flows to the wetland in the Nitsch Engineering report were lower for all storm events under both existing and proposed compared to the results of this wetland analysis. The Nitsch Engineering study did not analyze runoff from parcels outside of the high school property. Additionally, rainfall events used in the analysis were smaller than the storm events HW obtained from NOAA Atlas 14 “Plus”. HW believes the assumptions detailed in this wetland analysis are conservative and result in higher flows to the wetland. These assumptions accurately depict drainage conditions within the watershed.

During the data collection and field visit process of this study HW was informed that areas within this watershed have a history of flooding. Specifically, the stream adjacent to the Brookmeadows apartment complex at 135 Franklin Street; however, during the field visit HW observed no signs of flooding. The results of the watershed analysis show that the stream is capable of attenuating approximately 24,000 cf of runoff. Should flooding within the stream persist measures such as the green stormwater practices detailed above would reduce runoff to the stream and lessen flood risk.

REFERENCES

1. NOAA’s National Weather Service: Hydrometeorological Design Studies Center, Precipitation Frequency Data Server for Atlas 14 Point Precipitation Frequency Estimates: MA https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ma

2. Northeast Regional Climate Center and Natural Resources Conservation Service. 2010-2018. Extreme Precipitation for New York and New England. Version 1.12. http://precip.eas.cornell.edu/

APPENDIX A

Site Soil Evaluations Memo
NRCS Soils Report

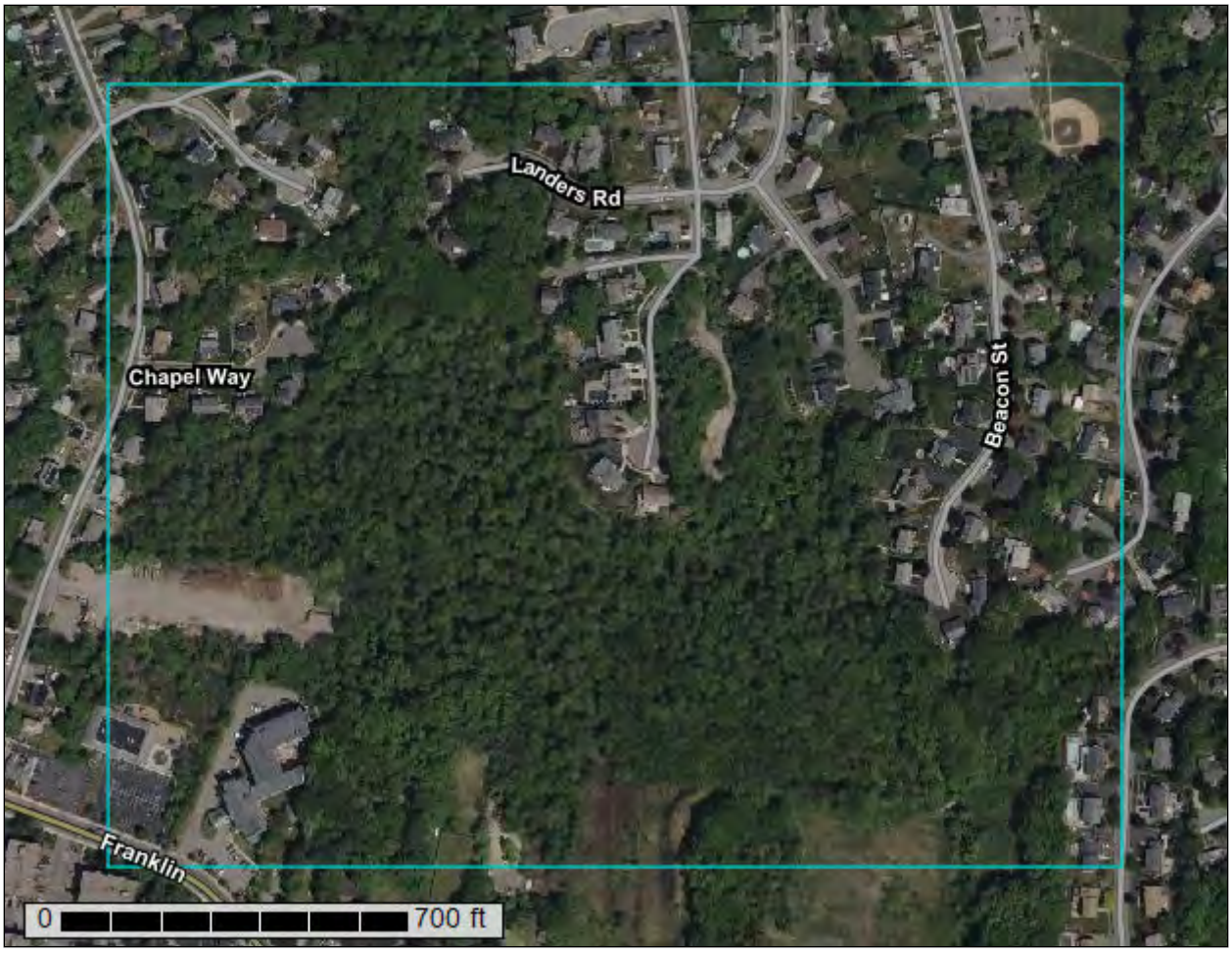
United States Department of Agriculture

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 Middlesex County, Massachusetts



May 17, 2023

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

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....8
Soil Map.....9
Legend.....10
Map Unit Legend.....11
Map Unit Descriptions.....11
Middlesex County, Massachusetts.....13
51A—Swansea muck, 0 to 1 percent slopes.....13
52A—Freetown muck, 0 to 1 percent slopes.....14
104D—Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes.....16
105E—Rock outcrop-Hollis complex, 3 to 35 percent slopes.....18
260B—Sudbury fine sandy loam, 3 to 8 percent slopes.....20
603—Urban land, wet substratum.....21
622C—Paxton-Urban land complex, 3 to 15 percent slopes.....22
631C—Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky.....24
654—Udorthents, loamy.....27
655—Udorthents, wet substratum.....28
References.....30

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

Map Scale: 1:4,060 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil 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: Middlesex County, Massachusetts
Survey Area Data: Version 22, Sep 9, 2022

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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	6.6	8.8%
52A	Freetown muck, 0 to 1 percent slopes	19.7	26.5%
104D	Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes	1.2	1.6%
105E	Rock outcrop-Hollis complex, 3 to 35 percent slopes	9.7	13.1%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	9.3	12.5%
603	Urban land, wet substratum	2.8	3.7%
622C	Paxton-Urban land complex, 3 to 15 percent slopes	0.1	0.1%
631C	Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky	13.6	18.4%
654	Udorthents, loamy	1.1	1.4%
655	Udorthents, wet substratum	10.2	13.8%
Totals for Area of Interest		**74.2**	**100.0%**

Map Unit Descriptions

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.

Middlesex County, Massachusetts

51A—Swansea muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2trl2
Elevation: 0 to 1,140 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Swansea and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Swansea

Setting

Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits

Typical profile

Oa1 - 0 to 24 inches: muck
Oa2 - 24 to 34 inches: muck
Cg - 34 to 79 inches: coarse sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 16.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Freetown

Percent of map unit: 10 percent
Landform: Bogs, swamps

Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Freetown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown

Setting

Landform: Depressions, depressions, swamps, kettles, marshes, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Whitman

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 5 percent
Landform: Bogs, swamps, marshes, depressions, depressions, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

104D—Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 98yh
Elevation: 0 to 1,530 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hollis and similar soils: 35 percent
Rock outcrop: 30 percent
Charlton and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Head slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam
H2 - 2 to 14 inches: fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Parent material: Granite and gneiss

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Charlton

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over friable loamy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 5 inches: fine sandy loam
H2 - 5 to 22 inches: sandy loam
H3 - 22 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Canton

Percent of map unit: 10 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Head slope
Down-slope shape: Convex
Across-slope shape: Convex

Hydric soil rating: No

Montauk

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Head slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Unnamed

Percent of map unit: 2 percent

105E—Rock outcrop-Hollis complex, 3 to 35 percent slopes

Map Unit Setting

National map unit symbol: 98yj
Elevation: 0 to 2,100 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Rock outcrop: 50 percent
Hollis and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rock Outcrop

Setting

Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Granite and gneiss

Properties and qualities

Slope: 5 to 20 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Hollis

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam
H2 - 2 to 14 inches: fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 35 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Minor Components

Whitman

Percent of map unit: 3 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 1 percent
Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Unnamed

Percent of map unit: 1 percent

260B—Sudbury fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9915
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sudbury and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sudbury

Setting

Landform: Plains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: fine sandy loam
H2 - 8 to 20 inches: fine sandy loam
H3 - 20 to 27 inches: loamy sand
H4 - 27 to 65 inches: stratified gravelly coarse sand to sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 8 percent
Landform: Terraces, plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Wareham

Percent of map unit: 4 percent
Landform: Depressions, deltas, terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Windsor

Percent of map unit: 2 percent
Landform: Flats, deltas, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Unnamed

Percent of map unit: 1 percent

603—Urban land, wet substratum

Map Unit Setting

National map unit symbol: 9951
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land over alluvium and/or marine deposits

Minor Components

Udorthents, loamy
Percent of map unit: 10 percent
Hydric soil rating: No

Rock outcrop
Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

622C—Paxton-Urban land complex, 3 to 15 percent slopes

Map Unit Setting
National map unit symbol: 2w67k
Elevation: 0 to 930 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Paxton and similar soils: 45 percent
Urban land: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton

Setting
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile
Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Woodbridge

Percent of map unit: 9 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Charlton

Percent of map unit: 6 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex

Hydric soil rating: No

Udorthents

Percent of map unit: 4 percent
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

Percent of map unit: 1 percent
Landform: Drumlins, depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

631C—Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky

Map Unit Setting

National map unit symbol: vr1g
Elevation: 0 to 1,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton and similar soils: 45 percent
Urban land: 35 percent
Hollis and similar soils: 10 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Ground moraines, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over friable loamy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 5 inches: fine sandy loam
H2 - 5 to 22 inches: sandy loam

H3 - 22 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Description of Hollis

Setting

Landform: Hillslopes, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam
H2 - 2 to 14 inches: fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Minor Components

Canton
Percent of map unit: 4 percent
Landform: Hills
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Rock outcrop
Percent of map unit: 2 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

Udorthents, loamy
Percent of map unit: 2 percent
Hydric soil rating: No

Scituate
Percent of map unit: 1 percent
Landform: Hillslopes, depressions
Landform position (two-dimensional): Summit, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Montauk
Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Head slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

654—Udorthents, loamy

Map Unit Setting

National map unit symbol: vr1l
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, loamy, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Loamy

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Udorthents, sandy

Percent of map unit: 10 percent
Hydric soil rating: No

Urban land

Percent of map unit: 5 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Udorthents, wet substratum

Percent of map unit: 5 percent
Hydric soil rating: Yes

655—Udorthents, wet substratum

Map Unit Setting

National map unit symbol: vr1n
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, wet substratum, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Wet Substratum

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Urban land

Percent of map unit: 8 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Freetown

Percent of map unit: 4 percent
Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent
Landform: Depressions, bogs

Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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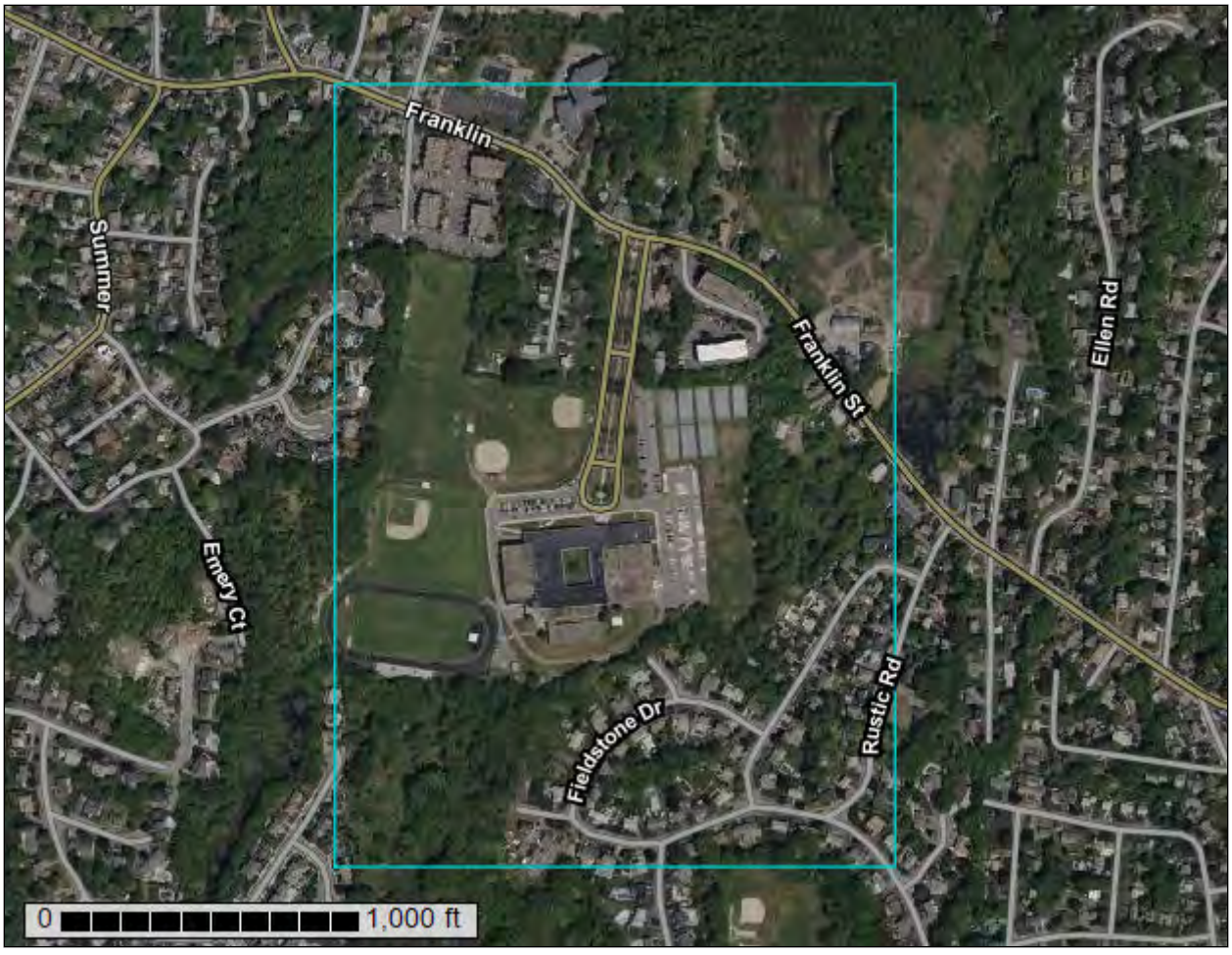
Custom Soil Resource Report for Middlesex County, Massachusetts



May 17, 2023

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

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....8
Soil Map.....9
Legend.....10
Map Unit Legend.....11
Map Unit Descriptions.....11
Middlesex County, Massachusetts.....14
51A—Swansea muck, 0 to 1 percent slopes.....14
52A—Freetown muck, 0 to 1 percent slopes.....15
104D—Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes.....17
105E—Rock outcrop-Hollis complex, 3 to 35 percent slopes.....19
253D—Hinckley loamy sand, 15 to 25 percent slopes.....21
260B—Sudbury fine sandy loam, 3 to 8 percent slopes.....22
602—Urban land.....24
603—Urban land, wet substratum.....25
626B—Merrimac-Urban land complex, 0 to 8 percent slopes.....26
631C—Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky.....28
655—Udorthents, wet substratum.....30
References.....32

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

Map Scale: 1:4,680 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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: Middlesex County, Massachusetts
Survey Area Data: Version 22, Sep 9, 2022

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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	4.4	3.9%
52A	Freetown muck, 0 to 1 percent slopes	4.5	4.0%
104D	Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes	2.2	1.9%
105E	Rock outcrop-Hollis complex, 3 to 35 percent slopes	9.1	8.0%
253D	Hinckley loamy sand, 15 to 25 percent slopes	0.0	0.0%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	2.9	2.5%
602	Urban land	13.6	11.9%
603	Urban land, wet substratum	5.4	4.8%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	2.5	2.2%
631C	Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky	38.3	33.7%
655	Udorthents, wet substratum	31.0	27.2%
Totals for Area of Interest		**113.8**	**100.0%**

Map Unit Descriptions

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.

Middlesex County, Massachusetts

51A—Swansea muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2trl2
Elevation: 0 to 1,140 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Swansea and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Swansea

Setting

Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits

Typical profile

Oa1 - 0 to 24 inches: muck
Oa2 - 24 to 34 inches: muck
Cg - 34 to 79 inches: coarse sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 16.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Freetown

Percent of map unit: 10 percent
Landform: Bogs, swamps

Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Freetown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown

Setting

Landform: Depressions, depressions, swamps, kettles, marshes, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Whitman

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 5 percent
Landform: Bogs, swamps, marshes, depressions, depressions, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

104D—Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 98yh
Elevation: 0 to 1,530 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hollis and similar soils: 35 percent
Rock outcrop: 30 percent
Charlton and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Head slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam
H2 - 2 to 14 inches: fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Parent material: Granite and gneiss

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Charlton

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over friable loamy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 5 inches: fine sandy loam
H2 - 5 to 22 inches: sandy loam
H3 - 22 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Canton

Percent of map unit: 10 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Head slope
Down-slope shape: Convex
Across-slope shape: Convex

Hydric soil rating: No

Montauk

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Head slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Unnamed

Percent of map unit: 2 percent

105E—Rock outcrop-Hollis complex, 3 to 35 percent slopes

Map Unit Setting

National map unit symbol: 98yj
Elevation: 0 to 2,100 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Rock outcrop: 50 percent
Hollis and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rock Outcrop

Setting

Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Granite and gneiss

Properties and qualities

Slope: 5 to 20 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Hollis

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam
H2 - 2 to 14 inches: fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 35 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Minor Components

Whitman

Percent of map unit: 3 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 1 percent
Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Unnamed

Percent of map unit: 1 percent

253D—Hinckley loamy sand, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 2svmc
Elevation: 0 to 1,460 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Kames, kame terraces, outwash deltas, outwash terraces, moraines, eskers, outwash plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 8 percent
Landform: Eskers, outwash terraces, kames, outwash plains, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Kames, kame terraces, moraines, eskers, outwash deltas, outwash terraces, outwash plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 2 percent
Landform: Eskers, kame terraces, outwash deltas, moraines, outwash plains, outwash terraces
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Convex, concave, linear
Across-slope shape: Convex, concave, linear
Hydric soil rating: No

260B—Sudbury fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9915
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sudbury and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sudbury

Setting

Landform: Plains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: fine sandy loam
H2 - 8 to 20 inches: fine sandy loam
H3 - 20 to 27 inches: loamy sand
H4 - 27 to 65 inches: stratified gravelly coarse sand to sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 8 percent
Landform: Terraces, plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Wareham

Percent of map unit: 4 percent
Landform: Depressions, deltas, terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip

Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Windsor

Percent of map unit: 2 percent
Landform: Flats, deltas, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Unnamed

Percent of map unit: 1 percent

602—Urban land

Map Unit Setting

National map unit symbol: 9950
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Udorthents, loamy

Percent of map unit: 5 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope

Down-slope shape: Concave
Across-slope shape: Concave

Udorthents, wet substratum
Percent of map unit: 5 percent
Hydric soil rating: No

603—Urban land, wet substratum

Map Unit Setting
National map unit symbol: 9951
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition
Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land over alluvium and/or marine deposits

Minor Components

Udorthents, loamy
Percent of map unit: 10 percent
Hydric soil rating: No

Rock outcrop
Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Crest, side slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Windsor

Percent of map unit: 5 percent
Landform: Outwash terraces, dunes, outwash plains, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, crest, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

631C—Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky

Map Unit Setting

National map unit symbol: vr1g
Elevation: 0 to 1,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton and similar soils: 45 percent
Urban land: 35 percent
Hollis and similar soils: 10 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Ground moraines, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over friable loamy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 5 inches: fine sandy loam
H2 - 5 to 22 inches: sandy loam
H3 - 22 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Description of Hollis

Setting

Landform: Hillslopes, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam
H2 - 2 to 14 inches: fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Minor Components

Canton

Percent of map unit: 4 percent
Landform: Hills
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Rock outcrop
Percent of map unit: 2 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

Udorthents, loamy
Percent of map unit: 2 percent
Hydric soil rating: No

Scituate
Percent of map unit: 1 percent
Landform: Hillslopes, depressions
Landform position (two-dimensional): Summit, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Montauk
Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Head slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

655—Udorthents, wet substratum

Map Unit Setting
National map unit symbol: vr1n
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Udorthents, wet substratum, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Wet Substratum

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Urban land

Percent of map unit: 8 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Freetown

Percent of map unit: 4 percent
Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent
Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

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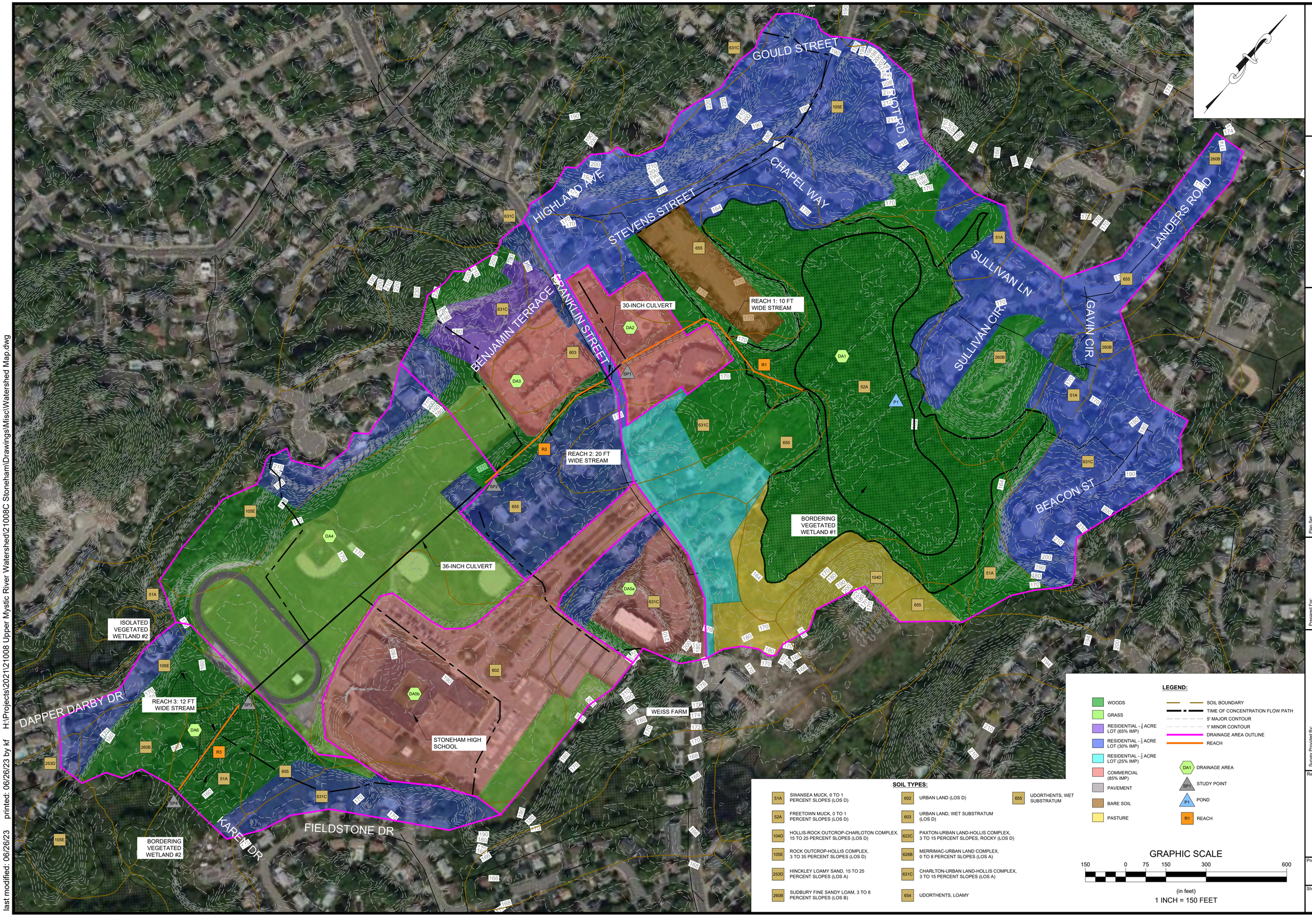
APPENDIX B

Drainage Area Map



SOIL TYPES:

51A	SWANSEA MUCK, 0 TO 1 PERCENT SLOPES (LOS D)	602	URBAN LAND (LOS D)	655	UDORTHENTS, WET SUBSTRATUM
52A	FREETOWN MUCK, 0 TO 1 PERCENT SLOPES (LOS D)	603	URBAN LAND, WET SUBSTRATUM (LOS D)		
104D	HOLLIS-ROCK OUTCROP-CHARLOTON COMPLEX, 15 TO 25 PERCENT SLOPES (LOS D)	622C	PAXTON-URBAN LAND-HOLLIS COMPLEX, 3 TO 15 PERCENT SLOPES, ROCKY (LOS D)		
105E	ROCK OUTCROP-HOLLIS COMPLEX, 3 TO 35 PERCENT SLOPES (LOS D)	626B	MERRIMAC-URBAN LAND COMPLEX, 0 TO 8 PERCENT SLOPES (LOS A)		
253D	HINCKLEY LOAMY SAND, 15 TO 25 PERCENT SLOPES (LOS A)	631C	CHARLTON-URBAN LAND-HOLLIS COMPLEX, 3 TO 15 PERCENT SLOPES (LOS A)		
260B	SUDBURY FINE SANDY LOAM, 3 TO 8 PERCENT SLOPES (LOS B)	654	UDORTHENTS, LOAMY		

LEGEND:

- WOODS
- GRASS
- RESIDENTIAL - ½ ACRE LOT (65% IMP)
- RESIDENTIAL - ¼ ACRE LOT (30% IMP)
- RESIDENTIAL - ⅛ ACRE LOT (25% IMP)
- COMMERCIAL (85% IMP)
- PAVEMENT
- BARE SOIL
- PASTURE
- SOIL BOUNDARY
- TIME OF CONCENTRATION FLOW PATH
- 5' MAJOR CONTOUR
- 1' MINOR CONTOUR
- DRAINAGE AREA OUTLINE
- REACH
- DA1 DRAINAGE AREA
- SP1 STUDY POINT
- P1 POND
- R1 REACH

GRAPHIC SCALE

150 0 75 150 300 600

(in feet)

1 INCH = 150 FEET

Revisions

Rev.	Date	By	Appr.	Description

Horsley Witten Group, Inc.
Sustainable Environmental Solutions
www.horsleywitten.com
90 Route 6A
Sandwich, MA 02563
508-833-6600 voice
508-833-3150 fax

Designed By: KF | Drawn By: KF | Checked By: JAVEC | Date: JUNE 2023

Plan Set: UPPER MYSTIC WATERSHED STONEHAM WATERSHED IMPROVEMENTS STONEHAM, MASSACHUSETTS

Plan Title: EXISTING DRAINAGE AREA MAP

Prepared For:
Town of Stoneham
35 Central Street
Stoneham, MA 02180
Phone:
Fax:

Survey Provided By:
Horsley Witten Group
90 Route 6A
Sandwich, MA 02563
Phone: (508) 833-6600
Fax: (508) 833-3150
Dated: February, 2006

Registration:

DRAFT
NOT FOR CONSTRUCTION

Project Number: 21008C

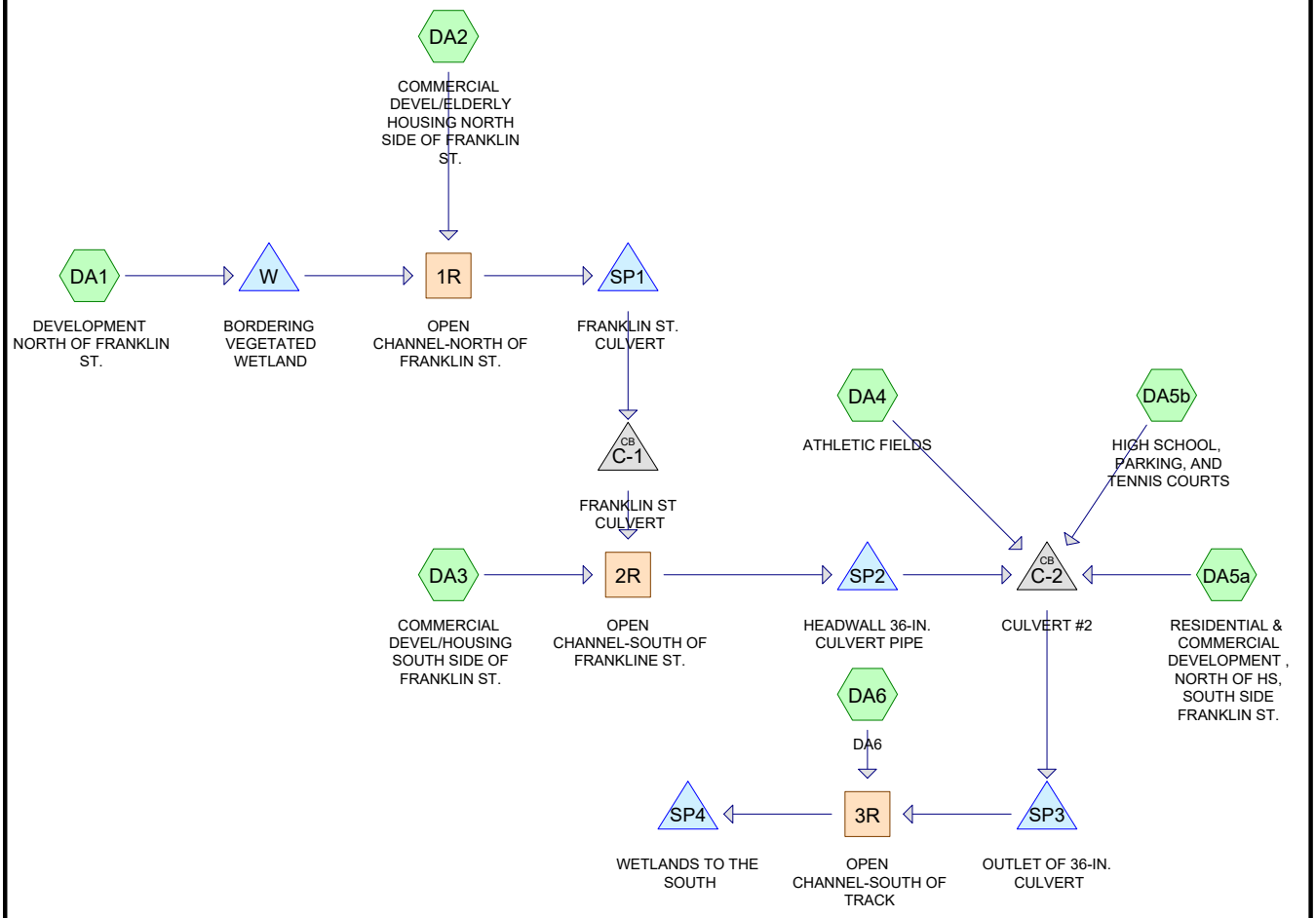
Sheet : 1 of 1

Sheet Number: C - 1

last modified: 06/26/23 printed: 06/26/23 by kf H:\Projects\2021\21008 Upper Mystic River Watershed\21008C Stoneham\Drawings\Misc\Watershed Map.dwg

APPENDIX C

HydroCAD® Drainage Calculations



Subcat Reach Pond Link

Routing Diagram for STONEHAM EX

Prepared by {enter your company name here}, Printed 6/26/2023

HydroCAD® 10.10-4a s/n 01445 © 2020 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 yr	Type III 24-hr		Default	24.00	1	3.65	2
2	10 yr	Type III 24-hr		Default	24.00	1	5.79	2
3	25 yr	Type III 24-hr		Default	24.00	1	7.49	2
4	100 yr	Type III 24-hr		Default	24.00	1	10.35	2
5	WQV	Type III 24-hr		Default	24.00	1	1.74	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.367	54	1/2 acre lots, 25% imp, HSG A (DA1)
1.378	85	1/2 acre lots, 25% imp, HSG D (DA1)
13.481	57	1/3 acre lots, 30% imp, HSG A (DA1, DA3, DA5a, DA5b, DA6)
5.629	72	1/3 acre lots, 30% imp, HSG B (DA1, DA6)
29.648	86	1/3 acre lots, 30% imp, HSG D (DA1, DA3, DA4, DA5a, DA6)
0.299	77	1/8 acre lots, 65% imp, HSG A (DA3)
1.787	92	1/8 acre lots, 65% imp, HSG D (DA3)
0.070	49	50-75% Grass cover, Fair, HSG A (DA6)
1.251	79	50-75% Grass cover, Fair, HSG C (DA5b)
1.180	84	50-75% Grass cover, Fair, HSG D (DA3, DA6)
13.800	74	>75% Grass cover, Good, HSG C (DA4)
2.289	94	Fallow, bare soil, HSG D (DA1)
4.872	84	Pasture/grassland/range, Fair, HSG D (DA1)
0.184	98	Paved parking, HSG D (DA6)
0.944	98	Unconnected pavement, HSG C (DA4)
4.856	89	Urban commercial, 85% imp, HSG A (DA2, DA3, DA5a, DA5b)
18.274	95	Urban commercial, 85% imp, HSG D (DA2, DA3, DA5b)
2.800	98	Water Surface, HSG A (DA1)
2.094	36	Woods, Fair, HSG A (DA1, DA5a, DA6)
4.287	60	Woods, Fair, HSG B (DA1, DA6)
35.723	79	Woods, Fair, HSG D (DA1, DA3, DA4, DA6)
148.213	**79**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
26.967	HSG A	DA1, DA2, DA3, DA5a, DA5b, DA6
9.916	HSG B	DA1, DA6
15.995	HSG C	DA4, DA5b
95.335	HSG D	DA1, DA2, DA3, DA4, DA5a, DA5b, DA6
0.000	Other	
148.213		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
3.367	0.000	0.000	1.378	0.000	4.745	1/2 acre lots, 25% imp	DA1
13.481	5.629	0.000	29.648	0.000	48.758	1/3 acre lots, 30% imp	DA1, DA3, DA4, DA5a, DA5b, DA6
0.299	0.000	0.000	1.787	0.000	2.086	1/8 acre lots, 65% imp	DA3
0.070	0.000	1.251	1.180	0.000	2.501	50-75% Grass cover, Fair	DA3, DA5b, DA6
0.000	0.000	13.800	0.000	0.000	13.800	>75% Grass cover, Good	DA4
0.000	0.000	0.000	2.289	0.000	2.289	Fallow, bare soil	DA1
0.000	0.000	0.000	4.872	0.000	4.872	Pasture/grassland/range, Fair	DA1
0.000	0.000	0.000	0.184	0.000	0.184	Paved parking	DA6
0.000	0.000	0.944	0.000	0.000	0.944	Unconnected pavement	DA4
4.856	0.000	0.000	18.274	0.000	23.130	Urban commercial, 85% imp	DA2, DA3, DA5a, DA5b
2.800	0.000	0.000	0.000	0.000	2.800	Water Surface	DA1
2.094	4.287	0.000	35.723	0.000	42.104	Woods, Fair	DA1, DA3, DA4, DA5a, DA6
26.967	**9.916**	**15.995**	**95.335**	**0.000**	**148.213**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	C-1	161.60	160.37	90.0	0.0137	0.013	30.0	0.0	0.0
2	C-2	162.50	159.79	1,170.0	0.0023	0.013	36.0	0.0	0.0

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DA1: DEVELOPMENT Runoff Area=77.543 ac 18.05% Impervious Runoff Depth=1.54"
Flow Length=520' Tc=15.9 min CN=77 Runoff=101.89 cfs 9.970 af

Subcatchment DA2: COMMERCIAL Runoff Area=3.723 ac 85.00% Impervious Runoff Depth=3.09"
Tc=6.0 min CN=95 Runoff=12.63 cfs 0.958 af

Subcatchment DA3: COMMERCIAL Runoff Area=14.449 ac 39.02% Impervious Runoff Depth=2.07"
Flow Length=906' Tc=8.3 min CN=84 Runoff=32.38 cfs 2.487 af

Subcatchment DA4: ATHLETIC FIELDS Runoff Area=20.386 ac 7.84% Impervious Runoff Depth=1.54"
Flow Length=339' Tc=16.1 min CN=77 Runoff=26.70 cfs 2.621 af

Subcatchment DA5a: RESIDENTIAL & Runoff Area=4.520 ac 64.87% Impervious Runoff Depth=1.54"
Tc=6.0 min CN=77 Runoff=8.07 cfs 0.581 af

Subcatchment DA5b: HIGH SCHOOL, Runoff Area=15.345 ac 76.43% Impervious Runoff Depth=2.78"
Flow Length=242' Tc=15.5 min CN=92 Runoff=36.47 cfs 3.556 af

Subcatchment DA6: DA6 Runoff Area=12.247 ac 13.89% Impervious Runoff Depth=1.22"
Tc=6.0 min CN=72 Runoff=16.70 cfs 1.245 af

Reach 1R: OPEN CHANNEL-NORTH OF Avg. Flow Depth=1.73' Max Vel=1.11 fps Inflow=12.63 cfs 4.659 af
n=0.040 L=463.0' S=0.0009 '/' Capacity=26.93 cfs Outflow=10.16 cfs 4.651 af

Reach 2R: OPEN CHANNEL-SOUTH OF Avg. Flow Depth=2.02' Max Vel=1.81 fps Inflow=42.33 cfs 7.138 af
n=0.040 L=590.0' S=0.0017 '/' Capacity=119.54 cfs Outflow=36.98 cfs 7.129 af

Reach 3R: OPEN CHANNEL-SOUTH Avg. Flow Depth=1.68' Max Vel=3.43 fps Inflow=115.44 cfs 15.132 af
L=390.0' S=0.0077 '/' Capacity=2,227.64 cfs Outflow=113.32 cfs 15.129 af

Pond C-1: FRANKLIN ST CULVERT Peak Elev=164.30' Inflow=10.16 cfs 4.651 af
30.0" Round Culvert n=0.013 L=90.0' S=0.0137 '/' Outflow=10.16 cfs 4.651 af

Pond C-2: CULVERT #2 Peak Elev=196.51' Inflow=104.20 cfs 13.887 af
36.0" Round Culvert n=0.013 L=1,170.0' S=0.0023 '/' Outflow=104.20 cfs 13.887 af

Pond SP1: FRANKLIN ST. CULVERT Inflow=10.16 cfs 4.651 af
Primary=10.16 cfs 4.651 af

Pond SP2: HEADWALL 36-IN. CULVERT PIPE Inflow=36.98 cfs 7.129 af
Primary=36.98 cfs 7.129 af

Pond SP3: OUTLET OF 36-IN. CULVERT Inflow=104.20 cfs 13.887 af
Primary=104.20 cfs 13.887 af

Pond SP4: WETLANDS TO THE SOUTH Inflow=113.32 cfs 15.129 af
Primary=113.32 cfs 15.129 af

Pond W: BORDERING VEGETATED Peak Elev=162.57' Storage=9.311 af Inflow=101.89 cfs 9.970 af
Outflow=0.97 cfs 3.701 af

Total Runoff Area = 148.213 ac Runoff Volume = 21.418 af Average Runoff Depth = 1.73"
72.50% Pervious = 107.455 ac 27.50% Impervious = 40.758 ac

Summary for Subcatchment DA1: DEVELOPMENT NORTH OF FRANKLIN ST.

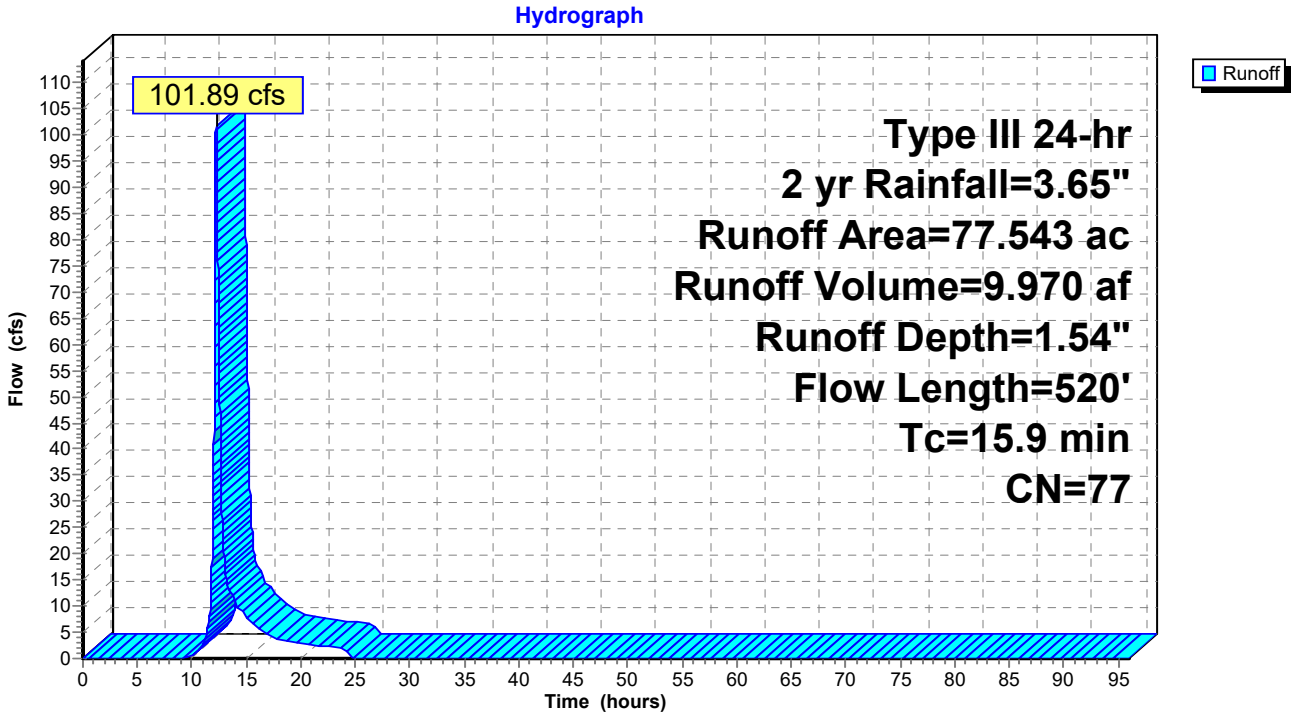
Runoff = 101.89 cfs @ 12.22 hrs, Volume= 9.970 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.65"

Area (ac)	CN	Description
25.200	79	Woods, Fair, HSG D
2.521	60	Woods, Fair, HSG B
1.749	36	Woods, Fair, HSG A
2.289	94	Fallow, bare soil, HSG D
4.872	84	Pasture/grassland/range, Fair, HSG D
3.367	54	1/2 acre lots, 25% imp, HSG A
1.378	85	1/2 acre lots, 25% imp, HSG D
20.876	86	1/3 acre lots, 30% imp, HSG D
7.254	57	1/3 acre lots, 30% imp, HSG A
5.237	72	1/3 acre lots, 30% imp, HSG B
2.800	98	Water Surface, HSG A
77.543	77	Weighted Average
63.547	73	81.95% Pervious Area
13.996	98	18.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	48	0.0140	0.09		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.21"
0.5	68	0.2180	2.33		**Shallow Concentrated Flow, Shallow Conc-woods** Woodland Kv= 5.0 fps
1.2	404	0.0720	5.45		**Shallow Concentrated Flow, Shallow Conc-gutter line** Paved Kv= 20.3 fps
5.0					**Direct Entry, Conveyance through pipe network**
15.9	520	Total			

Subcatchment DA1: DEVELOPMENT NORTH OF FRANKLIN ST.



ummary for Subcatchment DA2: COMMERCIAL DEVEL/ELDERLY HOUSING NORTH SIDE OF FRANKLIN

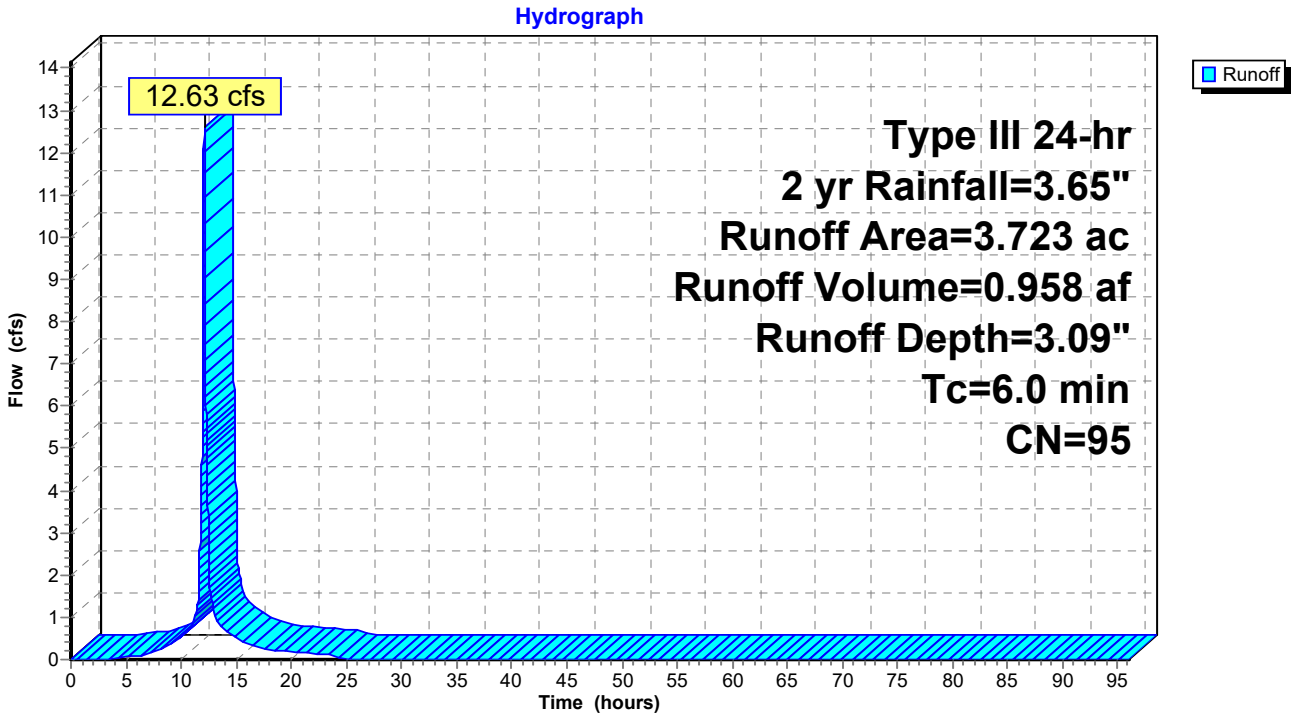
Runoff = 12.63 cfs @ 12.08 hrs, Volume= 0.958 af, Depth= 3.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.65"

Area (ac)	CN	Description
3.597	95	Urban commercial, 85% imp, HSG D
0.126	89	Urban commercial, 85% imp, HSG A
3.723	95	Weighted Average
0.558	77	15.00% Pervious Area
3.165	98	85.00% Impervious Area

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

Subcatchment DA2: COMMERCIAL DEVEL/ELDERLY HOUSING NORTH SIDE OF FRANKLIN ST.



Summary for Subcatchment DA3: COMMERCIAL DEVEL/HOUSING SOUTH SIDE OF FRANKLIN ST.

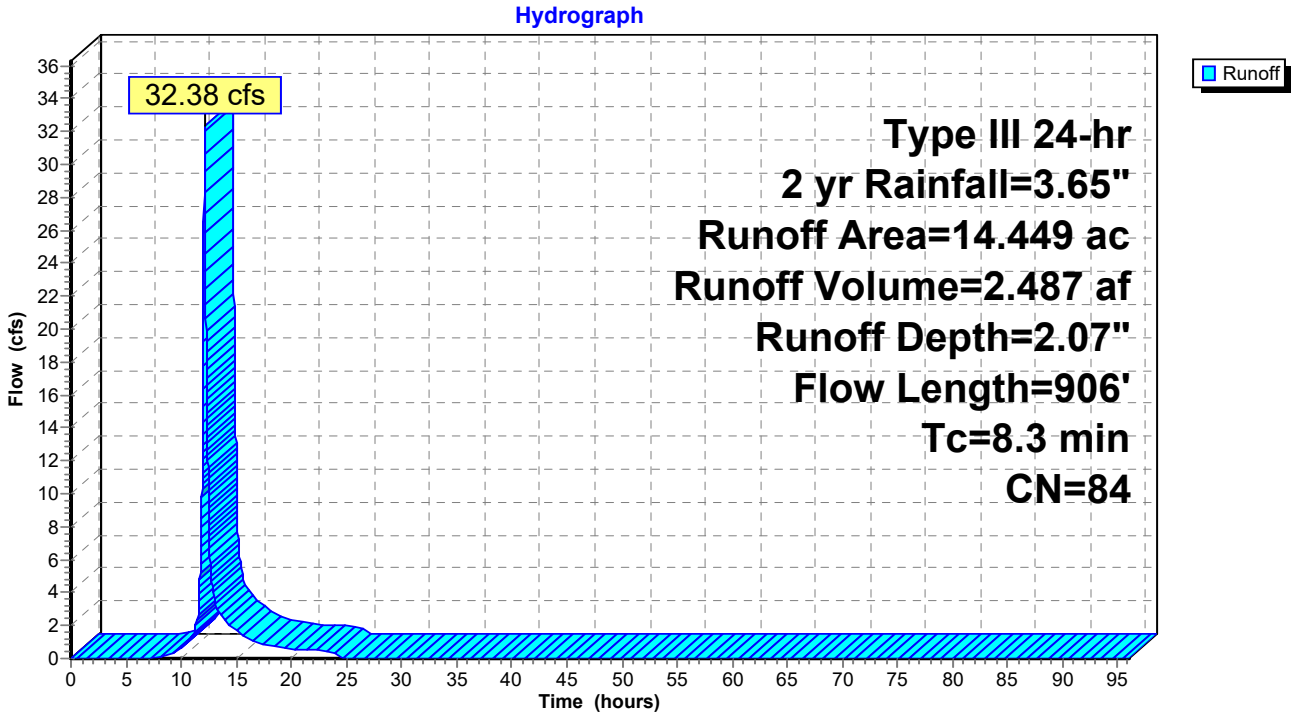
Runoff = 32.38 cfs @ 12.12 hrs, Volume= 2.487 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.65"

Area (ac)	CN	Description
2.578	95	Urban commercial, 85% imp, HSG D
0.158	89	Urban commercial, 85% imp, HSG A
1.787	92	1/8 acre lots, 65% imp, HSG D
0.299	77	1/8 acre lots, 65% imp, HSG A
4.832	86	1/3 acre lots, 30% imp, HSG D
1.691	57	1/3 acre lots, 30% imp, HSG A
2.217	79	Woods, Fair, HSG D
0.887	84	50-75% Grass cover, Fair, HSG D
14.449	84	Weighted Average
8.811	74	60.98% Pervious Area
5.638	98	39.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	16	0.0200	0.05		**Sheet Flow, Sheet flow through woods** Woods: Light underbrush n= 0.400 P2= 3.21"
0.6	81	0.2200	2.35		**Shallow Concentrated Flow, Shallow Conc through woods / law** Woodland Kv= 5.0 fps
1.7	557	0.0700	5.37		**Shallow Concentrated Flow, Shallow Conc on PVMNT** Paved Kv= 20.3 fps
1.0	252	0.0100	4.18	83.56	**Channel Flow, Open Channel Flow** Area= 20.0 sf Perim= 12.0' r= 1.67' n= 0.050 Earth, long dense weeds
8.3	906	Total			

Subcatchment DA3: COMMERCIAL DEVEL/HOUSING SOUTH SIDE OF FRANKLIN ST.



Summary for Subcatchment DA4: ATHLETIC FIELDS

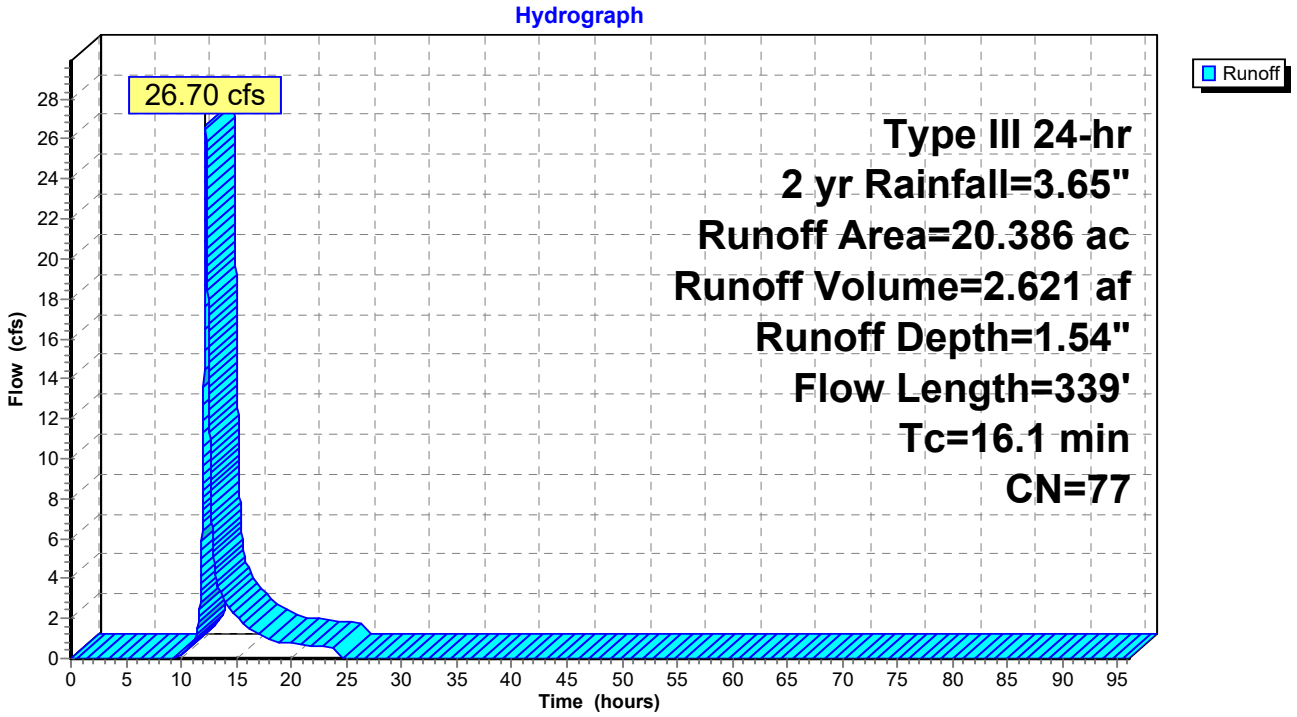
Runoff = 26.70 cfs @ 12.22 hrs, Volume= 2.621 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.65"

Area (ac)	CN	Description
0.944	98	Unconnected pavement, HSG C
2.179	86	1/3 acre lots, 30% imp, HSG D
13.800	74	>75% Grass cover, Good, HSG C
3.463	79	Woods, Fair, HSG D
20.386	77	Weighted Average
18.788	75	92.16% Pervious Area
1.598	98	7.84% Impervious Area
0.944		59.08% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	25	0.0050	0.03		**Sheet Flow, Sheet flow through woods** Woods: Light underbrush n= 0.400 P2= 3.21"
2.2	246	0.1400	1.87		**Shallow Concentrated Flow, Shallow Conc through woods** Woodland Kv= 5.0 fps
0.5	68	0.0880	2.08		**Shallow Concentrated Flow, Shallow Conc through grass** Short Grass Pasture Kv= 7.0 fps
1.0					**Direct Entry, Flow through closeed pipes**
16.1	339	Total			

Subcatchment DA4: ATHLETIC FIELDS



or Subcatchment DA5a: RESIDENTIAL & COMMERCIAL DEVELOPMENT , NORTH OF HS, SOUTH SIDE

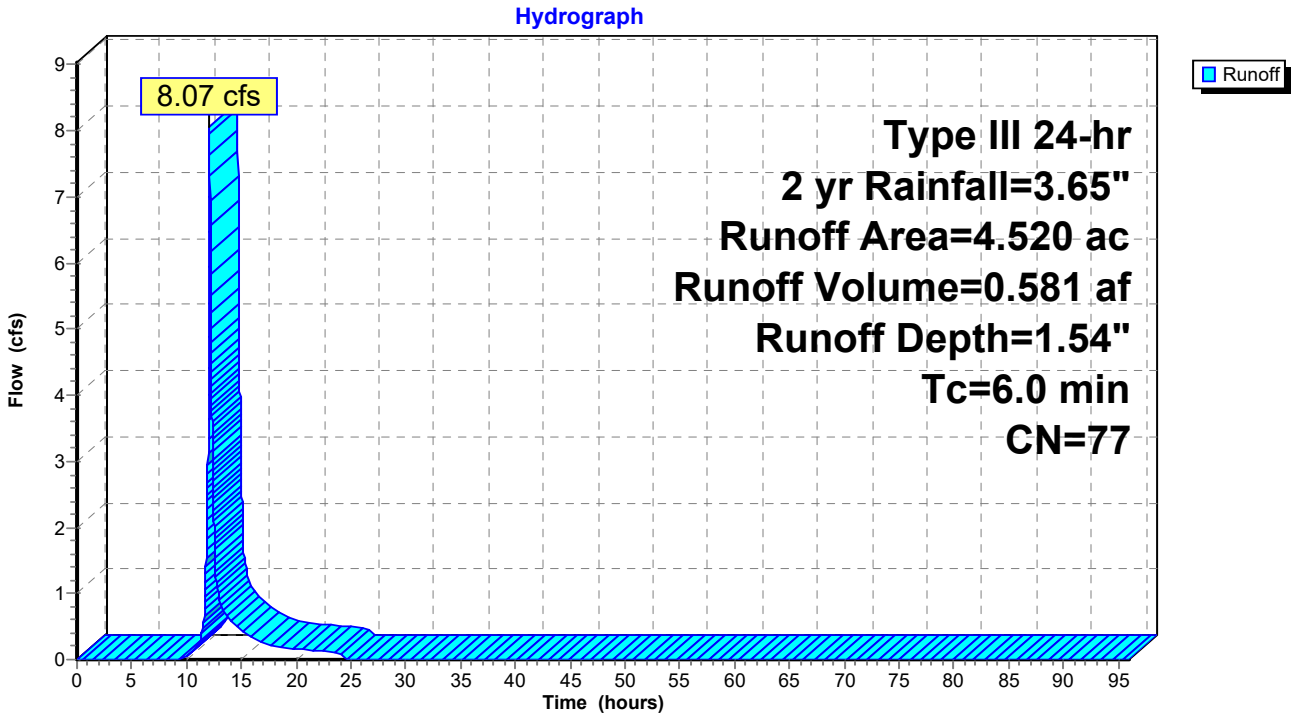
Runoff = 8.07 cfs @ 12.09 hrs, Volume= 0.581 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.65"

Area (ac)	CN	Description
3.036	89	Urban commercial, 85% imp, HSG A
0.069	86	1/3 acre lots, 30% imp, HSG D
1.103	57	1/3 acre lots, 30% imp, HSG A
0.312	36	Woods, Fair, HSG A
4.520	77	Weighted Average
1.588	40	35.13% Pervious Area
2.932	98	64.87% Impervious Area

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

catchment DA5a: RESIDENTIAL & COMMERCIAL DEVELOPMENT , NORTH OF HS, SOUTH SIDE FRANK



Summary for Subcatchment DA5b: HIGH SCHOOL, PARKING, AND TENNIS COURTS

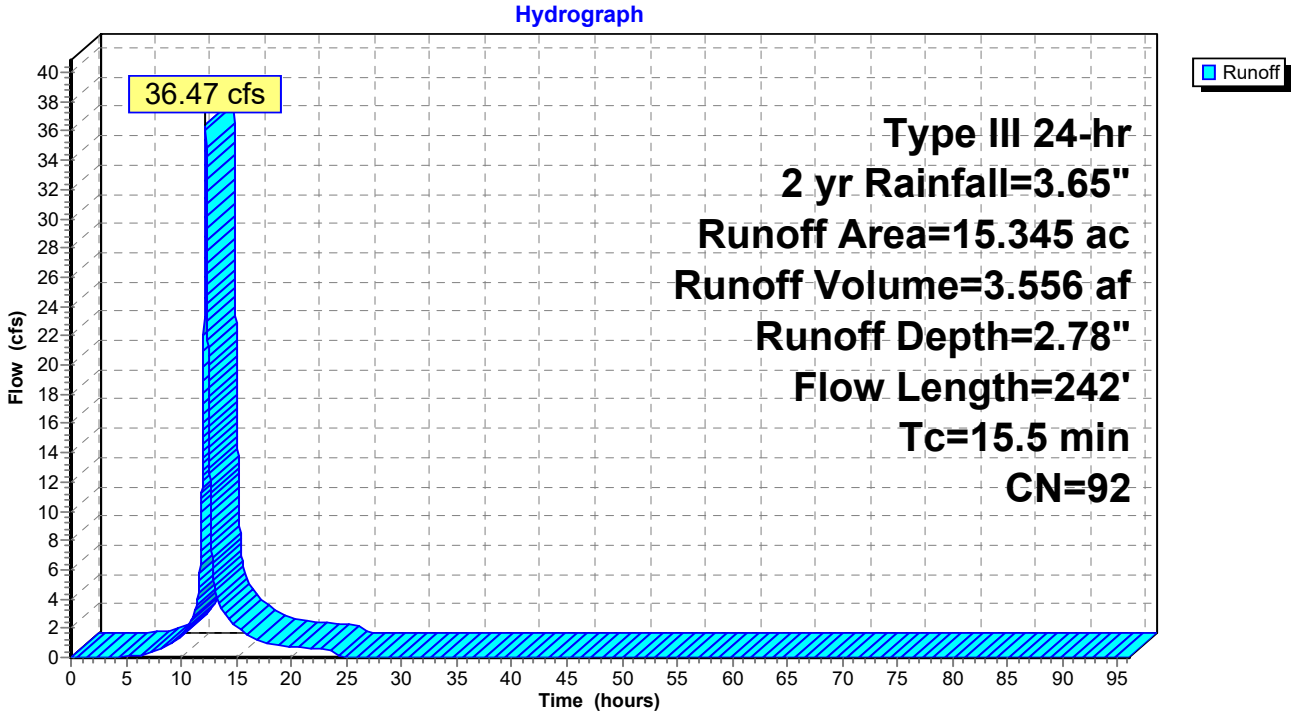
Runoff = 36.47 cfs @ 12.20 hrs, Volume= 3.556 af, Depth= 2.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.65"

Area (ac)	CN	Description
12.099	95	Urban commercial, 85% imp, HSG D
1.536	89	Urban commercial, 85% imp, HSG A
0.459	57	1/3 acre lots, 30% imp, HSG A
1.251	79	50-75% Grass cover, Fair, HSG C
15.345	92	Weighted Average
3.618	72	23.57% Pervious Area
11.727	98	76.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	40	0.0090	0.07		**Sheet Flow, Sheet flow through grass** Grass: Dense n= 0.240 P2= 3.21"
4.1	202	0.0140	0.83		**Shallow Concentrated Flow, Shallow Conc through grass** Short Grass Pasture Kv= 7.0 fps
2.0					**Direct Entry, Flow through closed pipes**
15.5	242	Total			

Subcatchment DA5b: HIGH SCHOOL, PARKING, AND TENNIS COURTS



Summary for Subcatchment DA6: DA6

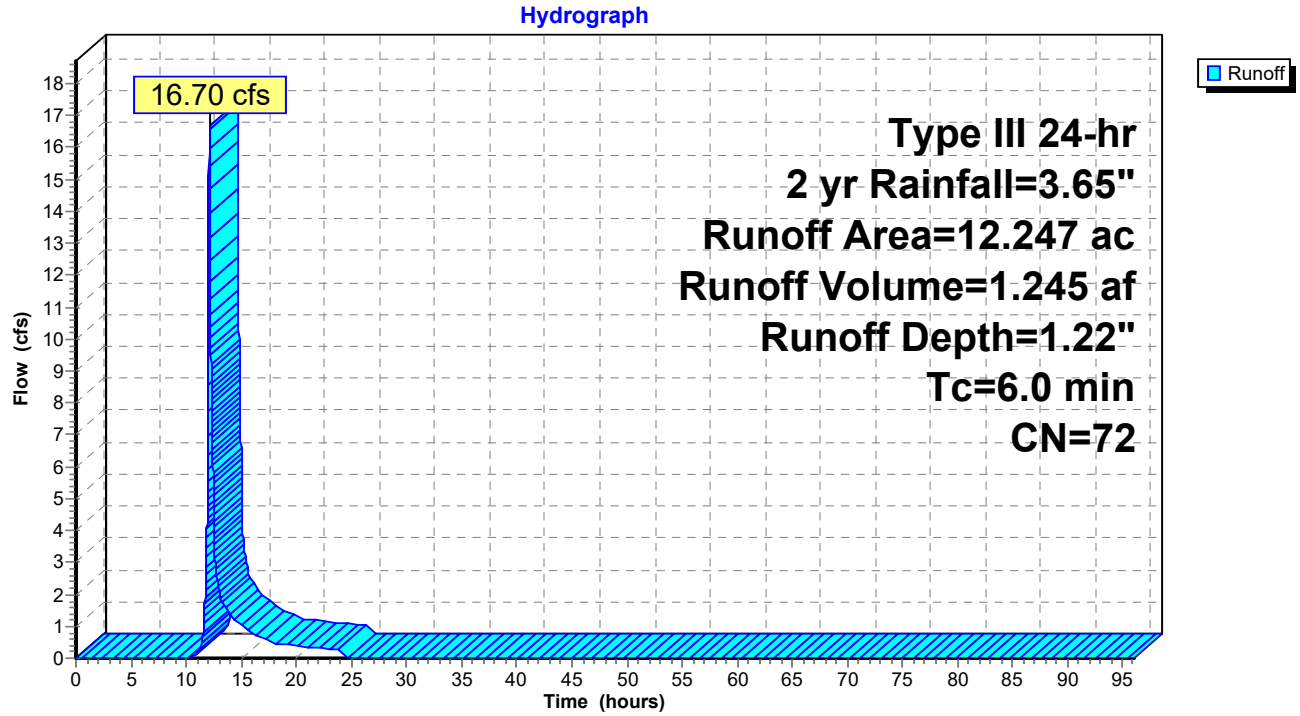
Runoff = 16.70 cfs @ 12.10 hrs, Volume= 1.245 af, Depth= 1.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.65"

Area (ac)	CN	Description
1.766	60	Woods, Fair, HSG B
4.843	79	Woods, Fair, HSG D
0.033	36	Woods, Fair, HSG A
1.692	86	1/3 acre lots, 30% imp, HSG D
2.974	57	1/3 acre lots, 30% imp, HSG A
0.392	72	1/3 acre lots, 30% imp, HSG B
0.184	98	Paved parking, HSG D
0.070	49	50-75% Grass cover, Fair, HSG A
0.293	84	50-75% Grass cover, Fair, HSG D
12.247	72	Weighted Average
10.546	68	86.11% Pervious Area
1.701	98	13.89% Impervious Area

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

Subcatchment DA6: DA6



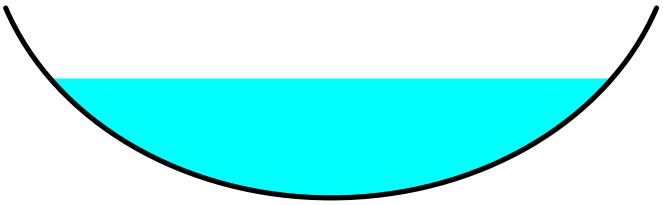
Summary for Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.

Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth > 0.69" for 2 yr event
Inflow = 12.63 cfs @ 12.08 hrs, Volume= 4.659 af
Outflow = 10.16 cfs @ 12.14 hrs, Volume= 4.651 af, Atten= 20%, Lag= 3.5 min

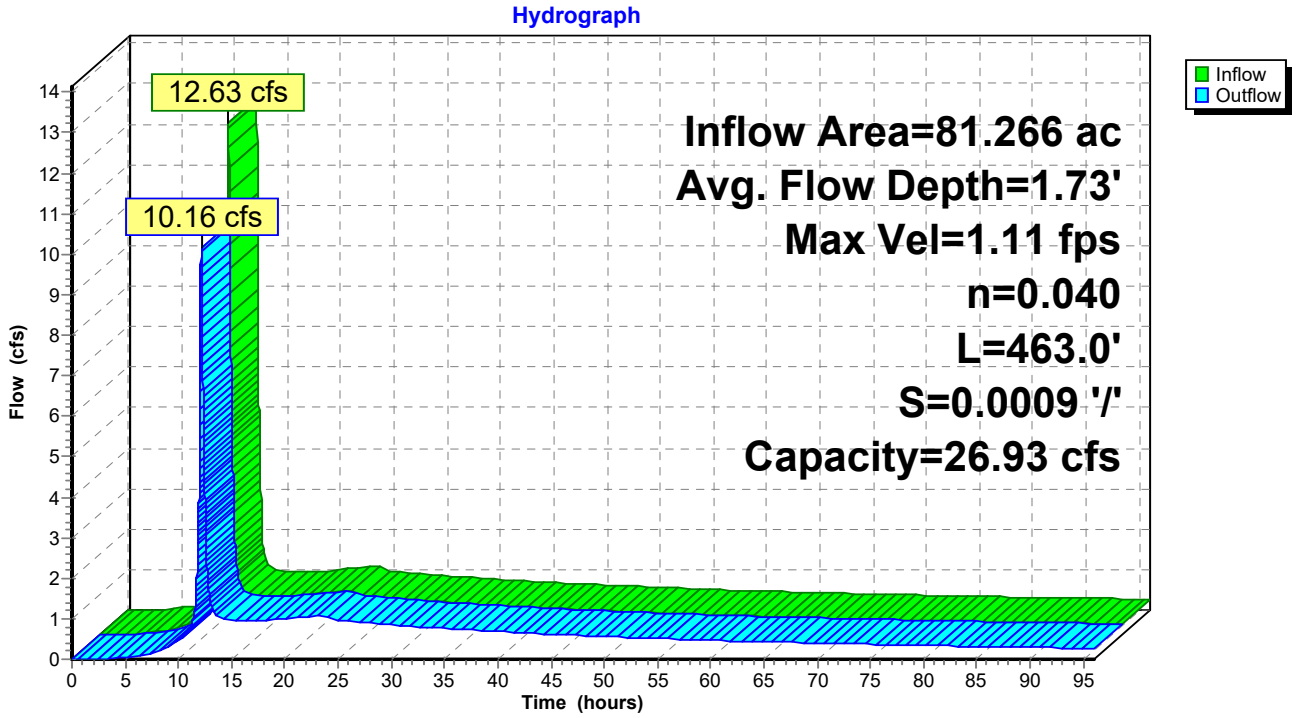
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 1.11 fps, Min. Travel Time= 6.9 min
Avg. Velocity = 0.46 fps, Avg. Travel Time= 16.7 min

Peak Storage= 4,218 cf @ 12.14 hrs
Average Depth at Peak Storage= 1.73' , Surface Width= 7.92'
Bank-Full Depth= 2.75' Flow Area= 18.3 sf, Capacity= 26.93 cfs

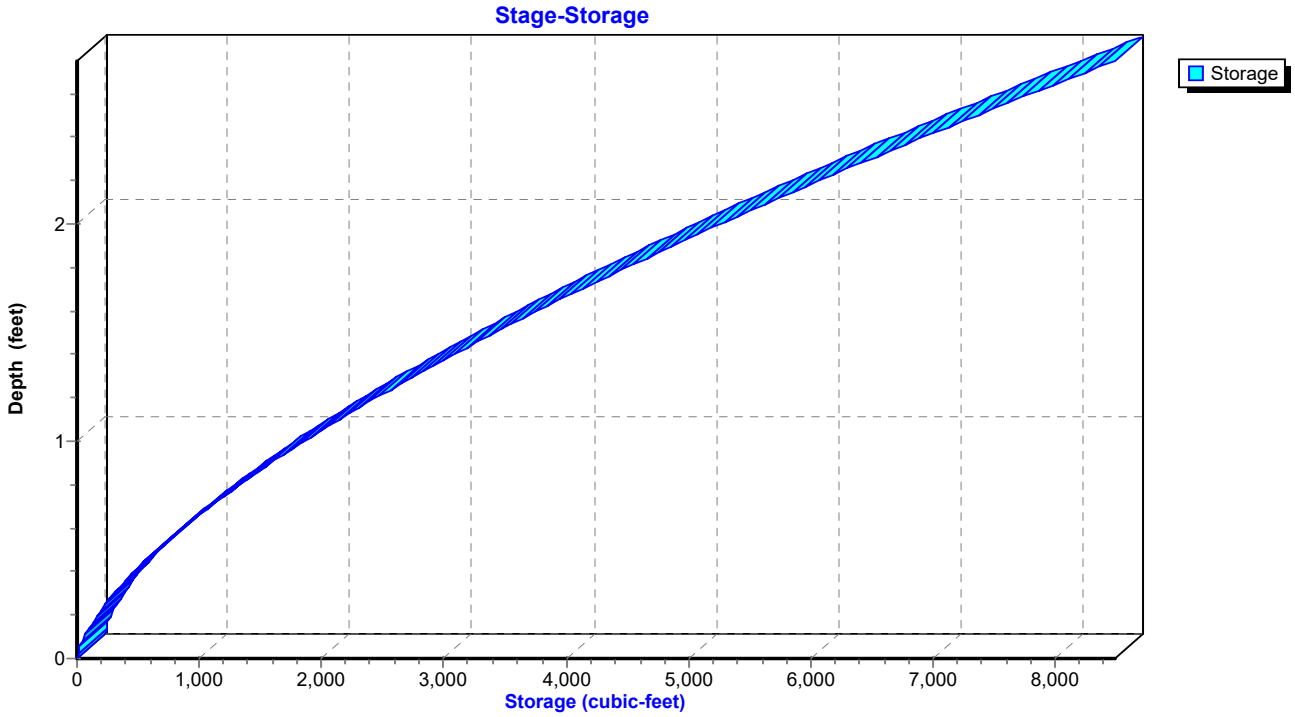
10.00' x 2.75' deep Parabolic Channel, n= 0.040 Earth, dense weeds
Length= 463.0' Slope= 0.0009 '/'
Inlet Invert= 162.00', Outlet Invert= 161.60'



Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.



Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.



Summary for Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.

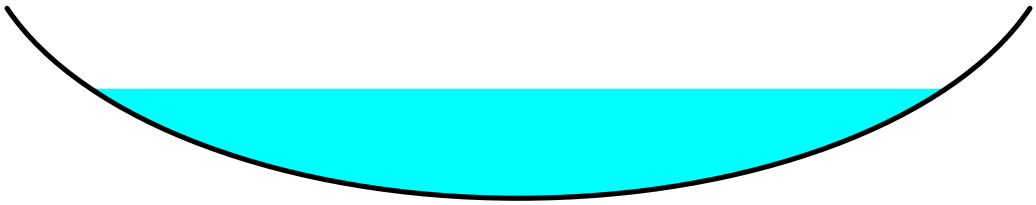
[80] Warning: Exceeded Pond C-1 by 0.35' @ 0.00 hrs (0.65 cfs 0.002 af)

Inflow Area = 95.715 ac, 23.82% Impervious, Inflow Depth > 0.89" for 2 yr event
Inflow = 42.33 cfs @ 12.12 hrs, Volume= 7.138 af
Outflow = 36.98 cfs @ 12.18 hrs, Volume= 7.129 af, Atten= 13%, Lag= 3.4 min

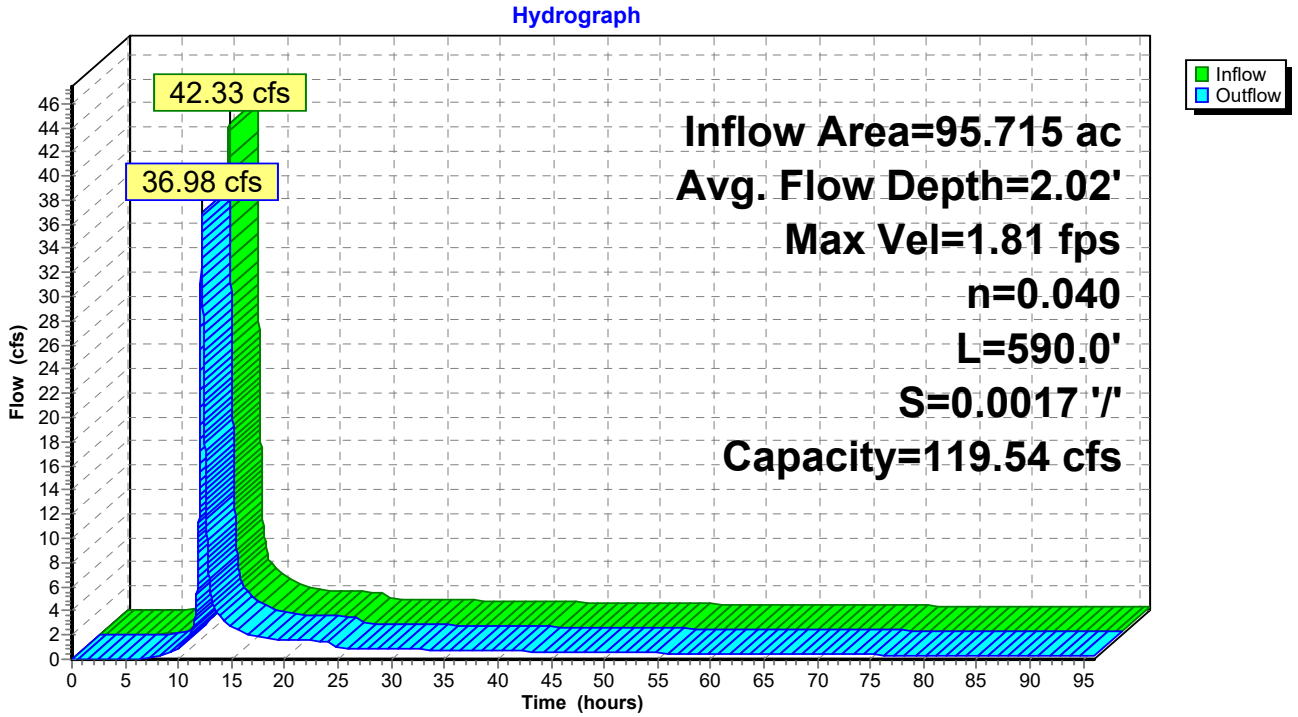
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 1.81 fps, Min. Travel Time= 5.4 min
Avg. Velocity = 0.52 fps, Avg. Travel Time= 18.8 min

Peak Storage= 12,056 cf @ 12.18 hrs
Average Depth at Peak Storage= 2.02' , Surface Width= 15.19'
Bank-Full Depth= 3.50' Flow Area= 46.7 sf, Capacity= 119.54 cfs

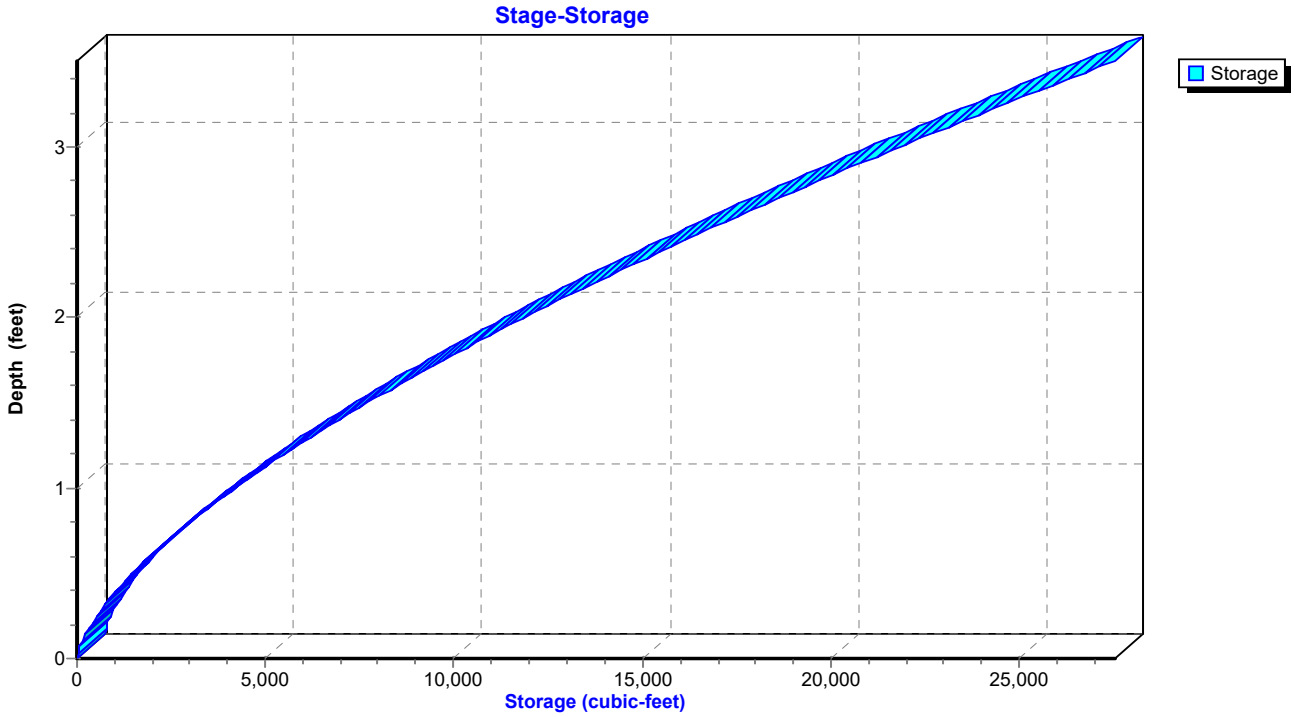
20.00' x 3.50' deep Parabolic Channel, n= 0.040
Length= 590.0' Slope= 0.0017 '/'
Inlet Invert= 162.00', Outlet Invert= 161.00'



Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.



Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.



Summary for Reach 3R: OPEN CHANNEL-SOUTH OF TRACK

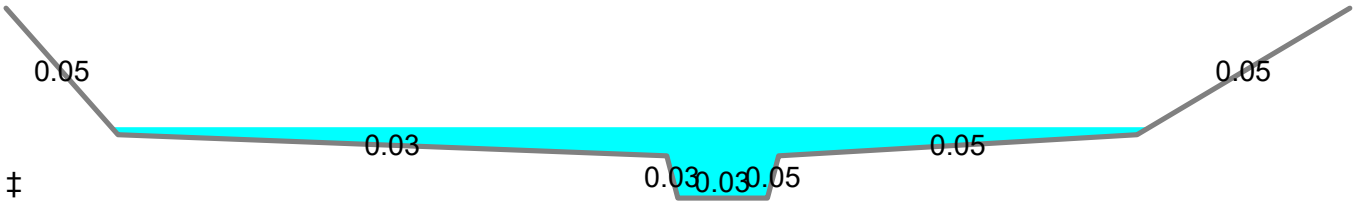
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=2)

Inflow Area = 148.213 ac, 27.50% Impervious, Inflow Depth > 1.23" for 2 yr event
Inflow = 115.44 cfs @ 12.18 hrs, Volume= 15.132 af
Outflow = 113.32 cfs @ 12.22 hrs, Volume= 15.129 af, Atten= 2%, Lag= 2.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.43 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 0.96 fps, Avg. Travel Time= 6.7 min

Peak Storage= 19,766 cf @ 12.22 hrs
Average Depth at Peak Storage= 1.68' , Surface Width= 92.73'
Bank-Full Depth= 4.50' Flow Area= 350.8 sf, Capacity= 2,227.64 cfs

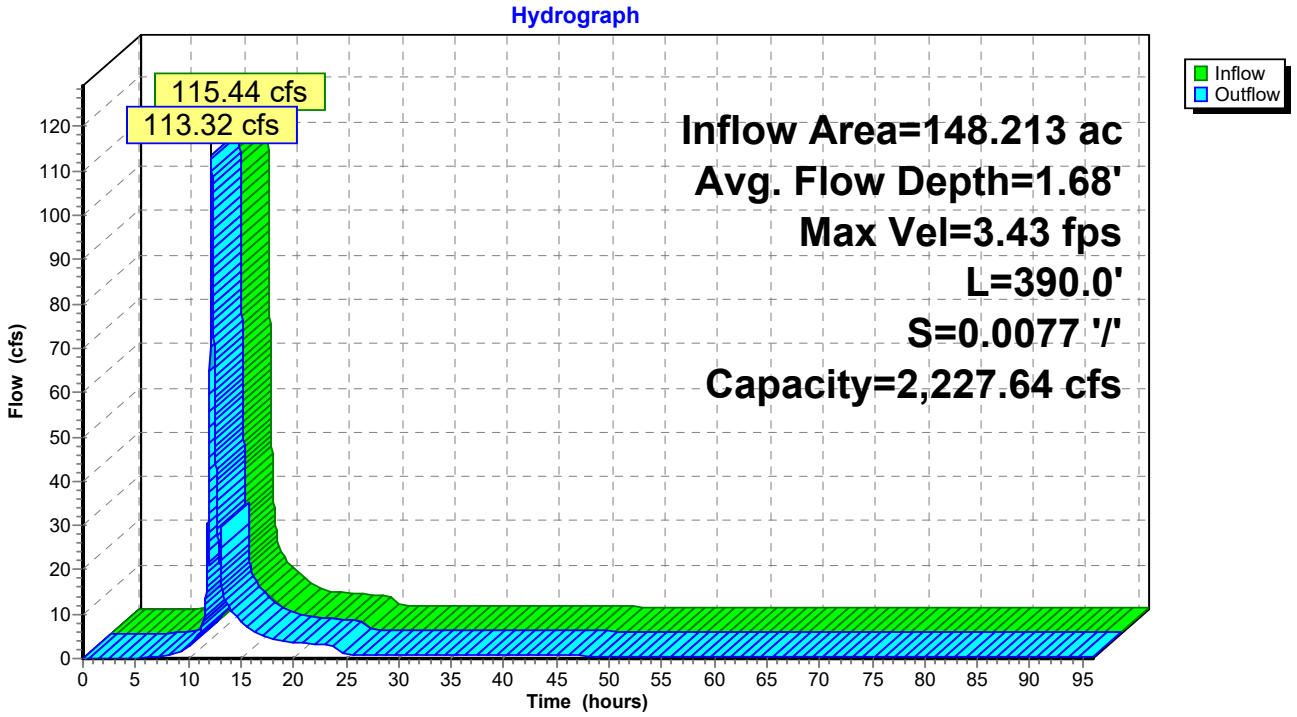
Custom cross-section, Length= 390.0' Slope= 0.0077 '/' (102 Elevation Intervals)
Composite Manning's value by Pavlovskii (shallow flow) method
Composite Manning's value at bank full= 0.042
Inlet Invert= 158.00', Outlet Invert= 155.00'



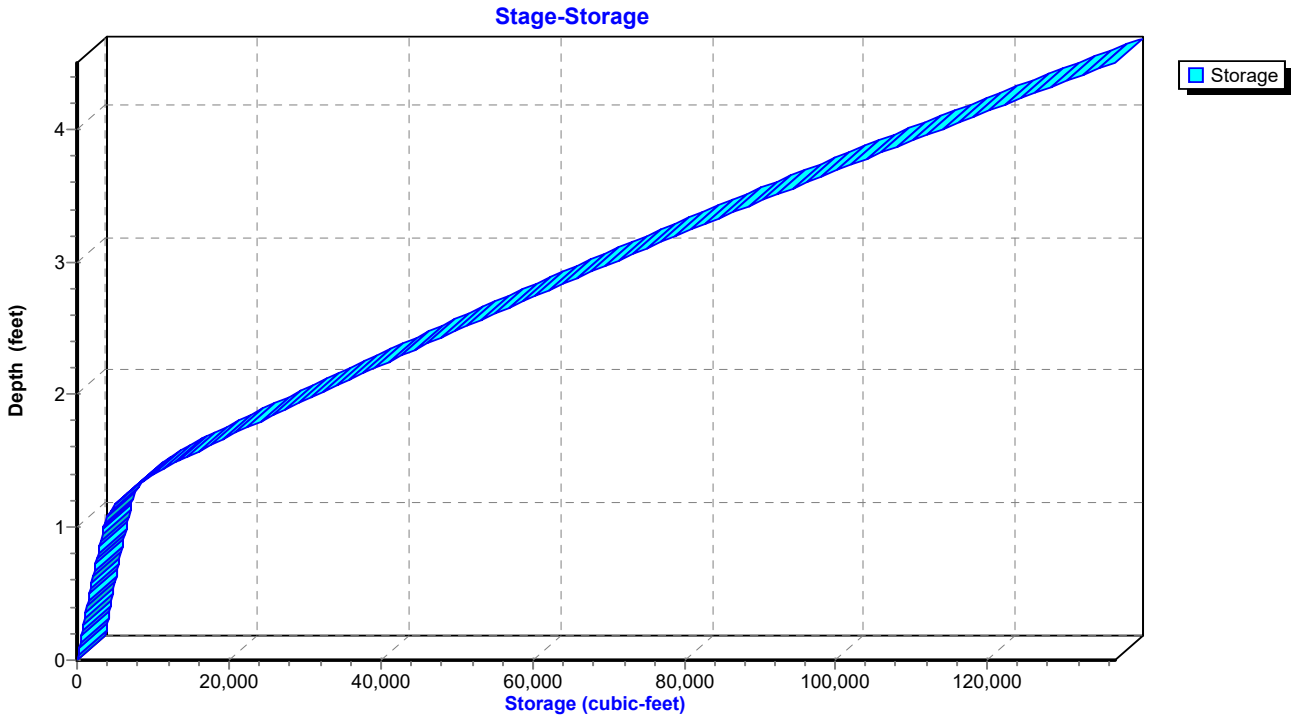
Offset (feet)	Elevation (feet)	Chan.Depth (feet)	n	Description
-60.00	158.00	0.00		
-50.00	155.00	3.00	0.050	Scattered brush, heavy weeds
-1.00	154.50	3.50	0.030	Earth, grassed & winding
0.00	153.50	4.50	0.030	Earth, grassed & winding
8.00	153.50	4.50	0.030	Earth, grassed & winding
9.00	154.50	3.50	0.050	Scattered brush, heavy weeds
41.00	155.00	3.00	0.050	Scattered brush, heavy weeds
60.00	158.00	0.00	0.050	Scattered brush, heavy weeds

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	8.0	0.0	0	0.00
1.00	9.0	10.8	10.0	3,510	31.14
1.50	34.3	91.8	91.0	13,358	60.07
4.50	350.8	121.5	120.0	136,793	2,227.64

Reach 3R: OPEN CHANNEL-SOUTH OF TRACK



Reach 3R: OPEN CHANNEL-SOUTH OF TRACK



Summary for Pond C-1: FRANKLIN ST CULVERT

[57] Hint: Peaked at 164.30' (Flood elevation advised)

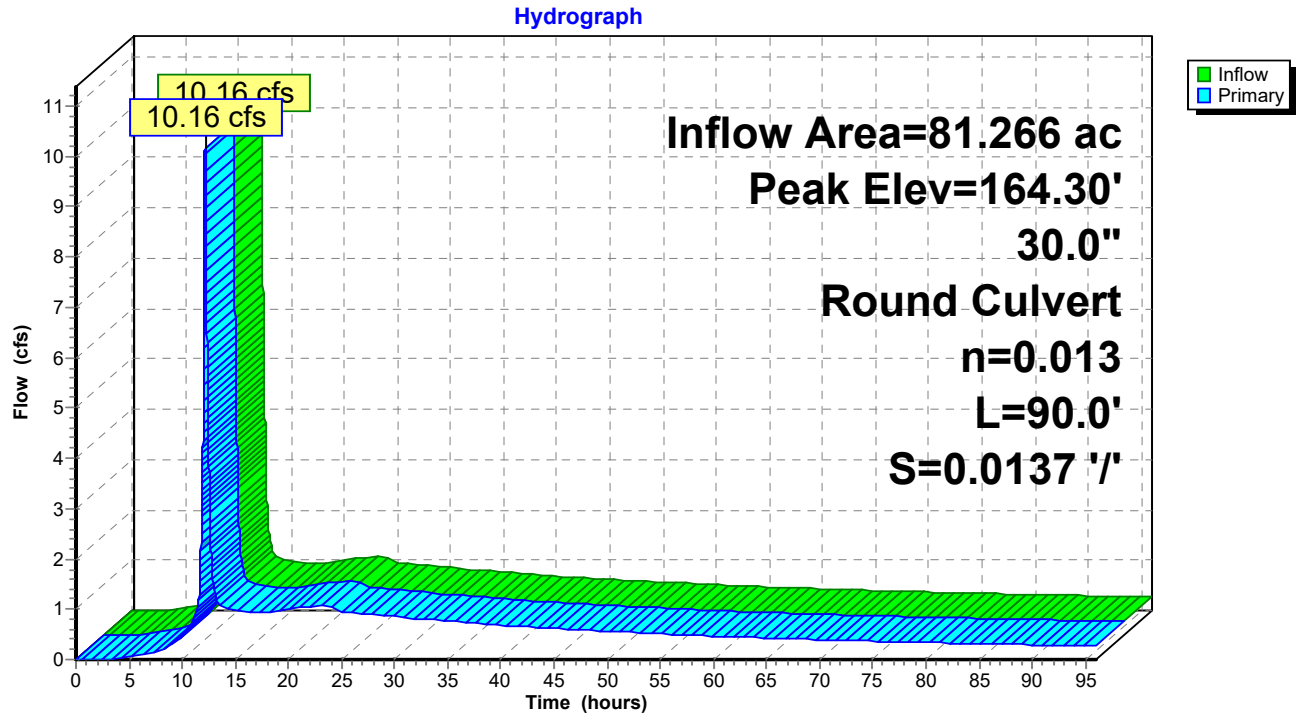
Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth > 0.69" for 2 yr event
Inflow = 10.16 cfs @ 12.14 hrs, Volume= 4.651 af
Outflow = 10.16 cfs @ 12.14 hrs, Volume= 4.651 af, Atten= 0%, Lag= 0.0 min
Primary = 10.16 cfs @ 12.14 hrs, Volume= 4.651 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 164.30' @ 12.17 hrs

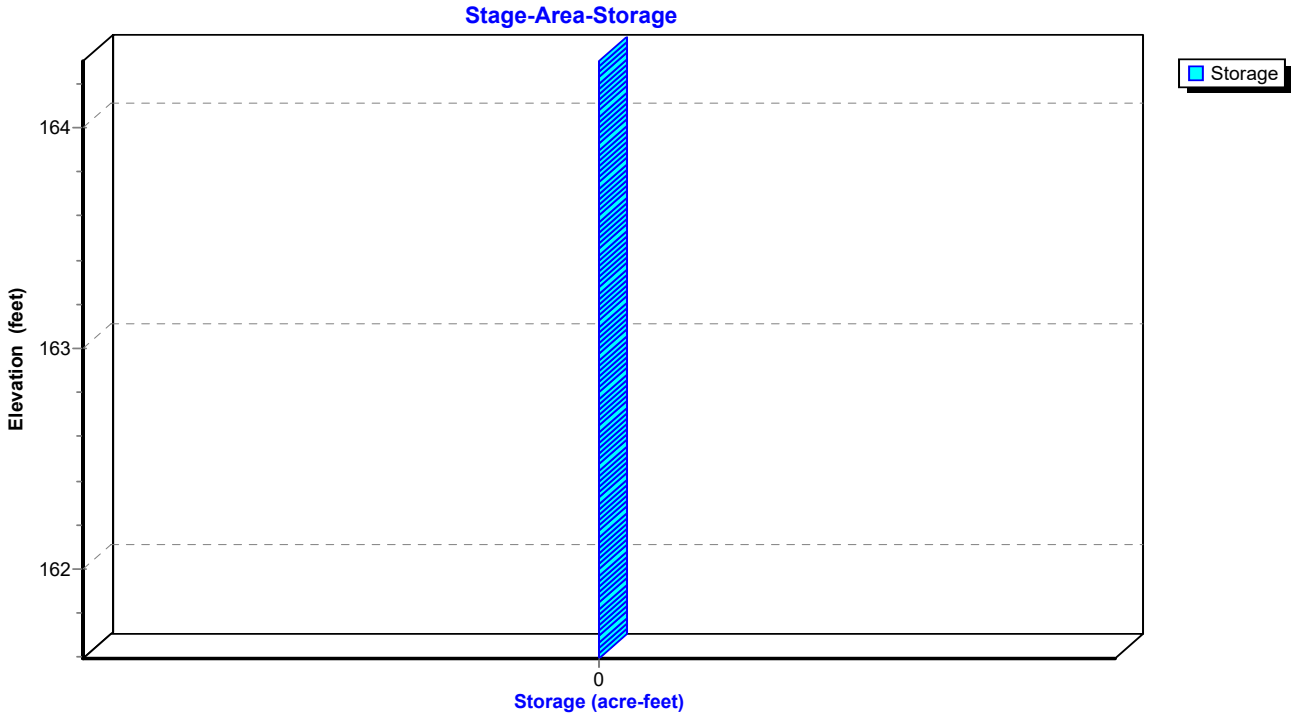
Device	Routing	Invert	Outlet Devices
#1	Primary	161.60'	**30.0" Round Culvert** L= 90.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 161.60' / 160.37' S= 0.0137 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 4.91 sf

Primary OutFlow Max=10.15 cfs @ 12.14 hrs HW=164.27' TW=163.97' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 10.15 cfs @ 2.07 fps)

Pond C-1: FRANKLIN ST CULVERT



Pond C-1: FRANKLIN ST CULVERT



Summary for Pond C-2: CULVERT #2

[57] Hint: Peaked at 196.51' (Flood elevation advised)

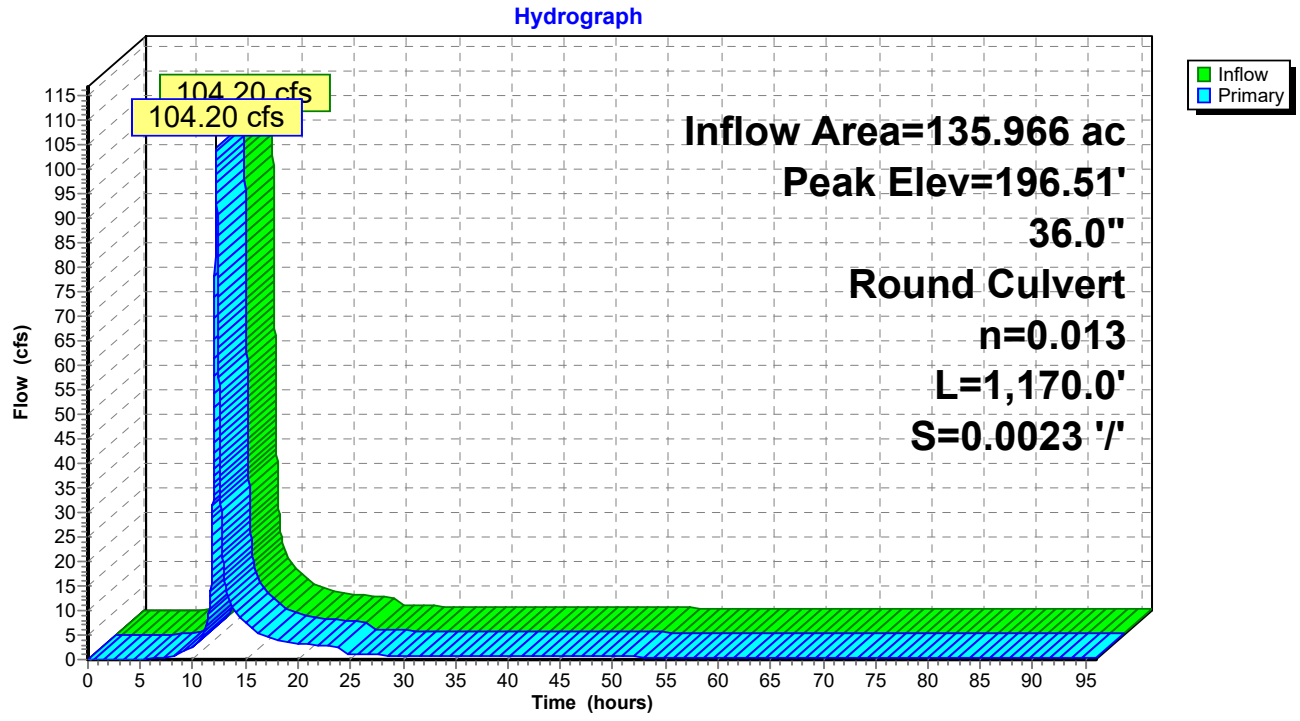
Inflow Area = 135.966 ac, 28.73% Impervious, Inflow Depth > 1.23" for 2 yr event
Inflow = 104.20 cfs @ 12.20 hrs, Volume= 13.887 af
Outflow = 104.20 cfs @ 12.20 hrs, Volume= 13.887 af, Atten= 0%, Lag= 0.0 min
Primary = 104.20 cfs @ 12.20 hrs, Volume= 13.887 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 196.51' @ 12.20 hrs

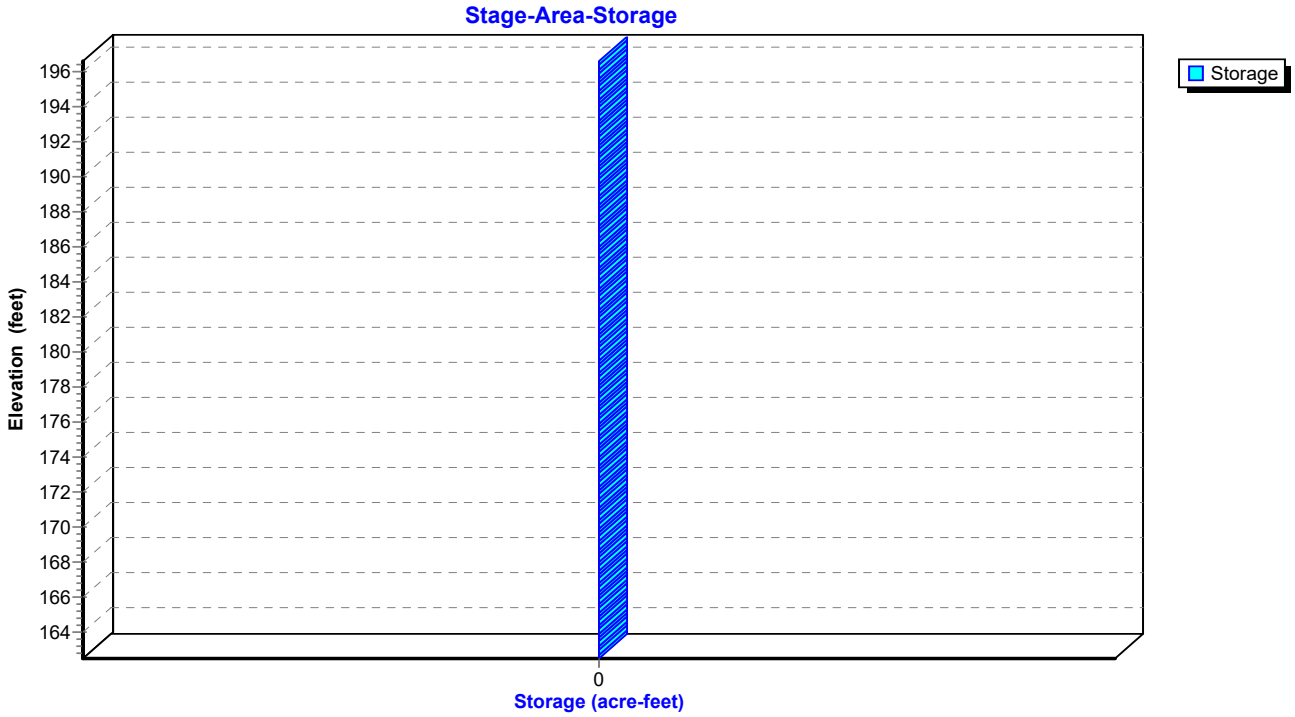
Device	Routing	Invert	Outlet Devices
#1	Primary	162.50'	**36.0" Round Culvert** L= 1,170.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 162.50' / 159.79' S= 0.0023 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=104.14 cfs @ 12.20 hrs HW=196.47' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 104.14 cfs @ 14.73 fps)

Pond C-2: CULVERT #2



Pond C-2: CULVERT #2



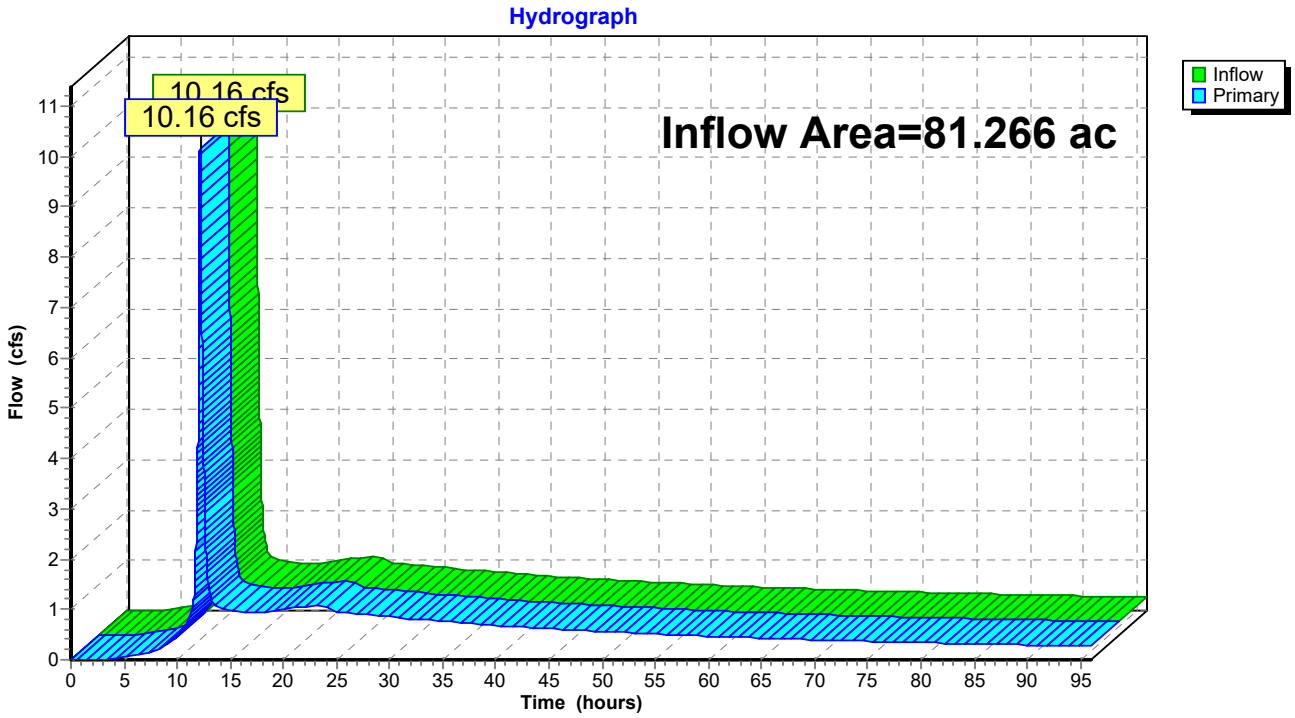
Summary for Pond SP1: FRANKLIN ST. CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth > 0.69" for 2 yr event
Inflow = 10.16 cfs @ 12.14 hrs, Volume= 4.651 af
Primary = 10.16 cfs @ 12.14 hrs, Volume= 4.651 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP1: FRANKLIN ST. CULVERT



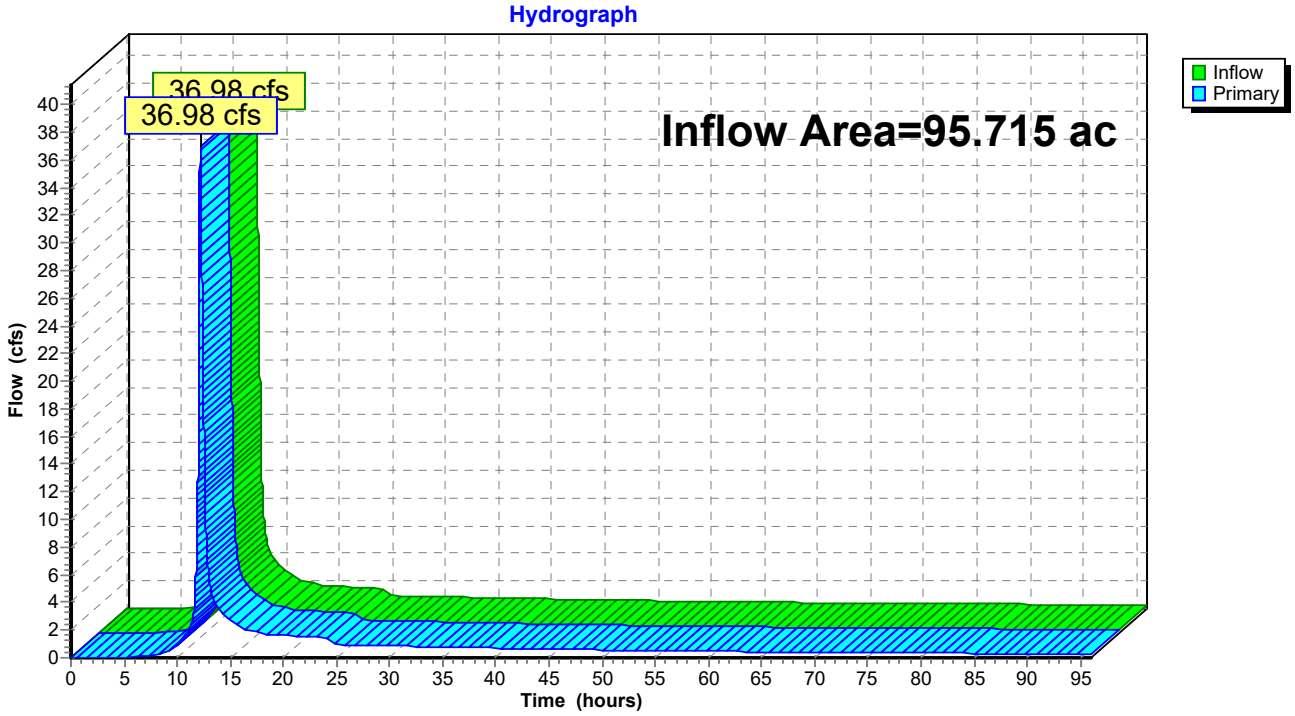
Summary for Pond SP2: HEADWALL 36-IN. CULVERT PIPE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 95.715 ac, 23.82% Impervious, Inflow Depth > 0.89" for 2 yr event
Inflow = 36.98 cfs @ 12.18 hrs, Volume= 7.129 af
Primary = 36.98 cfs @ 12.18 hrs, Volume= 7.129 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP2: HEADWALL 36-IN. CULVERT PIPE



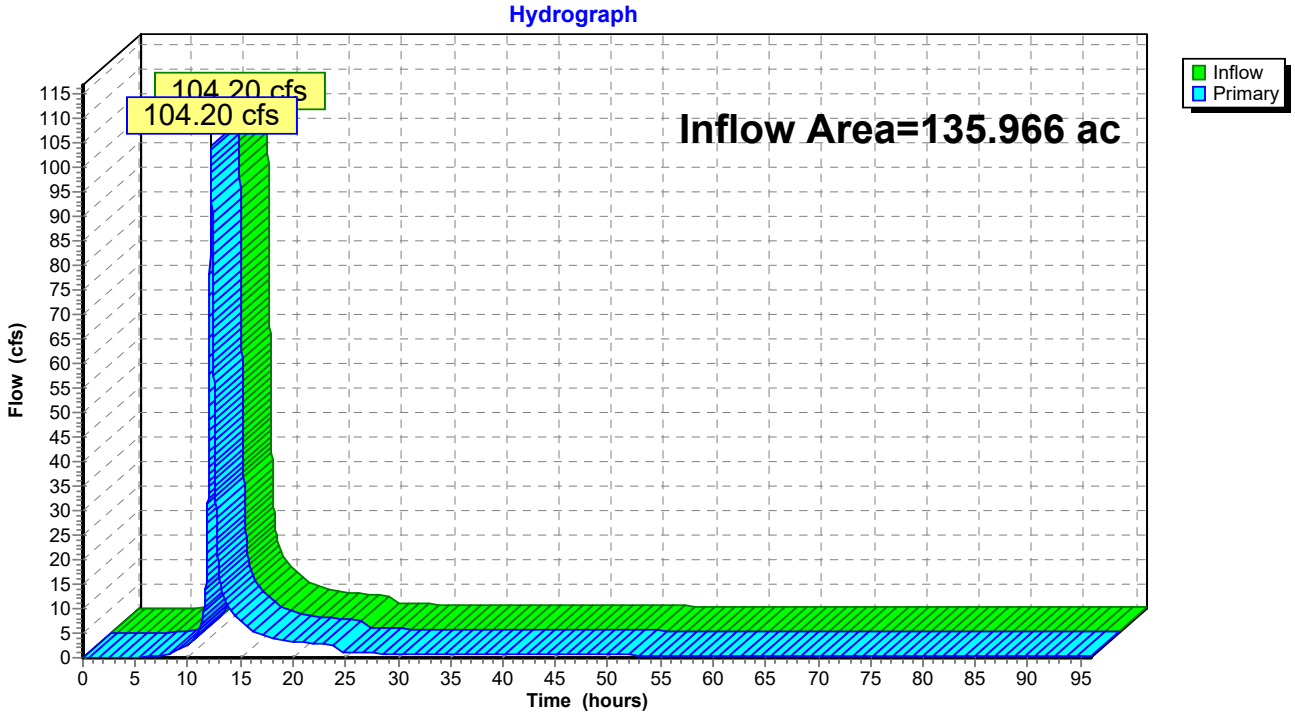
Summary for Pond SP3: OUTLET OF 36-IN. CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 135.966 ac, 28.73% Impervious, Inflow Depth > 1.23" for 2 yr event
Inflow = 104.20 cfs @ 12.20 hrs, Volume= 13.887 af
Primary = 104.20 cfs @ 12.20 hrs, Volume= 13.887 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP3: OUTLET OF 36-IN. CULVERT



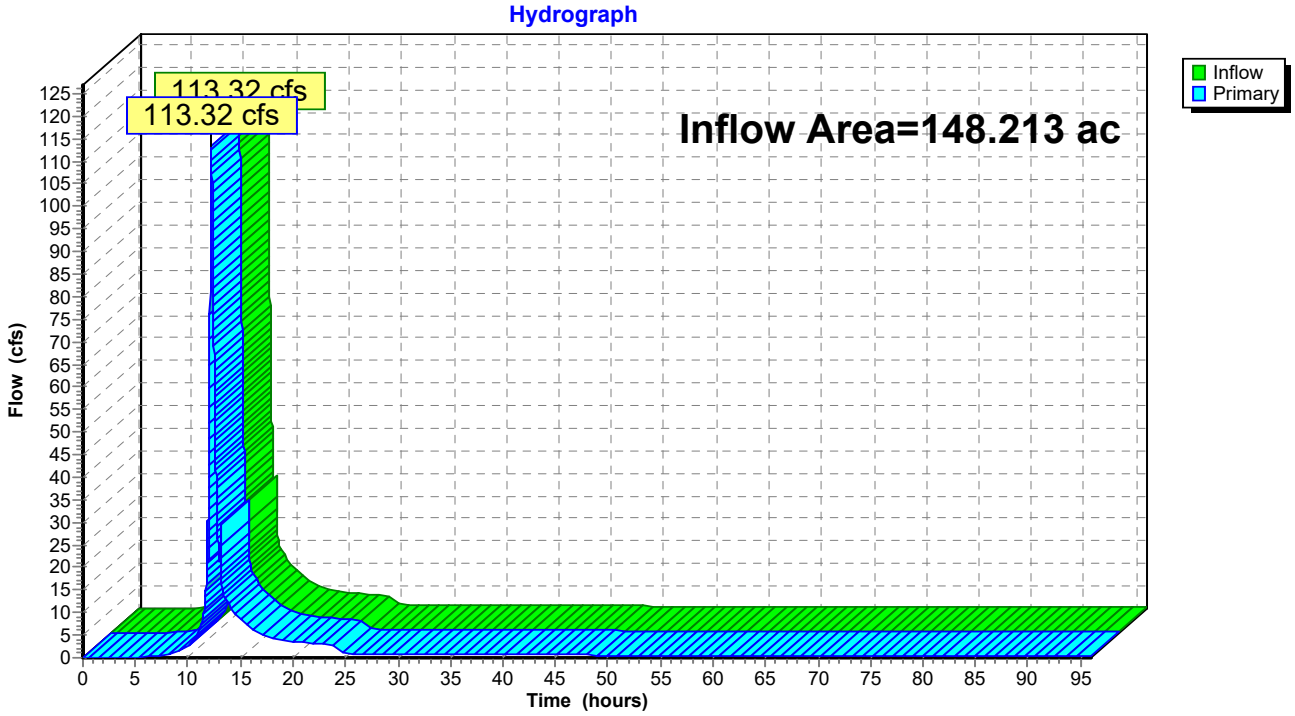
Summary for Pond SP4: WETLANDS TO THE SOUTH

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 148.213 ac, 27.50% Impervious, Inflow Depth > 1.22" for 2 yr event
Inflow = 113.32 cfs @ 12.22 hrs, Volume= 15.129 af
Primary = 113.32 cfs @ 12.22 hrs, Volume= 15.129 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP4: WETLANDS TO THE SOUTH



Summary for Pond W: BORDERING VEGETATED WETLAND

Inflow Area = 77.543 ac, 18.05% Impervious, Inflow Depth = 1.54" for 2 yr event
Inflow = 101.89 cfs @ 12.22 hrs, Volume= 9.970 af
Outflow = 0.97 cfs @ 24.22 hrs, Volume= 3.701 af, Atten= 99%, Lag= 719.6 min
Primary = 0.97 cfs @ 24.22 hrs, Volume= 3.701 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 162.57' @ 24.22 hrs Surf.Area= 12.568 ac Storage= 9.311 af

Plug-Flow detention time= 2,080.1 min calculated for 3.701 af (37% of inflow)
Center-of-Mass det. time= 1,949.2 min (2,803.5 - 854.3)

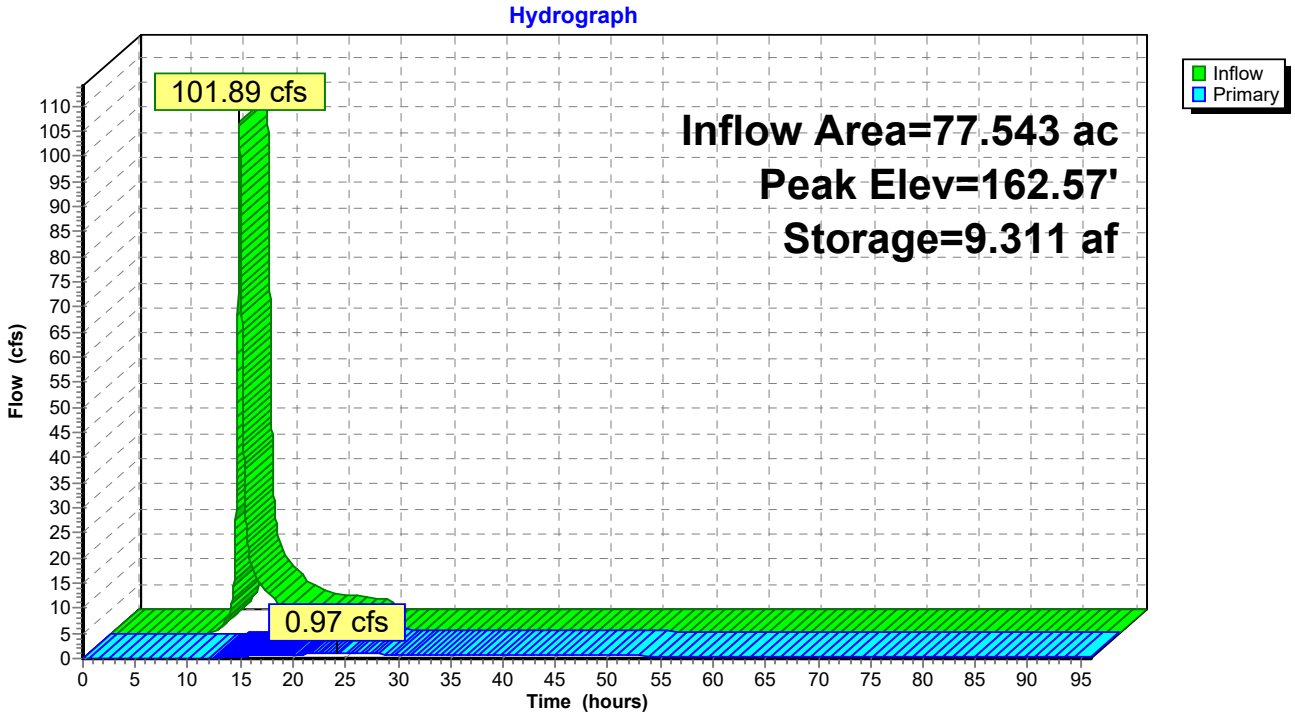
Volume	Invert	Avail.Storage	Storage Description
#1	161.50'	77.077 af	**Ponding storage in wetand (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
161.50	2.880	0.000	0.000
162.00	9.350	3.058	3.058
164.00	20.630	29.980	33.037
166.00	23.410	44.040	77.077

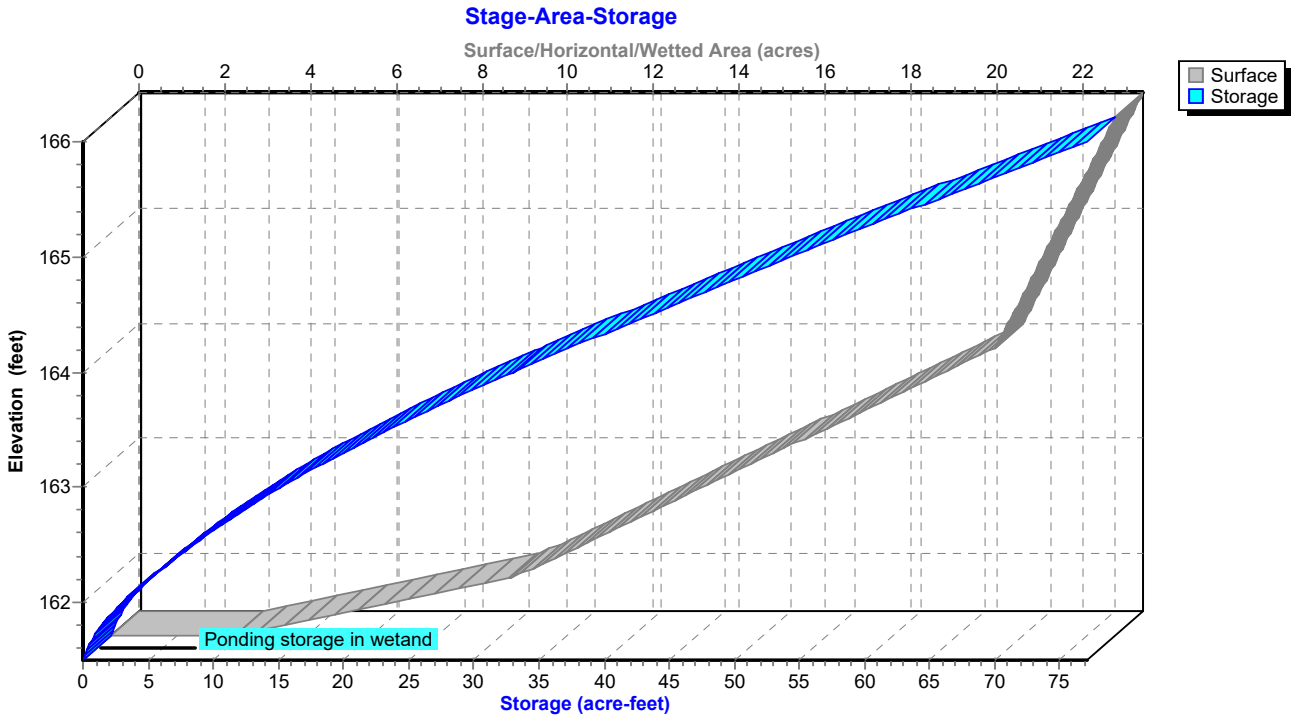
Device	Routing	Invert	Outlet Devices
#1	Primary	162.00'	**Channel/Reach** using Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.

Primary OutFlow Max=0.97 cfs @ 24.22 hrs HW=162.57' TW=162.58' (Dynamic Tailwater)
↑—**1=Channel/Reach** (Channel Controls 0.97 cfs @ 0.56 fps)

Pond W: BORDERING VEGETATED WETLAND



Pond W: BORDERING VEGETATED WETLAND



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DA1: DEVELOPMENT Runoff Area=77.543 ac 18.05% Impervious Runoff Depth=3.30"
Flow Length=520' Tc=15.9 min CN=77 Runoff=222.21 cfs 21.301 af

Subcatchment DA2: COMMERCIAL Runoff Area=3.723 ac 85.00% Impervious Runoff Depth=5.20"
Tc=6.0 min CN=95 Runoff=20.67 cfs 1.614 af

Subcatchment DA3: COMMERCIAL Runoff Area=14.449 ac 39.02% Impervious Runoff Depth=4.00"
Flow Length=906' Tc=8.3 min CN=84 Runoff=61.91 cfs 4.817 af

Subcatchment DA4: ATHLETIC FIELDS Runoff Area=20.386 ac 7.84% Impervious Runoff Depth=3.30"
Flow Length=339' Tc=16.1 min CN=77 Runoff=58.16 cfs 5.600 af

Subcatchment DA5a: RESIDENTIAL & Runoff Area=4.520 ac 64.87% Impervious Runoff Depth=3.30"
Tc=6.0 min CN=77 Runoff=17.48 cfs 1.242 af

Subcatchment DA5b: HIGH SCHOOL, Runoff Area=15.345 ac 76.43% Impervious Runoff Depth=4.86"
Flow Length=242' Tc=15.5 min CN=92 Runoff=62.02 cfs 6.219 af

Subcatchment DA6: DA6 Runoff Area=12.247 ac 13.89% Impervious Runoff Depth=2.82"
Tc=6.0 min CN=72 Runoff=40.42 cfs 2.880 af

Reach 1R: OPEN CHANNEL-NORTH Avg. Flow Depth=2.22' Max Vel=1.30 fps Inflow=20.69 cfs 15.100 af
n=0.040 L=463.0' S=0.0009 '/' Capacity=26.93 cfs Outflow=17.24 cfs 15.087 af

Reach 2R: OPEN CHANNEL-SOUTH Avg. Flow Depth=2.74' Max Vel=2.20 fps Inflow=78.87 cfs 19.904 af
n=0.040 L=590.0' S=0.0017 '/' Capacity=119.54 cfs Outflow=71.10 cfs 19.889 af

Reach 3R: OPEN CHANNEL-SOUTH Avg. Flow Depth=1.97' Max Vel=3.45 fps Inflow=226.91 cfs 35.829 af
L=390.0' S=0.0077 '/' Capacity=2,227.64 cfs Outflow=224.28 cfs 35.823 af

Pond C-1: FRANKLIN ST CULVERT Peak Elev=165.57' Inflow=17.24 cfs 15.087 af
30.0" Round Culvert n=0.013 L=90.0' S=0.0137 '/' Outflow=17.24 cfs 15.087 af

Pond C-2: CULVERT #2 Peak Elev=286.13' Inflow=199.28 cfs 32.949 af
36.0" Round Culvert n=0.013 L=1,170.0' S=0.0023 '/' Outflow=199.28 cfs 32.949 af

Pond SP1: FRANKLIN ST. CULVERT Inflow=17.24 cfs 15.087 af
Primary=17.24 cfs 15.087 af

Pond SP2: HEADWALL 36-IN. CULVERT PIPE Inflow=71.10 cfs 19.889 af
Primary=71.10 cfs 19.889 af

Pond SP3: OUTLET OF 36-IN. CULVERT Inflow=199.28 cfs 32.949 af
Primary=199.28 cfs 32.949 af

Pond SP4: WETLANDS TO THE SOUTH Inflow=224.28 cfs 35.823 af
Primary=224.28 cfs 35.823 af

Pond W: BORDERING VEGETATED Peak Elev=163.16' Storage=17.627 af Inflow=222.21 cfs 21.301 af
Outflow=4.36 cfs 13.486 af

Total Runoff Area = 148.213 ac Runoff Volume = 43.673 af Average Runoff Depth = 3.54"
72.50% Pervious = 107.455 ac 27.50% Impervious = 40.758 ac

Summary for Subcatchment DA1: DEVELOPMENT NORTH OF FRANKLIN ST.

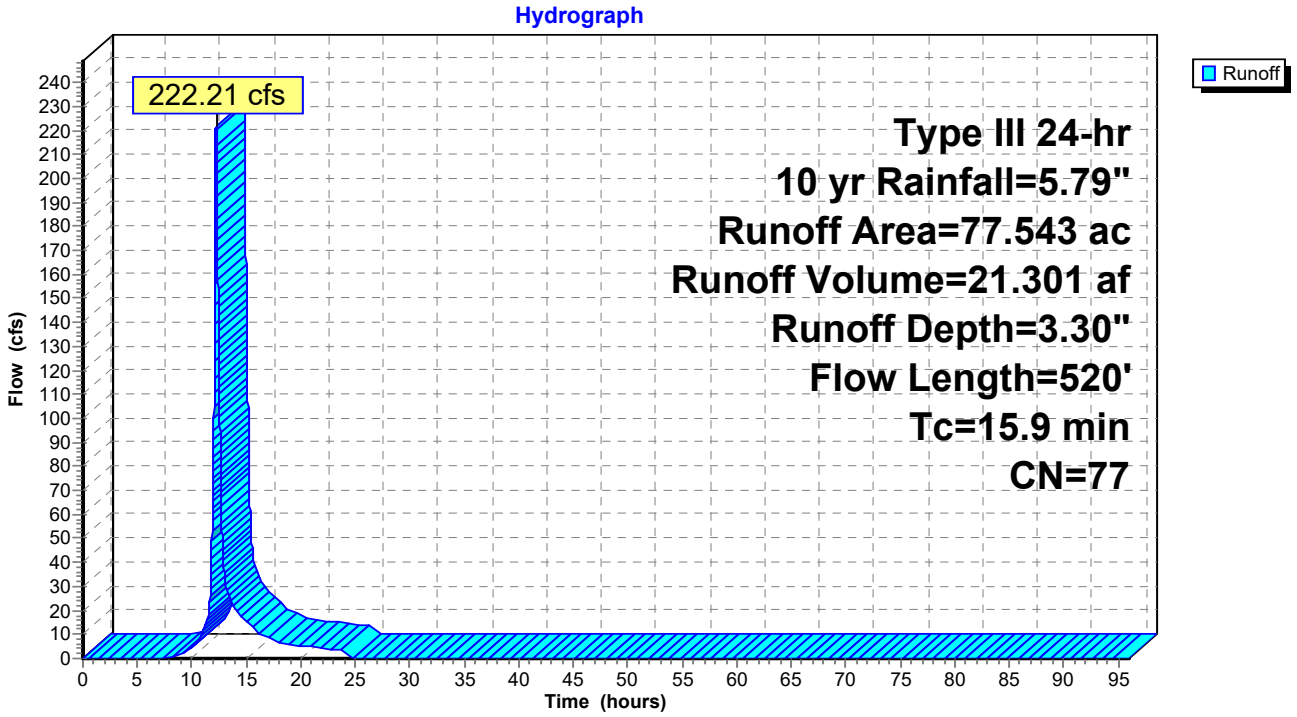
Runoff = 222.21 cfs @ 12.21 hrs, Volume= 21.301 af, Depth= 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=5.79"

Area (ac)	CN	Description
25.200	79	Woods, Fair, HSG D
2.521	60	Woods, Fair, HSG B
1.749	36	Woods, Fair, HSG A
2.289	94	Fallow, bare soil, HSG D
4.872	84	Pasture/grassland/range, Fair, HSG D
3.367	54	1/2 acre lots, 25% imp, HSG A
1.378	85	1/2 acre lots, 25% imp, HSG D
20.876	86	1/3 acre lots, 30% imp, HSG D
7.254	57	1/3 acre lots, 30% imp, HSG A
5.237	72	1/3 acre lots, 30% imp, HSG B
2.800	98	Water Surface, HSG A
77.543	77	Weighted Average
63.547	73	81.95% Pervious Area
13.996	98	18.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	48	0.0140	0.09		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.21"
0.5	68	0.2180	2.33		**Shallow Concentrated Flow, Shallow Conc-woods** Woodland Kv= 5.0 fps
1.2	404	0.0720	5.45		**Shallow Concentrated Flow, Shallow Conc-gutter line** Paved Kv= 20.3 fps
5.0					**Direct Entry, Conveyance through pipe network**
15.9	520	Total			

Subcatchment DA1: DEVELOPMENT NORTH OF FRANKLIN ST.



ummary for Subcatchment DA2: COMMERCIAL DEVEL/ELDERLY HOUSING NORTH SIDE OF FRANKLIN

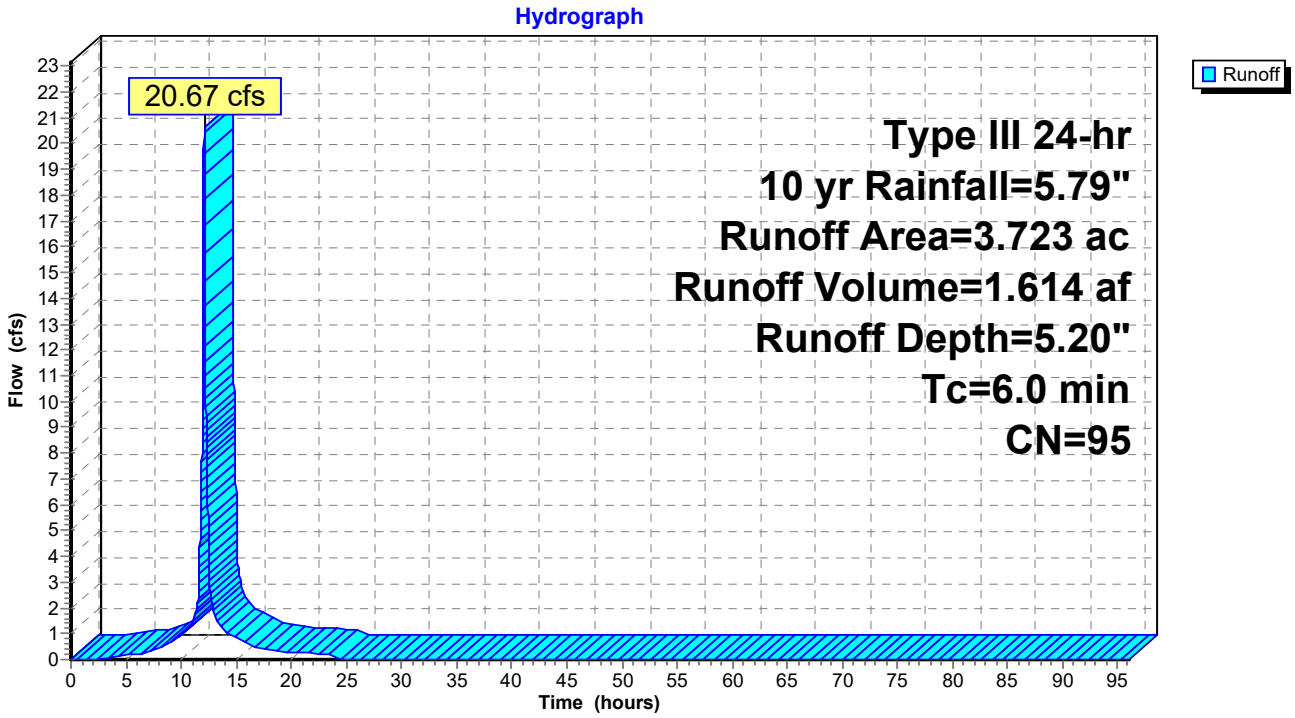
Runoff = 20.67 cfs @ 12.08 hrs, Volume= 1.614 af, Depth= 5.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=5.79"

Area (ac)	CN	Description
3.597	95	Urban commercial, 85% imp, HSG D
0.126	89	Urban commercial, 85% imp, HSG A
3.723	95	Weighted Average
0.558	77	15.00% Pervious Area
3.165	98	85.00% Impervious Area

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

Subcatchment DA2: COMMERCIAL DEVEL/ELDERLY HOUSING NORTH SIDE OF FRANKLIN ST.



Summary for Subcatchment DA3: COMMERCIAL DEVEL/HOUSING SOUTH SIDE OF FRANKLIN ST.

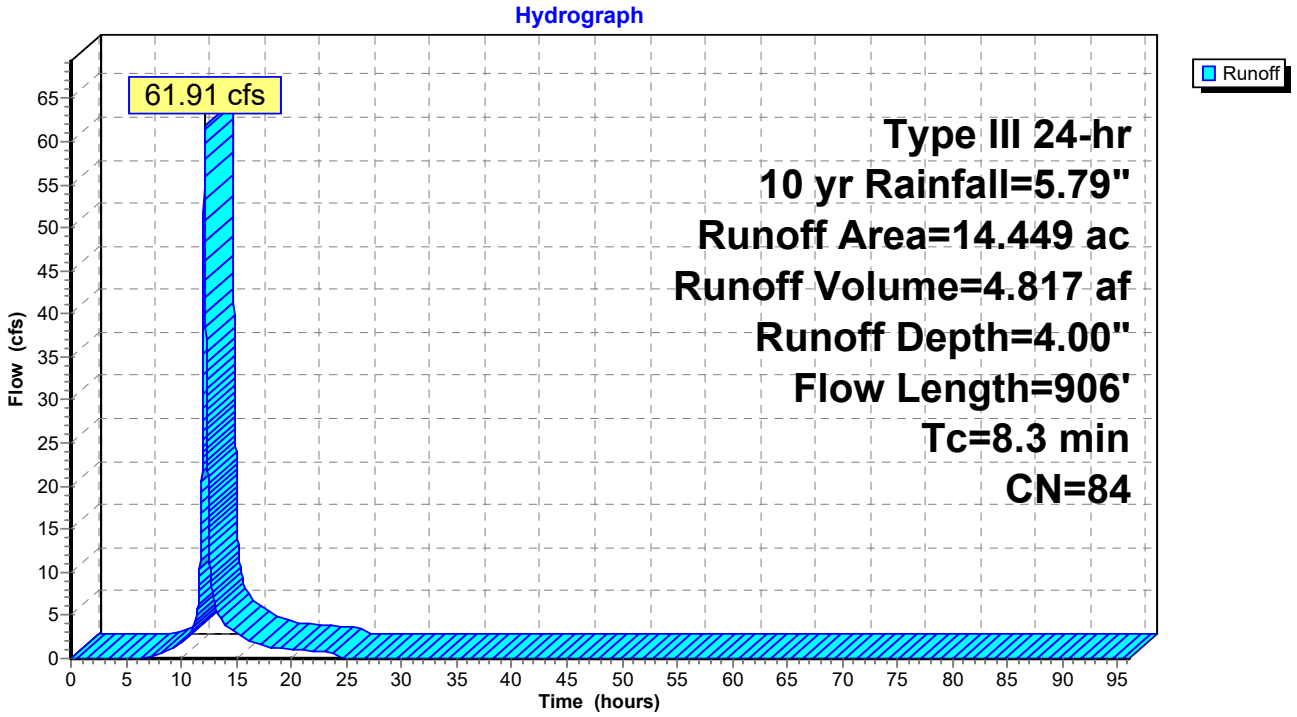
Runoff = 61.91 cfs @ 12.12 hrs, Volume= 4.817 af, Depth= 4.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=5.79"

Area (ac)	CN	Description
2.578	95	Urban commercial, 85% imp, HSG D
0.158	89	Urban commercial, 85% imp, HSG A
1.787	92	1/8 acre lots, 65% imp, HSG D
0.299	77	1/8 acre lots, 65% imp, HSG A
4.832	86	1/3 acre lots, 30% imp, HSG D
1.691	57	1/3 acre lots, 30% imp, HSG A
2.217	79	Woods, Fair, HSG D
0.887	84	50-75% Grass cover, Fair, HSG D
14.449	84	Weighted Average
8.811	74	60.98% Pervious Area
5.638	98	39.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	16	0.0200	0.05		**Sheet Flow, Sheet flow through woods** Woods: Light underbrush n= 0.400 P2= 3.21"
0.6	81	0.2200	2.35		**Shallow Concentrated Flow, Shallow Conc through woods / law** Woodland Kv= 5.0 fps
1.7	557	0.0700	5.37		**Shallow Concentrated Flow, Shallow Conc on PVMNT** Paved Kv= 20.3 fps
1.0	252	0.0100	4.18	83.56	**Channel Flow, Open Channel Flow** Area= 20.0 sf Perim= 12.0' r= 1.67' n= 0.050 Earth, long dense weeds
8.3	906	Total			

Subcatchment DA3: COMMERCIAL DEVEL/HOUSING SOUTH SIDE OF FRANKLIN ST.



Summary for Subcatchment DA4: ATHLETIC FIELDS

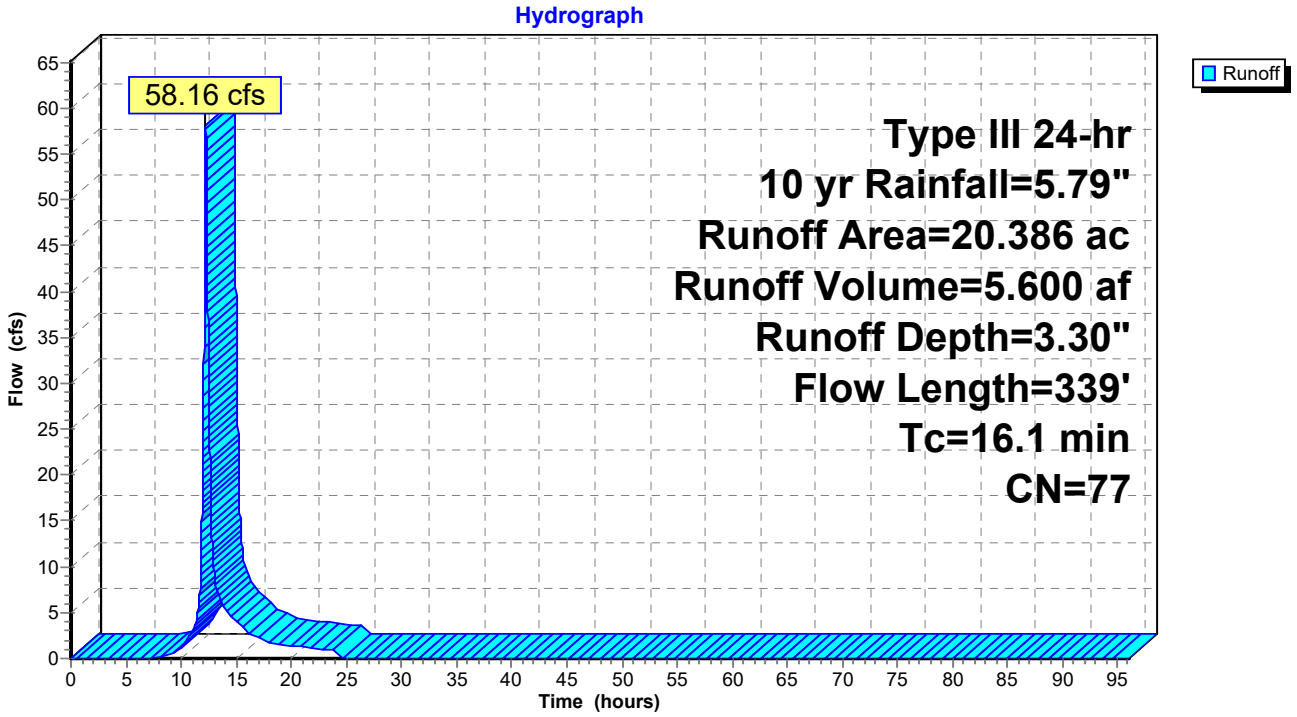
Runoff = 58.16 cfs @ 12.22 hrs, Volume= 5.600 af, Depth= 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=5.79"

Area (ac)	CN	Description
0.944	98	Unconnected pavement, HSG C
2.179	86	1/3 acre lots, 30% imp, HSG D
13.800	74	>75% Grass cover, Good, HSG C
3.463	79	Woods, Fair, HSG D
20.386	77	Weighted Average
18.788	75	92.16% Pervious Area
1.598	98	7.84% Impervious Area
0.944		59.08% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	25	0.0050	0.03		**Sheet Flow, Sheet flow through woods** Woods: Light underbrush n= 0.400 P2= 3.21"
2.2	246	0.1400	1.87		**Shallow Concentrated Flow, Shallow Conc through woods** Woodland Kv= 5.0 fps
0.5	68	0.0880	2.08		**Shallow Concentrated Flow, Shallow Conc through grass** Short Grass Pasture Kv= 7.0 fps
1.0					**Direct Entry, Flow through closeed pipes**
16.1	339	Total			

Subcatchment DA4: ATHLETIC FIELDS



or Subcatchment DA5a: RESIDENTIAL & COMMERCIAL DEVELOPMENT , NORTH OF HS, SOUTH SIDE

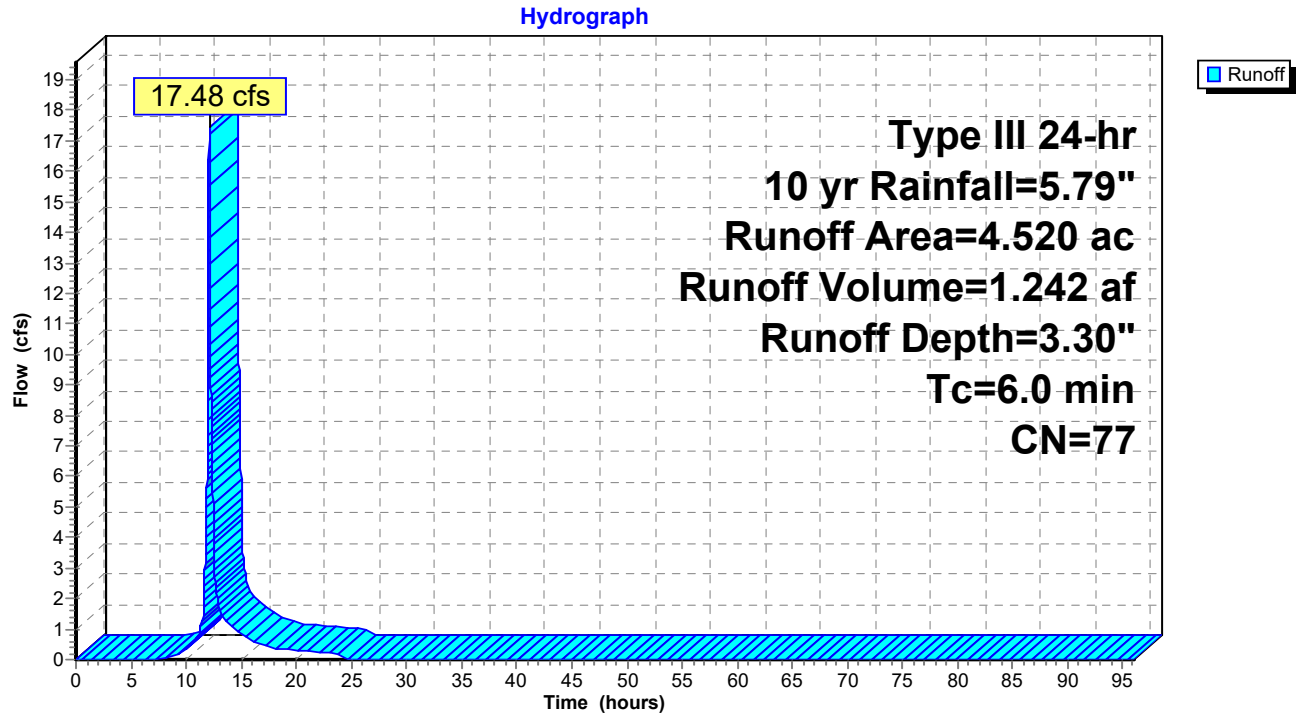
Runoff = 17.48 cfs @ 12.09 hrs, Volume= 1.242 af, Depth= 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=5.79"

Area (ac)	CN	Description
3.036	89	Urban commercial, 85% imp, HSG A
0.069	86	1/3 acre lots, 30% imp, HSG D
1.103	57	1/3 acre lots, 30% imp, HSG A
0.312	36	Woods, Fair, HSG A
4.520	77	Weighted Average
1.588	40	35.13% Pervious Area
2.932	98	64.87% Impervious Area

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

catchment DA5a: RESIDENTIAL & COMMERCIAL DEVELOPMENT , NORTH OF HS, SOUTH SIDE FRANK



Summary for Subcatchment DA5b: HIGH SCHOOL, PARKING, AND TENNIS COURTS

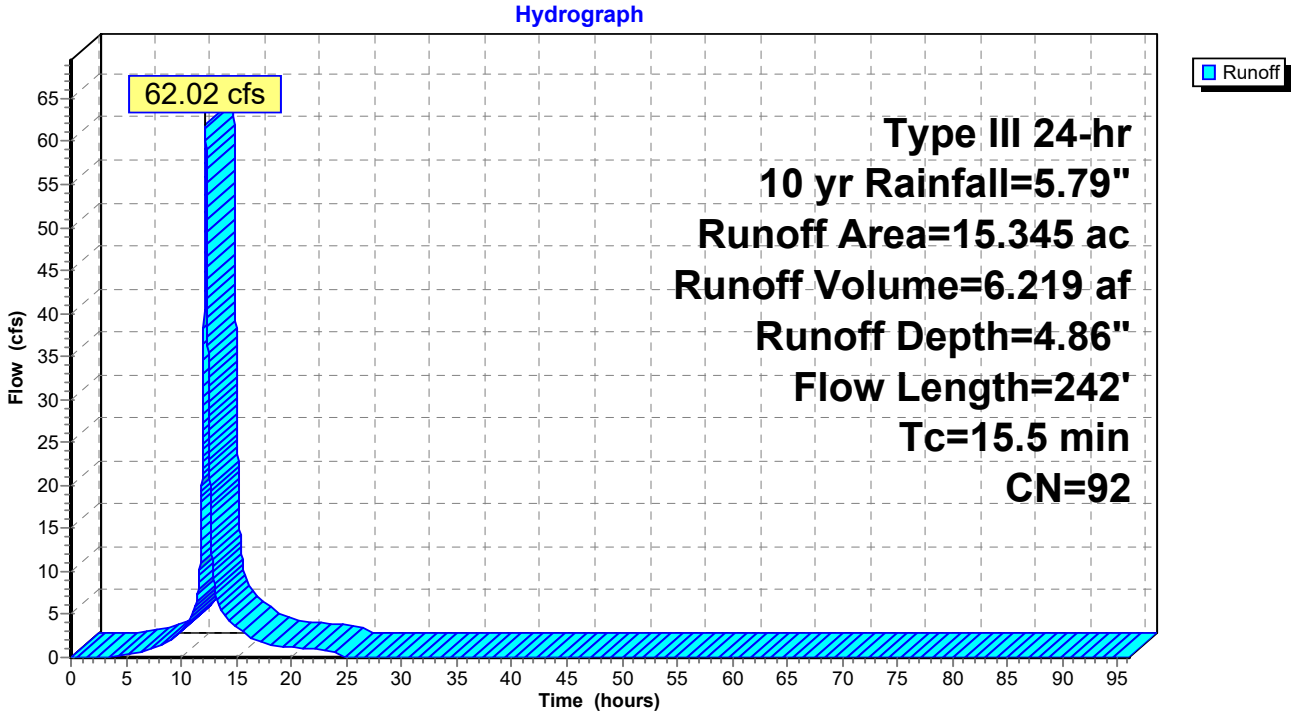
Runoff = 62.02 cfs @ 12.20 hrs, Volume= 6.219 af, Depth= 4.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=5.79"

Area (ac)	CN	Description
12.099	95	Urban commercial, 85% imp, HSG D
1.536	89	Urban commercial, 85% imp, HSG A
0.459	57	1/3 acre lots, 30% imp, HSG A
1.251	79	50-75% Grass cover, Fair, HSG C
15.345	92	Weighted Average
3.618	72	23.57% Pervious Area
11.727	98	76.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	40	0.0090	0.07		**Sheet Flow, Sheet flow through grass** Grass: Dense n= 0.240 P2= 3.21"
4.1	202	0.0140	0.83		**Shallow Concentrated Flow, Shallow Conc through grass** Short Grass Pasture Kv= 7.0 fps
2.0					**Direct Entry, Flow through closed pipes**
15.5	242	Total			

Subcatchment DA5b: HIGH SCHOOL, PARKING, AND TENNIS COURTS



Summary for Subcatchment DA6: DA6

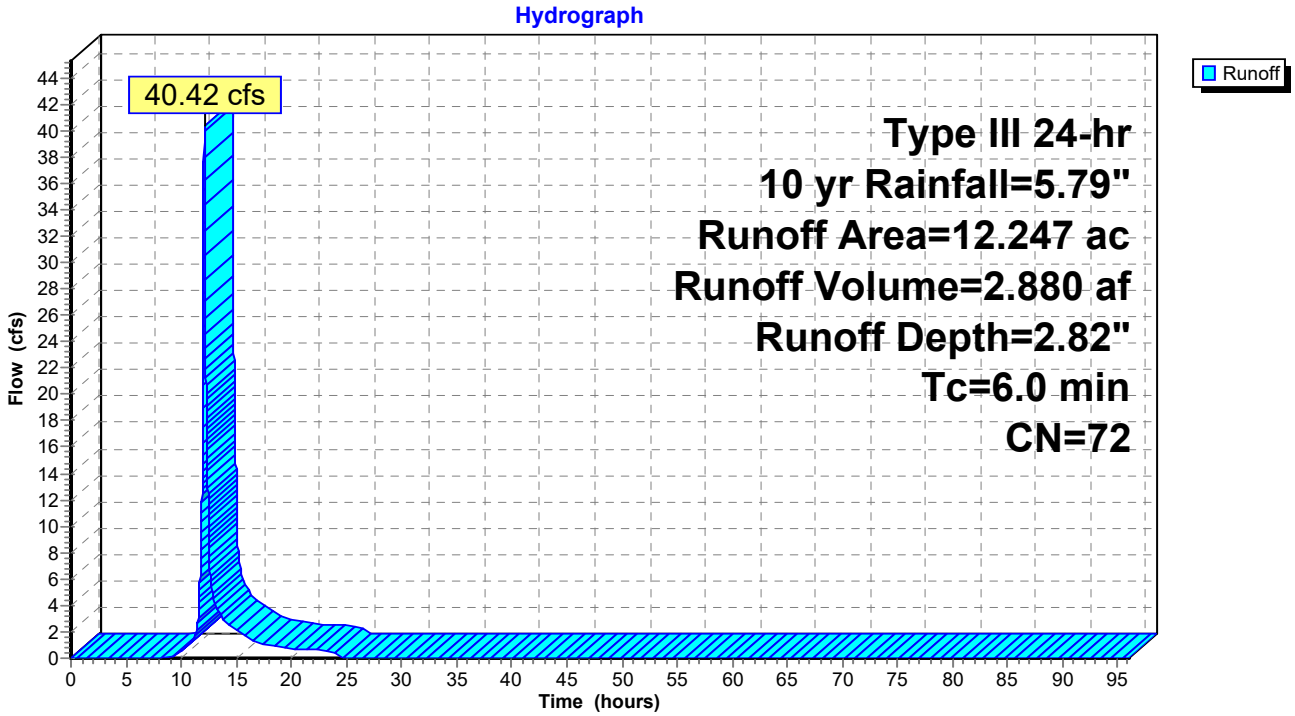
Runoff = 40.42 cfs @ 12.09 hrs, Volume= 2.880 af, Depth= 2.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=5.79"

Area (ac)	CN	Description
1.766	60	Woods, Fair, HSG B
4.843	79	Woods, Fair, HSG D
0.033	36	Woods, Fair, HSG A
1.692	86	1/3 acre lots, 30% imp, HSG D
2.974	57	1/3 acre lots, 30% imp, HSG A
0.392	72	1/3 acre lots, 30% imp, HSG B
0.184	98	Paved parking, HSG D
0.070	49	50-75% Grass cover, Fair, HSG A
0.293	84	50-75% Grass cover, Fair, HSG D
12.247	72	Weighted Average
10.546	68	86.11% Pervious Area
1.701	98	13.89% Impervious Area

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

Subcatchment DA6: DA6



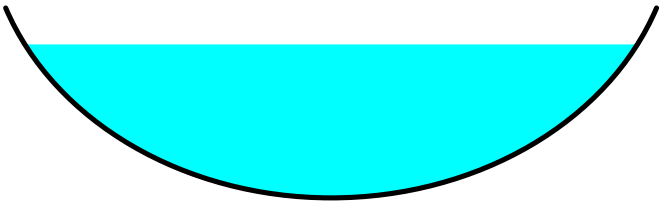
Summary for Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.

Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth > 2.23" for 10 yr event
Inflow = 20.69 cfs @ 12.08 hrs, Volume= 15.100 af
Outflow = 17.24 cfs @ 12.14 hrs, Volume= 15.087 af, Atten= 17%, Lag= 3.2 min

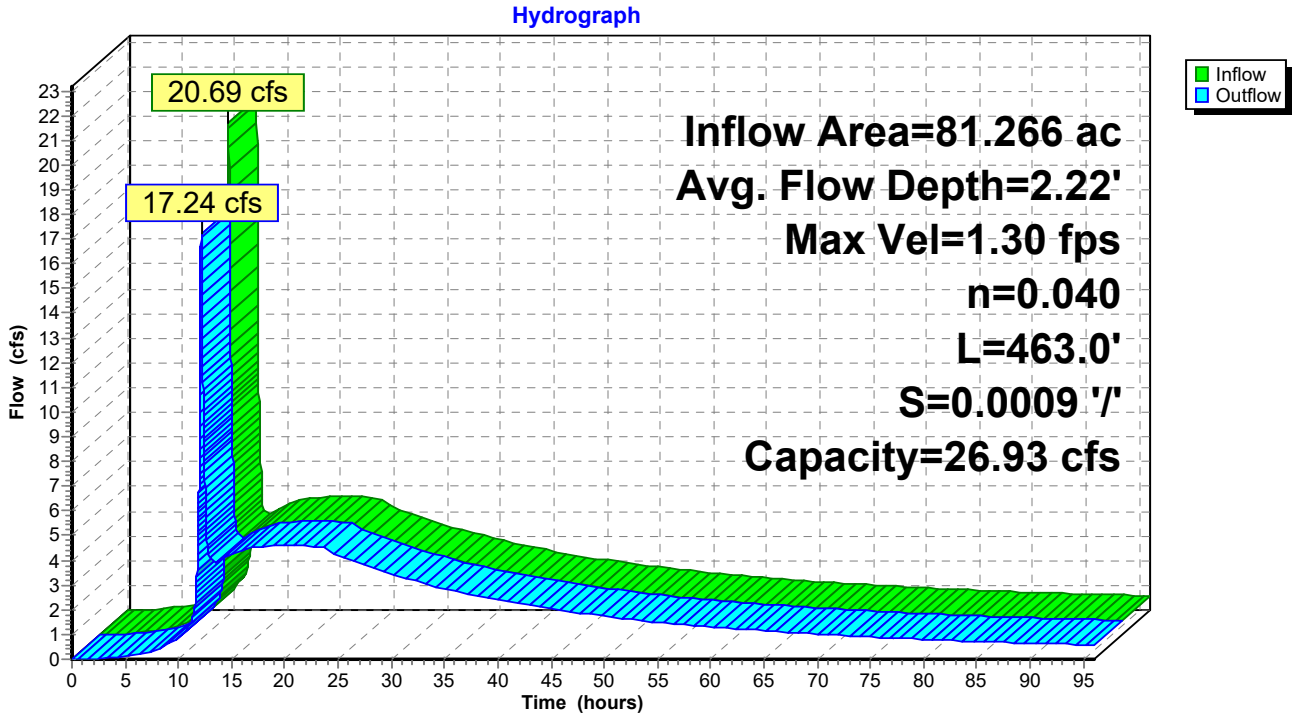
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 1.30 fps, Min. Travel Time= 6.0 min
Avg. Velocity = 0.64 fps, Avg. Travel Time= 12.1 min

Peak Storage= 6,159 cf @ 12.14 hrs
Average Depth at Peak Storage= 2.22' , Surface Width= 8.99'
Bank-Full Depth= 2.75' Flow Area= 18.3 sf, Capacity= 26.93 cfs

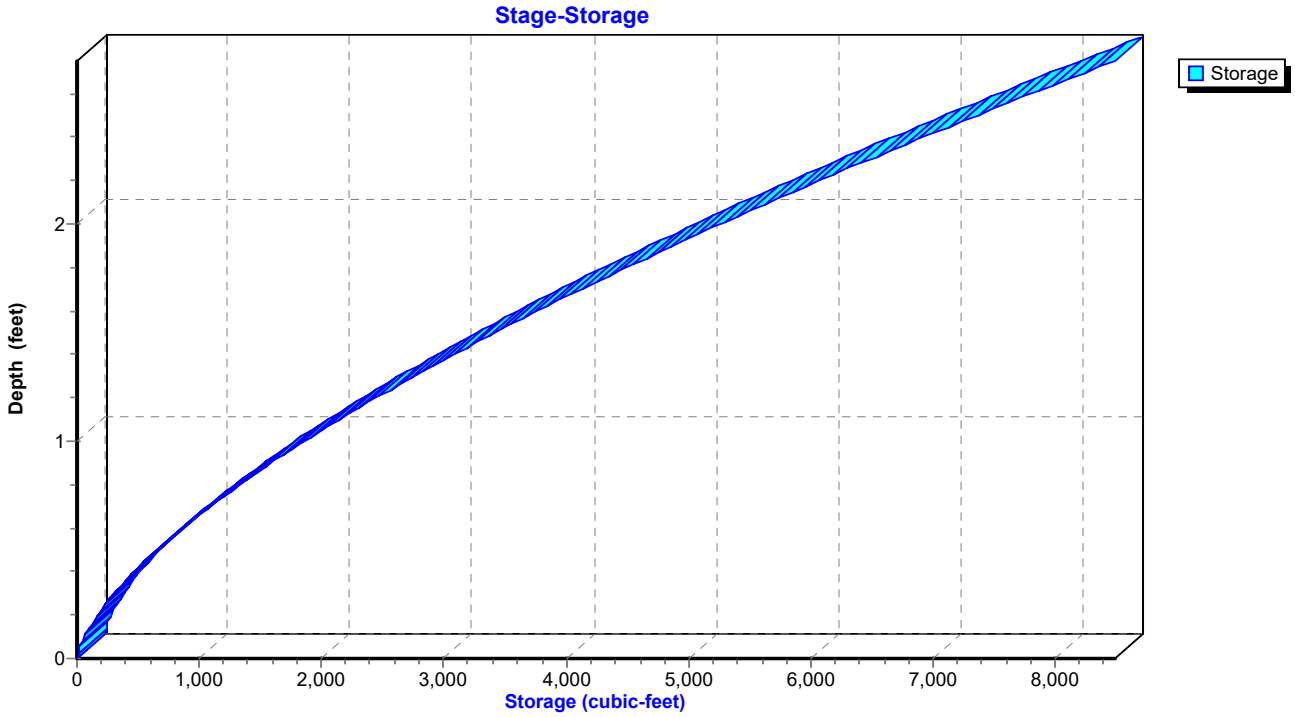
10.00' x 2.75' deep Parabolic Channel, n= 0.040 Earth, dense weeds
Length= 463.0' Slope= 0.0009 '/'
Inlet Invert= 162.00', Outlet Invert= 161.60'



Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.



Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.



Summary for Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.

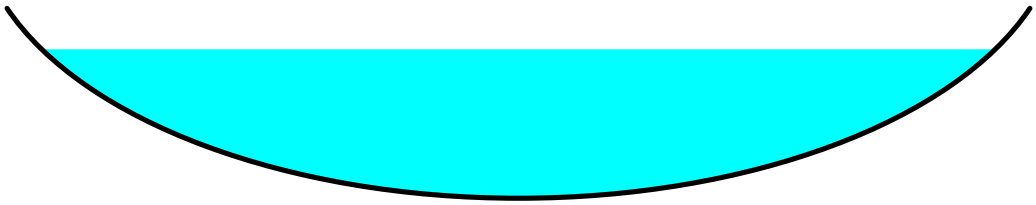
[80] Warning: Exceeded Pond C-1 by 0.35' @ 0.00 hrs (0.65 cfs 0.002 af)

Inflow Area = 95.715 ac, 23.82% Impervious, Inflow Depth > 2.50" for 10 yr event
Inflow = 78.87 cfs @ 12.12 hrs, Volume= 19.904 af
Outflow = 71.10 cfs @ 12.17 hrs, Volume= 19.889 af, Atten= 10%, Lag= 2.8 min

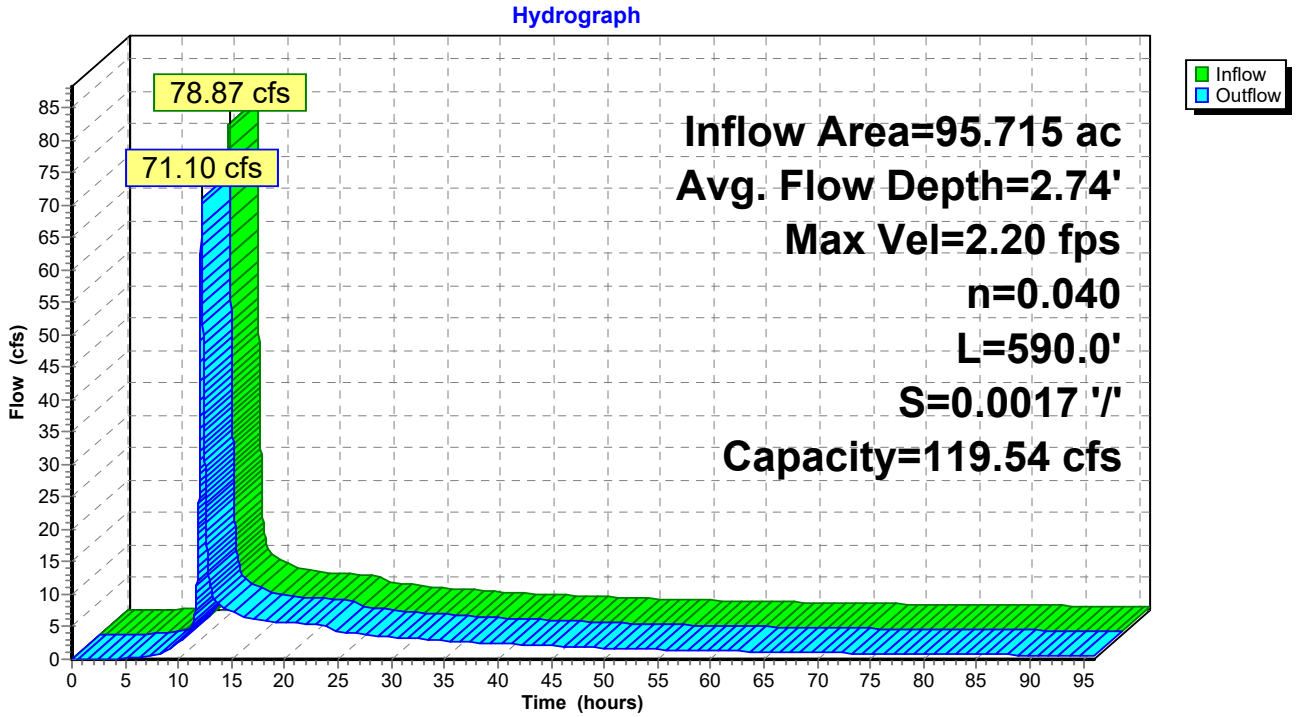
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 2.20 fps, Min. Travel Time= 4.5 min
Avg. Velocity = 0.72 fps, Avg. Travel Time= 13.6 min

Peak Storage= 19,084 cf @ 12.17 hrs
Average Depth at Peak Storage= 2.74' , Surface Width= 17.70'
Bank-Full Depth= 3.50' Flow Area= 46.7 sf, Capacity= 119.54 cfs

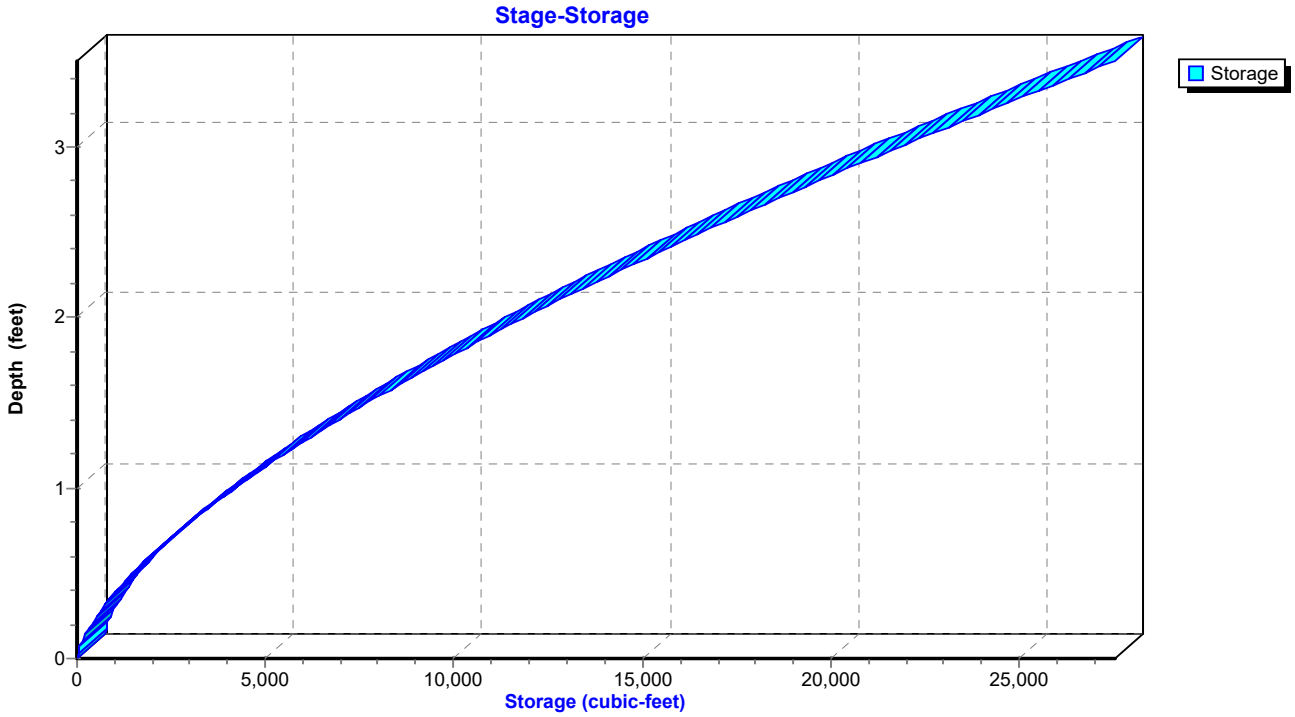
20.00' x 3.50' deep Parabolic Channel, n= 0.040
Length= 590.0' Slope= 0.0017 '/'
Inlet Invert= 162.00', Outlet Invert= 161.00'



Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.



Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.



Summary for Reach 3R: OPEN CHANNEL-SOUTH OF TRACK

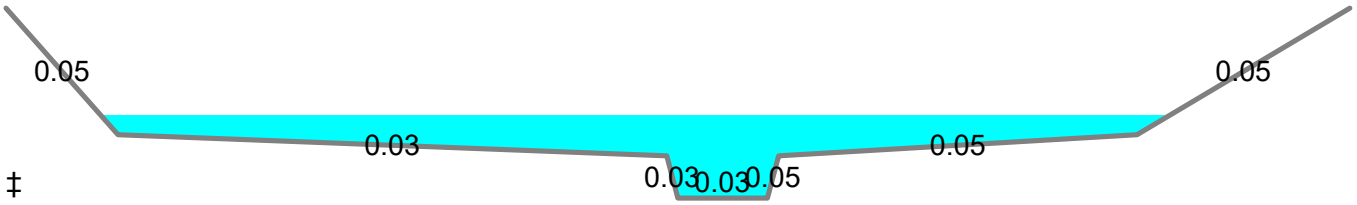
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=2)

Inflow Area = 148.213 ac, 27.50% Impervious, Inflow Depth > 2.90" for 10 yr event
Inflow = 226.91 cfs @ 12.17 hrs, Volume= 35.829 af
Outflow = 224.28 cfs @ 12.19 hrs, Volume= 35.823 af, Atten= 1%, Lag= 1.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.45 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 1.36 fps, Avg. Travel Time= 4.8 min

Peak Storage= 30,313 cf @ 12.19 hrs
Average Depth at Peak Storage= 1.97' , Surface Width= 95.51'
Bank-Full Depth= 4.50' Flow Area= 350.8 sf, Capacity= 2,227.64 cfs

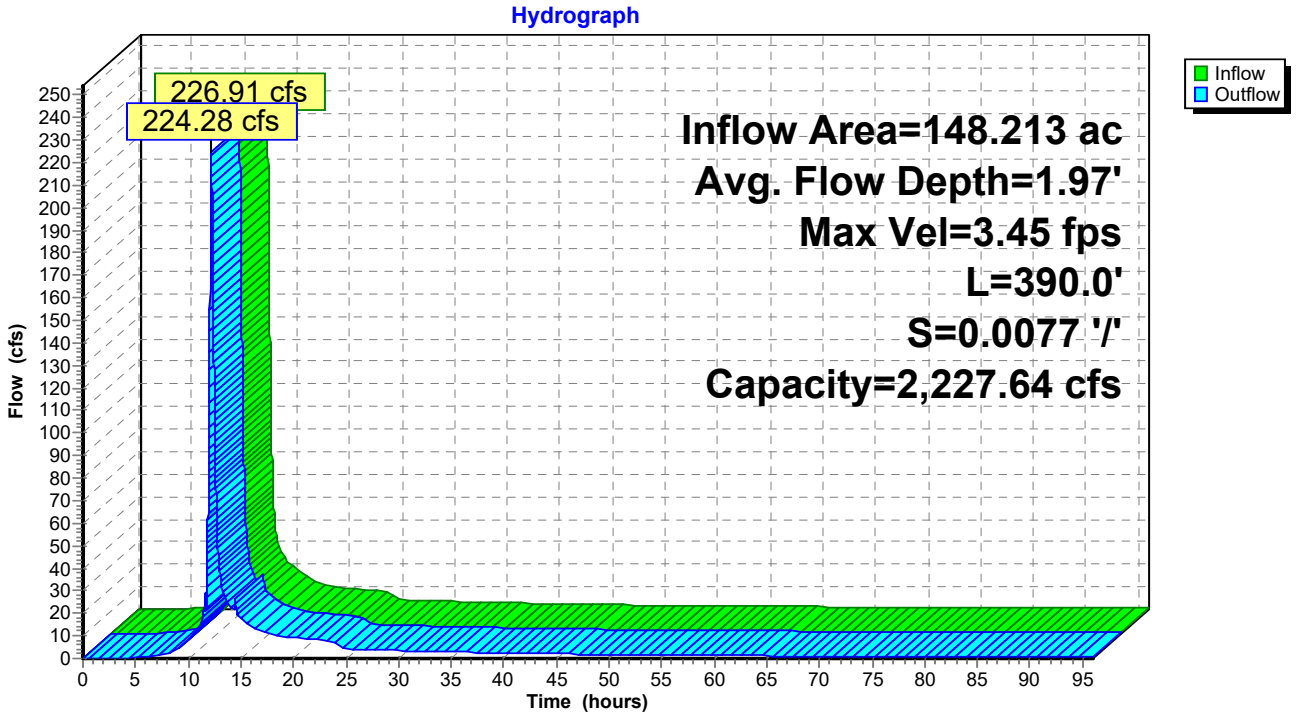
Custom cross-section, Length= 390.0' Slope= 0.0077 '/' (102 Elevation Intervals)
Composite Manning's value by Pavlovskii (shallow flow) method
Composite Manning's value at bank full= 0.042
Inlet Invert= 158.00', Outlet Invert= 155.00'



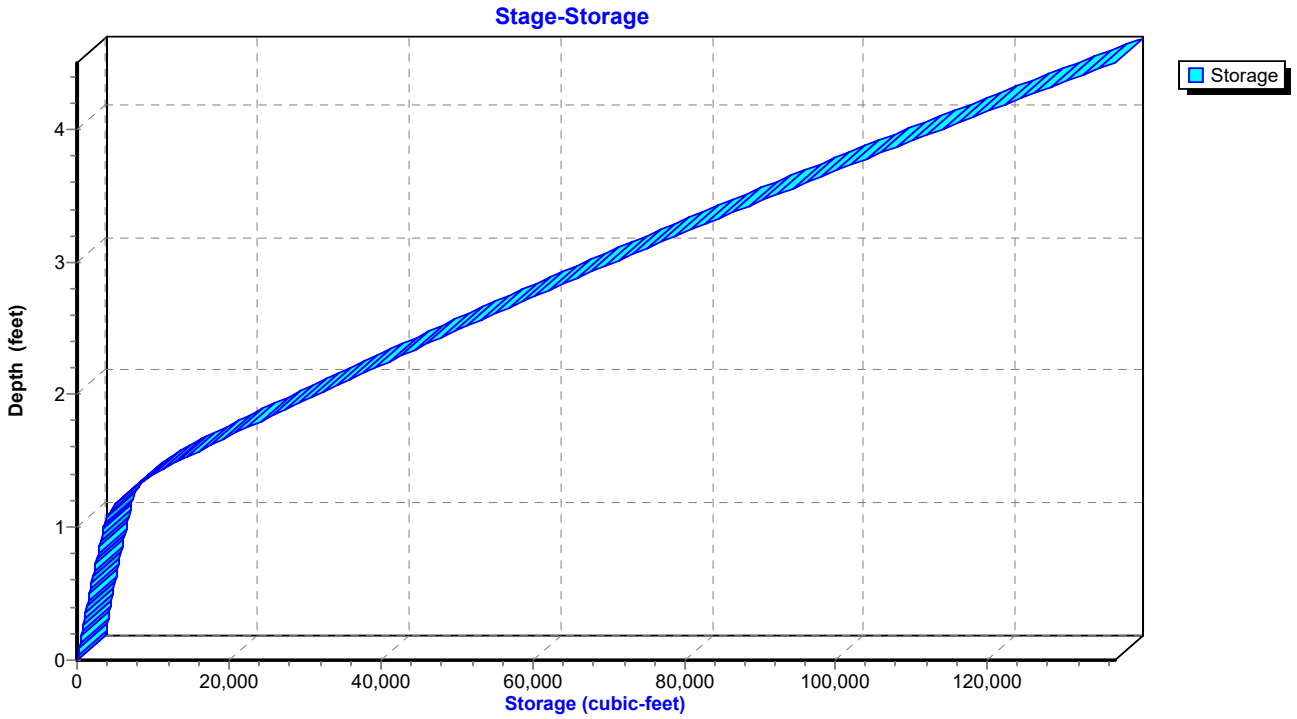
Offset (feet)	Elevation (feet)	Chan.Depth (feet)	n	Description
-60.00	158.00	0.00		
-50.00	155.00	3.00	0.050	Scattered brush, heavy weeds
-1.00	154.50	3.50	0.030	Earth, grassed & winding
0.00	153.50	4.50	0.030	Earth, grassed & winding
8.00	153.50	4.50	0.030	Earth, grassed & winding
9.00	154.50	3.50	0.050	Scattered brush, heavy weeds
41.00	155.00	3.00	0.050	Scattered brush, heavy weeds
60.00	158.00	0.00	0.050	Scattered brush, heavy weeds

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	8.0	0.0	0	0.00
1.00	9.0	10.8	10.0	3,510	31.14
1.50	34.3	91.8	91.0	13,358	60.07
4.50	350.8	121.5	120.0	136,793	2,227.64

Reach 3R: OPEN CHANNEL-SOUTH OF TRACK



Reach 3R: OPEN CHANNEL-SOUTH OF TRACK



Summary for Pond C-1: FRANKLIN ST CULVERT

[57] Hint: Peaked at 165.57' (Flood elevation advised)

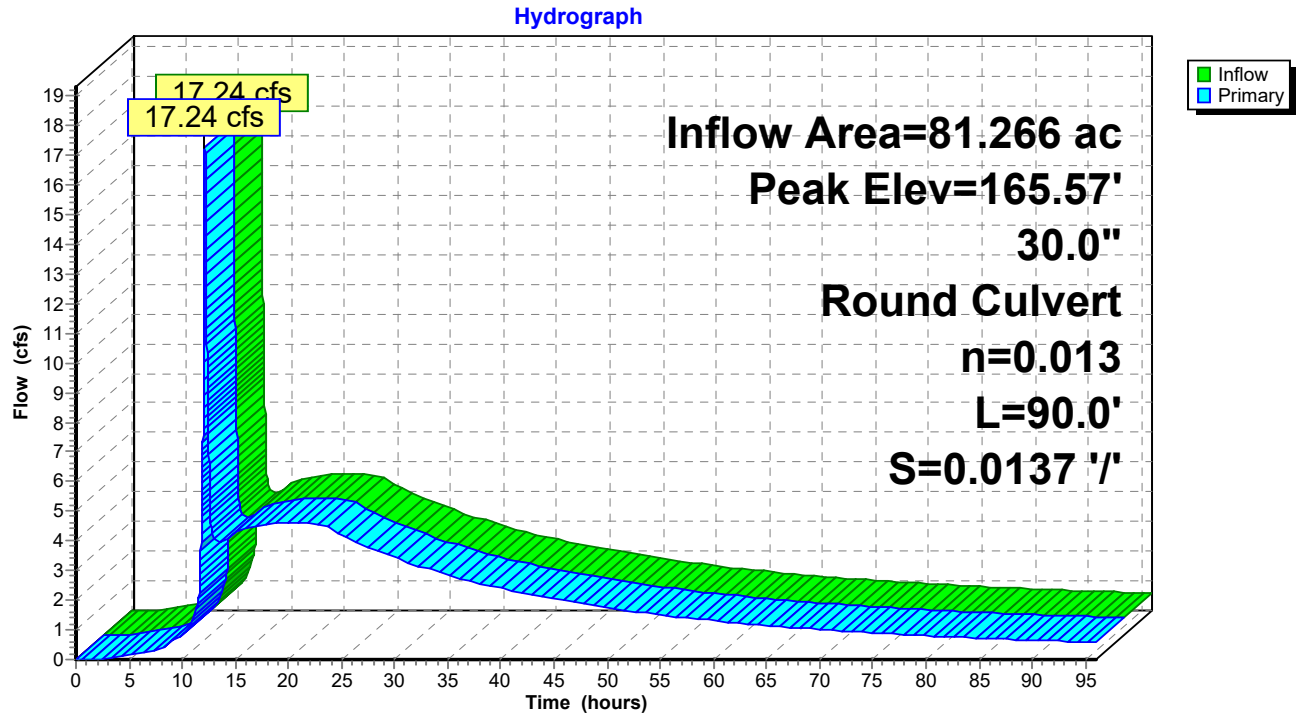
Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth > 2.23" for 10 yr event
Inflow = 17.24 cfs @ 12.14 hrs, Volume= 15.087 af
Outflow = 17.24 cfs @ 12.14 hrs, Volume= 15.087 af, Atten= 0%, Lag= 0.0 min
Primary = 17.24 cfs @ 12.14 hrs, Volume= 15.087 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 165.57' @ 12.15 hrs

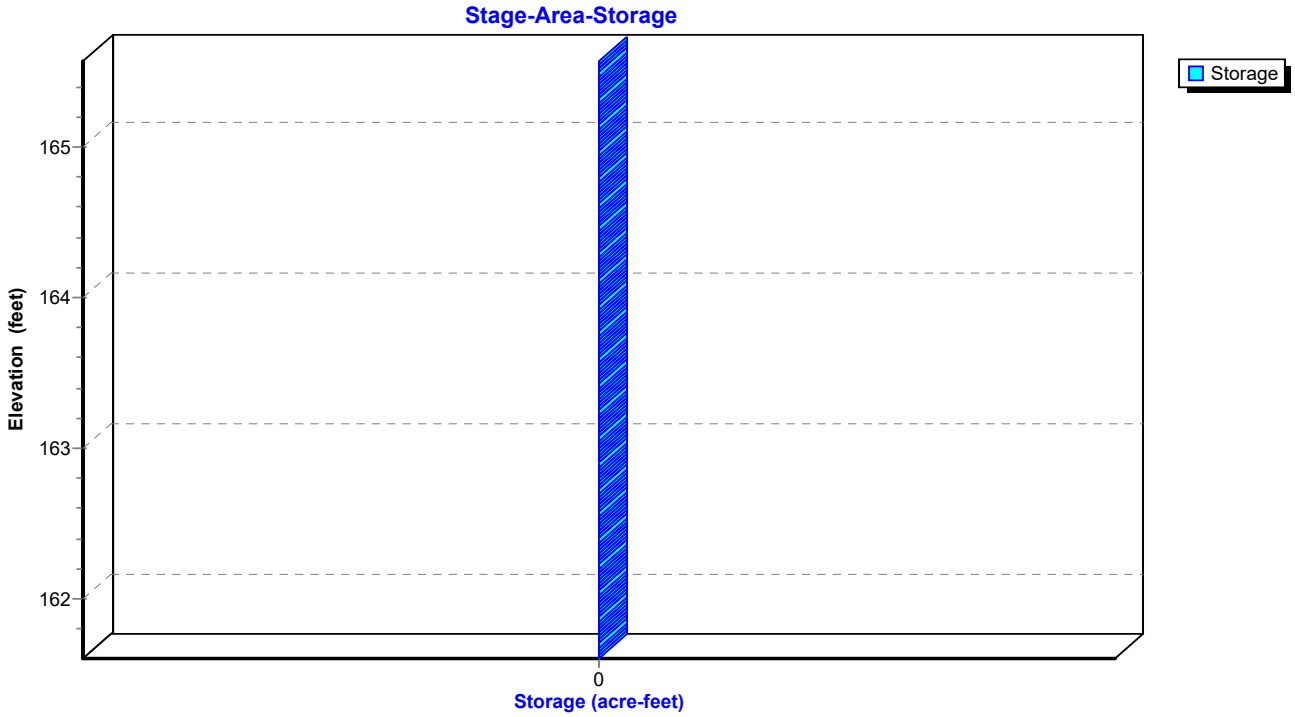
Device	Routing	Invert	Outlet Devices
#1	Primary	161.60'	**30.0" Round Culvert** L= 90.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 161.60' / 160.37' S= 0.0137 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 4.91 sf

Primary OutFlow Max=17.23 cfs @ 12.14 hrs HW=165.55' TW=164.70' (Dynamic Tailwater)
1=Culvert (Inlet Controls 17.23 cfs @ 3.51 fps)

Pond C-1: FRANKLIN ST CULVERT



Pond C-1: FRANKLIN ST CULVERT



Summary for Pond C-2: CULVERT #2

[57] Hint: Peaked at 286.13' (Flood elevation advised)

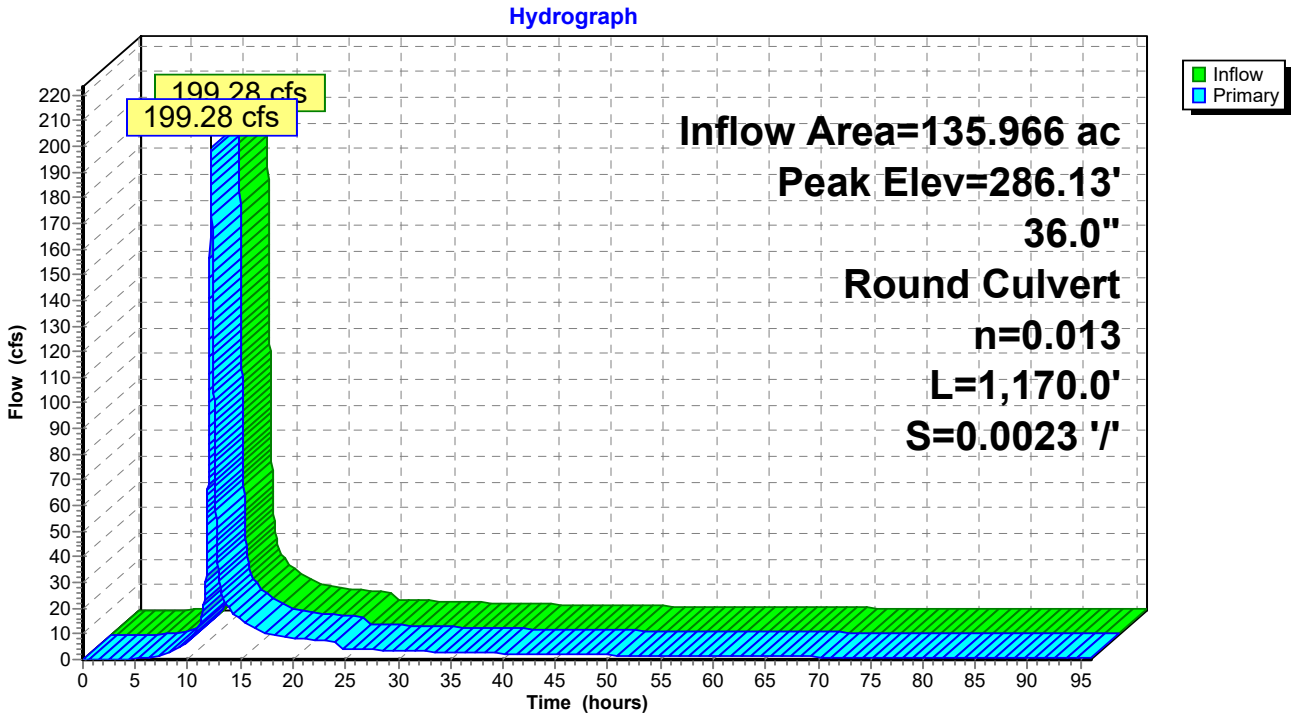
Inflow Area = 135.966 ac, 28.73% Impervious, Inflow Depth > 2.91" for 10 yr event
Inflow = 199.28 cfs @ 12.18 hrs, Volume= 32.949 af
Outflow = 199.28 cfs @ 12.18 hrs, Volume= 32.949 af, Atten= 0%, Lag= 0.0 min
Primary = 199.28 cfs @ 12.18 hrs, Volume= 32.949 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 286.13' @ 12.18 hrs

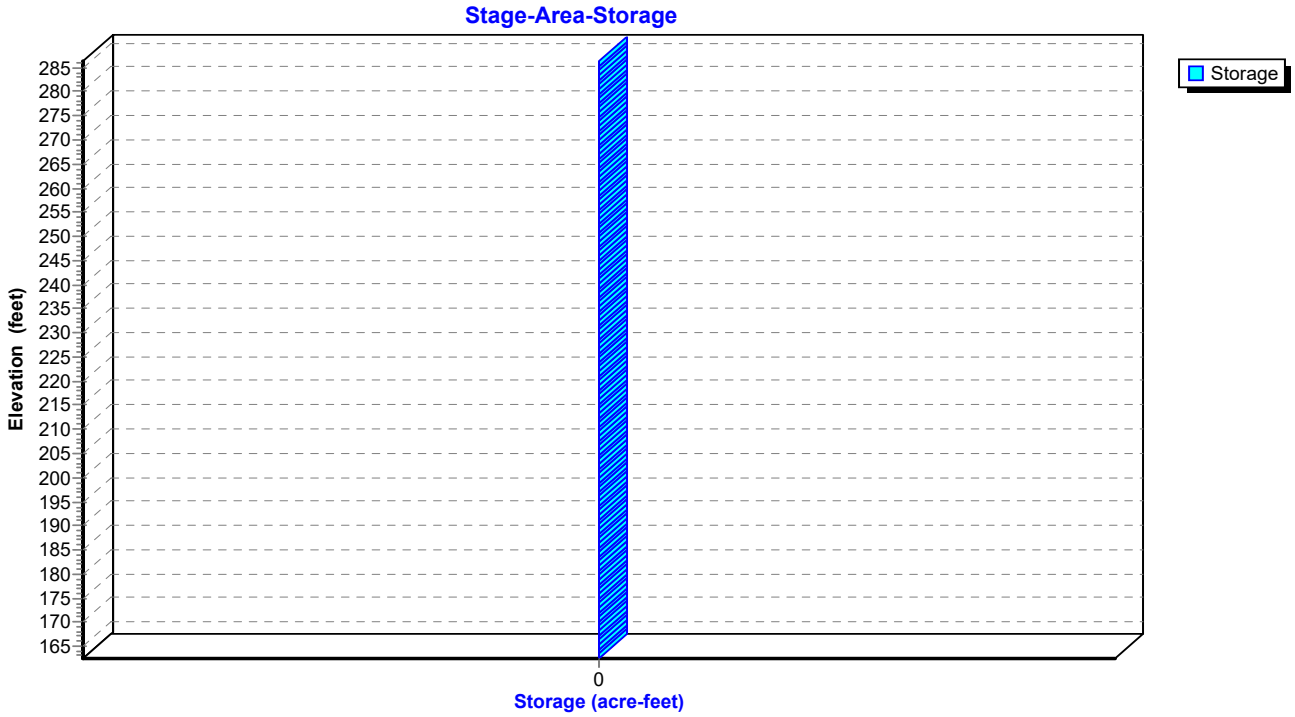
Device	Routing	Invert	Outlet Devices
#1	Primary	162.50'	**36.0" Round Culvert** L= 1,170.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 162.50' / 159.79' S= 0.0023 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=199.15 cfs @ 12.18 hrs HW=285.97' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 199.15 cfs @ 28.17 fps)

Pond C-2: CULVERT #2



Pond C-2: CULVERT #2



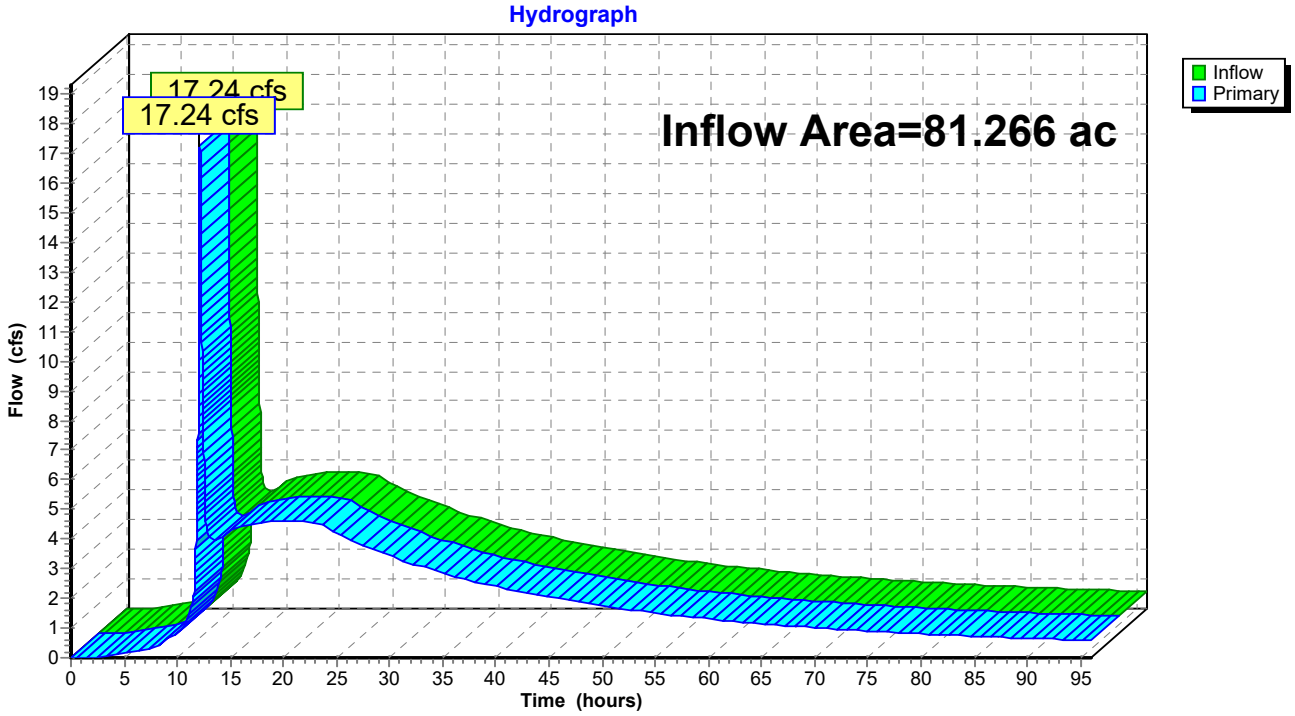
Summary for Pond SP1: FRANKLIN ST. CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth > 2.23" for 10 yr event
Inflow = 17.24 cfs @ 12.14 hrs, Volume= 15.087 af
Primary = 17.24 cfs @ 12.14 hrs, Volume= 15.087 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP1: FRANKLIN ST. CULVERT



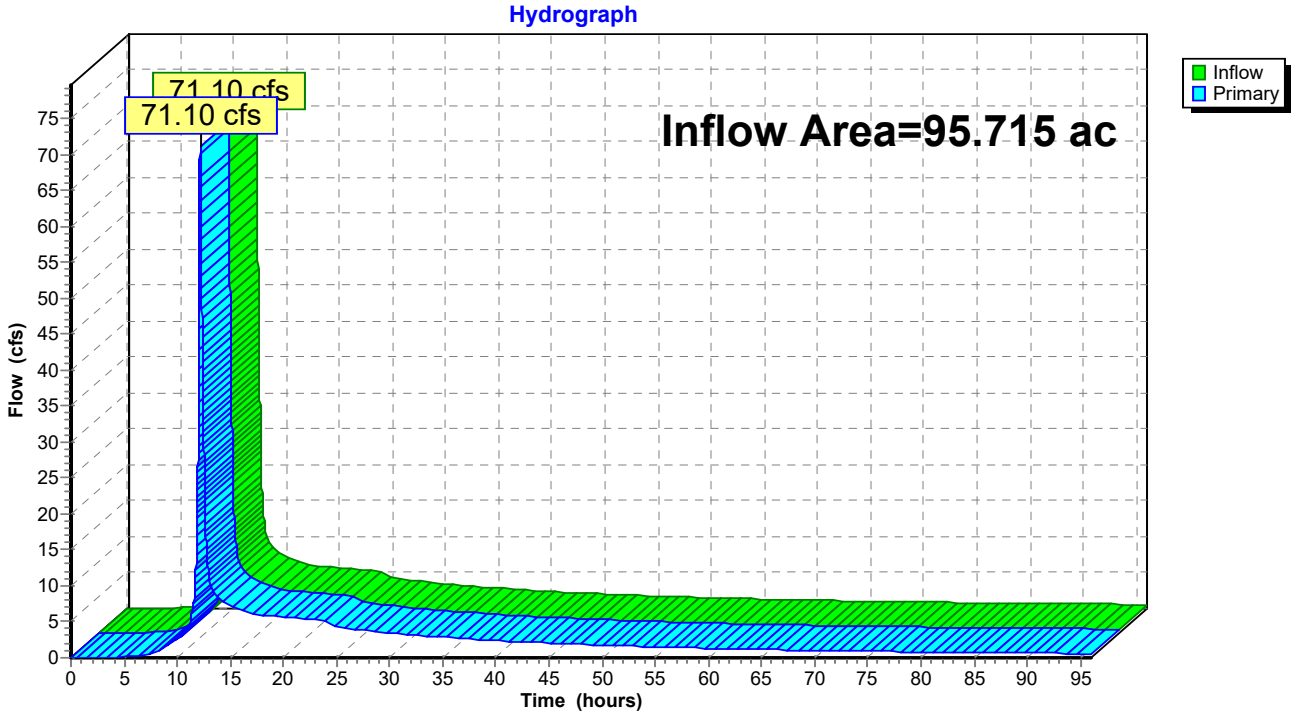
Summary for Pond SP2: HEADWALL 36-IN. CULVERT PIPE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 95.715 ac, 23.82% Impervious, Inflow Depth > 2.49" for 10 yr event
Inflow = 71.10 cfs @ 12.17 hrs, Volume= 19.889 af
Primary = 71.10 cfs @ 12.17 hrs, Volume= 19.889 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP2: HEADWALL 36-IN. CULVERT PIPE



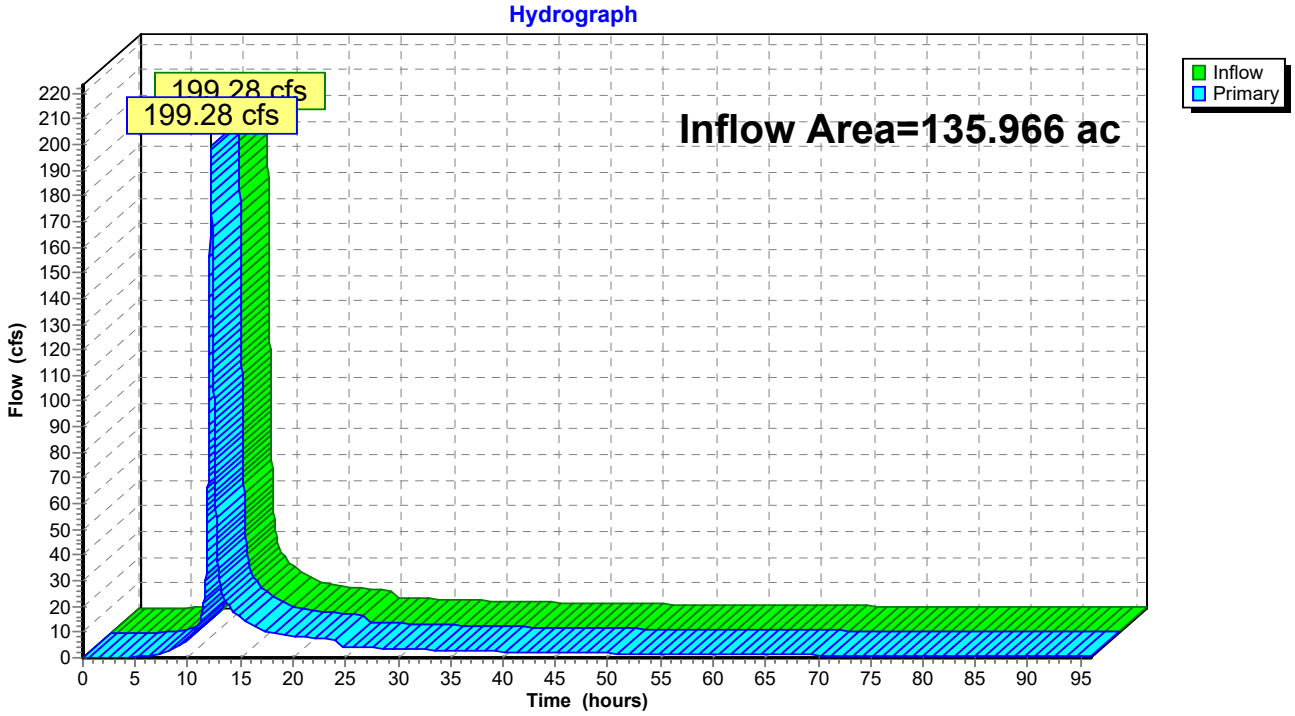
Summary for Pond SP3: OUTLET OF 36-IN. CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 135.966 ac, 28.73% Impervious, Inflow Depth > 2.91" for 10 yr event
Inflow = 199.28 cfs @ 12.18 hrs, Volume= 32.949 af
Primary = 199.28 cfs @ 12.18 hrs, Volume= 32.949 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP3: OUTLET OF 36-IN. CULVERT



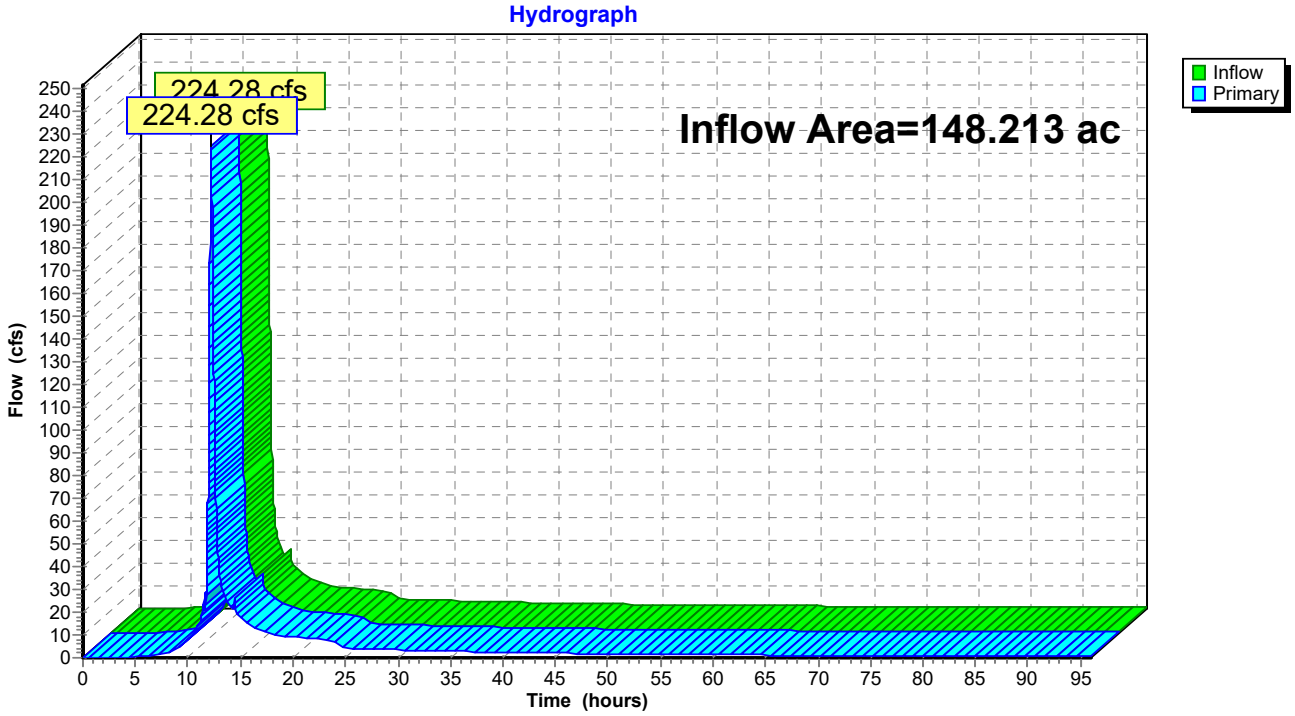
Summary for Pond SP4: WETLANDS TO THE SOUTH

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 148.213 ac, 27.50% Impervious, Inflow Depth > 2.90" for 10 yr event
Inflow = 224.28 cfs @ 12.19 hrs, Volume= 35.823 af
Primary = 224.28 cfs @ 12.19 hrs, Volume= 35.823 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP4: WETLANDS TO THE SOUTH



Summary for Pond W: BORDERING VEGETATED WETLAND

Inflow Area = 77.543 ac, 18.05% Impervious, Inflow Depth = 3.30" for 10 yr event
Inflow = 222.21 cfs @ 12.21 hrs, Volume= 21.301 af
Outflow = 4.36 cfs @ 21.88 hrs, Volume= 13.486 af, Atten= 98%, Lag= 580.0 min
Primary = 4.36 cfs @ 21.88 hrs, Volume= 13.486 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 163.16' @ 21.88 hrs Surf.Area= 15.867 ac Storage= 17.627 af

Plug-Flow detention time= 1,683.8 min calculated for 13.486 af (63% of inflow)
Center-of-Mass det. time= 1,579.3 min (2,411.6 - 832.3)

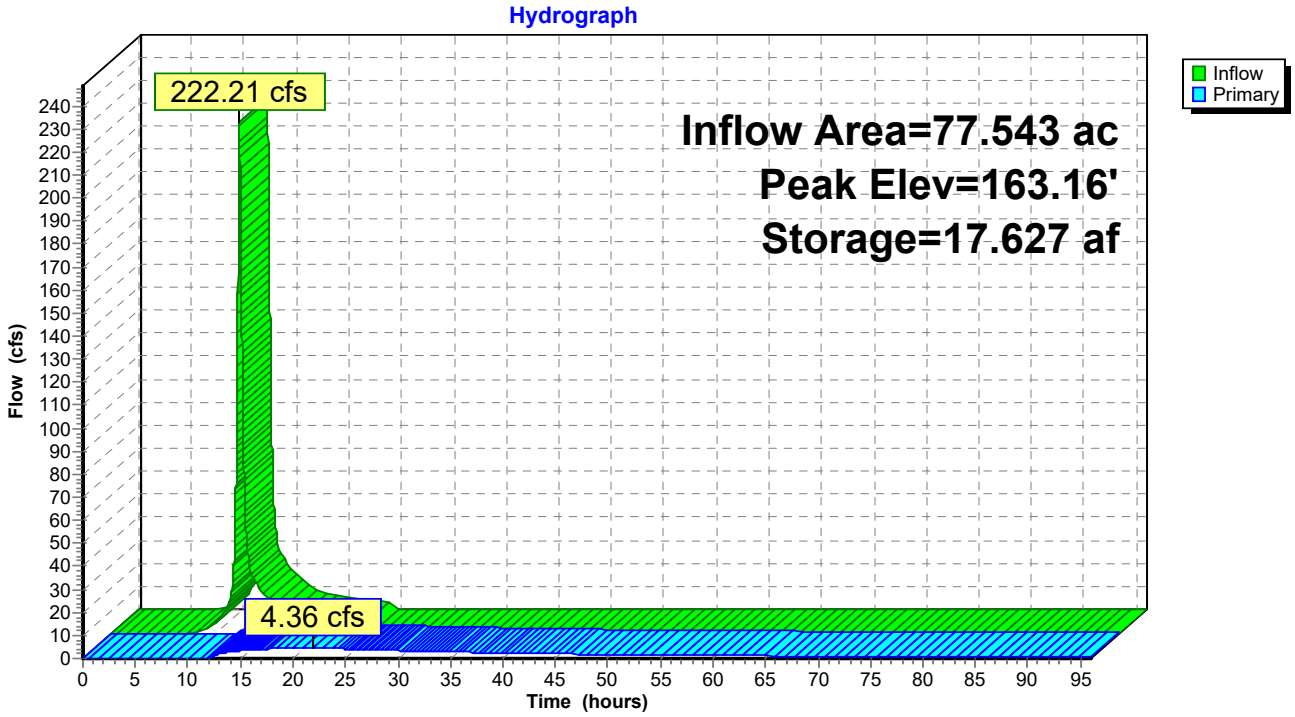
Volume	Invert	Avail.Storage	Storage Description
#1	161.50'	77.077 af	**Ponding storage in wetand (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
161.50	2.880	0.000	0.000
162.00	9.350	3.058	3.058
164.00	20.630	29.980	33.037
166.00	23.410	44.040	77.077

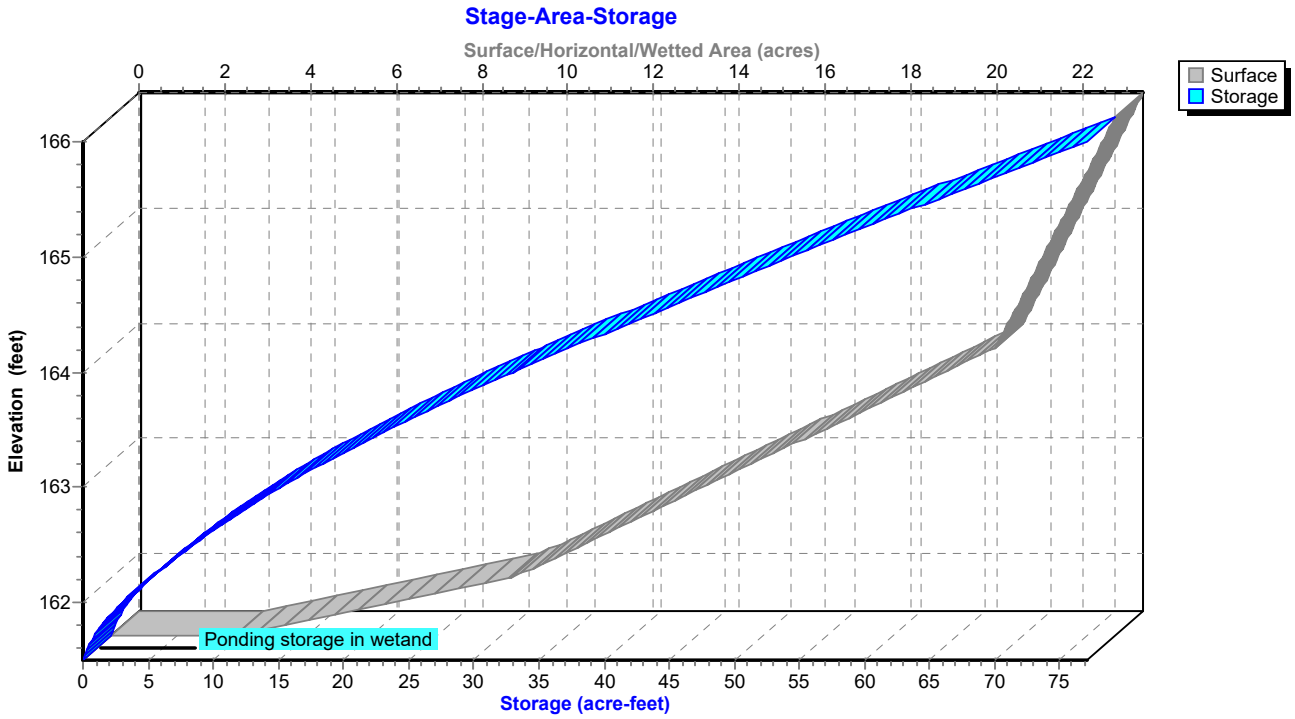
Device	Routing	Invert	Outlet Devices
#1	Primary	162.00'	**Channel/Reach** using Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.

Primary OutFlow Max=4.36 cfs @ 21.88 hrs HW=163.16' TW=163.19' (Dynamic Tailwater)
↑—**1=Channel/Reach** (Channel Controls 4.36 cfs @ 0.87 fps)

Pond W: BORDERING VEGETATED WETLAND



Pond W: BORDERING VEGETATED WETLAND



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DA1: DEVELOPMENT Runoff Area=77.543 ac 18.05% Impervious Runoff Depth=4.81"
Flow Length=520' Tc=15.9 min CN=77 Runoff=323.18 cfs 31.073 af

Subcatchment DA2: COMMERCIAL Runoff Area=3.723 ac 85.00% Impervious Runoff Depth=6.89"
Tc=6.0 min CN=95 Runoff=27.00 cfs 2.139 af

Subcatchment DA3: COMMERCIAL Runoff Area=14.449 ac 39.02% Impervious Runoff Depth=5.61"
Flow Length=906' Tc=8.3 min CN=84 Runoff=85.57 cfs 6.751 af

Subcatchment DA4: ATHLETIC FIELDS Runoff Area=20.386 ac 7.84% Impervious Runoff Depth=4.81"
Flow Length=339' Tc=16.1 min CN=77 Runoff=84.56 cfs 8.169 af

Subcatchment DA5a: RESIDENTIAL & Runoff Area=4.520 ac 64.87% Impervious Runoff Depth=4.81"
Tc=6.0 min CN=77 Runoff=25.35 cfs 1.811 af

Subcatchment DA5b: HIGH SCHOOL, Runoff Area=15.345 ac 76.43% Impervious Runoff Depth=6.54"
Flow Length=242' Tc=15.5 min CN=92 Runoff=82.05 cfs 8.362 af

Subcatchment DA6: DA6 Runoff Area=12.247 ac 13.89% Impervious Runoff Depth=4.25"
Tc=6.0 min CN=72 Runoff=61.05 cfs 4.337 af

Reach 1R: OPEN CHANNEL-NORTH Avg. Flow Depth=2.56' Max Vel=1.41 fps Inflow=27.38 cfs 24.702 af
n=0.040 L=463.0' S=0.0009 '/' Capacity=26.93 cfs Outflow=23.23 cfs 24.687 af

Reach 2R: OPEN CHANNEL-SOUTH Avg. Flow Depth=3.20' Max Vel=2.42 fps Inflow=108.46 cfs 31.438 af
n=0.040 L=590.0' S=0.0017 '/' Capacity=119.54 cfs Outflow=99.11 cfs 31.420 af

Reach 3R: OPEN CHANNEL-SOUTH Avg. Flow Depth=2.16' Max Vel=3.46 fps Inflow=319.31 cfs 54.099 af
L=390.0' S=0.0077 '/' Capacity=2,227.64 cfs Outflow=316.25 cfs 54.092 af

Pond C-1: FRANKLIN ST CULVERT Peak Elev=166.73' Inflow=23.23 cfs 24.687 af
30.0" Round Culvert n=0.013 L=90.0' S=0.0137 '/' Outflow=23.23 cfs 24.687 af

Pond C-2: CULVERT #2 Peak Elev=401.03' Inflow=276.97 cfs 49.762 af
36.0" Round Culvert n=0.013 L=1,170.0' S=0.0023 '/' Outflow=276.97 cfs 49.762 af

Pond SP1: FRANKLIN ST. CULVERT Inflow=23.23 cfs 24.687 af
Primary=23.23 cfs 24.687 af

Pond SP2: HEADWALL 36-IN. CULVERT PIPE Inflow=99.11 cfs 31.420 af
Primary=99.11 cfs 31.420 af

Pond SP3: OUTLET OF 36-IN. CULVERT Inflow=276.97 cfs 49.762 af
Primary=276.97 cfs 49.762 af

Pond SP4: WETLANDS TO THE SOUTH Inflow=316.25 cfs 54.092 af
Primary=316.25 cfs 54.092 af

Pond W: BORDERING VEGETATED Peak Elev=163.56' Storage=24.487 af Inflow=323.18 cfs 31.073 af
Outflow=8.20 cfs 22.564 af

Total Runoff Area = 148.213 ac Runoff Volume = 62.642 af Average Runoff Depth = 5.07"
72.50% Pervious = 107.455 ac 27.50% Impervious = 40.758 ac

Summary for Subcatchment DA1: DEVELOPMENT NORTH OF FRANKLIN ST.

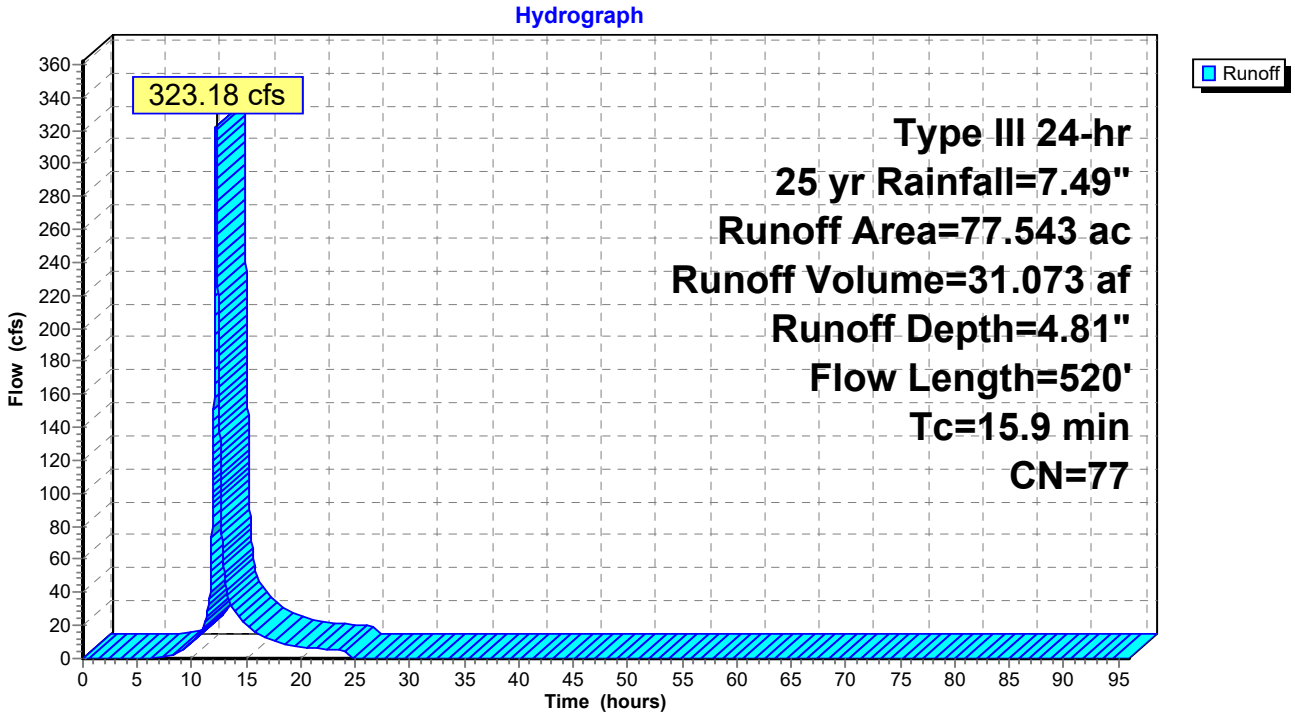
Runoff = 323.18 cfs @ 12.21 hrs, Volume= 31.073 af, Depth= 4.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=7.49"

Area (ac)	CN	Description
25.200	79	Woods, Fair, HSG D
2.521	60	Woods, Fair, HSG B
1.749	36	Woods, Fair, HSG A
2.289	94	Fallow, bare soil, HSG D
4.872	84	Pasture/grassland/range, Fair, HSG D
3.367	54	1/2 acre lots, 25% imp, HSG A
1.378	85	1/2 acre lots, 25% imp, HSG D
20.876	86	1/3 acre lots, 30% imp, HSG D
7.254	57	1/3 acre lots, 30% imp, HSG A
5.237	72	1/3 acre lots, 30% imp, HSG B
2.800	98	Water Surface, HSG A
77.543	77	Weighted Average
63.547	73	81.95% Pervious Area
13.996	98	18.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	48	0.0140	0.09		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.21"
0.5	68	0.2180	2.33		**Shallow Concentrated Flow, Shallow Conc-woods** Woodland Kv= 5.0 fps
1.2	404	0.0720	5.45		**Shallow Concentrated Flow, Shallow Conc-gutter line** Paved Kv= 20.3 fps
5.0					**Direct Entry, Conveyance through pipe network**
15.9	520	Total			

Subcatchment DA1: DEVELOPMENT NORTH OF FRANKLIN ST.



ummary for Subcatchment DA2: COMMERCIAL DEVEL/ELDERLY HOUSING NORTH SIDE OF FRANKLIN

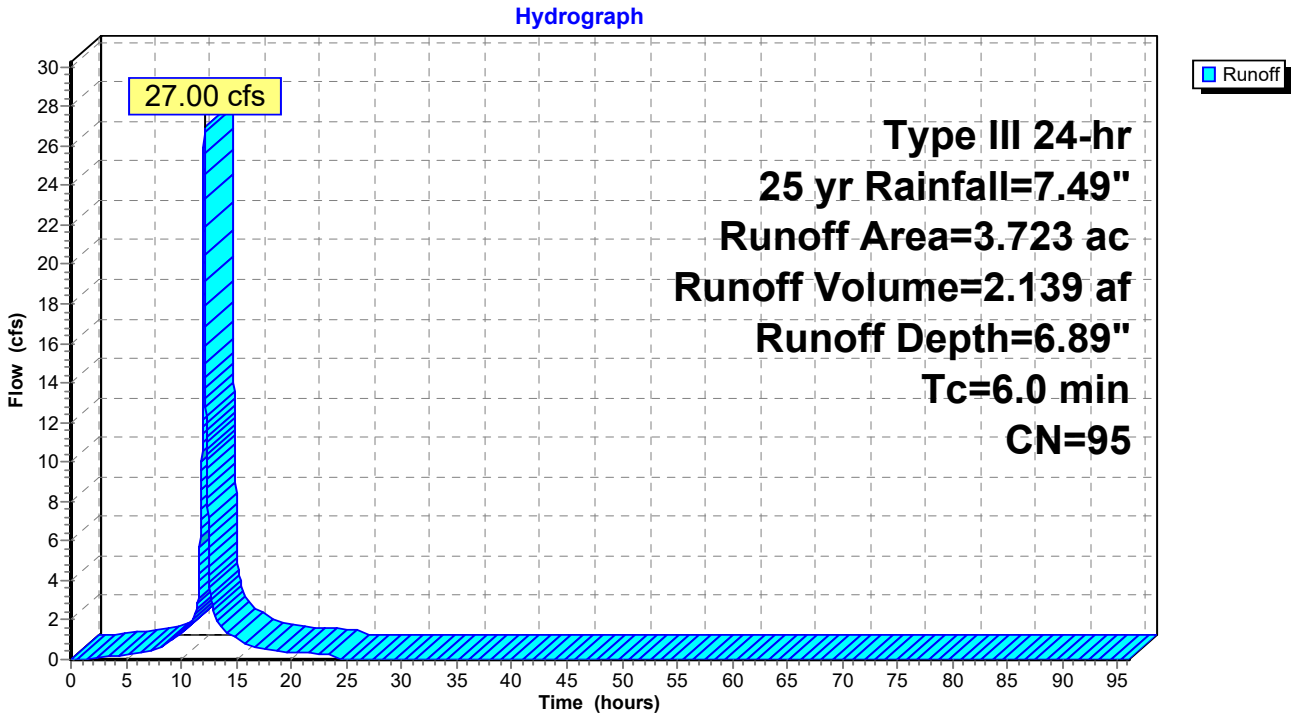
Runoff = 27.00 cfs @ 12.08 hrs, Volume= 2.139 af, Depth= 6.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=7.49"

Area (ac)	CN	Description
3.597	95	Urban commercial, 85% imp, HSG D
0.126	89	Urban commercial, 85% imp, HSG A
3.723	95	Weighted Average
0.558	77	15.00% Pervious Area
3.165	98	85.00% Impervious Area

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

Subcatchment DA2: COMMERCIAL DEVEL/ELDERLY HOUSING NORTH SIDE OF FRANKLIN ST.



Summary for Subcatchment DA3: COMMERCIAL DEVEL/HOUSING SOUTH SIDE OF FRANKLIN ST.

[47] Hint: Peak is 102% of capacity of segment #4

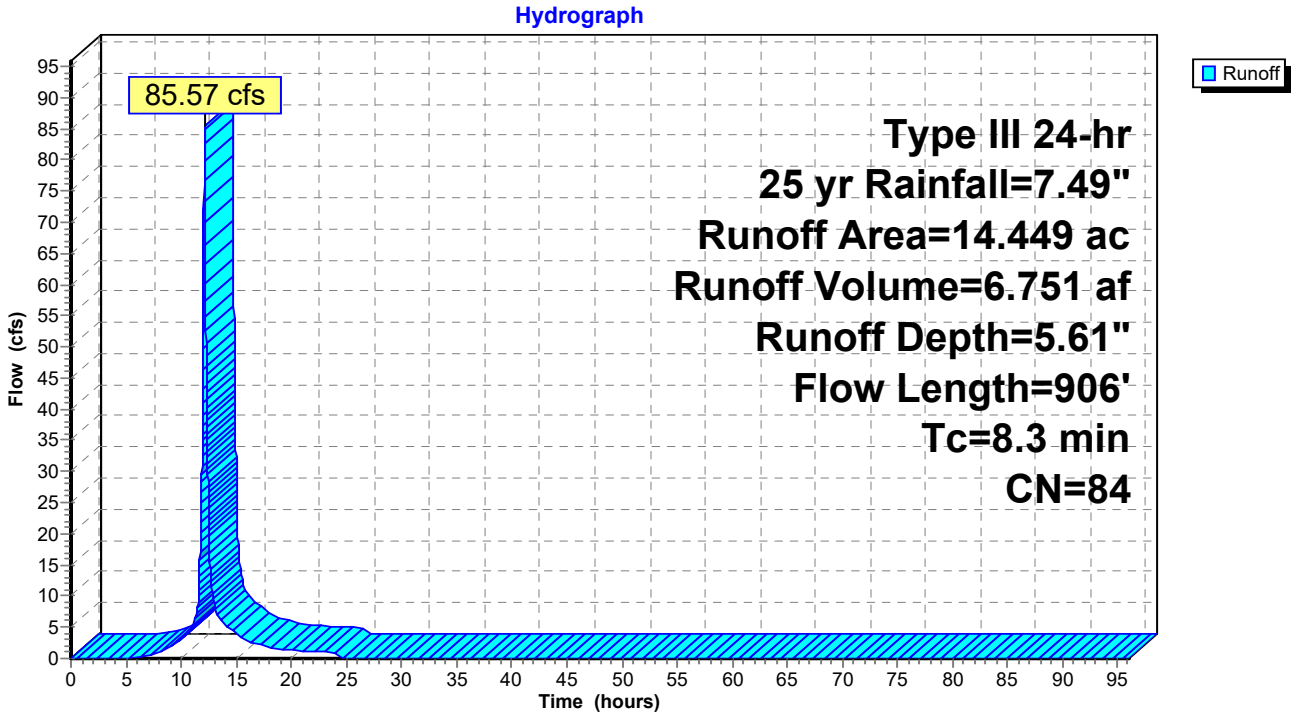
Runoff = 85.57 cfs @ 12.11 hrs, Volume= 6.751 af, Depth= 5.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=7.49"

Area (ac)	CN	Description
2.578	95	Urban commercial, 85% imp, HSG D
0.158	89	Urban commercial, 85% imp, HSG A
1.787	92	1/8 acre lots, 65% imp, HSG D
0.299	77	1/8 acre lots, 65% imp, HSG A
4.832	86	1/3 acre lots, 30% imp, HSG D
1.691	57	1/3 acre lots, 30% imp, HSG A
2.217	79	Woods, Fair, HSG D
0.887	84	50-75% Grass cover, Fair, HSG D
14.449	84	Weighted Average
8.811	74	60.98% Pervious Area
5.638	98	39.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	16	0.0200	0.05		**Sheet Flow, Sheet flow through woods** Woods: Light underbrush n= 0.400 P2= 3.21"
0.6	81	0.2200	2.35		**Shallow Concentrated Flow, Shallow Conc through woods / law** Woodland Kv= 5.0 fps
1.7	557	0.0700	5.37		**Shallow Concentrated Flow, Shallow Conc on PVMNT** Paved Kv= 20.3 fps
1.0	252	0.0100	4.18	83.56	**Channel Flow, Open Channel Flow** Area= 20.0 sf Perim= 12.0' r= 1.67' n= 0.050 Earth, long dense weeds
8.3	906	Total			

Subcatchment DA3: COMMERCIAL DEVEL/HOUSING SOUTH SIDE OF FRANKLIN ST.



Summary for Subcatchment DA4: ATHLETIC FIELDS

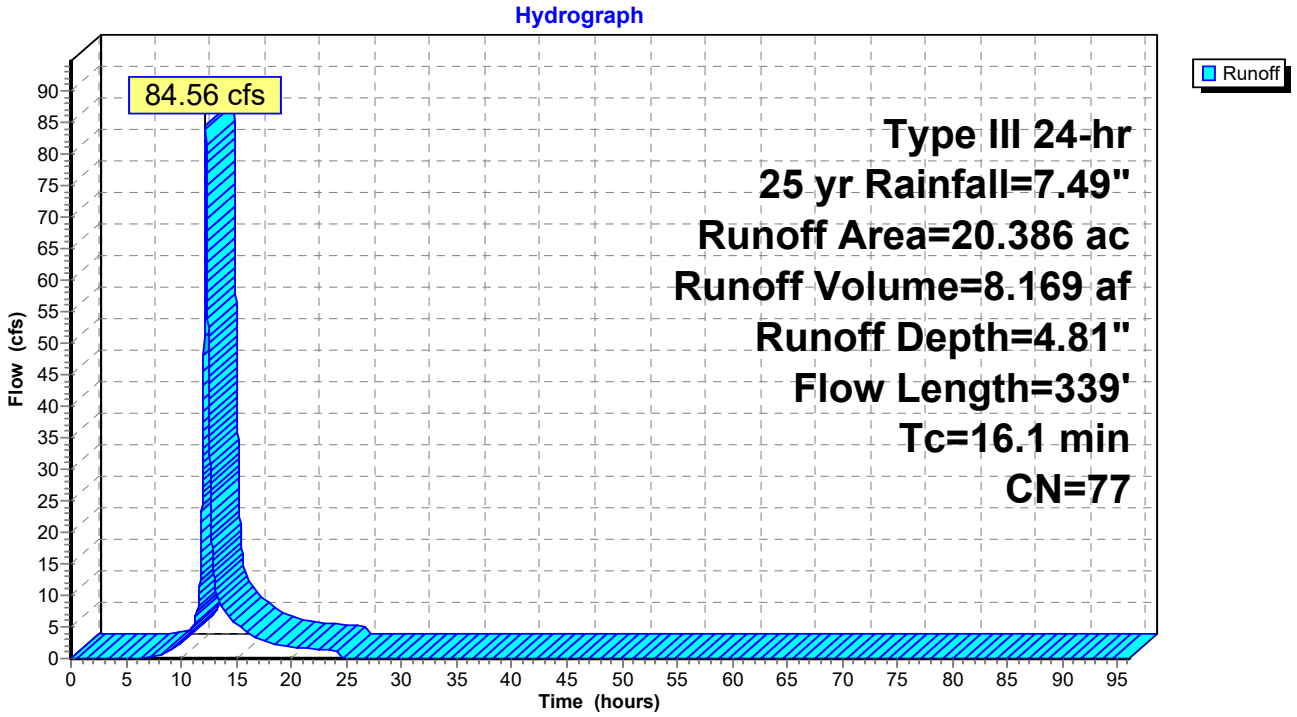
Runoff = 84.56 cfs @ 12.22 hrs, Volume= 8.169 af, Depth= 4.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=7.49"

Area (ac)	CN	Description
0.944	98	Unconnected pavement, HSG C
2.179	86	1/3 acre lots, 30% imp, HSG D
13.800	74	>75% Grass cover, Good, HSG C
3.463	79	Woods, Fair, HSG D
20.386	77	Weighted Average
18.788	75	92.16% Pervious Area
1.598	98	7.84% Impervious Area
0.944		59.08% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	25	0.0050	0.03		**Sheet Flow, Sheet flow through woods** Woods: Light underbrush n= 0.400 P2= 3.21"
2.2	246	0.1400	1.87		**Shallow Concentrated Flow, Shallow Conc through woods** Woodland Kv= 5.0 fps
0.5	68	0.0880	2.08		**Shallow Concentrated Flow, Shallow Conc through grass** Short Grass Pasture Kv= 7.0 fps
1.0					**Direct Entry, Flow through closeed pipes**
16.1	339	Total			

Subcatchment DA4: ATHLETIC FIELDS



or Subcatchment DA5a: RESIDENTIAL & COMMERCIAL DEVELOPMENT , NORTH OF HS, SOUTH SIDE

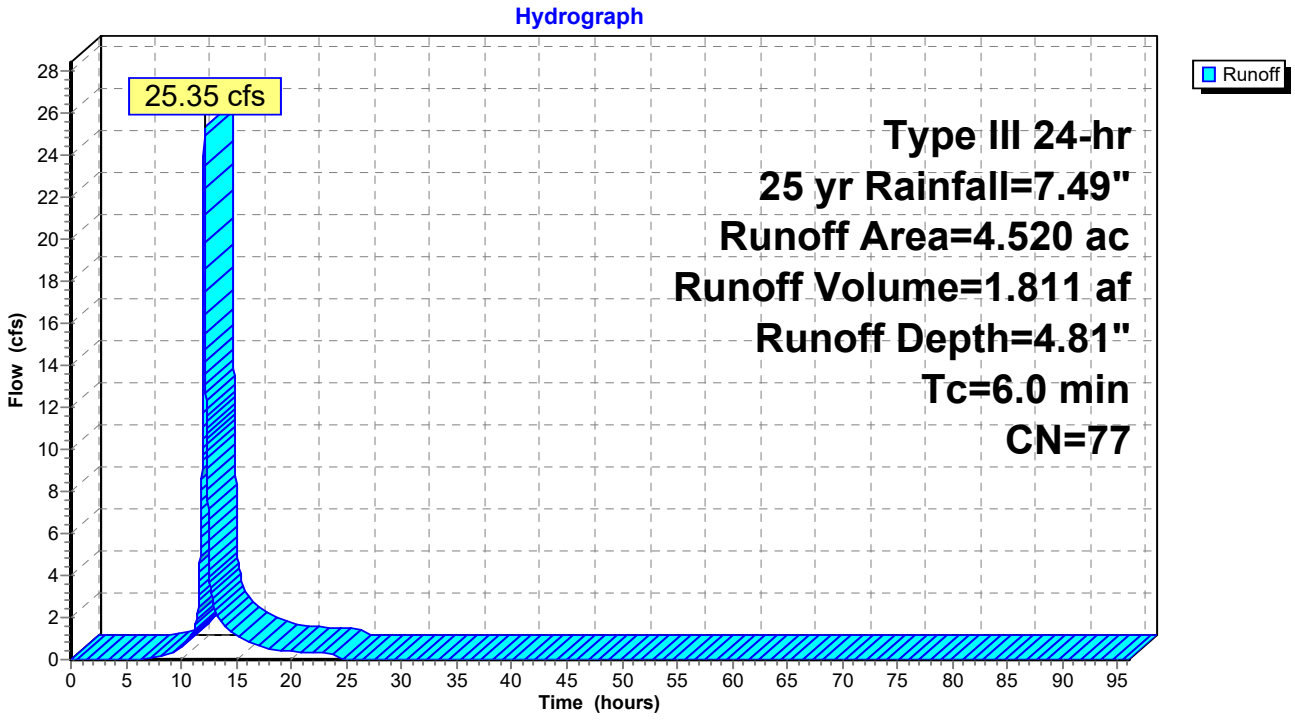
Runoff = 25.35 cfs @ 12.09 hrs, Volume= 1.811 af, Depth= 4.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=7.49"

Area (ac)	CN	Description
3.036	89	Urban commercial, 85% imp, HSG A
0.069	86	1/3 acre lots, 30% imp, HSG D
1.103	57	1/3 acre lots, 30% imp, HSG A
0.312	36	Woods, Fair, HSG A
4.520	77	Weighted Average
1.588	40	35.13% Pervious Area
2.932	98	64.87% Impervious Area

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

catchment DA5a: RESIDENTIAL & COMMERCIAL DEVELOPMENT , NORTH OF HS, SOUTH SIDE FRANK



Summary for Subcatchment DA5b: HIGH SCHOOL, PARKING, AND TENNIS COURTS

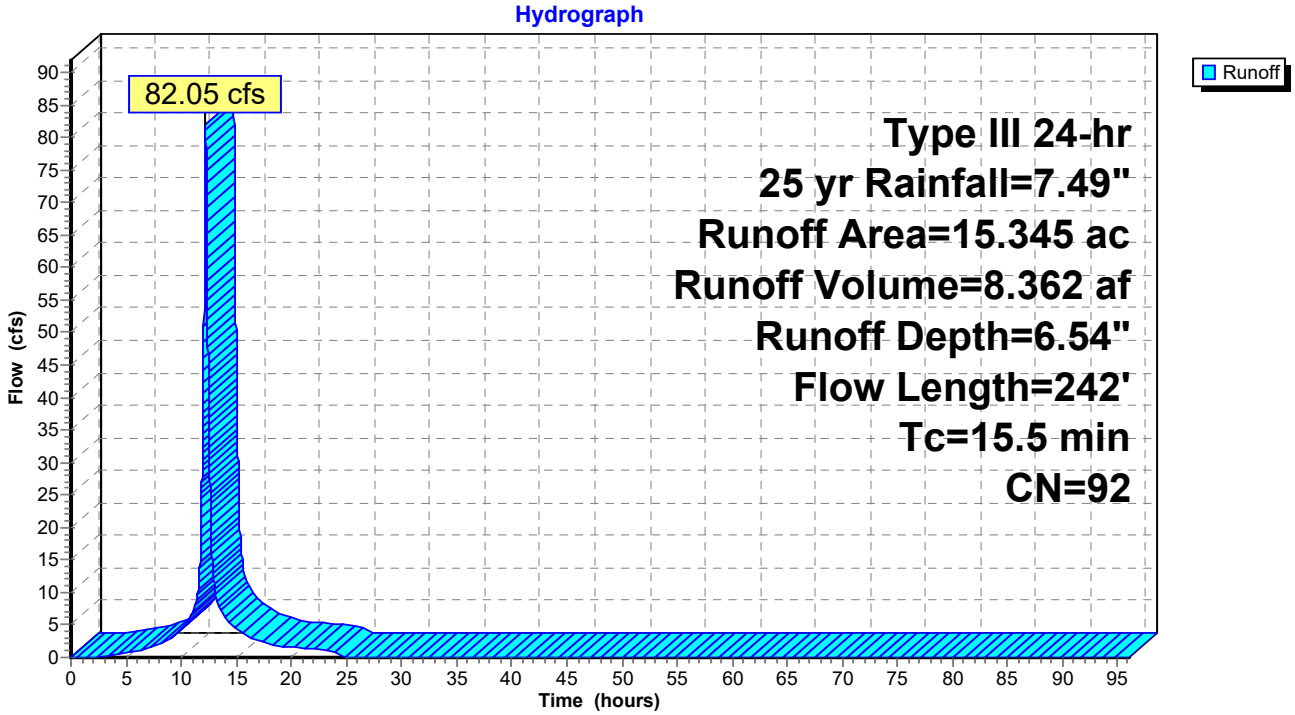
Runoff = 82.05 cfs @ 12.20 hrs, Volume= 8.362 af, Depth= 6.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=7.49"

Area (ac)	CN	Description
12.099	95	Urban commercial, 85% imp, HSG D
1.536	89	Urban commercial, 85% imp, HSG A
0.459	57	1/3 acre lots, 30% imp, HSG A
1.251	79	50-75% Grass cover, Fair, HSG C
15.345	92	Weighted Average
3.618	72	23.57% Pervious Area
11.727	98	76.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	40	0.0090	0.07		**Sheet Flow, Sheet flow through grass** Grass: Dense n= 0.240 P2= 3.21"
4.1	202	0.0140	0.83		**Shallow Concentrated Flow, Shallow Conc through grass** Short Grass Pasture Kv= 7.0 fps
2.0					**Direct Entry, Flow through closed pipes**
15.5	242	Total			

Subcatchment DA5b: HIGH SCHOOL, PARKING, AND TENNIS COURTS



Summary for Subcatchment DA6: DA6

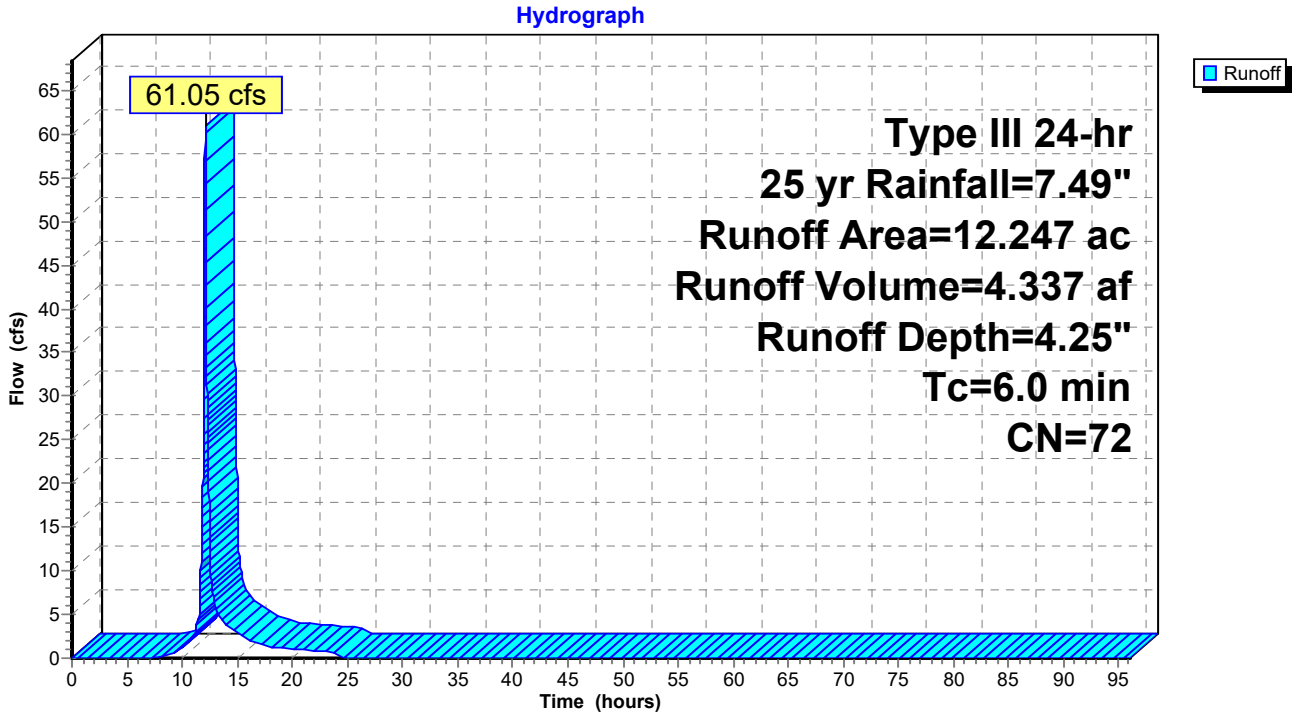
Runoff = 61.05 cfs @ 12.09 hrs, Volume= 4.337 af, Depth= 4.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=7.49"

Area (ac)	CN	Description
1.766	60	Woods, Fair, HSG B
4.843	79	Woods, Fair, HSG D
0.033	36	Woods, Fair, HSG A
1.692	86	1/3 acre lots, 30% imp, HSG D
2.974	57	1/3 acre lots, 30% imp, HSG A
0.392	72	1/3 acre lots, 30% imp, HSG B
0.184	98	Paved parking, HSG D
0.070	49	50-75% Grass cover, Fair, HSG A
0.293	84	50-75% Grass cover, Fair, HSG D
12.247	72	Weighted Average
10.546	68	86.11% Pervious Area
1.701	98	13.89% Impervious Area

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

Subcatchment DA6: DA6



Summary for Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.

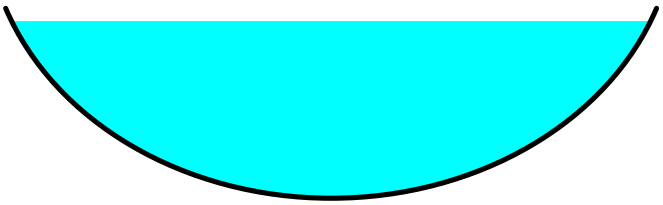
[55] Hint: Peak inflow is 102% of Manning's capacity

Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth > 3.65" for 25 yr event
Inflow = 27.38 cfs @ 12.08 hrs, Volume= 24.702 af
Outflow = 23.23 cfs @ 12.14 hrs, Volume= 24.687 af, Atten= 15%, Lag= 3.0 min

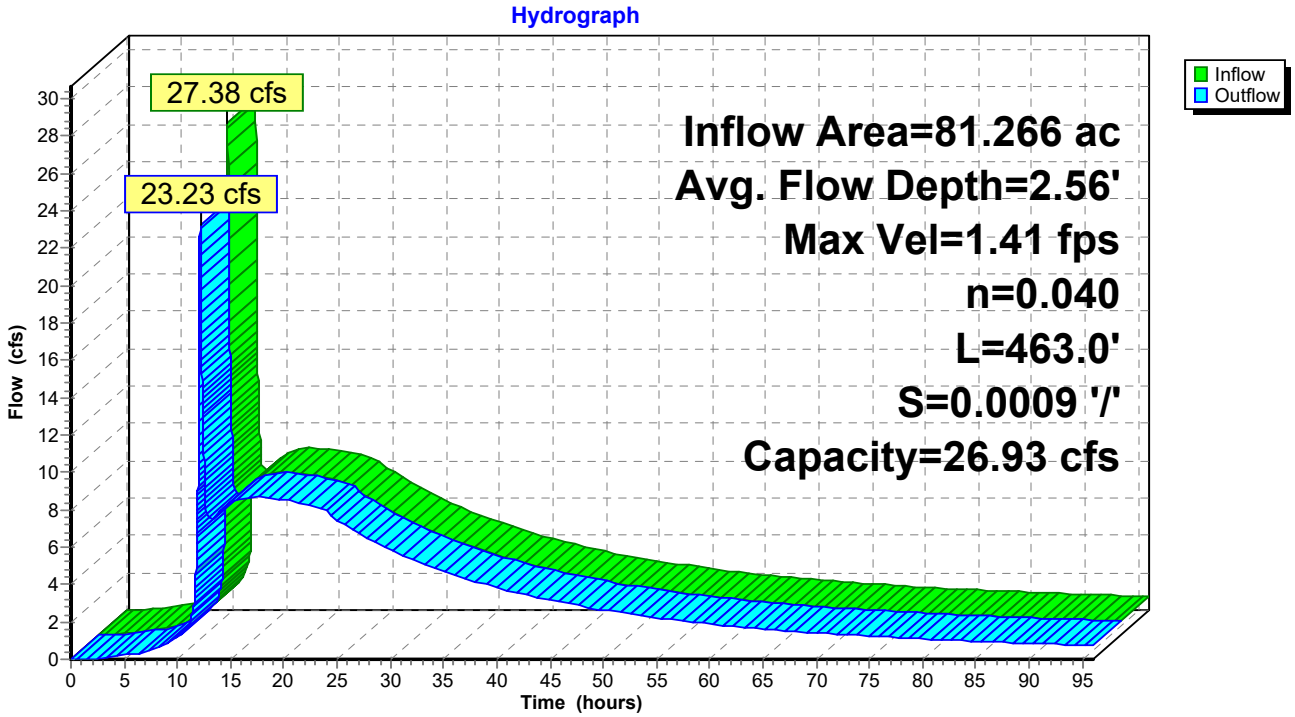
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 1.41 fps, Min. Travel Time= 5.5 min
Avg. Velocity = 0.73 fps, Avg. Travel Time= 10.6 min

Peak Storage= 7,632 cf @ 12.14 hrs
Average Depth at Peak Storage= 2.56' , Surface Width= 9.65'
Bank-Full Depth= 2.75' Flow Area= 18.3 sf, Capacity= 26.93 cfs

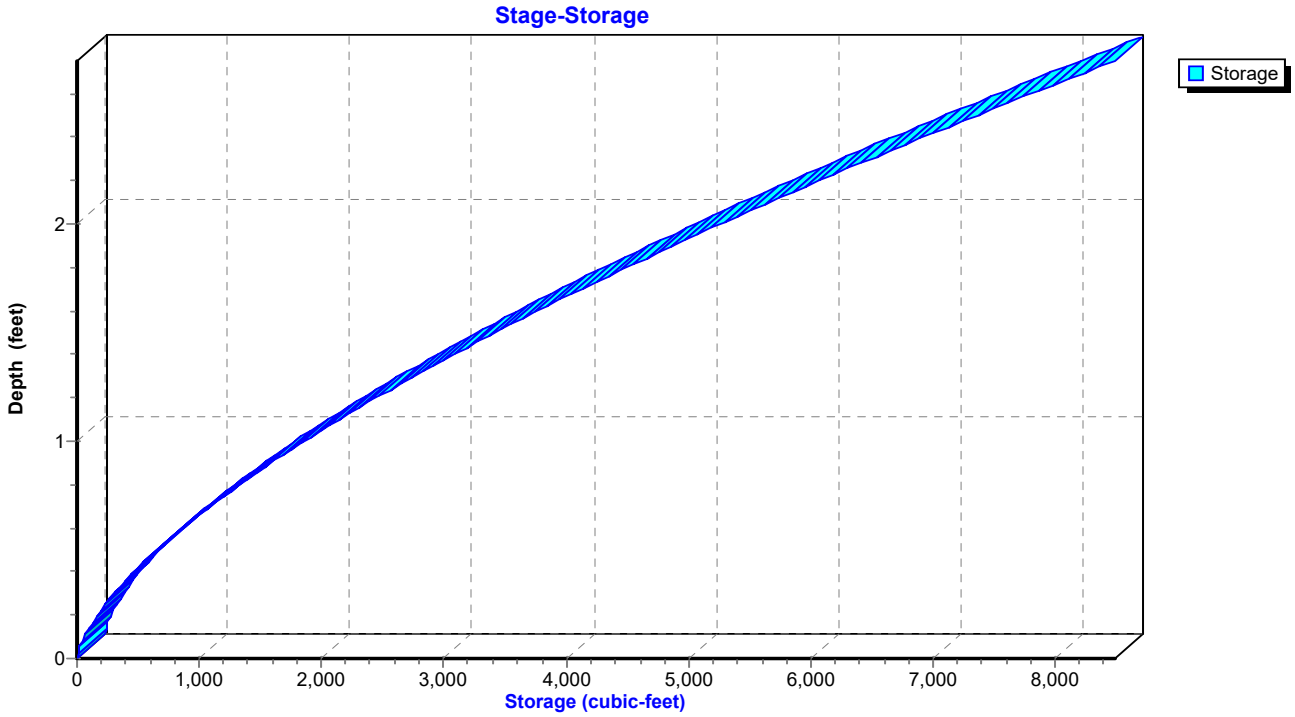
10.00' x 2.75' deep Parabolic Channel, n= 0.040 Earth, dense weeds
Length= 463.0' Slope= 0.0009 '/'
Inlet Invert= 162.00', Outlet Invert= 161.60'



Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.



Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.



Summary for Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.

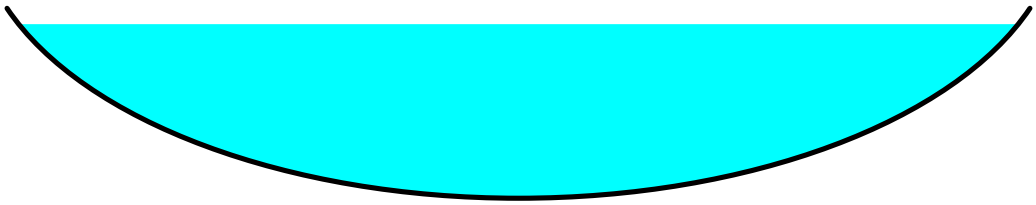
[80] Warning: Exceeded Pond C-1 by 0.35' @ 0.00 hrs (0.65 cfs 0.002 af)

Inflow Area = 95.715 ac, 23.82% Impervious, Inflow Depth > 3.94" for 25 yr event
Inflow = 108.46 cfs @ 12.12 hrs, Volume= 31.438 af
Outflow = 99.11 cfs @ 12.16 hrs, Volume= 31.420 af, Atten= 9%, Lag= 2.6 min

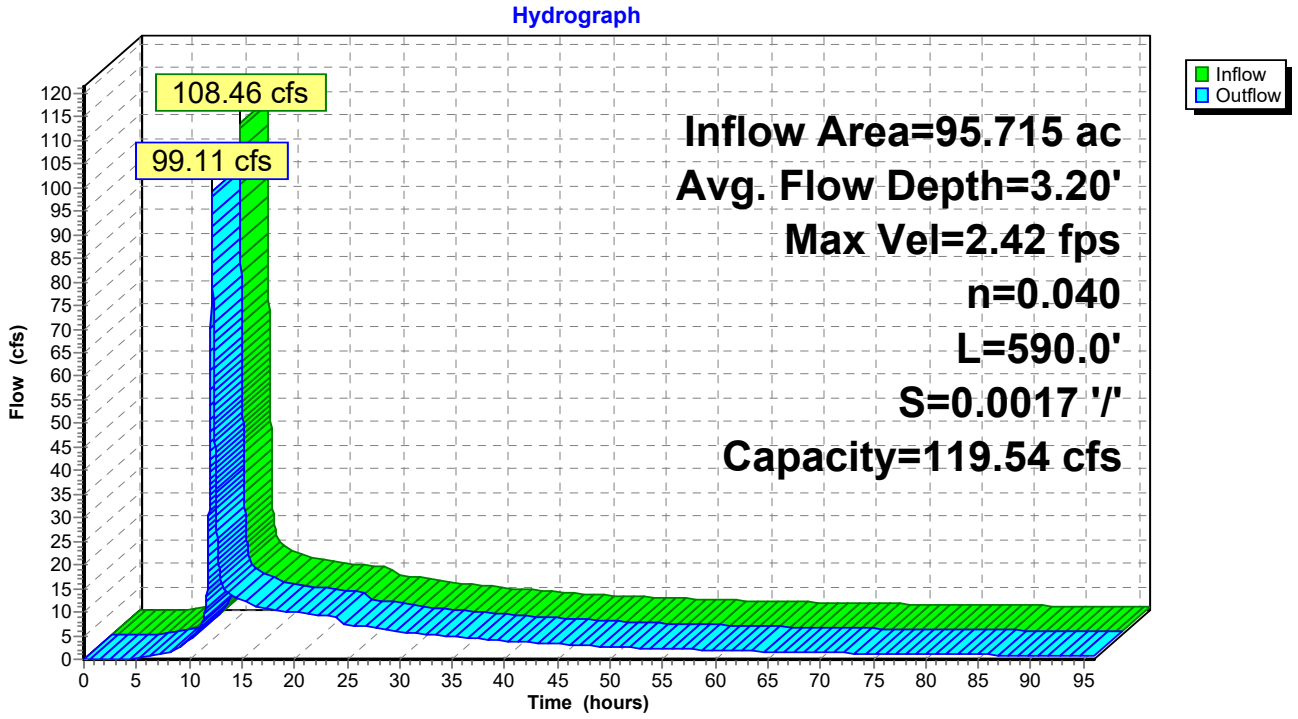
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 2.42 fps, Min. Travel Time= 4.1 min
Avg. Velocity = 0.82 fps, Avg. Travel Time= 12.0 min

Peak Storage= 24,119 cf @ 12.16 hrs
Average Depth at Peak Storage= 3.20' , Surface Width= 19.14'
Bank-Full Depth= 3.50' Flow Area= 46.7 sf, Capacity= 119.54 cfs

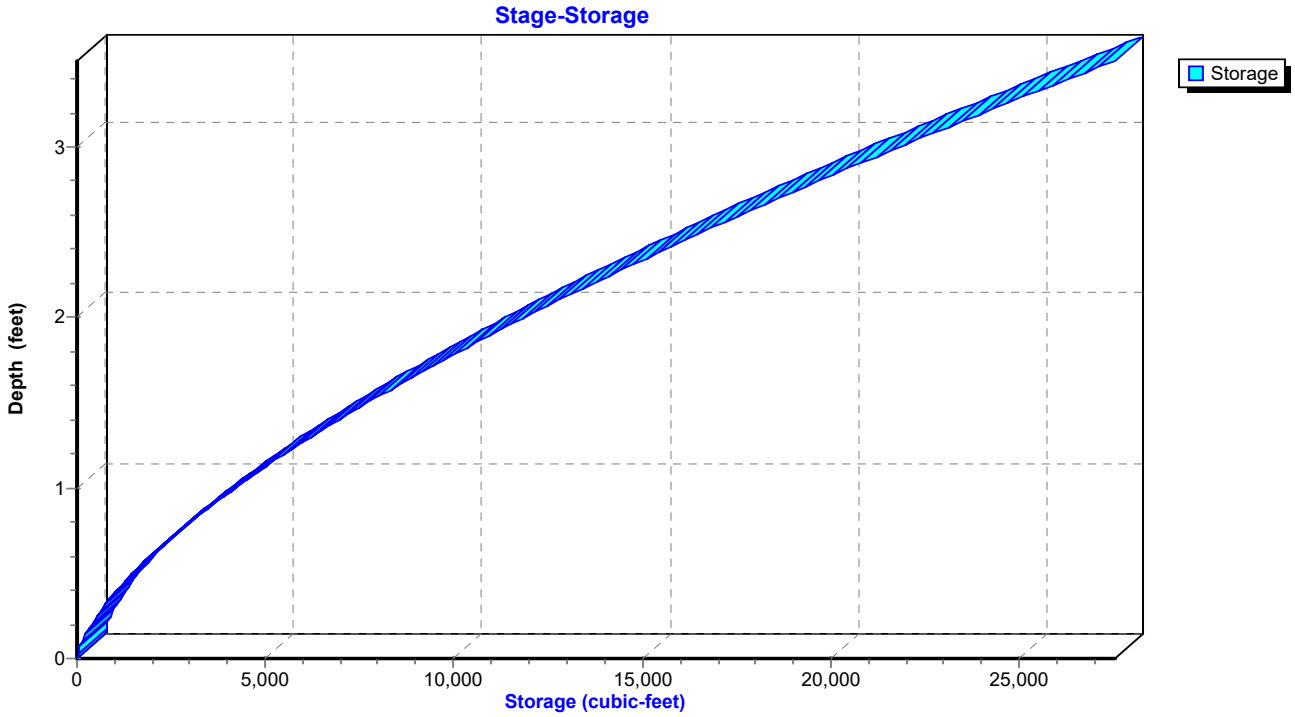
20.00' x 3.50' deep Parabolic Channel, n= 0.040
Length= 590.0' Slope= 0.0017 '/'
Inlet Invert= 162.00', Outlet Invert= 161.00'



Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.



Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.



Summary for Reach 3R: OPEN CHANNEL-SOUTH OF TRACK

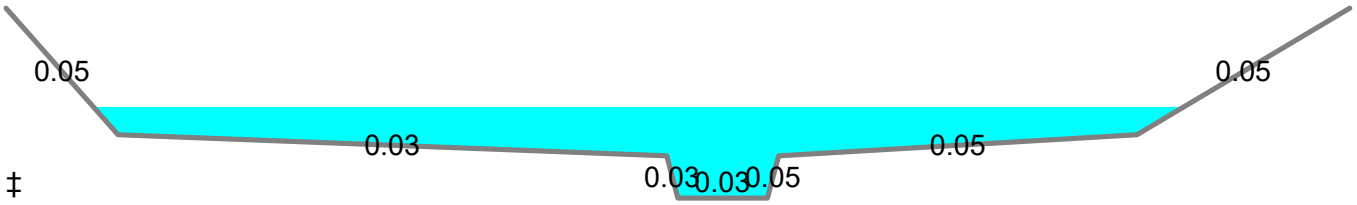
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=2)

Inflow Area = 148.213 ac, 27.50% Impervious, Inflow Depth > 4.38" for 25 yr event
Inflow = 319.31 cfs @ 12.16 hrs, Volume= 54.099 af
Outflow = 316.25 cfs @ 12.18 hrs, Volume= 54.092 af, Atten= 1%, Lag= 1.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.46 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 1.53 fps, Avg. Travel Time= 4.2 min

Peak Storage= 37,698 cf @ 12.18 hrs
Average Depth at Peak Storage= 2.16' , Surface Width= 97.40'
Bank-Full Depth= 4.50' Flow Area= 350.8 sf, Capacity= 2,227.64 cfs

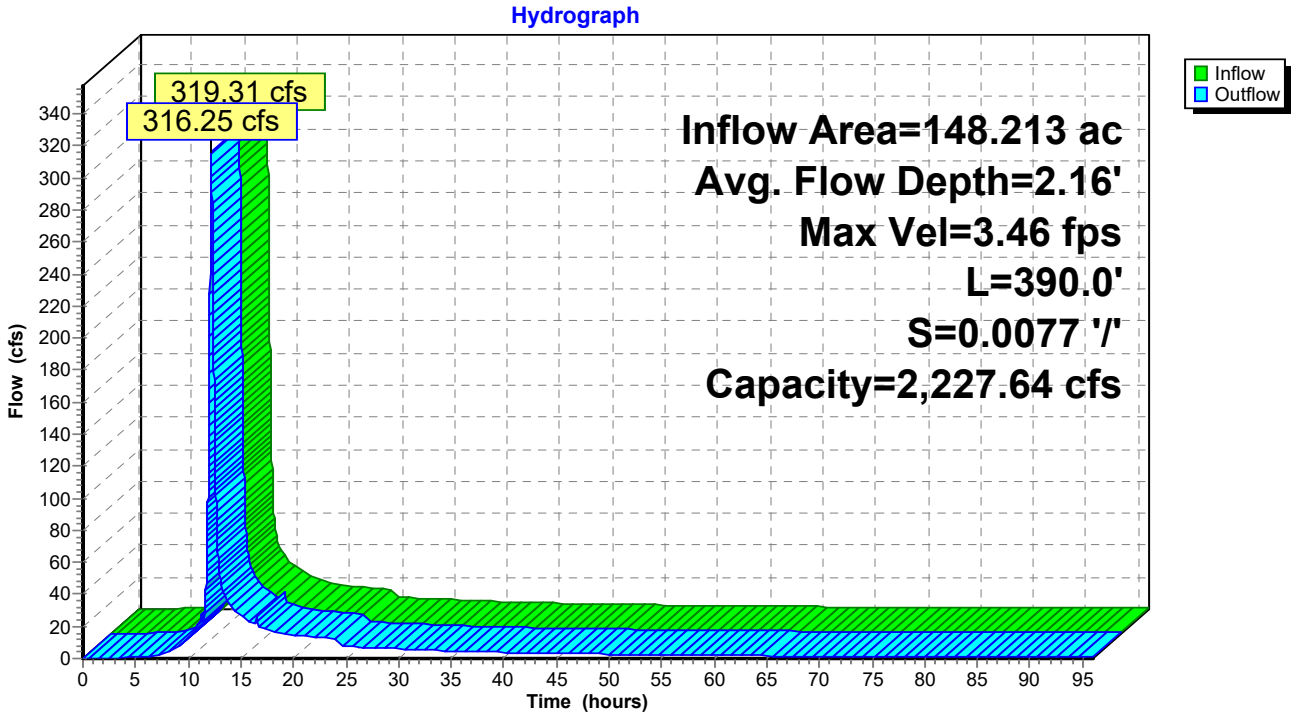
Custom cross-section, Length= 390.0' Slope= 0.0077 '/' (102 Elevation Intervals)
Composite Manning's value by Pavlovskii (shallow flow) method
Composite Manning's value at bank full= 0.042
Inlet Invert= 158.00', Outlet Invert= 155.00'



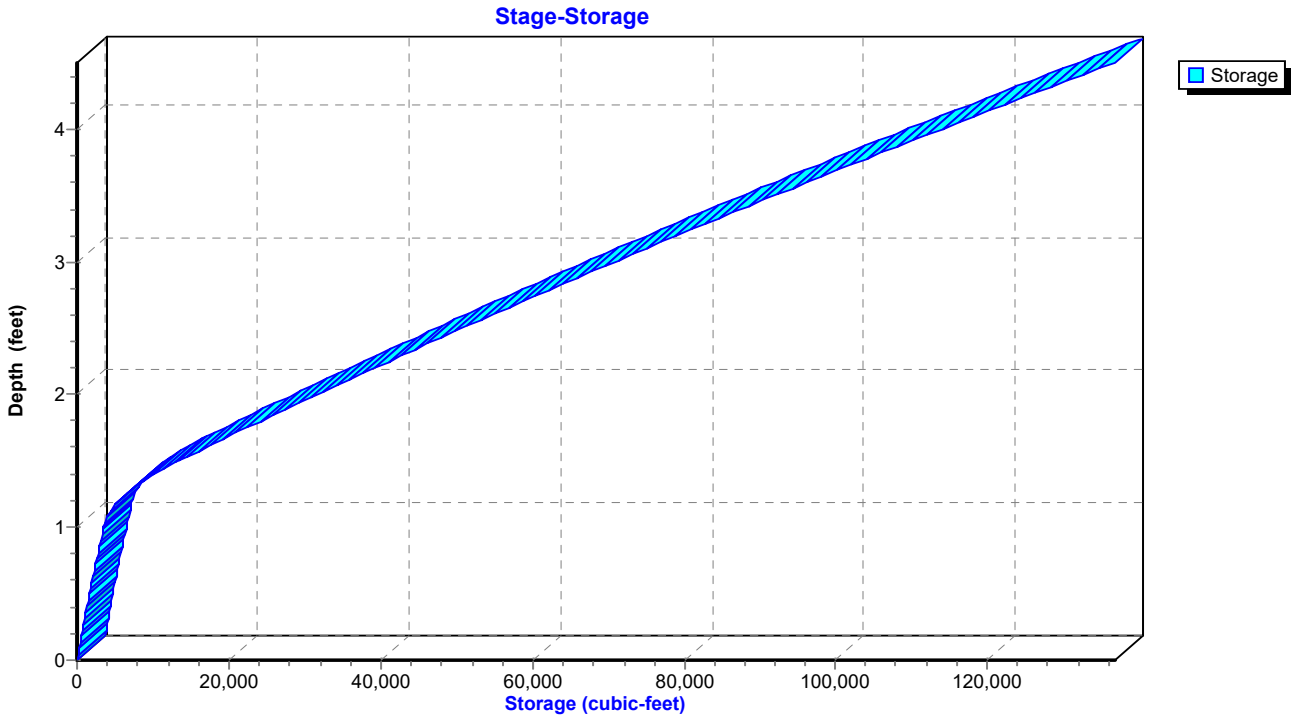
Offset (feet)	Elevation (feet)	Chan.Depth (feet)	n	Description
-60.00	158.00	0.00		
-50.00	155.00	3.00	0.050	Scattered brush, heavy weeds
-1.00	154.50	3.50	0.030	Earth, grassed & winding
0.00	153.50	4.50	0.030	Earth, grassed & winding
8.00	153.50	4.50	0.030	Earth, grassed & winding
9.00	154.50	3.50	0.050	Scattered brush, heavy weeds
41.00	155.00	3.00	0.050	Scattered brush, heavy weeds
60.00	158.00	0.00	0.050	Scattered brush, heavy weeds

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	8.0	0.0	0	0.00
1.00	9.0	10.8	10.0	3,510	31.14
1.50	34.3	91.8	91.0	13,358	60.07
4.50	350.8	121.5	120.0	136,793	2,227.64

Reach 3R: OPEN CHANNEL-SOUTH OF TRACK



Reach 3R: OPEN CHANNEL-SOUTH OF TRACK



Summary for Pond C-1: FRANKLIN ST CULVERT

[57] Hint: Peaked at 166.73' (Flood elevation advised)

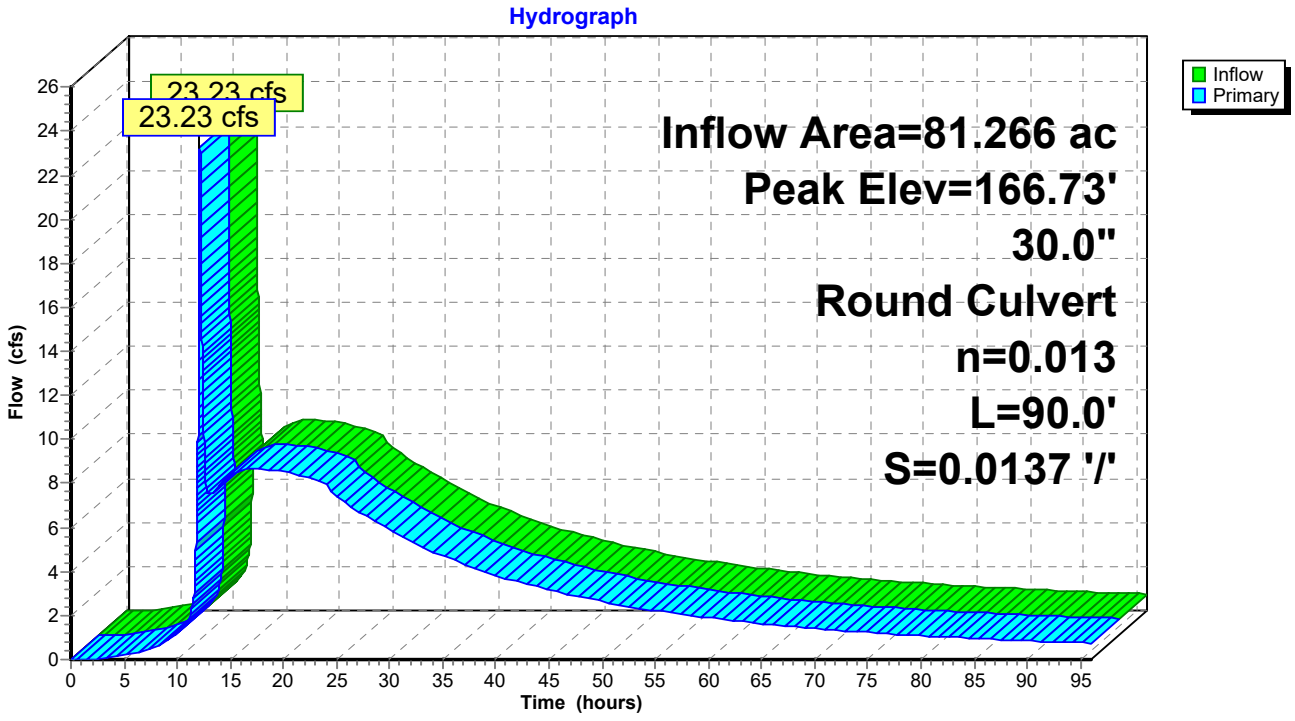
Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth > 3.65" for 25 yr event
Inflow = 23.23 cfs @ 12.14 hrs, Volume= 24.687 af
Outflow = 23.23 cfs @ 12.14 hrs, Volume= 24.687 af, Atten= 0%, Lag= 0.0 min
Primary = 23.23 cfs @ 12.14 hrs, Volume= 24.687 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 166.73' @ 12.14 hrs

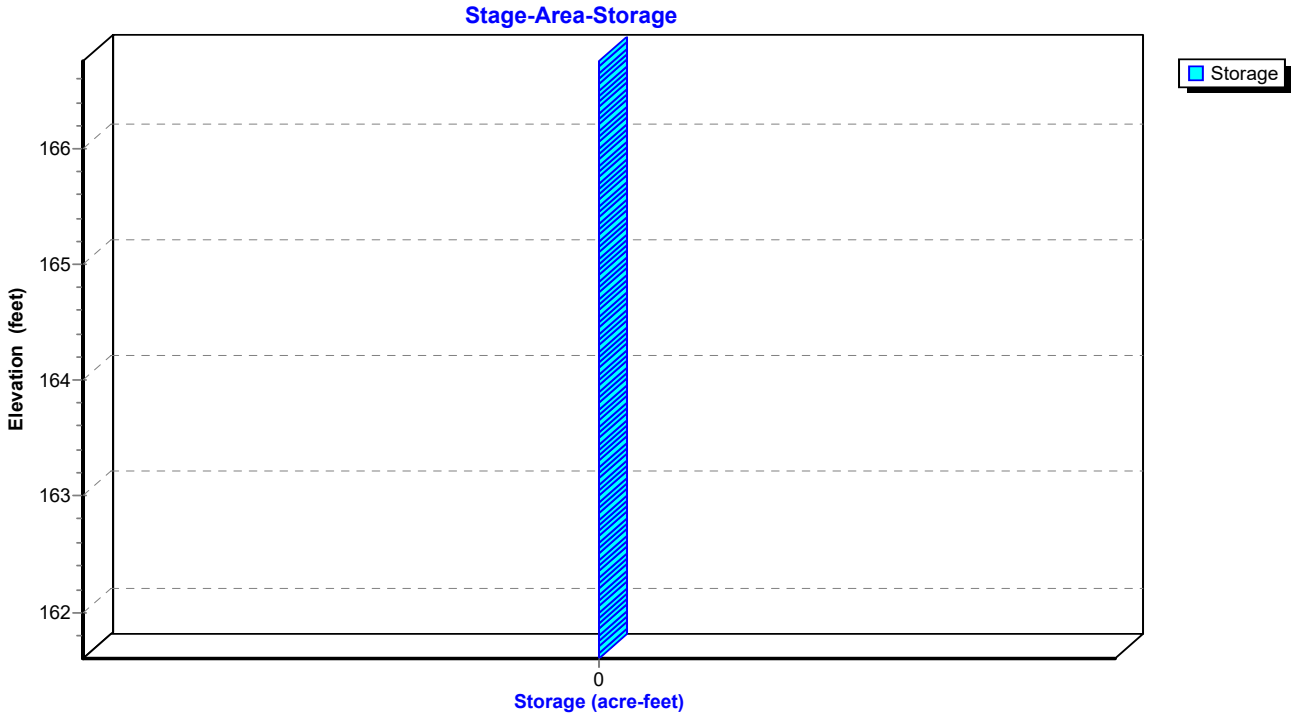
Device	Routing	Invert	Outlet Devices
#1	Primary	161.60'	**30.0" Round Culvert** L= 90.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 161.60' / 160.37' S= 0.0137 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 4.91 sf

Primary OutFlow Max=23.21 cfs @ 12.14 hrs HW=166.71' TW=165.16' (Dynamic Tailwater)
1=Culvert (Inlet Controls 23.21 cfs @ 4.73 fps)

Pond C-1: FRANKLIN ST CULVERT



Pond C-1: FRANKLIN ST CULVERT



Summary for Pond C-2: CULVERT #2

[57] Hint: Peaked at 401.03' (Flood elevation advised)

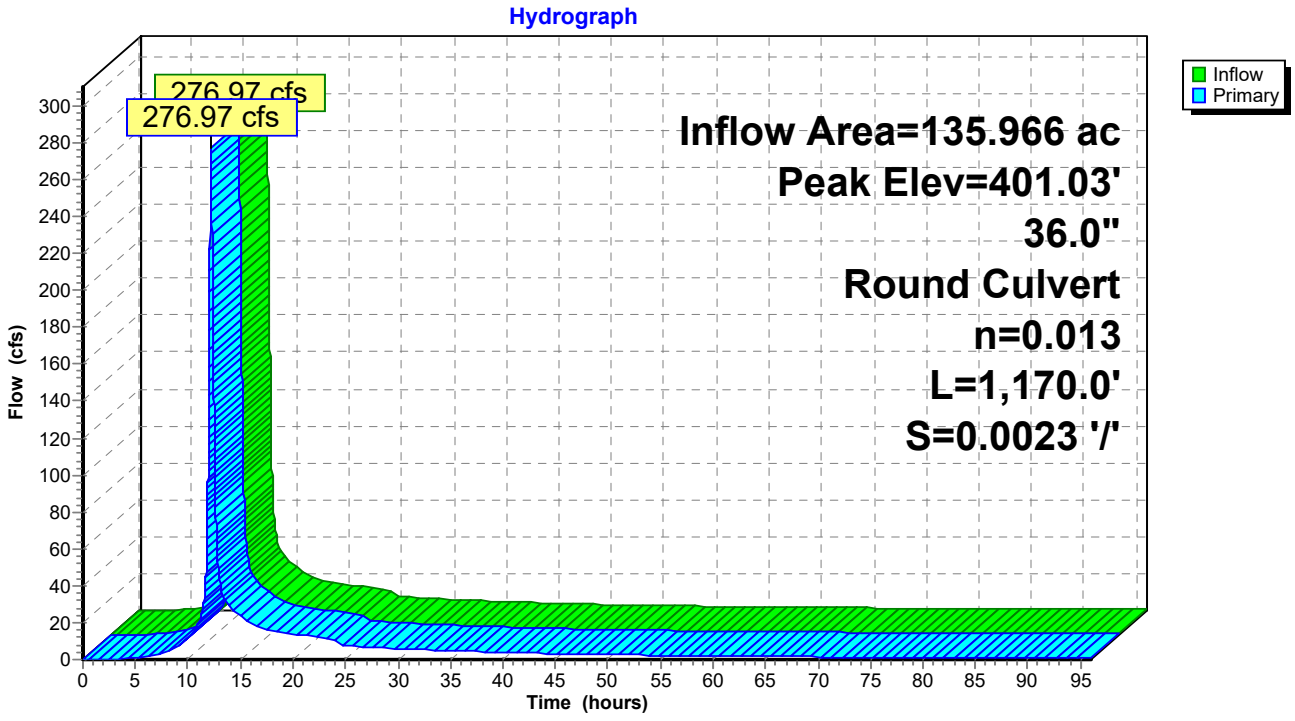
Inflow Area = 135.966 ac, 28.73% Impervious, Inflow Depth > 4.39" for 25 yr event
Inflow = 276.97 cfs @ 12.18 hrs, Volume= 49.762 af
Outflow = 276.97 cfs @ 12.18 hrs, Volume= 49.762 af, Atten= 0%, Lag= 0.0 min
Primary = 276.97 cfs @ 12.18 hrs, Volume= 49.762 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 401.03' @ 12.18 hrs

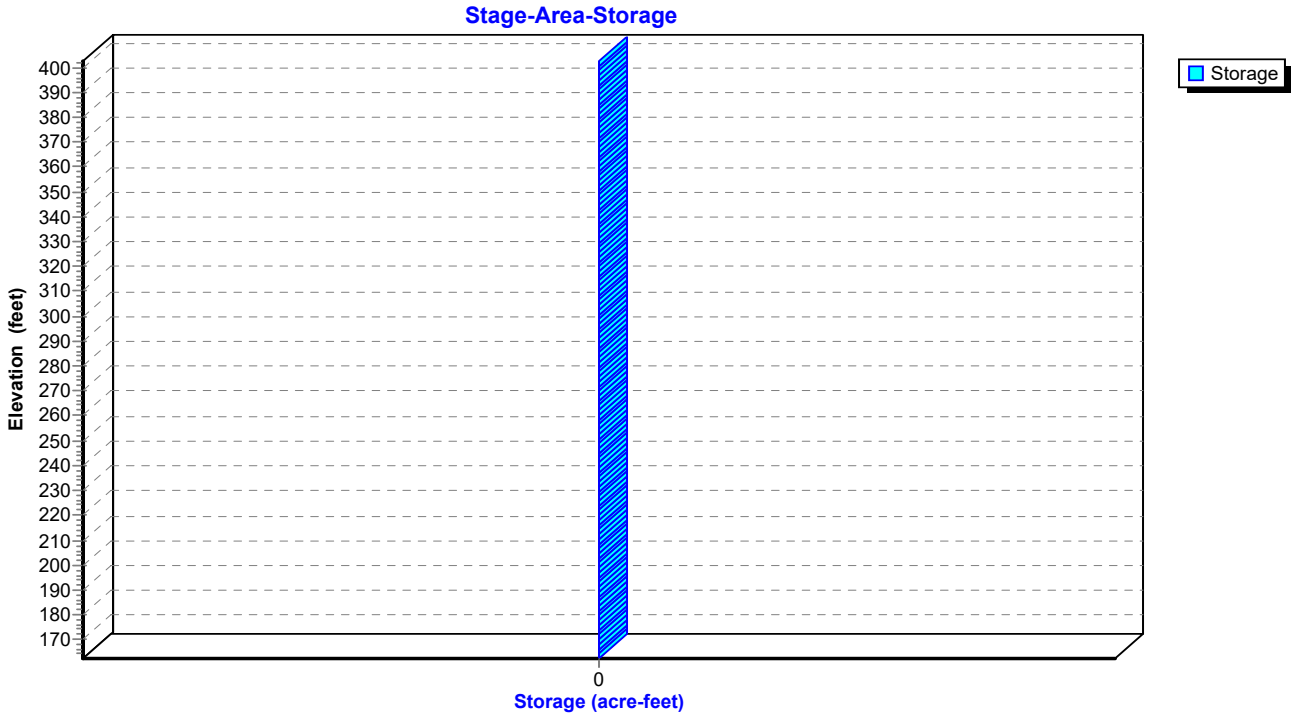
Device	Routing	Invert	Outlet Devices
#1	Primary	162.50'	**36.0" Round Culvert** L= 1,170.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 162.50' / 159.79' S= 0.0023 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=276.90 cfs @ 12.18 hrs HW=400.92' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 276.90 cfs @ 39.17 fps)

Pond C-2: CULVERT #2



Pond C-2: CULVERT #2



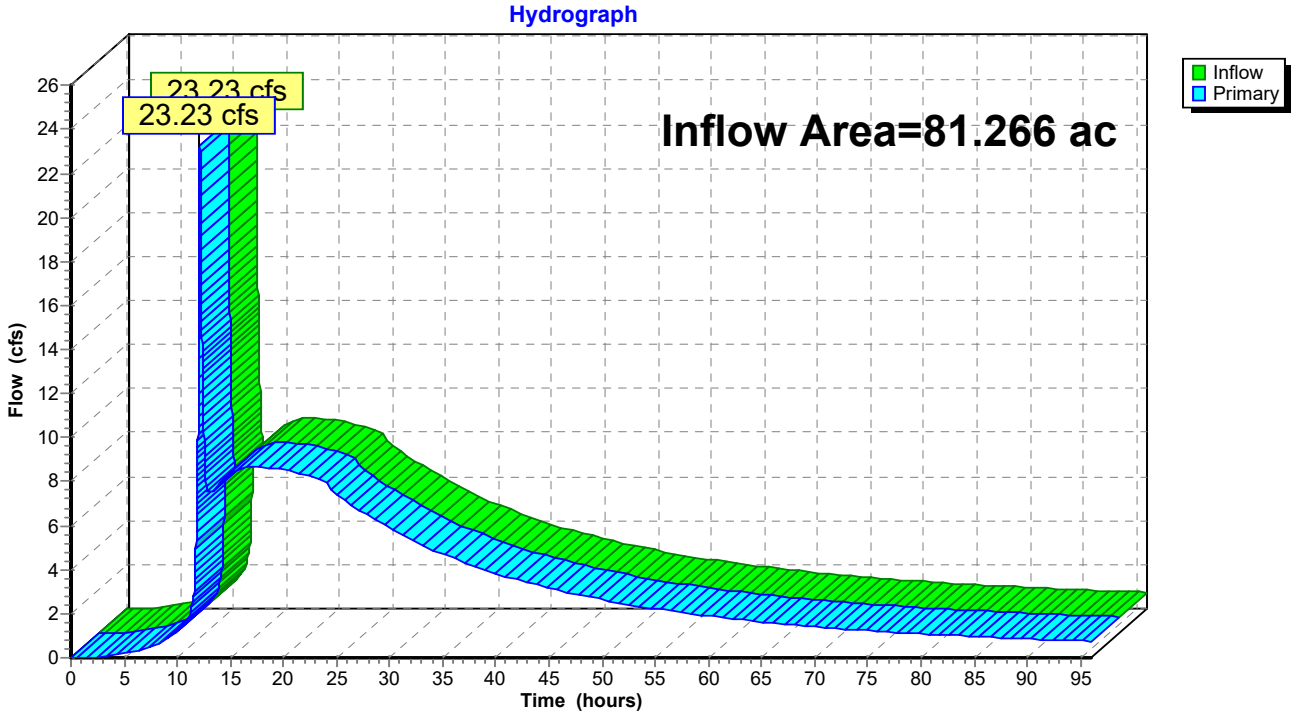
Summary for Pond SP1: FRANKLIN ST. CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth > 3.65" for 25 yr event
Inflow = 23.23 cfs @ 12.14 hrs, Volume= 24.687 af
Primary = 23.23 cfs @ 12.14 hrs, Volume= 24.687 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP1: FRANKLIN ST. CULVERT



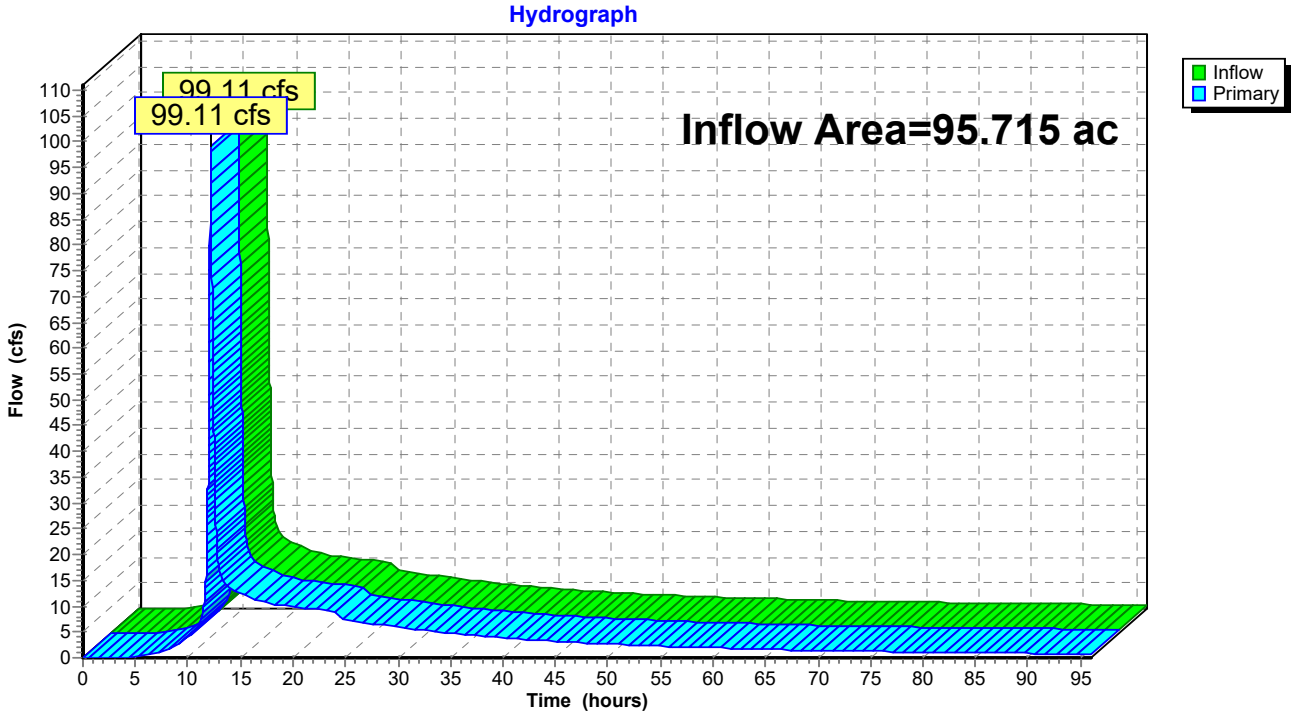
Summary for Pond SP2: HEADWALL 36-IN. CULVERT PIPE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 95.715 ac, 23.82% Impervious, Inflow Depth > 3.94" for 25 yr event
Inflow = 99.11 cfs @ 12.16 hrs, Volume= 31.420 af
Primary = 99.11 cfs @ 12.16 hrs, Volume= 31.420 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP2: HEADWALL 36-IN. CULVERT PIPE



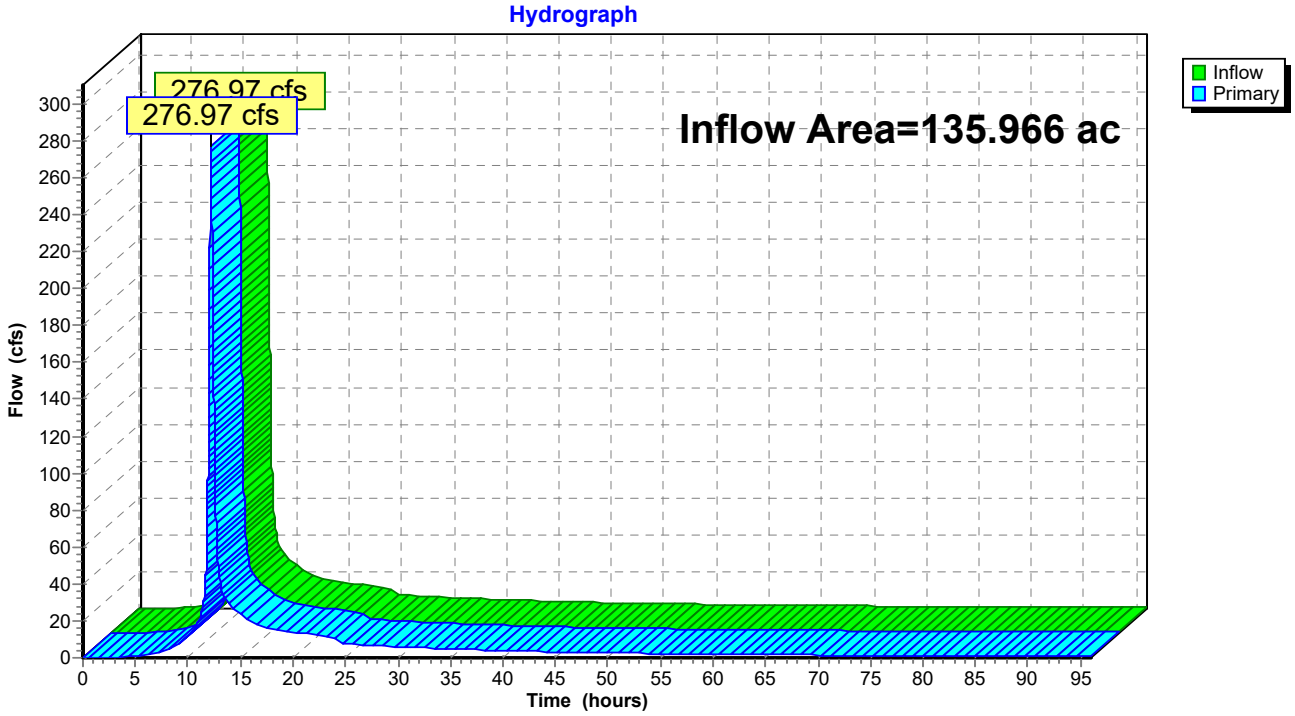
Summary for Pond SP3: OUTLET OF 36-IN. CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 135.966 ac, 28.73% Impervious, Inflow Depth > 4.39" for 25 yr event
Inflow = 276.97 cfs @ 12.18 hrs, Volume= 49.762 af
Primary = 276.97 cfs @ 12.18 hrs, Volume= 49.762 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP3: OUTLET OF 36-IN. CULVERT



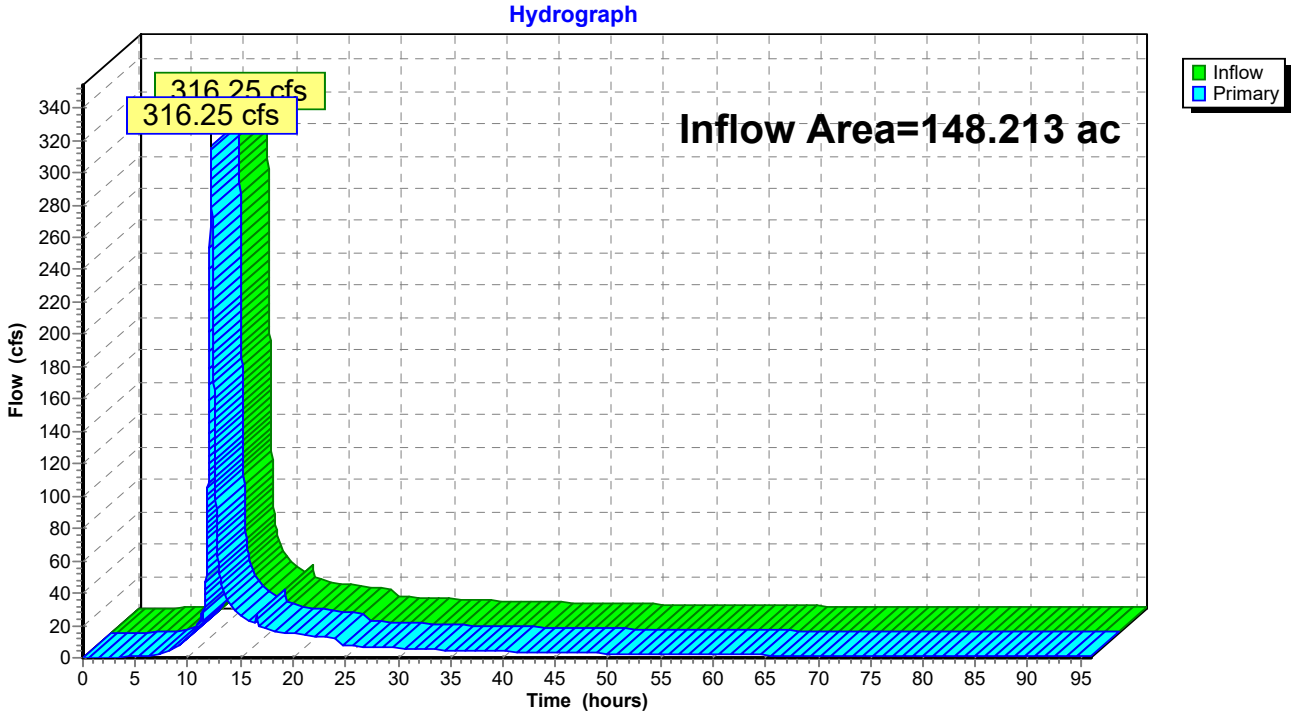
Summary for Pond SP4: WETLANDS TO THE SOUTH

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 148.213 ac, 27.50% Impervious, Inflow Depth > 4.38" for 25 yr event
Inflow = 316.25 cfs @ 12.18 hrs, Volume= 54.092 af
Primary = 316.25 cfs @ 12.18 hrs, Volume= 54.092 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP4: WETLANDS TO THE SOUTH



Summary for Pond W: BORDERING VEGETATED WETLAND

Inflow Area = 77.543 ac, 18.05% Impervious, Inflow Depth = 4.81" for 25 yr event
Inflow = 323.18 cfs @ 12.21 hrs, Volume= 31.073 af
Outflow = 8.20 cfs @ 18.52 hrs, Volume= 22.564 af, Atten= 97%, Lag= 378.7 min
Primary = 8.20 cfs @ 18.52 hrs, Volume= 22.564 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 163.56' @ 18.52 hrs Surf.Area= 18.143 ac Storage= 24.487 af

Plug-Flow detention time= 1,518.3 min calculated for 22.561 af (73% of inflow)
Center-of-Mass det. time= 1,428.3 min (2,249.8 - 821.5)

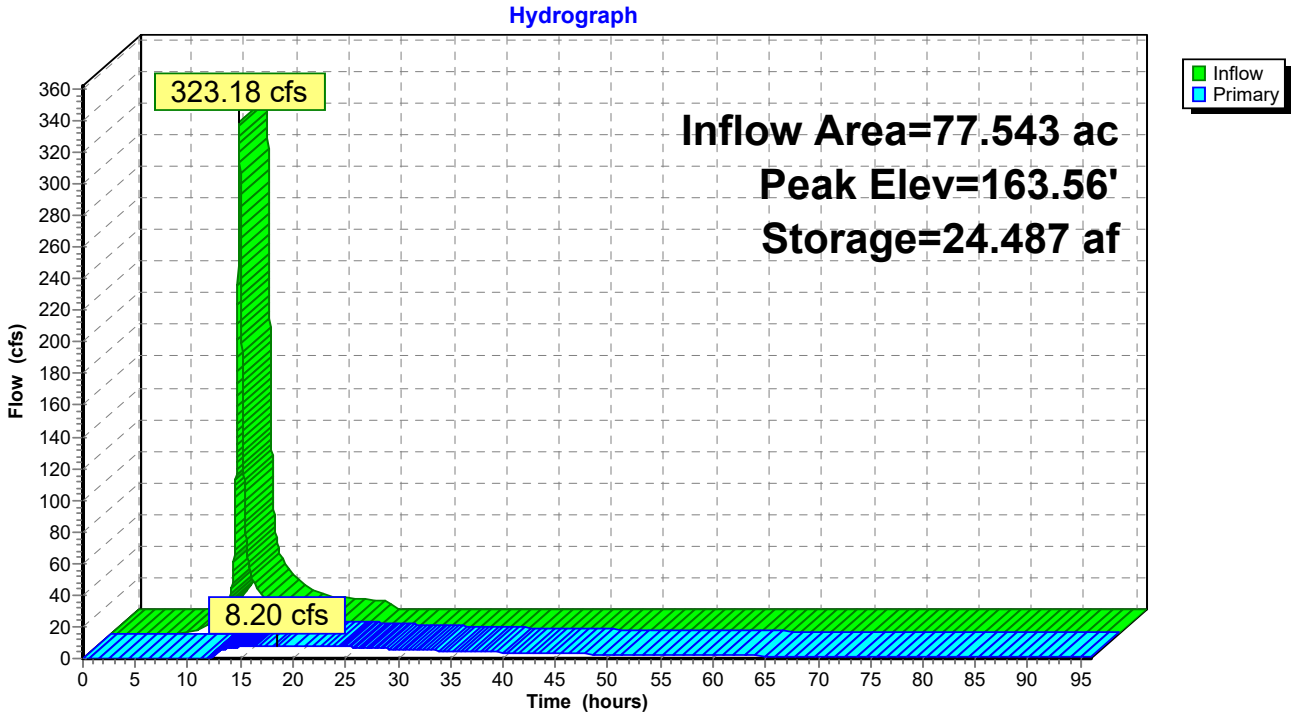
Volume	Invert	Avail.Storage	Storage Description
#1	161.50'	77.077 af	**Ponding storage in wetand (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
161.50	2.880	0.000	0.000
162.00	9.350	3.058	3.058
164.00	20.630	29.980	33.037
166.00	23.410	44.040	77.077

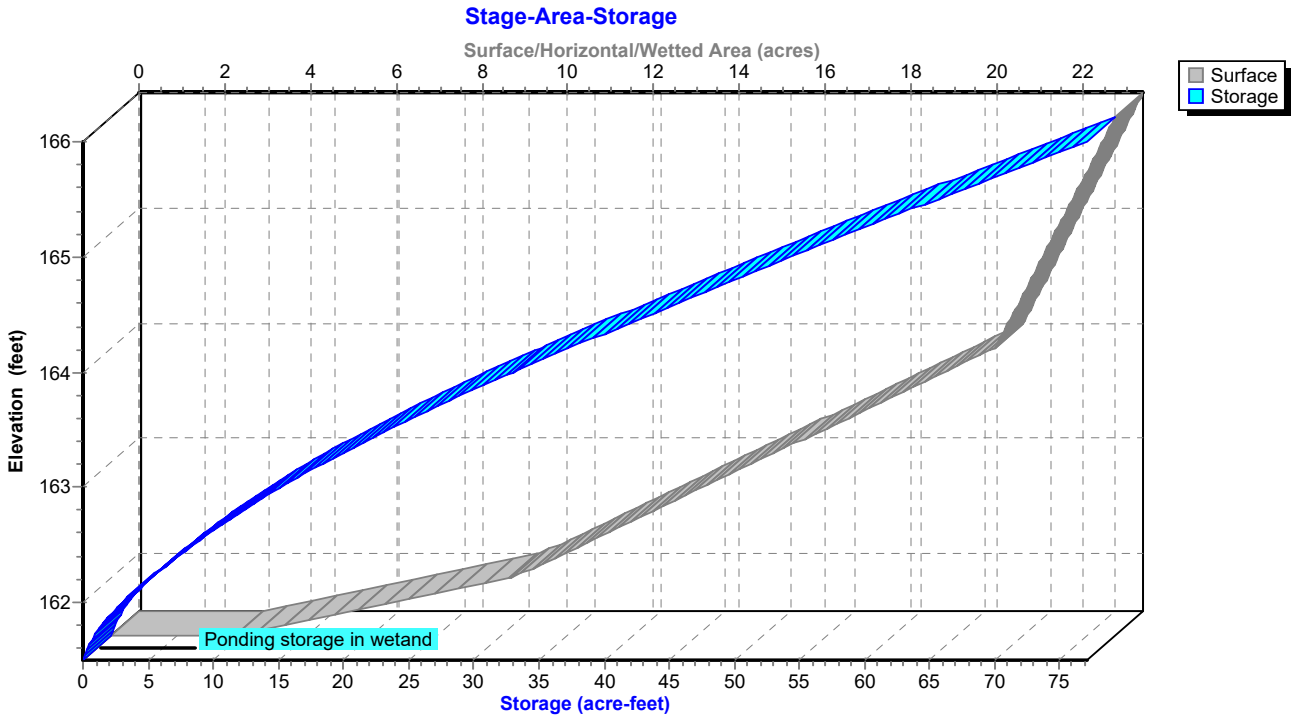
Device	Routing	Invert	Outlet Devices
#1	Primary	162.00'	**Channel/Reach** using Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.

Primary OutFlow Max=8.20 cfs @ 18.52 hrs HW=163.56' TW=163.60' (Dynamic Tailwater)
↑—**1=Channel/Reach** (Channel Controls 8.20 cfs @ 1.05 fps)

Pond W: BORDERING VEGETATED WETLAND



Pond W: BORDERING VEGETATED WETLAND



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DA1: DEVELOPMENT Runoff Area=77.543 ac 18.05% Impervious Runoff Depth=7.47"
Flow Length=520' Tc=15.9 min CN=77 Runoff=495.64 cfs 48.244 af

Subcatchment DA2: COMMERCIAL Runoff Area=3.723 ac 85.00% Impervious Runoff Depth=9.74"
Tc=6.0 min CN=95 Runoff=37.58 cfs 3.023 af

Subcatchment DA3: COMMERCIAL Runoff Area=14.449 ac 39.02% Impervious Runoff Depth=8.37"
Flow Length=906' Tc=8.3 min CN=84 Runoff=125.14 cfs 10.078 af

Subcatchment DA4: ATHLETIC FIELDS Runoff Area=20.386 ac 7.84% Impervious Runoff Depth=7.47"
Flow Length=339' Tc=16.1 min CN=77 Runoff=129.64 cfs 12.683 af

Subcatchment DA5a: RESIDENTIAL & Runoff Area=4.520 ac 64.87% Impervious Runoff Depth=7.47"
Tc=6.0 min CN=77 Runoff=38.78 cfs 2.812 af

Subcatchment DA5b: HIGH SCHOOL, Runoff Area=15.345 ac 76.43% Impervious Runoff Depth=9.37"
Flow Length=242' Tc=15.5 min CN=92 Runoff=115.45 cfs 11.988 af

Subcatchment DA6: DA6 Runoff Area=12.247 ac 13.89% Impervious Runoff Depth=6.81"
Tc=6.0 min CN=72 Runoff=97.01 cfs 6.947 af

Reach 1R: OPEN CHANNEL-NORTH Avg. Flow Depth=3.11' Max Vel=1.56 fps Inflow=39.58 cfs 41.976 af
n=0.040 L=463.0' S=0.0009 '/' Capacity=26.93 cfs Outflow=34.28 cfs 41.957 af

Reach 2R: OPEN CHANNEL-SOUTH Avg. Flow Depth=3.88' Max Vel=2.71 fps Inflow=158.96 cfs 52.035 af
n=0.040 L=590.0' S=0.0017 '/' Capacity=119.54 cfs Outflow=146.97 cfs 52.013 af

Reach 3R: OPEN CHANNEL-SOUTH Avg. Flow Depth=2.45' Max Vel=3.78 fps Inflow=477.22 cfs 86.444 af
L=390.0' S=0.0077 '/' Capacity=2,227.64 cfs Outflow=473.61 cfs 86.436 af

Pond C-1: FRANKLIN ST CULVERT Peak Elev=169.22' Inflow=34.28 cfs 41.957 af
30.0" Round Culvert n=0.013 L=90.0' S=0.0137 '/' Outflow=34.28 cfs 41.957 af

Pond C-2: CULVERT #2 Peak Elev=682.14' Inflow=408.93 cfs 79.497 af
36.0" Round Culvert n=0.013 L=1,170.0' S=0.0023 '/' Outflow=408.93 cfs 79.497 af

Pond SP1: FRANKLIN ST. CULVERT Inflow=34.28 cfs 41.957 af
Primary=34.28 cfs 41.957 af

Pond SP2: HEADWALL 36-IN. CULVERT PIPE Inflow=146.97 cfs 52.013 af
Primary=146.97 cfs 52.013 af

Pond SP3: OUTLET OF 36-IN. CULVERT Inflow=408.93 cfs 79.497 af
Primary=408.93 cfs 79.497 af

Pond SP4: WETLANDS TO THE SOUTH Inflow=473.61 cfs 86.436 af
Primary=473.61 cfs 86.436 af

Pond W: BORDERING VEGETATED Peak Elev=164.17' Storage=36.509 af Inflow=495.64 cfs 48.244 af
Outflow=16.39 cfs 38.952 af

Total Runoff Area = 148.213 ac Runoff Volume = 95.776 af Average Runoff Depth = 7.75"
72.50% Pervious = 107.455 ac 27.50% Impervious = 40.758 ac

Summary for Subcatchment DA1: DEVELOPMENT NORTH OF FRANKLIN ST.

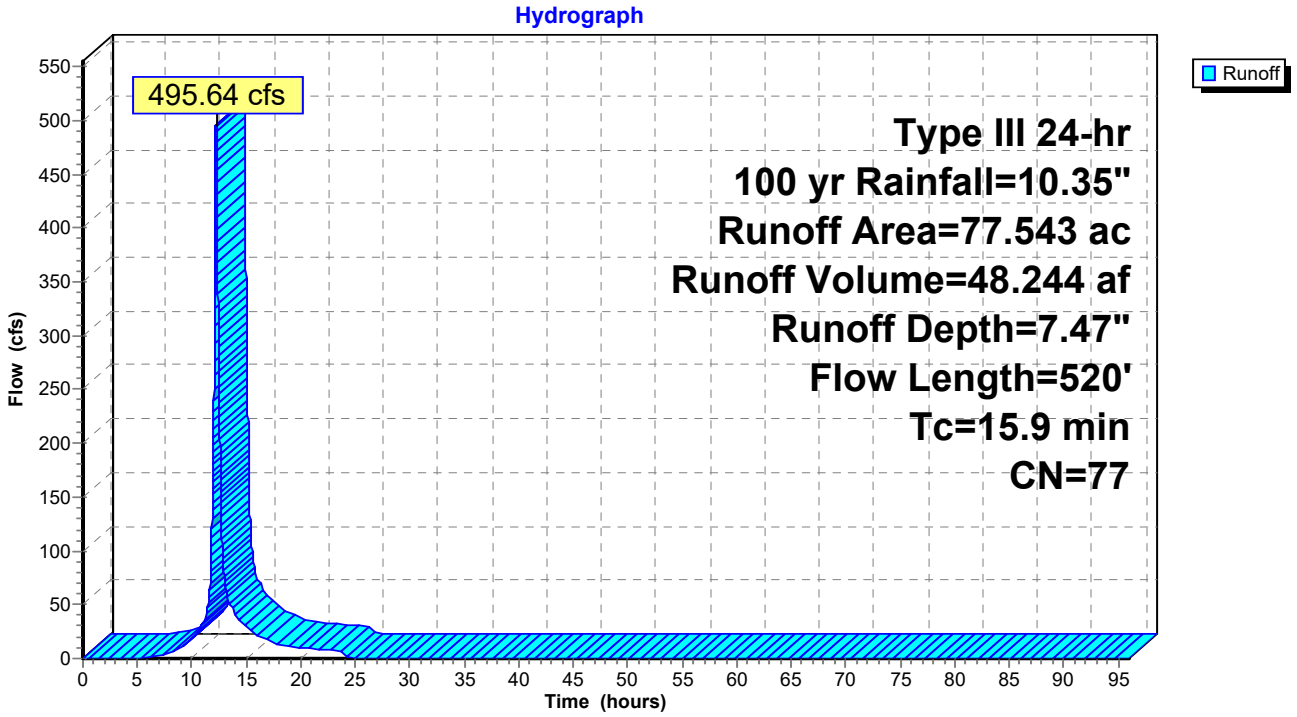
Runoff = 495.64 cfs @ 12.21 hrs, Volume= 48.244 af, Depth= 7.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=10.35"

Area (ac)	CN	Description
25.200	79	Woods, Fair, HSG D
2.521	60	Woods, Fair, HSG B
1.749	36	Woods, Fair, HSG A
2.289	94	Fallow, bare soil, HSG D
4.872	84	Pasture/grassland/range, Fair, HSG D
3.367	54	1/2 acre lots, 25% imp, HSG A
1.378	85	1/2 acre lots, 25% imp, HSG D
20.876	86	1/3 acre lots, 30% imp, HSG D
7.254	57	1/3 acre lots, 30% imp, HSG A
5.237	72	1/3 acre lots, 30% imp, HSG B
2.800	98	Water Surface, HSG A
77.543	77	Weighted Average
63.547	73	81.95% Pervious Area
13.996	98	18.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	48	0.0140	0.09		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.21"
0.5	68	0.2180	2.33		**Shallow Concentrated Flow, Shallow Conc-woods** Woodland Kv= 5.0 fps
1.2	404	0.0720	5.45		**Shallow Concentrated Flow, Shallow Conc-gutter line** Paved Kv= 20.3 fps
5.0					**Direct Entry, Conveyance through pipe network**
15.9	520	Total			

Subcatchment DA1: DEVELOPMENT NORTH OF FRANKLIN ST.



ummary for Subcatchment DA2: COMMERCIAL DEVEL/ELDERLY HOUSING NORTH SIDE OF FRANKLIN

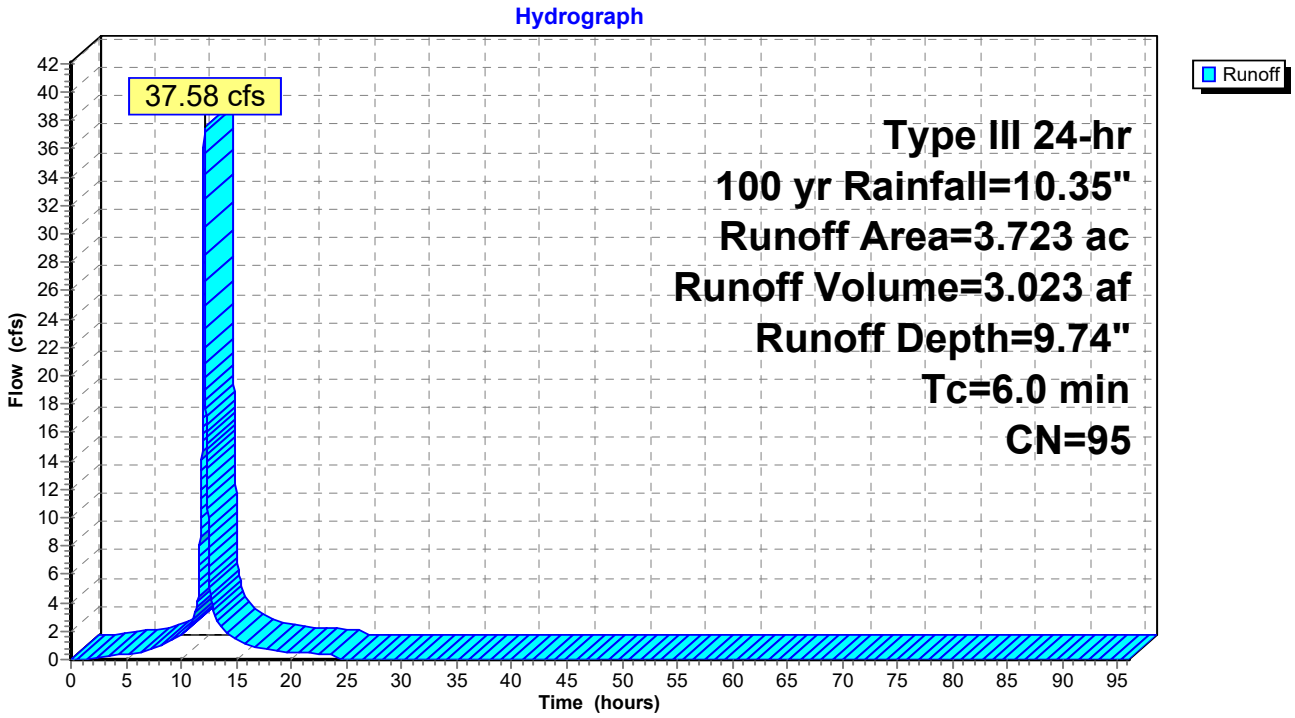
Runoff = 37.58 cfs @ 12.08 hrs, Volume= 3.023 af, Depth= 9.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=10.35"

Area (ac)	CN	Description
3.597	95	Urban commercial, 85% imp, HSG D
0.126	89	Urban commercial, 85% imp, HSG A
3.723	95	Weighted Average
0.558	77	15.00% Pervious Area
3.165	98	85.00% Impervious Area

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

Subcatchment DA2: COMMERCIAL DEVEL/ELDERLY HOUSING NORTH SIDE OF FRANKLIN ST.



Summary for Subcatchment DA3: COMMERCIAL DEVEL/HOUSING SOUTH SIDE OF FRANKLIN ST.

[47] Hint: Peak is 150% of capacity of segment #4

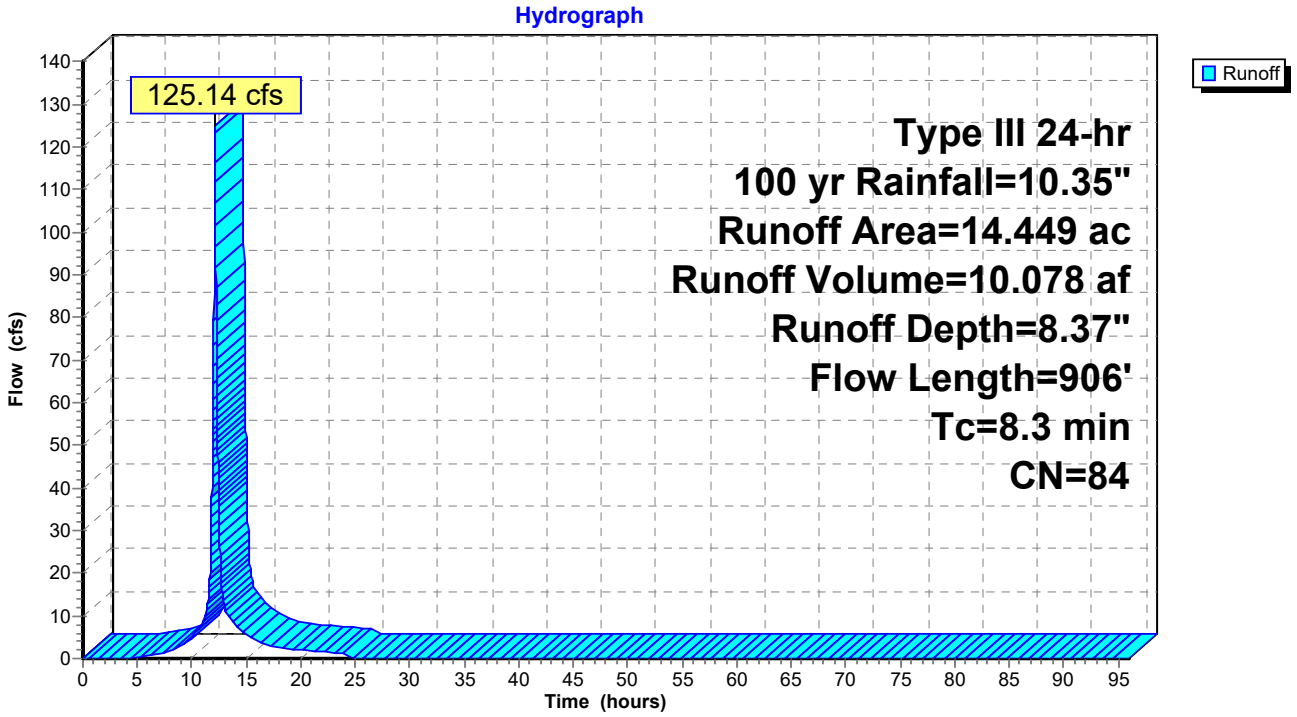
Runoff = 125.14 cfs @ 12.11 hrs, Volume= 10.078 af, Depth= 8.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=10.35"

Area (ac)	CN	Description
2.578	95	Urban commercial, 85% imp, HSG D
0.158	89	Urban commercial, 85% imp, HSG A
1.787	92	1/8 acre lots, 65% imp, HSG D
0.299	77	1/8 acre lots, 65% imp, HSG A
4.832	86	1/3 acre lots, 30% imp, HSG D
1.691	57	1/3 acre lots, 30% imp, HSG A
2.217	79	Woods, Fair, HSG D
0.887	84	50-75% Grass cover, Fair, HSG D
14.449	84	Weighted Average
8.811	74	60.98% Pervious Area
5.638	98	39.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	16	0.0200	0.05		**Sheet Flow, Sheet flow through woods** Woods: Light underbrush n= 0.400 P2= 3.21"
0.6	81	0.2200	2.35		**Shallow Concentrated Flow, Shallow Conc through woods / law** Woodland Kv= 5.0 fps
1.7	557	0.0700	5.37		**Shallow Concentrated Flow, Shallow Conc on PVMNT** Paved Kv= 20.3 fps
1.0	252	0.0100	4.18	83.56	**Channel Flow, Open Channel Flow** Area= 20.0 sf Perim= 12.0' r= 1.67' n= 0.050 Earth, long dense weeds
8.3	906	Total			

Subcatchment DA3: COMMERCIAL DEVEL/HOUSING SOUTH SIDE OF FRANKLIN ST.



Summary for Subcatchment DA4: ATHLETIC FIELDS

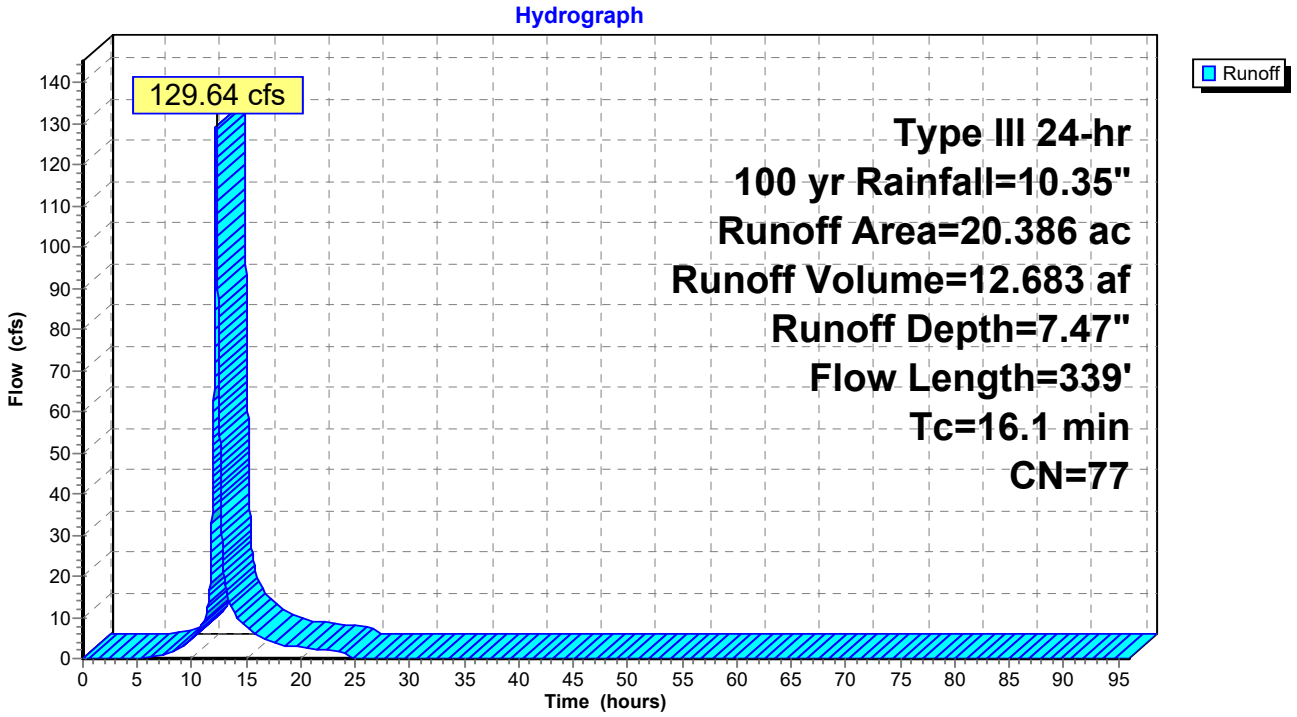
Runoff = 129.64 cfs @ 12.22 hrs, Volume= 12.683 af, Depth= 7.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=10.35"

Area (ac)	CN	Description
0.944	98	Unconnected pavement, HSG C
2.179	86	1/3 acre lots, 30% imp, HSG D
13.800	74	>75% Grass cover, Good, HSG C
3.463	79	Woods, Fair, HSG D
20.386	77	Weighted Average
18.788	75	92.16% Pervious Area
1.598	98	7.84% Impervious Area
0.944		59.08% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	25	0.0050	0.03		**Sheet Flow, Sheet flow through woods** Woods: Light underbrush n= 0.400 P2= 3.21"
2.2	246	0.1400	1.87		**Shallow Concentrated Flow, Shallow Conc through woods** Woodland Kv= 5.0 fps
0.5	68	0.0880	2.08		**Shallow Concentrated Flow, Shallow Conc through grass** Short Grass Pasture Kv= 7.0 fps
1.0					**Direct Entry, Flow through closeed pipes**
16.1	339	Total			

Subcatchment DA4: ATHLETIC FIELDS



or Subcatchment DA5a: RESIDENTIAL & COMMERCIAL DEVELOPMENT , NORTH OF HS, SOUTH SIDE

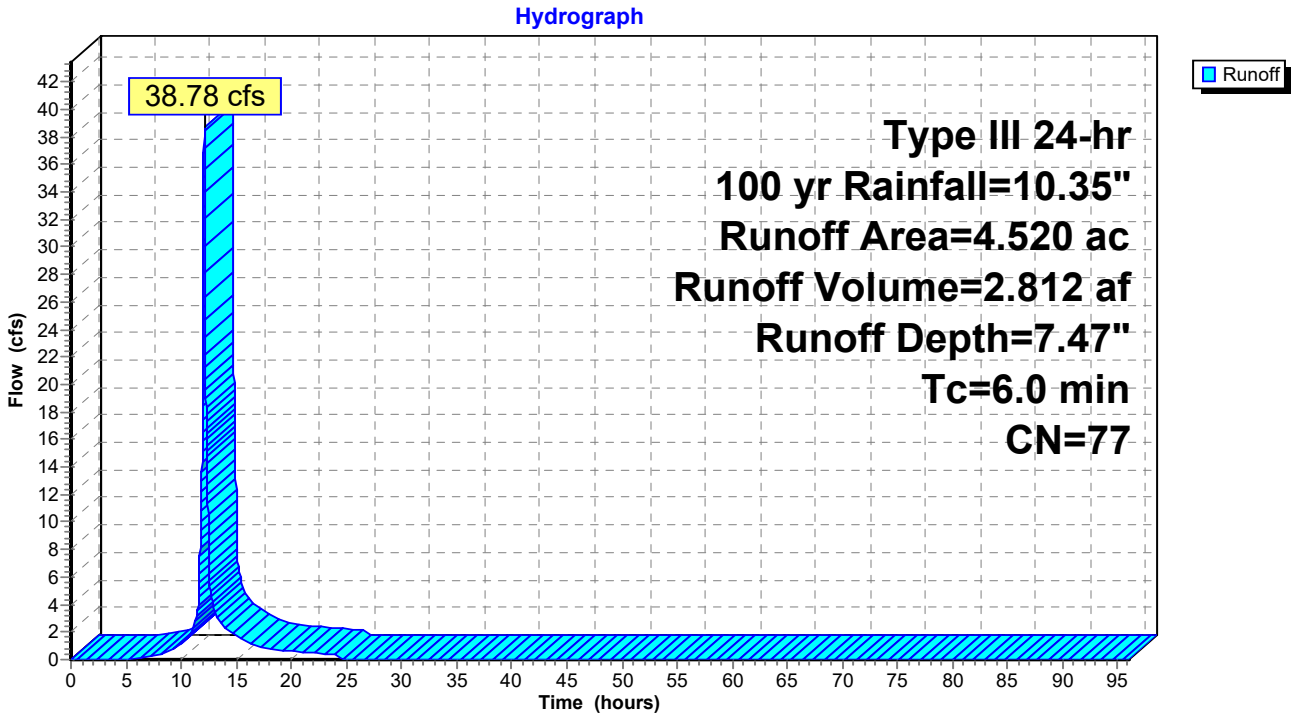
Runoff = 38.78 cfs @ 12.09 hrs, Volume= 2.812 af, Depth= 7.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=10.35"

Area (ac)	CN	Description
3.036	89	Urban commercial, 85% imp, HSG A
0.069	86	1/3 acre lots, 30% imp, HSG D
1.103	57	1/3 acre lots, 30% imp, HSG A
0.312	36	Woods, Fair, HSG A
4.520	77	Weighted Average
1.588	40	35.13% Pervious Area
2.932	98	64.87% Impervious Area

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

catchment DA5a: RESIDENTIAL & COMMERCIAL DEVELOPMENT , NORTH OF HS, SOUTH SIDE FRANK



Summary for Subcatchment DA5b: HIGH SCHOOL, PARKING, AND TENNIS COURTS

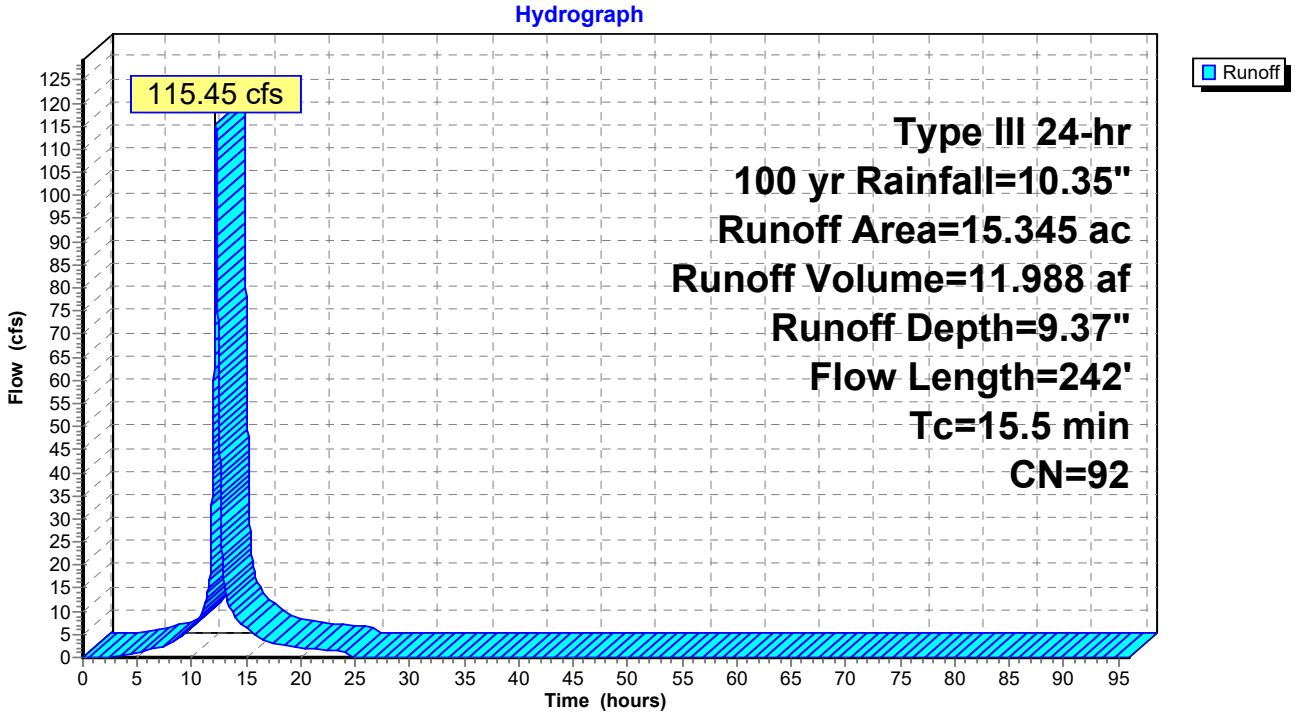
Runoff = 115.45 cfs @ 12.20 hrs, Volume= 11.988 af, Depth= 9.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=10.35"

Area (ac)	CN	Description
12.099	95	Urban commercial, 85% imp, HSG D
1.536	89	Urban commercial, 85% imp, HSG A
0.459	57	1/3 acre lots, 30% imp, HSG A
1.251	79	50-75% Grass cover, Fair, HSG C
15.345	92	Weighted Average
3.618	72	23.57% Pervious Area
11.727	98	76.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	40	0.0090	0.07		**Sheet Flow, Sheet flow through grass** Grass: Dense n= 0.240 P2= 3.21"
4.1	202	0.0140	0.83		**Shallow Concentrated Flow, Shallow Conc through grass** Short Grass Pasture Kv= 7.0 fps
2.0					**Direct Entry, Flow through closed pipes**
15.5	242	Total			

Subcatchment DA5b: HIGH SCHOOL, PARKING, AND TENNIS COURTS



Summary for Subcatchment DA6: DA6

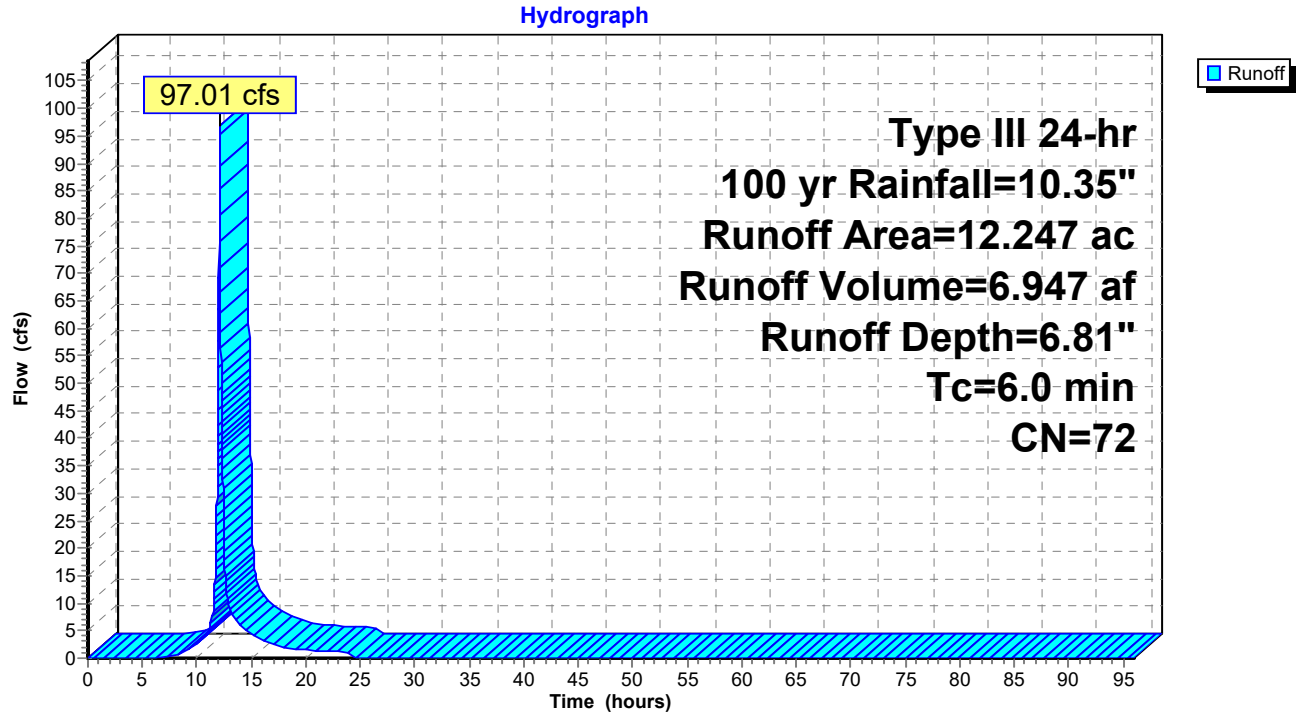
Runoff = 97.01 cfs @ 12.09 hrs, Volume= 6.947 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=10.35"

Area (ac)	CN	Description
1.766	60	Woods, Fair, HSG B
4.843	79	Woods, Fair, HSG D
0.033	36	Woods, Fair, HSG A
1.692	86	1/3 acre lots, 30% imp, HSG D
2.974	57	1/3 acre lots, 30% imp, HSG A
0.392	72	1/3 acre lots, 30% imp, HSG B
0.184	98	Paved parking, HSG D
0.070	49	50-75% Grass cover, Fair, HSG A
0.293	84	50-75% Grass cover, Fair, HSG D
12.247	72	Weighted Average
10.546	68	86.11% Pervious Area
1.701	98	13.89% Impervious Area

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

Subcatchment DA6: DA6



Summary for Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.

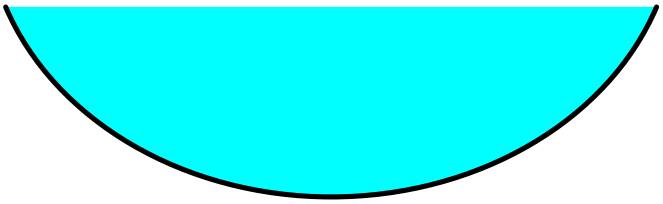
[91] Warning: Storage range exceeded by 0.36'
[55] Hint: Peak inflow is 147% of Manning's capacity

Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth > 6.20" for 100 yr event
Inflow = 39.58 cfs @ 12.09 hrs, Volume= 41.976 af
Outflow = 34.28 cfs @ 12.13 hrs, Volume= 41.957 af, Atten= 13%, Lag= 2.9 min

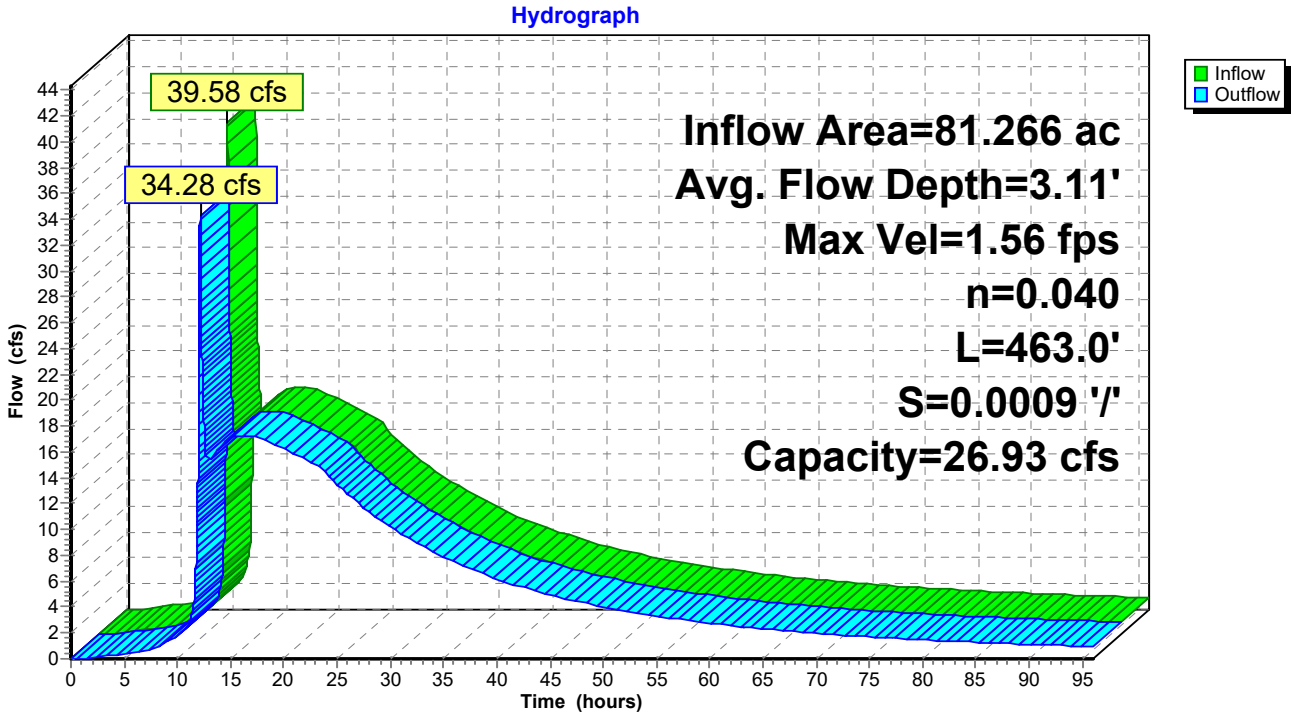
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 1.56 fps, Min. Travel Time= 4.9 min
Avg. Velocity = 0.83 fps, Avg. Travel Time= 9.3 min

Peak Storage= 10,167 cf @ 12.13 hrs
Average Depth at Peak Storage= 3.11' , Surface Width= 10.64'
Bank-Full Depth= 2.75' Flow Area= 18.3 sf, Capacity= 26.93 cfs

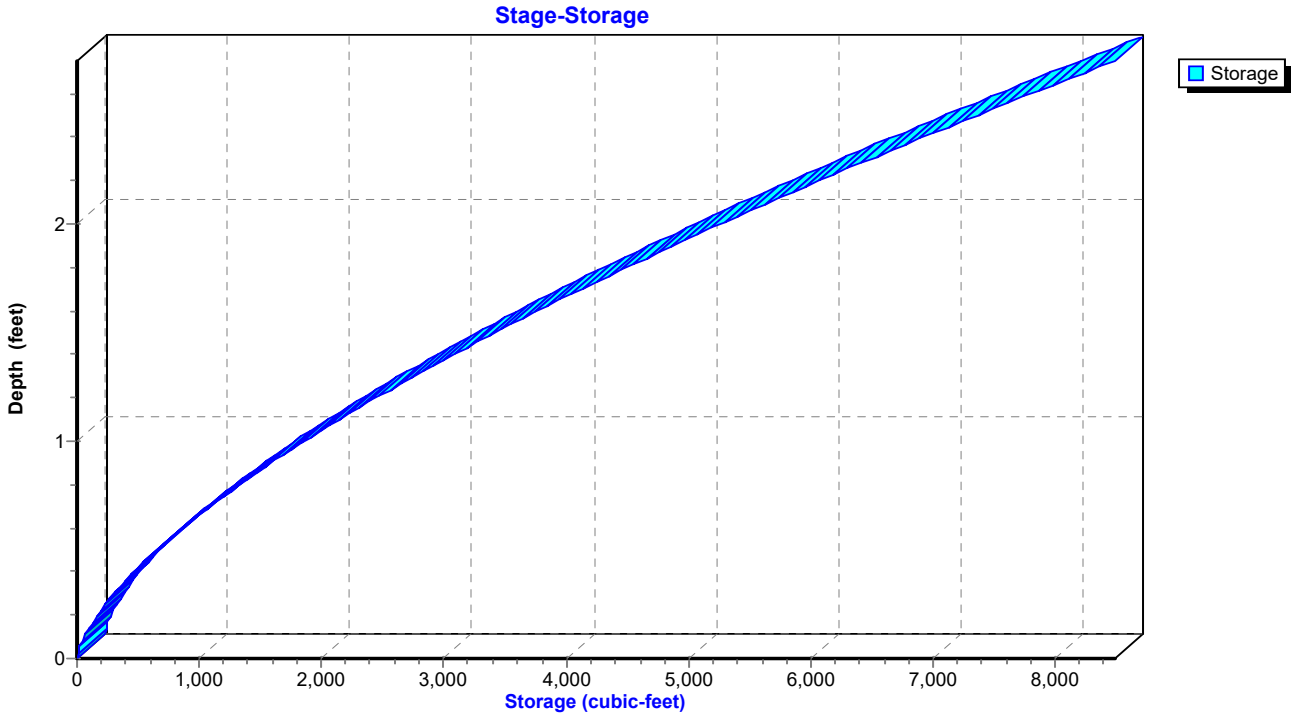
10.00' x 2.75' deep Parabolic Channel, n= 0.040 Earth, dense weeds
Length= 463.0' Slope= 0.0009 '/'
Inlet Invert= 162.00', Outlet Invert= 161.60'



Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.



Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.



Summary for Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.

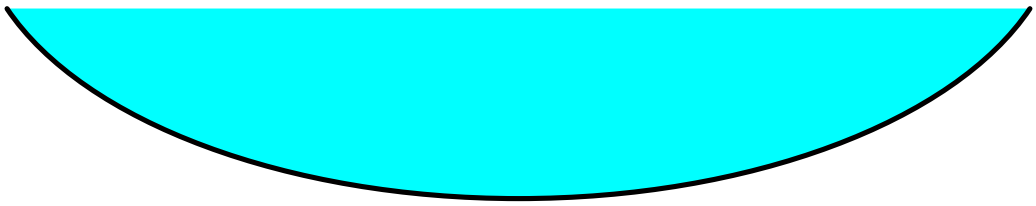
[91] Warning: Storage range exceeded by 0.38'
[55] Hint: Peak inflow is 133% of Manning's capacity
[80] Warning: Exceeded Pond C-1 by 0.35' @ 0.00 hrs (0.65 cfs 0.002 af)

Inflow Area = 95.715 ac, 23.82% Impervious, Inflow Depth > 6.52" for 100 yr event
Inflow = 158.96 cfs @ 12.12 hrs, Volume= 52.035 af
Outflow = 146.97 cfs @ 12.16 hrs, Volume= 52.013 af, Atten= 8%, Lag= 2.4 min

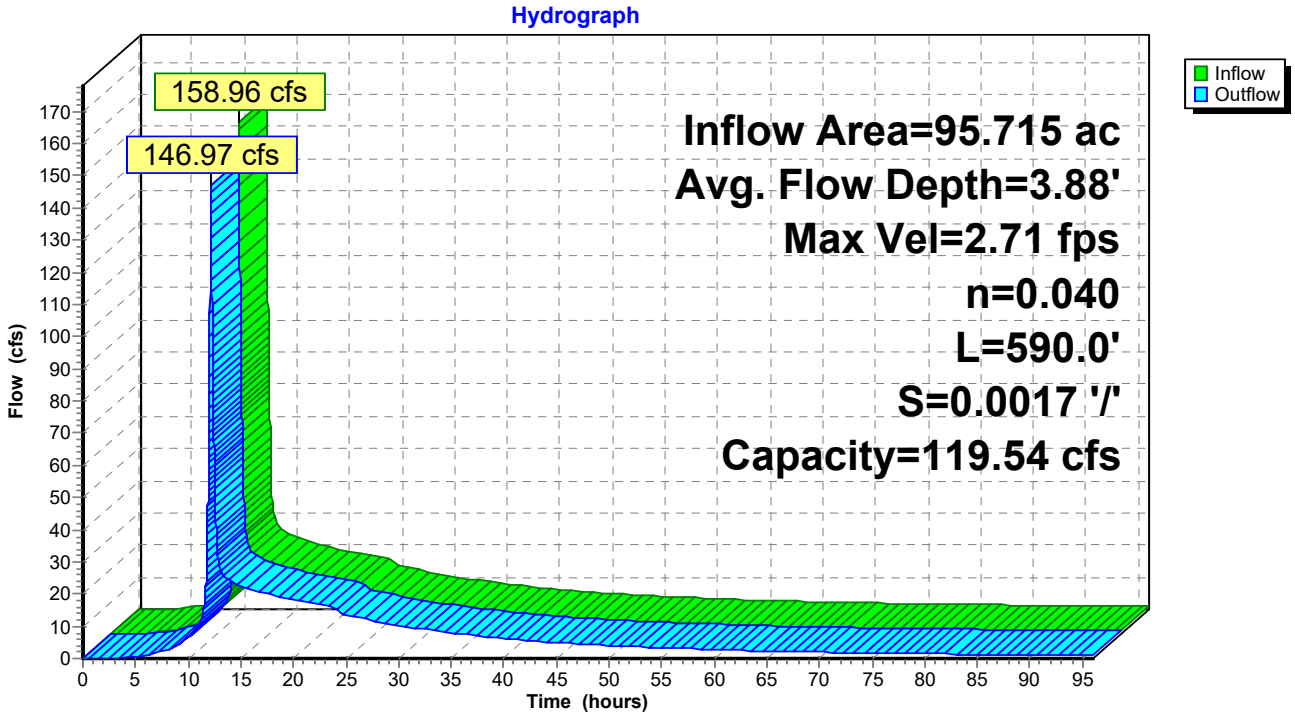
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 2.71 fps, Min. Travel Time= 3.6 min
Avg. Velocity = 0.94 fps, Avg. Travel Time= 10.4 min

Peak Storage= 32,012 cf @ 12.16 hrs
Average Depth at Peak Storage= 3.88' , Surface Width= 21.06'
Bank-Full Depth= 3.50' Flow Area= 46.7 sf, Capacity= 119.54 cfs

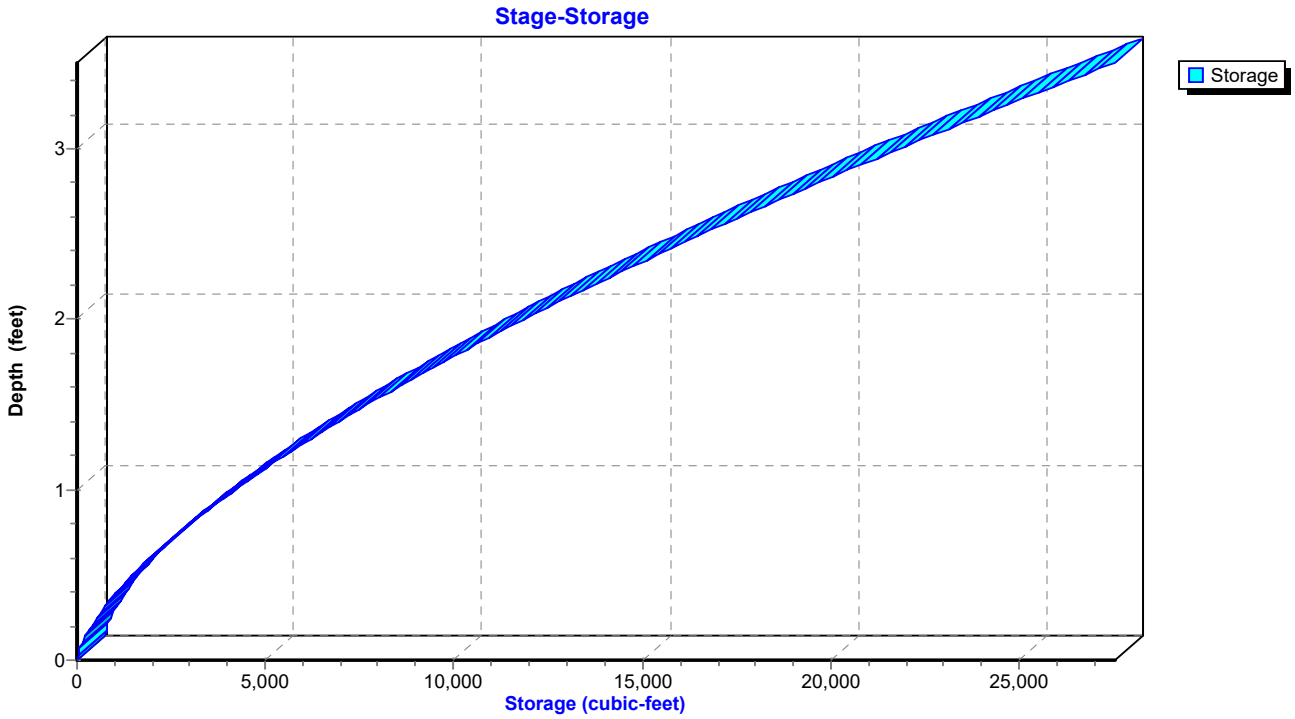
20.00' x 3.50' deep Parabolic Channel, n= 0.040
Length= 590.0' Slope= 0.0017 '/'
Inlet Invert= 162.00', Outlet Invert= 161.00'



Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.



Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.



Summary for Reach 3R: OPEN CHANNEL-SOUTH OF TRACK

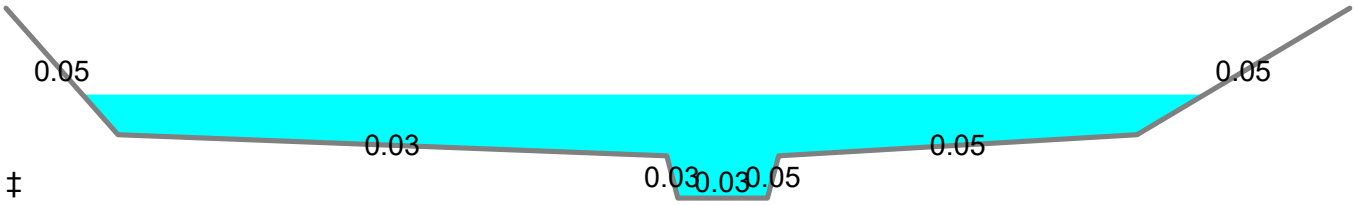
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=2)

Inflow Area = 148.213 ac, 27.50% Impervious, Inflow Depth > 7.00" for 100 yr event
Inflow = 477.22 cfs @ 12.15 hrs, Volume= 86.444 af
Outflow = 473.61 cfs @ 12.17 hrs, Volume= 86.436 af, Atten= 1%, Lag= 1.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.78 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.65 fps, Avg. Travel Time= 3.9 min

Peak Storage= 48,837 cf @ 12.17 hrs
Average Depth at Peak Storage= 2.45' , Surface Width= 100.20'
Bank-Full Depth= 4.50' Flow Area= 350.8 sf, Capacity= 2,227.64 cfs

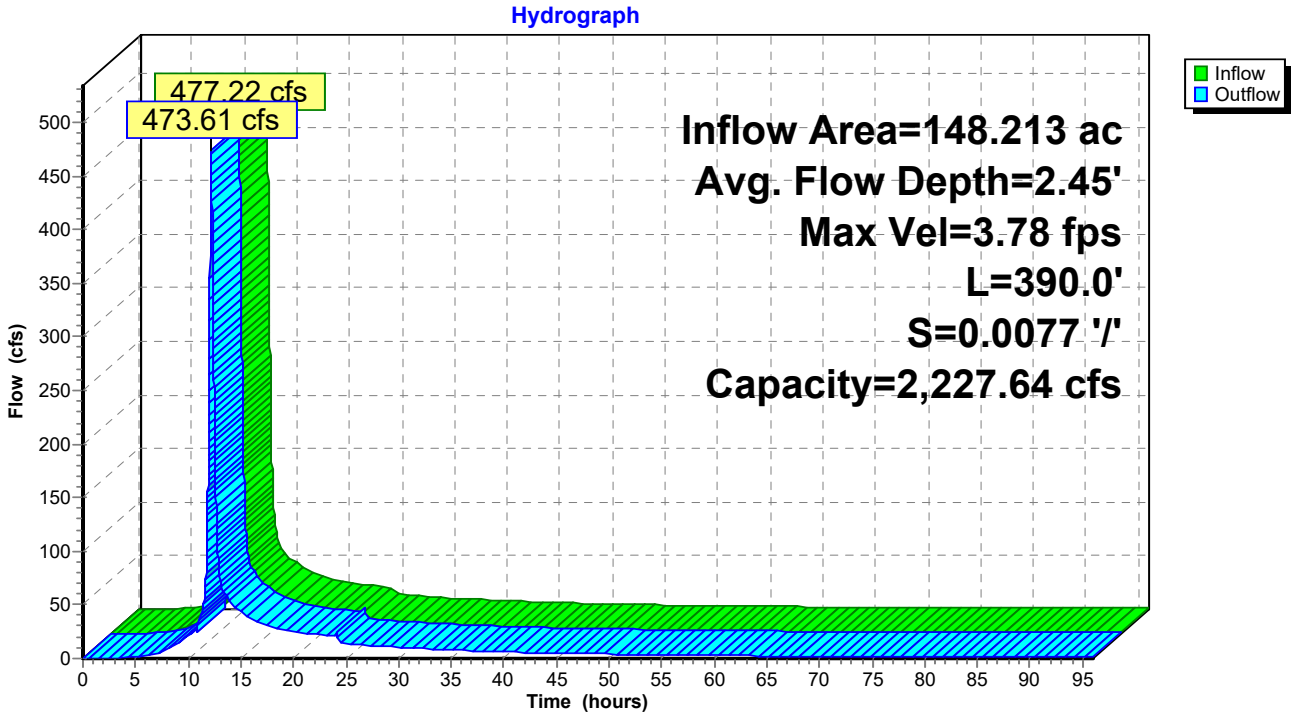
Custom cross-section, Length= 390.0' Slope= 0.0077 '/' (102 Elevation Intervals)
Composite Manning's value by Pavlovskii (shallow flow) method
Composite Manning's value at bank full= 0.042
Inlet Invert= 158.00', Outlet Invert= 155.00'



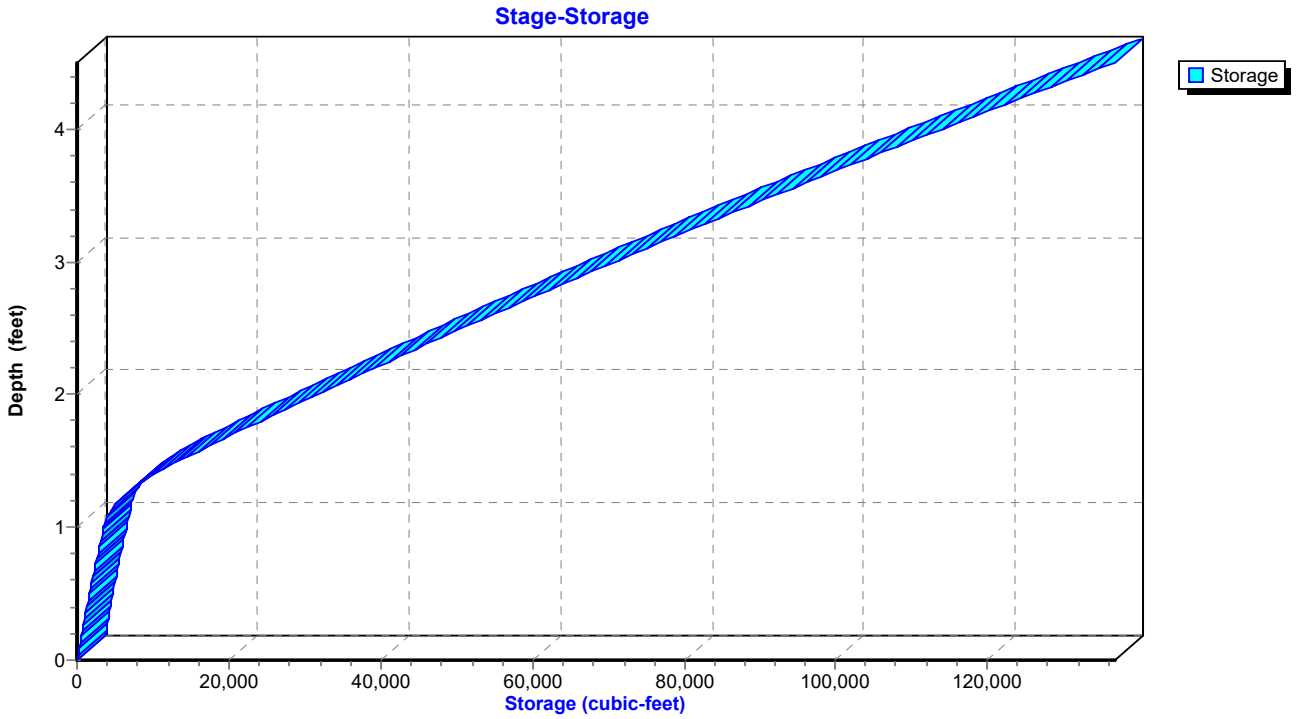
Offset (feet)	Elevation (feet)	Chan.Depth (feet)	n	Description
-60.00	158.00	0.00		
-50.00	155.00	3.00	0.050	Scattered brush, heavy weeds
-1.00	154.50	3.50	0.030	Earth, grassed & winding
0.00	153.50	4.50	0.030	Earth, grassed & winding
8.00	153.50	4.50	0.030	Earth, grassed & winding
9.00	154.50	3.50	0.050	Scattered brush, heavy weeds
41.00	155.00	3.00	0.050	Scattered brush, heavy weeds
60.00	158.00	0.00	0.050	Scattered brush, heavy weeds

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	8.0	0.0	0	0.00
1.00	9.0	10.8	10.0	3,510	31.14
1.50	34.3	91.8	91.0	13,358	60.07
4.50	350.8	121.5	120.0	136,793	2,227.64

Reach 3R: OPEN CHANNEL-SOUTH OF TRACK



Reach 3R: OPEN CHANNEL-SOUTH OF TRACK



Summary for Pond C-1: FRANKLIN ST CULVERT

[57] Hint: Peaked at 169.22' (Flood elevation advised)

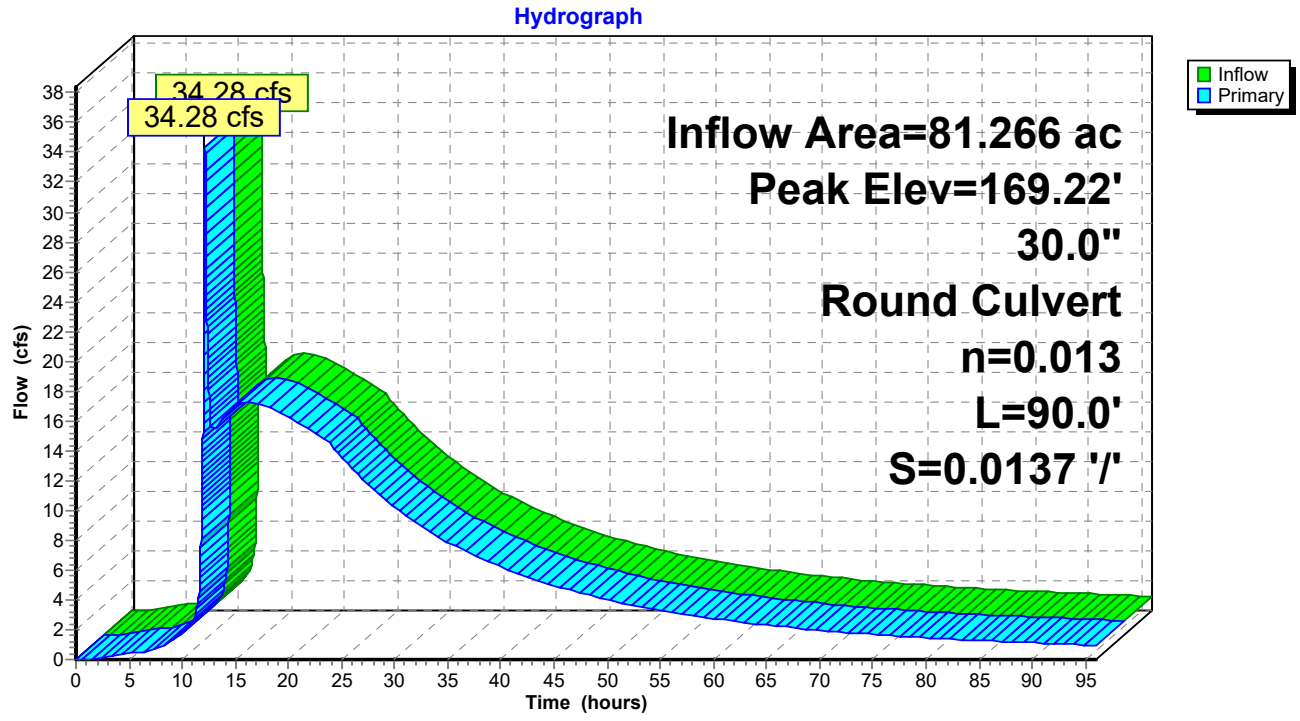
Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth > 6.20" for 100 yr event
Inflow = 34.28 cfs @ 12.13 hrs, Volume= 41.957 af
Outflow = 34.28 cfs @ 12.13 hrs, Volume= 41.957 af, Atten= 0%, Lag= 0.0 min
Primary = 34.28 cfs @ 12.13 hrs, Volume= 41.957 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 169.22' @ 12.14 hrs

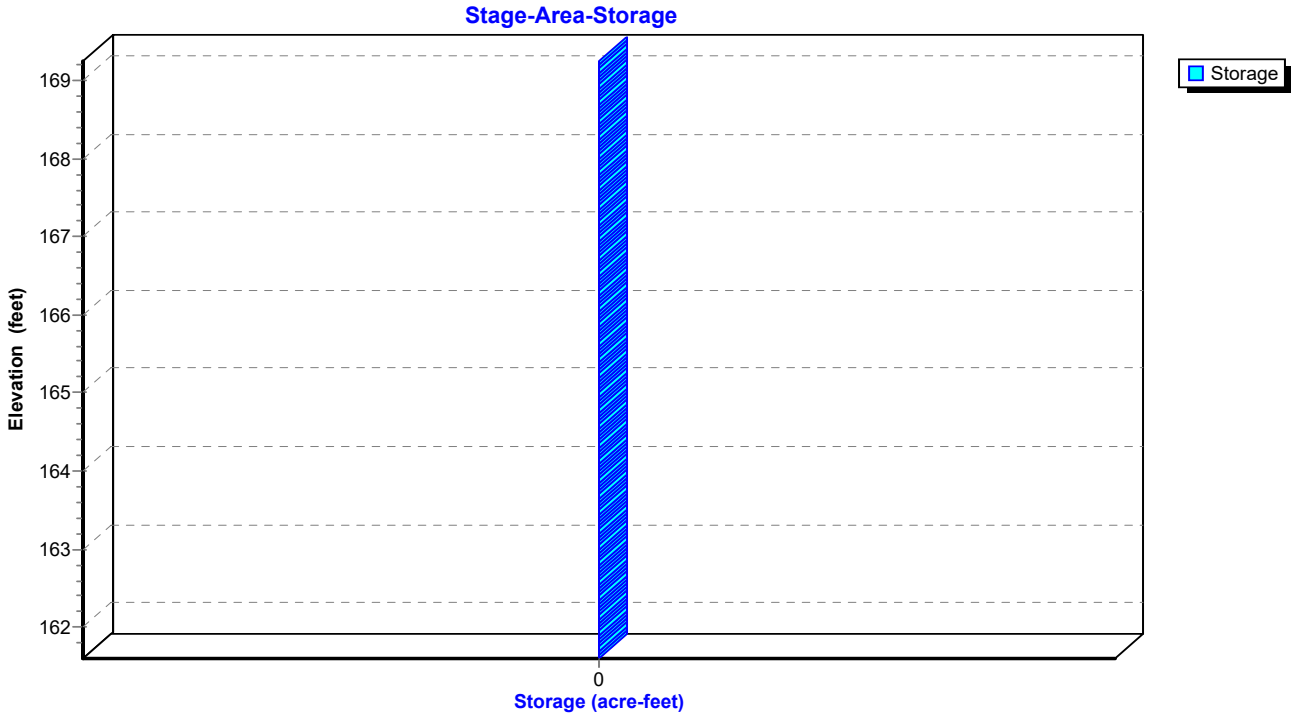
Device	Routing	Invert	Outlet Devices
#1	Primary	161.60'	**30.0" Round Culvert** L= 90.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 161.60' / 160.37' S= 0.0137 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 4.91 sf

Primary OutFlow Max=34.25 cfs @ 12.13 hrs HW=169.20' TW=165.84' (Dynamic Tailwater)
1=Culvert (Inlet Controls 34.25 cfs @ 6.98 fps)

Pond C-1: FRANKLIN ST CULVERT



Pond C-1: FRANKLIN ST CULVERT



Summary for Pond C-2: CULVERT #2

[57] Hint: Peaked at 682.14' (Flood elevation advised)

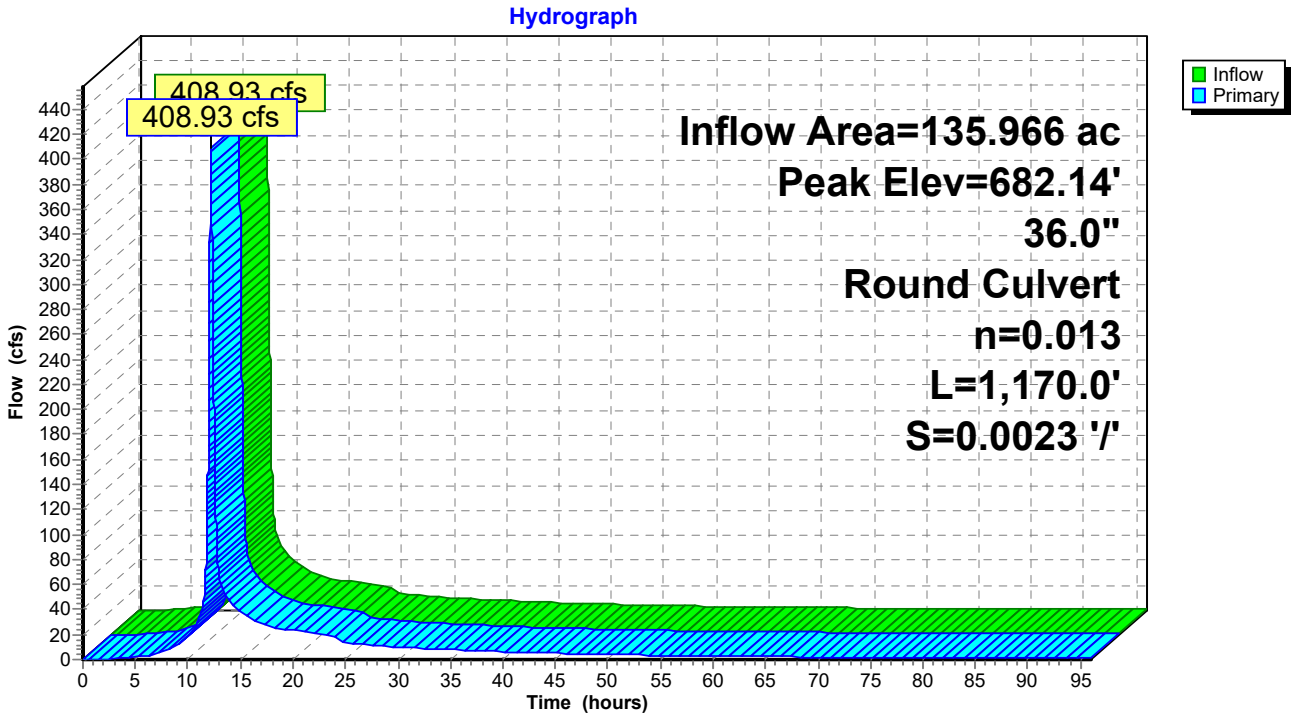
Inflow Area = 135.966 ac, 28.73% Impervious, Inflow Depth > 7.02" for 100 yr event
Inflow = 408.93 cfs @ 12.18 hrs, Volume= 79.497 af
Outflow = 408.93 cfs @ 12.18 hrs, Volume= 79.497 af, Atten= 0%, Lag= 0.0 min
Primary = 408.93 cfs @ 12.18 hrs, Volume= 79.497 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 682.14' @ 12.18 hrs

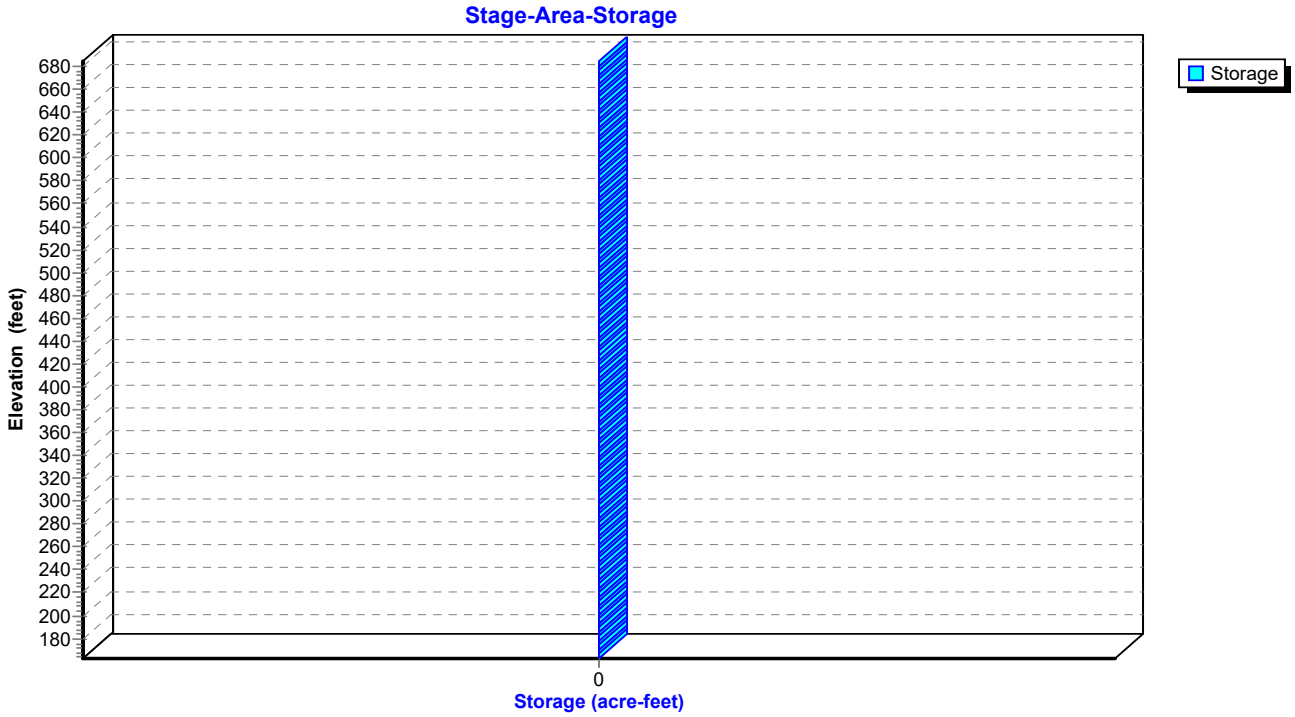
Device	Routing	Invert	Outlet Devices
#1	Primary	162.50'	**36.0" Round Culvert** L= 1,170.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 162.50' / 159.79' S= 0.0023 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=408.76 cfs @ 12.18 hrs HW=681.71' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 408.76 cfs @ 57.83 fps)

Pond C-2: CULVERT #2



Pond C-2: CULVERT #2



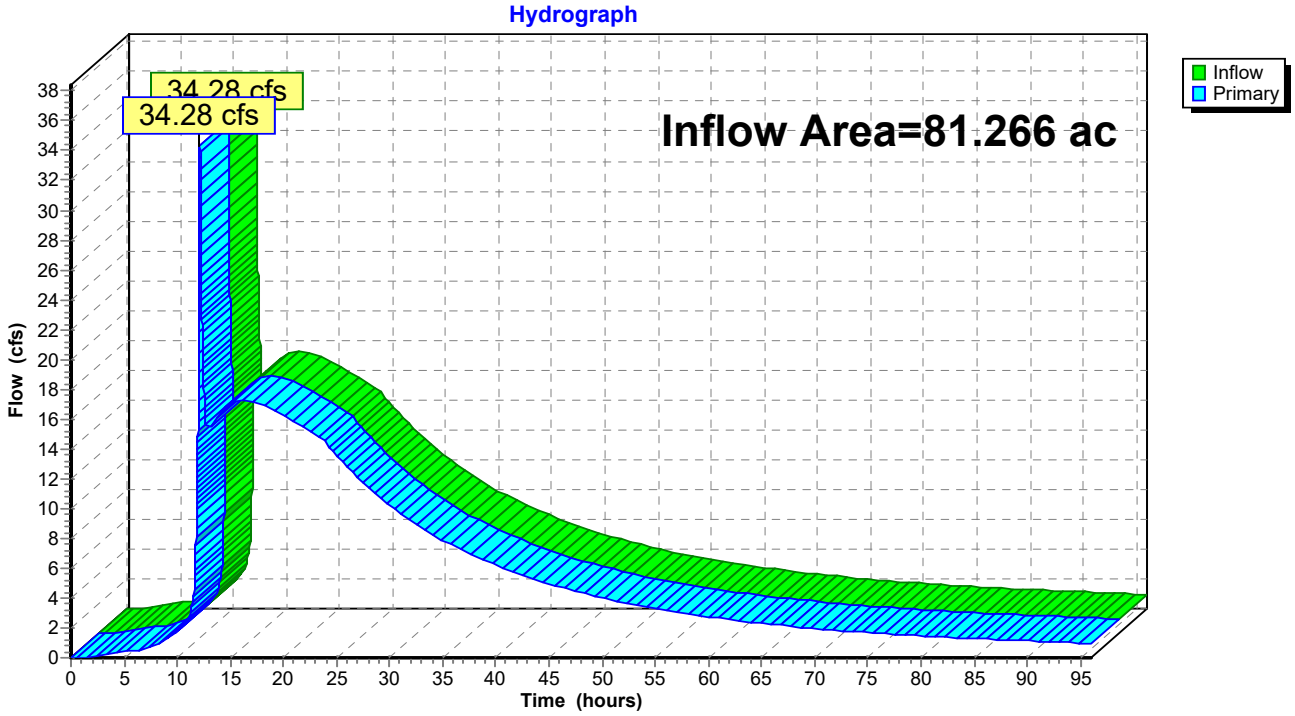
Summary for Pond SP1: FRANKLIN ST. CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth > 6.20" for 100 yr event
Inflow = 34.28 cfs @ 12.13 hrs, Volume= 41.957 af
Primary = 34.28 cfs @ 12.13 hrs, Volume= 41.957 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP1: FRANKLIN ST. CULVERT



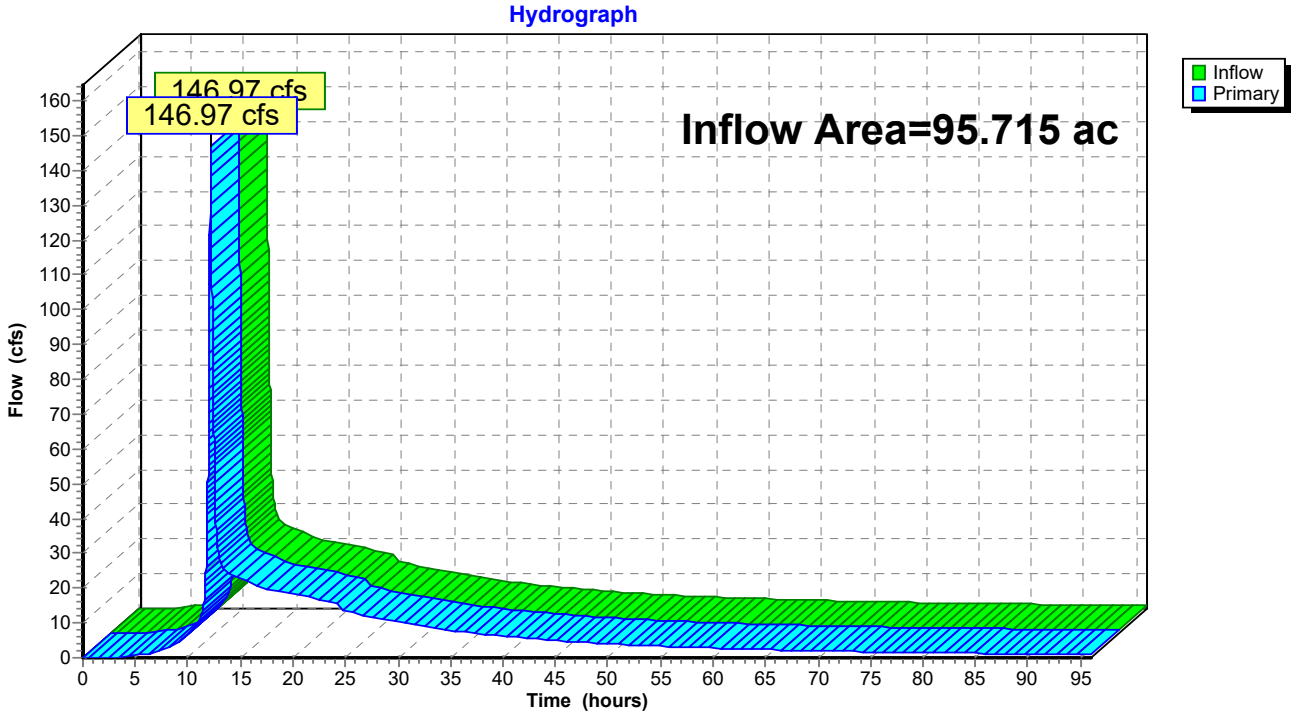
Summary for Pond SP2: HEADWALL 36-IN. CULVERT PIPE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 95.715 ac, 23.82% Impervious, Inflow Depth > 6.52" for 100 yr event
Inflow = 146.97 cfs @ 12.16 hrs, Volume= 52.013 af
Primary = 146.97 cfs @ 12.16 hrs, Volume= 52.013 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP2: HEADWALL 36-IN. CULVERT PIPE



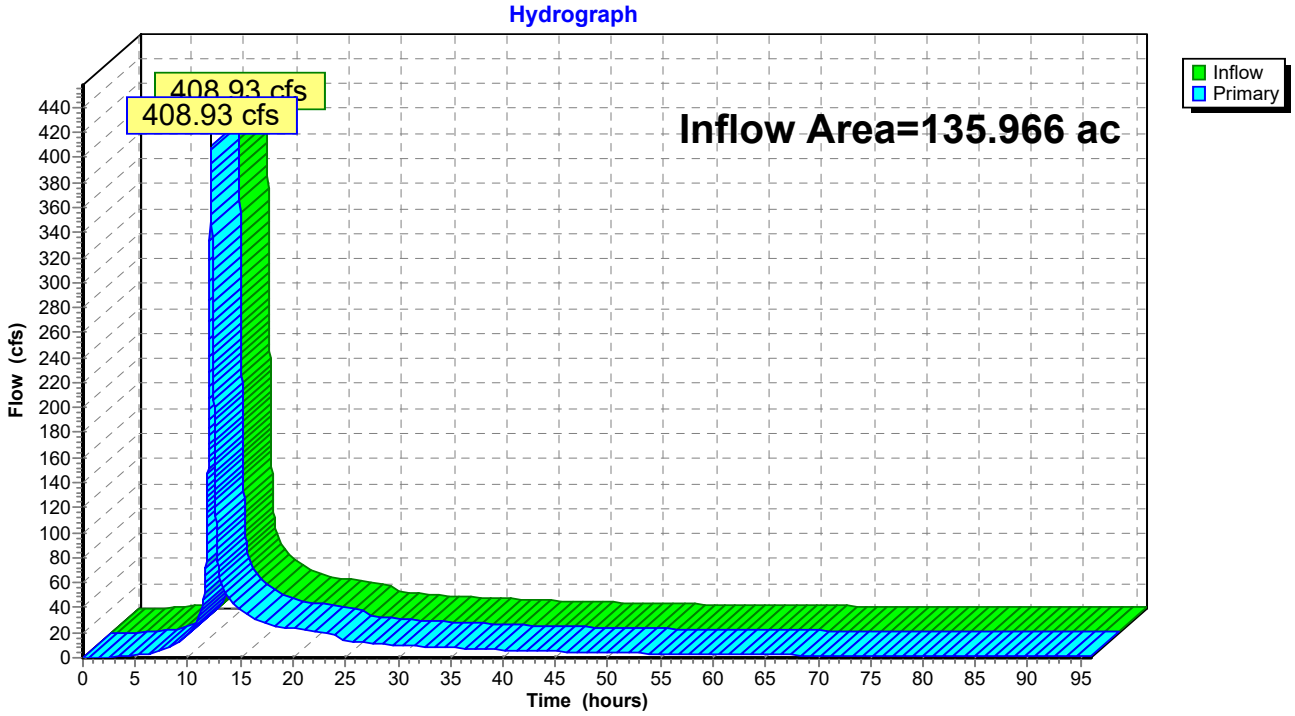
Summary for Pond SP3: OUTLET OF 36-IN. CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 135.966 ac, 28.73% Impervious, Inflow Depth > 7.02" for 100 yr event
Inflow = 408.93 cfs @ 12.18 hrs, Volume= 79.497 af
Primary = 408.93 cfs @ 12.18 hrs, Volume= 79.497 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP3: OUTLET OF 36-IN. CULVERT



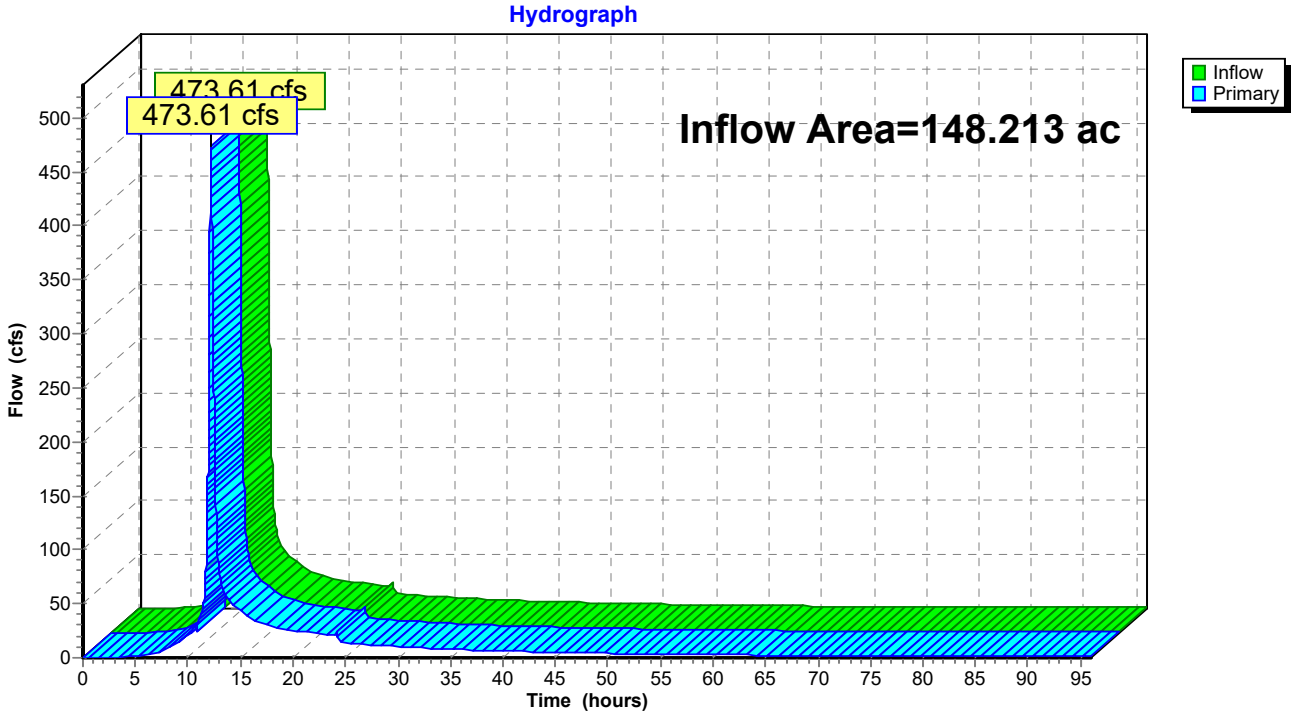
Summary for Pond SP4: WETLANDS TO THE SOUTH

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 148.213 ac, 27.50% Impervious, Inflow Depth > 7.00" for 100 yr event
Inflow = 473.61 cfs @ 12.17 hrs, Volume= 86.436 af
Primary = 473.61 cfs @ 12.17 hrs, Volume= 86.436 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP4: WETLANDS TO THE SOUTH



Summary for Pond W: BORDERING VEGETATED WETLAND

Inflow Area = 77.543 ac, 18.05% Impervious, Inflow Depth = 7.47" for 100 yr event
Inflow = 495.64 cfs @ 12.21 hrs, Volume= 48.244 af
Outflow = 16.39 cfs @ 17.12 hrs, Volume= 38.952 af, Atten= 97%, Lag= 294.3 min
Primary = 16.39 cfs @ 17.12 hrs, Volume= 38.952 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 164.17' @ 17.12 hrs Surf.Area= 20.863 ac Storage= 36.509 af

Plug-Flow detention time= 1,350.9 min calculated for 38.952 af (81% of inflow)
Center-of-Mass det. time= 1,276.7 min (2,085.8 - 809.1)

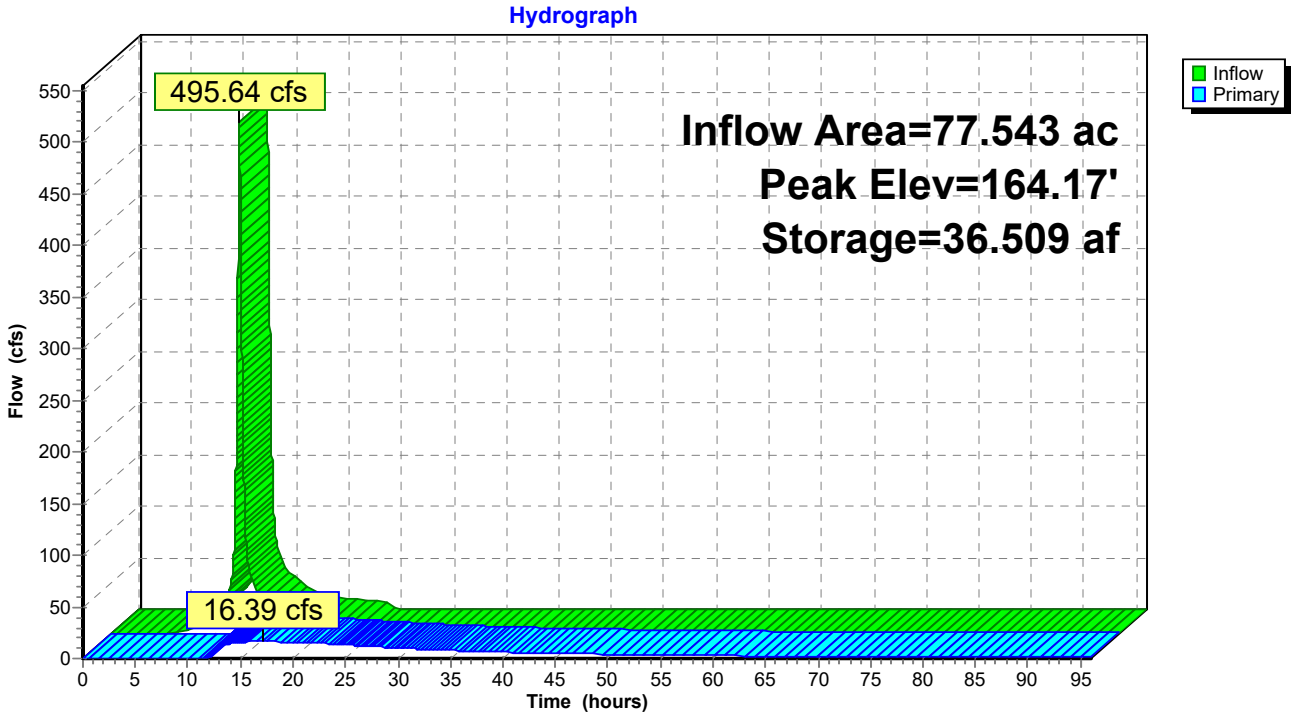
Volume	Invert	Avail.Storage	Storage Description
#1	161.50'	77.077 af	**Ponding storage in wetand (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
161.50	2.880	0.000	0.000
162.00	9.350	3.058	3.058
164.00	20.630	29.980	33.037
166.00	23.410	44.040	77.077

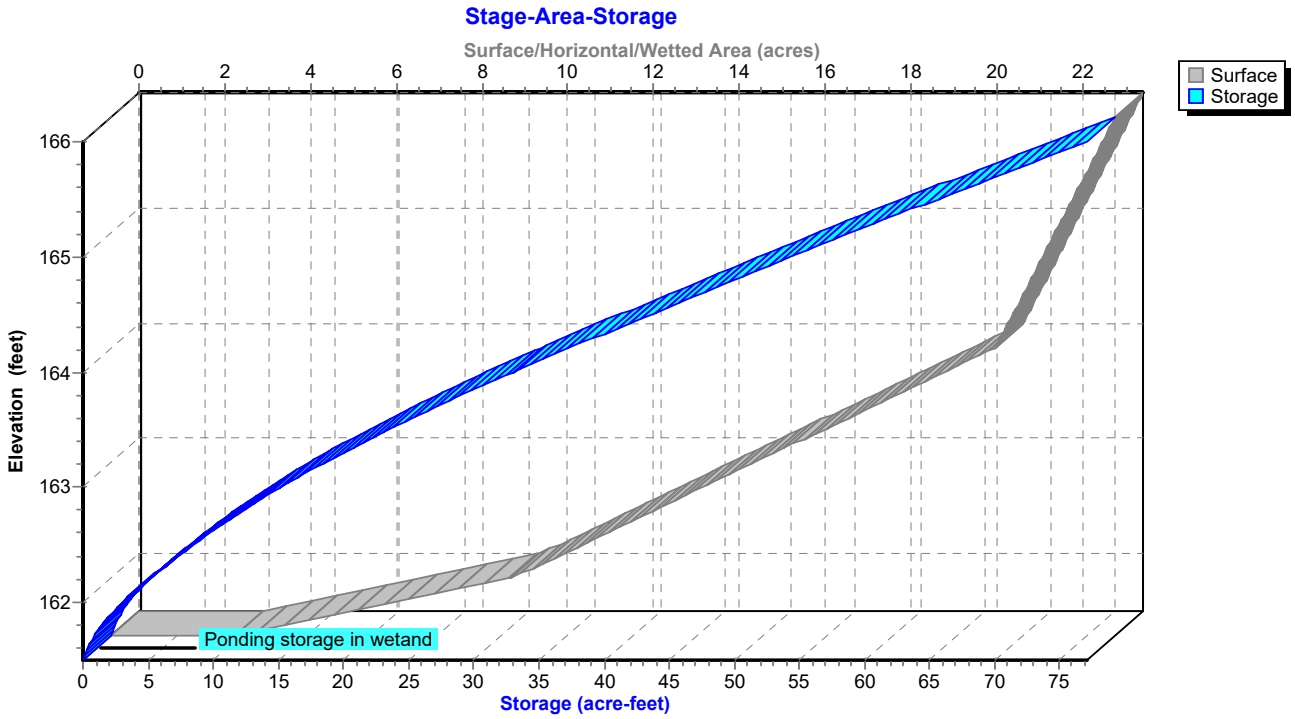
Device	Routing	Invert	Outlet Devices
#1	Primary	162.00'	**Channel/Reach** using Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.

Primary OutFlow Max=16.39 cfs @ 17.12 hrs HW=164.17' TW=164.22' (Dynamic Tailwater)
↑—**1=Channel/Reach** (Channel Controls 16.39 cfs @ 1.28 fps)

Pond W: BORDERING VEGETATED WETLAND



Pond W: BORDERING VEGETATED WETLAND



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DA1: DEVELOPMENT Runoff Area=77.543 ac 18.05% Impervious Runoff Depth=0.32"
Flow Length=520' Tc=15.9 min CN=77 Runoff=16.14 cfs 2.043 af

Subcatchment DA2: COMMERCIAL Runoff Area=3.723 ac 85.00% Impervious Runoff Depth=1.24"
Tc=6.0 min CN=95 Runoff=5.30 cfs 0.384 af

Subcatchment DA3: COMMERCIAL Runoff Area=14.449 ac 39.02% Impervious Runoff Depth=0.57"
Flow Length=906' Tc=8.3 min CN=84 Runoff=8.38 cfs 0.681 af

Subcatchment DA4: ATHLETIC FIELDS Runoff Area=20.386 ac 7.84% Impervious Runoff Depth=0.32"
Flow Length=339' Tc=16.1 min CN=77 Runoff=4.22 cfs 0.537 af

Subcatchment DA5a: RESIDENTIAL & Runoff Area=4.520 ac 64.87% Impervious Runoff Depth=0.32"
Tc=6.0 min CN=77 Runoff=1.28 cfs 0.119 af

Subcatchment DA5b: HIGH SCHOOL, Runoff Area=15.345 ac 76.43% Impervious Runoff Depth=1.01"
Flow Length=242' Tc=15.5 min CN=92 Runoff=13.53 cfs 1.288 af

Subcatchment DA6: DA6 Runoff Area=12.247 ac 13.89% Impervious Runoff Depth=0.19"
Tc=6.0 min CN=72 Runoff=1.31 cfs 0.195 af

Reach 1R: OPEN CHANNEL-NORTH OF Avg. Flow Depth=1.10' Max Vel=0.85 fps Inflow=5.30 cfs 0.384 af
n=0.040 L=463.0' S=0.0009 '/' Capacity=26.93 cfs Outflow=3.94 cfs 0.384 af

Reach 2R: OPEN CHANNEL-SOUTH OF Avg. Flow Depth=1.09' Max Vel=1.21 fps Inflow=12.22 cfs 1.065 af
n=0.040 L=590.0' S=0.0017 '/' Capacity=119.54 cfs Outflow=9.81 cfs 1.065 af

Reach 3R: OPEN CHANNEL-SOUTH OF Avg. Flow Depth=0.96' Max Vel=3.39 fps Inflow=29.45 cfs 3.204 af
L=390.0' S=0.0077 '/' Capacity=2,227.64 cfs Outflow=29.17 cfs 3.204 af

Pond C-1: FRANKLIN ST CULVERT Peak Elev=163.20' Inflow=3.94 cfs 0.384 af
30.0" Round Culvert n=0.013 L=90.0' S=0.0137 '/' Outflow=3.94 cfs 0.384 af

Pond C-2: CULVERT #2 Peak Elev=165.38' Inflow=28.24 cfs 3.009 af
36.0" Round Culvert n=0.013 L=1,170.0' S=0.0023 '/' Outflow=28.24 cfs 3.009 af

Pond SP1: FRANKLIN ST. CULVERT Inflow=3.94 cfs 0.384 af
Primary=3.94 cfs 0.384 af

Pond SP2: HEADWALL 36-IN. CULVERT PIPE Inflow=9.81 cfs 1.065 af
Primary=9.81 cfs 1.065 af

Pond SP3: OUTLET OF 36-IN. CULVERT Inflow=28.24 cfs 3.009 af
Primary=28.24 cfs 3.009 af

Pond SP4: WETLANDS TO THE SOUTH Inflow=29.17 cfs 3.204 af
Primary=29.17 cfs 3.204 af

Pond W: BORDERING VEGETATED Peak Elev=161.88' Storage=2.043 af Inflow=16.14 cfs 2.043 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 148.213 ac Runoff Volume = 5.247 af Average Runoff Depth = 0.42"
72.50% Pervious = 107.455 ac 27.50% Impervious = 40.758 ac

Summary for Subcatchment DA1: DEVELOPMENT NORTH OF FRANKLIN ST.

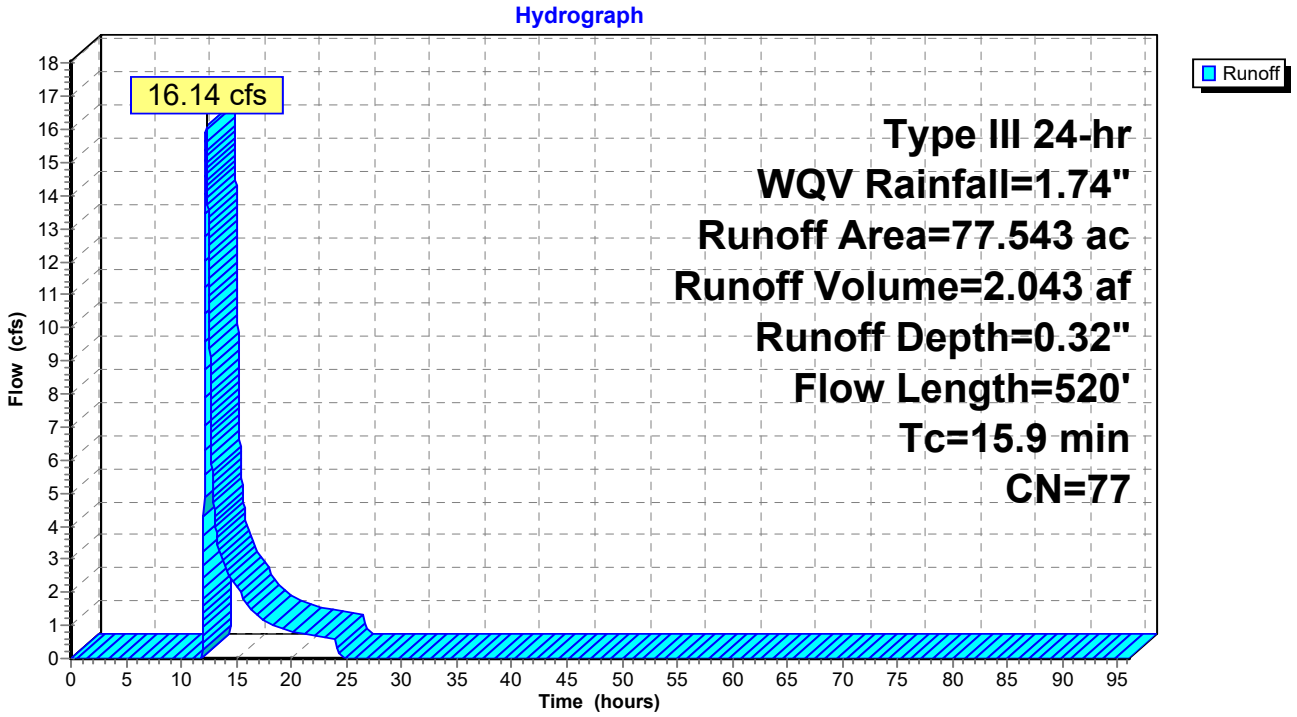
Runoff = 16.14 cfs @ 12.28 hrs, Volume= 2.043 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.74"

Area (ac)	CN	Description
25.200	79	Woods, Fair, HSG D
2.521	60	Woods, Fair, HSG B
1.749	36	Woods, Fair, HSG A
2.289	94	Fallow, bare soil, HSG D
4.872	84	Pasture/grassland/range, Fair, HSG D
3.367	54	1/2 acre lots, 25% imp, HSG A
1.378	85	1/2 acre lots, 25% imp, HSG D
20.876	86	1/3 acre lots, 30% imp, HSG D
7.254	57	1/3 acre lots, 30% imp, HSG A
5.237	72	1/3 acre lots, 30% imp, HSG B
2.800	98	Water Surface, HSG A
77.543	77	Weighted Average
63.547	73	81.95% Pervious Area
13.996	98	18.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	48	0.0140	0.09		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.21"
0.5	68	0.2180	2.33		**Shallow Concentrated Flow, Shallow Conc-woods** Woodland Kv= 5.0 fps
1.2	404	0.0720	5.45		**Shallow Concentrated Flow, Shallow Conc-gutter line** Paved Kv= 20.3 fps
5.0					**Direct Entry, Conveyance through pipe network**
15.9	520	Total			

Subcatchment DA1: DEVELOPMENT NORTH OF FRANKLIN ST.



ummary for Subcatchment DA2: COMMERCIAL DEVEL/ELDERLY HOUSING NORTH SIDE OF FRANKLIN

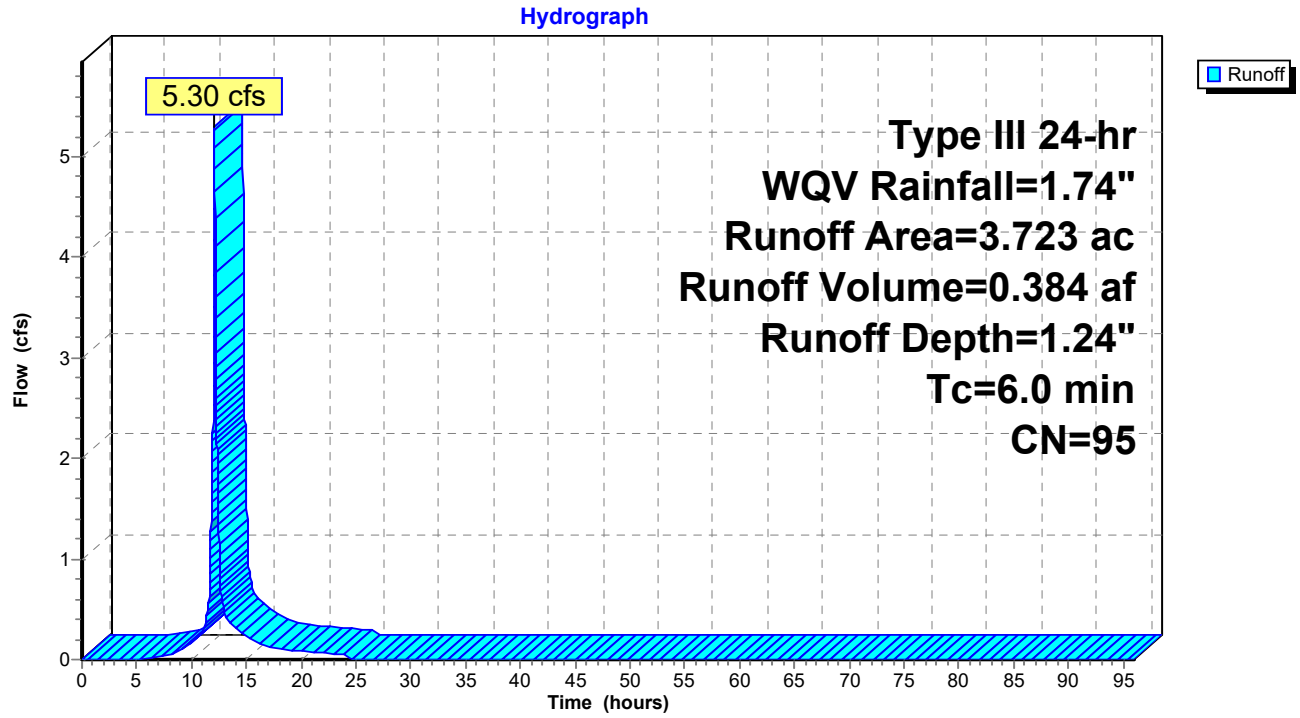
Runoff = 5.30 cfs @ 12.09 hrs, Volume= 0.384 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.74"

Area (ac)	CN	Description
3.597	95	Urban commercial, 85% imp, HSG D
0.126	89	Urban commercial, 85% imp, HSG A
3.723	95	Weighted Average
0.558	77	15.00% Pervious Area
3.165	98	85.00% Impervious Area

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

Subcatchment DA2: COMMERCIAL DEVEL/ELDERLY HOUSING NORTH SIDE OF FRANKLIN ST.



Summary for Subcatchment DA3: COMMERCIAL DEVEL/HOUSING SOUTH SIDE OF FRANKLIN ST.

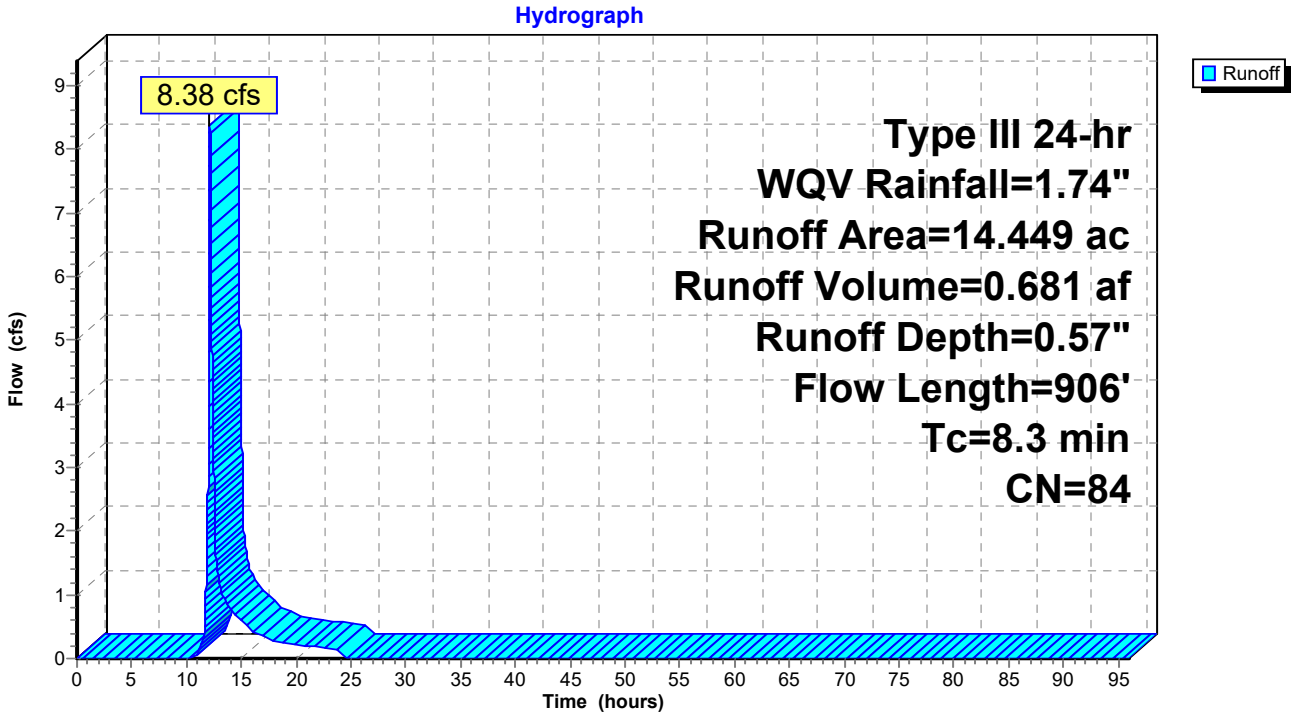
Runoff = 8.38 cfs @ 12.13 hrs, Volume= 0.681 af, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.74"

Area (ac)	CN	Description
2.578	95	Urban commercial, 85% imp, HSG D
0.158	89	Urban commercial, 85% imp, HSG A
1.787	92	1/8 acre lots, 65% imp, HSG D
0.299	77	1/8 acre lots, 65% imp, HSG A
4.832	86	1/3 acre lots, 30% imp, HSG D
1.691	57	1/3 acre lots, 30% imp, HSG A
2.217	79	Woods, Fair, HSG D
0.887	84	50-75% Grass cover, Fair, HSG D
14.449	84	Weighted Average
8.811	74	60.98% Pervious Area
5.638	98	39.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	16	0.0200	0.05		**Sheet Flow, Sheet flow through woods** Woods: Light underbrush n= 0.400 P2= 3.21"
0.6	81	0.2200	2.35		**Shallow Concentrated Flow, Shallow Conc through woods / law** Woodland Kv= 5.0 fps
1.7	557	0.0700	5.37		**Shallow Concentrated Flow, Shallow Conc on PVMNT** Paved Kv= 20.3 fps
1.0	252	0.0100	4.18	83.56	**Channel Flow, Open Channel Flow** Area= 20.0 sf Perim= 12.0' r= 1.67' n= 0.050 Earth, long dense weeds
8.3	906	Total			

Subcatchment DA3: COMMERCIAL DEVEL/HOUSING SOUTH SIDE OF FRANKLIN ST.



Summary for Subcatchment DA4: ATHLETIC FIELDS

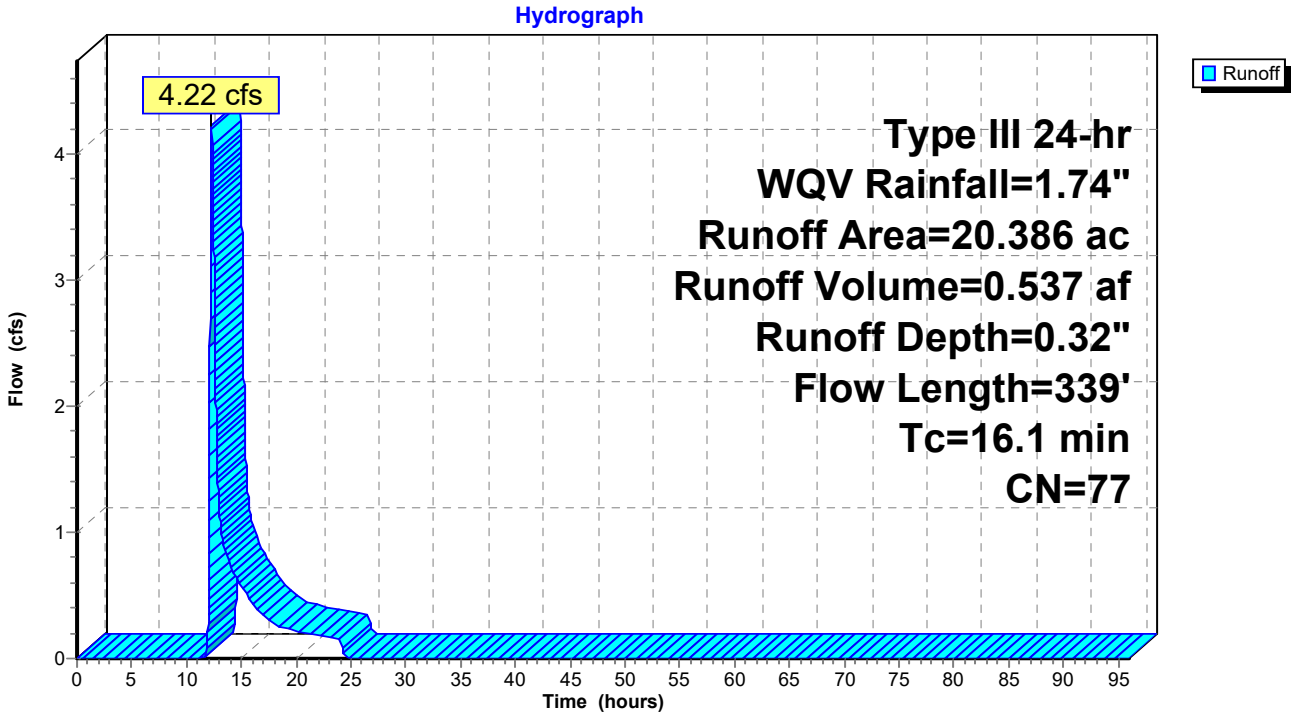
Runoff = 4.22 cfs @ 12.28 hrs, Volume= 0.537 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.74"

Area (ac)	CN	Description
0.944	98	Unconnected pavement, HSG C
2.179	86	1/3 acre lots, 30% imp, HSG D
13.800	74	>75% Grass cover, Good, HSG C
3.463	79	Woods, Fair, HSG D
20.386	77	Weighted Average
18.788	75	92.16% Pervious Area
1.598	98	7.84% Impervious Area
0.944		59.08% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	25	0.0050	0.03		**Sheet Flow, Sheet flow through woods** Woods: Light underbrush n= 0.400 P2= 3.21"
2.2	246	0.1400	1.87		**Shallow Concentrated Flow, Shallow Conc through woods** Woodland Kv= 5.0 fps
0.5	68	0.0880	2.08		**Shallow Concentrated Flow, Shallow Conc through grass** Short Grass Pasture Kv= 7.0 fps
1.0					**Direct Entry, Flow through closeed pipes**
16.1	339	Total			

Subcatchment DA4: ATHLETIC FIELDS



or Subcatchment DA5a: RESIDENTIAL & COMMERCIAL DEVELOPMENT , NORTH OF HS, SOUTH SIDE

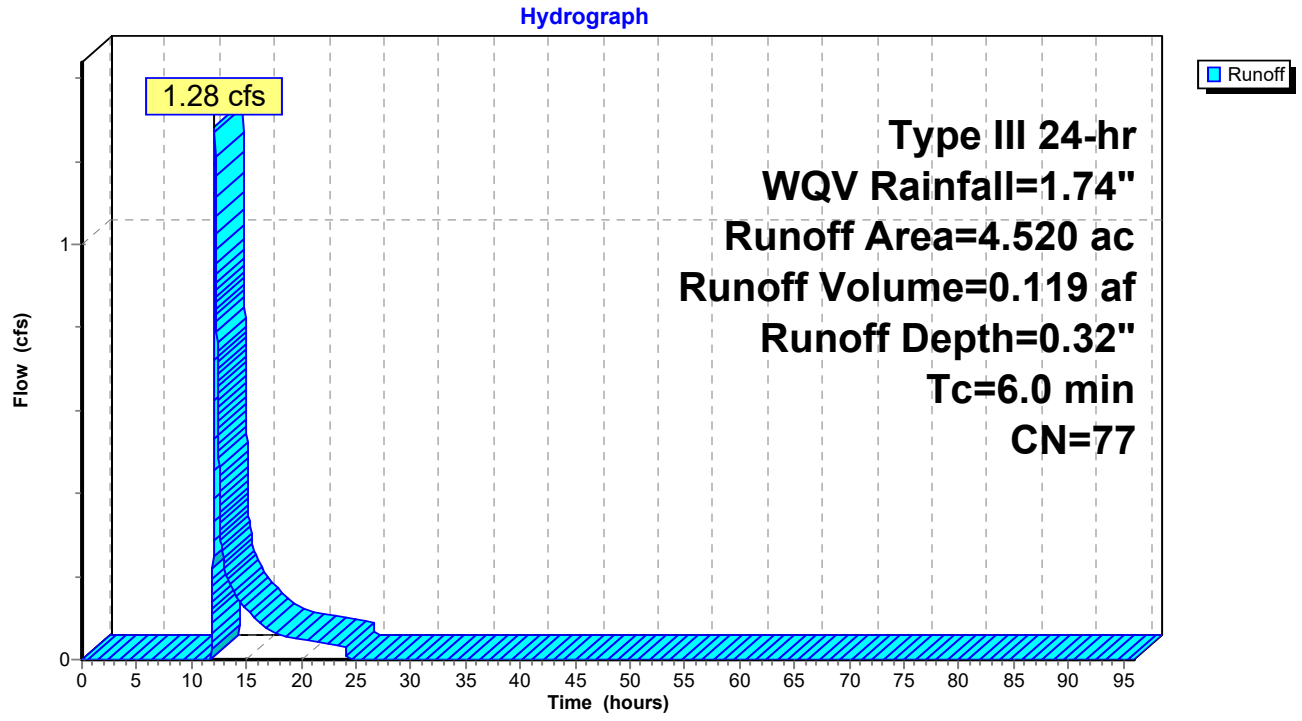
Runoff = 1.28 cfs @ 12.11 hrs, Volume= 0.119 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.74"

Area (ac)	CN	Description
3.036	89	Urban commercial, 85% imp, HSG A
0.069	86	1/3 acre lots, 30% imp, HSG D
1.103	57	1/3 acre lots, 30% imp, HSG A
0.312	36	Woods, Fair, HSG A
4.520	77	Weighted Average
1.588	40	35.13% Pervious Area
2.932	98	64.87% Impervious Area

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

catchment DA5a: RESIDENTIAL & COMMERCIAL DEVELOPMENT , NORTH OF HS, SOUTH SIDE FRANK



Summary for Subcatchment DA5b: HIGH SCHOOL, PARKING, AND TENNIS COURTS

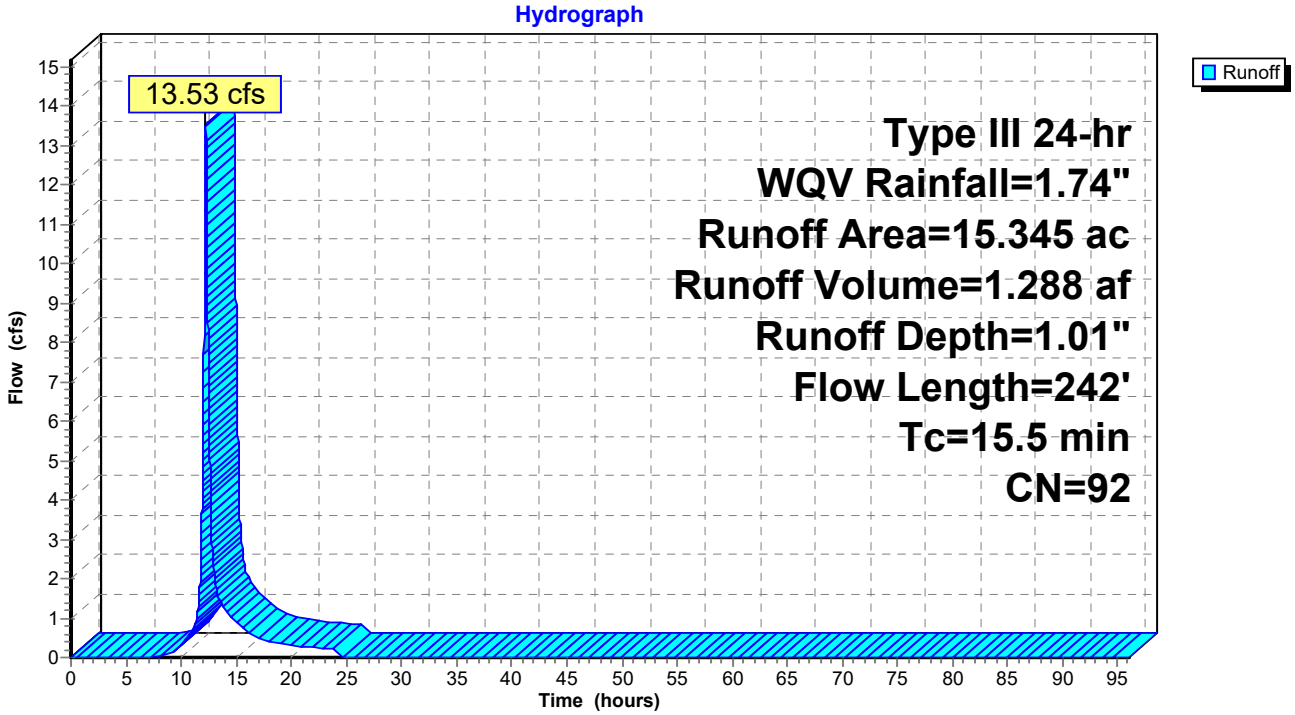
Runoff = 13.53 cfs @ 12.21 hrs, Volume= 1.288 af, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.74"

Area (ac)	CN	Description
12.099	95	Urban commercial, 85% imp, HSG D
1.536	89	Urban commercial, 85% imp, HSG A
0.459	57	1/3 acre lots, 30% imp, HSG A
1.251	79	50-75% Grass cover, Fair, HSG C
15.345	92	Weighted Average
3.618	72	23.57% Pervious Area
11.727	98	76.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	40	0.0090	0.07		**Sheet Flow, Sheet flow through grass** Grass: Dense n= 0.240 P2= 3.21"
4.1	202	0.0140	0.83		**Shallow Concentrated Flow, Shallow Conc through grass** Short Grass Pasture Kv= 7.0 fps
2.0					**Direct Entry, Flow through closed pipes**
15.5	242	Total			

Subcatchment DA5b: HIGH SCHOOL, PARKING, AND TENNIS COURTS



Summary for Subcatchment DA6: DA6

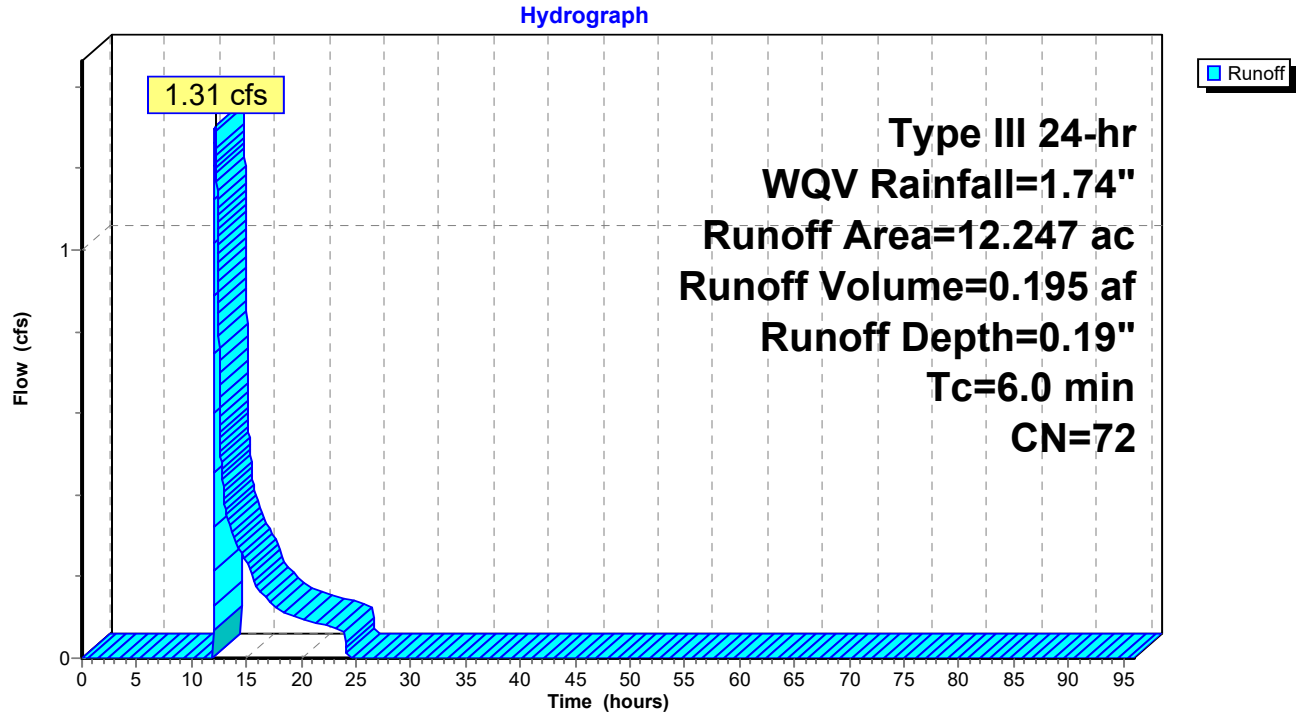
Runoff = 1.31 cfs @ 12.14 hrs, Volume= 0.195 af, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.74"

Area (ac)	CN	Description
1.766	60	Woods, Fair, HSG B
4.843	79	Woods, Fair, HSG D
0.033	36	Woods, Fair, HSG A
1.692	86	1/3 acre lots, 30% imp, HSG D
2.974	57	1/3 acre lots, 30% imp, HSG A
0.392	72	1/3 acre lots, 30% imp, HSG B
0.184	98	Paved parking, HSG D
0.070	49	50-75% Grass cover, Fair, HSG A
0.293	84	50-75% Grass cover, Fair, HSG D
12.247	72	Weighted Average
10.546	68	86.11% Pervious Area
1.701	98	13.89% Impervious Area

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

Subcatchment DA6: DA6



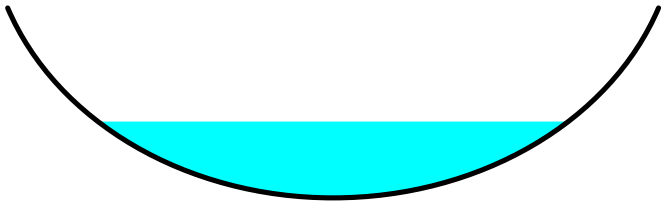
Summary for Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.

Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth = 0.06" for WQV event
Inflow = 5.30 cfs @ 12.09 hrs, Volume= 0.384 af
Outflow = 3.94 cfs @ 12.16 hrs, Volume= 0.384 af, Atten= 26%, Lag= 4.3 min

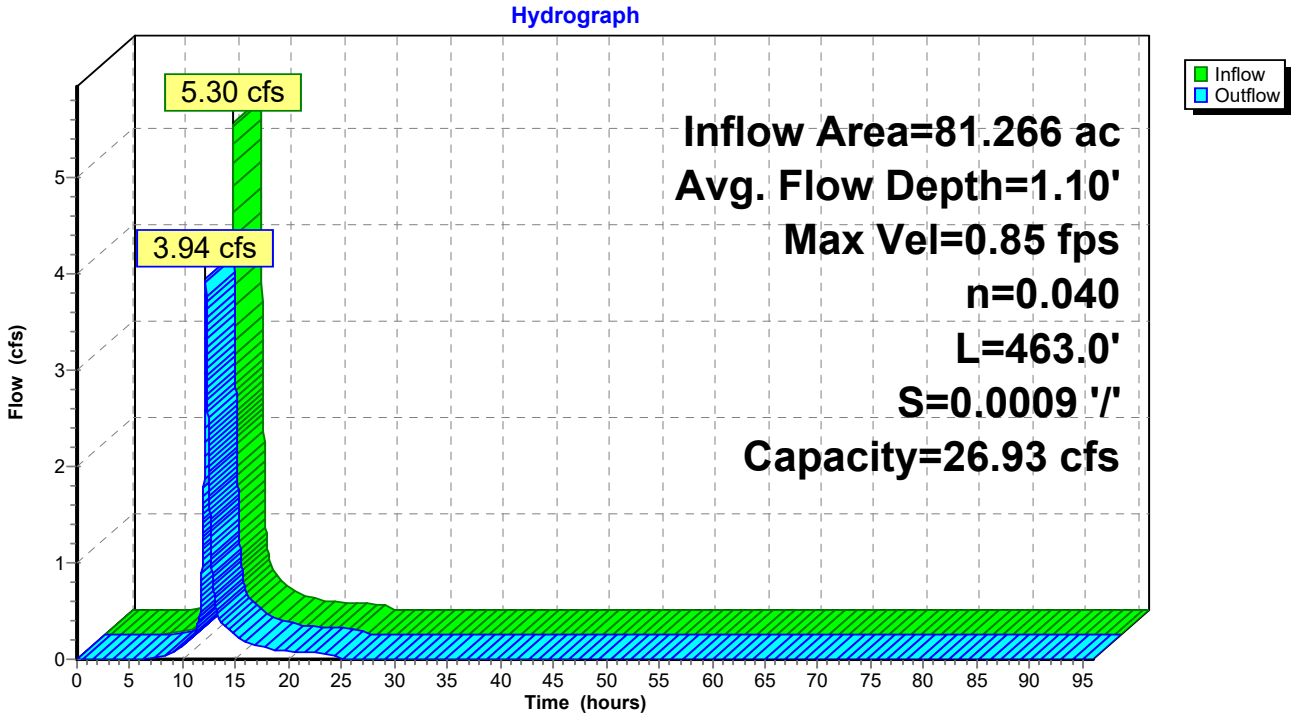
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 0.85 fps, Min. Travel Time= 9.1 min
Avg. Velocity = 0.22 fps, Avg. Travel Time= 34.7 min

Peak Storage= 2,154 cf @ 12.16 hrs
Average Depth at Peak Storage= 1.10' , Surface Width= 6.33'
Bank-Full Depth= 2.75' Flow Area= 18.3 sf, Capacity= 26.93 cfs

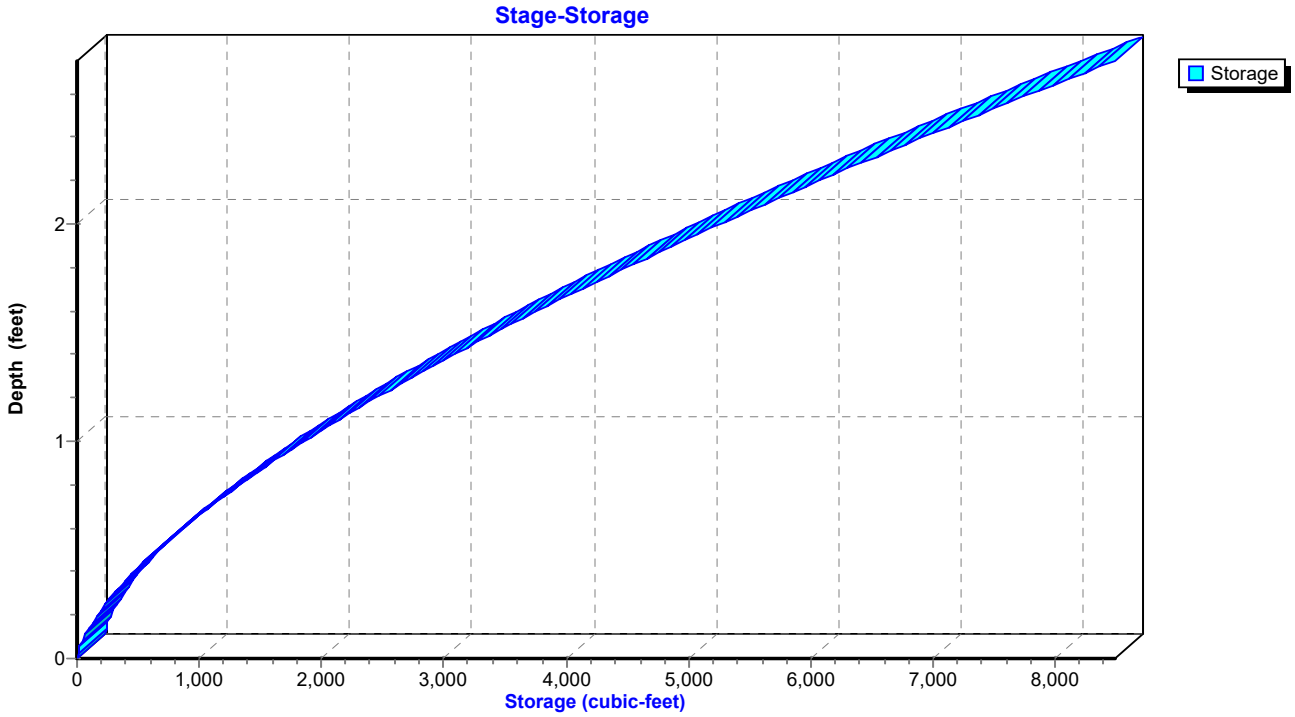
10.00' x 2.75' deep Parabolic Channel, n= 0.040 Earth, dense weeds
Length= 463.0' Slope= 0.0009 '/'
Inlet Invert= 162.00', Outlet Invert= 161.60'



Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.



Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.



Summary for Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.

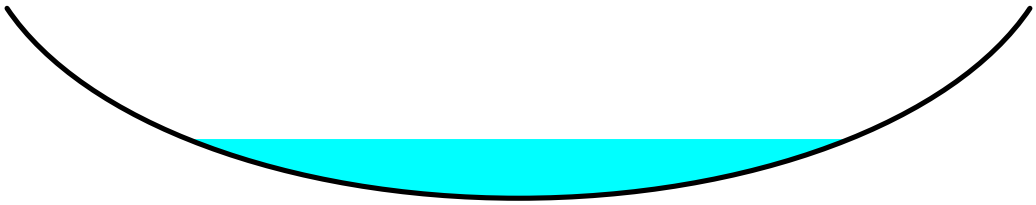
[80] Warning: Exceeded Pond C-1 by 0.45' @ 25.70 hrs (0.93 cfs 1.982 af)

Inflow Area = 95.715 ac, 23.82% Impervious, Inflow Depth = 0.13" for WQV event
Inflow = 12.22 cfs @ 12.13 hrs, Volume= 1.065 af
Outflow = 9.81 cfs @ 12.22 hrs, Volume= 1.065 af, Atten= 20%, Lag= 5.4 min

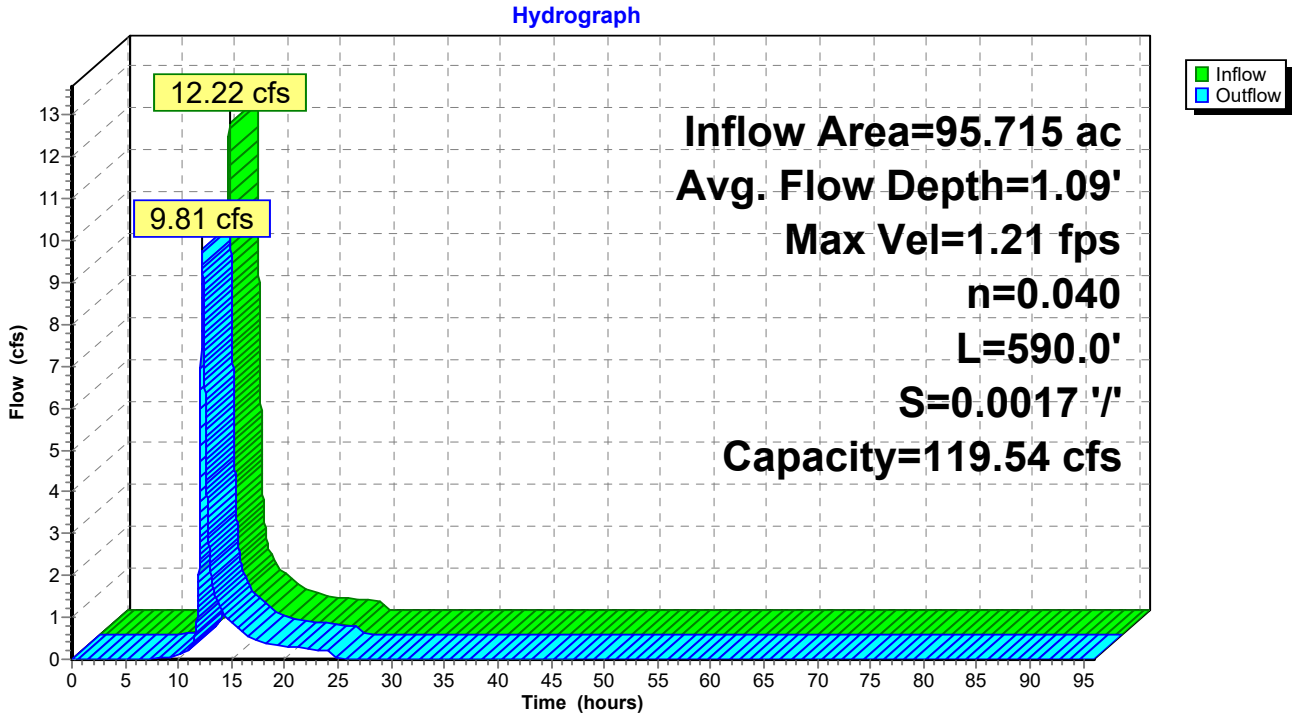
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 1.21 fps, Min. Travel Time= 8.1 min
Avg. Velocity = 0.31 fps, Avg. Travel Time= 31.3 min

Peak Storage= 4,768 cf @ 12.22 hrs
Average Depth at Peak Storage= 1.09' , Surface Width= 11.15'
Bank-Full Depth= 3.50' Flow Area= 46.7 sf, Capacity= 119.54 cfs

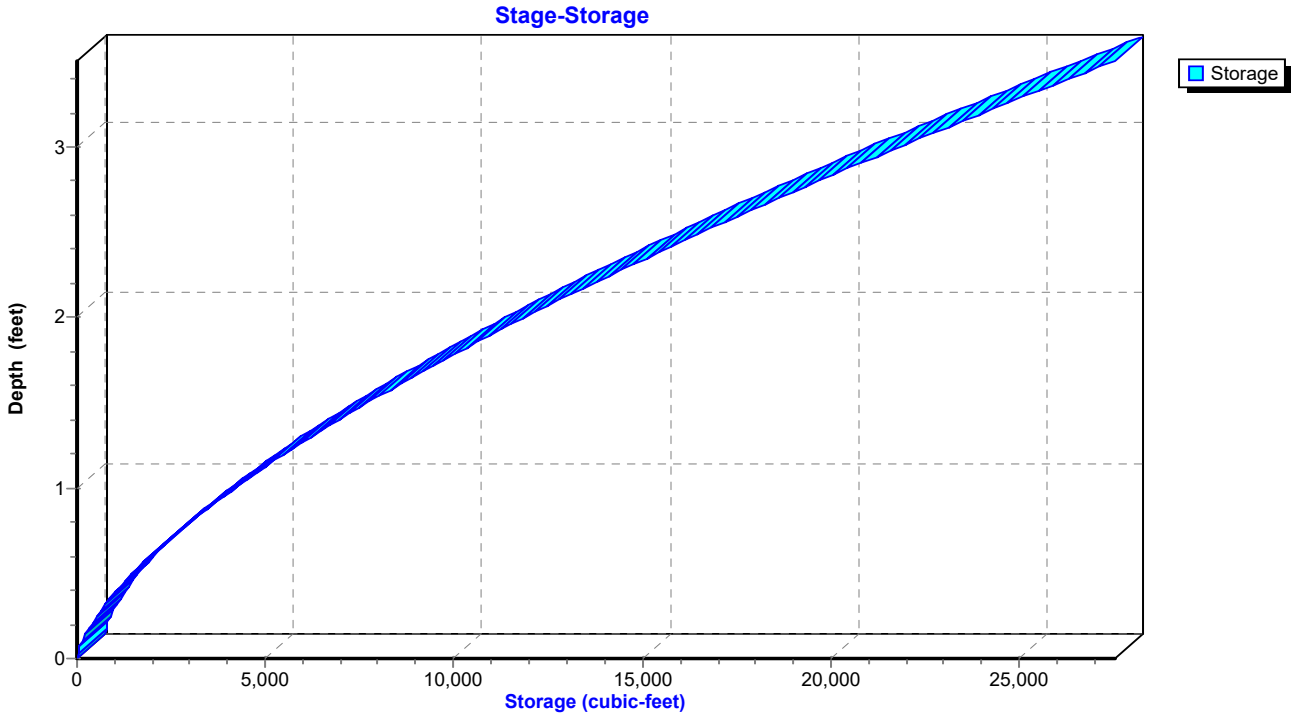
20.00' x 3.50' deep Parabolic Channel, n= 0.040
Length= 590.0' Slope= 0.0017 '/'
Inlet Invert= 162.00', Outlet Invert= 161.00'



Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.



Reach 2R: OPEN CHANNEL-SOUTH OF FRANKLINE ST.



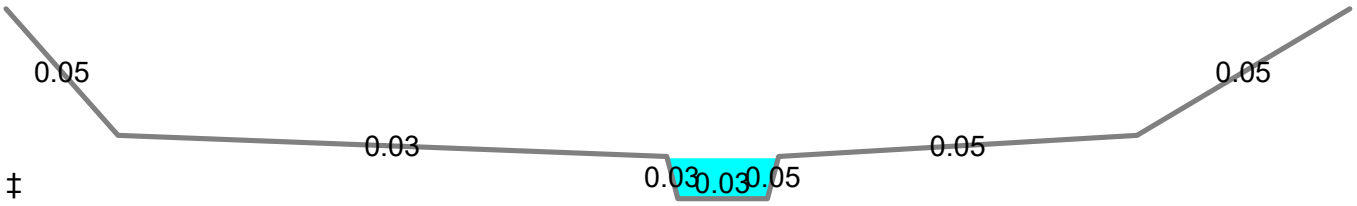
Summary for Reach 3R: OPEN CHANNEL-SOUTH OF TRACK

Inflow Area = 148.213 ac, 27.50% Impervious, Inflow Depth = 0.26" for WQV event
Inflow = 29.45 cfs @ 12.22 hrs, Volume= 3.204 af
Outflow = 29.17 cfs @ 12.25 hrs, Volume= 3.204 af, Atten= 1%, Lag= 1.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.39 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 0.91 fps, Avg. Travel Time= 7.1 min

Peak Storage= 3,355 cf @ 12.25 hrs
Average Depth at Peak Storage= 0.96' , Surface Width= 9.92'
Bank-Full Depth= 4.50' Flow Area= 350.8 sf, Capacity= 2,227.64 cfs

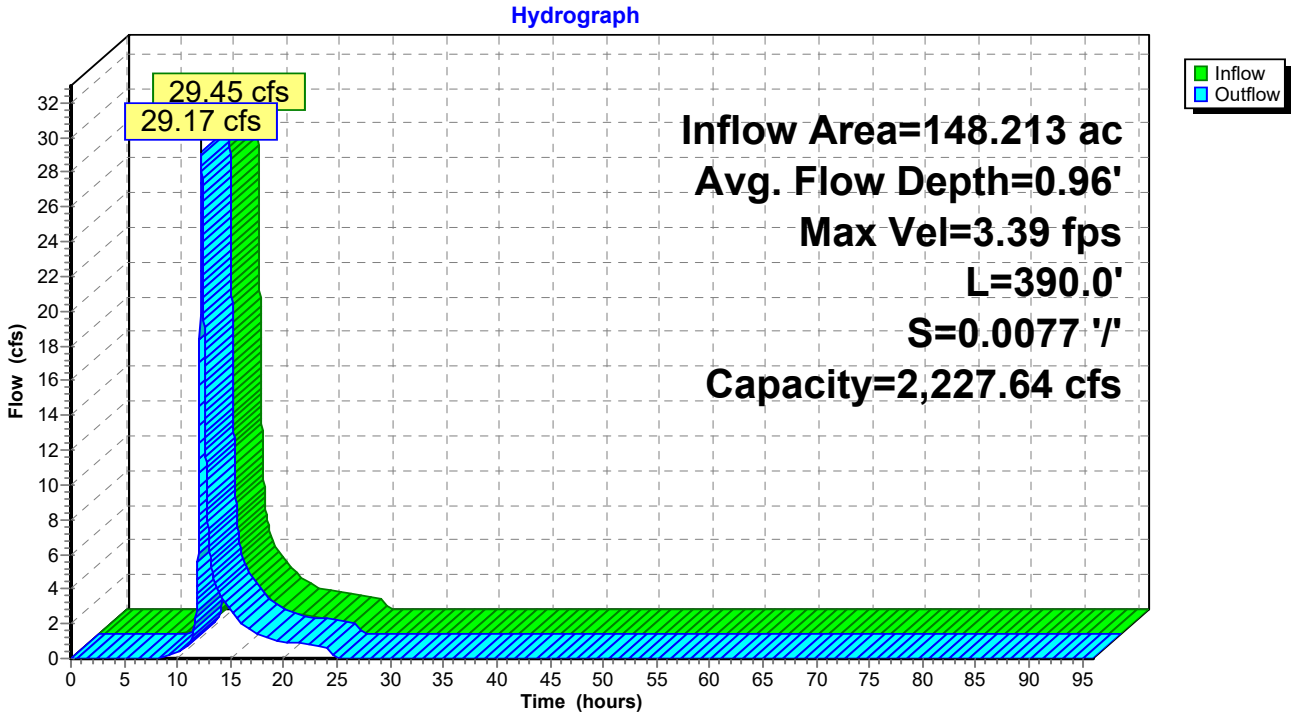
Custom cross-section, Length= 390.0' Slope= 0.0077 '/' (102 Elevation Intervals)
Composite Manning's value by Pavlovskii (shallow flow) method
Composite Manning's value at bank full= 0.042
Inlet Invert= 158.00', Outlet Invert= 155.00'



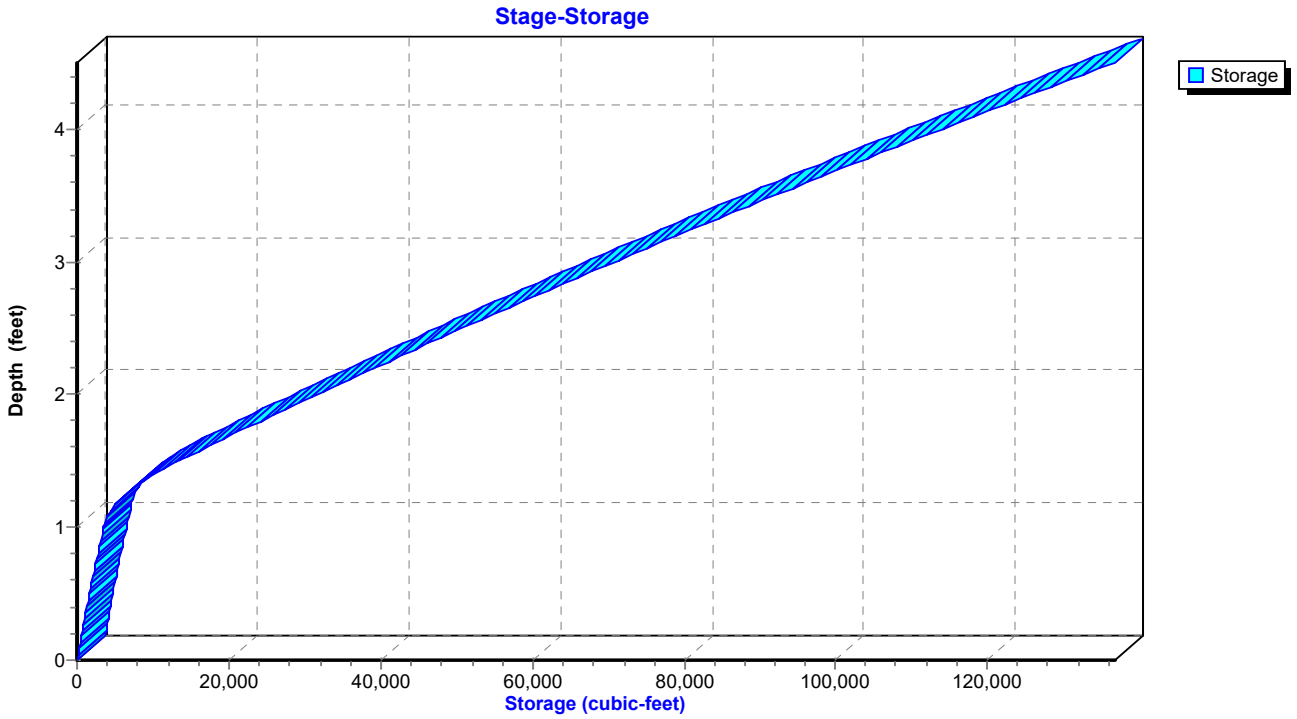
Offset (feet)	Elevation (feet)	Chan.Depth (feet)	n	Description
-60.00	158.00	0.00		
-50.00	155.00	3.00	0.050	Scattered brush, heavy weeds
-1.00	154.50	3.50	0.030	Earth, grassed & winding
0.00	153.50	4.50	0.030	Earth, grassed & winding
8.00	153.50	4.50	0.030	Earth, grassed & winding
9.00	154.50	3.50	0.050	Scattered brush, heavy weeds
41.00	155.00	3.00	0.050	Scattered brush, heavy weeds
60.00	158.00	0.00	0.050	Scattered brush, heavy weeds

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	8.0	0.0	0	0.00
1.00	9.0	10.8	10.0	3,510	31.14
1.50	34.3	91.8	91.0	13,358	60.07
4.50	350.8	121.5	120.0	136,793	2,227.64

Reach 3R: OPEN CHANNEL-SOUTH OF TRACK



Reach 3R: OPEN CHANNEL-SOUTH OF TRACK



Summary for Pond C-1: FRANKLIN ST CULVERT

[57] Hint: Peaked at 163.20' (Flood elevation advised)

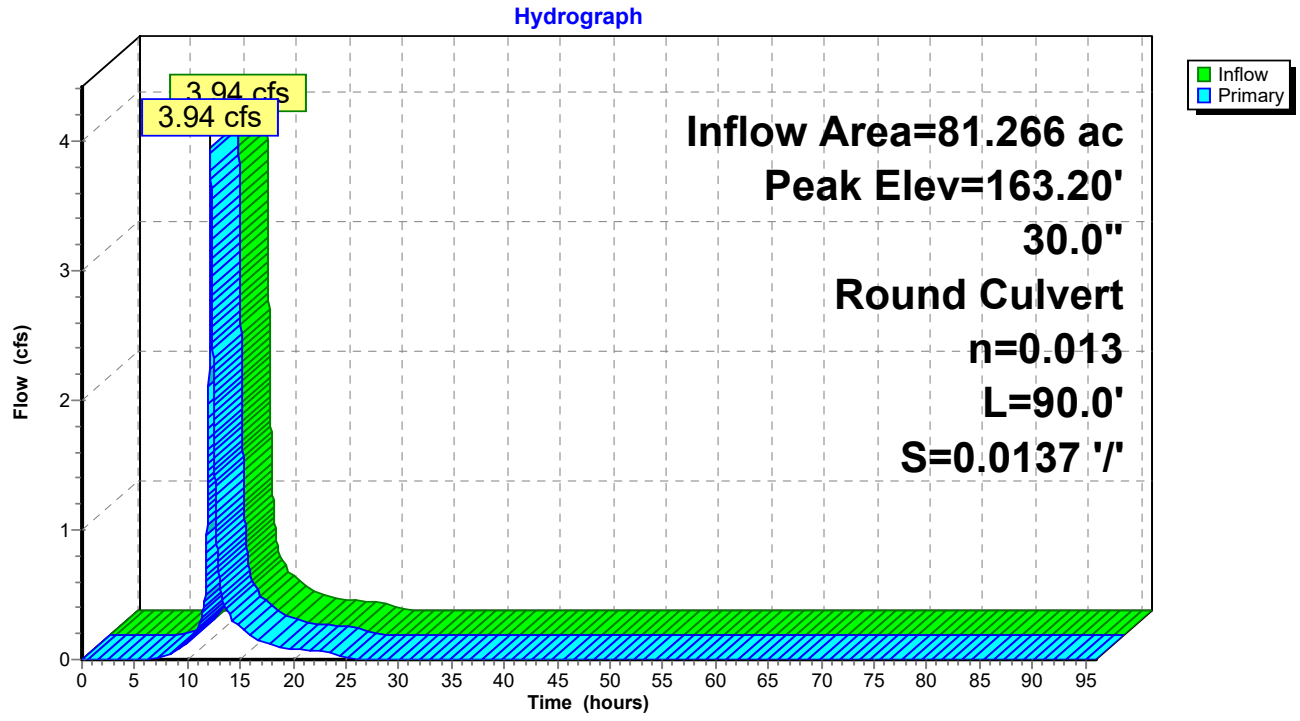
Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth = 0.06" for WQV event
Inflow = 3.94 cfs @ 12.16 hrs, Volume= 0.384 af
Outflow = 3.94 cfs @ 12.16 hrs, Volume= 0.384 af, Atten= 0%, Lag= 0.0 min
Primary = 3.94 cfs @ 12.16 hrs, Volume= 0.384 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 163.20' @ 12.20 hrs

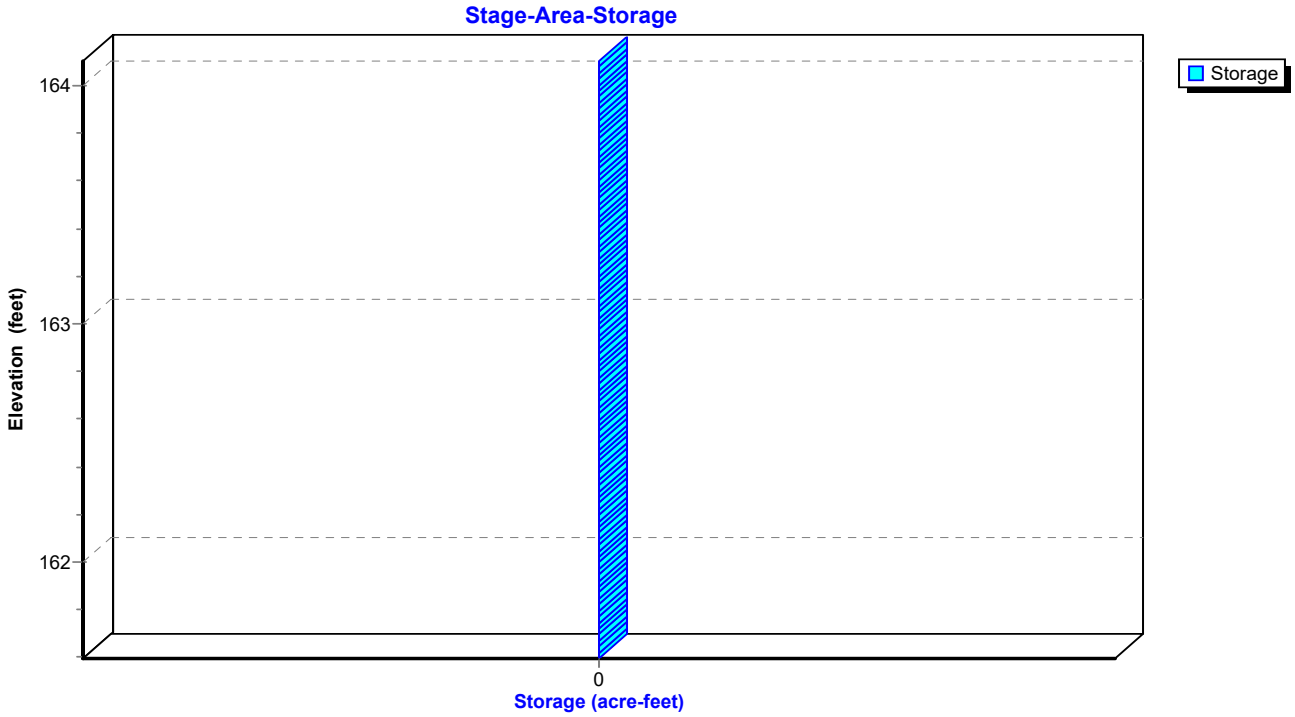
Device	Routing	Invert	Outlet Devices
#1	Primary	161.60'	**30.0" Round Culvert** L= 90.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 161.60' / 160.37' S= 0.0137 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 4.91 sf

Primary OutFlow Max=3.94 cfs @ 12.16 hrs HW=163.17' TW=163.04' (Dynamic Tailwater)
1=Culvert (Outlet Controls 3.94 cfs @ 1.74 fps)

Pond C-1: FRANKLIN ST CULVERT



Pond C-1: FRANKLIN ST CULVERT



Summary for Pond C-2: CULVERT #2

[57] Hint: Peaked at 165.38' (Flood elevation advised)

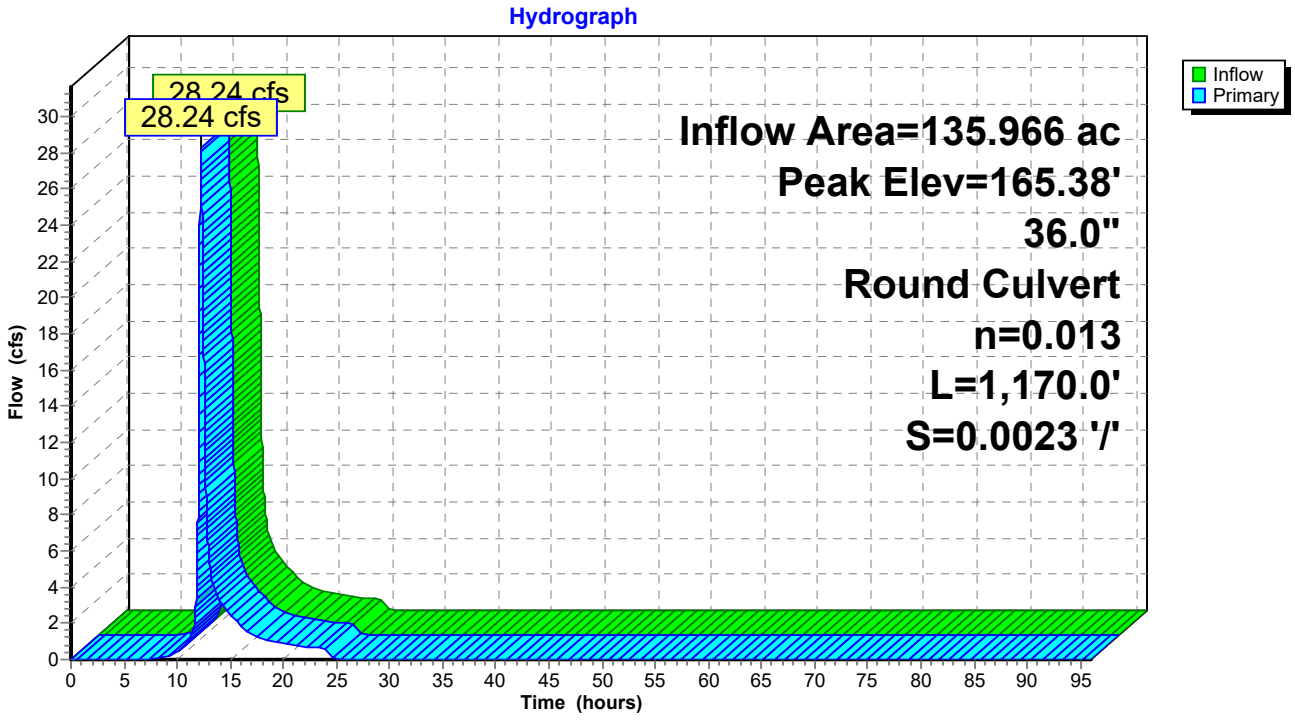
Inflow Area = 135.966 ac, 28.73% Impervious, Inflow Depth = 0.27" for WQV event
Inflow = 28.24 cfs @ 12.22 hrs, Volume= 3.009 af
Outflow = 28.24 cfs @ 12.22 hrs, Volume= 3.009 af, Atten= 0%, Lag= 0.0 min
Primary = 28.24 cfs @ 12.22 hrs, Volume= 3.009 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 165.38' @ 12.22 hrs

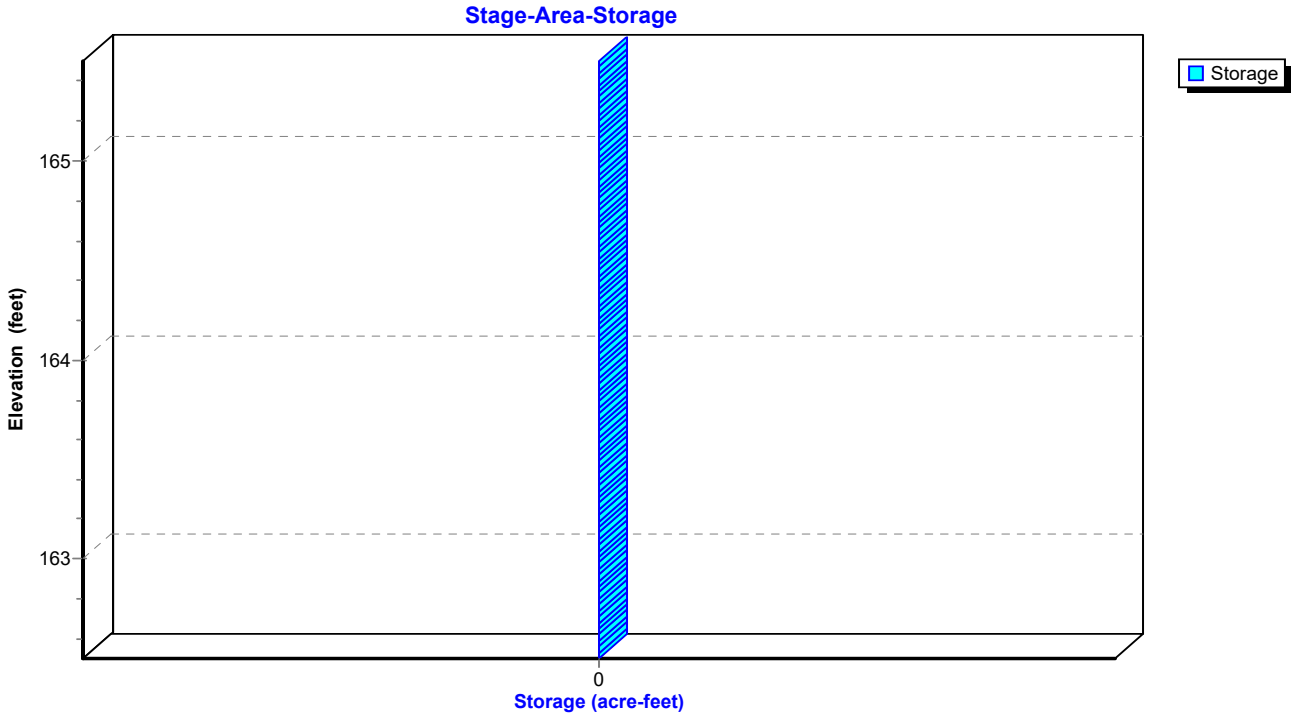
Device	Routing	Invert	Outlet Devices
#1	Primary	162.50'	**36.0" Round Culvert** L= 1,170.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 162.50' / 159.79' S= 0.0023 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=28.23 cfs @ 12.22 hrs HW=165.38' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 28.23 cfs @ 5.19 fps)

Pond C-2: CULVERT #2



Pond C-2: CULVERT #2



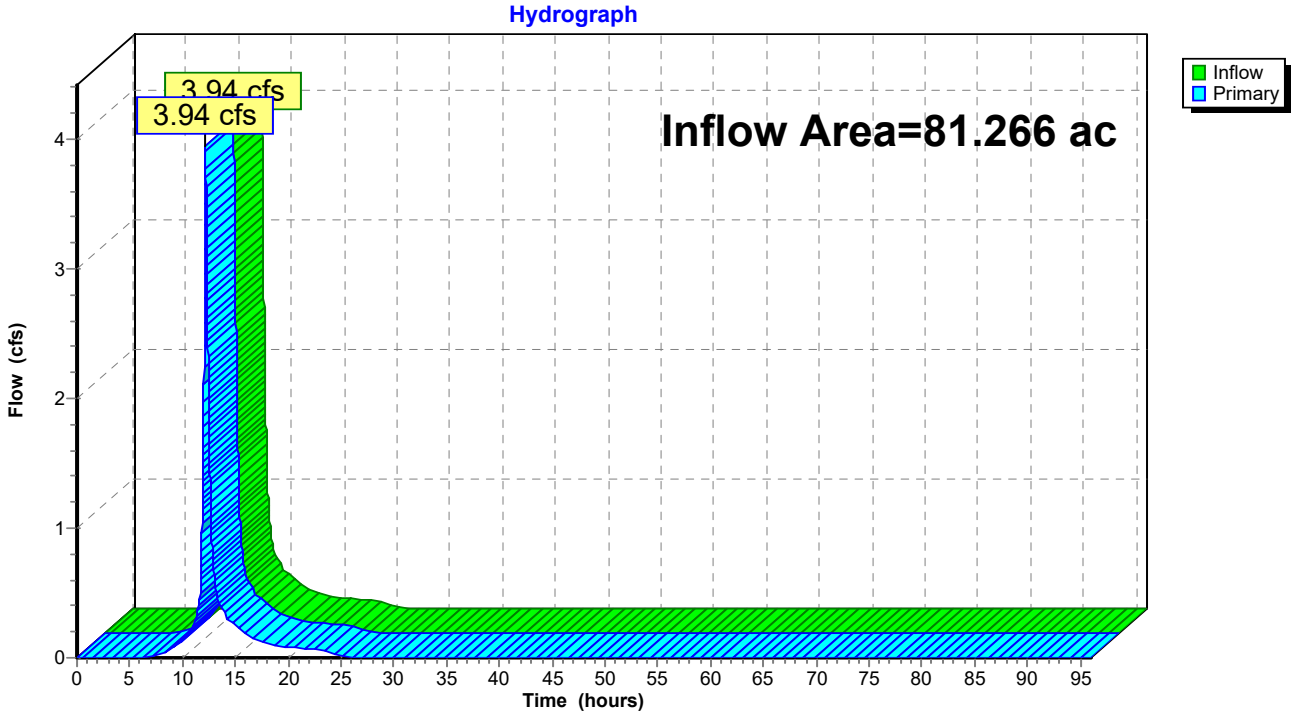
Summary for Pond SP1: FRANKLIN ST. CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 81.266 ac, 21.12% Impervious, Inflow Depth = 0.06" for WQV event
Inflow = 3.94 cfs @ 12.16 hrs, Volume= 0.384 af
Primary = 3.94 cfs @ 12.16 hrs, Volume= 0.384 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP1: FRANKLIN ST. CULVERT



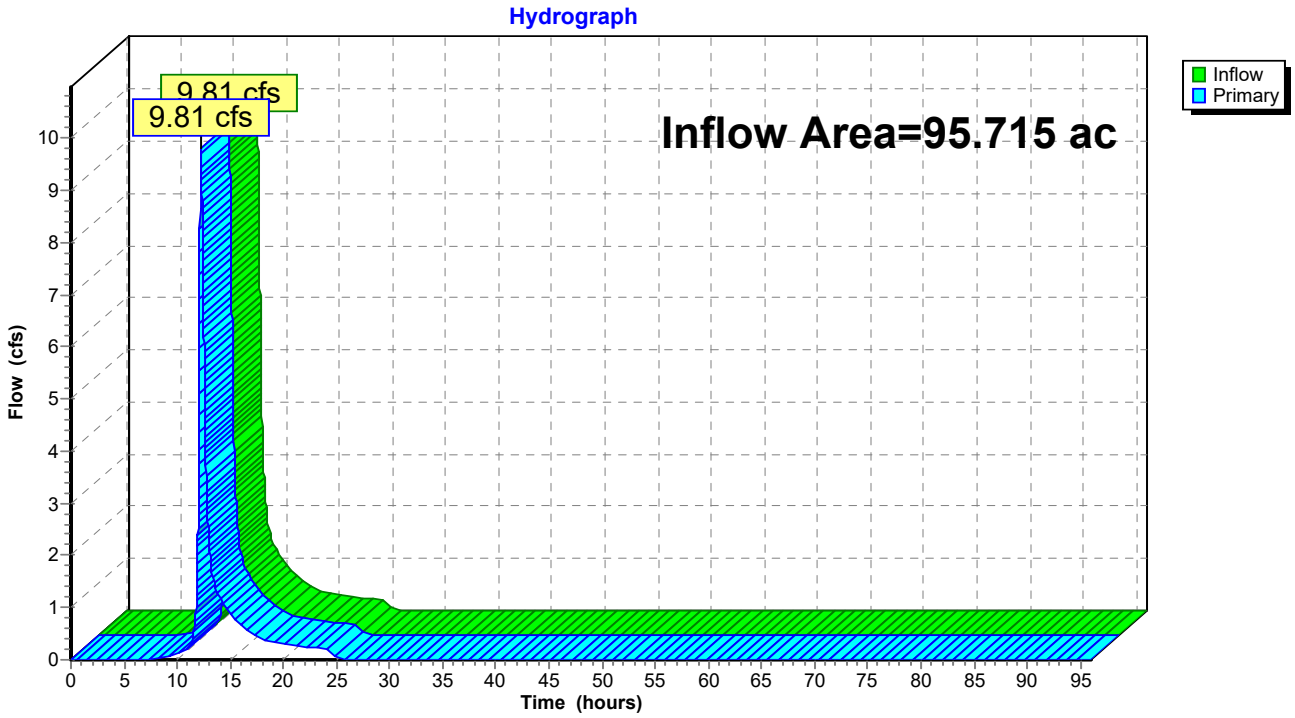
Summary for Pond SP2: HEADWALL 36-IN. CULVERT PIPE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 95.715 ac, 23.82% Impervious, Inflow Depth = 0.13" for WQV event
Inflow = 9.81 cfs @ 12.22 hrs, Volume= 1.065 af
Primary = 9.81 cfs @ 12.22 hrs, Volume= 1.065 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP2: HEADWALL 36-IN. CULVERT PIPE



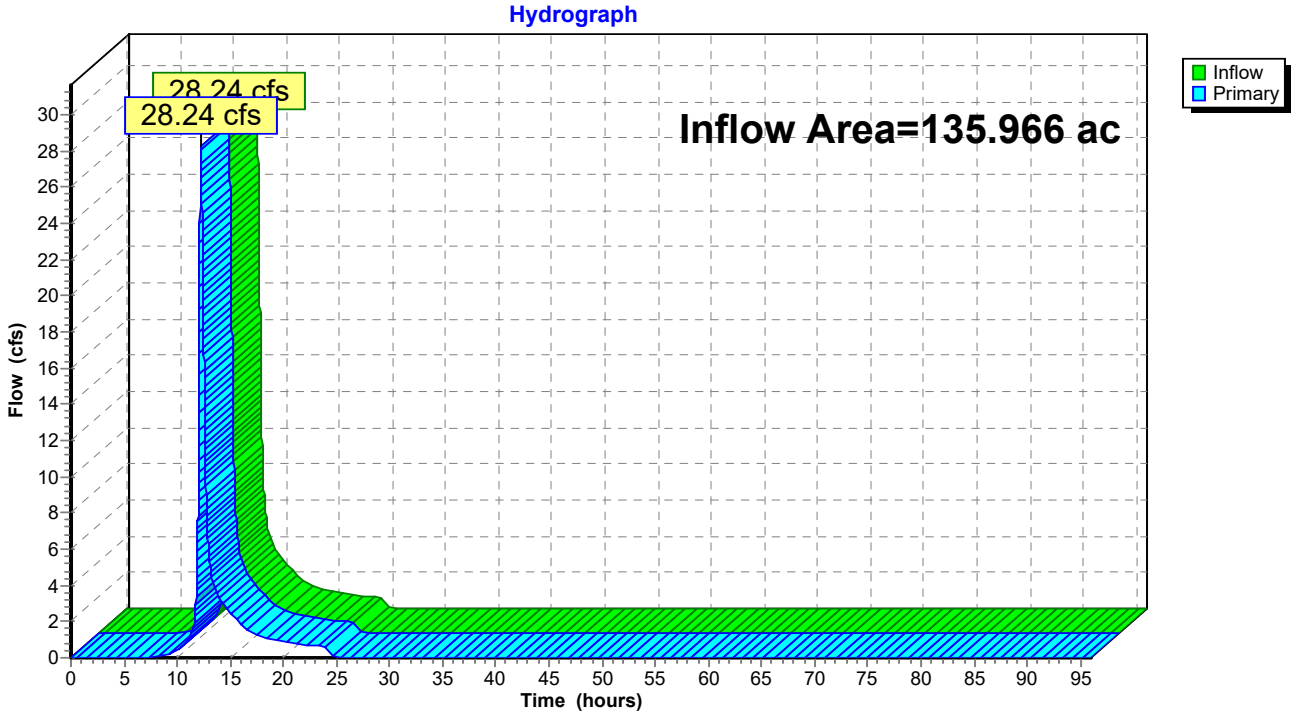
Summary for Pond SP3: OUTLET OF 36-IN. CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 135.966 ac, 28.73% Impervious, Inflow Depth = 0.27" for WQV event
Inflow = 28.24 cfs @ 12.22 hrs, Volume= 3.009 af
Primary = 28.24 cfs @ 12.22 hrs, Volume= 3.009 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP3: OUTLET OF 36-IN. CULVERT



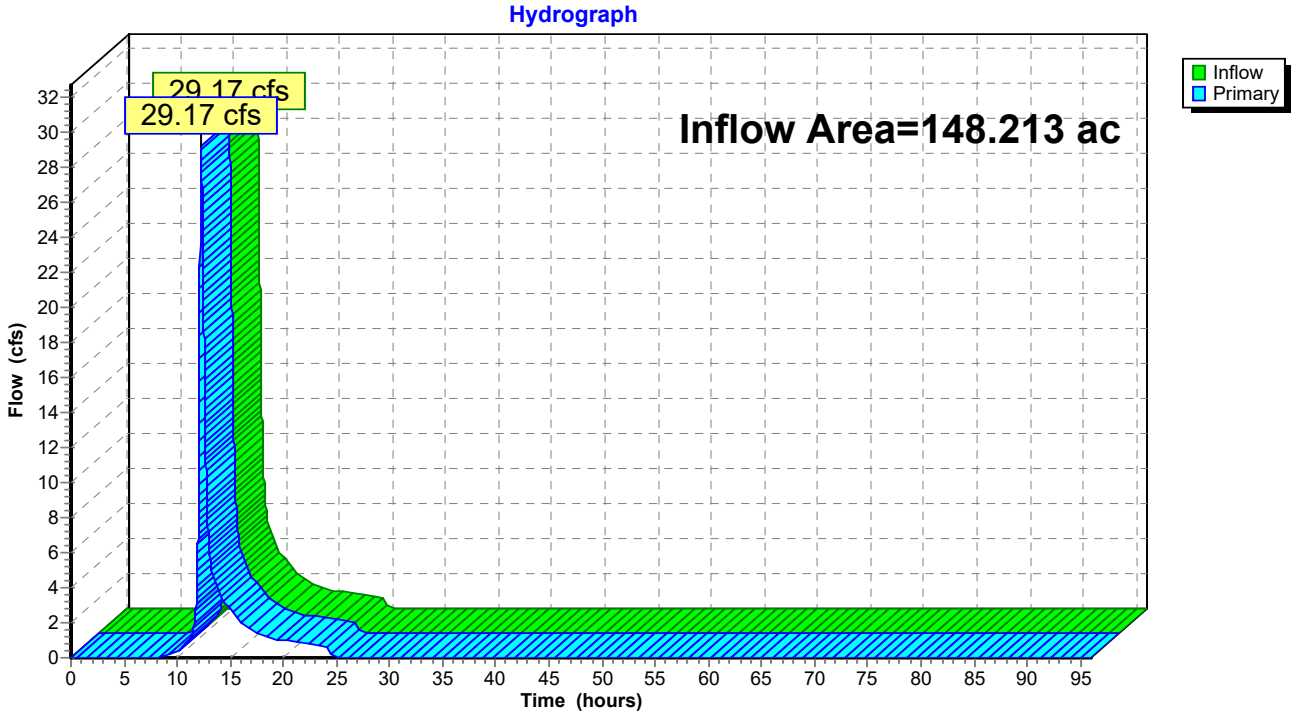
Summary for Pond SP4: WETLANDS TO THE SOUTH

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 148.213 ac, 27.50% Impervious, Inflow Depth = 0.26" for WQV event
Inflow = 29.17 cfs @ 12.25 hrs, Volume= 3.204 af
Primary = 29.17 cfs @ 12.25 hrs, Volume= 3.204 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3

Pond SP4: WETLANDS TO THE SOUTH



Summary for Pond W: BORDERING VEGETATED WETLAND

Inflow Area = 77.543 ac, 18.05% Impervious, Inflow Depth = 0.32" for WQV event
Inflow = 16.14 cfs @ 12.28 hrs, Volume= 2.043 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 161.88' @ 24.92 hrs Surf.Area= 7.821 ac Storage= 2.043 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

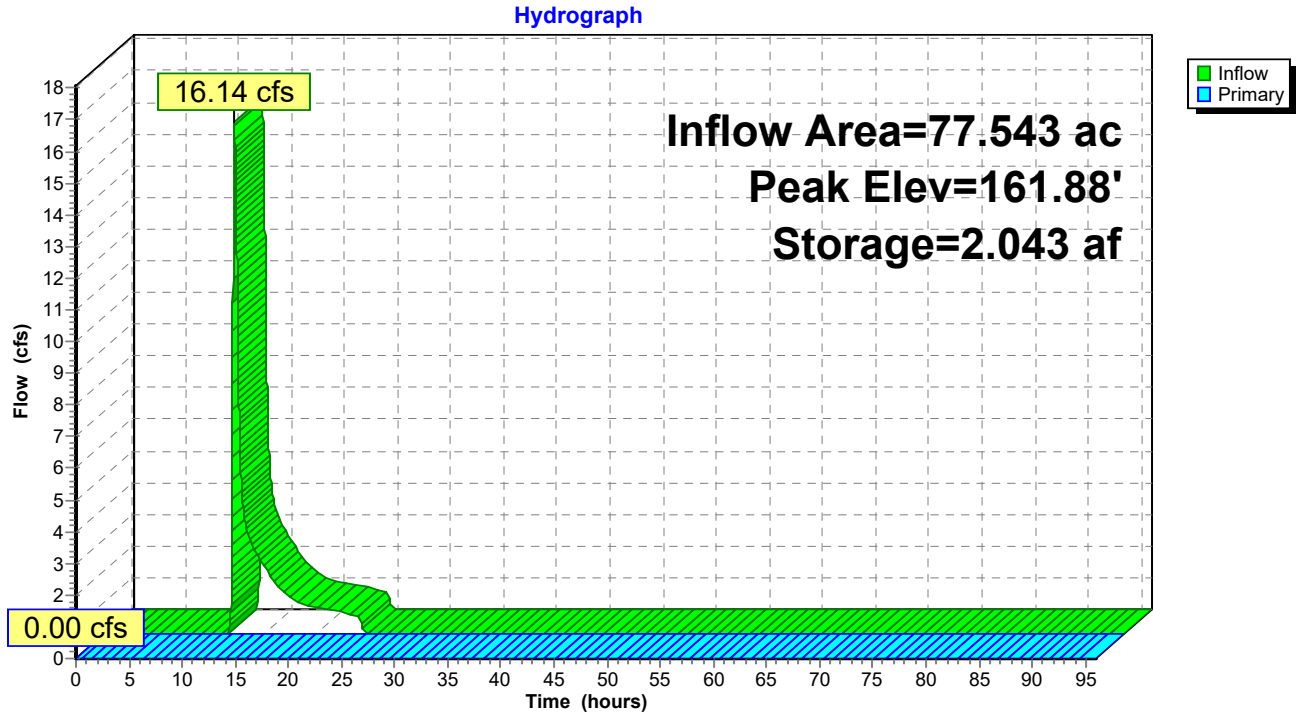
Volume	Invert	Avail.Storage	Storage Description
#1	161.50'	77.077 af	**Ponding storage in wetand (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
161.50	2.880	0.000	0.000
162.00	9.350	3.058	3.058
164.00	20.630	29.980	33.037
166.00	23.410	44.040	77.077

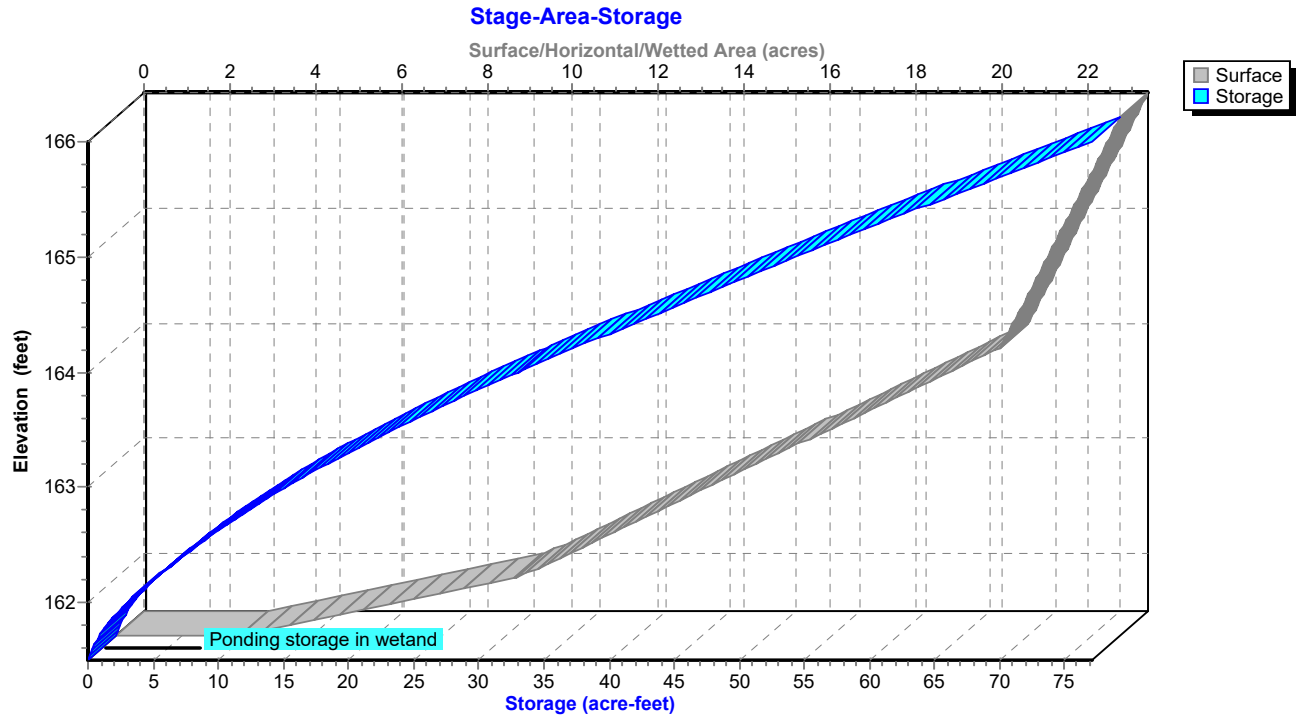
Device	Routing	Invert	Outlet Devices
#1	Primary	162.00'	**Channel/Reach** using Reach 1R: OPEN CHANNEL-NORTH OF FRANKLIN ST.

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=161.50' TW=162.00' (Dynamic Tailwater)
↑—**1=Channel/Reach** (Controls 0.00 cfs)

Pond W: BORDERING VEGETATED WETLAND



Pond W: BORDERING VEGETATED WETLAND



Attachment F – Post Construction Operation and Maintenance Plan

Post Construction Operation and Maintenance Plan

Stoneham High School Wetlands
149 Franklin Street, Stoneham, Massachusetts

In conformance with Standard 9 of the Stormwater Standards we offer the following information for Post Construction Operation and Maintenance of the stormwater system associated with the proposed improvements.

Responsible Parties

Owner and Responsible Party:

Town of Stoneham
25 Central Street
781-279-2696

Stormwater Related Maintenance Tasks

The stormwater management for the Site uses a "country drainage" approach and relies on sheet flow, small swales and the current infiltration/filtration properties of soil and plants to remove pollutants from stormwater runoff and provide recharge, prior to reaching the Neponset River. It is based on the following four basic stormwater design elements, or steps:

1. **Collect** stormwater and maintain sheet flow.
2. **Reduce** mobilization of materials (erosion and sedimentation) from existing slopes and proposed paths.
3. **Move** the water through the landscape with sheet flow.
4. **Filter and Infiltrate** the water as it moves through the landscape and infiltrates through the porous surfaces.

What is required for Maintenance?

This stormwater management approach relies on vegetation management and general maintenance which typically falls under landscape and/or park maintenance services. The regularly scheduled maintenance is critical to ensure proper function, maintain sheet flow and preserve the pollutant removal and infiltration capabilities of the design. Regularly scheduled maintenance can prevent deficiencies in the effectiveness of the systems, due to sediment build-up, plant damage, erosion or deterioration.

General maintenance includes the following:

1. Regularly inspecting paths to ensure stabilization of slopes and surfaces and removing sediment and debris from the paths and landscape when necessary.

2. Maintaining healthy native trees, plants, and vegetative cover as well as the removal of unwanted invasive species.
3. Adhering to the snow removal plans at entrances (Karen Drive, Dapper Darby Drive) and regular street sweeping to remove trash and debris in adjacent rights-of-way.

The stormwater management will be maintained in good working order; if a repair is necessary, it will be initiated within 48 hours of discovery. All sediment and debris materials will be disposed of properly in a pre-approved off-site location.

When to Inspect?

During inspections, the following components will be reviewed for signs of potential issues, as listed below.

- **Inlet and Outlet Structures (catch basins, culvert)**
  - Blocked flow paths
  - Inlets are functioning as expected
  - Outlet is performing as expected
  - Structural damage
  - Vegetation is well established and there are no signs of erosion
  - Evaluate level of sedimentation and trash accumulation

- **Shallow swales and depressions ('country drainage')**
  - Flow is dispersed evenly throughout
  - Erosion and rutting on the side slopes
  - Vegetation is well established, and invasive species are not present
  - Review to evaluate whether standing water exists 72 hours after a rain event

- **Reinforced granite swale**
  - Leaf litter and debris
  - Erosion and rutting on the side of the footpaths
  - Evidence of stormwater from the surrounding landscape draining onto the footpaths.
  - Ponding water

During inspection, areas where follow-up maintenance is warranted will be indicated within inspection checklists and/or follow-up reports. The following maintenance activities will occur based on condition determined during annual inspections:

- Repair structural damage
- Remove excess sediment, trash, and debris
- Re-establish vegetation
- Remove invasive vegetation
- Re-grade areas, as necessary to ensure proper flow patterns

- Stabilize eroded areas via vegetation establishment, placement of stone, or other energy dissipation measures

The following table and sections describes the general maintenance schedule of the site as it relates to onsite stormwater.

Maintenance Schedule

Activity	Time of Year	Frequency
Shallow and granite swales, depressions		
Mow side slopes	Spring through Fall	Bi-annually
Remove sediment	Year round	As required, at least once every 5 years
Remove sediment, trash and debris	Spring through Fall	Bi-annually (Minimum)
Aerate existing soil and replace vegetation as needed	Late spring/early summer	As needed
Stormwater-related landscape		
Remove dead vegetation	Fall and spring	Bi-annually
Remove invasive vegetation	Spring or fall	Annually
Prune	Spring or fall	Annually
If identified during inspections as needed		
Replace dead vegetation	Spring	As Needed
Stabilize eroded areas	Spring through Fall	As Needed
Re-grade areas to ensure proper flow patterns	Spring through Fall	As Needed
Remove excess sediment, trash, and debris	Spring through Fall	As Needed
Repair structural damage	Spring through Fall	As Needed

General Maintenance Tasks

The following are general maintenance tasks that will be required onsite as part of post-construction activities.

Mowing

Herbaceous material along the shoulder and bottom of the stormwater management facilities will be mowed a minimum of two times per year or as necessary. Extent of mowing is intended to accommodate access for maintenance of the stormwater facilities.

Invasive Plant Control and Removal of Vegetation

Any invasive vegetation that is encroaching or growing over the paths and boardwalks will be eradicated through hand tool removal or selective application of herbicides. Invasive species targeted for management include Japanese knotweed, porcelain berry, Asiatic bittersweet, and multiflora rose (*Rosa multiflora*), as well as poison ivy (*Toxicodendron radicans*) and other non-native invasive species as determined necessary and approved for removal by the Town Conservation Commission and/or its agent.

Trail Surface Aggregate

Inspect and document any washouts, gullying and/or erosion. Repair surface gullying and/or ponded areas as necessary. Full replacement of material will need to be conducted every 10-15 years or as determined necessary due to field conditions.

Bituminous Asphalt

Repair surface with patching as necessary. Inspect and document heaving and any cracking. Repair concrete and seal pavement as necessary. Full pavement replacement will need to be conducted every 15-20 years or as determined necessary due to field conditions.

Stone/Rock, Walls, and Stone

Inspection will be annually. Remove and replace as necessary.

Snow Management/Removal

Plowed snow will be deposited onto available pervious locations.

Litter/Trash Collection

Litter a trash collection from the property to be conducted bi-annually or as required during other operation activity.

Soil/Surface Erosion Management

Soil erosion to be monitored and remediated as necessary. Soil washout into adjacent properties and/or resource areas to be removed and surface to be re-established.

Graffiti Control

Graffiti to be reported to the Police Department and removed by environmentally safe detergent and water or repainted as necessary.

Vandalism

Vandalism to be reported to the Police Department and repaired as necessary.

Landscape Maintenance Tasks

Plantings

By design, plants in the swales and depressions are meant to flourish throughout the growing season leaving dry standing stalks during the dormant months. Plants do not require fertilizers and/or watering. This area is designated as No Mow because frequent mowing would eliminate selected meadow species, may promote the growth of undesirable plants, and require additional maintenance and watering. It is recommended this area be cut back no more than one time per

year. Remove and replace vegetation as necessary, using the appropriate species as shown on the Planting Plan. The best time to plant is in early to mid-fall or early to mid-spring.

Seeding
Loam and reseed bare spots with the specified seed mix as shown on the Planting Plan.

Pruning
Prune trees and shrubs to remove deadwood and low hanging branches.

Watering
Water only during drought conditions or during seed or plant establishment period.

Fertilizing
No fertilizer shall be used.

Weeding
Weeding should be limited to invasive and weedy species (e.g., Weed Guide at https://web.uri.edu/riss/files/In-the-Weeds.pdf). Non-chemical methods (hand pulling and hoeing) are required; chemical herbicides should be avoided. Properly remove and dispose off site all invasive species as to prevent colonization elsewhere; this includes disposal on land beyond the project area.

Monitoring
During the establishment period, walk the area monthly without the intent to cut, but to look for invasive species, bare spots and identify potential pest or disease problems. Refer to Invasive Species Management Plan and/or

Long-term Pollution Prevention Plan

Long-term pollution prevention measures implemented throughout the Site will further reduce pollutants in stormwater discharges after construction.

Pet Waste Management
Park visitors are encouraged to pick up after their pets with signage along lawn areas. Pet waste stations should be considered.

Solid Waste Management
Proper trash receptacles should be provided on site and emptied on a regular basis.

Spill Prevention & Control Measures
To minimize the risk of spills or other accidental exposure of materials and substances to stormwater runoff, the following material management is to be used when working on site.

- Any materials stored within the contributing drainage area must be stored in a neat, orderly manner in their appropriate containers.
- Products will be kept in their original containers with the original manufacturer's label.
- Substances will not be mixed with one another unless recommended by the manufacturer.
- Manufacturers' recommendations for proper use and disposal will be followed.
- The contractor's supervisor will be issued this Guide to ensure proper use and disposal of materials.

Materials or substances listed below may be present on-site for maintenance and care should be taken to avoid spills:

- Petroleum Based Products

The following product-specific measures will be followed on-site:

- *Petroleum Products* - All on-site vehicles and equipment will be monitored for leaks and receive preventative maintenance to reduce the chance of leakage.
- *Grass Clipping, Leaf Litter and Plant Debris* – are to be removed from the property and not disposed on site.

Personnel Training

All staff and/or contractors responsible for maintaining the practices will be given a copy of this plan and will receive training in the applicable practices and implementation described herein.

Estimated Operation and Maintenance Budget

The estimated average annual operating and maintenance budget for the project is as follows:

General Maintenance (Mowing, Debris and Trash Pickup, etc.):	*$1,500*
Stormwater and Related Landscape Maintenance:	*$2,500*
Invasive Species Management:	*TBD*
Estimated Total Annual Maintenance Cost:	*$4,000*

Operation and Maintenance Log Form

Operation and maintenance log form is provided on the following page.

Operation and Maintenance Checklist

Stoneham High School Wetlands
Stoneham, Massachusetts

Date: _____
Time: _____
Inspector:

Maintenance Item	Description	Maintenance Required? (Y/N)
Shallow swales and depression areas		
Sediment Removal	Remove sediment from the bottom when sediment buildup is >1".	
Side Slopes and Surface	Repair any soil gullying and revegetate/ replenish topsoil on barren areas as necessary.	
Reinforced granite swale	Repair or replace granite as necessary. Remove sediment as needed. Remove trash and debris.	
Vegetation Replacement	Replace dead or dying vegetation as necessary.	
Pruning	Prune as necessary. Separation of herbaceous vegetation root stock is necessary when over-crowding is observed (1x/3yrs).	
Mowing	Cut grasses up to twice annually to maintain grass heights less than 12 inches.	
Path and Reinforced Granite Swale		
Debris Removal	Remove trash from paths, granite swale and perimeter areas.	
Edges	Ensure transitions at edges are at grade and no lip or edge exists at granite swale or between path and seating areas.	
Structural Repair	Repair erosion, gullying and/or other structural issues as necessary by replacing and compacting material as required.	
Routine Maintenance – Perform annually		
Trash Removal	Remove trash from paved and perimeter areas.	
Pavement	Sweep right-of-way pavement after spring thaw and remove debris at entrances if needed.	

Maintenance Item	Description	Maintenance Required? (Y/N)
Drainage Network	Ensure proper operation of existing drainage infrastructure. Make sure outlet is free of debris.	

Comments:

Actions to be taken: