IMPROVING COMMUNITIES TOGETHER

February 16, 2023

Patrick Gallagher, Chair
Franklin Conservation Commission
355 E Central Street
Franklin, MA 02038

Re: Notice of Intent
Grove Street Shared Use Path & Roadway Improvements
Franklin, MA

Dear Chairperson Gallagher and Commissioners:

On behalf of the Town of Franklin Department of Public Works (DPW), BETA Group, Inc. (BETA) is submitting a Notice of Intent (NOI) for the construction of a shared-use path and associated roadway improvements along Grove Street in the Town of Franklin, Massachusetts (the Project). This Project is the second phase of a two-phase project that aims to improve the use of Grove Street by motorists, pedestrians, and bicyclists (the Overall Project).

The DPW previously secured $2.2M in funding through a MassWorks grant to improve the Town of Franklin's public infrastructure. This grant, in addition to supplemental local funding, was used to support Phase I of the Overall Project, which received an Order of Conditions from the Franklin Conservation Commission under MassDEP File No. 159-1247 on February 22, 2022. The Overall Project consists of the construction of an approximately 6,000-linear foot shared use path along Grove Street; pavement and roadway geometry improvements; signage improvements; intersection improvements; and upgrades to the existing stormwater management infrastructure. Phase II of the Overall Project, as presented under this NOI, will consist of several activities including the construction of stormwater management improvements; grading; continued construction of the shared use path; and repaving along Grove Street between Tobacco Road and Kenwood Circle.

Work associated with the Project will take place within Areas Subject to Protection/Jurisdiction under the Massachusetts Wetlands Protection Act (M.G.L. ch.131 s.40) and its Regulations at 310 CMR 10.00 (the Act), as well as the Town of Franklin Wetlands Protection Bylaw (Chapter 181) and associated regulations (the Bylaw) including Bordering Vegetated Wetland (BVW), Bordering Land Subject to Flooding (BLSF), Riverfront Area (RA), the local 100-foot Buffer Zone Resource Area, and the state and local 100-foot Buffer Zone. Proposed mitigation measures for Resource Area impacts include wetland replication and restoration, stabilization of disturbed soils, and improvements to the municipal stormwater management system. Erosion controls will be maintained throughout the duration of the Project to protect the adjacent Resource Areas.

This NOI has been concurrently submitted to the Massachusetts Department of Environmental Protection (MassDEP) Central Regional Office. As a municipal project, this NOI filing is not subject to fees under the Act or Bylaw. Abutter notification has been undertaken in accordance with the Act and the Bylaw.

We trust that the following application provides adequate information to facilitate the issuance of an Order of Conditions. Should you have any additional questions, please do not hesitate to contact us.

Very truly yours,
BETA Group, Inc.

Elyse Tripp
Staff Scientist

Jonathan Niro
Project Scientist

cc: Michael Maglio, P.E., Town of Franklin
Robert Cantoreggi, Town of Franklin
Benjamin Boynton, BETA
William McGrath, BETA
Emily Slotnick, AICP, CFM, BETA
Laura Krause, BETA
MassDEP CERO, Division of Wetlands

Job No: 22.10613.00

Franklin, Massachusetts

Shared Use Path & Roadway Improvements

Grove Street

February 2023

NOTICE OF INTENT

89 Shrewsbury Street
Suite 300
Worcester, MA 01604
508.756.1600
www.BETA-Inc.com

Shared Use Path &
Roadway Improvements

Franklin, Massachusetts

Grove Street

NOTICE OF INTENT

Prepared by: BETA GROUP, INC.
Prepared for: The Town of Franklin Department of Public Works

February 2023

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WPA Form 3 – Notice of Intent

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 Number

Document Transaction Number

Franklin
City/Town

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

Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

A. General Information

1. Project Location (**Note:** electronic filers will click on button to locate project site):

Grove Street	Franklin	02038
a. Street Address	b. City/Town	c. Zip Code

Latitude and Longitude: 42.055968 (d. Latitude) -71.427835 (e. Longitude)

N/A - Public ROW	N/A - Public ROW
f. Assessors Map/Plat Number	g. Parcel /Lot Number

2. Applicant:

Michael	Maglio
a. First Name	b. Last Name

Town of Franklin Department of Public Work (DPW)
c. Organization

257 Fisher Street
d. Street Address

Franklin	MA	02038
e. City/Town	f. State	g. Zip Code
508-553-5500		mmaglio@franklin.ma.us
h. Phone Number	i. Fax Number	j. Email Address

3. Property owner (required if different from applicant): ☐ Check if more than one owner

a. First Name	b. Last Name

Town of Franklin
c. Organization

355 E Central Street
d. Street Address

Franklin	MA	02038
e. City/Town	f. State	g. Zip Code
508-258-7900		
h. Phone Number	i. Fax Number	j. Email address

4. Representative (if any):

Jonathan	Niro
a. First Name	b. Last Name

BETA Group, Inc
c. Company

89 Shrewsbury Street, Suite 300
d. Street Address

Worcester	MA	01604
e. City/Town	f. State	g. Zip Code
774-573-9694		jniro@beta-inc.com
h. Phone Number	i. Fax Number	j. Email address

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

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

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A. General Information (continued)

6. General Project Description:

The Project consists of Phase II of a two (2)-phase Overall Project to improve public infrastructure through a MassWorks grant supplemented with local funding along Grove Street in Franklin, Massachusetts. Specific activities proposed under this filing include the construction of a shared use path, general roadway improvements, wetland replication and restoration, and upgrades to the municipal stormwater management system.

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

1. ☐ Single Family Home
2. ☐ Residential Subdivision
3. ☐ Commercial/Industrial
4. ☐ Dock/Pier
5. ☐ Utilities
6. ☐ Coastal engineering Structure
7. ☐ Agriculture (e.g., cranberries, forestry)
8. ☒ Transportation
9. ☐ Other

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration 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. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

310 CMR 10.53(6) for construction of a shared use path.
2. Limited Project Type

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

N/A
a. County

N/A
b. Certificate # (if registered land)

N/A
c. Book

N/A
d. Page Number

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

1. ☐ Buffer Zone Only – 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).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

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

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Bank	1. linear feet	2. linear feet
b. ☒ Bordering Vegetated Wetland	32 (perm) 1,363 (temp) 1. square feet	66 (replication) 1,363 (restoration)
c. ☐ Land Under Waterbodies and Waterways	1. square feet 3. cubic yards dredged	2. square feet

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. ☒ Bordering Land Subject to Flooding	773 1. square feet 111 3. cubic feet of flood storage lost	773 2. square feet 122 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 available) - **specify coastal or inland**	

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: 74,612 square feet

4. Proposed alteration of the Riverfront Area:

34,251 (non degraded)	21,190 (non degraded)	13,061 (non-degraded)
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)

Note: for coastal riverfront areas, please complete **Section B.2.f**. above.

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

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

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 Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. ☐ Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. ☐ Coastal Dunes	1. square feet	2. cubic yards dune nourishment

	Size of Proposed Alteration	Proposed Replacement (if any)
f. ☐ Coastal Banks	1. linear feet	
g. ☐ Rocky Intertidal Shores	1. square feet	
h. ☐ Salt Marshes	1. square feet	2. sq ft restoration, rehab., creation
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
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 enter the additional amount here.

a. square feet of BVW

b. square feet of Salt Marsh

5. ☐ Project Involves Stream Crossings

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

C. Other Applicable Standards and Requirements

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Limited Project Checklists – Required Actions (310 CMR 10.11).

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 and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm.

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

August 2021
b. Date of map

If *yes*, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.2.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

c. Submit Supplemental Information for Endangered Species Review*

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

2. ☐ Project plans for entire project site, including wetland resource areas and areas outside of wetlands 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)

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see https://www.mass.gov/ma-endangered-species-act-mesa-regulatory-review).
Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.
** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.

(b) ☐ Photographs representative of the site

C. Other Applicable Standards and Requirements (cont'd)

(c) ☐ MESA filing fee (fee information available at https://www.mass.gov/how-to/how-to-file-for-a-mesa-project-review).
Make check payable to "Commonwealth of Massachusetts - NHESP" 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

(f) 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, https://www.mass.gov/service-details/exemptions-from-review-for-projectsactivities-in-priority-habitat; 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 # ______ 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.

3. For coastal projects only, is any portion of the proposed project located below the mean high water line or in a fish run?

a. ☒ Not applicable – project is in inland resource area only b. ☐ Yes ☐ No

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

South Shore - Cohasset to Rhode Island border, and the Cape & Islands:

Division of Marine Fisheries -
Southeast Marine Fisheries Station
Attn: Environmental Reviewer
836 South Rodney French Blvd.
New Bedford, MA 02744
Email: dmf.envreview-south@mass.gov

North Shore - Hull to New Hampshire border:

Division of Marine Fisheries -
North Shore Office
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930
Email: dmf.envreview-north@mass.gov

Also if yes, the project 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.

c. ☒ Is this an aquaculture project? d. ☐ Yes ☒ No

If yes, include a copy of the Division of Marine Fisheries Certification Letter (M.G.L. c. 130, § 57).

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C. Other Applicable Standards and Requirements (cont'd)

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

4. 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 MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.

   b. ACEC

5. 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

6. 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

7. 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. Check why the project is exempt:
      1. ☐ Single-family house
      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

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

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.

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

D. Additional Information (cont'd)

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.

Grove Street Improvements Phase 2
a. Plan Title

BETA Group, Inc.
b. Prepared By

William P. McGrath, MA P.E. No. 33716
c. Signed and Stamped by

February 2023
d. Final Revision Date

As noted
e. Scale

f. Additional Plan or Document Title

g. Date

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. Payor name on check: First Name

7. Payor name on check: Last Name

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

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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: 2/15/23

3. Signature of Property Owner (if different) — 4. Date

5. Signature of Representative (if any) — 6. Date: 2/15/2023

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 any part of Section C, Item 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.

LOCAL FILING FORMS

Town of Franklin Conservation Commission

APPLICATION PROCESS SIGNATURE FORM

There are three different applications that can be submitted to undertake work in a jurisdictional area: a Notice of Intent (NOI), a Request for Determination (RDA) and a Minor Buffer Zone Activity (MBZA). All three applications have different criteria for submission and approval and the NOI and RDA are governed by both the state law and the local bylaw. The MBZA is issued under the local bylaw only.

When a potential applicant requests advice from the Conservation Agent on which application to file, the opinion of the Agent is based on the information given by the potential applicant and any other information available to the Agent, e.g. the town's GIS system. The Agent has no legal right to go onto private property at any time until after an application is filed or permission of the property owner is given.

It is important that all applicants understand that after an application is filed, additional information may come to light e.g. via a field inspection or a review of the application, that may impact the scope of the submitted application and the approval process. **Therefore, it is the ultimate responsibility of the applicant to decide which application to file.**

In light of the above, please sign below indicating an understanding of this policy and submit it with the application.

______________________ 2/15/23

Signature of Property Owner Date

Town of Franklin Conservation Commission

PROPERTY ACCESS SIGNATURE FORM

I hereby request that the Franklin Conservation Commission review this NOI/RDA/ANRAD application. I (we) grant authority to the Franklin Conservation Commission members and agents to go onto my (our) property solely for purposes directly related to the inspection and approval of this application and for follow-up compliance with the permit conditions.

_______________________________ 2/15/23

Signature of Property Owner Date

Town of Franklin Conservation Commission

RESOURCE AREA IMPACT SUMMARY FORM

The Franklin Wetlands Protection Bylaw
Franklin Town Code Section 181

Resource Area	Alteration Proposed	Mitigation Proposed
Bordering Vegetated Wetland (SF)	32 (perm) 1,363 (temp)	66 (replication) 1,363 (restoration)
Bank (LF)	0	0
Land Under Water Bodies (SF)	0	0
Isolated Wetland (SF)	0	0
Vernal Pool (SF)	0	0
Buffer Zone (SF)	60,985 SF (34,410 SF within existing paved areas)	Stormwater improvements – see NOI narrative.
Riverfront (SF)	76,612 sf (40,361 sf within degraded Riverfront Area)	Stormwater improvements – see NOI narrative.
100-Year Floodplain (CF)	111	122
(SF) = Square Feet (LF) = Linear Feet (CF) = Cubic Feet Flood Storage		

ABUTTERS INFORMATION

Town of Franklin – Board of Assessors
355 East Central Street
Franklin, MA 02038
Tel # 508-520-4920
Fax # 508-520-4923

Abutters List Request Form

Please Note: **A $25.00 fee per list is required to process your request. Payment is due at the time of submission of this form. Please allow <u>10 days</u> from the date of both payment and submission of the form for the Assessors office to complete processing your request. (Revised 1-1-22)**

Date of Request 01 / 20 / 2023

Assessors Parcel ID # (12 digits) N/A - See attached sketch (Public Right-of-Way)

Property Street Address N/A - See attached sketch (Public Right-of-Way)

Distance Required From Parcel # listed above (**Circle One**): **500** **300** **100**
(Note: if a distance is not circled, we cannot process your request)

Property Owner Town of Franklin

Property Owner's Mailing Address 355 E Central Street

Town/City Franklin State MA Zip Code 02038

Property Owner's Telephone # 508 - 528 - 7900

Requestor's Name (if different from Owner) Elyse Tripp, Staff Scientist (BETA Group, Inc.)

Requestor's Address 89 Shrewsbury St., Suite 300, Worcester MA, 01604

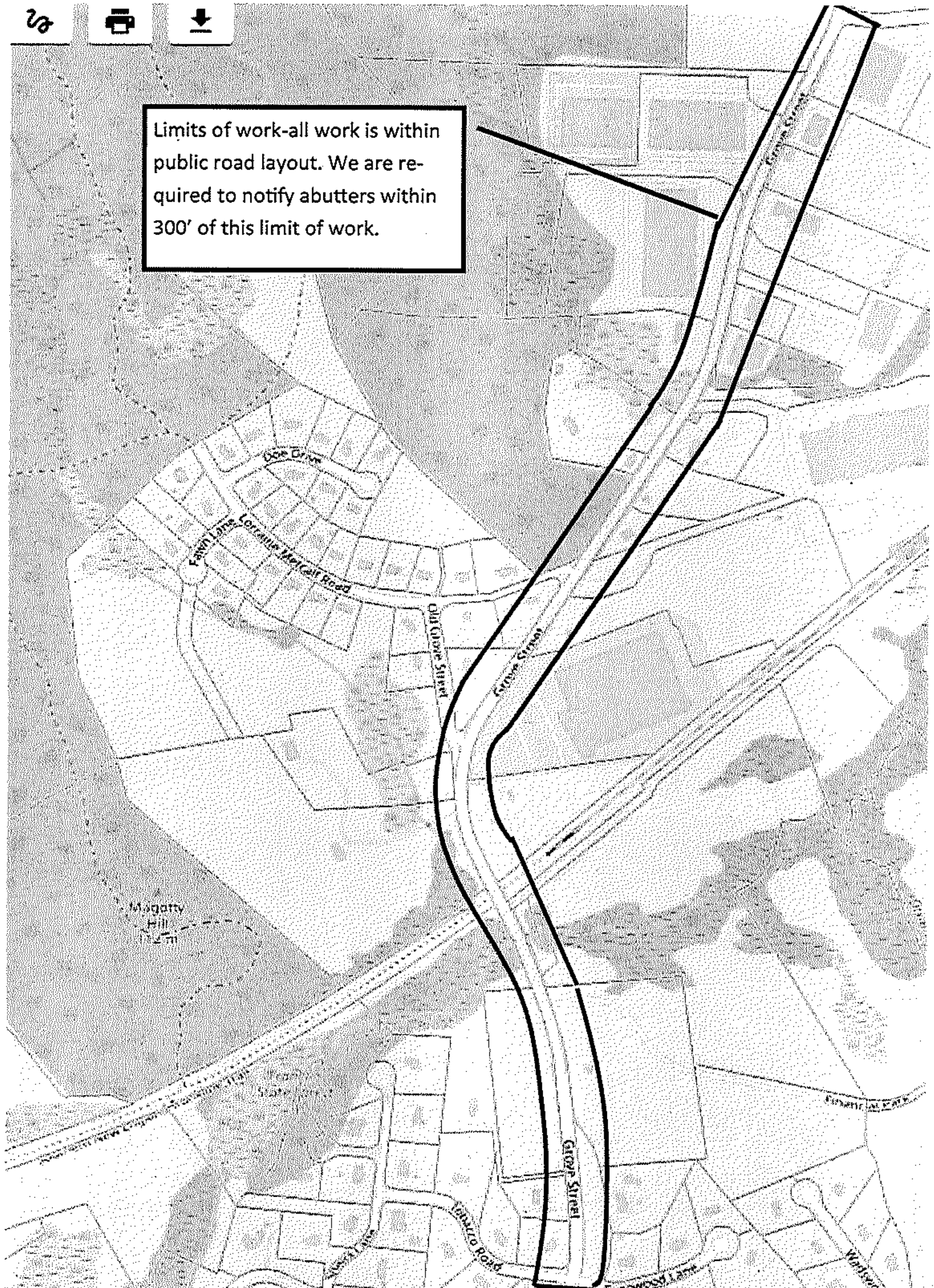
Requestor's Telephone # 844 - 800 - 2382

Office Use Only: Date Fee Paid ___/___/_______ Paid in Cash $ ___.___

Paid by Check $ ________ Check # ____________ Town Receipt # __________

Please Circle One:

Administration Conservation Planning Zoning Board of Appeals


Limits of work-all work is within public road layout. We are required to notify abutters within 300' of this limit of work.
Grove Street
Old Grove Street
Doe Grove
Fawn Lane
Lorraine Metcalf Road
Tobacco Road
Rosewood Lane

FRANKLIN
Abutters List

Subject Parcel ID:

Subject Property Location: GROVE ST abutters, Kenwood to Tobacco

ParcelID	Location	Owner	Co-Owner	Mailing Address	City	State	Zip
294-001-000-000	151 GROVE ST	M S S 151 GROVE ST LLC		958 OCEAN BOULEVARD - U	HAMPTON	NH	03842
294-002-000-000	GROVE ST	COMMONWEALTH OF MASSACH	DIVISION OF STATE PARKS	251 CAUSEWAY STREET - S	BOSTON	MA	02114-2104
294-003-000-000	GROVE ST	NEW ENGLAND POWER CO	PROPERTY TAX DEPT	40 SYLVAN RD	WALTHAM	MA	02451-2286
294-004-000-000	GROVE ST	HUGHES STEPHEN V JR	NEW ENGLAND POWER CO	40 SYLVAN RD	WALTHAM	MA	02451-2286
294-005-000-000	GROVE ST	NEW ENGLAND POWER CO	PROPERTY TAX DEPT	40 SYLVAN RD	WALTHAM	MA	02451-2286
295-005-000-000	GROVE ST	NEW ENGLAND POWER CO	PROPERTY TAX DEPT	40 SYLVAN RD	WALTHAM	MA	02451-2286
295-006-000-000	GROVE ST	FRENCH SHIRLEY	FRENCH REALTY TRUST F	486 SUMMER ST	FRANKLIN	MA	02038
295-006-001-000	GROVE ST	NEW ENGLAND POWER CO		40 SYLVAN RD	WALTHAM	MA	02451-2286
295-013-000-000	1 3 KENWOOD CIR	KENWOOD PROPERTIES LLC		63 CENTRE ST	DOVER	MA	02030
295-014-000-000	CONRAIL	NEW YORK CENTRAL LINES LLC	C/O CSX TRANSPORTATIO	500 WATER ST (C 910)	JACKSONVILLE	FL	32202
306-001-000-000	158 GROVE ST	LEWIS ALBERT G, TR	GROVE STREET REALTY T	7 UNCAS BROOK ROW	FRANKLIN	MA	02038
306-002-000-000	160 GROVE ST	HENNEP PROPERTIES LLC		200 BROOKLINE AVE #508	BOSTON	MA	02215
306-003-000-000	162 GROVE ST	CHARLEY2017 LLC		7 MYRTLE ST	NORFOLK	MA	02056
306-004-000-000	164 GROVE ST	CC LIGHTS LLC		4 GURNEE AVE	NYACK	NY	10960
306-005-000-000	166 GROVE ST	CORE REAL ESTATE HOLDINGS, L		2 HAMPSHIRE ST - SUITE 30	FOXBORO	MA	02035
306-006-000-000	168 GROVE ST	YERGATIAN VERNON C	V & A REALTY TRUST AVED	168 GROVE STREET	FRANKLIN	MA	02038
306-007-000-000	170 GROVE ST	170 GROVE STREET LLC		170 GROVE ST	FRANKLIN	MA	02038
306-009-000-000	180 GROVE ST	FRANKLIN TOWN OF		355 EAST CENTRAL STREE	FRANKLIN	MA	02038
306-010-000-000	186 GROVE ST	NO SHOES ON GROVE LLC		186 GROVE ST	FRANKLIN	MA	02038
306-012-000-000	196 GROVE ST	WAITE STEPHEN		196 GROVE ST	FRANKLIN	MA	02038
306-013-000-000	198 GROVE ST	WAITE SCOTT S	WAITE PAULA G	198 GROVE ST	FRANKLIN	MA	02038
306-035-004-000	23 OLD GROVE ST	RANA SAGAR	SINGH SHIKHA	23 OLD GROVE ST	FRANKLIN	MA	02038
306-035-005-000	21 OLD GROVE ST	OBRIEN JAMES F	OBRIEN VIRNA C	21 OLD GROVE ST	FRANKLIN	MA	02038
306-036-000-000	GROVE ST	COMMONWEALTH OF MASSACH	DIVISION OF STATE PARKS	251 CAUSEWAY STREET - S	BOSTON	MA	02114-2104
306-037-000-000	191 GROVE ST	WOODS PAUL E	WOODS NICOLE M	191 GROVE ST	FRANKLIN	MA	02038
306-038-000-000	185 GROVE ST	BOSLEY BRIAN T		185 GROVE ST	FRANKLIN	MA	02038
306-039-000-000	177 GROVE ST	BATISTA ANTERO	BATISTA DONNA M	P O BOX 668	FRANKLIN	MA	02038
306-040-000-000	165 GROVE ST	TRPF 157 165 GROVE ST LLC	C/O NUVEEN	PO BOX 30428	CHARLOTTE	NC	28230
306-042-000-000	161 GROVE ST	161 GROVE LLC		13 WHEELING AVE	WOBURN	MA	01801
306-043-000-000	157 GROVE ST	TRPF 157 165 GROVE STREET LL	C/O NUVEEN	PO BOX 30428	CHARLOTTE	NC	28230
311-001-000-000	176 GROVE ST	MCP III 176 GROVE LLC	C/O MARCUS PARTNERS, I	260 FRANKLIN ST	BOSTON	MA	02110
311-001-001-000	206 GROVE ST	MCP III 206 GROVE LLC	C/O MARCUS PARTNERS, I	260 FRANKLIN ST	BOSTON	MA	02110
311-002-000-000	210 GROVE ST	MCP III 210 GROVE LLC	C/O MARCUS PROPERTIES	201 WASHINGTON ST - STE	BOSTON	MA	02108
311-003-000-000	230 GROVE ST	ISAR LLC		3 MADISON STREET	PLAINVILLE	MA	02762
311-004-000-000	GROVE ST	FRANKLIN TOWN OF		355 EAST CENTRAL ST	FRANKLIN	MA	02038
311-005-000-000	350 GROVE ST	FRANKLIN TOWN OF		355 EAST CENTRAL ST	FRANKLIN	MA	02038
311-006-000-000	235 GROVE ST	ROSSETTI STEVEN J & DALE M, T	CEDAR HILL FARM REALTY	235 GROVE ST	FRANKLIN	MA	02038
311-006-001-000	231 GROVE ST	ROSSETTI WILLIAM J		231 GROVE ST	FRANKLIN	MA	02038
311-008-000-000	30 OLD GROVE ST	PALEOLOGOS ANDREW A	PALEOLOGOS SHANNON P	30 OLD GROVE ST	FRANKLIN	MA	02038
311-009-000-000	22 OLD GROVE ST	BOUDREAU MARY P L/E	FRANCIS, SCOTT FRANCIS,	22 OLD GROVE ST	FRANKLIN	MA	02038

FRANKLIN
Abutters List

Subject Parcel ID:

Subject Property Location:

ParcelID	Location	Owner	Co-Owner	Mailing Address	City	State	Zip
311-010-000-000	24 OLD GROVE ST	PETITT EVERETT J III	PETITT SUSAN J	24 OLD GROVE ST	FRANKLIN	MA	02038
311-011-000-000	16 OLD GROVE ST	LIU SIYUAN	ZHAO ZIYUAN	16 OLD GROVE ST	FRANKLIN	MA	02038
311-012-000-000	26 LORRAINE METCALF RD	KROUSHL PAUL W	KROUSHL DIANA L	26 LORRAINE METCALF RD	FRANKLIN	MA	02038
311-018-000-000	OLD GROVE ST	FRANKLIN TOWN OF		355 EAST CENTRAL STREE	FRANKLIN	MA	02038
312-021-000-000	340 GROVE ST	FRANKLIN TOWN OF		355 EAST CENTRAL STREE	FRANKLIN	MA	02038
322-001-000-000	352 GROVE ST	FRANKLIN TOWN OF		355 EAST CENTRAL STREE	FRANKLIN	MA	02038
322-002-000-000	360 GROVE ST	COLLAMATI ROGER L L/E	COLLAMATI, ERNEST M CO	360 GROVE ST	FRANKLIN	MA	02038
322-003-000-000	2 ROSEWOOD LN	ALGER JOSEPH E & PAMELA A T	ALGER FAMILY REVOCABL	2 ROSEWOOD LN	FRANKLIN	MA	02038
322-009-000-000	1 ROSEWOOD LN	SCHATZ ANTHONY M		1 ROSEWOOD LN	FRANKLIN	MA	02038
322-084-000-000	365 GROVE ST	DALE CHRISTOPHER J		365 GROVE ST	FRANKLIN	MA	02038
322-089-000-000	9 TOBACCO RD	YOUNG CHARLES P	YOUNG HEATHER K	9 TOBACCO RD	FRANKLIN	MA	02038
322-091-000-000	3 TOBACCO RD	PANICO THOMAS R		3 TOBACCO RD	FRANKLIN	MA	02038
322-092-000-000	359 GROVE ST	GIACALONE MICHAEL J	GIACALONE SUZANNE	359 GROVE ST	FRANKLIN	MA	02038
322-093-000-000	GROVE ST	FRANKLIN TOWN OF		355 EAST CENTRAL STREE	FRANKLIN	MA	02038
323-048-000-000	GROVE ST	COMMONWEALTH OF MASSACH	DIVISION OF STATE PARKS	251 CAUSEWAY STREET - S	BOSTON	MA	02114-2104

Parcel Count: **55**

End of Report

Kevin W. Doyle, 1-24-2023
Director of Assessing
Town of Franklin, MA

Town of Franklin Conservation Commission

NOTIFICATION TO ABUTTERS

Under the Massachusetts Wetlands Protection Act
And
The Franklin Wetlands Protection Bylaw

In accordance with the second paragraph of Massachusetts General Laws Chapter 131, Section 40, you are hereby notified of the following proposed project:

Michael Maglio, P.E. (Town of Franklin DPW) has filed a Notice of Intent with the Franklin Conservation Commission for the construction of roadway improvements and a shared use path along Grove Street between Tobacco Road and Kenwood Circle on 2/16/2023, under the Wetlands Protection Act (M.G.L c.131 §40).

Copies of the Notice of Intent may be examined during regular office hours by contacting Jonathan Niro, Project Scientist (BETA Group, Inc.)
Email: jniro@BETA-inc.com Ph.: 774-573-9694
Copies may also be examined by contacting the Franklin Conservation Department located at 355 East Central Street, Franklin, MA, (508) 520-4929.

Notice of the public hearing including the date, time, and place will be published at least five (5) days in advance in the Milford Daily News.

Notice of the public hearing including the date, time, and place will be posted in the Franklin Town Hall at least forty eight (48) hours in advance of the public hearing.

The public hearing will be held on Thursday, February 23, 2023, at 7:00 pm at the Town Council Chambers, located on the Second Floor of the Municipal Building on 355 East Central Street. The meeting is also available via Zoom, and can be accessed through the Conservation Commission agenda for that night, which will be posted on the Town's website 48 hours prior to the meeting. Please call the Conservation Department at (508) 520-4929 if you have any questions.

You may also contact the Massachusetts Department of Environmental Protection, Central Regional Office, Worcester, MA at (508) 792-7650.

Town of Franklin Conservation Commission

AFFIDAVIT OF SERVICE

Under the Massachusetts Wetlands Protection Act

(To be submitted to the Massachusetts Department of Environmental Protection and the Franklin Conservation Commission when filing a Notice of Intent)

I, Jonathan Chidekel hereby certify under the pains and penalties of perjury that on February 14, 2023, I gave Notification to Abutters in compliance with second paragraph of Massachusetts General Laws Chapter 131, Section 40 in connection with the following matter:

A Notice of Intent filed under the Massachusetts Wetlands Protection Act by BETA Group, Inc. with the Franklin Conservation Commission on February 16, 2023 for property located on Grove Street, Franklin, MA.

The Notification to Abutters form and list of the abutters to whom it was given and their addresses are attached to the Affidavit of Service.

Signature

February 14, 2023

Date

7022 2410 0003 4910 9028

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		47
Extra Services & Fees (check box, add fee as appropriate)	$3.35	
☐ Return Receipt (hardcopy)	$0.00	
☐ Return Receipt (electronic)	$0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$0.00	
☐ Adult Signature Required	$0.00	
☐ Adult Signature Restricted Delivery		
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

Sent To
BATISTA ANTERO
P O BOX 668
FRANKLIN, MA 02038

Street
City, State, ZIP+4®

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☐ Return Receipt (electronic)	$0.00	Postmark Here
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☐ Adult Signature Required	$0.00	
☐ Adult Signature Restricted Delivery		
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

Sent To
170 GROVE STREET LLC
170 GROVE ST
FRANKLIN, MA 02038

Street
City

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Extra Services & Fees (check box, add fee as appropriate)	$3.35	
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☐ Return Receipt (electronic)	$0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$0.00	
☐ Adult Signature Required	$0.00	
☐ Adult Signature Restricted Delivery		
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

Sent To
WAITE SCOTT S
198 GROVE ST
FRANKLIN, MA 02038

Street
City

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Extra Services & Fees (check box, add fee as appropriate)	$3.35	
☐ Return Receipt (hardcopy)	$0.00	
☐ Return Receipt (electronic)	$0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$0.00	
☐ Adult Signature Required	$0.00	
☐ Adult Signature Restricted Delivery		
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

Sent To
WAITE STEPHEN
196 GROVE ST
FRANKLIN, MA 02038

Street
City

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7022 2410 0003 4910 89[illegible]4

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$		47
Extra Services & Fees (check box, add fee as appropriate)	$3.25	
☐ Return Receipt (hardcopy)	$ $0.00	
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$	
Postage		
$		
Total Postage and Fees	$8.13	02/14/2023
$		

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Sent To
OBOUZS JAMES,F
Street and Apt. No., or PO Box No.
21 OLD GROVE ST
City, State, ZIP+4®
FRANKLIN, MA 02038

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$		47
Extra Services & Fees (check box, add fee as appropriate)	$3.25	
☐ Return Receipt (hardcopy)	$ $0.00	01613
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$	
Postage	$0.63	
$		
Total Postage and Fees	$8.13	02/14/2023
$		

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Sent To
RANA SAGAR
Street and Apt. No., or PO Box No.
23 OLD GROVE ST
City, State, ZIP+4®
FRANKLIN, MA 02038

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Extra Services & Fees (check box, add fee as appropriate)	$3.25	01613
☐ Return Receipt (hardcopy)	$ $0.00	
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$	
Postage	$0.63	
$		
Total Postage and Fees	$8.13	02/14/2023
$		

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Sent To
YERGATIAN VERNON C
Street and Apt. No., or PO Box No.
168 GROVE STREET
City, State, ZIP+4®
FRANKLIN, MA 02038

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Extra Services & Fees (check box, add fee as appropriate)	$3.25	
☐ Return Receipt (hardcopy)	$ $0.00	01613
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$	
Postage	$0.63	
$		
Total Postage and Fees	$8.13	02/14/2023
$		

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Sent To
NO SHOES ON GROVE LLC
Street and Apt. No., or PO Box No.
186 GROVE ST
City, State, ZIP+4®
FRANKLIN, MA 02038

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☐ Return Receipt (hardcopy)	$0.00
☐ Return Receipt (electronic)	$0.00
☐ Certified Mail Restricted Delivery	$0.00
☐ Adult Signature Required	$0.00
☐ Adult Signature Restricted Delivery	$
Postage	$0.63
Total Postage and Fees	$8.13

Postmark Here

WORC MA 01613 FEB 2023

02/14/2023

Sent To
Street and Apt. No., or PO Box No.
City, State, ZIP+4®

ALGER JOSEPH E & PAMELA A TRS
2 ROSEWOOD LN
FRANKLIN, MA 02038

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☐ Return Receipt (hardcopy)	$0.00
☐ Return Receipt (electronic)	$0.00
☐ Certified Mail Restricted Delivery	$0.00
☐ Adult Signature Required	$0.00
☐ Adult Signature Restricted Delivery	$
Postage	$0.63
Total Postage and Fees	$8.13

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WOODS PAUL E
191 GROVE ST
FRANKLIN, MA 02038

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☐ Return Receipt (hardcopy)	$0.00
☐ Return Receipt (electronic)	$0.00
☐ Certified Mail Restricted Delivery	$0.00
☐ Adult Signature Required	$0.00
☐ Adult Signature Restricted Delivery	$
Postage	$0.63
Total Postage and Fees	$8.13

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02/14/2023

Sent To
Street and Apt. No., or PO Box No.
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YOUNG CHARLES P
9 TOBACCO RD
FRANKLIN, MA 02038

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☐ Return Receipt (hardcopy)	$0.00
☐ Return Receipt (electronic)	$0.00
☐ Certified Mail Restricted Delivery	$0.00
☐ Adult Signature Required	$0.00
☐ Adult Signature Restricted Delivery	$
Postage	$0.63
Total Postage and Fees	$8.13

Postmark Here

WORC MA 01613 FEB 2023

02/14/2023

Sent To
Street and Apt. No., or PO Box No.
City, State, ZIP+4®

PANICO THOMAS R
3 TOBACCO RD
FRANKLIN, MA 02038

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Extra Services & Fees (check box, add fee as appropriate)	$3.35	47
☐ Return Receipt (hardcopy)	$ $0.00	
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$	
☐ Adult Signature Restricted Delivery	$ $0.00	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

Sent To
BOSLEY BRIAN T
185 GROVE ST
FRANKLIN, MA 02038

Street and Apt.
City, State, ZIP+4®

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Extra Services & Fees (check box, add fee as appropriate)	$3.35	47
☐ Return Receipt (hardcopy)	$ $0.00	
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$	
☐ Adult Signature Restricted Delivery	$ $0.00	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

WORC MA FEB 2023 01613

Sent To
DALE CHRISTOPHER J
365 GROVE ST
FRANKLIN, MA 02038

Street and Apt.
City, State, ZIP+4®

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7022 2410 0003 4910 [illegible]

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Certified Mail Fee	$4.15	0101
Extra Services & Fees (check box, add fee as appropriate)	$3.35	47
☐ Return Receipt (hardcopy)	$ $0.00	
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$	
☐ Adult Signature Restricted Delivery	$ $0.00	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

MA FEB 2023 01613

Sent To
GIACALONE MICHAEL J
359 GROVE ST
FRANKLIN, MA 02038

Street and Apt.
City, State, ZIP+4®

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7022 2410 0003 4910 8878

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Certified Mail Fee	$4.15	0101
Extra Services & Fees (check box, add fee as appropriate)	$3.35	47
☐ Return Receipt (hardcopy)	$ $0.00	
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$	
☐ Adult Signature Restricted Delivery	$ $0.00	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

WORC MA FEB 2023 01613

Sent To
SCHATZ ANTHONY M
1 ROSEWOOD LN
FRANKLIN, MA 02038

Street and Apt.
City, State, ZIP+4®

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Woburn, MA 01801

OFFICIAL USE

Certified Mail Fee	$4.15	0101
$		47
Extra Services & Fees (check box, add fee as appropriate)	$3.35	
☐ Return Receipt (hardcopy)	$ $0.00	
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$	
Postage	$0.63	02/14/2023
$		
Total Postage and Fees	$8.13	
$		

WORC MA FEB 2023 01613

Sent To
161 GROVE LLC
Street and
13 WHEELING AVE
City, State, ZIP+4®
WOBURN, MA 01801

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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Franklin, MA 02038

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$		47
Extra Services & Fees (check box, add fee as appropriate)	$3.35	
☐ Return Receipt (hardcopy)	$ $0.00	
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$	
Postage	$0.63	02/14/2023
$		
Total Postage and Fees	$8.13	
$		

WORC MA FEB 2023 01613

Sent To
KROUGHL PAUL W
Street and
26 LORRAINE METCALF RD
City, State, ZIP+4®
FRANKLIN, MA 02038

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Extra Services & Fees (check box, add fee as appropriate)	$3.35	
☐ Return Receipt (hardcopy)	$ $0.00	
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$	
Postage	$0.63	02/14/2023
$		
Total Postage and Fees	$8.13	
$		

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Sent To
LIU SIYUAN
16 OLD GROVE ST
FRANKLIN, MA 02038

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$		47
Extra Services & Fees (check box, add fee as appropriate)	$3.35	
☐ Return Receipt (hardcopy)	$ $0.00	
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$	
Postage	$0.63	02/14/2023
$		
Total Postage and Fees	$8.13	
$		

WORC MA FEB 2023

Sent To
COLLAMATI ROGER L L/E
Street and
360 GROVE ST
City, State, ZIP+4®
FRANKLIN, MA 02038

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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Franklin, MA 02038

Certified Mail Fee $4.15

Extra Services & Fees $3.35

$0.00

$0.00

$0.00

$0.00

Postage $0.63

Total $8.13

0101

47

02/14/2023

WORC MA FEB 2023 01613

FRANKLIN TOWN OF
355 EAST CENTRAL ST
FRANKLIN, MA 02038

Sent To

Street and Apt. No., or PO Box No.

City, State, ZIP+4®

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OFFICIAL USE

Boston, MA 02108

Certified Mail Fee $4.15

Extra Services & Fees (check box, add fee as appropriate) $3.35

☐ Return Receipt (hardcopy) $ $0.00

☐ Return Receipt (electronic) $ $0.00

☐ Certified Mail Restricted Delivery $ $0.00

☐ Adult Signature Required $ $0.00

☐ Adult Signature Restricted Delivery $

Postage $0.63

Total $8.13

0101

47

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WORC MA FEB 2023 01613

02/14/2023

MCP III 210 GROVE LLC
201 WASHINGTON ST - STE 2100
BOSTON, MA 02108

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OFFICIAL USE

Plainville, MA 02762

Certified Mail Fee $4.15

Extra Services & Fees (check box, add fee as appropriate) $3.35

☐ Return Receipt (hardcopy) $ $0.00

☐ Return Receipt (electronic) $ $0.00

☐ Certified Mail Restricted Delivery $ $0.00

☐ Adult Signature Required $ $0.00

☐ Adult Signature Restricted Delivery $

Postage $0.63

Total Postage and Fees $8.13

0101

47

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WORC MA FEB 2023 01613

02/14/2023

ISAB LLC
3 MADISON STREET
PLAINVILLE, MA 02762

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Street and Apt. No., or PO Box No.

City, State, ZIP+4®

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Boston, MA 02110

Certified Mail Fee $4.15

Extra Services & Fees (check box, add fee as appropriate) $3.35

☐ Return Receipt (hardcopy) $ $0.00

☐ Return Receipt (electronic) $ $0.00

☐ Certified Mail Restricted Delivery $ $0.00

☐ Adult Signature Required $ $0.00

☐ Adult Signature Restricted Delivery $

Postage $0.63

Total $8.13

0101

47

Postmark Here

WORC MA FEB 2023 01613

02/14/2023

MCP III 260 GROVE LLC
260 FRANKLIN ST
BOSTON, MA 02110

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Charlotte, NC 28230

OFFICIAL USE

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$		47
Extra Services & Fees (check box, add fee as appropriate)	$3.35	
☐ Return Receipt (hardcopy)	$ $0.00	
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

TRPF 157 165 GROVE ST LLC
PO BOX 30428
CHARLOTTE, NC 28230

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Franklin, MA 02038

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Certified Mail Fee	$4.15	0101
$		47
Extra Services & Fees (check box, add fee as appropriate)	$3.35	
☐ Return Receipt (hardcopy)	$ $0.00	
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$ $0.00	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

PETITT EVERETT J III
24 OLD GROVE ST
FRANKLIN, MA 02038

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Boston, MA 02110

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Certified Mail Fee	$4.15	0101
$		47
Extra Services & Fees (check box, add fee as appropriate)	$3.35	
☐ Return Receipt (hardcopy)	$ $0.00	
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$ $0.00	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

MCP III 176 GROVE LLC
260 FRANKLIN ST
BOSTON, MA 02110

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$		47
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☐ Return Receipt (hardcopy)	$ $0.00	
☐ Return Receipt (electronic)	$ $0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$ $0.00	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

BOUDREAU MARY P L/E
22 OLD GROVE ST
FRANKLIN, MA 02038

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Certified Mail Fee	$4.15	0101
$	$3.35	47
Extra Services & Fees (check box, add fee as appropriate)		
☐ Return Receipt (hardcopy)	$ $0.00	Postmark Here
☐ Return Receipt (electronic)	$ $0.00	
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

WORC MA FEB 2023 01613

ROSSETTI WILLIAM J
231 GROVE ST
FRANKLIN, MA 02038

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7022 2410 0003 4910 8809

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Franklin, MA 02038

OFFICIAL USE

Certified Mail Fee	$4.15	0101
$	$3.35	47
Extra Services & Fees (check box, add fee as appropriate)		
☐ Return Receipt (hardcopy)	$ $0.00	Postmark Here
☐ Return Receipt (electronic)	$ $0.00	
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$ $0.00	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

WORC MA FEB 2023 01613

PALEOLOGOS ANDREW A
30 OLD GROVE ST
FRANKLIN, MA 02038

Sent To
Street and Apt. No., or PO Box No.
City, State, ZIP+4®

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7022 2410 0003 4910 8709

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Franklin, MA 02038

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$	$3.35	47
Extra Services & Fees (check box, add fee as appropriate)		
☐ Return Receipt (hardcopy)	$ $0.00	Postmark Here
☐ Return Receipt (electronic)	$ $0.00	
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

WORC MA FEB 2023 01613

ROSSETTI STEVEN J DALE M TRS
235 GROVE ST
FRANKLIN, MA 02038

Sent To
Street and Apt. No., or PO Box No.
City, State, ZIP+4®

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7022 2410 0003 4910 8700

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Foxboro, MA 02035

OFFICIAL USE

Certified Mail Fee	$4.15	0101
$	$3.35	47
Extra Services & Fees (check box, add fee as appropriate)		
☐ Return Receipt (hardcopy)	$ $0.00	Postmark Here
☐ Return Receipt (electronic)	$ $0.00	
☐ Certified Mail Restricted Delivery	$ $0.00	
☐ Adult Signature Required	$ $0.00	
☐ Adult Signature Restricted Delivery	$ $0.00	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

WORC MA FEB 2023 01613

CORE REAL ESTATE HOLDINGS, LLC
2 HAMPSHIRE ST - SUITE 302
FOXBORO, MA 02035

Sent To
Street and Apt. No., or PO Box No.
City, State, ZIP+4®

FRANKLIN TOWN OF

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Nyack, NY 10960
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Extra Services & Fees (check box, add fee as appropriate)	$3.35
☐ Return Receipt (hardcopy)	$0.00
☐ Return Receipt (electronic)	$0.00
☐ Certified Mail Restricted Delivery	$0.00
☐ Adult Signature Required	$0.00
☐ Adult Signature Restricted Delivery	$
Postage	$0.63
Total Postage and Fees	$8.13

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47
Postmark Here
02/14/2023

Sent To CC Lights LLC
Street and Apt. No., or PO Box No. 4 Gurnee Ave
City, State, ZIP+4® Nyack, NY 10960

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Boston, MA 02114
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Extra Services & Fees (check box, add fee as appropriate)	$3.35
☐ Return Receipt (hardcopy)	$0.00
☐ Return Receipt (electronic)	$0.00
☐ Certified Mail Restricted Delivery	$0.00
☐ Adult Signature Required	$0.00
☐ Adult Signature Restricted Delivery	$
Postage	$0.63
Total Postage and Fees	$8.13

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47
Postmark Here
02/14/2023

COMMONWEALTH OF MASSACHUSETTS
251 CAUSEWAY STREET - SUITE 600
BOSTON, MA 02114-2104

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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Extra Services & Fees (check box, add fee as appropriate)	$3.35
☐ Return Receipt (hardcopy)	$0.00
☐ Return Receipt (electronic)	$0.00
☐ Certified Mail Restricted Delivery	$0.00
☐ Adult Signature Required	$0.00
☐ Adult Signature Restricted Delivery	$
Postage	$0.63
Total Postage and Fees	$8.13

0101
47
Postmark Here
02/14/2023

LEWIS ALBERT G, TR
7 UNCAS BROOK ROW
FRANKLIN, MA 02038

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Waltham, MA 02451
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Certified Mail Fee	$4.15
Extra Services & Fees (check box, add fee as appropriate)	$3.35
☐ Return Receipt (hardcopy)	$0.00
☐ Return Receipt (electronic)	$0.00
☐ Certified Mail Restricted Delivery	$0.00
☐ Adult Signature Required	$0.00
☐ Adult Signature Restricted Delivery	$
Postage	$0.63
Total Postage and Fees	$8.13

0101
47
Postmark Here
02/14/2023

NEW ENGLAND POWER CO
40 SYLVAN RD
WALTHAM, MA 02451-2286

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Dover, MA 02030

OFFICIAL USE

Certified Mail Fee	$4.15	0101
Extra Services & Fees (check box, add fee as appropriate)	$3.25	47
☐ Return Receipt (hardcopy)	$0.00	
☐ Return Receipt (electronic)	$0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$0.00	
☐ Adult Signature Required	$0.00	
☐ Adult Signature Restricted Delivery	$	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

WORC MA FEB 2023 01910

Sent To: KENWOOD PROPERTIES LLC
63 CENTRE ST
DOVER, MA 02030

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Jacksonville, FL 32202

OFFICIAL USE

Certified Mail Fee	$4.15	0101
Extra Services & Fees (check box, add fee as appropriate)	$3.35	47
☐ Return Receipt (hardcopy)	$0.00	
☐ Return Receipt (electronic)	$0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$0.00	
☐ Adult Signature Required	$0.00	
☐ Adult Signature Restricted Delivery	$	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

WORC MA FEB 2023 01910

Sent To: NEW YORK CENTRAL LINES LLC
500 WATER ST (C 910)
JACKSONVILLE, FL 32202

7022 2410 0003 4910 [illegible]

U.S. Postal Service™
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Norfolk, MA 02056

OFFICIAL USE

Certified Mail Fee	$4.15	0101
Extra Services & Fees (check box, add fee as appropriate)	$3.35	47
☐ Return Receipt (hardcopy)	$0.00	
☐ Return Receipt (electronic)	$0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$0.00	
☐ Adult Signature Required	$0.00	
☐ Adult Signature Restricted Delivery	$	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

WORC MA FEB 2023 01913

Sent To: CHARLES 1017 LLC
7 MYRTLE ST
NORFOLK, MA 02056

YERGATIAN VERNON C

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7022 2410 0003 4910 8687

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Boston, MA 02215

OFFICIAL USE

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Extra Services & Fees (check box, add fee as appropriate)	$3.35	47
☐ Return Receipt (hardcopy)	$0.00	
☐ Return Receipt (electronic)	$0.00	Postmark Here
☐ Certified Mail Restricted Delivery	$0.00	
☐ Adult Signature Required	$0.00	
☐ Adult Signature Restricted Delivery	$	
Postage	$0.63	
Total Postage and Fees	$8.13	02/14/2023

WORC MA FEB 2023 01910

Sent To: HENNEP PROPERTIES LLC
200 BROOKLINE AVE #508
BOSTON, MA 02215

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Franklin, MA 02038

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$ $3.35

Extra Services & Fees (check box, add fee as appropriate)

- ☐ Return Receipt (hardcopy) $ $0.00
- ☐ Return Receipt (electronic) $ $0.00
- ☐ Certified Mail Restricted Delivery $ $0.00
- ☐ Adult Signature Required $ $0.00
- ☐ Adult Signature Restricted Delivery $

Postage $0.63

Total Postage and Fees $

0101
47

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02/14/2023

Sent To
FRENCH SHIRLEY
486 SUMMER ST
FRANKLIN, MA 02038

Street
City

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Hampton, NH 03842

OFFICIAL USE

Certified Mail Fee $4.15

$ $3.35

Extra Services & Fees (check box, add fee as appropriate)

- ☐ Return Receipt (hardcopy) $ $0.00
- ☐ Return Receipt (electronic) $ $0.00
- ☐ Certified Mail Restricted Delivery $ $0.00
- ☐ Adult Signature Required $ $0.00
- ☐ Adult Signature Restricted Delivery $

Postage $0.63

Total Postage and Fees $8.13

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47

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FEB 2023 MA WORC

02/14/2023

Sent To
M S S 151 GROVE ST LLC
958 OCEAN BOULEVARD - UNIT 1
HAMPTON, NH 03842

Street
City

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Waltham, MA 02451

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$ $3.35

Extra Services & Fees (check box, add fee as appropriate)

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- ☐ Return Receipt (electronic) $ $0.00
- ☐ Certified Mail Restricted Delivery $ $0.00
- ☐ Adult Signature Required $ $0.00
- ☐ Adult Signature Restricted Delivery $

Postage $0.63

Total Postage and Fees $8.13

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47

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FEB MA WORC

02/14/2023

Sent To
HUGHES STEPHEN V JR
40 SYLVAN RD
WALTHAM, MA 02451-2286

Street
City

PS Form 3800 ... Instructions

NARRATIVE

1.0 INTRODUCTION

On behalf of the Town of Franklin Department of Public Works (DPW), BETA Group, Inc. (BETA) is submitting a Notice of Intent (NOI) for the construction of a shared use path and associated roadway improvements along Grove Street in the Town of Franklin, Massachusetts (the Project). This Project is the second phase of a two-phase project that aims to improve the use of Grove Street by motorists, pedestrians, and bicyclists (the Overall Project).

The DPW previously secured $2.2M in funding through a MassWorks grant to improve the Town of Franklin's public infrastructure. This grant, in addition to supplemental local funding, was used to support Phase I of the Overall Project, which received an Order of Conditions from the Franklin Conservation Commission under MassDEP File No. 159-1247 on February 22, 2022. The Overall Project consists of the construction of an approximately 6,000-linear foot shared use path along Grove Street; pavement and roadway geometry improvements; signage improvements; intersection improvements; and upgrades to the existing stormwater management infrastructure. Phase II of the Overall Project, as presented under this NOI, will consist of several activities including the construction of stormwater management improvements; grading; continued construction of the shared use path; and repaving along Grove Street between Tobacco Road and Kenwood Circle.

The following specific activities are proposed as part of the Project (i.e., Phase II) along Grove Street:

- Construction of a shared use path ranging in width from 8 to 10 feet;
- Mill and overlay of pavement;
- Grading and placement of rock fill;
- Creation of a landscaped buffer;
- Improvements to pedestrian signage;
- Installation of stormwater best management practices (BMPs);
- Construction of modular block retaining walls;
- Installation of granite curbing;
- Construction of a wetland replication area;
- Restoration of temporary wetland impacts; and
- Reconstruction of private bituminous driveways.

Work associated with the Project will take place within Areas Subject to Protection and Jurisdiction under the Massachusetts Wetlands Protection Act (M.G.L. ch.131 s.40) and its Regulations at 310 CMR 10.00 (the Act), as well as the Town of Franklin Wetlands Protection Bylaw (Chapter 181), the Town of Franklin Conservation Commission Bylaw (Chapter 271) and its implementing Regulations (collectively "the Bylaw") including Bordering Vegetated Wetland (BVW), Bordering Land Subject to Flooding (BLSF), Riverfront Area (RA), the local 100-foot Buffer Zone Resource Area, and the local/state 100-foot Buffer Zone.

To mitigate for an increase in impervious area within the 100-foot Buffer Zone, all new impervious areas will be graded to drain to the municipal roadway drainage system for treatment and/or discharge to either the infiltration basin constructed as part of Phase I, existing outfalls, or new outfalls. Erosion controls will be maintained throughout the duration of the Project to protect the adjacent Resource Areas. All permanent BVW impacts will be mitigated at a minimum 2:1 ratio, and all temporary BVW impacts will be restored in place.

2.0 Site Description

The Site of proposed Phase II activities is located along the Grove Street right-of-way from its intersection with Tobacco Road to its intersection with Kenwood Circle (Figure 1 – Site Locus). Land uses in the vicinity of the Site generally consist of residential, commercial, and undeveloped parcels. Existing improvements at the Site include a two-lane bituminous roadway, guardrails, municipal drainage infrastructure including catch basins and manholes, and vegetated roadway shoulders.

2.1 Wetland Resource Areas

A Site inspection was conducted by BETA Wetland Scientists on May 13, 2021, to identify and delineate the boundary of existing Resource Areas within and in the immediate vicinity of the Site[1]. Resource Area boundaries were identified and delineated in accordance with the methods developed by the Massachusetts Department of Environmental Protection's *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act*, dated 1995, as well as definitions set forth in the Act and the Bylaw.

State and local jurisdictional Resource Areas identified at the Site consist of Bank, BVW, Land Under Water (LUW), Bordering Land Subject to Flooding (BLSF), and Riverfront Area (RA), while local jurisdictional Resources Areas consist of Isolated Vegetated Wetland (IVW)[2] and the 100-foot Buffer Zone Resource Area. The Resource Area Boundary Delineation Report in Appendix B describes BETA's findings.

2.2 NHESP-Mapped Habitat and Other Sensitive Areas

There are no Natural Heritage and Endangered Species Program (NHESP)-mapped Priority Habitats of Rare Species or Estimated Habitats of Rare Wildlife at the Site. In addition, there are no Areas of Critical Environmental Concern (ACECs), Surface Water Protection Areas (Zones A, B, C), or Outstanding Resource Waters (ORWs). Zone I and Zone II Wellhead Protection Areas[3] encompass portions of the Site (Figure 2 – Environmental Resources). No Interim Wellhead Protection Areas (IWPAs) exist within or near the Site.

In accordance with Section 7.7 of the Franklin Regulations, BETA has identified three (3) Potential Vernal Pools (PVPs) located in proximity of the Project but outside of the limits of work (Figure 2 – Environmental Resources). These PVPs are depicted on MassGIS as PVP #8240 (within the WF1 Series IVW), PVP #8239 (within the WF2 Series BVW), and PVP #8235 (within the WF6 BVW). BETA did not conduct a vernal pool species survey at the time of the delineation; however, typical vernal pool characteristics such as deep ponding, attachment sites, and defined depressions were observed. No Certified Vernal Pools (CVPs) exist at the Site.

The Site is located within the range of the Northern Long-Eared Bat (*Myotis septentrionalis*), a species listed as endangered per the federal Endangered Species Act (ESA). It is anticipated that any ESA coordination will be completed with the application to the U.S. Army Corps of Engineers (USACE) for coverage under the Section 404 Massachusetts General Permit.

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[1] The report in Appendix B also includes Resource Areas that are relevant to Phase II of the Overall Project, but not Phase I.
[2] IVWs are protected under the Bylaw as Freshwater Wetlands.
[3] The onsite Zone II is associated with two (2) public drinking water supply wells located approximately 850 north of the Site, identified as PWS #2101-000-03G and PWS #2101000-13G.

2.3 Buffer Zones

Several portions of Grove Street are constrained by the local 100-foot Buffer Zone to IVW and the state/local 100-foot Buffer Zone to BVW and Bank. Buffer Zone generally consists of the bituminous roadways, vegetated roadway shoulders, and forested areas.

3.0 Work Description

3.1 Work within Jurisdictional Resource Areas

The Project will occur within Resource Areas including the 100-foot Buffer Zone Resource Area[4], BVW, BLSF, and RA.

3.1.1 100-foot Buffer Zone Resource Area – Bylaw Regulations Section 4

Numerous segments of the Project are located within the local 100-foot Buffer Zone Resource Area and include the following proposed activities:

- Installation of erosion control measures;
- Mill and overlay of pavement;
- Installation of granite curbing;
- Construction of portions of the shared use path;
- Installation of modified rockfill along the adjacent slope of the shared use path;
- Creation of a vegetated filter strip;
- Installation of guard rails and retaining walls;
- Reconstruction of a private bituminous driveway; and
- Installation of stormwater BMP's including stormwater outfalls and catch basins.

Work within the 100-foot Buffer Zone Resource Area will result in the following impacts, the majority of which will occur within existing paved areas:

IMPACT TYPE	IMPACTS WITHIN 0 – 25 FEET (SF)	IMPACTS WITHIN 25 – 50 FEET (SF)	IMPACTS WITHIN 50 – 100 FEET (SF)
Mill and overlay of existing pavement, installation of drainage structures within the roadway, and reconstruction of an existing driveway aprons	1,580	11,315	21,515
Construction of an 8 to 10-foot-wide shared use path, retaining walls, and rock filled slope	8,630*	7,410*	7,010*
Widening of Grove Street	40*	1,105*	2,380*
			Total Impacts: 60,985 SF
			Total New Impervious Area: 26,575 SF

[4] Section 4.1.1.: The Town of Franklin considers 100 feet from a defined/delineated resource area as the buffer zone and consequently an additional protected resource.

** Denotes new impervious area*

Exact sequencing of work activities will be determined by the contractor; however, it is anticipated that the Project would be approached as follows:

- Install erosion control measures as discussed in Section 4.1.
- Conduct vegetative clearing required to establish limits of work.
- Perform rough grading for roadway shoulders and the alignment of the shared use path.
- Install drainage infrastructure.
- Place riprap along the roadway shoulders where required and begin stabilization (i.e., seeding) where riprap is not proposed.
- Conduct paving of the shared use path and repaving of the roadway.
- Construct the wetland replication area and complete restoration of temporary wetland impact areas.
- Complete signage and pavement marking improvements.

Any areas of exposed soils following construction will be stabilized with an approved, native seed mixture[5].

3.1.2 Bordering Vegetated Wetlands – 310 CMR 10.55 (4)(b)

Permanent and temporary impacts to BVW are required to construct the Project. Temporary impacts to BVW are associated with the installation of erosion controls and vegetative clearing necessary to install the erosion controls and establish work areas; however, no grubbing is proposed. Temporarily impacted BVW will be restored with a native wetland seed mix.

Permanent impacts to BVW are associated with the construction of a stormwater outfall near Station 47+00 where approximately 3 sf will be impacted by the installation of riprap, and near Station 48+00 where installation of a retaining wall and guardrail will result in fill of 29 sf of BVW.

Replication for the 32 sf of permanently altered BVW is proposed at a 2:1 ratio pursuant to the local Regulations as discussed in Section 5.1.3 of this narrative. Table 2 below provides a summary of BVW impacts.

Table 2. Temporary and Permanent Bordering Vegetated Wetland Impacts

Station Location	Temporary Impacts (sf)	Permanent Impacts (sf)
St. 23+00 to 24+00	62	0
St. 45+ 90 to 47+00	417	0
St. 47+00 to 48+00	813	32
St. 61+75	71	0
Total	**1,363**	**32**

[5] The New England Wetland Plants Erosion Control/Restoration Mix for Dry Sites is an example of a potential seed mix. Species include Red Fescue (Festuca rubra), Canada Wild Rye (Elymus canadensis), Annual Ryegrass (Lolium multiflorum), Perennial Ryegrass (Lolium perenne), Little Bluestem (Schizachyrium scoparium), Indian Grass (Sorghastrum nutans), Switch Grass (Panicum virgatum), and Upland Bentgrass (Agrostis perennans).

3.1.3 Bordering Land Subject to Flooding – 310 CMR 10.57

Temporary and permanent impacts to BLSF total 773 sf. Approximately 168 sf of temporary impact is proposed near Station 20+75. Temporary impacts at this location include installation of erosion controls, grading, and vegetative clearing. Permanent impacts at this location include the installation of riprap associated with the construction of a stormwater outfall. In addition, approximately 605 sf of impact is proposed near Station 23+50. Temporary impacts at this location include installation of erosion controls, grading, and vegetative clearing. Permanent impacts include construction of a riprap slope along the roadway. All temporarily impacted floodplain will be restored with an approved, native seed mixture. Any grade changes will be mitigated through the establishment of compensatory flood storage.

3.1.4 Riverfront Area – 310 CMR 10.58

A total of 74,612 sf of RA is present at the Site, 40,361 sf of which consists of areas previously degraded by the existing paved roadway and hard-packed gravel shoulders.

Temporary and permanent impacts are proposed within RA from Station 18+50 to Station 27+25 and from Station 45+ 00 to Station 49+00. Work proposed within previously degraded areas includes pavement mill and overlay and portions of the proposed shared use path. Near Station 22+50, an approximately 344 sf section of existing pavement is proposed to be loamed and seeded.

The remaining 34,251 sf of impacts consists of non-degraded RA, of which 14,494 sf will be permanently impacted through the construction of the shared use path, installation of rock fill along the side slope downgradient of the shared use path, installation of retaining walls, installation of guard rails, and construction of stormwater BMP’s. Temporarily impacted RA is associated with the installation of erosion controls, vegetation clearing, and grading. All temporarily impacted areas will be restored within loam and seed upon completion of construction.

3.2 Work in Buffer Zones

Proposed work within Buffer Zone mirrors that which is described above in Section 3.1.1.

4.0 Mitigation Measures

4.1 Erosion and Sedimentation Controls

Erosion and sediment control best management practices (BMPs) will be employed in order to protect the adjacent Resource Areas.

Compost filter tubes of at least a 12-inch diameter will be placed along the limits of work within Buffer Zone and to ensure protection of the downgradient Resource Areas. Any stockpiles of soils or materials placed within Jurisdictional Areas will be underlain by plastic sheeting and surrounded by erosion controls. Following the completion of the project, erosion controls will be removed, and any exposed soils will be seeded with the approved, native seed mixture. Any catch basins along the limits of work will be fitted with silt sacs to ensure that loose sediment does not enter the municipal drainage system.

In order to construct the retaining wall along the WF8 Series BVW, water control is anticipated to be required due to consistent ponding present within this BVW. As depicted on the Dewatering Plan included in Appendix D, a work area will be isolated with sheeting surrounding by a floating silt curtain in order to prevent migration of sediment. The work area will be pumped dry, and water will be discharged to a sediment filtering bag situated within an upland area. It is anticipated that the Conservation Agent will review the dewatering setup in the field.

4.2 Stormwater Management

According to the Massachusetts Stormwater Management Standards (310 CMR 10.05(6)(k-q) – the Standards), the portion of the proposed work involving mill and overlay of Grove Street is considered a Redevelopment Project. Redevelopment projects are required to meet the Standards 1 and 7 through 10 fully and Standards 2 through 6 only to the maximum extent practicable but must at least improve existing conditions. 310 CMR 10.05(6)(m)6. also states that footpaths (i.e., the proposed shared use path) are only subject to the Massachusetts Stormwater Management Standards to the extent practicable.

A Stormwater Report detailed the Project's approach to stormwater management is included in Appendix C.

4.3 Wetland Replication and Restoration

Wetland replication totaling 66 sf will be provided to mitigate the proposed 32 sf of permanent impact to BVW. A wetland replication plan is provided with the Project Plans in Appendix D.

Generally, sequencing of the replication area construction will consist of the following:

i. Erosion controls consisting of compost filter tubes will be installed along the existing wetland boundary where replication is proposed.

ii. Machinery will be staged within the existing roadway to conduct the required grading. It is anticipated that final grade for the replication area will be approximately one (1) foot lower than existing conditions; however, target grades will be established in the field by a Wetland Scientist.

iii. Once the target grade is established, the replication area will be over excavated by one (1) foot and backfilled with hydric soils from the impacted wetland. Should stockpiling hydric soils not be feasible, a mix of half clean loam and half compost will be created onsite under the supervision of the Wetland Scientist and placed within the replication area.

iv. The replication area shall be seeded and planted as described on the plan in Appendix D. Application of clean straw mulch may be required for interim stabilization.

v. The wetland replication area will be monitored to ensure compliance with the BVW General Performance Standards over the course of two (2) growing seasons.

In addition to wetland replication providing mitigation for permanent BVW impacts, all temporary BVW impacts will be restored in place. This will consist of scarifying and loosening underlying soils and applying a native wetland seed mix. Clean straw mulch will be applied for interim stabilization and erosion controls will remain in place until stabilization is achieved.

4.4 Undisturbed Buffer Zone Restoration

Impacts to undisturbed portions of Buffer Zone will be required to construct the Project. As mitigation, all disturbed areas will be seeded with a native seed mixture and returned to existing grade. Although woody plantings were considered, it was determined to be inconsistent with the Project purpose due to potential sight line issues.

In addition to the use of a native seed mix, the proposed stormwater management improvements are anticipated to provide a benefit to the Buffer Zone. Areas where roadway runoff previously flowed off of the roadway shoulders with no treatment will now be directed to catch basins and proprietary treatment units. This will improve water quality of runoff within the Buffer Zone and reduce the likelihood of continued erosion and scour that is currently present along Grove Street under existing conditions.

4.5 Avoid / Minimize / Mitigate

The Avoid / Minimize / Mitigate sequencing was followed to ensure that wetland impacts would be avoided and minimized to the extent practicable. Avoiding wetland impacts entirely was determined infeasible early in the design stages due to the limited right-of-way present and the need to isolate the shared use path from the roadway travel lanes for safety.

During the early design stages, it was determined that the Project would result in over 500 sf of impacts to BVW resulting from the construction of the shared use path. Although not preferable from a roadway design perspective, the shared use path was reconfigured to incorporate narrower sections where adjacent to Resource Areas to limit impacts. In addition, a retaining wall was proposed to minimize grading, further reducing BVW impacts. The currently proposed BVW impacts (32 sf) represent a fraction of the impacts proposed under the original design.

Mitigation for unavoidable impacts is being provided through wetland replication as discussed above in Section 4.3. All temporary wetland impacts will also be restored in place.

5.0 Regulatory Compliance

The Project is anticipated to support the interests of the Act and comply with the Bylaw requirements for work within the 100-foot Buffer Zone Resource Area.

5.1 Massachusetts Wetlands Protection Act and Regulations

5.1.1 Limited Project Provisions – 310 CMR 10.53(6)

Construction of the shared use path within RA is eligible to be treated as a limited project pursuant to 10.53(6)[6]. The Project was designed so that construction of the shared use path would not result in direct impacts to Resource Areas other than RA, with the exception of the unavoidable 32 sf in BVW impacts. The shared use path within RA is variable in width from 8 to 10 feet. The width of the path was reduced to 8 feet where crossing over culverts to prevent impacts to other Resource Areas, and portions of the path that are 10 feet in width are partially within previously altered areas that are currently paved or otherwise degraded.

5.1.2 Bordering Vegetated Wetlands General Performance Standards – 310 CMR 10.55 (4)(b)

The Project proposes 32 sf of BVW impact to the WF8 Series BVW. In accordance with 310 CMR 10.55(4)(B), loss of up to 5,000 sf of BVW is allowable when the lost area is replaced in accordance with the General Performance Standards 1 through 7 as presented below. A Functions and Values Assessment has been completed for the WF8 Series per Section 7.14.2 of the Bylaw Regulations (Appendix A).

1. Replication of the lost area is proposed at a 2:1 ratio in accordance with Section 7.14 of the Town Regulations. The Project will provide 66 sf of replication for 32 sf of lost area within the WF8 Series BVW.

[6] 310 CMR 10.53(6) Notwithstanding the provisions of 310 CMR 10.58, the Issuing Authority may issue an Order of Conditions permitting as a limited project the construction, rehabilitation, and maintenance of footpaths, bikepaths, and other pedestrian or nonmotorized vehicle access to or along riverfront areas but outside other resource areas, provided that adverse impacts from the work are minimized and that the design specifications are commensurate with the projected use and are compatible with the character of the riverfront area. Generally, the width of the access shall not exceed ten feet of pavement, except within an area that is already altered (e.g., railroad beds within rights of way). Access shall not be located in vernal pools or fenced in a manner which would impede the movement of wildlife.

2. The replication area is proposed in the same vicinity of the lost area and grading will be conducted to match the elevation of the lost area. A Wetland Scientist will oversee grading to ensure that target elevations are achieved.
3. The horizontal configuration of the replication area in relation to the Bank will be similar to that of the lost area, i.e., it will be located along the same wetland (WF8 Series BVW) and along the same end of the adjacent culvert.
4. The replication area is located on the same side of the adjacent culvert as the lost area; therefore, no hydraulic restrictions will be present.
5. The replication area is proposed within the same reach of the stream that provides hydrology to the WF8 Series BVW.
6. Once completed, the replication area will be monitored over the course of two growing seasons to ensure at least 75% of the replication area is vegetated with native species.
7. The replication area is consistent with all other General Performance Standards for each resource area in Part III of 310 CMR 10.00.

Therefore, the Project complies with all BVW Performance Standards.

5.1.3 Bordering Land Subject to Flooding – 310 CMR 10.57(4)(a)

The 773 sf of impacts proposed within BLSF will not result in a loss of flood storage volume and will therefore meet the performance standards at 310 CMR 10.57(4)(a)(1 through 3). Through the grading of compensatory storage at elevation-by-elevation increments, work conducted within BLSF will not restrict flow, increase flood stage, or increase peak runoff flows or volume. A Floodplain Impact Volume table is provided on sheet 21 of the attached Project plans (Appendix D). Due to proposed impacts to areas of BLSF presumed valuable to wildlife habitat totaling less than 5,000 sf, a Wildlife Habitat Evaluation is not required.

Therefore, the Project complies with all BLSF Performance Standards.

5.1.4 Riverfront Area – Performance Standards – 310 CMR 10.58 (4)

The Project is subject to the Limited Project provisions of 310 CMR 10.53(6); therefore, strict compliance with RA Performance Standards is not required. However, an Alternatives Analysis prepared in compliance with 310 CMR 10.58(4)(c)(2) has been provided in Section 6 of this narrative documenting that there is no practicable alternative to the proposed Project that would have less adverse effects on wetland interests provided by the RA. As a Limited Project, efforts including the restoration of temporary impacts with a native seed mix have been made to limit impacts to non-degraded RA. Areas where the Project will encroach into non-degraded 100-foot Inner Riparian Zones currently do not provide the full 100 feet of undisturbed vegetation under existing conditions. Vegetative cover within RA will be maintained to the maximum extent practicable.

The Project also includes previously developed areas within RA which meet the definition of degraded areas. Per 310 CMR 10.58(5):

> *"A previously developed riverfront area contains areas degraded prior to August 7, 1996 by impervious surfaces from existing structures or pavement, absence of topsoil, junkyards, or abandoned dumping grounds".*

Previously developed areas at the Site include impervious surfaces associated with the existing paved Grove Street right-of-way and the absence of topsoil associated with gravel shoulders. The following is a summary of the Project as it relates to the criteria of 310 CMR 10.58(5):

(a) Proposed work will improve the management of runoff over existing conditions with the installation of new stormwater BMPs. In areas where new impervious surface is proposed, pavement will be graded to drain to the municipal roadway drainage system for treatment and/or discharge to a stabilized area.

(b) The Project was designed to meet the Massachusetts Stormwater Management Standards to the maximum extent practicable as a Redevelopment and pedestrian path project (Appendix C).

(c) Within the 200-foot Riverfront Area, portions of the proposed work inside previously developed area will be closer to Mine Brook and its tributaries than existing conditions. These encroachments are associated with the shared use path and therefore subject to the Limited Project provisions of 310 CMR 10.53(6).

(d) Portions of the work are proposed outside of existing degraded RA. These encroachments are associated with the shared use path and therefore subject to the Limited Project provisions of 310 CMR 10.53(6).

(e) The Project will result in the creation of new degraded areas. These encroachments are associated with the shared use path and therefore subject to the Limited Project provisions of 310 CMR 10.53(6).

(f) Restoration of onsite degraded Riverfront Area is not proposed.

(g) Mitigation for work within previously degraded RA is proposed through the installation of stormwater BMPs and restoration of temporarily impacted areas with a native seed mix.

5.2 TOWN OF FRANKLIN WETLANDS PROTECTION BYLAW AND REGULATIONS

The Bylaw Regulations set forth specific Performance Standards for work within the Buffer Zone Resource Area.

5.2.1 0 TO 25-FOOT BUFFER ZONE RESOURCE AREA

Section 4.2 of the Bylaw Regulations states that no work or disturbance including grading activities shall occur within the 0- to 25-foot Buffer Zone Resource Area. Onsite Buffer Zone Resource Area consists of a mix of both degraded and non-degraded areas. Where work required to construct the Project is proposed within the 0- to 25-foot Buffer Zone Resource Area due to existing right-of-way constraints, a Variance is requested pursuant to Section 5 of the Bylaw Regulations. A Variance request is included in Section 7.0 of this NOI. Erosion controls are proposed to protect downgradient BVW and Bank in these areas and all temporary impacts will be restored in place with a native seed mix.

5.2.2 25 TO 50-FOOT BUFFER ZONE RESOURCE AREA

Section 4.3 of the Bylaw Regulations states that alteration within the 25- to 50-foot Buffer Zone Resource Area is limited to grading, tree clearing, installation of stormwater management system components, and other low impact uses. Work within this Resource Area is generally within existing developed area and includes grading, vegetative clearing, and installation of stormwater BMPs. However, the Project requires construction of portions of the shared use path within this Resource Area due to existing right-of-way constraints; therefore, a Variance is requested pursuant to Section 5 of the Bylaw Regulations for the construction of a shared use path within the 25-to 50-foot Buffer Zone Resource Area. A Variance request is included in Section 7.0 of this NOI.

5.2.3 50 TO 100-FOOT BUFFER ZONE RESOURCE AREA

Section 4.4 of the Bylaw Regulations states that work on slopes in excess of 10% within the 50 to 100-foot Buffer Zone Resource Area may be subject to additional mitigation requirements as deemed necessary by the Commission. It is BETA's opinion that additional mitigation for the riprap slopes is not warranted, as runoff from developed away will be graded away from the slopes and directed to the municipal drainage system. In addition, any temporarily impacted areas surrounding these slopes will be stabilized with a native seed mix.

5.2.4 FUNCTIONS AND CHARACTERISTICS STATEMENT

In accordance with Section 7.13 of the Bylaw Regulations, the following summary of the Project's potential effects on Resource Area functions and characteristics is provided for the Commission's review:

Public Water Supplies

Two (2) public water supply wells are located within the vicinity of the Site. Accordingly, the Project is located within a Zone II Wellhead Protection Area and will treat the required water quality volume accordingly. The proposed stormwater BMPs will treat and direct runoff back into the groundwater aquifer associated with these public wells. Therefore, this function is upheld.

Private Water Supplies

There are no known private wells in the area – this function is not applicable.

Groundwater

Groundwater recharge will be accomplished through the discharge of stormwater to vegetated areas following treatment. In addition, the southern portions of the Project will discharge to the infiltration basin approved under the Phase I NOI. Therefore, this function is upheld.

Flood Control

The Project will not result in the reduction of flood storage volume within wetlands or the 100-year floodplain. Therefore, this function is upheld.

Erosion and Sedimentation

As discussed in Section 4.1 of this NOI, erosion control measures consisting of compost filter tubes and catch basin inlet protection will be implemented during construction. Following construction, all areas of exposed soil will be stabilized with the approved seed mixture. These measures are anticipated to be adequate in preventing construction-period erosion and sedimentation and support the Buffer Zone Resource Area's ability to provide this function in the future. Therefore, this function is upheld.

Storm Damage Prevention

Any runoff generated from new impervious areas will be directed to stormwater management BMPs, and temporarily impacted areas will be vegetated with herbaceous vegetation. Therefore, the Resource Area's ability to function as a means of storm damage prevention is upheld.

Water Quality

The erosion and sedimentation controls described in Section 4.1 will prevent negative impacts to water quality during construction. Following completion of the Project, the new stormwater BMPs will provide treatment of currently untreated stormwater runoff. Therefore, good water quality will be upheld by the Project.

Fisheries

There are no Resource Areas known to be functioning as fisheries at the Site – this function is not applicable.

Wildlife Habitat

Work will occur primarily within existing pavement and roadway shoulders consisting of disturbed herbaceous vegetation. Any clearing of vegetation will be mitigated through the application of loam and a native seed mix. Therefore, it is anticipated that wildlife habitat will be maintained.

Rare Species Habitat

There are no known rare species present at the Site – this function is not applicable.

Agriculture

There are no known agricultural operations at the Site – this function is not applicable.

Recreation

The Project will serve to provide both improved mediums of transportation and provide a safer corridor for recreational activities such as walking and bicycling. By implementing the mitigation measures discussed in this NOI, this opportunity for public recreation will be accomplished while limiting impacts to Resource Areas. Therefore, this function is upheld.

6.0 Alternatives Analysis

As required by the General Performance Standards for RA at 310 CMR 10.58(4)(c)(1-3), there must be no practicable and substantially equivalent economic alternative to the proposed project with less adverse effects on the interests identified in M.G.L. c. 131 § 40[7]. An alternative is practicable and substantially equivalent economically if it is available and capable of being done after taking into consideration costs, existing technology, proposed use, and logistics in light of overall project purposes. Available and capable of being done means the alternative is obtainable and feasible.[8]

This alternatives analysis is also being completed pursuant to Section 7.13.1 of the local Regulations that requires an alternatives analysis narrative in compliance with the requirements as presented in 310 CMR 10.58 (4) for certain project types. This Project requires an alternatives analysis pursuant to the local Regulations as work is within RA and wetland impacts are proposed.

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[7] The eight interests of M.G.L. c. 131 § 40 include the protection of private and public water supply; protection of ground water; flood control; prevention of storm damage; prevention of pollution; protection of land containing shellfish; protection of wildlife habitat; and the protection of fisheries.

[8] 310 CMR 10.58(4)(c)(1) Definition of Practicable

6.1 Scope and Evaluation of Alternatives

6.1.1 Project Purpose

The purpose of the Project is for the DPW to improve the Town of Franklin's public infrastructure by constructing a shared use path along Grove Street and improve existing roadway and stormwater management infrastructure. The Project will result in a safe and effective alternative means of transportation connecting a residential part of Franklin to the town's center and a state forest while upgrading important infrastructure along Grove Street.

6.1.2 Scope of Alternatives

According to 310 CMR 10.58(4)(c)(2), the scope of alternatives to consider shall be commensurate with the type and scope of the project. The issuing authority shall presume that alternatives beyond the scope are not practicable and therefore need not be considered. For this Project, the area under consideration for practicable alternatives extends to the original parcels, any adjacent parcels, and any other land which can reasonably be obtained within the municipality for activities conducted by municipal government.

For adjacent lots if practicable, "reasonably be obtained" means to purchase at market prices. For other land, "reasonably be obtained" means adequate in size to accommodate the project purpose and listed for sale at the time of filing the Notice of Intent.

6.1.3 Evaluation of Alternatives

The Applicant is required to submit information to describe sites and the work both for a proposed location and alternative site locations and configurations sufficient for a No Significant Adverse Impact determination by the issuing authority. The level of detail of information shall be commensurate with the scope of the project and the practicability of alternatives. If siting of a project entirely outside the riverfront area is not practicable, the alternatives shall be evaluated to locate the project as far as possible from the river.[9]

Based on the Evaluation of Alternatives presented herein, it has been determined that no practicable and substantially equivalent economic alternative to the current design of the Project exists that meets the Project Purpose with less adverse effects on the interests identified in M.G.L. c. 131 § 40.

6.2 Project Alternatives

During the design phase of the Project, alternatives were considered in development of the shared use path. Given the overlap of Riverfront Area impacts and BVW impacts, Project alternatives for both Resource Areas were reviewed together.

The alternatives for this Project were analyzed based on the following evaluation criteria: Impacts to inland Resource Areas; Impacts to rare species and unique wildlife habitat; Ability to meet the Project goals; Construction, maintenance, and cost; and resiliency.

6.2.1 No-Build Alternative

A No-Build scenario would result in no impacts to wetlands and would not require vegetative clearing. Although the No-Build alternative would be cost-effective, it would require pedestrians, cyclists, and other users to use roadway shoulders and inadequately marked intersections for travel which results in safety concerns. Pedestrian improvements are especially important along Grove Street as the Franklin Town

[9] 310 CMR 10.58(4)(c)(3) Evaluation of Alternatives

Forest borders multiple portions of Grove Street, and the Southern New England Trunkline Trail (SNNE Trunkline Trail) crosses Grove Street between Stations 22+00 and 23+00. The No-Build scenario also would necessitate the continued use of aging roadway infrastructure and stormwater controls, increasing risks of their eventual failure. Accordingly, this scenario does not achieve the Project's goal of improving safety and infrastructure.

6.2.2 Shared Use Path Design Alternatives

Alternatives to the proposed design of the shared use path and materials used to construct the path were considered. Considerations included

1. Option 1 – A reduced path width generally less than 8 to 10 feet; and
2. Option 2 – An unpaved shared use path instead of the currently proposed hot mixed asphalt (HMA) path.

Reduction of the shared use path width as considered with Option 1 would reduce overall Project cost as less materials and permitting would be necessary. Additionally, a reduced path width would reduce Resource Area impacts BVW and RA; however, it would also reduce the usability of the path for alternative means of transportation, which conflicts with the Project purpose. Reduction of the width of the path would not provide enough passing room for pedestrians and cyclists traveling concurrently. Incorporating adequate space for both pedestrians and cyclists is especially important given that the SSNE Trunkline Trail bisects Grove Street within the Project area and is anticipated to result in significant shared use path use by pedestrians.

Use of pervious materials for the shared use path as considered with Option 2 would reduce the amount of impervious surface within Riverfront Area, but it would not reduce impacts to the BVW. Although impervious surface would be reduced, an unpaved pathway would be more difficult to maintain, would not be as accessible, and would eventually become compacted like a paved surface. Use of a pervious asphalt or similar material would be costly to install and difficult to maintain long-term.

6.2.3 Findings

Based on the Alternatives Analysis presented herein, it has been determined that no practicable and substantially equivalent economic alternative to the current design of the Project exists that meets the Project Purpose with less adverse effects on the interests identified in M.G.L. c. 131 § 40.

7.0 Variance Request

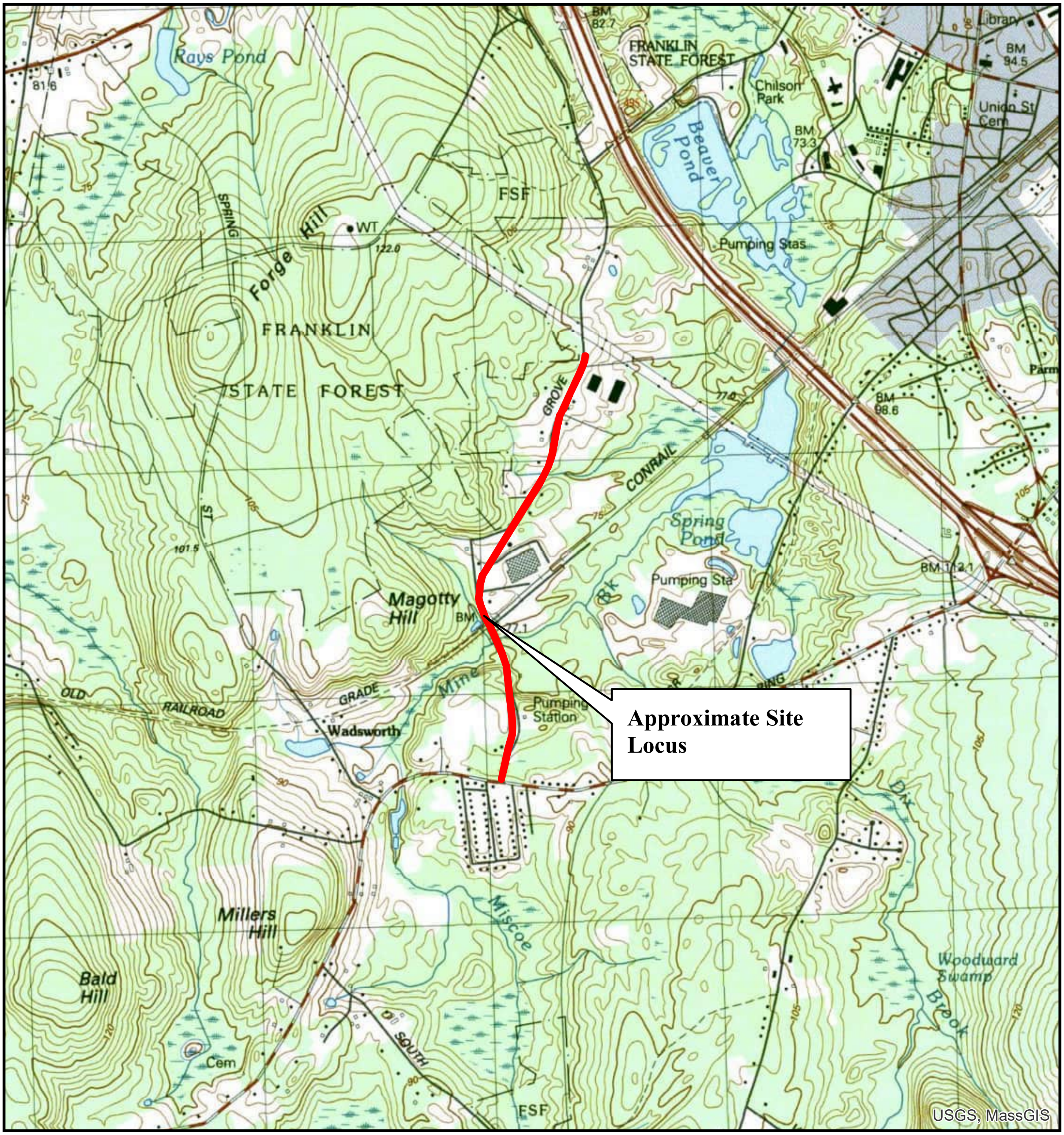
Pursuant to Section 5 of the Bylaw Regulations, the DPW respectfully requests a Variance from the Buffer Zone Resource Area Performance Standards. Strict enforcement of the 0- to 25-foot and 25- to 50-foot Buffer Zones Resource Area Performance Standards would result in a hardship by rendering the Project as non-constructible. Due to the existing right-of-way constraints associated with Grove Street, the locations of the shared use path and other roadway improvements are limited to either side of the roadway. Wetland resource areas are present along several portions of the roadway, directly abutting existing infrastructure. Through the design phase of the Project, Resource Area impacts have been avoided where possible. Where impacts are required, they have been minimized through the use of erosion controls, retaining walls, and reduced shared use path width. Mitigation for unavoidable impacts includes stormwater management system improvements, wetland replication and restoration, and restoration of temporarily impacted Buffer Zone Resource Area.

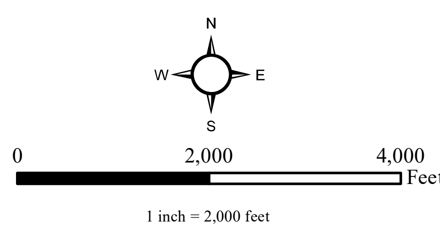
8.0 SUMMARY

The Project will result in substantial improvements to a transportation corridor within the Town of Franklin and offer a safer means of non-motorized travel. Erosion control measures and stormwater management BMPs are anticipated to mitigate for an increase in impervious areas, and wetland replication and restoration will be provided where impacts are required.

The Project Team feels the Commission has sufficient information to describe the Site, the work, and the effect of the work on the interests identified in the Act and the Bylaw. This NOI respectfully requests the issuance of an Order of Conditions approving the Project.

Figures





IMPROVING COMMUNITIES TOGETHER

Figure 1
Site Locus
Proposed Roadway Improvements
Franklin, MA

Data Source: MassGIS USGS Topographic Quadrangle Images (2001)

Figure 2
Environmental Resources Map
Proposed Roadway Improvements
Franklin, MA

Wetland Resources Legend

- MassDEP Hydrologic Feature
- Marsh/Bog
- Wooded marsh
- Open Water
- NFHL 100 Year Flood Zone
- Area of Critical Environmental Concern (ACEC)
- Zone A
- Zone B
- Outstanding Resource Water
- MassDEP IWPA
- MassDEP Zone I
- MassDEP Zone II

Mapped Habitat Legend

- NHESP Potential Vernal Pool
- NHESP Certified Vernal Pool
- NHESP Priority Habitat of Rare Species
- NHESP Estimated Habitats of Rare Wildlife

N E S W

0 500 1,000 Feet

1 inch = 500 feet

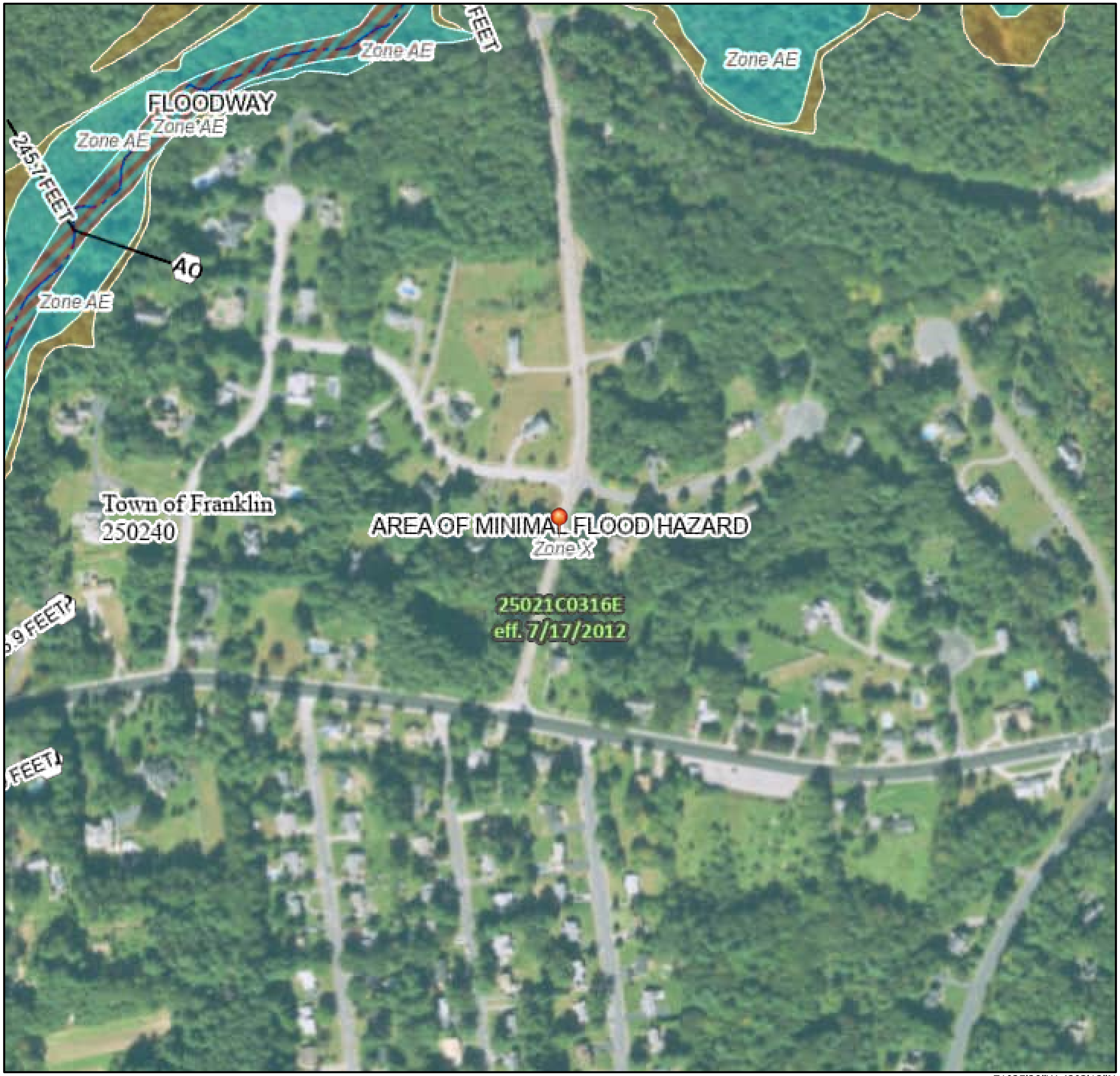
Data Source: MassGIS USGS Color Ortho Imagery (2014), MassDEP Wetlands (1:12000) (2009), NHESP Potential Vernal Pools (2000), NHESP Certified Vernal Pools, NHESP Priority Habitats of Rare Species (2008), NHESP Estimated Habitats of Rare Species (2008), Areas of Critical Environmental Concern (2009), FEMA National Flood Hazard Layer (2014),

BETA
IMPROVING COMMUNITIES TOGETHER

National Flood Hazard Layer FIRMette

FEMA

71°25'57"W 42°3'39"N



71°25'20"W 42°3'12"N

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

1:6,000

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

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

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National Flood Hazard Layer FIRMette

FEMA

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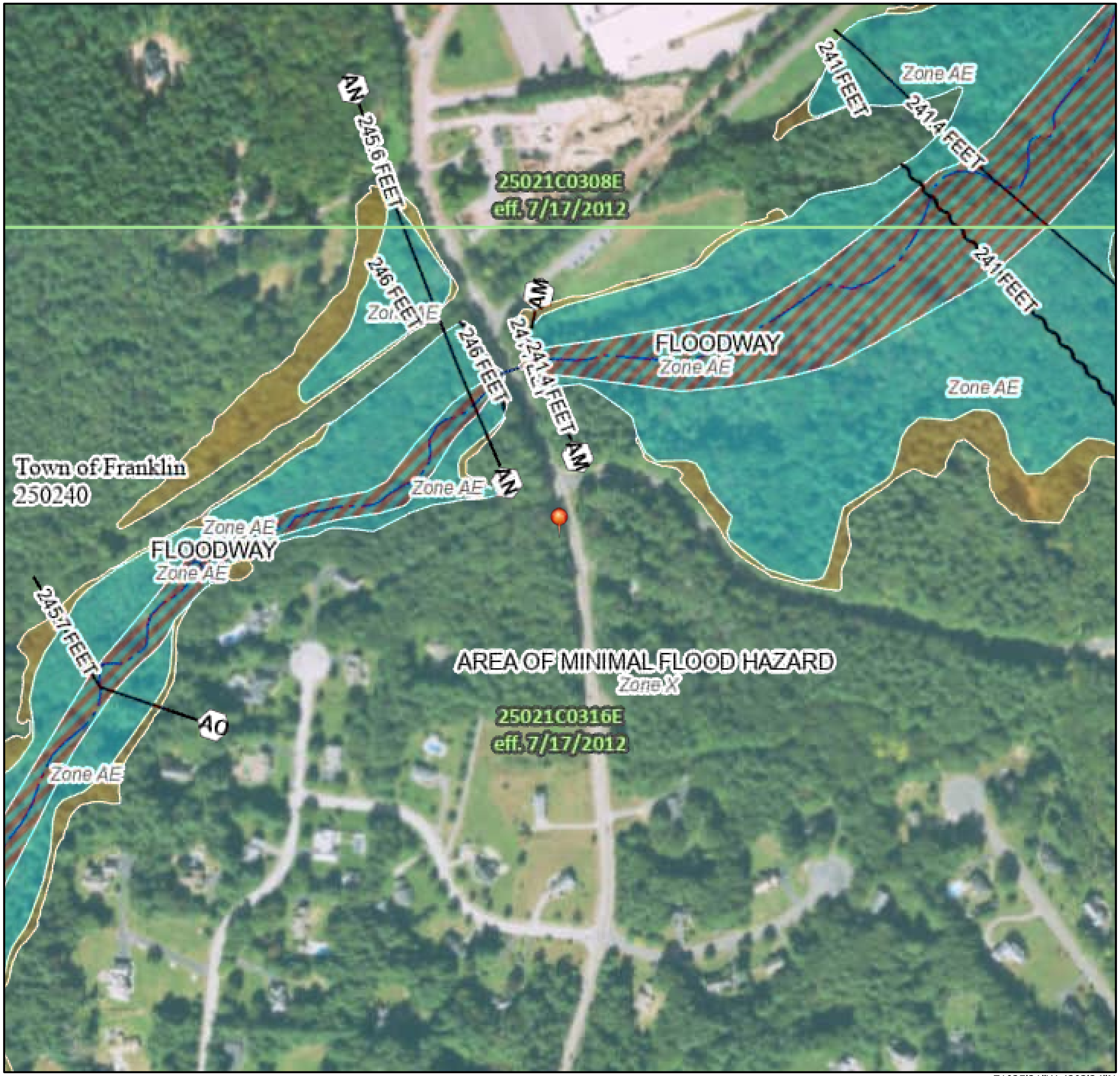

0 250 500 1,000 1,500 2,000 Feet

1:6,000

71°25'21"W 42°3'24"N

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

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

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National Flood Hazard Layer FIRMette

FEMA

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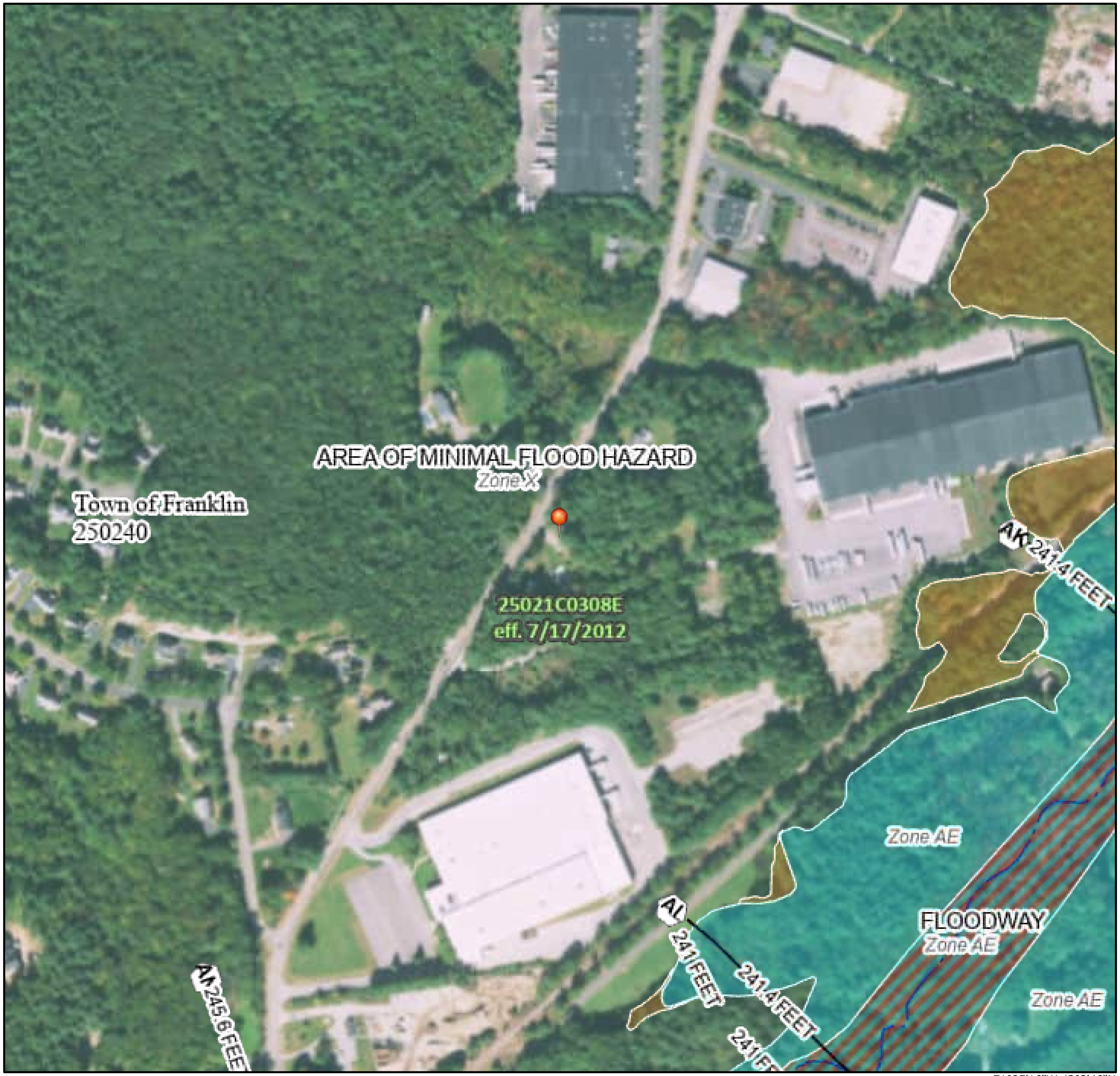

71°25'16"W 42°3'46"N

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

1:6,000

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

Legend

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

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS

- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES

- B 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/12/2021 at 4:44 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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National Flood Hazard Layer FIRMette

FEMA

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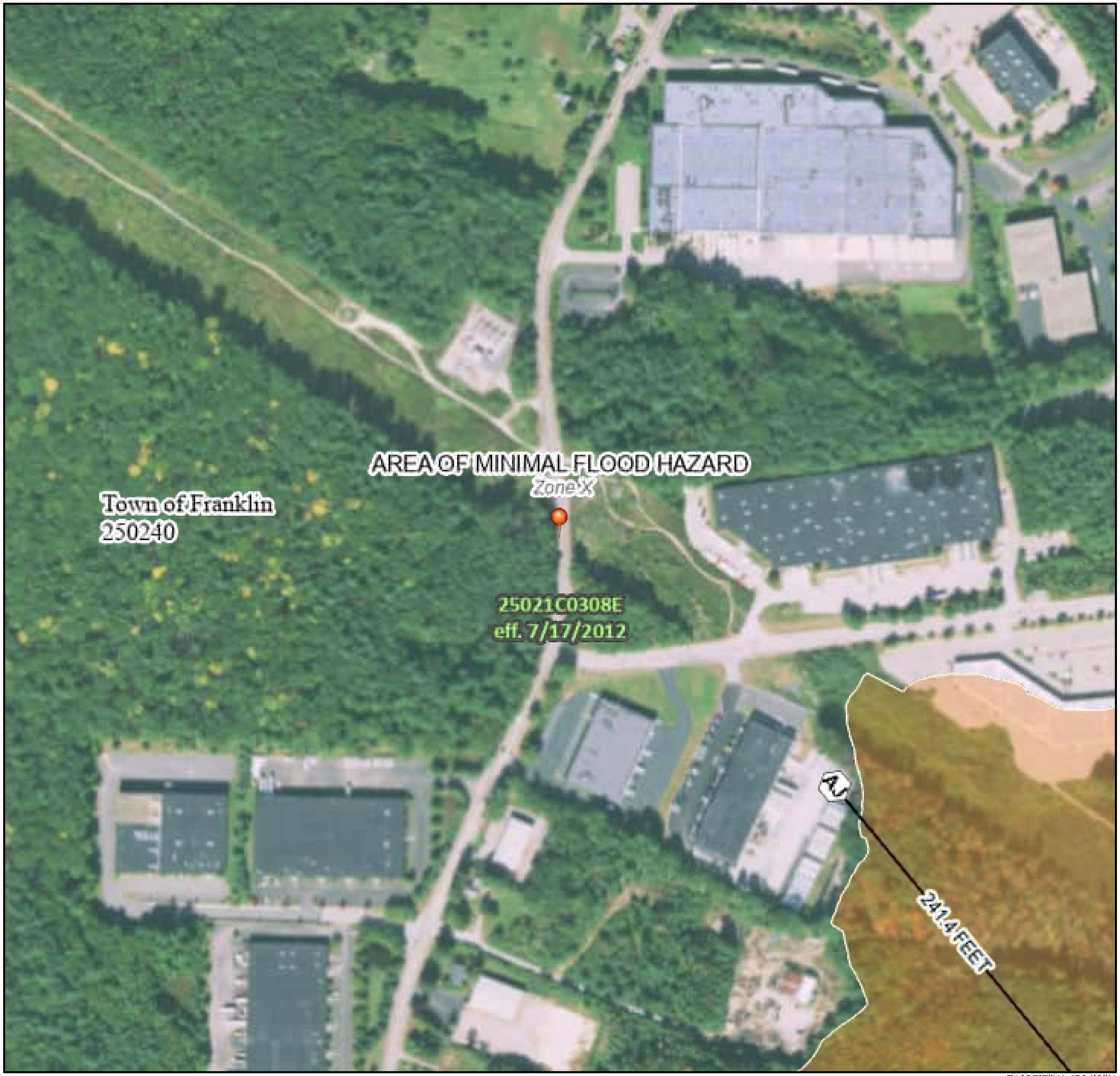

71°25'5"W 42°4'9"N

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

1:6,000

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

Legend

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

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

N

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

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

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Photographic Documentation

Photo 1

View of the WF1 Series IVW—facing west.

Photo 2

View of the interior of the WF2 Series BVW—facing southeast.

PHOTOGRAPHIC DOCUMENTATION

Grove Street

Franklin, Massachusetts

Photographs Documented 05.13.2021

Photo 3

View of the WF3 Series BVW and adjacent public well pump house—facing northeast.

Photo 4

View of Mine Brook, taken from Grove Street—facing east.

Photo 5

View of the culvert carrying Mine Brook, taken from the east side of Grove Street—facing west.

Photo 6

View of Mine Brook, taken from Grove Street—facing west.

PHOTOGRAPHIC DOCUMENTATION

Grove Street

Franklin, Massachusetts

Photographs Documented 05.13.2021

Photo 7

View of the WF6 Series BVW; note the sediment deposition in the foreground—facing west.

Photo 8

View of the unnamed tributary to Mine Brook flowing through a culvert under the Southern New England Trunkline Trail—facing northeast.

Photo 9

View of the unnamed tributary to Mine Brook, north of the Southern New England Trunkline Trail—facing north.

Photo 10

View of cinnamon fern (*Osmundastrum cinnamomeum*) within the WF7 Series IVW—facing west.

Photo 11

View of a forested portion of the WF8 Series BVW—facing west.

Photo 12

View of the unnamed perennial stream connecting the WF8 and WF9 Series BVWs at the east side of Grove Street; note the damaged infrastructure—facing east.

Photo 13

Typical view of a maintained stormwater basin at the northern end of the Site (157/161 Grove Street)—facing south.

Photo 14

View of an unmaintained stormwater basin (WF11 Series IVW) at the northern end of the Site (157/161 Grove Street)—facing west.

Photo 15

View of a small pocket IVW (WF10 Series) formed from roadway stormwater runoff—facing east.

APPENDIX A – Functions and Values Form

Wetland Function-Value Evaluation Form

Total area of wetland________ Human made?_______ Is wetland part of a wildlife corridor?_________ or a "habitat island"?_________

Adjacent land use Roadway Distance to nearest roadway or other development 10 feet

Dominant wetland systems present__________ Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system?__________ If not, where does the wetland lie in the drainage basin?__________

How many tributaries contribute to the wetland? one Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. WF8 Series

Latitude__________ Longitude__________

Prepared by: BETA Date January 2023

Wetland Impact:
Type__________ Area__________

Evaluation based on:
Office X Field X

Corps manual wetland delineation completed? Y_____ N X

Function/Value	Suitability Y / N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	Y	13,15		
Floodflow Alteration	Y	3,5,9,10		Adjacent to road, able to contain flood water runnoff from road to control flooding
Fish and Shellfish Habitat	N			
Sediment/Toxicant Retention	Y	1,2,3,5		Primarily receives water from Grove Street, with high potential for sediment and toxicants. Retains water, no outlet.
Nutrient Removal	Y	3,4,5,9,10		Possibility for sediment retention. Ponding exists in this wetland. Plentiful vegetation to utilize nutrients.
Production Export	Y	7,11		
Sediment/Shoreline Stabilization	Y	2,3,15		Herbaceous vegetation present to capture siltation from flood events
Wildlife Habitat	Y	1,6,11,19		Provides habitat for wetland species where little other habitat is present
Recreation	Y	5		Retains ability to provide valuable wildlife habitat
Educational/Scientific Value	Y	5		Retains ability to provide valuable wildlife habitat
Uniqueness/Heritage	Y	1,5, 6		
Visual Quality/Aesthetics	Y	6,8,12		Most of the wetland is visible from the road. Diversity of habitats creates nice backdrop.
ES Endangered Species Habitat	N			
Other	N			

Notes:

* Refer to backup list of numbered considerations.

APPENDIX B – Resource Area Boundary Delineation Report

Resource Area Boundary Delineation
Grove Street
Franklin, Massachusetts

January 4, 2021

On May 13, 2021, BETA Group, Inc. (BETA) conducted resource area boundary delineations along a portion of the Grove Street public right-of-way in Franklin, Massachusetts. This report describes resource areas Subject to Protection under the Massachusetts Wetlands Protection Act (M.G.L. Chapter 131 Section 40) (the Act), the federal Clean Water Act (33 U.S.C. §1251 et seq (1972)), the Massachusetts Clean Waters Act (MGL Chapter 21 Section 26-53), and the Town of Franklin Wetlands Protection Bylaw (Chapter 181) (the Bylaw) that exist on the site and methodology used to delineate their boundaries.

Site Description

The Site consists of an approximately 6,500-linear foot portion of the Grove Street public right-of-way in Franklin, Massachusetts, from its intersection with Washington Street to its intersection with Kenwood Circle. Land uses along the Site corridor generally consist of residential and commercial parcels. In addition, the Franklin State Forest abuts portions of the west side of the Site and Town of Franklin public water supply wells exist to the east of the Site (Figure 1 – Site Locus). The Site is bisected by Mine Brook (Figure 2 – Environmental Resources) as well as the Southern New England Trunkline Trail (SNETT), an improved but unpaved multi-use path. Existing improvements at the Site include a two-lane bituminous roadway, guardrails, stormwater management infrastructure, and vegetated roadway shoulders.

According to the USDA Natural Resources Conservation Service – Soil Survey, mapped soils on the Site and in the vicinity of the Site are classified as Udorthents-sandy, Urban land, Merrimac fine sandy loam, Sudbury fine sandy loam, Hinckley loamy sand, Hollis-Rock outcrop-Charlton complex, Carlton-Hollis-Rock outcrop complex, Whitman fine sandy loam, Ridgebury fine sandy loam, Swansea muck, and Scarboro/Birdsall soils. Our field work generally confirmed the soil types within the Site. The *Custom Soil Resource Report for Norfolk and Suffolk Counties, Massachusetts* is attached.

State jurisdictional resource areas identified on the Site include Bank (to perennial and intermittent streams), Bordering Vegetated Wetlands (BVW), Land Under Water (LUW), Bordering Land Subject to Flooding (BLSF), and Riverfront Area (RA). The MassGIS database was used as the initial step in identifying critical areas on or within proximity to the Site that would be examined more closely if construction activities are proposed. The table below describes selected environmentally critical categories as determined through MassGIS.

Table 1: Selected MassGIS Environmental Data Layers

Mapped Resource On or Within Proximity to Site	Yes	No
Area of Critical Environmental Concern		✓
NHESP Certified Vernal Pool		✓
NHESP Potential Vernal Pool	✓	
NHESP Estimated Habitat of Rare Wildlife		✓
NHESP Priority Habitat of Rare Species		✓
Outstanding Resource Waters		✓
FEMA Flood Zones	✓	
Surface Water Protection Area (Zones A and B)		✓

Mapped Resource On or Within Proximity to Site	Yes	No
Interim Wellhead Protection Area		✓
Zone I Wellhead Protection Area	✓	
Zone II Wellhead Protection Area	✓	
Wild and Scenic River		✓
DFW Coldwater Fisheries Resource	✓[1]	

Source: MassGIS

[1]Mine Brook is a tributary to Dix Brook, which is mapped by the DFW as a Coldwater Fishery. The confluence of Mine Brook and Dix Brook is located approximately 1,350 feet northeast of the Site. Miscoe Brook, a tributary to Mine Brook, is also mapped as a Coldwater Fishery; their confluence is located approximately 2,100 feet southwest of the Site.

Jurisdictional Wetland Resource Areas – Massachusetts Wetlands Protection Act

A Site inspection was conducted by BETA's Wetland Scientists on May 13, 2021 to identify and delineate the boundary of resource areas on the Site and in the immediate vicinity of the Site. Resource area boundaries were identified and delineated in accordance with methods developed by the Massachusetts Department of Environmental Protection's *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act*, dated 1995, as well as definitions set forth in the Wetland Regulations, 310 CMR 10.00. Five (5) Areas Subject to Protection under the Act exist at the Site and are described below.

Bank (Inland) – 310 CMR 10.54

According to 310 CMR 10.54(2), the definition of a Bank is the portion of the land surface which normally abuts and confines a water body, occurring 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. The upper boundary of a Bank is the first observable break in the slope or the mean annual flood level, whichever is lower.

BETA identified the resource Bank associated to one (1) intermittent stream and three (3) perennial streams in proximity to the Site. The Banks within 100 feet of the Site were delineated in the field with blue flagging as described below in Table 2: Bank Boundary Description.

Table 2: Bank Boundary Description

Flag Series	Stream Type & Location	Description / Notes
B1 & B2 Series *Flags* *B1-100 to B1-102* *&* *B2-100 to B2-102*	Intermittent stream interior to the WF4 Series BVW, north of 352 Grove Street	The southern (*B1 Series*) and northern (*B2 Series*) Banks of an intermittent stream interior to the WF4 Series BVW were delineated based on a coincident first observable break in slope and mean annual flood level. This channel is approximately two (2) feet wide with approximately six (6) inches of standing water at the time of the Site visit; no flow was observed. This stream is not depicted on USGS topographic maps or the USGS StreamStats program.
B3 & B4 Series *Flags* *B3-100 to B3-108* *&* *B4-100 to B4-109*	Mine Brook crossing at Grove Street, north of 352 Grove Street	The southern (*B3 Series*) and northern (*B4 Series*) Banks of Mine Brook, a perennial stream (River), were delineated in the vicinity of the crossing under Grove Street via a stone arch bridge with a span of approximately ten (10) feet. Mine Brook flows easterly and is approximately ten (10) feet wide with eight (8) inches of water near the stone culvert at the time of the Site visit. Bank is coincident with the Mean Annual High Water (MAHW) mark; the

BETA

Flag Series	Stream Type & Location	Description / Notes
		MAHW mark/mean annual flood level are upgradient of the first observable break in slope and were delineated as Bank*. The substrate of Mine Brook consists of sand with small stones, and vegetation along the Banks include red maple (*Acer rubrum*), poison ivy (*Toxicodendron radicans*), and skunk cabbage (*Symplocarpus foetidus*).
B5 Series Flags B5-87 to B5-114	West side of Grove Street, north and south sides of the SNETT	The eastern (*B5 Series*) Bank of an unnamed perennial tributary to Mine Brook was delineated from its confluence with Mine Brook to a point approximately 500 feet north. The tributary flows south through a four (4)-foot-wide stone culvert under the SNETT and is approximately five (5) feet wide with a water depth varying from four (4) to twelve (12) inches at the time of the Site visit. The substrate consists of pebbles and sand, and vegetation along the Bank includes skunk cabbage (*Symplocarpus foetidus*) and cinnamon fern (*Osmundastrum cinnamomeum*). Bank was delineated along the mean annual flood level/MAHW where it was observed upgradient of the first observable break in slope*.
B6 & B7 Series Flags B6-100 to B6-103 B7-100 to B7-102	East side of Grove Street, between the WF8 and WF9 Series BVWs	The southern (*B6 Series*) and northern (*B7 Series*) Banks/MAHW of an unnamed perennial stream connecting the WF8 and WF9 BVWs were delineated at the east side of Grove Street. Banks of the stream west of Grove Street were not visible due to water levels within the WF8 BVW. The first observable break in slope is coincident with the mean annual flood level. This easterly flowing channel is approximately four (4) feet wide and had a water depth of three (3) inches the time of the Site visit. Vegetation along the Banks includes oriental bittersweet (*Celastrus orbiculatus*) and slippery elm (*Ulmus rubra*).

**Bank was delineated per the Bylaw definition as discussed later in this report.*

Bordering Vegetated Wetlands – 310 CMR 10.55

According to 310 CMR 10.55(2), the definition of BVW are freshwater wetlands which border on creeks, rivers, streams, ponds and lakes and are areas where the soils are saturated and/or inundated such that they support a predominance of wetland indicator plants. The boundary of BVW is the line within which 50% or more of the vegetation community consists of wetland indicator plants and saturated or inundated conditions exist.

BETA identified seven (7) areas of BVW at the Site. The boundaries of these wetlands were delineated in the field with pink flagging. US Army Corps of Engineers' *Vegetated Wetland Boundary Delineation Field Data Sheets* are attached documenting BETA's observed evidence of hydrology, soils, and hydrophytic vegetation at specific data plots.

Table 3: BVW Boundary Description

Flag Series	Location	Description / Notes
WF2 Series Flags WF2-100 to WF2-106	Northeast of the intersection of Grove Street and Washington Street	The WF2 Series BVW is a scrub shrub wetland located at the toe of a steep slope along the east side of Grove Street. Inundation was observed within the interior of the wetland and water-stained leaves were present at the outer extents. Dominant vegetation within the BVW includes skunk cabbage, jewelweed (*Impatiens capensis*), and sensitive fern (*Onoclea sensibilis*). This wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed at this location.
WF3 Series Flags WF3-100 to WF3-124	East of Grove Street, adjacent to a public well pump house at 352 Grove Street	The WF3 Series BVW is a red maple swamp with significant ponding present within the interior of the wetland. The wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils as documented on the attached U.S. Army Corps of Engineers Field Data Sheet.
WF4 Series Flags WF4-100 to WF4-104	East of Grove Street, along Mine Brook	This BVW is a forested swamp that borders on Mine Brook. An interior intermittent stream was observed to the south of Mine Brook. Dominant vegetation within the BVW includes red maple and skunk cabbage. This wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed at this location.
WF5 Series Flags WF5-100 to WF5-105	East of Grove Street, north of the WF4 Series BVW and south of the SNETT	The WF5 Series BVW is a forested swamp located north of Mine Brook. The portion of this BVW along Grove Street is separated from the WF4 Series BVW along Grove Street by an upland hummock. Dominant vegetation within the BVW includes red maple. This wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed at this location.
WF6 Series Flags WF6-100 to WF6-128	West of Grove Street, south and north of Mine Brook	The WF6 Series BVW borders on Mine Brook and is bisected by the SNETT. The BVW to the south of the SNETT is a scrub shrub swamp, while the BVW to the north of the trail is a red maple swamp. Sediment accumulation was observed within a ponded portion of the BVW along Grove Street to the south of Mine Brook. The wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils as documented on the attached U.S. Army Corps of Engineers Field Data Sheet.
WF8 Series Flags WF8-100 to WF8-109	Along the frontage of 177 Grove Street	This BVW is a deep marsh that abruptly transitions to the filled side slopes along Grove Street. Fencing is present upgradient of, and within, a portion of this wetland which restricted access for the delineation. The WF8 Series BVW borders on a perennial stream; the associated culvert was submerged on the west side of Grove Street. This wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed

Flag Series	Location	Description / Notes
		at this location.
WF9 Series Flags WF9-100 to WF9-105	East of Grove Street, north of 176 Grove Street	The WF9 Series BVW is a red maple swamp that borders on an unnamed perennial stream that flows east under Grove Street from the WF8 Series BVW. This wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed at this location.

<u>Land Under Water – 310 CMR 10.56</u>

According to 310 CMR 10.56(2), the definition of LUW is the land beneath any creek, river, stream, pond or lake and may be composed of organic muck or peat, fine sediments, rocks or bedrock. LUW exists between the Bank boundaries below the mean annual low water level of Mine Brook and the two (2) unnamed perennial streams. The boundary of LUW is the mean annual low water level. This boundary was not delineated in the field.

<u>Bordering Land Subject to Flooding – 310 CMR 10.57</u>

According to the FEMA FIRM Numbers 25021C0316E and 25021C0308Edated July 17, 2012, a Zone AE Flood Hazard and Regulatory Floodway associated with Mine Brook are present at the Site. Base Flood Elevations (BFEs) associated with the Zone AE Flood Hazard range from 241.4 feet (NAVD88) to 246 feet (NAVD88). Any work performed below the BFE is subject to jurisdiction under the Act.

<u>Riverfront Area – 310 CMR 10.58</u>

According to its definition at 310 CMR 10.58(3), the boundary of RA is the area of land between as River's mean annual high-water (MAHW) line measured horizontally outward from the River and a parallel line located 200 feet away. A River is any natural flowing body of water that empties to any ocean, lake, pond, or other River flowing throughout the year and is shown as perennial on the current USGS or more recent map provided by the Department, has a watershed size of at least one (1) square mile, or has a watershed size of at least 0.50 square miles and a predicted flow rate greater than or equal to 0.01 cubic feet per second at the 99% flow duration using the USGS Stream Stats Method.

Mine Brook (*B3 & B4 Series Banks*), its unnamed tributary (*B5 Series Bank*), and the stream connecting the WF8 Series and WF9 Series BVWs (*B6 & B7 Series Banks*) are depicted as perennial streams (Rivers) on USGS topographic maps and are afforded 200-foot RAs. The MAHW mark is coincident with all Bank delineations described above in Table 2.

Jurisdictional Wetland Resource Areas – Town of Franklin

The Bylaw maintains many regulatory definitions consistent with the Act, with the exception of the following:

<u>Isolated Vegetated Wetlands</u>

The Bylaw protects all freshwater wetlands, whether or not they border surface waters. BETA identified four (4) areas that qualify as Isolated Vegetated Wetlands (IVWs) as described below in Table 4.

Table 4: IVW Boundary Description

Flag Series	Location	Description / Notes
WF1 Series Flags WF1-100 to WF1-108	Northwest of the intersection of Grove Street and Washington Street	The WF1 Series IVW is a defined depression that was inundated at the time of the Site visit. MassGIS depicts a PVP at this location. The wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils as documented on the attached U.S. Army Corps of Engineers Field Data Sheet.
WF7 Series Flags WF7-100 to WF7-104	Southwest of 191 Grove Street	The WF7 Series IVW is a shallow depression depicted as a stream on MassGIS, though no stream or channel was observed in the field. Dominant vegetation within this depression includes skunk cabbage, elderberry (*Sambucus canadensis*), and cinnamon fern. This wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed at this location.
WF10 Series Flags WF10-100 to WF10-103	Southwest of the intersection of Grove Street and Kenwood Circle	The WF10 Series IVW is a small roadside depression that receives stormwater runoff from Grove Street. Vegetation within the IVW includes highbush blueberry (*Vaccinium corymbosum*), greenbrier (*Smilax rotundifolia*), and red maple. This wetland boundary was established based on evidence hydrology (including the presence of Hydrogen Sulfide Odor), as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed at this location.
WF11 Series Flags WF11-100 to WF11-104	Along Grove Street at 161 Grove Street	This IVW is located within a stormwater basin that was constructed between 2001 and 2005 based on historic aerial imagery. The basin appears to not have been maintained in accordance with the MassDEP Stormwater Handbook as evidenced by the growth of substantial woody and herbaceous vegetation including cattail (*Typha latifolia*). Nearby basins appear to be maintained through mowing. This wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed at this location.

<u>Bank</u>

Bank is defined as the land area which normally abuts and confines a water body; the lower boundary being the mean annual low flow level, and the upper boundary being the first observable break in the slope or the mean annual flood level, *whichever is higher.*

The mean annual flood level was delineated as Bank wherever it occurred upgradient of the first observable break in slope. Therefore, the Bank delineation complies with the Bylaw definition.

<u>Rare Species</u>

The Bylaw states that Rare Species includes, without limitation, all vertebrate and invertebrate animal and all plant species listed as endangered, threatened, or of special concern by the Massachusetts Division of Fisheries and Wildlife, *regardless of whether the site in which they occur has been previously identified by the Division.*

The Site is located outside of Priority Habitat of Rare Species as identified by the Division. Coordination with the Conservation Commission will be required through the Notice of Intent filing process to determine if the Site qualifies as Rare Species habitat under the Bylaw.

Vernal Pool

The Bylaw defines a vernal pool as a confined basin depression which, at least in most years, holds water for a minimum of two continuous months during the spring and/or summer and which is free of adult fish populations, *regardless of whether the site has been certified by the Massachusetts Division of Wildlife and Fisheries.*

MassGIS depicts Potential Vernal Pools (PVPs) within the WF1 Series IVW and the WF2, WF4, and WF6 Series BVWs. The PVP depicted within the WF1 Series IVW most closely meets this definition based on topography and hydrology; however, the time of year did not facilitate the investigation of vernal pool species. A determination will need to be made by the Conservation Commission regarding the status of these areas as vernal pools under the Bylaw.

Buffer Zone

Under the Bylaw, Buffer Zones are protected as Resource Areas and are subject to local Buffer Zone Performance Standards.

The Bylaw Regulations protect a 25-foot No Disturb Zone from the boundary of Resource Areas excluding Bordering/Isolated Lands Subject to Flooding (BLSF/ILSF) and RA. Applicants may work within this No Disturb Zone if the activity is considered minor or if a variance is sought.

The Bylaw Regulations also prohibit structures within 50 feet from the boundary of Resource Areas excluding BLSF/ILSF and RA. Structures may be permitted within this setback if the area was disturbed prior to June 29, 2006 or if a variance is sought.

Additional mitigation may be required by the Conservation Commission when a project results in more than 30% of the 50-100-foot Buffer Zone being converted to impervious area.

Jurisdictional Wetland Resource Areas – Federal Clean Water Act (Section 404)

The wetlands and streams located on the Site are "Waters of the United States," and are therefore subject to the federal Clean Water Act, 33 U.S.C. §1251 et seq (1972). The boundary to "Waters of the United States" is the Vegetated Wetlands boundary, or, in the absence of Vegetated Wetlands, is the Ordinary High Water Mark (OHWM) for non-tidal rivers and streams, as specified at 33 CFR §328.4.

According to 33 CFR §328.3(c)(4), Vegetated Wetlands are defined as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." The wetland boundary previously described in this report was delineated in accordance with this definition. The US Army Corps of Engineers' *Vegetated Wetland Boundary Delineation Field Data Sheets* are attached documenting BETA's observed evidence of hydrology, soils, and hydrophytic vegetation at specific data plots.

The OHWM of the streams, as defined at 33 CFR §328.3(c)(6), is coincident with the Bank.

The boundary of Vegetated Wetlands is consistent with the delineated BVW and IVW boundaries and would be considered the extent of Federal Section 404 Jurisdiction for most of the Site, except for areas where there are no Vegetated Wetlands along Streambanks. In those locations, such as to the east of Grove Street near the B6/B7 Series Stream and along portions of the B3/B4 Series Stream, the OHWM is the extent of Federal Section 404 Jurisdiction. Work conducted below the boundary of Vegetated Wetlands or the OHWM is Subject to Jurisdiction under Section 404 of the Clean Water Act.

Jurisdictional Wetland Resource Areas – Massachusetts Clean Waters Act (Section 401)

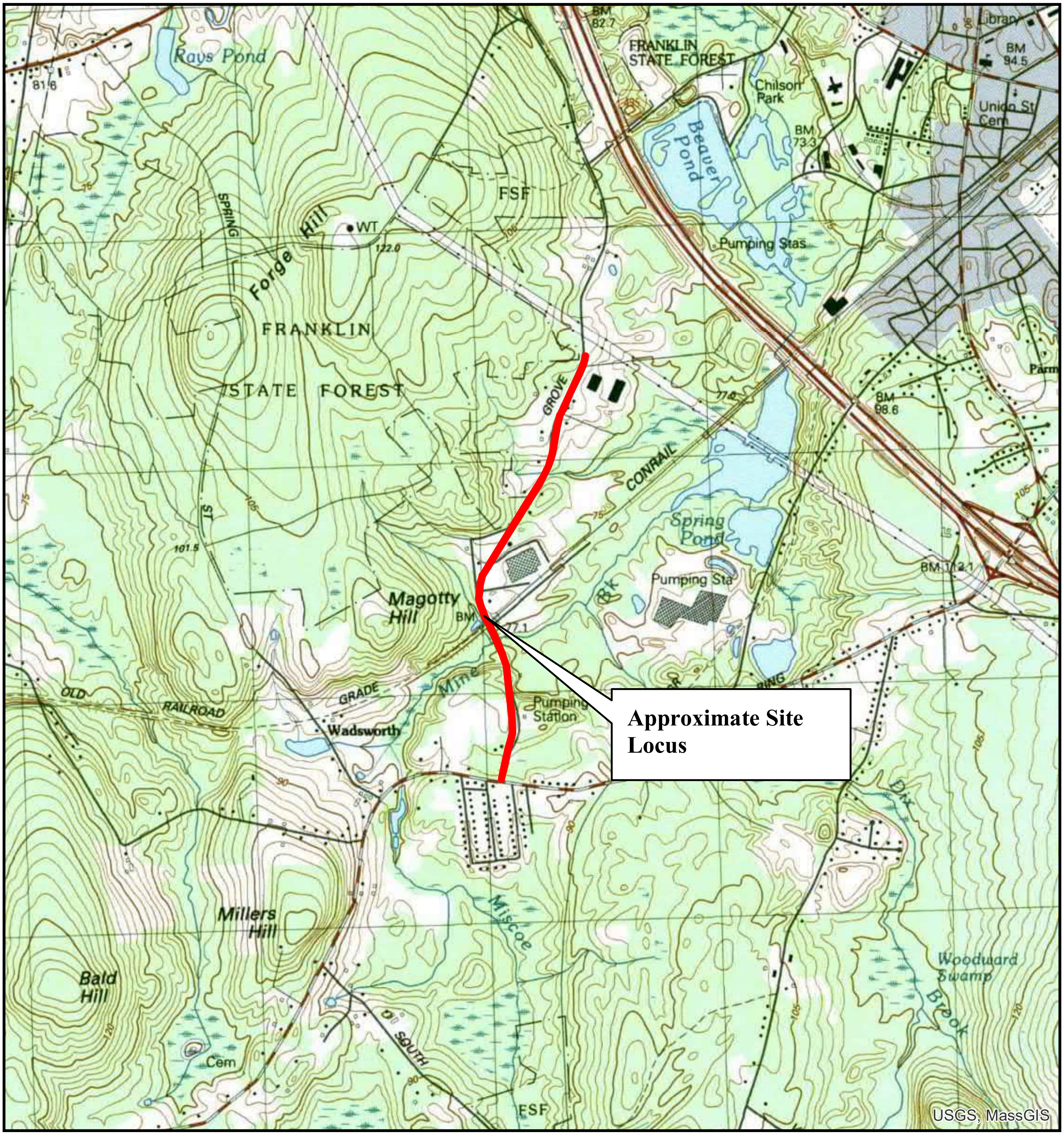
The limit of jurisdiction under Massachusetts Clean Waters Act (Section 401), as specified in 314 CMR 9.00, is the limit of Section 404 jurisdiction under the federal Clean Water Act. Exceedances of the jurisdictional threshold under 314 CMR 9.00 require filing for a Water Quality Certification under Section 401.

Findings and Recommendations

BETA has identified areas Subject to Protection and/or Jurisdiction under the Massachusetts Wetlands Protection Act, the federal Clean Water Act, the Massachusetts Clean Waters Act, and the Town of Franklin Wetlands Protection Bylaw on or within 100 feet of the Site and has delineated the boundaries of BVW, IVW, and Bank. In order to definitively determine the extent of Conservation Commission jurisdiction, Army Corps of Engineers jurisdiction, and MassDEP jurisdiction, the boundary flags would need to be located and depicted on a to-scale plan of the Site.

Attachments: Figure 1 – Site Locus
Figure 2 – Environmental Resources Map
Figure 3 – FEMA FIRMette
Photographic Documentation
US Army Corps of Engineers' *Vegetated Wetland Boundary Delineation Field Data Sheets*
Custom Soil Report for Norfolk and Suffolk Counties, Massachusetts

Job No: 21.07548.00



IMPROVING COMMUNITIES TOGETHER

N
W E
S

0 2,000 4,000 Feet

1 inch = 2,000 feet

Figure 1
Site Locus
Grove Street
Franklin, MA

Data Source: MassGIS USGS Topographic Quadrangle Images (2001)

Figure 2
Environmental Resources Map
Grove Street
Franklin, MA

Wetland Resources Legend

- MassDEP Hydrologic Feature
- Marsh/Bog
- Wooded marsh
- Open Water
- NFHL 100 Year Flood Zone
- Area of Critical Environmental Concern (ACEC)
- Zone A
- Zone B
- Outstanding Resource Water
- MassDEP IWPA
- MassDEP Zone I
- MassDEP Zone II

Mapped Habitat Legend

- NHESP Potential Vernal Pool
- NHESP Certified Vernal Pool
- NHESP Priority Habitat of Rare Species
- NHESP Estimated Habitats of Rare Wildlife

N E S W

0 500 1,000 Feet

1 inch = 500 feet

Data Source: MassGIS USGS Color Ortho Imagery (2014), MassDEP Wetlands (1:12000) (2009), NHESP Potential Vernal Pools (2000), NHESP Certified Vernal Pools, NHESP Priority Habitats of Rare Species (2008), NHESP Estimated Habitats of Rare Species (2008), Areas of Critical Environmental Concern (2009), FEMA National Flood Hazard Layer (2014),

BETA
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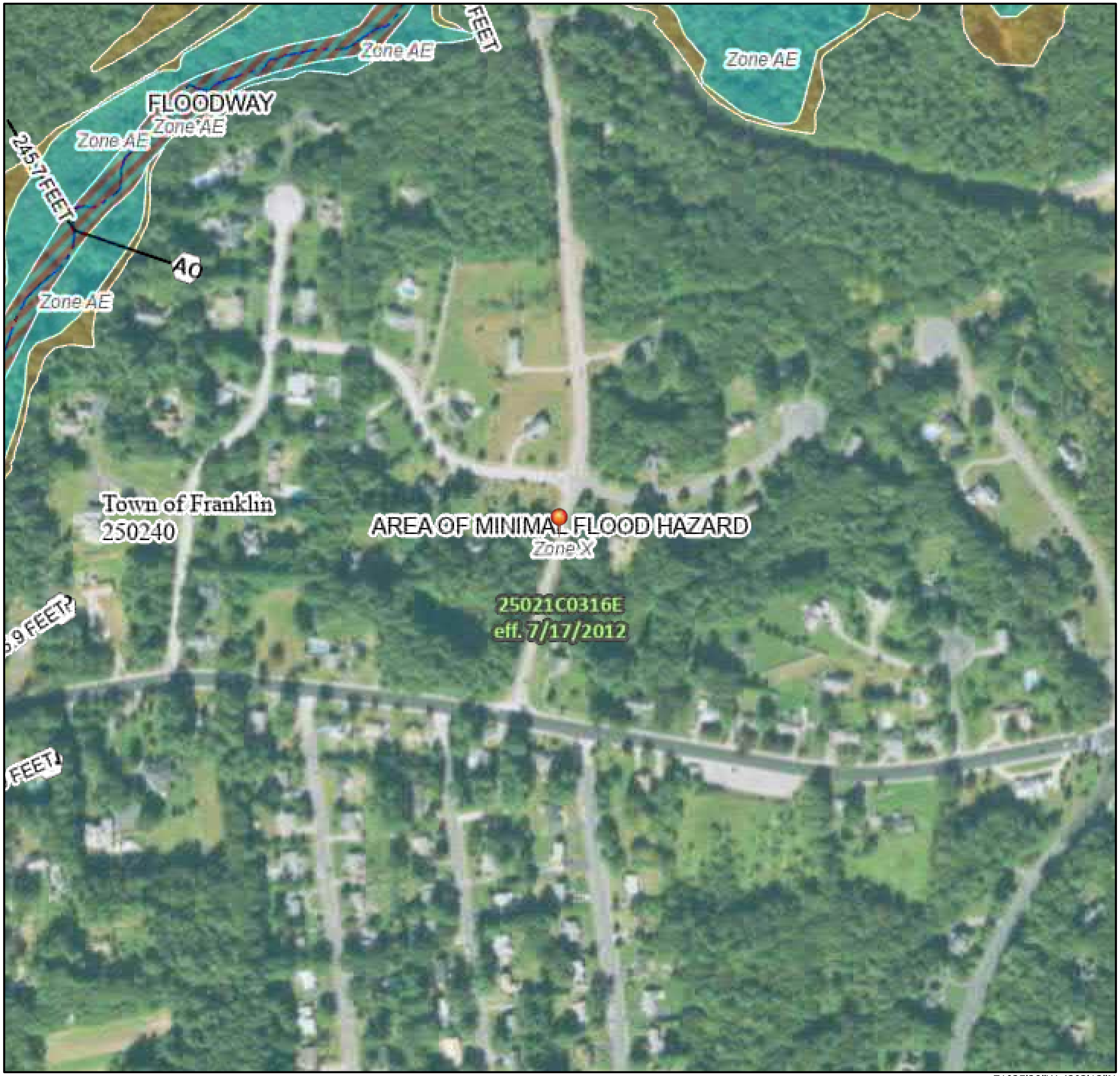
National Flood Hazard Layer FIRMette

FEMA

71°25'57"W 42°3'39"N



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

1:6,000

71°25'20"W 42°3'12"N

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

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

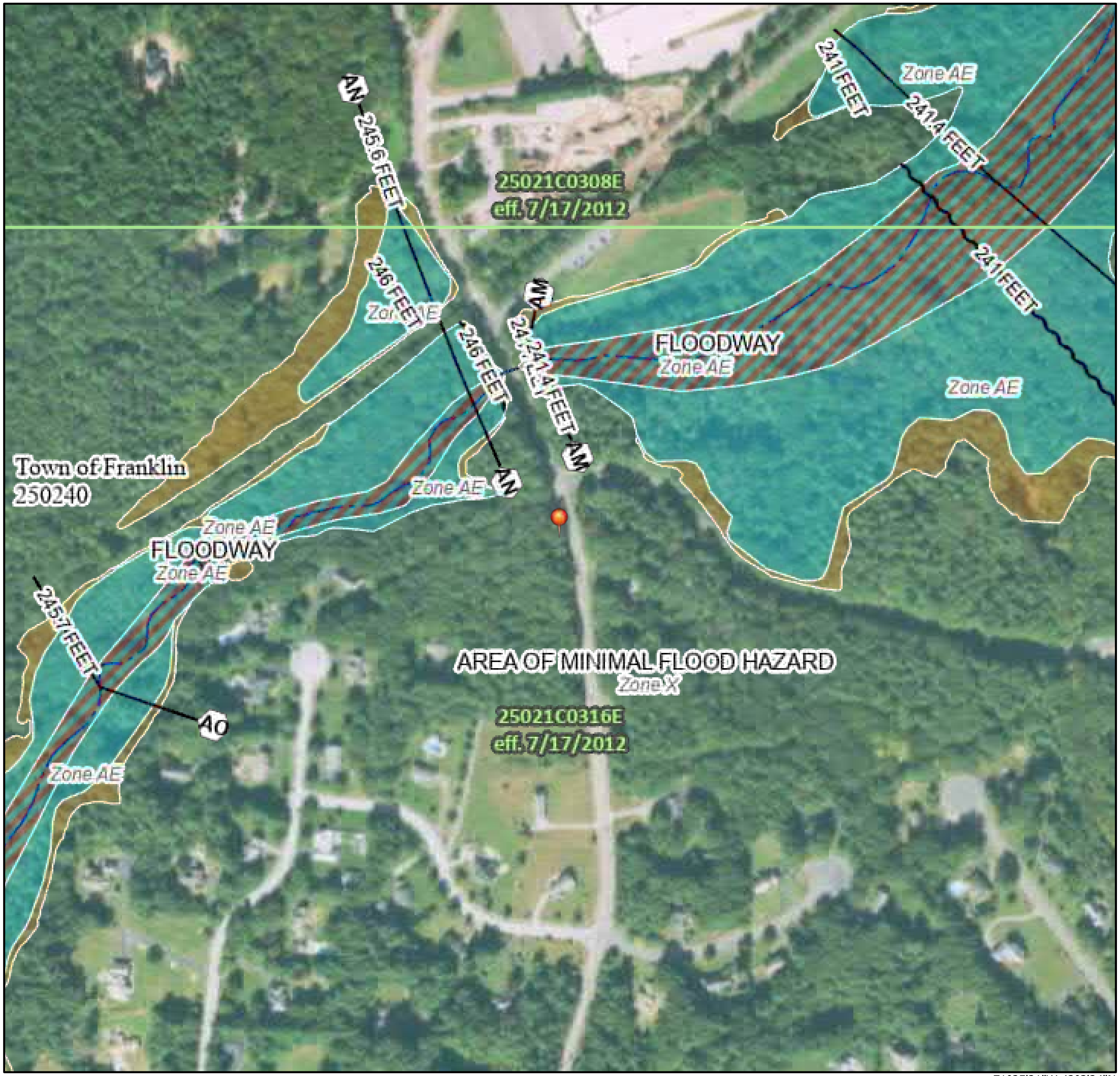
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/12/2021 at 4:47 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

National Flood Hazard Layer FIRMette

FEMA

71°25'58"W 42°3'51"N



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

1:6,000

71°25'21"W 42°3'24"N

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

Legend

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

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99* With BFE or Depth *Zone AE, AO, AH, VE, AR* Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X* Future Conditions 1% Annual Chance Flood Hazard *Zone X* Area with Reduced Flood Risk due to Levee. See Notes. *Zone X* Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X* Effective LOMRs Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer Levee, Dike, or Floodwall
OTHER FEATURES	B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation 8 Coastal Transect 513 Base Flood Elevation Line (BFE) Limit of Study Jurisdiction Boundary Coastal Transect Baseline Profile Baseline Hydrographic Feature
MAP PANELS	Digital Data Available No Digital Data Available Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/12/2021 at 4:45 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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National Flood Hazard Layer FIRMette

FEMA

71°25'53"W 42°4'13"N

71°25'16"W 42°3'46"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

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

Legend

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/12/2021 at 4:44 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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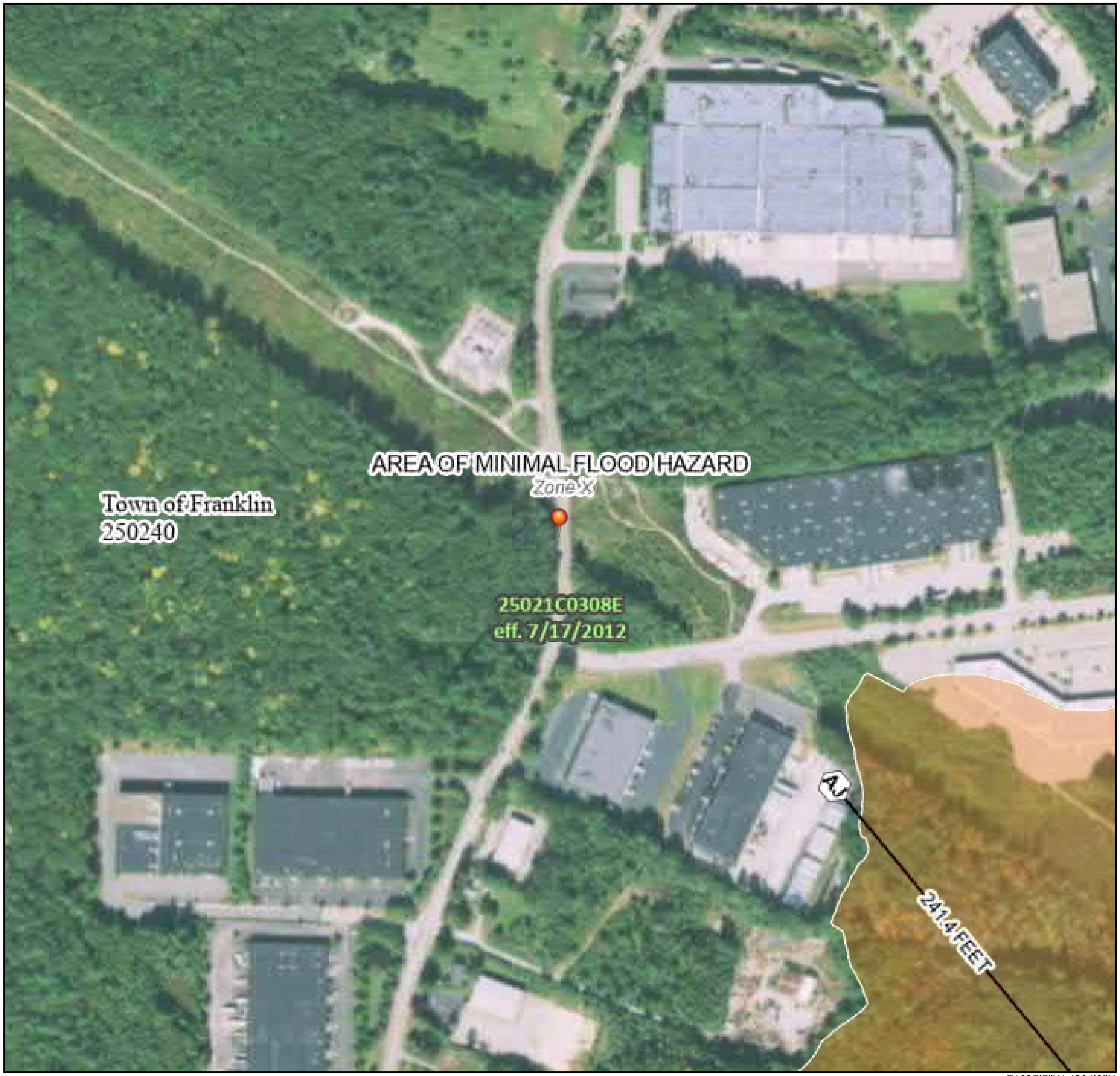
National Flood Hazard Layer FIRMette

FEMA

71°25'43"W 42°4'36"N



71°25'5"W 42°4'9"N

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

1:6,000

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

Legend

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/12/2021 at 4:42 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Photo 1

View of the WF1 Series IVW—facing west.

Photo 2

View of the interior of the WF2 Series BVW—facing southeast.

PHOTOGRAPHIC DOCUMENTATION

Grove Street

Franklin, Massachusetts

Photographs Documented 05.13.2021

Photo 3

View of the WF3 Series BVW and adjacent public well pump house—facing northeast.

Photo 4

View of Mine Brook, taken from Grove Street—facing east.

Photo 5

View of the culvert carrying Mine Brook, taken from the east side of Grove Street—facing west.

Photo 6

View of Mine Brook, taken from Grove Street—facing west.

PHOTOGRAPHIC DOCUMENTATION

Grove Street

Franklin, Massachusetts

Photographs Documented 05.13.2021

Photo 7

View of the WF6 Series BVW; note the sediment deposition in the foreground—facing west.

Photo 8

View of the unnamed tributary to Mine Brook flowing through a culvert under the Southern New England Trunkline Trail—facing northeast.

PHOTOGRAPHIC DOCUMENTATION

Grove Street

Franklin, Massachusetts

Photographs Documented 05.13.2021

Photo 9

View of the unnamed tributary to Mine Brook, north of the Southern New England Trunkline Trail—facing north.

Photo 10

View of cinnamon fern (*Osmundastrum cinnamomeum*) within the WF7 Series IVW—facing west.

Photo 11

View of a forested portion of the WF8 Series BVW—facing west.

Photo 12

View of the unnamed perennial stream connecting the WF8 and WF9 Series BVWs at the east side of Grove Street; note the damaged infrastructure—facing east.

Photo 13

Typical view of a maintained stormwater basin at the northern end of the Site (157/161 Grove Street)—facing south.

Photo 14

View of an unmaintained stormwater basin (WF11 Series IVW) at the northern end of the Site (157/161 Grove Street)—facing west.

Photo 15

View of a small pocket IVW (WF10 Series) formed from roadway stormwater runoff—facing east.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Upland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Confined depression Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Hinckley loamy sand, 8 to 15 percent slopes NWI classification: N/A

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___ No X	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** X
Hydric Soil Present?	Yes ___ No X	
Wetland Hydrology Present?	Yes ___ No X	If yes, optional Wetland Site ID: WF1-106

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: Upland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Pinus strobus*	40	Yes	FACU
2. *Acer rubrum*	40	Yes	FAC
3. *Tsuga canadensis*	20	Yes	FACU
4.			
5.			
6.			
7.			
	100	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Maianthemum canadense*	40	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	40	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	40	x 3 =	120
FACU species	100	x 4 =	400
UPL species	0	x 5 =	0
Column Totals:	140 (A)		520 (B)

Prevalence Index = B/A = 3.71

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Upland

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR 2/1							Organic "duff" layer
1-16	10YR 3/3							Fine sandy loam
16-20	10YR 4/3							Fine sandy loam

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Wetland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Confined depression Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Hinckley loamy sand, 8 to 15 percent slopes NWI classification: PEM1E

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ___	**Is the Sampled Area within a Wetland?** **Yes** X **No** ___
Hydric Soil Present?	Yes X No ___	
Wetland Hydrology Present?	Yes X No ___	If yes, optional Wetland Site ID: WF1-106

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

X Surface Water (A1)	___ Water-Stained Leaves (B9)	
X High Water Table (A2)	___ Aquatic Fauna (B13)	
X Saturation (A3)	___ Marl Deposits (B15)	
___ Water Marks (B1)	___ Hydrogen Sulfide Odor (C1)	
___ Sediment Deposits (B2)	___ Oxidized Rhizospheres on Living Roots (C3)	
___ Drift Deposits (B3)	___ Presence of Reduced Iron (C4)	
___ Algal Mat or Crust (B4)	___ Recent Iron Reduction in Tilled Soils (C6)	
___ Iron Deposits (B5)	___ Thin Muck Surface (C7)	
X Inundation Visible on Aerial Imagery (B7)	___ Other (Explain in Remarks)	
___ Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
X Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
X Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches): 12
Water Table Present?	Yes X	No ___	Depth (inches): 2
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: Wetland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	30	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	30	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Spiraea tomentosa*	5	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	5	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	30	x 3 =	90
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	35 (A)		100 (B)

Prevalence Index = B/A = 2.86

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Wetland

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/2	100						Fine sandy loam
2-6	10YR 4/3	100						Fine sandy loam
6-18	10YR 3/2	90	10YR 4/3	10	C	M		Faint redox concentrations

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
X Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)

___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? **Yes** X **No** ____

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Upland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Toe of roadside slope Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Hinckley loamy sand, 3 to 8 percent slopes NWI classification: N/A

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ___ No X		**Is the Sampled Area within a Wetland?** **Yes** ___ **No** X
Hydric Soil Present? Yes ___ No X		If yes, optional Wetland Site ID: WF3-118
Wetland Hydrology Present? Yes ___ No X		

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___
Water Table Present? Yes ___ No X Depth (inches): ___
Saturation Present? Yes ___ No X Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: Upland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	40	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	40	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1. *Prunus serotina*	10	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	10	=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Dennstaedtia punctilobula*	15	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	15	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	40	x 3 =	120
FACU species	10	x 4 =	40
UPL species	15	x 5 =	75
Column Totals:	65	(A)	235 (B)

Prevalence Index = B/A = 3.62

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Upland

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 2/1	100						Organic "duff" layer
2-18	10YR 4/4	100						Fine sandy loam

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)

___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ___ **No** X

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Wetland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Toe of roadside slope Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Hinckley loamy sand, 3 to 8 percent slopes NWI classification: N/A

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ___ Hydric Soil Present? Yes X No ___ Wetland Hydrology Present? Yes X No ___	**Is the Sampled Area within a Wetland? Yes** X **No** ___ If yes, optional Wetland Site ID: WF3-118

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches): 12
Water Table Present?	Yes X	No ___	Depth (inches): 5
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: Wetland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	40	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	40	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Maianthemum canadense*	10	Yes	FACU
2. *Osmundastrum cinnamomeum*	20	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	30	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	20	x 2 =	40
FAC species	40	x 3 =	120
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	70 (A)		200 (B)

Prevalence Index = B/A = 2.86

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Wetland

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

Depth	Matrix		Redox Features				Texture	Remarks
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-3	10YR 2/1	100						Organic "duff" layer
3-8	10YR 2/1	100						Sapric
8-18	10YR 4/3	80	10YR 4/2	20	C	M		Sandy with redox

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
X Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Upland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Hinckley loamy sand, 3 to 8 percent slopes NWI classification: N/A

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___ No X	**Is the Sampled Area within a Wetland?**	**Yes** ___ **No** X
Hydric Soil Present?	Yes ___ No X	If yes, optional Wetland Site ID:	WF6-111
Wetland Hydrology Present?	Yes ___ No X		

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: Upland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	50	Yes	FAC
2. *Pinus strobus*	10	No	FACU
3.			
4.			
5.			
6.			
7.			
	60	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1. *Berberis thunbergii*	10	Yes	FACU
2. *Rosa multiflora*	30	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	40	=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Maianthemum canadense*	80	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	80	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	50	x 3 =	150
FACU species	130	x 4 =	520
UPL species	0	x 5 =	0
Column Totals:	180 (A)		670 (B)

Prevalence Index = B/A = 3.72

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Upland

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 2/1	100						Organic "duff" layer
2-3	10YR 3/3	100						Loamy sand
3-7	10YR 3/4	100						Fine sandy loam
7-18	7.5YR 4/4	100						Sand

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)

___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Wetland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Hinckley loamy sand, 3 to 8 percent slopes NWI classification: PFO1E

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ___
Hydric Soil Present? Yes X No ___
Wetland Hydrology Present? Yes X No ___

Is the Sampled Area within a Wetland? **Yes** X **No** ___
If yes, optional Wetland Site ID: WF6-111

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
X Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
X Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___
Water Table Present? Yes ___ No X Depth (inches): ___
Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: Wetland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	50	Yes	FAC
2. *Pinus strobus*	10	No	FACU
3.			
4.			
5.			
6.			
7.			
	60	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1. *Frangula alnus*	10	Yes	FAC
2. *Rosa multiflora*	30	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	40	=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Maianthemum canadense*	60	Yes	FACU
2. *Symplocarpus foetidus*	15	Yes	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	75	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	0	x 2 =	0
FAC species	60	x 3 =	180
FACU species	100	x 4 =	400
UPL species	0	x 5 =	0
Column Totals:	175 (A)		595 (B)

Prevalence Index = B/A = 3.40

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Wetland

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/2	100						20% organic material
4-10	10YR 2/1	100						Organic
10-20	10YR 3/2	80	10YR 4/1	20	C	M		Redox concentrations

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
X Dark Surface (S7)

___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes X **No** ___

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Upland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Toe of roadside slope Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Swansea muck, 0 to 1 percent slopes NWI classification: N/A

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No X
Hydric Soil Present?	Yes ___	No X
Wetland Hydrology Present?	Yes ___	No X

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

If yes, optional Wetland Site ID: WF9-103

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: Upland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	50	Yes	FAC
2. *Pinus strobus*	15	Yes	FACU
3. *Betula populifolia*	3	No	FAC
4.			
5.			
6.			
7.			
	68	=Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Euonymus alatus*	5	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	5	=Total Cover	

Herb Stratum (Plot size: 5' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Maianthemum canadense*	80	Yes	FACU
2. *Toxicodendron radicans*	15	No	FAC
3. *Pteridium aquilinum*	10	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	105	=Total Cover	

Woody Vine Stratum (Plot size: 15' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	68	x 3 =	204
FACU species	105	x 4 =	420
UPL species	5	x 5 =	25
Column Totals:	178 (A)		649 (B)

Prevalence Index = B/A = 3.65

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Upland

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	100						Gravelly/sandy loam (fill)
6-15	10YR 4/3							Gravelly/sandy loam (fill)

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Wetland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Toe of roadside slope Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Swansea muck, 0 to 1 percent slopes NWI classification: PFO1E

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ___	**Is the Sampled Area within a Wetland?** **Yes** X **No** ___
Hydric Soil Present?	Yes X No ___	
Wetland Hydrology Present?	Yes X No ___	If yes, optional Wetland Site ID: WF9-103

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
X Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
X Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
X Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: Wetland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	80	Yes	FAC
2. *Pinus strobus*	3	No	FACU
3.			
4.			
5.			
6.			
7.			
	83	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1. *Viburnum dentatum*	8	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	8	=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Symplocarpus foetidus*	80	Yes	OBL
2. *Osmundastrum cinnamomeum*	10	No	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	90	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	80	x 1 =	80
FACW species	10	x 2 =	20
FAC species	88	x 3 =	264
FACU species	3	x 4 =	12
UPL species	0	x 5 =	0
Column Totals:	181 (A)		376 (B)

Prevalence Index = B/A = 2.08

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

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Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Wetland

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 2/1	100						Sapric

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

Hydric Soil Indicators:

X Histosol (A1)
___ Histic Epipedon (A2)
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Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** X **No** ___

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

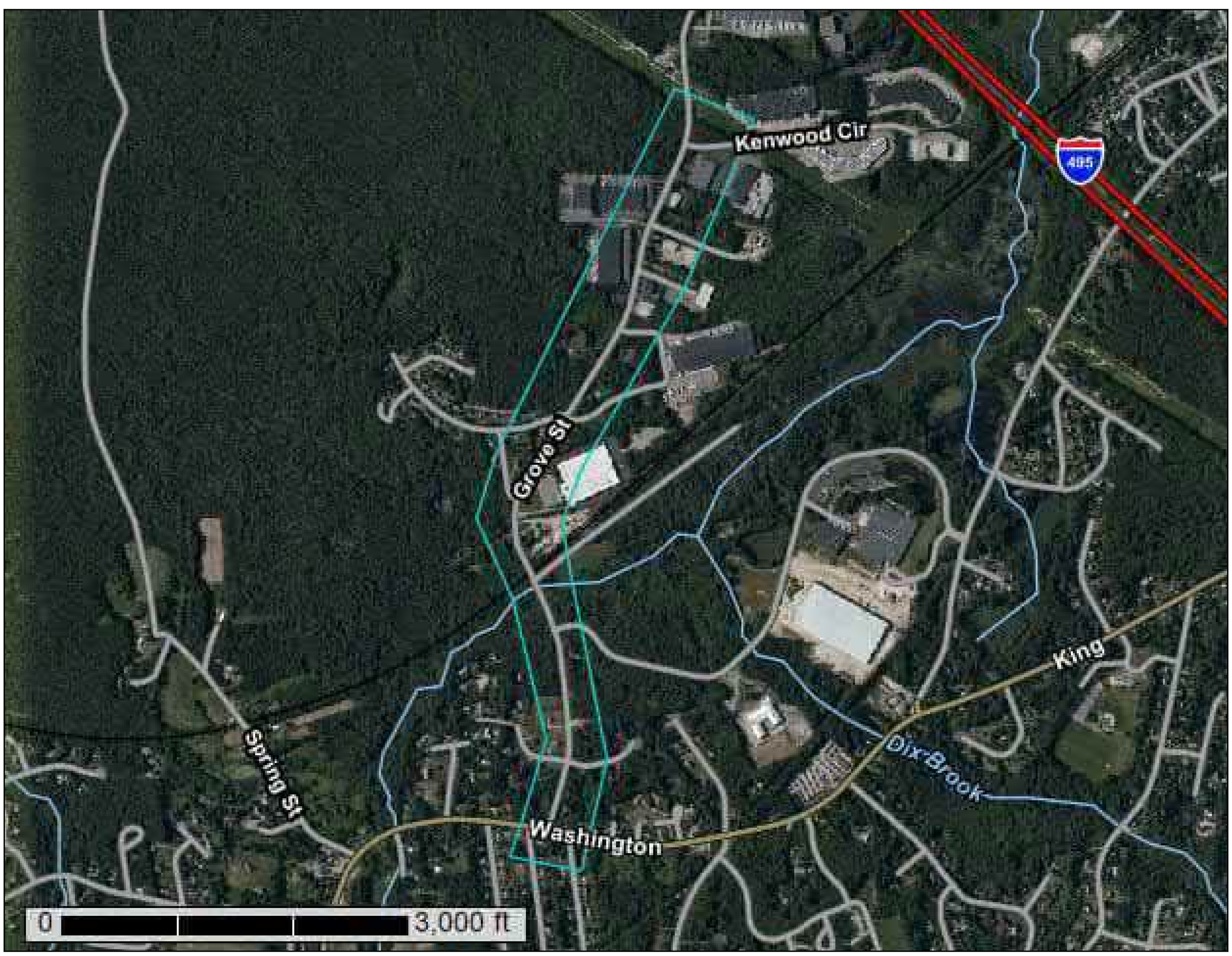
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for
Norfolk and Suffolk Counties, Massachusetts



May 12, 2021

Preface

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

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

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

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

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

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

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Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

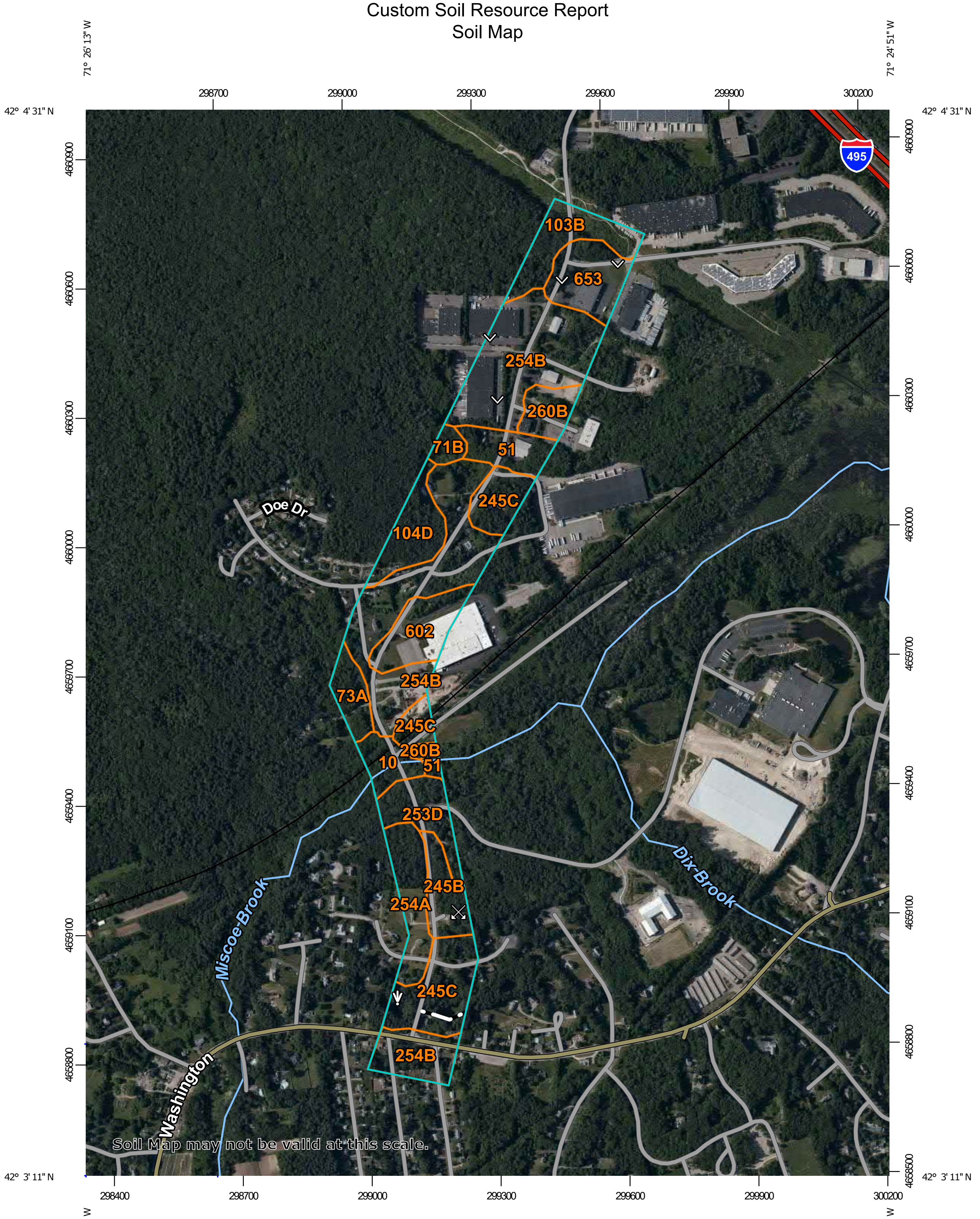
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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

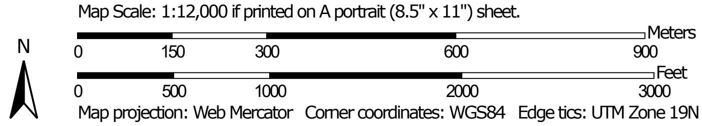
Soil Map

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

Soil Map



Map Scale: 1:12,000 if printed on A portrait (8.5" x 11") sheet.



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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

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

Special Point Features

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 16, Jun 11, 2020

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

Date(s) aerial images were photographed: Jul 5, 2019—Jul 8, 2019

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
10	Scarboro and Birdsall soils, 0 to 3 percent slopes	3.2	2.9%
51	Swansea muck, 0 to 1 percent slopes	4.8	4.4%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	1.4	1.2%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	3.2	2.9%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	6.4	5.8%
104D	Hollis-Rock outcrop-Charlton complex, 15 to 35 percent slopes	5.6	5.1%
245B	Hinckley loamy sand, 3 to 8 percent slopes	4.2	3.9%
245C	Hinckley loamy sand, 8 to 15 percent slopes	13.9	12.6%
253D	Hinckley loamy sand, 15 to 35 percent slopes	5.3	4.8%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	6.2	5.6%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	39.7	35.9%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	3.7	3.4%
602	Urban land, 0 to 15 percent slopes	6.1	5.6%
653	Udorthents, sandy	6.6	6.0%
Totals for Area of Interest		**110.3**	**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.

Norfolk and Suffolk Counties, Massachusetts

10—Scarboro and Birdsall soils, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vkxw
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: Not prime farmland

Map Unit Composition

Scarboro and similar soils: 65 percent
Birdsall and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scarboro

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 9 inches: mucky fine sandy loam
H2 - 9 to 60 inches: stratified loamy fine sand to gravelly coarse sand

Properties and qualities

Slope: 0 to 3 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): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water capacity: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Description of Birdsall

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Soft coarse-silty glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: very fine sandy loam
H2 - 8 to 16 inches: very fine sandy loam
H3 - 16 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 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 moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water capacity: Very high (about 12.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 5 percent
Landform: Bogs
Hydric soil rating: Yes

Raynham

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Walpole

Percent of map unit: 2 percent
Landform: Terraces
Hydric soil rating: Yes

51—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 capacity: 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: Swamps, bogs
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways

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: Depressions, drainageways
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

71B—Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w69c
Elevation: 0 to 1,290 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

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

Description of Ridgebury, Extremely Stony

Setting

Landform: Drumlins, drainageways, hills, ground moraines, depressions
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 6 inches: fine sandy loam
Bw - 6 to 10 inches: sandy loam
Bg - 10 to 19 inches: gravelly sandy loam
Cd - 19 to 66 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Poorly drained
Runoff class: Very high
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 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Woodbridge, extremely stony

Percent of map unit: 10 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Footslope, summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Whitman, extremely stony

Percent of map unit: 8 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Paxton, extremely stony

Percent of map unit: 2 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Hydric soil rating: No

73A—Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w695
Elevation: 0 to 1,580 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

Whitman, extremely stony, and similar soils: 81 percent
Minor components: 19 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Whitman, Extremely Stony

Setting

Landform: Drainageways, hills, ground moraines, drumlins, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 1 inches: peat
A - 1 to 10 inches: fine sandy loam
Bg - 10 to 17 inches: gravelly fine sandy loam
Cdg - 17 to 61 inches: fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 7 to 38 inches to densic material
Drainage class: Very poorly drained
Runoff class: Negligible
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 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY041MA - Very Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Ridgebury, extremely stony

Percent of map unit: 10 percent
Landform: Drumlins, drainageways, hills, ground moraines, depressions
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways, outwash deltas, outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent
Landform: Marshes, swamps, bogs
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Woodbridge, extremely stony

Percent of map unit: 1 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

103B—Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: vktd
Elevation: 0 to 480 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton and similar soils: 40 percent
Hollis and similar soils: 25 percent
Rock outcrop: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable coarse-loamy ablation till derived from granite

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 36 inches: fine sandy loam
H3 - 36 to 60 inches: fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
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 capacity: Moderate (about 7.8 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

Description of Hollis

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Shallow, friable loamy ablation till derived from igneous rock

Typical profile

H1 - 0 to 3 inches: fine sandy loam
H2 - 3 to 14 inches: gravelly fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
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 capacity: Very low (about 1.8 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: Igneous and metamorphic rock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Canton

Percent of map unit: 7 percent
Hydric soil rating: No

Chatfield

Percent of map unit: 5 percent
Hydric soil rating: No

Scituate

Percent of map unit: 2 percent
Hydric soil rating: No

Whitman

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

104D—Hollis-Rock outcrop-Charlton complex, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: vkvh
Elevation: 20 to 610 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 120 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: 25 percent

Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Shallow, friable loamy ablation till derived from igneous and metamorphic rock

Typical profile

H1 - 0 to 3 inches: fine sandy loam
H2 - 3 to 14 inches: gravelly fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
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 capacity: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Parent material: Igneous and metamorphic rock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Description of Charlton

Setting

Landform: Hills
Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable coarse-loamy ablation till derived from granite

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 36 inches: fine sandy loam
H3 - 36 to 60 inches: fine sandy loam

Properties and qualities

Slope: 15 to 35 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
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 capacity: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Canton

Percent of map unit: 5 percent
Hydric soil rating: No

Chatfield

Percent of map unit: 5 percent
Hydric soil rating: No

245B—Hinckley loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svm8
Elevation: 0 to 1,430 feet
Mean annual precipitation: 36 to 53 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Farmland of statewide importance

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: Moraines, kame terraces, kames, outwash terraces, outwash deltas, outwash plains, eskers
Landform position (two-dimensional): Summit, backslope, footslope, shoulder
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, tread, riser
Down-slope shape: Linear, convex, concave
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: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: 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
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 8 percent
Landform: Outwash plains, kames, eskers, moraines, outwash terraces, outwash deltas, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, tread, riser
Down-slope shape: Linear, convex, concave

Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Moraines, outwash terraces, outwash deltas, kame terraces, outwash plains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, base slope, head slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Eskers, moraines, outwash terraces, outwash deltas, kame terraces, outwash plains, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

245C—Hinckley loamy sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2svm9
Elevation: 0 to 1,480 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: Farmland of statewide importance

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: Outwash deltas, kame terraces, outwash plains, kames, eskers, moraines, outwash terraces
Landform position (two-dimensional): Shoulder, toeslope, footslope, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser
Down-slope shape: Convex, concave, linear
Across-slope shape: Concave, linear, convex

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: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: 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
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 5 percent
Landform: Eskers, moraines, outwash terraces, outwash plains, kames
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Side slope, head slope, nose slope, crest, riser
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Moraines, kame terraces, outwash plains, outwash terraces, outwash deltas, kames, eskers
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser
Down-slope shape: Convex, linear, concave
Across-slope shape: Linear, convex, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent

Landform: Outwash terraces, kame terraces, outwash plains, moraines, outwash deltas
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

253D—Hinckley loamy sand, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2svmd
Elevation: 0 to 860 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: Outwash plains, kames, eskers, moraines, outwash terraces, outwash deltas, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Crest, nose slope, side slope, head slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Linear, convex, 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 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: 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
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: 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

Windsor

Percent of map unit: 10 percent
Landform: Moraines, kame terraces, outwash plains, outwash terraces, outwash deltas, kames, eskers
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, crest, side slope, head slope, riser
Down-slope shape: Convex, linear, concave
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Merrimac

Percent of map unit: 3 percent
Landform: Kames, eskers, moraines, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest, head slope, nose slope, riser
Down-slope shape: Convex, concave, linear
Across-slope shape: Concave, convex, linear
Hydric soil rating: No

Sudbury

Percent of map unit: 2 percent
Landform: Moraines, outwash terraces, kame terraces, outwash plains, outwash deltas
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Hydric soil rating: No

254A—Merrimac fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tyqr
Elevation: 0 to 1,100 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: All areas are prime farmland

Map Unit Composition

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

Description of Merrimac

Setting

Landform: Moraines, outwash terraces, outwash plains, kames, eskers
Landform position (two-dimensional): Backslope, footslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, 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 3 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 capacity: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
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: Outwash plains, eskers, kames, deltas
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Agawam

Percent of map unit: 3 percent
Landform: Outwash plains, outwash terraces, stream terraces, kames, eskers, moraines
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 2 percent
Landform: Outwash terraces, deltas, dunes, outwash plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

254B—Merrimac fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyqs
Elevation: 0 to 1,290 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: All areas are prime farmland

Map Unit Composition

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

Description of Merrimac

Setting

Landform: Kames, eskers, moraines, outwash terraces, outwash plains
Landform position (two-dimensional): Backslope, footslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest, 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: 3 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 capacity: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
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, outwash plains, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Windsor

Percent of map unit: 3 percent
Landform: Outwash terraces, outwash plains, deltas, dunes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Moraines, outwash terraces, outwash plains, kames, eskers, stream terraces
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

260B—Sudbury fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: vky4
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: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser

Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable coarse-loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 11 inches: sandy loam
H2 - 11 to 22 inches: sandy loam
H3 - 22 to 60 inches: gravelly coarse sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Drainage class: Moderately well drained
Runoff class: Low
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 capacity: Low (about 4.0 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

Walpole

Percent of map unit: 5 percent
Landform: Terraces
Hydric soil rating: Yes

Deerfield

Percent of map unit: 5 percent
Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Hydric soil rating: No

602—Urban land, 0 to 15 percent slopes

Map Unit Setting

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

Map Unit Composition

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

Description of Urban Land

Setting

Parent material: Excavated and filled land

Minor Components

Rock outcrops

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

653—Udorthents, sandy

Map Unit Setting

National map unit symbol: vky8
Elevation: 0 to 3,000 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: Not prime farmland

Map Unit Composition

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

Description of Udorthents

Setting

Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Excavated and filled sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: variable
H2 - 6 to 60 inches: variable

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Urban land

Percent of map unit: 5 percent
Hydric soil rating: Unranked

Swansea

Percent of map unit: 2 percent
Landform: Bogs
Hydric soil rating: Yes

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

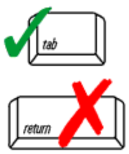
APPENDIX C – Stormwater Management Report & Checklist

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

COMMONWEALTH OF MASSACHUSETTS
WILLIAM P
McGRATH
CIVIL
No. 33716
REGISTERED
PROFESSIONAL ENGINEER

2-10-2023

Signature and Date

Checklist

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

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

☒ is within the Zone II or Interim Wellhead Protection Area

☐ is near or to other critical areas

☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)

☐ involves runoff from land uses with higher potential pollutant loads.

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☐ An Illicit Discharge Compliance Statement is attached;

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

Franklin, MA

Grove Street Improvements – Phase 2

February 2023

STORMWATER MANAGEMENT REPORT

COMMONWEALTH OF MASSACHUSETTS
WILLIAM P. McGRATH
CIVIL
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2/10/2023

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Grove Street Improvements – Phase 2
Franklin, MA

STORMWATER MANAGEMENT REPORT

Prepared by: BETA GROUP, INC.
Prepared for: Town of Franklin

February 2023

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1.0 INTRODUCTION

In accordance with the Massachusetts Wetlands Protection Act, M.G.L. Chapter 131, Section 40, and the Town of Franklin Wetlands Ordinance, BETA Group, Inc. (BETA) has completed the Stormwater Report for submission to the Massachusetts Department of Environmental Protection (MADEP) on behalf of the Town of Franklin. The proposed project includes the widening, proposed milling and overlay of Grove Street, construction of a shared-use path, installation of new curbing and wheelchair ramps, construction of low retaining walls, and installation of a new closed drainage system with hydrodynamic separators.

A locus map of the project area is shown in Figure 1 – Project Locus Map.

2.0 PROJECT SUMMARY

The proposed project consists of reconstruction of a 1.1-mile segment of Grove Street from Tobacco Road/Rosewood Lane (meeting with the end of Phase 1) to Kenwood Circle. The project limits are shown in Figure 1. The purpose of the project is to construct a shared use path along the north/west side of Grove Street, which will provide improved pedestrian and bicycle access along the corridor and connect to the existing Southern New England Trunkline Trail (SNETT). The existing roadway width is generally between 28 feet and 40 feet wide with 2' shoulders and no sidewalks throughout the project limits.

The improvements will include a cross section with 12-foot travel lanes, 2-foot shoulders, enhanced pavement conditions through a combination of reconstruction/reclamation and resurfacing, and providing bicycle and pedestrian accommodations through an 8-foot to 10-foot shared use path. The project will also include upgrades to the existing drainage system to improve runoff collection and stormwater quality. The new shared use path is proposed along the north/west side of Grove Street.

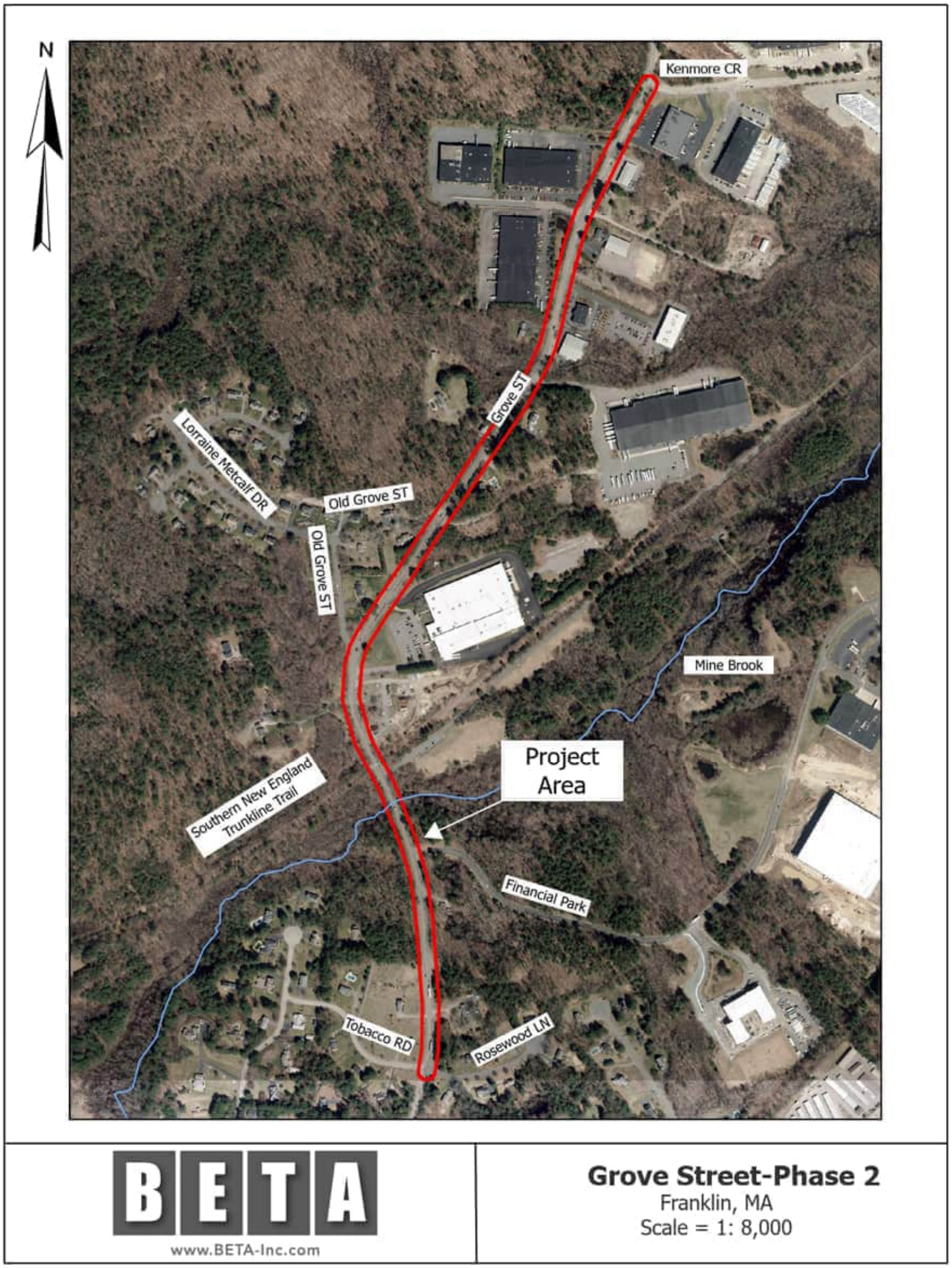


Figure 1 – Project Locus Map

3.0 EXISTING CONDITIONS

The Phase 2 project area is approximately 7 acres and begins at the intersection of Tobacco Road and Grove Street in Franklin (Figure 1), which meets the end of the Phase 1 Grove Street project. Grove Street is a two-lane bituminous asphalt roadway with various commercial and industrial properties as well as some private residences along its length. The project corridor is adjacent to Town land (for public wellhead protection) as well as State land. There is generally no curbing or berm on either side. At several locations, there are wetlands adjacent to the roadway, and there are several existing culverts. Near the beginning of the project (~STA 23+00 LT), there is an entrance to the Southern New England Trunkline Trail (SNETT), and one major objective of this project is to provide improved access to this existing trail.

There are wetland resource areas within 100 feet of the proposed activities, and the site also includes a wellhead protection area (Zones I and II).

<u>SITE PARAMETERS</u>

Soil Classification

Please refer to Appendix F – Soil Map. According to the Soil Survey of Norfolk County, Massachusetts, prepared by the US Department of Agriculture, Natural Resources Conservation Service, Underlying soils within the project area consists of nine soil types, which are predominately Hydrologic Soil Group (HSG) A. The project also includes smaller areas of soils that are HSG A/D, B/D, and Urban land. For areas with HSG A/D, A soils were assumed to be dominant within the roadway area, and for areas with HSG B/D, B soils were assumed to be dominant within the roadway. For roadway soils classified as urban land, HSG A was assumed, as that is the classification of soils directly adjacent to that roadway segment.

Detailed individual descriptions of these soils are not provided herein but may be found in the referenced USDA soil survey.

Hydrologic Soil Groups (HSG) are based on estimates of runoff potential. Soils are assigned to one of four groups, according to the rate of water infiltration when 1) the soils are not protected by vegetation, 2) are thoroughly wet, and 3) receive precipitation from long-duration storms.

Per the soil survey, the general characteristics of the four (4) hydrologic soil groups are as follows:

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

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

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

<u>Group D</u> – Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high-water

table, soils that have a clay pan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

As depicted in the Appendix F, the underlying soils within the upland project area belong mostly to HSG A, meaning that the project area likely has a high infiltration rate with a low potential for runoff.

Subsurface Investigation

As a part of the Phase 1 work, a subsurface investigation (in the form of a soil evaluation) was performed onsite to confirm the condition of the existing soils as well as determine the seasonal high groundwater levels.

The test pit was performed at the location of what is now the newly-constructed stormwater BMP, off the east side of Grove Street approximately 100' south of Rosewood Lane (~STA 5+00 RT). The soil was classified as sand. Seasonal high groundwater was not found within 10' of the surface. The results from the Phase 1 soil evaluation can be found in Appendix E.

Existing Drainage Collection

Stormwater runoff along Grove Street currently sheet flows off the roadway into the existing wetlands on both sides of the road. There is a small existing closed drainage system trunkline in the vicinity of the intersection with Old Grove Street as well as some catch basins near Kenwood Circle.

For an overview of existing drainage catchment areas and their characteristics, refer to the Watershed Plans in Appendix C.

Key features in and around the project area include wetland resource areas, FEMA Flood Zones, and Zone II areas.

Wetland Resources

Wetland resource areas along the project alignment were delineated in 2020 by BETA Group, Inc. A copy of the Wetland Report is included in the Appendix C. The Wetland Report describes wetland resource areas subject to Protection under the Massachusetts Wetlands Protection Act, the federal Clean Water Act, the Massachusetts Clean Waters Act, and local bylaws.

Flood Zone Classification

Please refer to Appendix G – FEMA Flood Map. According to the Flood Insurance Rate Maps (FIRM) for Norfolk County, Map Number 25021C0316E, effective date July 17, 2012, the northern portion of Mine Brook, which flows through a culvert under under Grove Street (~STA 21+00), is located within FEMA Floodway and Flood Zone AE. There is a Bordering Land Subject to Flooding (BLSF) associated with this flood zone.

Zone AE Flood Hazard areas indicate the limits of the 100-year floodplain, with an associated Base Flood Elevation (BFE).

4.0 Proposed Conditions

The proposed project includes the addition of a paved shared use pathway along the north/west side of Grove Street, as well as proposed milling and overlay of Grove Street, installation of new curbing and wheelchair ramps, installation of tree wells, installation of a new closed drainage system with hydrodynamic separators, and a connection to a previously constructed infiltration basin.

These measures will improve the stormwater characteristics at the site by providing water quality pretreatment and stormwater recharge for the proposed impervious area.

While the roadway impervious area will be reduced, the overall impervious area for the project will increase due to the addition of shared use path. The Town of Franklin will be responsible for the annual inspection and maintenance of the new stormwater management system.

STORMWATER MANAGEMENT

The proposed project is a redevelopment project. The following describes the methodology used in the analysis and design of the stormwater management system for the roadways.

PROJECT AREA ANALYSIS AND STORMWATER REQUIREMENTS CALCULATIONS

The overall project area was analyzed to determine the stormwater management requirements for the project; specifically, the groundwater recharge volume (ReV) and water quality volume (WQV) requirements were determined, based on the existing and proposed project-wide impervious areas.

Existing, Proposed & Net Impervious Areas
The existing, proposed, and net increase impervious areas within the project limits were determined and the net increase to impervious area was used in the calculations of the required ReV and WQV. Impervious areas consist of existing roadways, bituminous and cement concrete sidewalks, and paved driveways within and to the extents of the project limits of disturbance; impervious areas outside of the project limits of disturbance (e.g. driveways, buildings, walls, impervious site features) were not included in the determinations of existing and proposed impervious areas.

The net (new) impervious area for the project is 33,270 s.f. This represents a net increase of 14%.

Table 1 Changes to Impervious Areas

Existing Impervious	New Impervious (Pathway)	New Impervious (Roadway)	Net New Impervious	Total Impervious
204,362 SF	43,038 SF	-9,769 SF	33,270 SF	237,632 SF

Minimum ReV Requirement

The required recharge volume (ReV) is the product of the total new impervious area created by the project and a target recharge factor (measured in inches of rainfall per square foot of impervious area) for the project area. The target recharge factor is based on the HSG(s) of the underlying soil(s) present within the project area.

The impervious area within the project site is located where the soil type is predominantly HSG A with a relatively small impervious area within HSG B soils. The recharge target for A soils is 0.6 in/s.f., while B is 0.35 in/s.f. Based on 26,145 s.f. of new impervious area in A soils and 7,125 s.f. in B soils, the minimum ReV required calculates to 1,521 c.f.

Minimum WQV Requirement

The Franklin Bylaw 21-867 states that redevelopment projects are required to retain the volume of runoff equivalent to 0.8 inches multiplied by the post construction impervious area. This bylaw applies for 22,775 s.f. of the project. However, since 19,246 s.f. of the project area is classified as a Zone II well protection area, the required water quality treatment volume (WQV) for that area must be equal to 1.0 inch of rainfall over the total net impervious area created by the proposed project. Based on the new impervious areas, the minimum WQV for the project is 3,198 c.f. Pre-treatment will be provided by tree wells and deep sump catch basins while hydrodynamic separators and an existing infiltration basin will provide a portion of the water quality treatment. The required water quality volume of 3,198 c.f. is greater than the required recharge volume of 1,521 c.f. and will be used as the target treatment volume.

The Phase 1 proposed site stormwater management system was designed to provide excess storage capacity (more than 4,000 c.f. total). Therefore, there is additional capacity available for water quality treatment in this recently constructed basin. Due to site grading constraints, only a portion of the Phase 2 proposed stormwater water quality volume (~628 c.f.) can be directed to the Infiltration Basin for treatment.

Drawdown

The required drawdown for an infiltration BMP is 72 hours to ensure that the BMP drains completely between storm events. Using a Hydraulic Conductivity factor of 8.27 inches/hour (See Table 2.3.3 of the Stormwater Manual), it was determined that the drawdown of the infiltration system is 2.63 hours (based on drawing down the sum of the design volumes from Phase 1 and new impervious volume contributing to the basin from Phase 2), which complies with the 72-hour threshold.

STORMWATER MANAGEMENT SYSTEM ANALYSIS AND DESIGN

The proposed stormwater management system will collect, pretreat, and treat surface runoff from Grove Street to discharge into a recently constructed infiltration basin as well as two hydrodynamic separators and several tree wells. As there are no existing stormwater treatment measures on site, the implementation of the proposed system will result in an overall decrease in overall post development peak runoff from the site for design storms including the 2-year, 10-year, 25-year, and 100-year events.

Two proposed hydrodynamic separators and the existing infiltration basin will treat the required water quality volume for the proposed impervious areas.

Closed Drainage Systems

The proposed closed system is designed with deep sump catch basins and hydrodynamic separators to provide initial TSS removal. It is anticipated that this train of pretreatment devices at each of the two proposed outfalls will provide 96% TSS removal prior to the discharge to design points. Depending on the closed system, TSS removal varies from 25% to 96%. For TSS removal worksheets, please refer to Appendix D.

Infiltration Basin System

A portion of the proposed drainage system will discharge to an existing infiltration basin located on the east side of Grove Street and south of Rosewood Lane. This recently-constructed stormwater infiltration basin from the Grove Street Phase 1 project has excess capacity and will be modified to accept a portion of additional flows from Phase 2 areas. From Phase 2, the infiltration basin is anticipated to provide infiltration from approximately 7,535 s.f. of impervious area (about 3,193 s.f. from the proposed shared use path).

For an overview of proposed drainage catchment areas and their characteristics, refer to the Watershed Plans in Appendix C.

Table 5 lists the proposed BMPs and provides a description of each.

Table 2 Existing/Proposed BMPs

BMP	Description
BMP 1 – Existing Infiltration Basin	Grove Street Station 5+00 RT
BMP 2 – Hydrodynamic Separator	Grove Street Station 20+52 LT
BMP 3 – Hydrodynamic Separator	Grove Street Station 47+08 LT
Tree Filters	Various Locations – See Plans

5.0 IMPAIRED WATERS AND TMDLS

A portion of this project will discharge to Mine Brook. This water body has the following impairments based on MassDEP Year 2018/2020 Integrated List of Waters, also known as the 303(d) list:

Table 3 Impaired Waters and TMDL Information

Water Body	Water Body ID	Impairments
Mine Brook	MA72-14	(Habitat Assessment*); E. Coli, Temperature

*TMDL not required

6.0 STORMWATER MANAGEMENT STANDARDS

As demonstrated below, the proposed Project complies with the MassDEP Stormwater Management Standards (the Standards) to the maximum extent practicable. The Project is a redevelopment project, therefore, per 310 CMR 10.05(6)(k)(7), the project must only meet Standards 2, 3, 4, 5 and 6 to the maximum extent practicable. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable.

6.1 STANDARD 1 - MET (TO THE MAXIMUM EXTENT PRACTICABLE)

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

The Project has been designed to comply with Standard 1 to the maximum extent practicable. All new outfalls are designed with headwalls and stone for pipe ends to prevent erosion to the receiving water bodies and wetlands.

There will be no new untreated discharges created as part of this project. Existing discharges will be improved to the maximum extent practicable through the installation of deep sump catch basins. Stormwater generated from the site will be captured by the closed drainage system and treated through proposed deep sump catch basins and hydrodynamic separators at new discharge locations. A portion of the project area will also be infiltrated through the stormwater basin constructed during Phase 1.

6.2 STANDARD 2 – MET (TO THE MAXIMUM EXTENT PRACTICABLE)

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.

The Project has been designed to comply with Standard 2 to the maximum extent practicable. There will be an increase to the impervious area as a result of this project. There will be several changes to the drainage collection and conveyance system in order to incorporate water quality treatment measures and conform to roadway standards. Two new BMPs are proposed as part of the drainage improvements, and

several tree filters will also be used as well as a reduction in roadway impervious area. However, the new shared use path will result in a net increase in impervious area.
In the proposed condition, the roadway and shared use path will be collected in a closed drainage network and routed to deep sump catch basins and hydrodynamic separators. A portion will also be routed to the existing stormwater basin that was recently constructed in Phase 1. The basin retains and infiltrates all the Phase 1 stormwater runoff up to the 10-year storm as well as a portion of the Phase 2 stormwater runoff.

In order to provide adequate room for the proposed shared use path and guardrail, a few small areas of existing wetland will be permanently disturbed in the vicinity of Sta 46+30 LT to Sta 48+00 LT (504 s.f. total). Wetland replication that amounts to at least double the permanent impact will be provided in vicinity of the impacts. Additionally, while there is no permanent wetland impact near Sta 23+50 LT, compensatory flood storage will be provided in this area due to impacts on the 100-yr floodplain by the proposed rockfill slope at this location.

Hydrologic analyses of the site were conducted under existing and proposed conditions for the 2, 10, 25, and 100-year storms.

The results of the analyses indicate that there will be an increase of the proposed peak runoff rates and volumes to the adjacent wetlands. Therefore, this standard is not fully met. However, due to the project being a shared use path construction, this standard only needs to be met to the greatest extent practicable. Due to Right-of-Way (ROW) constraints and abutting state-owned forest (which falls under Article 97 protection), areas for potential BMPs for infiltration and attenuation are limited within the project. Although the peak discharges increase slightly, no impact to the 100-year flood elevation is anticipated since the overall size of the receiving watershed is comparatively much larger than the increase in impervious area from the project.

Refer to Appendix D for full results of the existing and proposed Autodesk Storm and Sanitary Sewers analysis as well as partial HydroCAD analysis for the area contributing to the infiltration basin from Phase 1.

To verify that the existing basin from Phase 1 has adequate capacity to treat a portion of the Phase 2 water quality volume, a limited HydroCAD analysis was performed using a modified version of the Phase 1 HydroCAD analysis. This modified model includes the addition of flows from subcatchment area PR-sub-1 into Basin #1 via a catch basin with a flow diversion weir. The flow diversion is present to ensure only flows from the water quality storm will be directed to the existing infiltration basin. Rainfall depths used in the HydroCAD model are listed below:

Rainfall Depths (in)

Design Storm Event	Rainfall Depth (in)
2-year	3.36
10-year	5.23
25-year	6.39
100-year	8.19

Drainage system pipes were designed utilizing peak flows from the Rational Method for the 10-year storm event utilizing AutoCAD Storm and Sanitary Analysis 2020.

The table below provides a summary of peak rates for each design point under existing and proposed conditions. Appendix D provides computations and supporting information regarding the hydraulic and hydrologic modeling.

Peak Discharge Rates (cfs)

	Existing				Proposed			
Design Point	2-year	10-year	25-year	100-year	2-year	10-year	25-year	100-year
*DP-1**	*0.34*	*0.72*	*0.99*	*1.44*	*0.61*	*1.07*	*1.38*	*1.88*
DP-5	*0.81*	*1.23*	*1.50*	*1.90*	*2.47*	*3.79*	*4.63*	*5.86*
DP-6	*0.40*	*0.61*	*0.74*	*0.93*	*0.51*	*0.75*	*0.90*	*1.11*
DP-7	*1.24*	*1.89*	*2.28*	*2.92*	*1.35*	*2.01*	*2.40*	*3.00*
DP-10	*0.56*	*0.85*	*1.03*	*1.31*	*0.71*	*1.08*	*1.30*	*1.63*
DP-13	*1.04*	*1.59*	*1.92*	*2.45*	*1.03*	*1.58*	*1.92*	*2.43*
DP-16	*1.76*	*2.69*	*3.26*	*4.14*	*2.03*	*3.10*	*3.70*	*3.82*
DP-18	*2.30*	*3.51*	*4.27*	*5.41*	*2.39*	*3.65*	*4.43*	*5.66*
DP-20	*1.00*	*1.52*	*1.85*	*2.35*	*2.12*	*3.24*	*3.92*	*4.99*

**For DP-1, Peak Discharge Rates were calculated using HydroCAD, in order to model that a portion of proposed flows being directed to the Phase 1 infiltration basin BMP.*

The results of the analysis indicate that post-development peak discharge rates will increase at most design points from pre-development discharge rates due to the increase in impervious area from the shared use pathway and addition of a closed drainage system. It should be noted that for DP-1, the increase in peak flow is less than it would be due to a portion of the flow being directed to the infiltration basin from Phase 1. The watershed figures and supporting analysis can be found in Appendix C.

6.3 Standard 3 – Met (to the maximum extent practicable)

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.

The Project has been designed to comply with Standard 3 to the maximum extent practicable. The stormwater management design infiltrates a portion of the required recharge volume to groundwater in the infiltration basin that was constructed as part of Phase 1. While this basin has adequate capacity to provide an additional recharge volume from Phase 2, the site grading and surface cover will only allow around 628 c.f. to be directed to the infiltration basin for treatment. Assuming 7.6 c.f. of recharge volume per tree filter leads to an additional 45.8 c.f. of recharge volume that can be provided.

So, while 1,521 c.f. of recharge is required, only 673.8 c.f. of recharge volume is able to be provided as part of this project. It is worth noting, however that there is more than 3,000 linear feet of proposed grass buffer that will be able to intercept stormwater flowing off the new pavement of the shared use path. Some portion of this flow will infiltrate into groundwater before reaching the roadway gutter.

6.4 Standard 4 – Met (to the maximum extent practicable)

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

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

The Project has been designed to comply with Standard 4 to the maximum extent practicable as this is a redevelopment project. Stormwater control measures have been sized to treat a portion of the required water quality volume (WQV). The addition of off-line deep sump catch basins and tree filters will also provide some water quality treatment to stormwater entering the resource areas. While the proposed tree filters do not directly connect to catch basins, they do intercept the gutter flow prior to it reaching the downstream catch basin. This ensures that treatment of gutter flows are provided until the tree filter becomes bypassed by larger storm events or clogging. Where existing closed systems are being modified, a TSS removal of at least 25% is achieved, assuming installation of deep-sump catch basins. For areas where entirely new closed systems are present, the TSS removal rates range from 85-96%. TSS Removal worksheets can be found in Appendix D.

It should be noted that the runoff leaving the roadway and ultimately entering the wetland resource areas currently receives no treatment at all; therefore, the proposed mitigation features, while not achieving the entire treatment standard, will still result in a significant improvement to the water quality of the runoff.

6.5 Standard 5 – N/A

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.

The project area does not qualify as an area with higher potential pollutant loads; therefore, this standard is not applicable.

6.6 Standard 6 - Met

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.

Approximately 51% of the project is located within Zone II Wellhead Protection Area. The new outfalls located at Station 20+65 LT (within Zone II) and 47+06 LT (outside Zone II) are designed with headwalls and stone for pipe ends to prevent erosion to the receiving wetlands. The proposed outfalls are set back from the existing wetlands. Hydrodynamic separators and deep sump catch basins are proposed as part of this system. Stormwater BMPs were considered in these locations but were determined to be impractical due to close proximity to wetlands and limited area within the right-of-way.

Appendix H shows the Wellhead Protection Areas in the vicinity of the project site.
The work within the Zone II area of the project consists of full depth path construction, milling and overlay, slope grading, and construction of guardrail and retaining walls/moment slab. Minor roadway widening is proposed to provide a consistent cross section meeting minimum MassDOT requirements. No stormwater discharges are proposed within Zone I areas.

6.7 Standard 7 - Met

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

The proposed project is a redevelopment project. As discussed above, the standard has been met to the maximum extent practicable.

6.8 Standard 8 - Met

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.

Soil and erosion control shall be provided during construction by means of compost filter socks and catch basin silt sacks. A Construction Period Pollution Prevention and Erosion and Sediment Control Plan has been developed for the project site and is included in Appendix B.

6.9 Standard 9 - Met

All stormwater management systems must have an operation and maintenance plan to ensure that systems function as designed.

The long-term post-construction implementation of the Operation and Maintenance (O&M) plan for the stormwater structures within the project area will be the responsibility of the Town of Franklin. The O&M plan is attached to this report in Appendix H.

6.10 Standard 10 - Met

All illicit discharges to the stormwater management system are prohibited.

The project's stormwater management system, as shown on the plans submitted with this report, have been designed in full compliance with Standard 10. The project area does not have any known illicit connections.

7.0 Conclusion

While the Grove Street Improvements Phase 2 project will result in a net increase in impervious areas, this is due wholly to the addition of a paved shared use path. By using a combination of hydrodynamic separators, tree wells, and taking advantage of excess treatment capacity within an existing stormwater basin, the effects of the project on adjacent wetlands will be mitigated to the greatest extent practicable. Treatment of stormwater runoff has been provided and meets the requirements set forth by the Massachusetts Department of Environmental Protection and Town of Franklin Bylaws to the greatest extent practicable. Any unavoidable impacts to Resource Areas are to be mitigated by replicating new wetlands.

APPENDIX A

WETLAND DELINEATION REPORT

Resource Area Boundary Delineation
Grove Street
Franklin, Massachusetts

January 4, 2021

On May 13, 2021, BETA Group, Inc. (BETA) conducted resource area boundary delineations along a portion of the Grove Street public right-of-way in Franklin, Massachusetts. This report describes resource areas Subject to Protection under the Massachusetts Wetlands Protection Act (M.G.L. Chapter 131 Section 40) (the Act), the federal Clean Water Act (33 U.S.C. §1251 et seq (1972)), the Massachusetts Clean Waters Act (MGL Chapter 21 Section 26-53), and the Town of Franklin Wetlands Protection Bylaw (Chapter 181) (the Bylaw) that exist on the site and methodology used to delineate their boundaries.

Site Description

The Site consists of an approximately 6,500-linear foot portion of the Grove Street public right-of-way in Franklin, Massachusetts, from its intersection with Washington Street to its intersection with Kenwood Circle. Land uses along the Site corridor generally consist of residential and commercial parcels. In addition, the Franklin State Forest abuts portions of the west side of the Site and Town of Franklin public water supply wells exist to the east of the Site (Figure 1 – Site Locus). The Site is bisected by Mine Brook (Figure 2 – Environmental Resources) as well as the Southern New England Trunkline Trail (SNETT), an improved but unpaved multi-use path. Existing improvements at the Site include a two-lane bituminous roadway, guardrails, stormwater management infrastructure, and vegetated roadway shoulders.

According to the USDA Natural Resources Conservation Service – Soil Survey, mapped soils on the Site and in the vicinity of the Site are classified as Udorthents-sandy, Urban land, Merrimac fine sandy loam, Sudbury fine sandy loam, Hinckley loamy sand, Hollis-Rock outcrop-Charlton complex, Carlton-Hollis-Rock outcrop complex, Whitman fine sandy loam, Ridgebury fine sandy loam, Swansea muck, and Scarboro/Birdsall soils. Our field work generally confirmed the soil types within the Site. The *Custom Soil Resource Report for Norfolk and Suffolk Counties, Massachusetts* is attached.

State jurisdictional resource areas identified on the Site include Bank (to perennial and intermittent streams), Bordering Vegetated Wetlands (BVW), Land Under Water (LUW), Bordering Land Subject to Flooding (BLSF), and Riverfront Area (RA). The MassGIS database was used as the initial step in identifying critical areas on or within proximity to the Site that would be examined more closely if construction activities are proposed. The table below describes selected environmentally critical categories as determined through MassGIS.

Table 1: Selected MassGIS Environmental Data Layers

Mapped Resource On or Within Proximity to Site	Yes	No
Area of Critical Environmental Concern		✓
NHESP Certified Vernal Pool		✓
NHESP Potential Vernal Pool	✓	
NHESP Estimated Habitat of Rare Wildlife		✓
NHESP Priority Habitat of Rare Species		✓
Outstanding Resource Waters		✓
FEMA Flood Zones	✓	
Surface Water Protection Area (Zones A and B)		✓

Mapped Resource On or Within Proximity to Site	Yes	No
Interim Wellhead Protection Area		✓
Zone I Wellhead Protection Area	✓	
Zone II Wellhead Protection Area	✓	
Wild and Scenic River		✓
DFW Coldwater Fisheries Resource	✓[1]	

Source: MassGIS

[1]Mine Brook is a tributary to Dix Brook, which is mapped by the DFW as a Coldwater Fishery. The confluence of Mine Brook and Dix Brook is located approximately 1,350 feet northeast of the Site. Miscoe Brook, a tributary to Mine Brook, is also mapped as a Coldwater Fishery; their confluence is located approximately 2,100 feet southwest of the Site.

Jurisdictional Wetland Resource Areas – Massachusetts Wetlands Protection Act

A Site inspection was conducted by BETA's Wetland Scientists on May 13, 2021 to identify and delineate the boundary of resource areas on the Site and in the immediate vicinity of the Site. Resource area boundaries were identified and delineated in accordance with methods developed by the Massachusetts Department of Environmental Protection's *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act*, dated 1995, as well as definitions set forth in the Wetland Regulations, 310 CMR 10.00. Five (5) Areas Subject to Protection under the Act exist at the Site and are described below.

<u>Bank (Inland) – 310 CMR 10.54</u>

According to 310 CMR 10.54(2), the definition of a Bank is the portion of the land surface which normally abuts and confines a water body, occurring 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. The upper boundary of a Bank is the first observable break in the slope or the mean annual flood level, whichever is lower.

BETA identified the resource Bank associated to one (1) intermittent stream and three (3) perennial streams in proximity to the Site. The Banks within 100 feet of the Site were delineated in the field with blue flagging as described below in Table 2: Bank Boundary Description.

Table 2: Bank Boundary Description

Flag Series	Stream Type & Location	Description / Notes
B1 & B2 Series *Flags* *B1-100 to B1-102* *&* *B2-100 to B2-102*	Intermittent stream interior to the WF4 Series BVW, north of 352 Grove Street	The southern (*B1 Series*) and northern (*B2 Series*) Banks of an intermittent stream interior to the WF4 Series BVW were delineated based on a coincident first observable break in slope and mean annual flood level. This channel is approximately two (2) feet wide with approximately six (6) inches of standing water at the time of the Site visit; no flow was observed. This stream is not depicted on USGS topographic maps or the USGS StreamStats program.
B3 & B4 Series *Flags* *B3-100 to B3-108* *&* *B4-100 to B4-109*	Mine Brook crossing at Grove Street, north of 352 Grove Street	The southern (*B3 Series*) and northern (*B4 Series*) Banks of Mine Brook, a perennial stream (River), were delineated in the vicinity of the crossing under Grove Street via a stone arch bridge with a span of approximately ten (10) feet. Mine Brook flows easterly and is approximately ten (10) feet wide with eight (8) inches of water near the stone culvert at the time of the Site visit. Bank is coincident with the Mean Annual High Water (MAHW) mark; the

Flag Series	Stream Type & Location	Description / Notes
		MAHW mark/mean annual flood level are upgradient of the first observable break in slope and were delineated as Bank*. The substrate of Mine Brook consists of sand with small stones, and vegetation along the Banks include red maple (*Acer rubrum*), poison ivy (*Toxicodendron radicans*), and skunk cabbage (*Symplocarpus foetidus*).
B5 Series Flags B5-87 to B5-114	West side of Grove Street, north and south sides of the SNETT	The eastern (*B5 Series*) Bank of an unnamed perennial tributary to Mine Brook was delineated from its confluence with Mine Brook to a point approximately 500 feet north. The tributary flows south through a four (4)-foot-wide stone culvert under the SNETT and is approximately five (5) feet wide with a water depth varying from four (4) to twelve (12) inches at the time of the Site visit. The substrate consists of pebbles and sand, and vegetation along the Bank includes skunk cabbage (*Symplocarpus foetidus*) and cinnamon fern (*Osmundastrum cinnamomeum*). Bank was delineated along the mean annual flood level/MAHW where it was observed upgradient of the first observable break in slope*.
B6 & B7 Series Flags B6-100 to B6-103 B7-100 to B7-102	East side of Grove Street, between the WF8 and WF9 Series BVWs	The southern (*B6 Series*) and northern (*B7 Series*) Banks/MAHW of an unnamed perennial stream connecting the WF8 and WF9 BVWs were delineated at the east side of Grove Street. Banks of the stream west of Grove Street were not visible due to water levels within the WF8 BVW. The first observable break in slope is coincident with the mean annual flood level. This easterly flowing channel is approximately four (4) feet wide and had a water depth of three (3) inches the time of the Site visit. Vegetation along the Banks includes oriental bittersweet (*Celastrus orbiculatus*) and slippery elm (*Ulmus rubra*).

**Bank was delineated per the Bylaw definition as discussed later in this report.*

Bordering Vegetated Wetlands – 310 CMR 10.55

According to 310 CMR 10.55(2), the definition of BVW are freshwater wetlands which border on creeks, rivers, streams, ponds and lakes and are areas where the soils are saturated and/or inundated such that they support a predominance of wetland indicator plants. The boundary of BVW is the line within which 50% or more of the vegetation community consists of wetland indicator plants and saturated or inundated conditions exist.

BETA identified seven (7) areas of BVW at the Site. The boundaries of these wetlands were delineated in the field with pink flagging. US Army Corps of Engineers' *Vegetated Wetland Boundary Delineation Field Data Sheets* are attached documenting BETA's observed evidence of hydrology, soils, and hydrophytic vegetation at specific data plots.

Table 3: BVW Boundary Description

Flag Series	Location	Description / Notes
WF2 Series Flags WF2-100 to WF2-106	Northeast of the intersection of Grove Street and Washington Street	The WF2 Series BVW is a scrub shrub wetland located at the toe of a steep slope along the east side of Grove Street. Inundation was observed within the interior of the wetland and water-stained leaves were present at the outer extents. Dominant vegetation within the BVW includes skunk cabbage, jewelweed (*Impatiens capensis*), and sensitive fern (*Onoclea sensibilis*). This wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed at this location.
WF3 Series Flags WF3-100 to WF3-124	East of Grove Street, adjacent to a public well pump house at 352 Grove Street	The WF3 Series BVW is a red maple swamp with significant ponding present within the interior of the wetland. The wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils as documented on the attached U.S. Army Corps of Engineers Field Data Sheet.
WF4 Series Flags WF4-100 to WF4-104	East of Grove Street, along Mine Brook	This BVW is a forested swamp that borders on Mine Brook. An interior intermittent stream was observed to the south of Mine Brook. Dominant vegetation within the BVW includes red maple and skunk cabbage. This wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed at this location.
WF5 Series Flags WF5-100 to WF5-105	East of Grove Street, north of the WF4 Series BVW and south of the SNETT	The WF5 Series BVW is a forested swamp located north of Mine Brook. The portion of this BVW along Grove Street is separated from the WF4 Series BVW along Grove Street by an upland hummock. Dominant vegetation within the BVW includes red maple. This wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed at this location.
WF6 Series Flags WF6-100 to WF6-128	West of Grove Street, south and north of Mine Brook	The WF6 Series BVW borders on Mine Brook and is bisected by the SNETT. The BVW to the south of the SNETT is a scrub shrub swamp, while the BVW to the north of the trail is a red maple swamp. Sediment accumulation was observed within a ponded portion of the BVW along Grove Street to the south of Mine Brook. The wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils as documented on the attached U.S. Army Corps of Engineers Field Data Sheet.
WF8 Series Flags WF8-100 to WF8-109	Along the frontage of 177 Grove Street	This BVW is a deep marsh that abruptly transitions to the filled side slopes along Grove Street. Fencing is present upgradient of, and within, a portion of this wetland which restricted access for the delineation. The WF8 Series BVW borders on a perennial stream; the associated culvert was submerged on the west side of Grove Street. This wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed

Flag Series	Location	Description / Notes
		at this location.
WF9 Series Flags WF9-100 to WF9-105	East of Grove Street, north of 176 Grove Street	The WF9 Series BVW is a red maple swamp that borders on an unnamed perennial stream that flows east under Grove Street from the WF8 Series BVW. This wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed at this location.

<u>Land Under Water – 310 CMR 10.56</u>

According to 310 CMR 10.56(2), the definition of LUW is the land beneath any creek, river, stream, pond or lake and may be composed of organic muck or peat, fine sediments, rocks or bedrock. LUW exists between the Bank boundaries below the mean annual low water level of Mine Brook and the two (2) unnamed perennial streams. The boundary of LUW is the mean annual low water level. This boundary was not delineated in the field.

<u>Bordering Land Subject to Flooding – 310 CMR 10.57</u>

According to the FEMA FIRM Numbers 25021C0316E and 25021C0308Edated July 17, 2012, a Zone AE Flood Hazard and Regulatory Floodway associated with Mine Brook are present at the Site. Base Flood Elevations (BFEs) associated with the Zone AE Flood Hazard range from 241.4 feet (NAVD88) to 246 feet (NAVD88). Any work performed below the BFE is subject to jurisdiction under the Act.

<u>Riverfront Area – 310 CMR 10.58</u>

According to its definition at 310 CMR 10.58(3), the boundary of RA is the area of land between as River's mean annual high-water (MAHW) line measured horizontally outward from the River and a parallel line located 200 feet away. A River is any natural flowing body of water that empties to any ocean, lake, pond, or other River flowing throughout the year and is shown as perennial on the current USGS or more recent map provided by the Department, has a watershed size of at least one (1) square mile, or has a watershed size of at least 0.50 square miles and a predicted flow rate greater than or equal to 0.01 cubic feet per second at the 99% flow duration using the USGS Stream Stats Method.

Mine Brook (*B3 & B4 Series Banks*), its unnamed tributary (*B5 Series Bank*), and the stream connecting the WF8 Series and WF9 Series BVWs (*B6 & B7 Series Banks*) are depicted as perennial streams (Rivers) on USGS topographic maps and are afforded 200-foot RAs. The MAHW mark is coincident with all Bank delineations described above in Table 2.

Jurisdictional Wetland Resource Areas – Town of Franklin

The Bylaw maintains many regulatory definitions consistent with the Act, with the exception of the following:

<u>Isolated Vegetated Wetlands</u>

The Bylaw protects all freshwater wetlands, whether or not they border surface waters. BETA identified four (4) areas that qualify as Isolated Vegetated Wetlands (IVWs) as described below in Table 4.

Table 4: IVW Boundary Description

Flag Series	Location	Description / Notes
WF1 Series Flags WF1-100 to WF1-108	Northwest of the intersection of Grove Street and Washington Street	The WF1 Series IVW is a defined depression that was inundated at the time of the Site visit. MassGIS depicts a PVP at this location. The wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils as documented on the attached U.S. Army Corps of Engineers Field Data Sheet.
WF7 Series Flags WF7-100 to WF7-104	Southwest of 191 Grove Street	The WF7 Series IVW is a shallow depression depicted as a stream on MassGIS, though no stream or channel was observed in the field. Dominant vegetation within this depression includes skunk cabbage, elderberry (*Sambucus canadensis*), and cinnamon fern. This wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed at this location.
WF10 Series Flags WF10-100 to WF10-103	Southwest of the intersection of Grove Street and Kenwood Circle	The WF10 Series IVW is a small roadside depression that receives stormwater runoff from Grove Street. Vegetation within the IVW includes highbush blueberry (*Vaccinium corymbosum*), greenbrier (*Smilax rotundifolia*), and red maple. This wetland boundary was established based on evidence hydrology (including the presence of Hydrogen Sulfide Odor), as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed at this location.
WF11 Series Flags WF11-100 to WF11-104	Along Grove Street at 161 Grove Street	This IVW is located within a stormwater basin that was constructed between 2001 and 2005 based on historic aerial imagery. The basin appears to not have been maintained in accordance with the MassDEP Stormwater Handbook as evidenced by the growth of substantial woody and herbaceous vegetation including cattail (*Typha latifolia*). Nearby basins appear to be maintained through mowing. This wetland boundary was established based on evidence hydrology, as well as the presence of hydrophytic vegetation and hydric soils. A formal data plot was not performed at this location.

<u>Bank</u>

Bank is defined as the land area which normally abuts and confines a water body; the lower boundary being the mean annual low flow level, and the upper boundary being the first observable break in the slope or the mean annual flood level, *whichever is higher.*

The mean annual flood level was delineated as Bank wherever it occurred upgradient of the first observable break in slope. Therefore, the Bank delineation complies with the Bylaw definition.

<u>Rare Species</u>

The Bylaw states that Rare Species includes, without limitation, all vertebrate and invertebrate animal and all plant species listed as endangered, threatened, or of special concern by the Massachusetts Division of Fisheries and Wildlife, *regardless of whether the site in which they occur has been previously identified by the Division.*

The Site is located outside of Priority Habitat of Rare Species as identified by the Division. Coordination with the Conservation Commission will be required through the Notice of Intent filing process to determine if the Site qualifies as Rare Species habitat under the Bylaw.

Vernal Pool

The Bylaw defines a vernal pool as a confined basin depression which, at least in most years, holds water for a minimum of two continuous months during the spring and/or summer and which is free of adult fish populations, *regardless of whether the site has been certified by the Massachusetts Division of Wildlife and Fisheries.*

MassGIS depicts Potential Vernal Pools (PVPs) within the WF1 Series IVW and the WF2, WF4, and WF6 Series BVWs. The PVP depicted within the WF1 Series IVW most closely meets this definition based on topography and hydrology; however, the time of year did not facilitate the investigation of vernal pool species. A determination will need to be made by the Conservation Commission regarding the status of these areas as vernal pools under the Bylaw.

Buffer Zone

Under the Bylaw, Buffer Zones are protected as Resource Areas and are subject to local Buffer Zone Performance Standards.

The Bylaw Regulations protect a 25-foot No Disturb Zone from the boundary of Resource Areas excluding Bordering/Isolated Lands Subject to Flooding (BLSF/ILSF) and RA. Applicants may work within this No Disturb Zone if the activity is considered minor or if a variance is sought.

The Bylaw Regulations also prohibit structures within 50 feet from the boundary of Resource Areas excluding BLSF/ILSF and RA. Structures may be permitted within this setback if the area was disturbed prior to June 29, 2006 or if a variance is sought.

Additional mitigation may be required by the Conservation Commission when a project results in more than 30% of the 50-100-foot Buffer Zone being converted to impervious area.

Jurisdictional Wetland Resource Areas – Federal Clean Water Act (Section 404)

The wetlands and streams located on the Site are “Waters of the United States,” and are therefore subject to the federal Clean Water Act, 33 U.S.C. §1251 et seq (1972). The boundary to “Waters of the United States” is the Vegetated Wetlands boundary, or, in the absence of Vegetated Wetlands, is the Ordinary High Water Mark (OHWM) for non-tidal rivers and streams, as specified at 33 CFR §328.4.

According to 33 CFR §328.3(c)(4), Vegetated Wetlands are defined as “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” The wetland boundary previously described in this report was delineated in accordance with this definition. The US Army Corps of Engineers’ *Vegetated Wetland Boundary Delineation Field Data Sheets* are attached documenting BETA’s observed evidence of hydrology, soils, and hydrophytic vegetation at specific data plots.

The OHWM of the streams, as defined at 33 CFR §328.3(c)(6), is coincident with the Bank.

The boundary of Vegetated Wetlands is consistent with the delineated BVW and IVW boundaries and would be considered the extent of Federal Section 404 Jurisdiction for most of the Site, except for areas where there are no Vegetated Wetlands along Streambanks. In those locations, such as to the east of Grove Street near the B6/B7 Series Stream and along portions of the B3/B4 Series Stream, the OHWM is the extent of Federal Section 404 Jurisdiction. Work conducted below the boundary of Vegetated Wetlands or the OHWM is Subject to Jurisdiction under Section 404 of the Clean Water Act.

Jurisdictional Wetland Resource Areas – Massachusetts Clean Waters Act (Section 401)

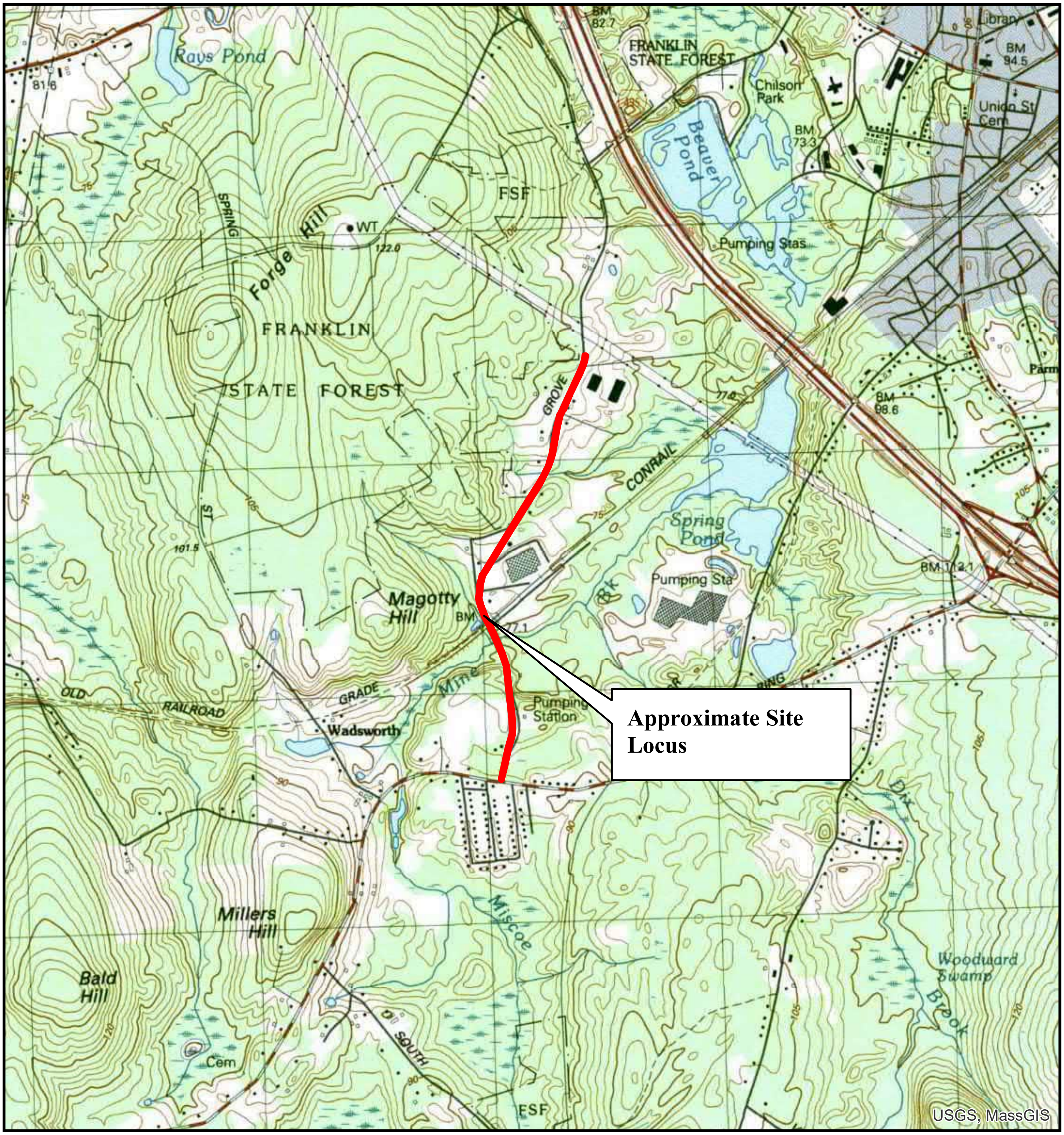
The limit of jurisdiction under Massachusetts Clean Waters Act (Section 401), as specified in 314 CMR 9.00, is the limit of Section 404 jurisdiction under the federal Clean Water Act. Exceedances of the jurisdictional threshold under 314 CMR 9.00 require filing for a Water Quality Certification under Section 401.

Findings and Recommendations

BETA has identified areas Subject to Protection and/or Jurisdiction under the Massachusetts Wetlands Protection Act, the federal Clean Water Act, the Massachusetts Clean Waters Act, and the Town of Franklin Wetlands Protection Bylaw on or within 100 feet of the Site and has delineated the boundaries of BVW, IVW, and Bank. In order to definitively determine the extent of Conservation Commission jurisdiction, Army Corps of Engineers jurisdiction, and MassDEP jurisdiction, the boundary flags would need to be located and depicted on a to-scale plan of the Site.

Attachments: Figure 1 – Site Locus
Figure 2 – Environmental Resources Map
Figure 3 – FEMA FIRMette
Photographic Documentation
US Army Corps of Engineers' *Vegetated Wetland Boundary Delineation Field Data Sheets*
Custom Soil Report for Norfolk and Suffolk Counties, Massachusetts

Job No: 21.07548.00



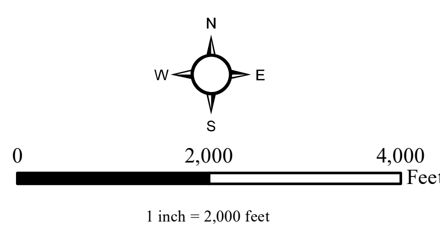


Figure 1
Site Locus
Grove Street
Franklin, MA

Data Source: MassGIS USGS Topographic Quadrangle Images (2001)

Figure 2
Environmental Resources Map
Grove Street
Franklin, MA

Wetland Resources Legend

- MassDEP Hydrologic Feature
- Marsh/Bog
- Wooded marsh
- Open Water
- NFHL 100 Year Flood Zone
- Area of Critical Environmental Concern (ACEC)
- Zone A
- Zone B
- Outstanding Resource Water
- MassDEP IWPA
- MassDEP Zone I
- MassDEP Zone II

Mapped Habitat Legend

- NHESP Potential Vernal Pool
- NHESP Certified Vernal Pool
- NHESP Priority Habitat of Rare Species
- NHESP Estimated Habitats of Rare Wildlife

N E S W

0 500 1,000 Feet

1 inch = 500 feet

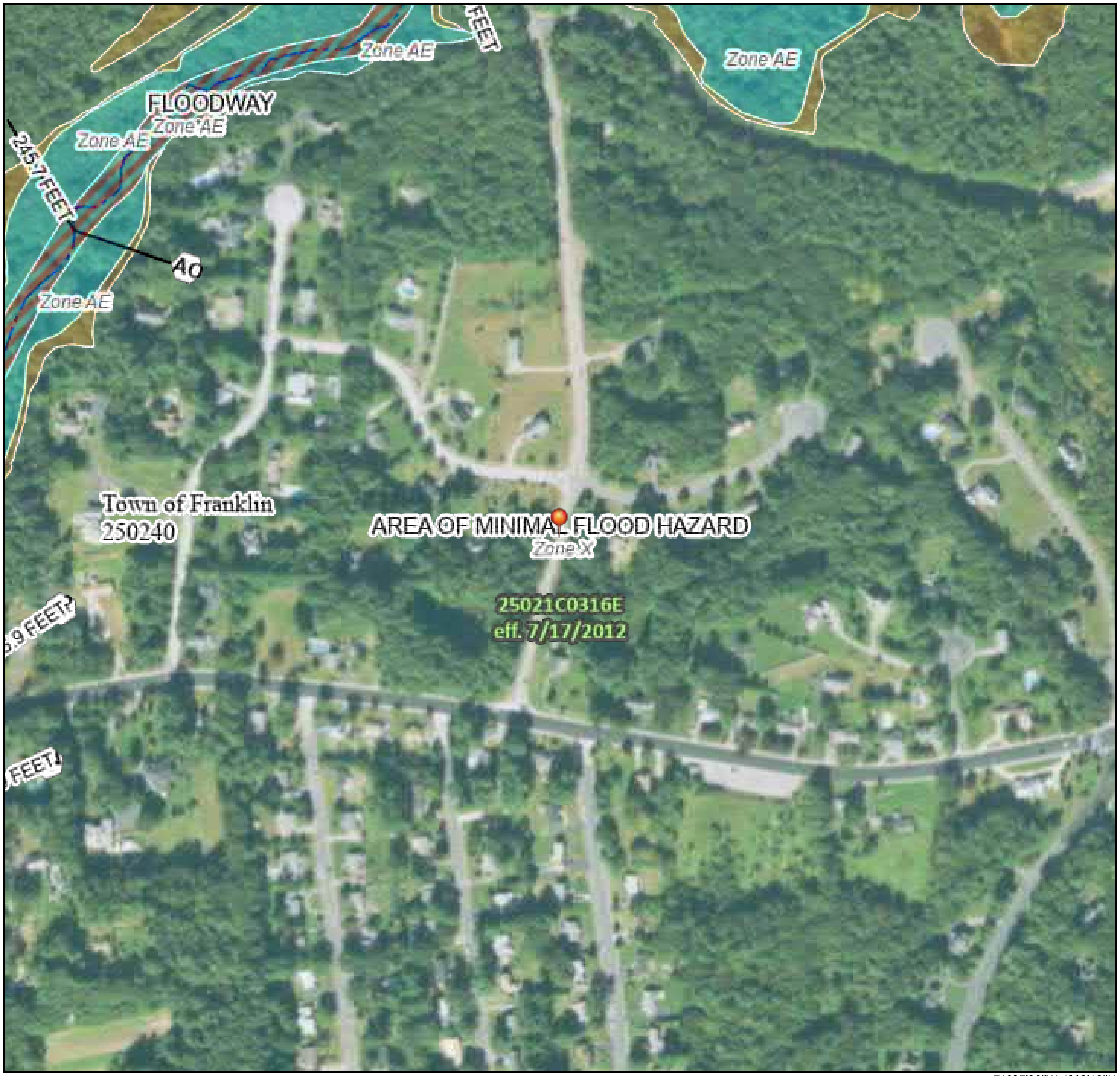
Data Source: MassGIS USGS Color Ortho Imagery (2014), MassDEP Wetlands (1:12000) (2009), NHESP Potential Vernal Pools (2000), NHESP Certified Vernal Pools, NHESP Priority Habitats of Rare Species (2008), NHESP Estimated Habitats of Rare Species (2008), Areas of Critical Environmental Concern (2009), FEMA National Flood Hazard Layer (2014),

BETA
IMPROVING COMMUNITIES TOGETHER

National Flood Hazard Layer FIRMette

FEMA

71°25'57"W 42°3'39"N



Feet

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1:6,000

71°25'20"W 42°3'12"N

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

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/12/2021 at 4:47 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

National Flood Hazard Layer FIRMette

FEMA

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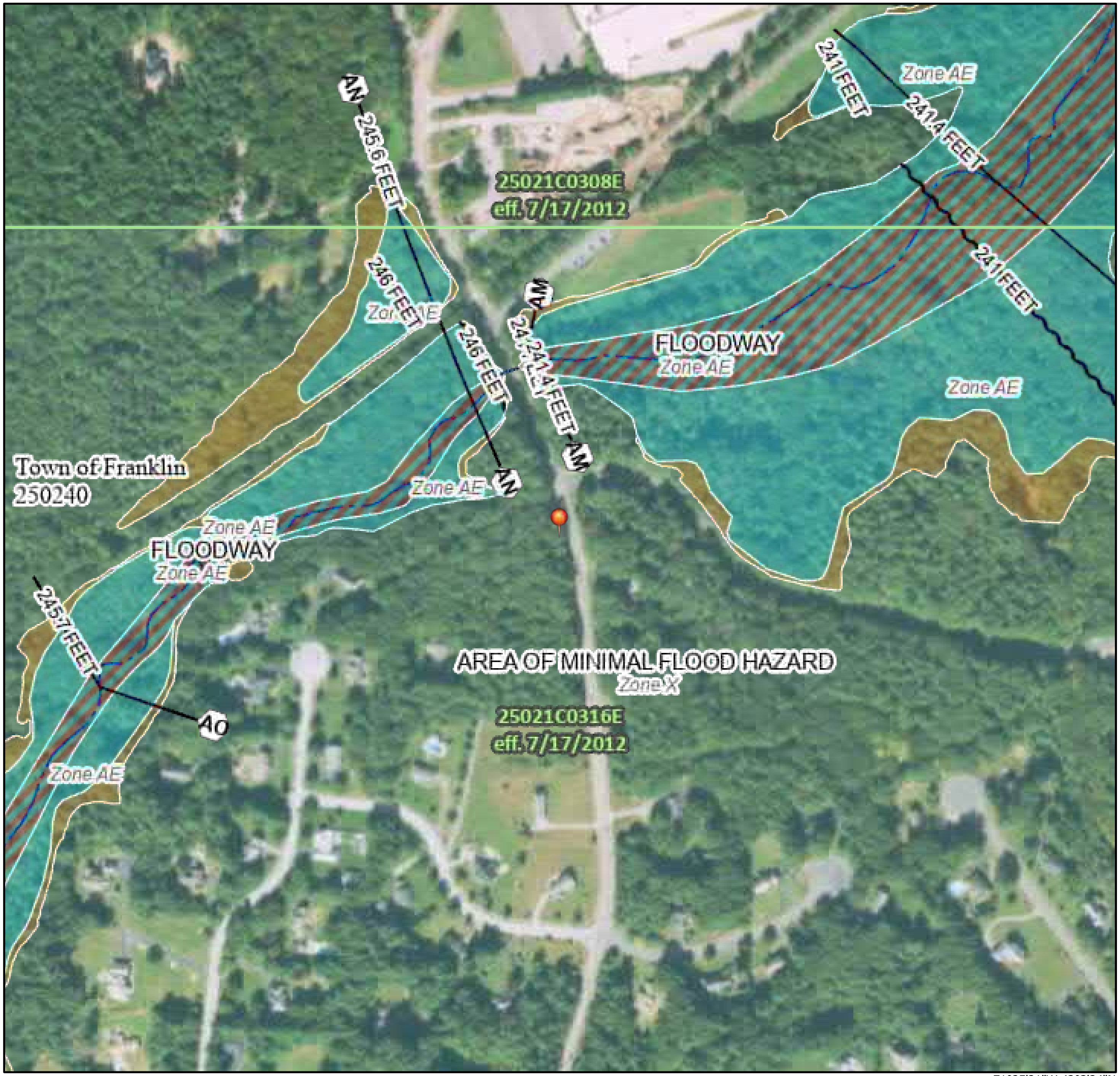

0 250 500 1,000 1,500 2,000 Feet

1:6,000

71°25'21"W 42°3'24"N

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

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
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MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/12/2021 at 4:45 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

National Flood Hazard Layer FIRMette

FEMA

71°25'53"W 42°4'13"N

71°25'16"W 42°3'46"N

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

1:6,000

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

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

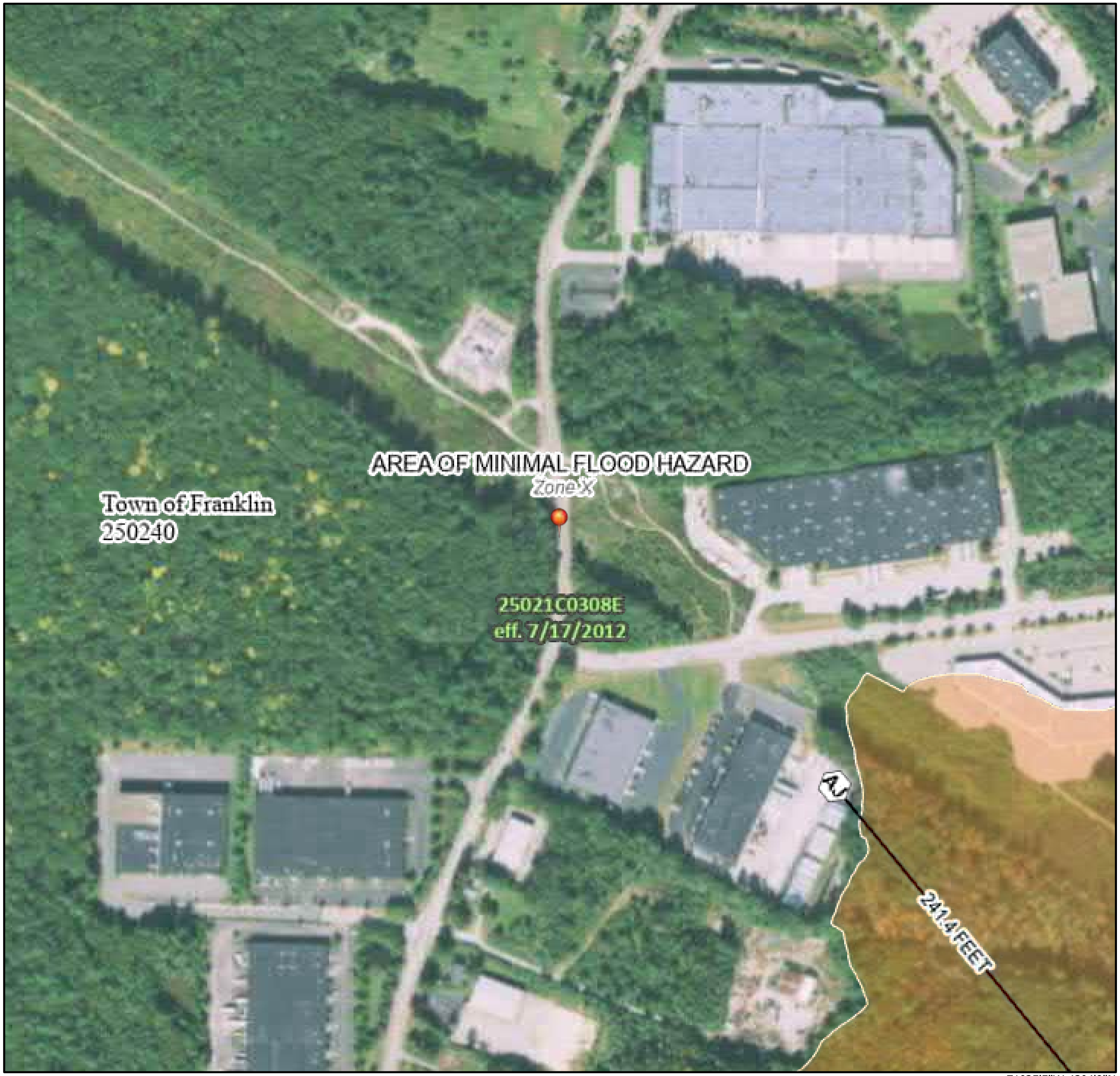
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/12/2021 at 4:44 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

National Flood Hazard Layer FIRMette

FEMA

71°25'43"W 42°4'36"N



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

1:6,000

71°25'5"W 42°4'9"N

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

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/12/2021 at 4:42 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Photo 1

View of the WF1 Series IVW—facing west.

Photo 2

View of the interior of the WF2 Series BVW—facing southeast.

PHOTOGRAPHIC DOCUMENTATION

Grove Street

Franklin, Massachusetts

Photographs Documented 05.13.2021

Photo 3

View of the WF3 Series BVW and adjacent public well pump house—facing northeast.

Photo 4

View of Mine Brook, taken from Grove Street—facing east.

Photo 5

View of the culvert carrying Mine Brook, taken from the east side of Grove Street—facing west.

Photo 6

View of Mine Brook, taken from Grove Street—facing west.

PHOTOGRAPHIC DOCUMENTATION

Grove Street

Franklin, Massachusetts

Photographs Documented 05.13.2021

Photo 7

View of the WF6 Series BVW; note the sediment deposition in the foreground—facing west.

Photo 8

View of the unnamed tributary to Mine Brook flowing through a culvert under the Southern New England Trunkline Trail—facing northeast.

PHOTOGRAPHIC DOCUMENTATION

Grove Street

Franklin, Massachusetts

Photographs Documented 05.13.2021

Photo 9

View of the unnamed tributary to Mine Brook, north of the Southern New England Trunkline Trail—facing north.

Photo 10

View of cinnamon fern (*Osmundastrum cinnamomeum*) within the WF7 Series IVW—facing west.

Photo 11

View of a forested portion of the WF8 Series BVW—facing west.

Photo 12

View of the unnamed perennial stream connecting the WF8 and WF9 Series BVWs at the east side of Grove Street; note the damaged infrastructure—facing east.

Photo 13

Typical view of a maintained stormwater basin at the northern end of the Site (157/161 Grove Street)—facing south.

Photo 14

View of an unmaintained stormwater basin (WF11 Series IVW) at the northern end of the Site (157/161 Grove Street)—facing west.

Photo 15

View of a small pocket IVW (WF10 Series) formed from roadway stormwater runoff—facing east.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Upland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Confined depression Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Hinckley loamy sand, 8 to 15 percent slopes NWI classification: N/A

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___ No X	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** X
Hydric Soil Present?	Yes ___ No X	If yes, optional Wetland Site ID: WF1-106
Wetland Hydrology Present?	Yes ___ No X	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: Upland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Pinus strobus*	40	Yes	FACU
2. *Acer rubrum*	40	Yes	FAC
3. *Tsuga canadensis*	20	Yes	FACU
4.			
5.			
6.			
7.			
	100	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Maianthemum canadense*	40	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	40	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	40	x 3 =	120
FACU species	100	x 4 =	400
UPL species	0	x 5 =	0
Column Totals:	140 (A)		520 (B)

Prevalence Index = B/A = 3.71

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Upland

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR 2/1							Organic "duff" layer
1-16	10YR 3/3							Fine sandy loam
16-20	10YR 4/3							Fine sandy loam

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Wetland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Confined depression Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Hinckley loamy sand, 8 to 15 percent slopes NWI classification: PEM1E

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ___	**Is the Sampled Area within a Wetland?** **Yes** X **No** ___
Hydric Soil Present?	Yes X No ___	
Wetland Hydrology Present?	Yes X No ___	If yes, optional Wetland Site ID: WF1-106

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

X Surface Water (A1)	___ Water-Stained Leaves (B9)	
X High Water Table (A2)	___ Aquatic Fauna (B13)	
X Saturation (A3)	___ Marl Deposits (B15)	
___ Water Marks (B1)	___ Hydrogen Sulfide Odor (C1)	
___ Sediment Deposits (B2)	___ Oxidized Rhizospheres on Living Roots (C3)	
___ Drift Deposits (B3)	___ Presence of Reduced Iron (C4)	
___ Algal Mat or Crust (B4)	___ Recent Iron Reduction in Tilled Soils (C6)	
___ Iron Deposits (B5)	___ Thin Muck Surface (C7)	
X Inundation Visible on Aerial Imagery (B7)	___ Other (Explain in Remarks)	
___ Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches): 12
Water Table Present?	Yes X	No ___	Depth (inches): 2
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: Wetland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	30	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	30	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Spiraea tomentosa*	5	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	5	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	30	x 3 =	90
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	35 (A)		100 (B)

Prevalence Index = B/A = 2.86

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Wetland

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/2	100						Fine sandy loam
2-6	10YR 4/3	100						Fine sandy loam
6-18	10YR 3/2	90	10YR 4/3	10	C	M		Faint redox concentrations

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
X Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? **Yes** X **No** ___

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Upland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Toe of roadside slope Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Hinckley loamy sand, 3 to 8 percent slopes NWI classification: N/A

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No X	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** X
Hydric Soil Present?	Yes ___	No X	
Wetland Hydrology Present?	Yes ___	No X	If yes, optional Wetland Site ID: WF3-118

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: Upland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	40	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	40	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1. *Prunus serotina*	10	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	10	=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Dennstaedtia punctilobula*	15	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	15	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	40	x 3 =	120
FACU species	10	x 4 =	40
UPL species	15	x 5 =	75
Column Totals:	65 (A)		235 (B)

Prevalence Index = B/A = 3.62

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Upland

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 2/1	100						Organic "duff" layer
2-18	10YR 4/4	100						Fine sandy loam

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Wetland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Toe of roadside slope Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Hinckley loamy sand, 3 to 8 percent slopes NWI classification: N/A

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ___ Hydric Soil Present? Yes X No ___ Wetland Hydrology Present? Yes X No ___	**Is the Sampled Area within a Wetland?** **Yes** X **No** ___ If yes, optional Wetland Site ID: WF3-118

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches): 12
Water Table Present?	Yes X	No ___	Depth (inches): 5
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: Wetland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	40	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	40	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Maianthemum canadense*	10	Yes	FACU
2. *Osmundastrum cinnamomeum*	20	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	30	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	20	x 2 =	40
FAC species	40	x 3 =	120
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	70 (A)		200 (B)

Prevalence Index = B/A = 2.86

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Wetland

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 2/1	100						Organic "duff" layer
3-8	10YR 2/1	100						Sapric
8-18	10YR 4/3	80	10YR 4/2	20	C	M		Sandy with redox

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- X Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** X **No** ___

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Upland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Hinckley loamy sand, 3 to 8 percent slopes NWI classification: N/A

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No X	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** X
Hydric Soil Present?	Yes ___	No X	
Wetland Hydrology Present?	Yes ___	No X	If yes, optional Wetland Site ID: WF6-111

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: Upland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	50	Yes	FAC
2. *Pinus strobus*	10	No	FACU
3.			
4.			
5.			
6.			
7.			
	60	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1. *Berberis thunbergii*	10	Yes	FACU
2. *Rosa multiflora*	30	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	40	=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Maianthemum canadense*	80	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	80	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	50	x 3 =	150
FACU species	130	x 4 =	520
UPL species	0	x 5 =	0
Column Totals:	180 (A)		670 (B)

Prevalence Index = B/A = 3.72

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Upland

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 2/1	100						Organic "duff" layer
2-3	10YR 3/3	100						Loamy sand
3-7	10YR 3/4	100						Fine sandy loam
7-18	7.5YR 4/4	100						Sand

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Wetland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Hinckley loamy sand, 3 to 8 percent slopes NWI classification: PFO1E

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ___	**Is the Sampled Area within a Wetland?** **Yes** X **No** ___
Hydric Soil Present?	Yes X No ___	If yes, optional Wetland Site ID: WF6-111
Wetland Hydrology Present?	Yes X No ___	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: Wetland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	50	Yes	FAC
2. *Pinus strobus*	10	No	FACU
3.			
4.			
5.			
6.			
7.			
	60	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1. *Frangula alnus*	10	Yes	FAC
2. *Rosa multiflora*	30	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	40	=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Maianthemum canadense*	60	Yes	FACU
2. *Symplocarpus foetidus*	15	Yes	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	75	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	0	x 2 =	0
FAC species	60	x 3 =	180
FACU species	100	x 4 =	400
UPL species	0	x 5 =	0
Column Totals:	175 (A)		595 (B)

Prevalence Index = B/A = 3.40

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Wetland

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/2	100						20% organic material
4-10	10YR 2/1	100						Organic
10-20	10YR 3/2	80	10YR 4/1	20	C	M		Redox concentrations

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- X Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Upland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Toe of roadside slope Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Swansea muck, 0 to 1 percent slopes NWI classification: N/A

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No X
Hydric Soil Present?	Yes ___	No X
Wetland Hydrology Present?	Yes ___	No X

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

If yes, optional Wetland Site ID: WF9-103

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: Upland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	50	Yes	FAC
2. *Pinus strobus*	15	Yes	FACU
3. *Betula populifolia*	3	No	FAC
4.			
5.			
6.			
7.			
	68	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1. *Euonymus alatus*	5	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	5	=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Maianthemum canadense*	80	Yes	FACU
2. *Toxicodendron radicans*	15	No	FAC
3. *Pteridium aquilinum*	10	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	105	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	68	x 3 =	204
FACU species	105	x 4 =	420
UPL species	5	x 5 =	25
Column Totals:	178 (A)		649 (B)

Prevalence Index = B/A = 3.65

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Upland

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	100						Gravelly/sandy loam (fill)
6-15	10YR 4/3							Gravelly/sandy loam (fill)

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)

___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Grove Street City/County: Franklin Sampling Date: 5/13/2021

Applicant/Owner: Town of Franklin State: MA Sampling Point: Wetland

Investigator(s): Jonathan Niro & Julia Stearns (BETA Group, Inc.) Section, Township, Range: Norfolk County

Landform (hillside, terrace, etc.): Toe of roadside slope Local relief (concave, convex, none): Concave Slope %: 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.066353 Long: -71.426820 Datum: WGS84

Soil Map Unit Name: Swansea muck, 0 to 1 percent slopes NWI classification: PFO1E

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

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ___		**Is the Sampled Area within a Wetland?** **Yes** X **No** ___
Hydric Soil Present? Yes X No ___		If yes, optional Wetland Site ID: WF9-103
Wetland Hydrology Present? Yes X No ___		

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
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- X Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		X	
Water Table Present?		X	
Saturation Present? (includes capillary fringe)	X		0

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: Wetland

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	80	Yes	FAC
2. *Pinus strobus*	3	No	FACU
3.			
4.			
5.			
6.			
7.			
	83	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' radius)			
1. *Viburnum dentatum*	8	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	8	=Total Cover	
Herb Stratum (Plot size: 5' radius)			
1. *Symplocarpus foetidus*	80	Yes	OBL
2. *Osmundastrum cinnamomeum*	10	No	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	90	=Total Cover	
Woody Vine Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	80	x 1 =	80
FACW species	10	x 2 =	20
FAC species	88	x 3 =	264
FACU species	3	x 4 =	12
UPL species	0	x 5 =	0
Column Totals:	181 (A)		376 (B)

Prevalence Index = B/A = 2.08

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

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Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point Wetland

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 2/1	100						Sapric

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

Hydric Soil Indicators:

- X Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
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- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

United States Department of Agriculture

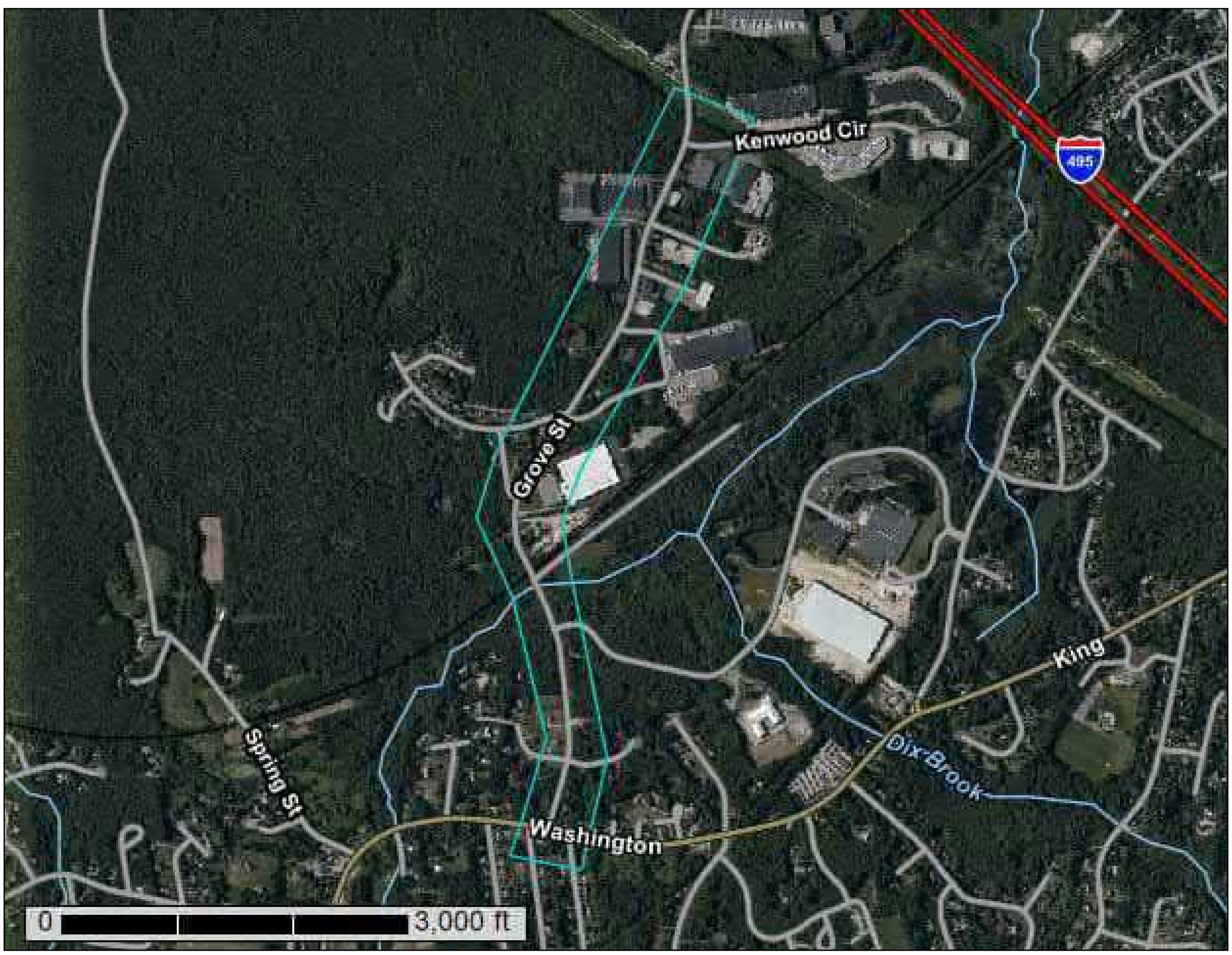
NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for

Norfolk and Suffolk Counties, Massachusetts



May 12, 2021

Preface

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

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

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

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

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

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

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Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

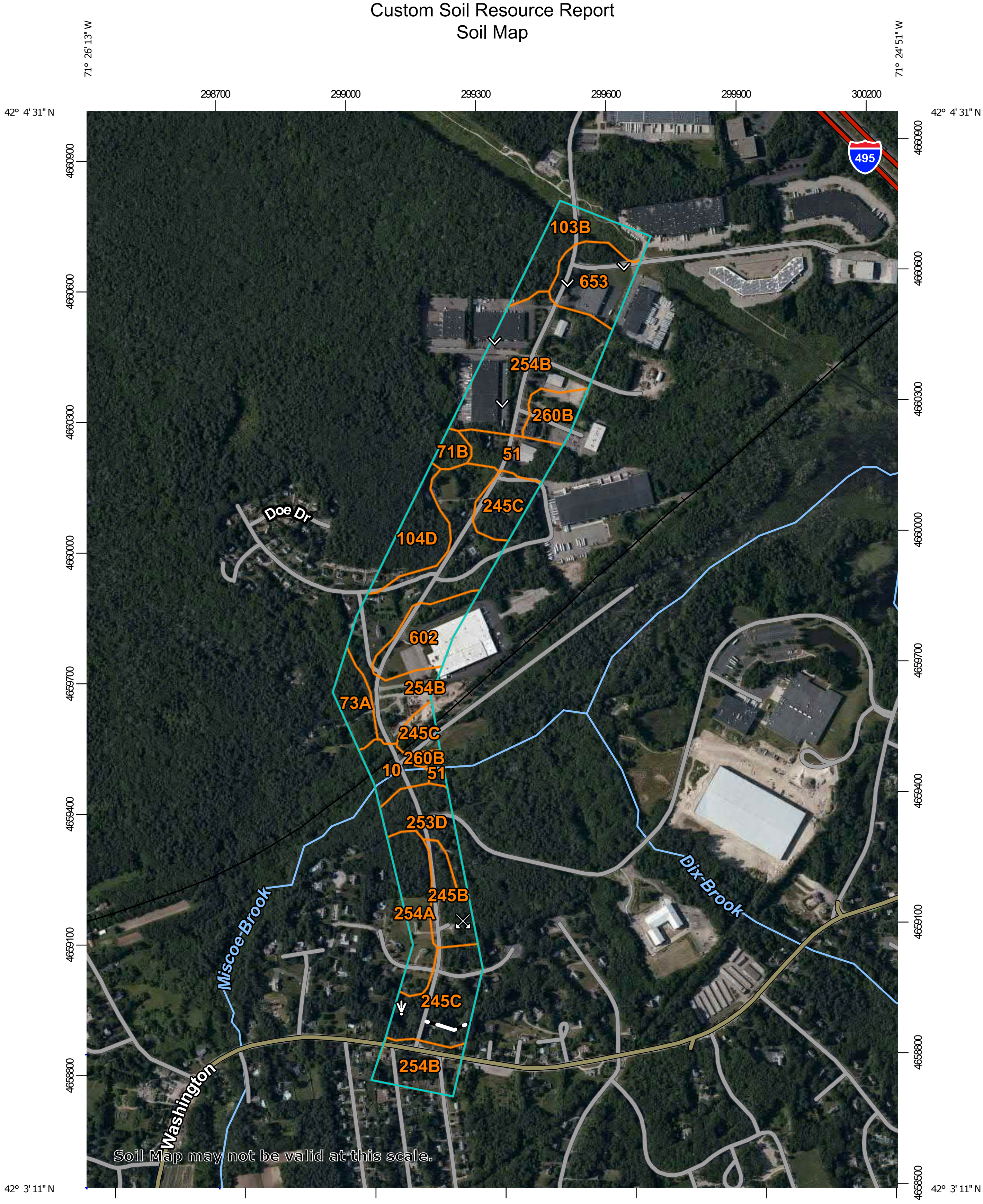
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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

Soil Map

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

Soil Map



Map Scale: 1:12,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 150, 300, 600, 900

Feet: 0, 500, 1000, 2000, 3000

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 16, Jun 11, 2020

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

Date(s) aerial images were photographed: Jul 5, 2019—Jul 8, 2019

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
10	Scarboro and Birdsall soils, 0 to 3 percent slopes	3.2	2.9%
51	Swansea muck, 0 to 1 percent slopes	4.8	4.4%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	1.4	1.2%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	3.2	2.9%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	6.4	5.8%
104D	Hollis-Rock outcrop-Charlton complex, 15 to 35 percent slopes	5.6	5.1%
245B	Hinckley loamy sand, 3 to 8 percent slopes	4.2	3.9%
245C	Hinckley loamy sand, 8 to 15 percent slopes	13.9	12.6%
253D	Hinckley loamy sand, 15 to 35 percent slopes	5.3	4.8%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	6.2	5.6%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	39.7	35.9%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	3.7	3.4%
602	Urban land, 0 to 15 percent slopes	6.1	5.6%
653	Udorthents, sandy	6.6	6.0%
Totals for Area of Interest		**110.3**	**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.

Norfolk and Suffolk Counties, Massachusetts

10—Scarboro and Birdsall soils, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vkxw
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: Not prime farmland

Map Unit Composition

Scarboro and similar soils: 65 percent
Birdsall and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scarboro

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 9 inches: mucky fine sandy loam
H2 - 9 to 60 inches: stratified loamy fine sand to gravelly coarse sand

Properties and qualities

Slope: 0 to 3 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): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water capacity: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Description of Birdsall

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Soft coarse-silty glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: very fine sandy loam
H2 - 8 to 16 inches: very fine sandy loam
H3 - 16 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 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 moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water capacity: Very high (about 12.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 5 percent
Landform: Bogs
Hydric soil rating: Yes

Raynham

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Walpole

Percent of map unit: 2 percent
Landform: Terraces
Hydric soil rating: Yes

51—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 capacity: 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: Swamps, bogs
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways

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: Depressions, drainageways
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

71B—Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w69c
Elevation: 0 to 1,290 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

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

Description of Ridgebury, Extremely Stony

Setting

Landform: Drumlins, drainageways, hills, ground moraines, depressions
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 6 inches: fine sandy loam
Bw - 6 to 10 inches: sandy loam
Bg - 10 to 19 inches: gravelly sandy loam
Cd - 19 to 66 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Poorly drained
Runoff class: Very high
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 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Woodbridge, extremely stony

Percent of map unit: 10 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Footslope, summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Whitman, extremely stony

Percent of map unit: 8 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Paxton, extremely stony

Percent of map unit: 2 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Hydric soil rating: No

73A—Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w695
Elevation: 0 to 1,580 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

Whitman, extremely stony, and similar soils: 81 percent
Minor components: 19 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Whitman, Extremely Stony

Setting

Landform: Drainageways, hills, ground moraines, drumlins, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 1 inches: peat
A - 1 to 10 inches: fine sandy loam
Bg - 10 to 17 inches: gravelly fine sandy loam
Cdg - 17 to 61 inches: fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 7 to 38 inches to densic material
Drainage class: Very poorly drained
Runoff class: Negligible
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 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY041MA - Very Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Ridgebury, extremely stony

Percent of map unit: 10 percent
Landform: Drumlins, drainageways, hills, ground moraines, depressions
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways, outwash deltas, outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent
Landform: Marshes, swamps, bogs
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Woodbridge, extremely stony

Percent of map unit: 1 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

103B—Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: vktd
Elevation: 0 to 480 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton and similar soils: 40 percent
Hollis and similar soils: 25 percent
Rock outcrop: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable coarse-loamy ablation till derived from granite

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 36 inches: fine sandy loam
H3 - 36 to 60 inches: fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
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 capacity: Moderate (about 7.8 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

Description of Hollis

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Shallow, friable loamy ablation till derived from igneous rock

Typical profile

H1 - 0 to 3 inches: fine sandy loam
H2 - 3 to 14 inches: gravelly fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
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 capacity: Very low (about 1.8 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: Igneous and metamorphic rock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Canton

Percent of map unit: 7 percent
Hydric soil rating: No

Chatfield

Percent of map unit: 5 percent
Hydric soil rating: No

Scituate

Percent of map unit: 2 percent
Hydric soil rating: No

Whitman

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

104D—Hollis-Rock outcrop-Charlton complex, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: vkvh
Elevation: 20 to 610 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 120 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: 25 percent

Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Shallow, friable loamy ablation till derived from igneous and metamorphic rock

Typical profile

H1 - 0 to 3 inches: fine sandy loam
H2 - 3 to 14 inches: gravelly fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
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 capacity: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Parent material: Igneous and metamorphic rock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Description of Charlton

Setting

Landform: Hills
Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable coarse-loamy ablation till derived from granite

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 36 inches: fine sandy loam
H3 - 36 to 60 inches: fine sandy loam

Properties and qualities

Slope: 15 to 35 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
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 capacity: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Canton

Percent of map unit: 5 percent
Hydric soil rating: No

Chatfield

Percent of map unit: 5 percent
Hydric soil rating: No

245B—Hinckley loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svm8
Elevation: 0 to 1,430 feet
Mean annual precipitation: 36 to 53 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Farmland of statewide importance

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: Moraines, kame terraces, kames, outwash terraces, outwash deltas, outwash plains, eskers
Landform position (two-dimensional): Summit, backslope, footslope, shoulder
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, tread, riser
Down-slope shape: Linear, convex, concave
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: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: 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
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 8 percent
Landform: Outwash plains, kames, eskers, moraines, outwash terraces, outwash deltas, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, tread, riser
Down-slope shape: Linear, convex, concave

Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Moraines, outwash terraces, outwash deltas, kame terraces, outwash plains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, base slope, head slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Eskers, moraines, outwash terraces, outwash deltas, kame terraces, outwash plains, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

245C—Hinckley loamy sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2svm9
Elevation: 0 to 1,480 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: Farmland of statewide importance

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: Outwash deltas, kame terraces, outwash plains, kames, eskers, moraines, outwash terraces
Landform position (two-dimensional): Shoulder, toeslope, footslope, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser
Down-slope shape: Convex, concave, linear
Across-slope shape: Concave, linear, convex

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: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: 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
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 5 percent
Landform: Eskers, moraines, outwash terraces, outwash plains, kames
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Side slope, head slope, nose slope, crest, riser
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Moraines, kame terraces, outwash plains, outwash terraces, outwash deltas, kames, eskers
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser
Down-slope shape: Convex, linear, concave
Across-slope shape: Linear, convex, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent

Landform: Outwash terraces, kame terraces, outwash plains, moraines, outwash deltas
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

253D—Hinckley loamy sand, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2svmd
Elevation: 0 to 860 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: Outwash plains, kames, eskers, moraines, outwash terraces, outwash deltas, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Crest, nose slope, side slope, head slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Linear, convex, 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 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: 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
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: 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

Windsor

Percent of map unit: 10 percent
Landform: Moraines, kame terraces, outwash plains, outwash terraces, outwash deltas, kames, eskers
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, crest, side slope, head slope, riser
Down-slope shape: Convex, linear, concave
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Merrimac

Percent of map unit: 3 percent
Landform: Kames, eskers, moraines, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest, head slope, nose slope, riser
Down-slope shape: Convex, concave, linear
Across-slope shape: Concave, convex, linear
Hydric soil rating: No

Sudbury

Percent of map unit: 2 percent
Landform: Moraines, outwash terraces, kame terraces, outwash plains, outwash deltas
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Hydric soil rating: No

254A—Merrimac fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tyqr
Elevation: 0 to 1,100 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: All areas are prime farmland

Map Unit Composition

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

Description of Merrimac

Setting

Landform: Moraines, outwash terraces, outwash plains, kames, eskers
Landform position (two-dimensional): Backslope, footslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, 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 3 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 capacity: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
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: Outwash plains, eskers, kames, deltas
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Agawam

Percent of map unit: 3 percent
Landform: Outwash plains, outwash terraces, stream terraces, kames, eskers, moraines
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 2 percent
Landform: Outwash terraces, deltas, dunes, outwash plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

254B—Merrimac fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyqs
Elevation: 0 to 1,290 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: All areas are prime farmland

Map Unit Composition

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

Description of Merrimac

Setting

Landform: Kames, eskers, moraines, outwash terraces, outwash plains
Landform position (two-dimensional): Backslope, footslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest, 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: 3 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 capacity: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
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, outwash plains, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Windsor

Percent of map unit: 3 percent
Landform: Outwash terraces, outwash plains, deltas, dunes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Moraines, outwash terraces, outwash plains, kames, eskers, stream terraces
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

260B—Sudbury fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: vky4
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: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser

Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable coarse-loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 11 inches: sandy loam
H2 - 11 to 22 inches: sandy loam
H3 - 22 to 60 inches: gravelly coarse sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Drainage class: Moderately well drained
Runoff class: Low
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 capacity: Low (about 4.0 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

Walpole

Percent of map unit: 5 percent
Landform: Terraces
Hydric soil rating: Yes

Deerfield

Percent of map unit: 5 percent
Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Hydric soil rating: No

602—Urban land, 0 to 15 percent slopes

Map Unit Setting

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

Map Unit Composition

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

Description of Urban Land

Setting

Parent material: Excavated and filled land

Minor Components

Rock outcrops

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

653—Udorthents, sandy

Map Unit Setting

National map unit symbol: vky8
Elevation: 0 to 3,000 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: Not prime farmland

Map Unit Composition

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

Description of Udorthents

Setting

Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Excavated and filled sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: variable
H2 - 6 to 60 inches: variable

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Urban land

Percent of map unit: 5 percent
Hydric soil rating: Unranked

Swansea

Percent of map unit: 2 percent
Landform: Bogs
Hydric soil rating: Yes

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

APPENDIX B

CONSTRUCTION PERIOD POLLUTION PLAN EROSION AND SEDIMENT CONTROL PLAN

CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN

SITE DESCRIPTION			
Project Name and Location; (Latitude, Longitude, or Address	Grove Street Improvements (42.062019, -71.428375) Franklin, MA	Owner Name and Address:	Town of Franklin 355 E Central Street Franklin, MA 02038

Description: (Purpose and Types of Soil Disturbing Activities)	The following information is based on information obtained from the project plans and supporting documents prepared by BETA Group, Inc.

The project area includes the entire project limits from Tobacco Road to Kenwood Circle. The proposed work includes paved shared use path, new drainage network, stormwater treatment, milling and overlay, areas of full depth pavement reconstruction, moment slab installation, retaining walls, new and reset granite curbing, cement concrete wheelchair ramps and sidewalk, new crosswalks, pavement markings, signing work and safety controls as well as signing for construction operations.

Runoff Coefficient	Approximately 0.98 (mostly impervious)
Site Area:	The project area is approximately 7.0 acres.

Sequence of Major Activities

The order of activities will be as follows:
See attached construction sequence and project plans for additional information.

Type of Receiving Resource Area:	Bordering Vegetated Wetland (BVW), 100' BVW Buffer 30-FT No Alteration Zone, 50-ft No-Build Zone

CONTROLS

Erosion and Sediment Controls

Stabilization Practices

Temporary Stabilization - Topsoil stockpiles and disturbed portions of the site where construction activity temporarily ceases for at least 21 days will be stabilized with temporary seed and mulch no later than 14 days from the last construction activity in that area. The temporary seed shall be Rye (grain) applied at the rate of 50 pounds per 1000 sq. ft. After seeding, erosion control matting shall be installed over the seeded area.

Permanent Stabilization - Disturbed portions of the site where construction activities permanently cease shall be stabilized with permanent seed mix no later than 14 days after the last construction activity. The permanent seed mix shall be as specified in the construction documents and shall be properly maintained by the contractor until the grass has established an adequate level of growth.

Disturbed areas with slopes of 2:1 (or steeper) will have temporary or permanent geotextile slope reinforcement (as appropriate) and/or plantings to stabilize slopes while grass is becoming established.

CONTROLS (Continued)

Structural Practices

Compost Filter Tubes – Erosion of or sedimentation from disturbed areas will be prevented by installation of compost filter tubes during construction. Compost filter tubes conform more naturally to existing ground topography, require no excavation or ground disturbance for installation, and may be cut open and left in place at the conclusion of the project rather than removed and disposed of.

Storm Water Management

All components of the drainage system have been designed to duplicate existing stormwater flow patterns (flow rates and volumes) to the maximum extent practicable, in order to avoid adverse impacts to adjacent properties and/or environmental resource areas which could result from substantial alterations to the existing stormwater flow patterns. The installation of a proposed drainage system will provide additional water quality pretreatment to the existing wetland resource area where none was provided before.

OTHER CONTROLS

Waste Disposal:

Waste Materials
All waste materials will be collected and stored in securely lidded metal dumpsters (number and locations as required). The dumpster(s) will meet all local Town and any State solid waste management regulations. All trash and construction debris from the site will be deposited in the dumpster(s), which shall be emptied as needed, and the trash hauled from and legally disposed of off-site. No construction waste materials will be buried onsite. All personnel will be instructed regarding the correct procedure for waste disposal. Notices stating these practices will be posted in the office trailer, and the individual who manages the day-to-day site operations will be responsible for seeing that these procedures are followed by all personnel.

Hazardous Waste
All hazardous waste materials will be disposed of in the manner specified by local or State regulations, or by the manufacturer. Site personnel will be instructed in these practices, and the individual who manages day-to-day site operations will be responsible for seeing that these practices are followed by all personnel.

Sanitary Waste
Adequate sanitary waste units ("port-a-johns") for all site personnel shall be provided for the duration of the work. All sanitary waste will be collected from the portable units and removed from the site as often as needed, but at a minimum of once a week by a licensed sanitary waste management contractor, as required by local regulation.

Offsite Vehicle Tracking:

All impervious areas (paved roadways, driveways, sidewalks, etc.) within and/or adjacent to the site will be swept as needed to remove any excess mud, dirt or rock tracked from the site onto same.

Beds of dump trucks or any construction vehicles hauling material from the construction site will be completely covered with a tarpaulin. When leaving unpaved areas to enter paved areas (whether on or off-site), all construction vehicles shall pass over designated and adequately-sized construction pads consisting of coarse angular uniform graded crushed stone gravel. Construction pads shall be maintained regularly by the contractor, and stone refreshed/replaced as needed to provide its intended function.

TIMING OF CONTROLS/MEASURES
As indicated in the Plans, structural erosion control measures (compost filter socks) will be established prior to clearing or grading of any other portions of the site. Areas where construction activity temporarily ceases for more than 21 days will be stabilized with temporary seed and mulch within 14 days of the last disturbance. Once construction activity ceases permanently the area will be stabilized with permanent seed and mulch.

CERTIFICATION OF COMPLIANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS
The construction period pollution prevention and erosion and sedimentation control plan reflect the requirements established by the Massachusetts Stormwater Handbook for all construction activities.

MAINTENANCE/INSPECTION PROCEDURES

Erosion and Sediment Control Inspection and Maintenance Practices

These are the inspection and maintenance practices that will be used to maintain erosion and sediment controls.

- All control measures will be inspected at least once every seven calendar days and within 24 hours after any storm event of 0.25 inches or greater in a 24-hour period, or upon the request of the owner or engineer.
- All measures will be maintained in good working order; if a repair is necessary, it will be initiated within 24 hours of report.
- If ponding becomes excessive, and sediment reaches to the midpoint of the compost filter sock, additional compost filter sock should be added in the areas without disturbance of soil or collected sediment.
- Any sediment deposits remaining in place after the compost filter sock has been removed should be dressed to conform to the existing grade, prepared, and seeded.
- Temporary and permanent seeding and planting will be inspected for bare spots, washouts, and healthy growth.
- A maintenance inspection report will be made after each inspection. A copy of the report form to be completed by the inspector is attached.
- The site superintendent will select one individual who will be responsible for inspections, maintenance and repair activities, and filling out the inspection and maintenance report.
- Personnel selected for inspection and maintenance responsibilities will receive training from site superintendent. They will be trained in all the inspection and maintenance practices necessary for keeping the erosion and sediment controls used onsite in good working order.

MAINTENANCE /INSPECTION PROCEDURES (Continued)

Non-Storm-Water Discharges

It is expected that the following non-storm water discharges may occur from the site during the construction period:

- Pavement wash waters (where no spills or leaks of toxic or hazardous materials have occurred).

INVENTORY FOR POLLUTION PREVENTION PLAN

The materials or substances, but not limited to those listed below, will potentially be present onsite during construction:

- Paints (enamel and latex)
- Fertilizers
- Petroleum Based Products
- Cleaning Solvents
- Asphalt
- Detergents
- Wood
- Tar
- Concrete

SPILL PREVENTION

Material Management Practices

The following are the material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff.

Good Housekeeping

The following good housekeeping practices will be followed onsite during the construction project

- An effort will be made to store on-site only enough products and materials required to do the job.
- All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
- 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.
- Whenever possible, all of a product will be used up before disposing of the container.
- Manufacturers' recommendations for proper use and disposal will be followed.
- The site superintendent will inspect daily to ensure proper use and disposal of materials onsite.

Hazardous Products:

These practices are used to reduce the risks associated with hazardous materials.

- Products will be kept in original containers unless they are not re-sealable.
- Original labels and material safety data will be retained; they contain important product information.
- If surplus product must be disposed of, manufacturers' or local and State recommended methods for proper disposal will be followed.

SPILL PREVENTION (Continued)

Product Specific Practices

The following product specific practices will be followed onsite:

Petroleum Products

All onsite vehicles will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage. Petroleum products will be stored in tightly sealed containers which are clearly labeled. Any asphalt substances used onsite will be applied according to the manufacturer's recommendations.

Fertilizers:

Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.

Paints:

All containers will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm sewer system but will be properly disposed of according to manufacturers' instructions or State and local regulations.

Concrete Trucks:

Concrete trucks will be allowed to wash out or discharge surplus concrete or drum wash water to a dedicated area (or areas) on site. The contractor shall designate concrete wash-out areas and shall maintain adequate controls within and around the areas to prevent the migration of concrete from the wash-out area(s).

Spill Control Practices

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup:

- Manufacturers' recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies.
- Materials and equipment necessary for spill cleanup will be kept in a storage area onsite. Equipment and materials will include but not be limited to brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, sawdust, and plastic and metal trash containers specifically for this purpose.
- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
- Spills of toxic or hazardous material will be reported to the appropriate State or local government agency, regardless of the size.
- The spill prevention plan will be adjusted to include measures to prevent this type of spilt from reoccurring and how to clean up the spill if there is another one. A description of the spill, what caused it, and the cleanup measures will also be included.
- The site superintendent responsible for the day-to-day site operations will be the spill prevention and cleanup coordinator. He will designate at least three other site personnel who will receive spill prevention and cleanup training. The individual will each become responsible for a particular phase of prevention and cleanup. The names of responsible spill personnel will be posted in the office trailer onsite.

GROVE STREET IMPROVEMENTS PROJECT
CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN
INSPECTION AND MAINTENANCE REPORT FORM

TO BE COMPLETED EVERY 7 DAYS AND WITHIN 24 HOURS OF A RAINFALL EVENT OF 0.25 INCHES OR MORE

INSPECTOR:____ DATE:_____________________________________

INSPECTOR'S QUALIFICATIONS:

____

____

____

____

DAYS SINCE LAST RAINFALL:_________________ AMOUNT OF LAST RAINFALL:___________ INCHES

STABILIZATION MEASURES

AREA	DATE SINCE LAST DISTURBANCE	DATE OF NEXT DISTURBANCE	STABILIZED? (YES/NO)	STABILIZED WITH	CONDITION

STABILIZATION REQUIRED:

____

____

____

____

TO BE PERFORMED BY:________________________________ ON OR BEFORE: ____________________________

GROVE STREET IMPROVEMENTS PROJECT
CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN
INSPECTION AND MAINTENANCE REPORT FORM

STRUCTURAL CONTROLS
(Compost Filter Sock)

DATE:____________________________

DRAINAGE AREA PERIMETER	**HAS SILT REACHED 1/2 OF FILTER SOCK HEIGHT?**	**IS FILTER SOCK PROPERLY SECURED?**	**IS THERE EVIDENCE OF WASHOUT OR OVERTOPPING?**

MAINTENANCE REQUIRED FOR COMPOST FILTER SOCK:

____

____

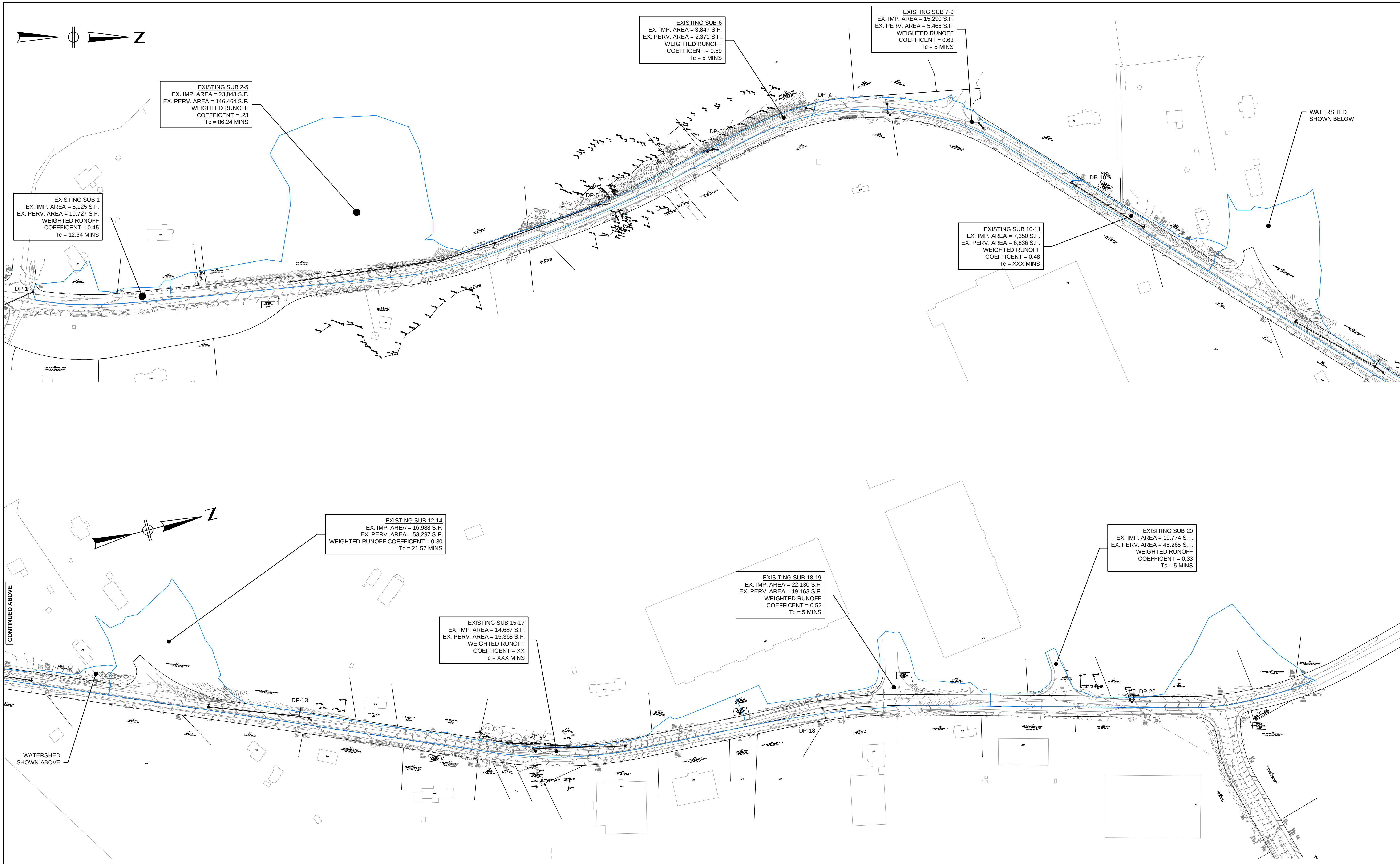
____

____

TO BE PERFORMED BY:________________________________ ON OR BEFORE:_____________________________

APPENDIX C

WATERSHED PLANS

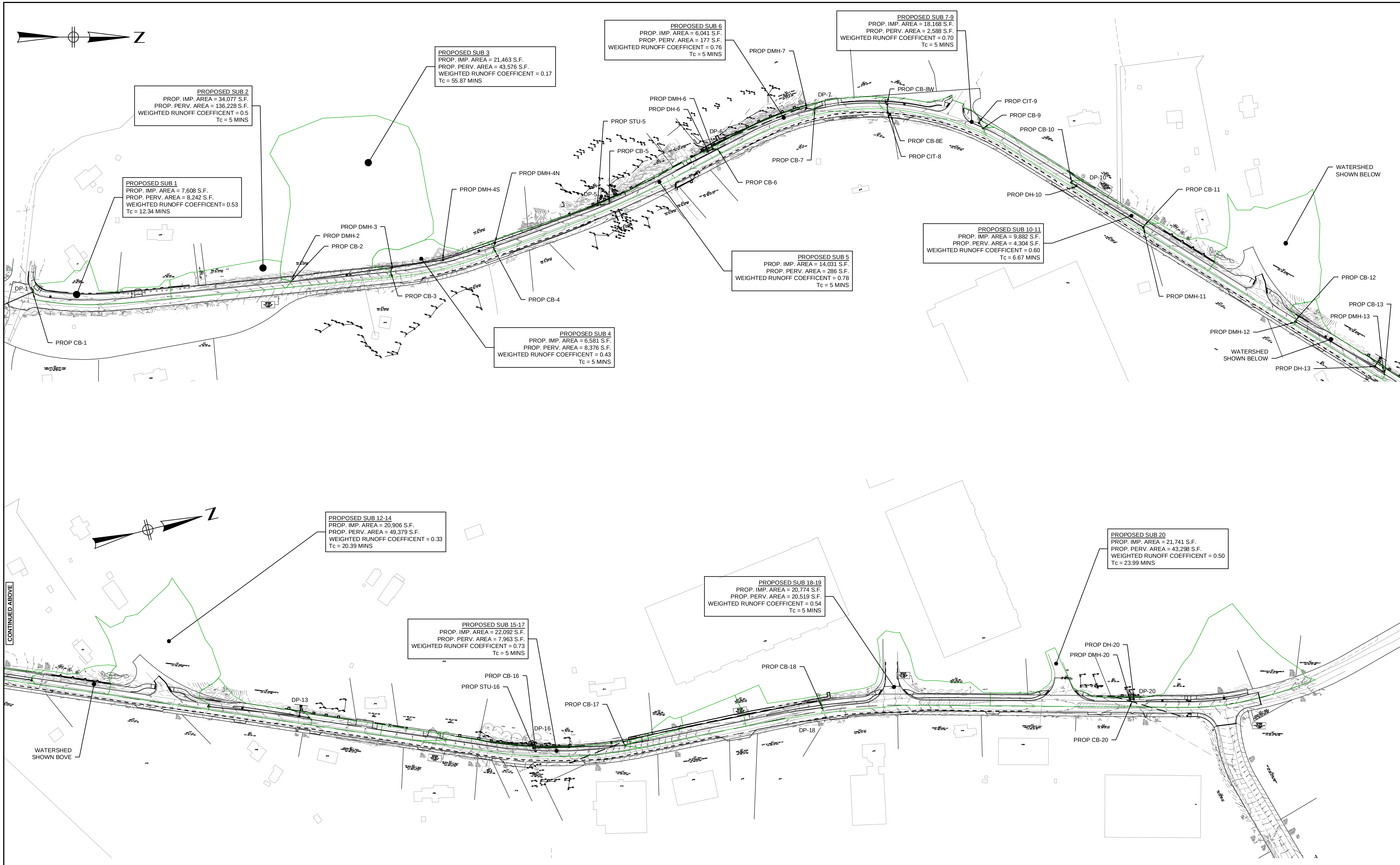


NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY:	RS
DESIGNED BY:	RS
CHECKED BY:	BB
REGISTERED PROFESSIONAL	Not for Construction
PREPARED BY	BETA www.BETA-Inc.com
SUBCONSULTANT	
SCALE	100 0 100 200 SCALE IN FEET: 1"=100'
TITLE	GROVE STREET IMPROVEMENTS EXISTING WATERSHED PLAN FRANKLIN, MA
BETA JOB NO.	7548
ISSUE DATE	8/26/2022
SHEET NO.	4

UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

1/30/2023 1:32 PM \\BETA-INC.COM\MA\PROJECTS\10600S\10613 - FRANKLIN, MA - GROVE ST ROADWAY DESIGN PHASE 2\DRAWING FILES\MISC\7548_WATERSHED PLANS.DWG (BETA STB BW.STB)



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NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: RS

DESIGNED BY: RS

CHECKED BY: BB

REGISTERED PROFESSIONAL

Not for Construction

PREPARED BY

BETA
www.BETA-Inc.com

SUBCONSULTANT

SCALE

100 0 100 200

SCALE IN FEET: 1"=100'

UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

TITLE

GROVE STREET IMPROVEMENTS

PROPOSED WATERSHED PLAN

FRANKLIN, MA

BETA JOB NO. 7548

ISSUE DATE 8/26/2022

SHEET NO. 4

APPENDIX D

STORMWATER CALCULATIONS

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

Version 1, Automated: Mar. 4, 2008

Location: Grove Street - 7+00 LT

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Treebox Filter	**0.80**	**1.00**	**0.80**	**0.20**
Deep Sump and Hooded Catch Basin	**0.25**	**0.20**	**0.05**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**

Total TSS Removal = 85%

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

Project: **Grove Street Phase 2**
Prepared By: **CML**
Date: **1/25/2023**

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

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

Mass. Dept. of Environmental Protection

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

Version 1, Automated: Mar. 4, 2008

Location: Grove Street - 20+64 LT

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Treebox Filter	0.80	1.00	0.80	0.20
Deep Sump and Hooded Catch Basin	0.25	0.20	0.05	0.15
Proprietary Treatment Practice	0.75	0.15	0.11	0.04

Total TSS Removal = 96%

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

Project: Grove Street Phase 2
Prepared By: CML
Date: 1/25/2023

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

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

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

Version 1, Automated: Mar. 4, 2008

Location: Grove Street - 23+50 LT

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**

Total TSS Removal = 25%

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

Project: **Grove Street Phase 2**
Prepared By: **CML**
Date: **1/25/2023**

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

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

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

Version 1, Automated: Mar. 4, 2008

Location: Grove Street - 26+05 LT

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**

Total TSS Removal = **25%**

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

Project: Grove Street Phase 2
Prepared By: CML
Date: 1/25/2023

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

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

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

Version 1, Automated: Mar. 4, 2008

Location: Grove Street - 27+98 LT

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Treebox Filter	0.80	1.00	0.80	0.20
Deep Sump and Hooded Catch Basin	0.25	0.20	0.05	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

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

Project: Grove Street Phase 2
Prepared By: CML
Date: 1/25/2023

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

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

Mass. Dept. of Environmental Protection

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

Version 1, Automated: Mar. 4, 2008

Location: Grove Street - 30+17 LT

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**

Total TSS Removal = 25%

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

Project: **Grove Street Phase 2**
Prepared By: **CML**
Date: **1/25/2023**

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

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

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

Version 1, Automated: Mar. 4, 2008

Location: Grove Street - 33+94 LT

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**

Total TSS Removal = 25%

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

Project: **Grove Street Phase 2**
Prepared By: **CML**
Date: **1/25/2023**

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

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

Mass. Dept. of Environmental Protection

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

Version 1, Automated: Mar. 4, 2008

Location: Grove Street - 41+37 LT

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Treebox Filter	**0.80**	**0.75**	**0.60**	**0.15**
Proprietary Treatment Practice	0.75	**0.15**	0.11	0.04

Total TSS Removal = 96%

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

Project: **Grove Street Phase 2**
Prepared By: **CML**
Date: **1/25/2023**

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

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

Mass. Dept. of Environmental Protection

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

Version 1, Automated: Mar. 4, 2008

Location: Grove Street - 54+18 LT

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**

Total TSS Removal = **25%**

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

Project: **Grove Street Phase 2**
Prepared By: **CML**
Date: **1/25/2023**

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

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

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

Version 1, Automated: Mar. 4, 2008

Location: Grove Street - 61+69 LT

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Treebox Filter	0.80	1.00	0.80	0.20
Deep Sump and Hooded Catch Basin	0.25	0.20	0.05	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

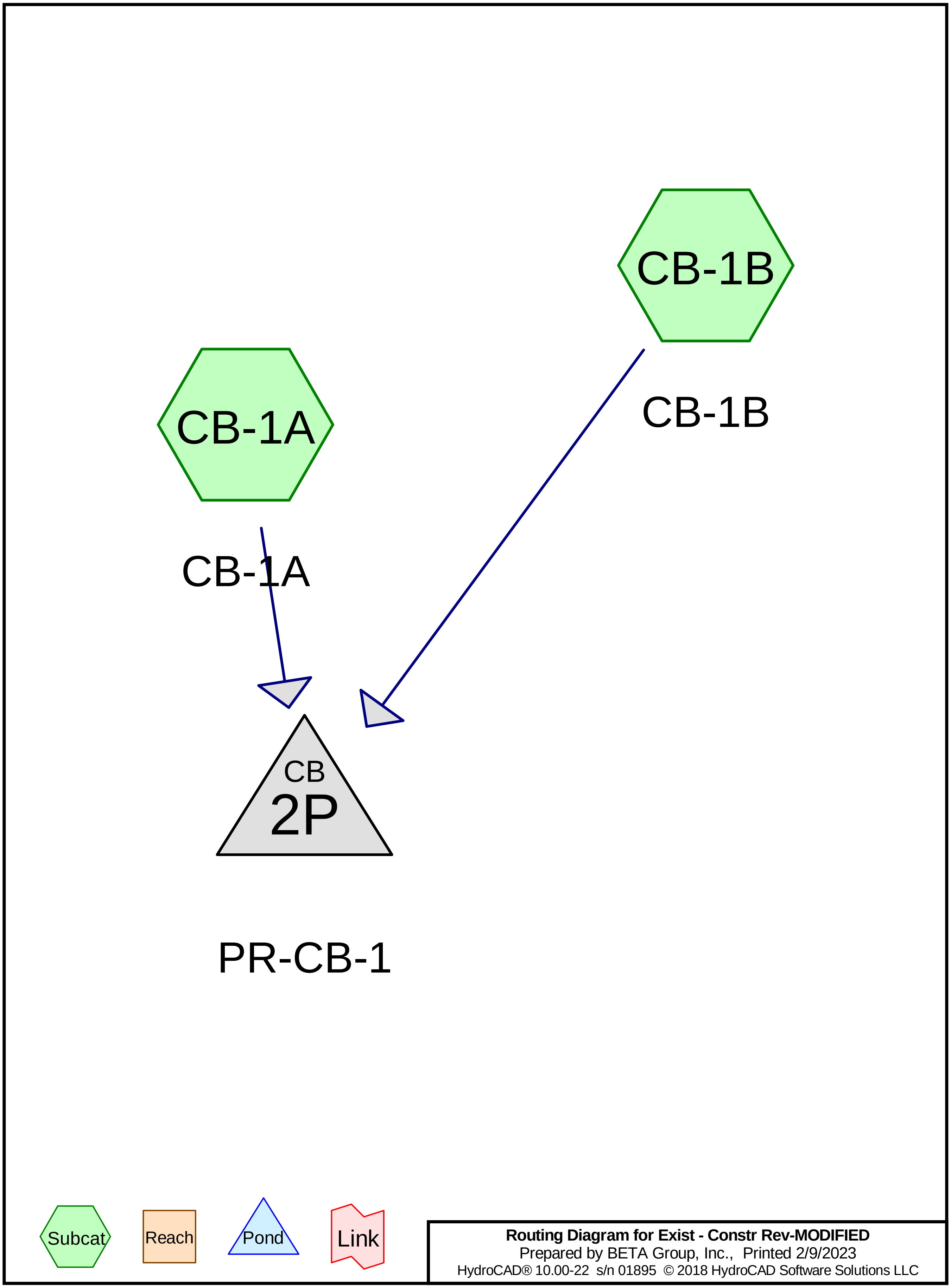
Total TSS Removal = 85%

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

Project: Grove Street Phase 2
Prepared By: CML
Date: 1/25/2023

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

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



Routing Diagram for Exist - Constr Rev-MODIFIED
Prepared by BETA Group, Inc., Printed 2/9/2023
HydroCAD® 10.00-22 s/n 01895 © 2018 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
11,826	61	1/4 acre lots, 38% imp, HSG A (CB-1B)
4,026	98	Paved roads w/curbs & sewers, HSG A (CB-1A)

Summary for Subcatchment CB-1A: CB-1A

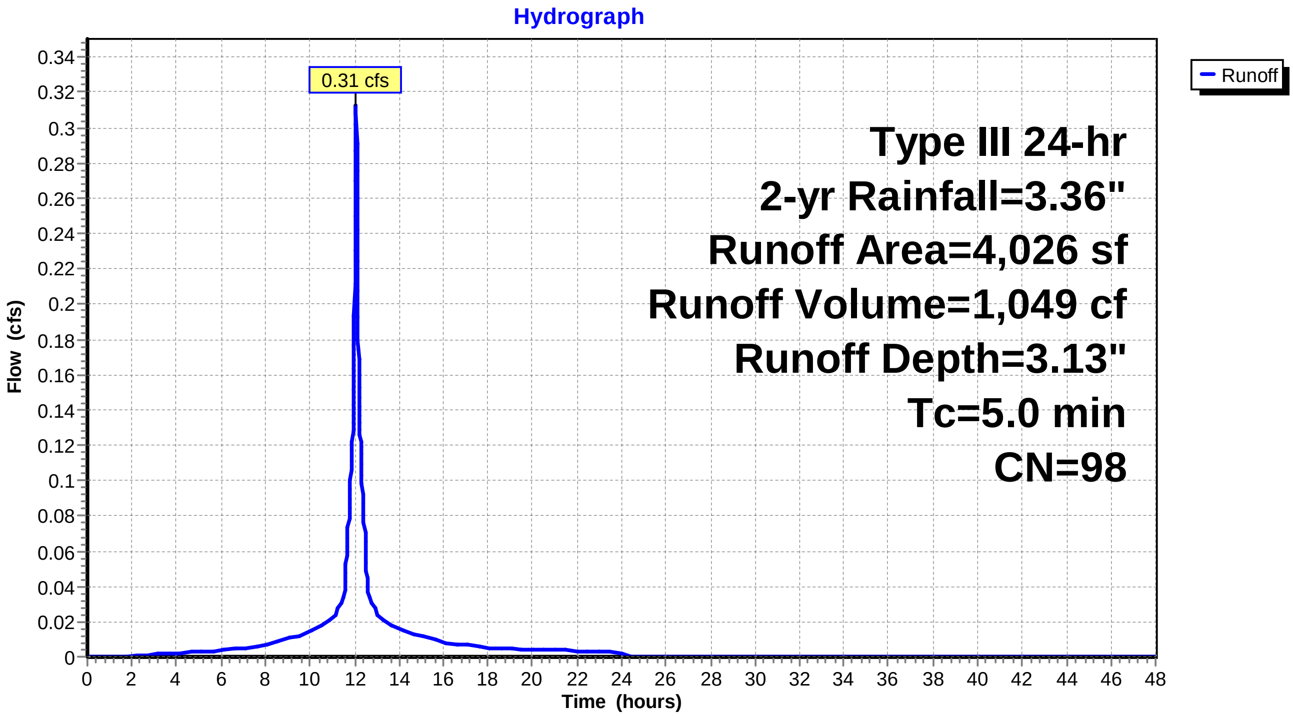
Runoff = 0.31 cfs @ 12.07 hrs, Volume= 1,049 cf, Depth= 3.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.36"

	Area (sf)	CN	Description
*	4,026	98	Paved roads w/curbs & sewers, HSG A
	4,026		100.00% Impervious Area

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

Subcatchment CB-1A: CB-1A



Summary for Subcatchment CB-1B: CB-1B

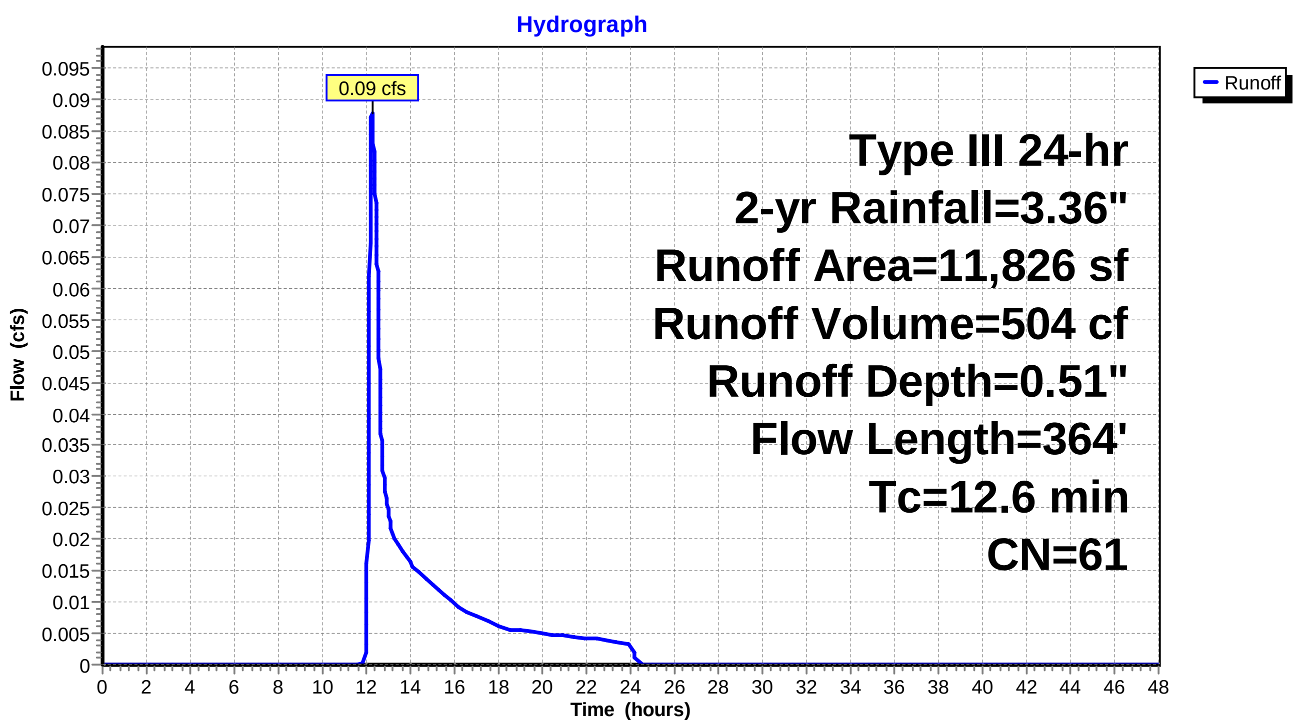
Runoff = 0.09 cfs @ 12.23 hrs, Volume= 504 cf, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
11,826	61	1/4 acre lots, 38% imp, HSG A
7,332		62.00% Pervious Area
4,494		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	34	0.0153	0.06		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.60"
2.9	330	0.0090	1.93		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
12.6	364	Total			

Subcatchment CB-1B: CB-1B



Summary for Pond 2P: PR-CB-1

Inflow Area =	15,852 sf,	53.75% Impervious,	Inflow Depth = 1.18"	for 2-yr event
Inflow =	0.34 cfs @	12.08 hrs, Volume=	1,553 cf	
Outflow =	0.34 cfs @	12.08 hrs, Volume=	1,553 cf,	Atten= 0%, Lag= 0.0 min
Primary =	0.34 cfs @	12.08 hrs, Volume=	1,553 cf	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0 cf	

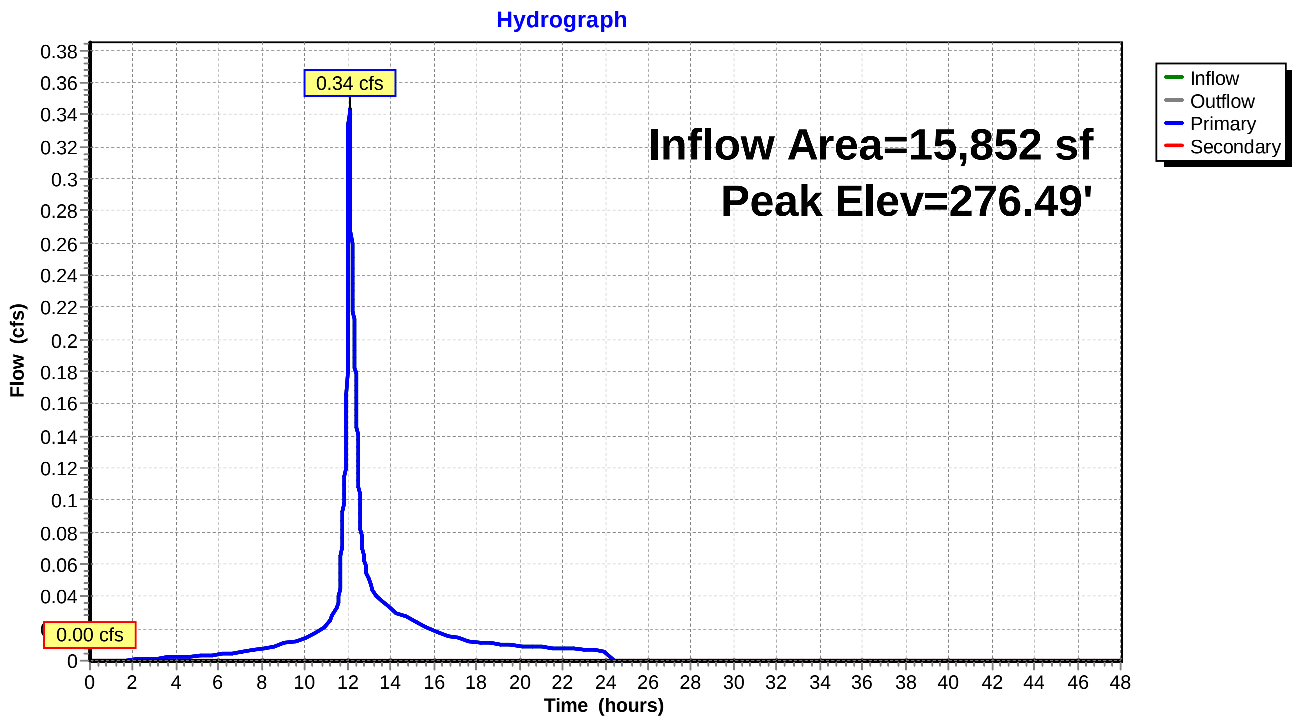
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 276.49' @ 12.08 hrs
Flood Elev= 280.40'

Device	Routing	Invert	Outlet Devices
#1	Secondary	280.40'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	276.20'	**12.0" Round Culvert** L= 37.4' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 276.20' / 275.00' S= 0.0321 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.34 cfs @ 12.08 hrs HW=276.49' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.34 cfs @ 1.83 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=276.20' (Free Discharge)
└─**1=CB Grate** (Controls 0.00 cfs)

Pond 2P: PR-CB-1



Summary for Subcatchment CB-1A: CB-1A

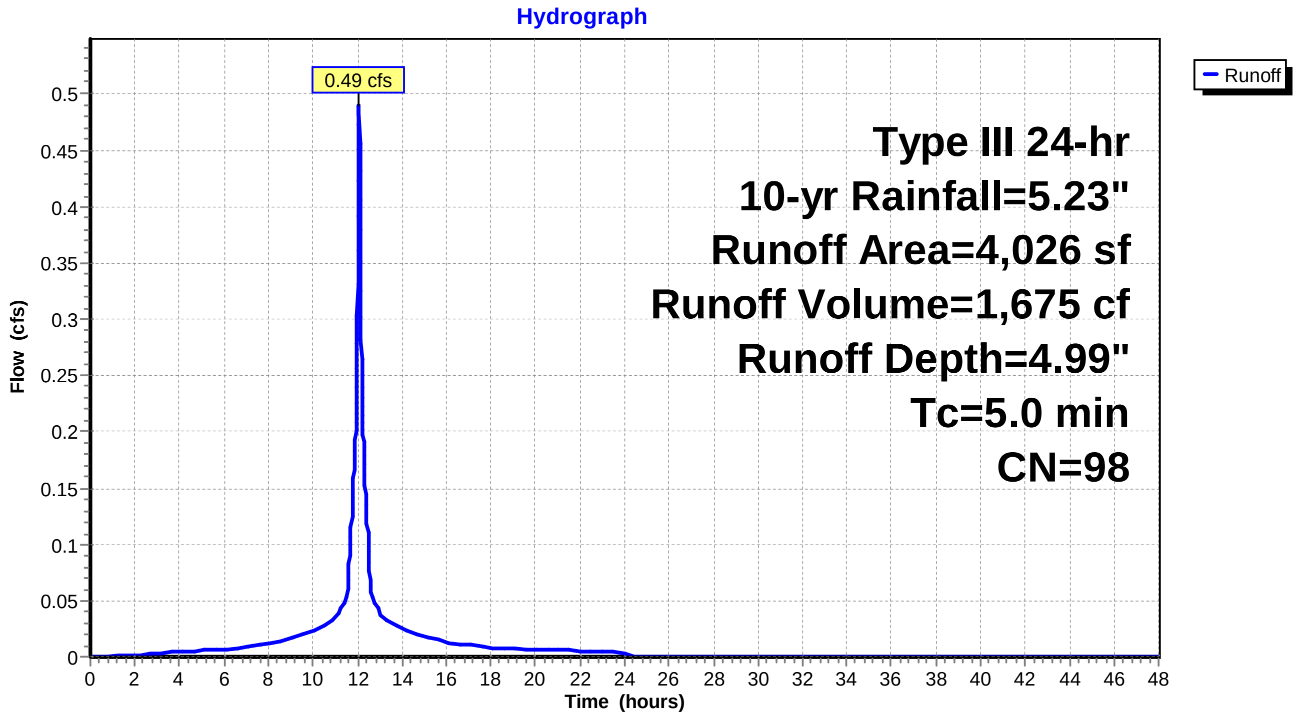
Runoff = 0.49 cfs @ 12.07 hrs, Volume= 1,675 cf, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=5.23"

	Area (sf)	CN	Description
*	4,026	98	Paved roads w/curbs & sewers, HSG A
	4,026		100.00% Impervious Area

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

Subcatchment CB-1A: CB-1A



Summary for Subcatchment CB-1B: CB-1B

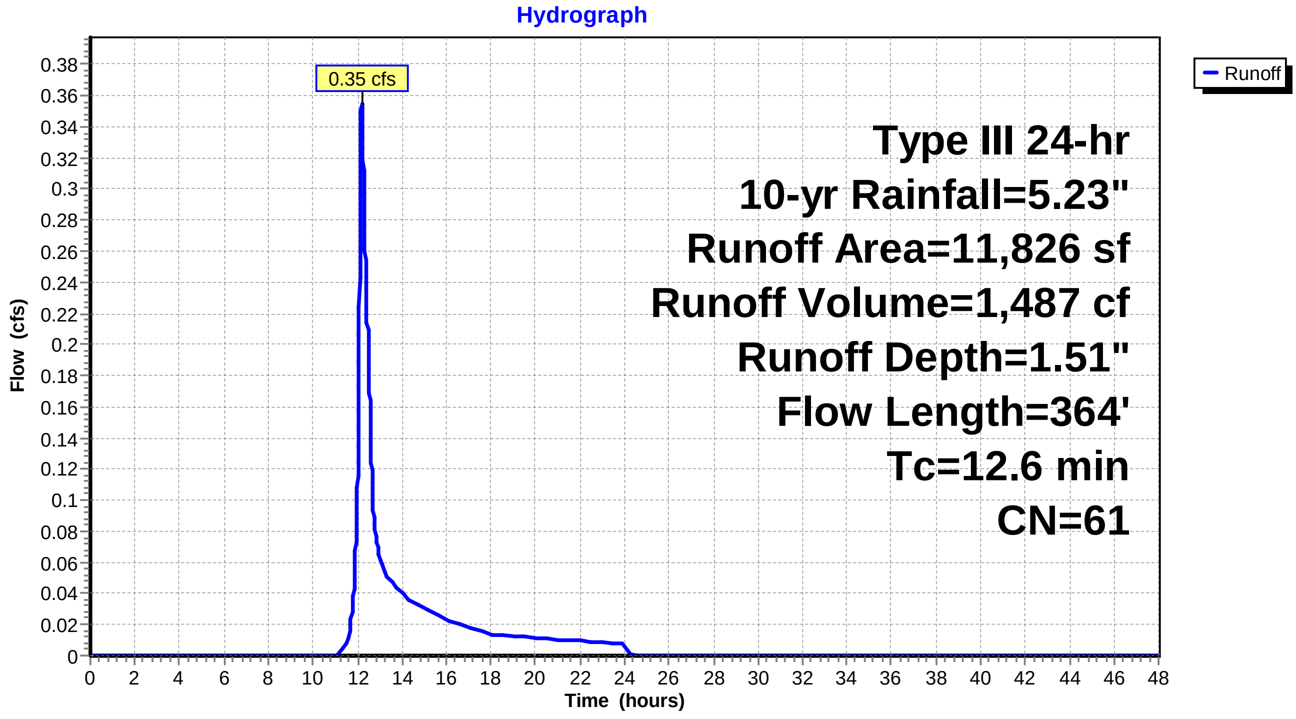
Runoff = 0.35 cfs @ 12.19 hrs, Volume= 1,487 cf, Depth= 1.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=5.23"

Area (sf)	CN	Description
11,826	61	1/4 acre lots, 38% imp, HSG A
7,332		62.00% Pervious Area
4,494		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	34	0.0153	0.06		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.60"
2.9	330	0.0090	1.93		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
12.6	364	Total			

Subcatchment CB-1B: CB-1B



Summary for Pond 2P: PR-CB-1

Inflow Area = 15,852 sf, 53.75% Impervious, Inflow Depth = 2.39" for 10-yr event
Inflow = 0.72 cfs @ 12.10 hrs, Volume= 3,162 cf
Outflow = 0.72 cfs @ 12.10 hrs, Volume= 3,162 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.72 cfs @ 12.10 hrs, Volume= 3,162 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

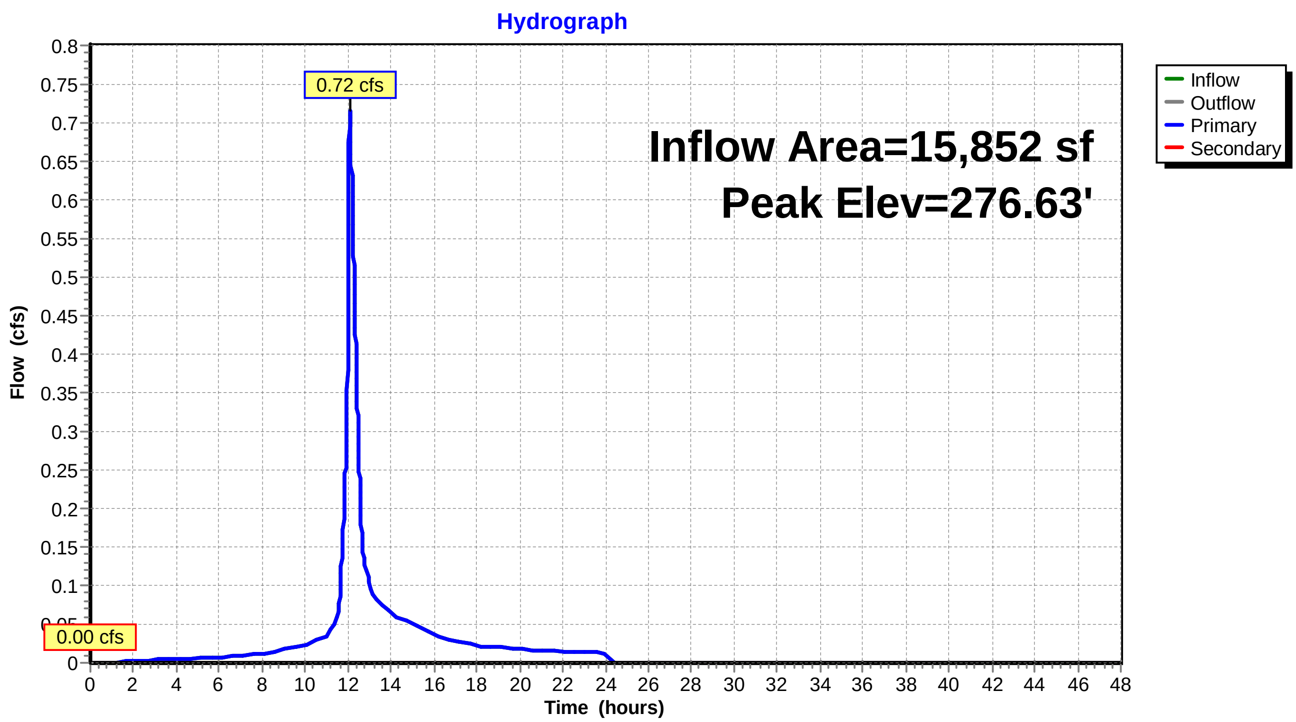
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 276.63' @ 12.10 hrs
Flood Elev= 280.40'

Device	Routing	Invert	Outlet Devices
#1	Secondary	280.40'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	276.20'	**12.0" Round Culvert** L= 37.4' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 276.20' / 275.00' S= 0.0321 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.72 cfs @ 12.10 hrs HW=276.63' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.72 cfs @ 2.23 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=276.20' (Free Discharge)
↑—**1=CB Grate** (Controls 0.00 cfs)

Pond 2P: PR-CB-1



Summary for Subcatchment CB-1A: CB-1A

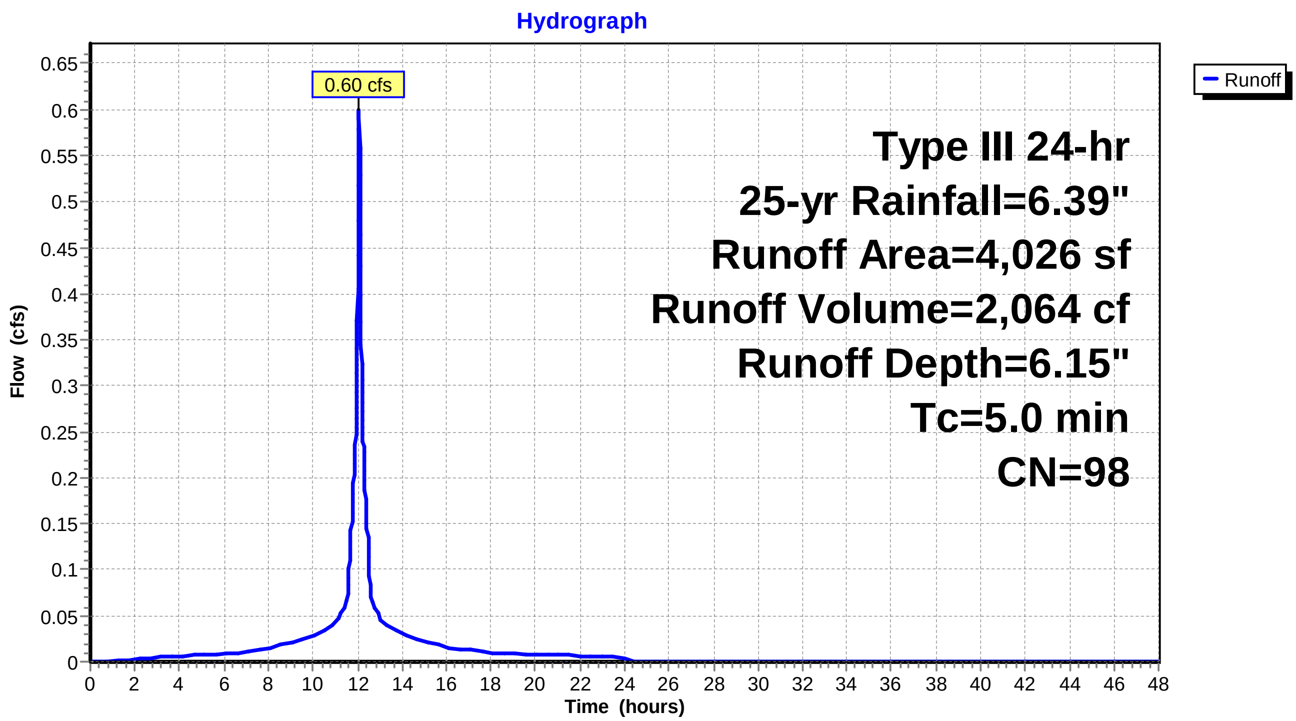
Runoff = 0.60 cfs @ 12.07 hrs, Volume= 2,064 cf, Depth= 6.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.39"

	Area (sf)	CN	Description
*	4,026	98	Paved roads w/curbs & sewers, HSG A
	4,026		100.00% Impervious Area

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

Subcatchment CB-1A: CB-1A



Summary for Subcatchment CB-1B: CB-1B

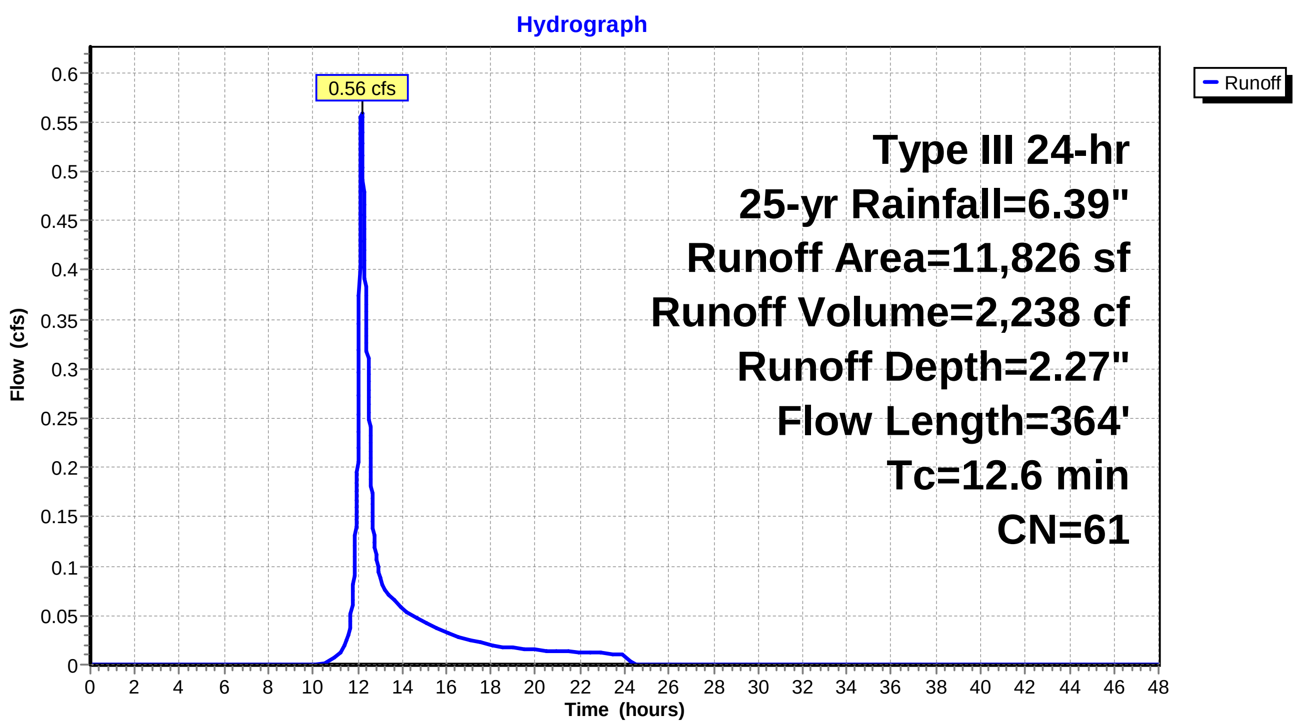
Runoff = 0.56 cfs @ 12.19 hrs, Volume= 2,238 cf, Depth= 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.39"

Area (sf)	CN	Description
11,826	61	1/4 acre lots, 38% imp, HSG A
7,332		62.00% Pervious Area
4,494		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	34	0.0153	0.06		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.60"
2.9	330	0.0090	1.93		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
12.6	364	Total			

Subcatchment CB-1B: CB-1B



Summary for Pond 2P: PR-CB-1

Inflow Area = 15,852 sf, 53.75% Impervious, Inflow Depth = 3.26" for 25-yr event
Inflow = 0.99 cfs @ 12.10 hrs, Volume= 4,302 cf
Outflow = 0.99 cfs @ 12.10 hrs, Volume= 4,302 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.99 cfs @ 12.10 hrs, Volume= 4,302 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

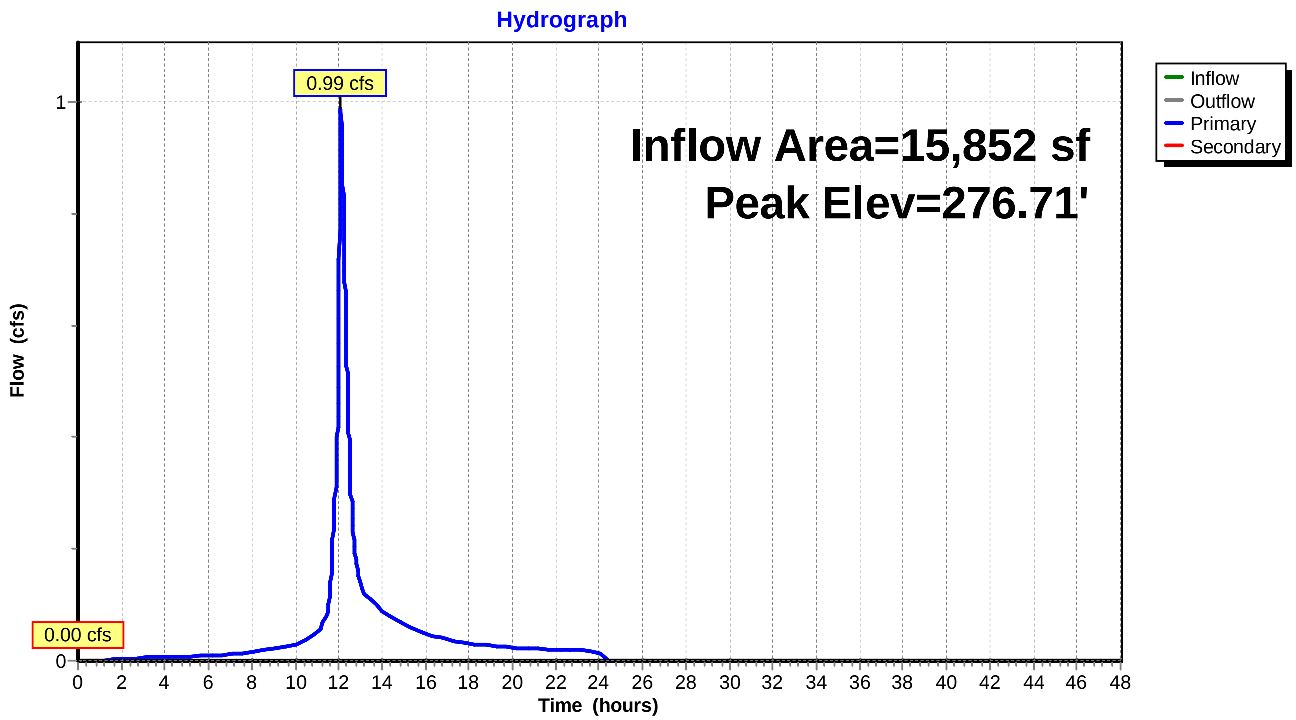
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 276.71' @ 12.10 hrs
Flood Elev= 280.40'

Device	Routing	Invert	Outlet Devices
#1	Secondary	280.40'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	276.20'	**12.0" Round Culvert** L= 37.4' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 276.20' / 275.00' S= 0.0321 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.99 cfs @ 12.10 hrs HW=276.71' (Free Discharge)
└─2=Culvert (Inlet Controls 0.99 cfs @ 2.44 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=276.20' (Free Discharge)
└─1=CB Grate (Controls 0.00 cfs)

Pond 2P: PR-CB-1



Summary for Subcatchment CB-1A: CB-1A

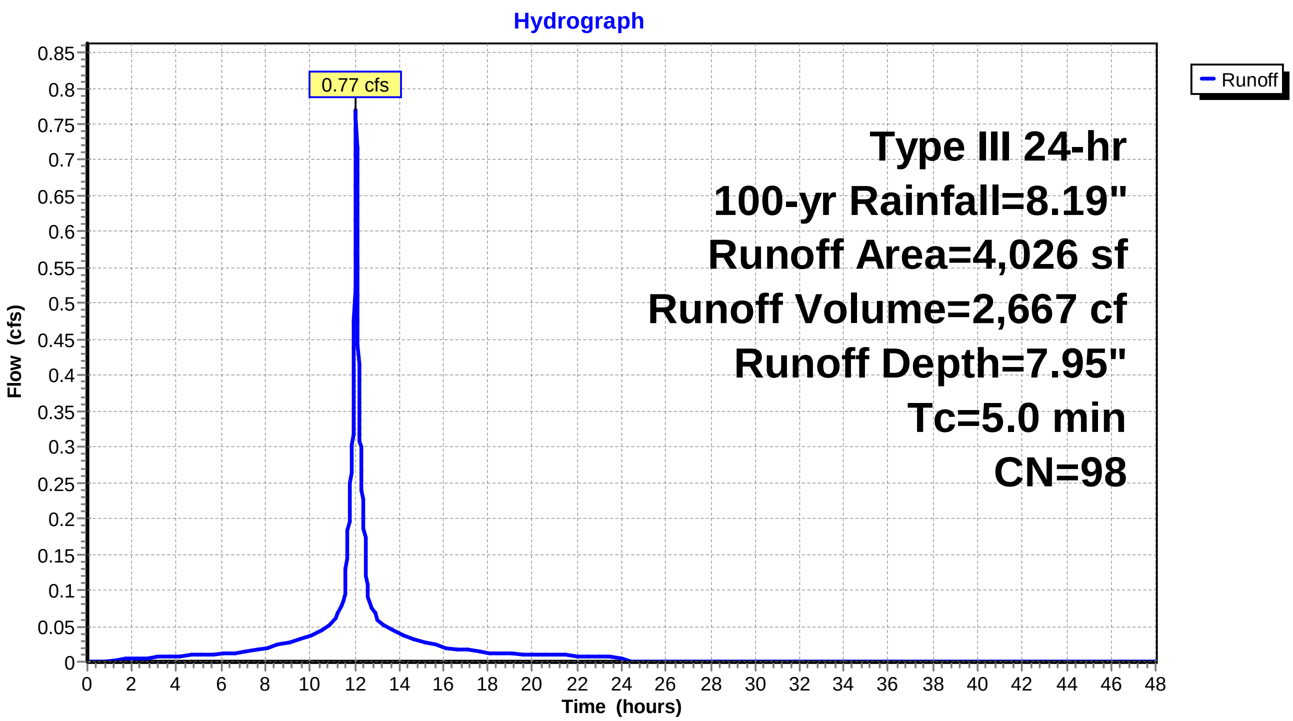
Runoff = 0.77 cfs @ 12.07 hrs, Volume= 2,667 cf, Depth= 7.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.19"

	Area (sf)	CN	Description
*	4,026	98	Paved roads w/curbs & sewers, HSG A
	4,026		100.00% Impervious Area

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

Subcatchment CB-1A: CB-1A



Summary for Subcatchment CB-1B: CB-1B

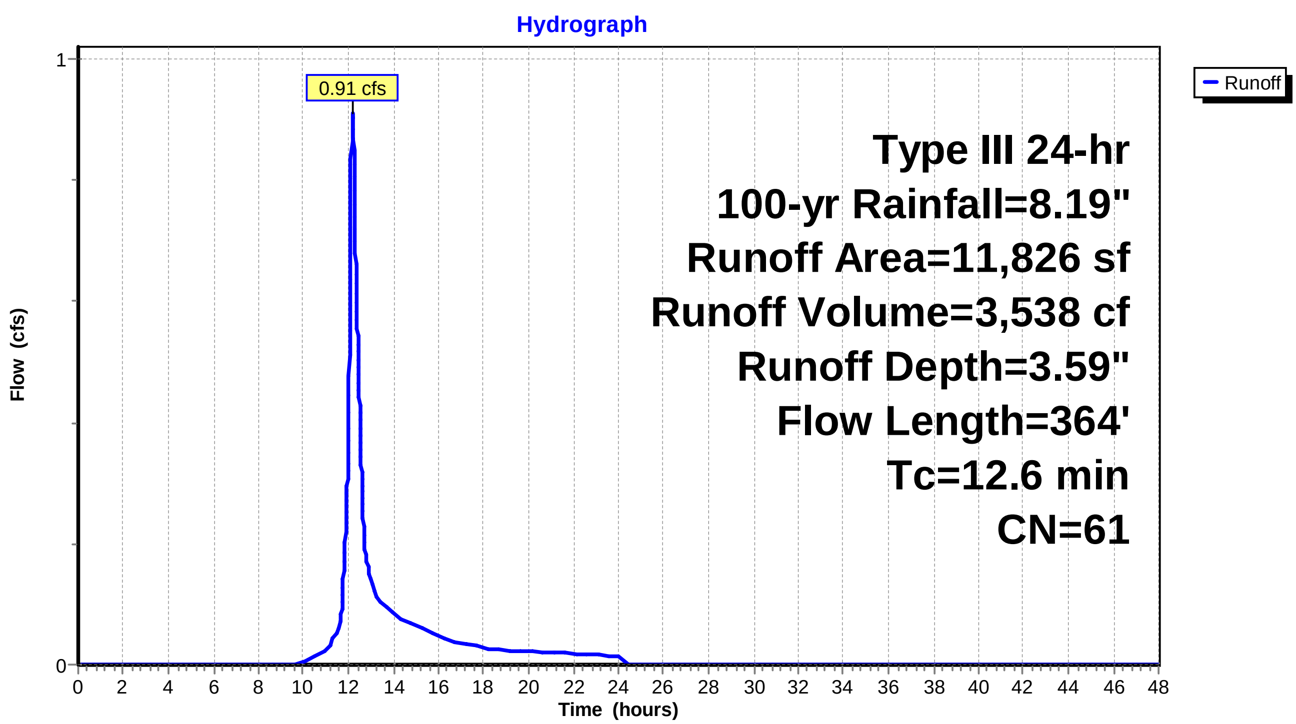
Runoff = 0.91 cfs @ 12.18 hrs, Volume= 3,538 cf, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
11,826	61	1/4 acre lots, 38% imp, HSG A
7,332		62.00% Pervious Area
4,494		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	34	0.0153	0.06		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.60"
2.9	330	0.0090	1.93		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
12.6	364	Total			

Subcatchment CB-1B: CB-1B



Summary for Pond 2P: PR-CB-1

Inflow Area =	15,852 sf,	53.75% Impervious,	Inflow Depth = 4.70"	for 100-yr event
Inflow =	1.44 cfs @	12.11 hrs, Volume=	6,205 cf	
Outflow =	1.44 cfs @	12.11 hrs, Volume=	6,205 cf,	Atten= 0%, Lag= 0.0 min
Primary =	1.44 cfs @	12.11 hrs, Volume=	6,205 cf	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0 cf	

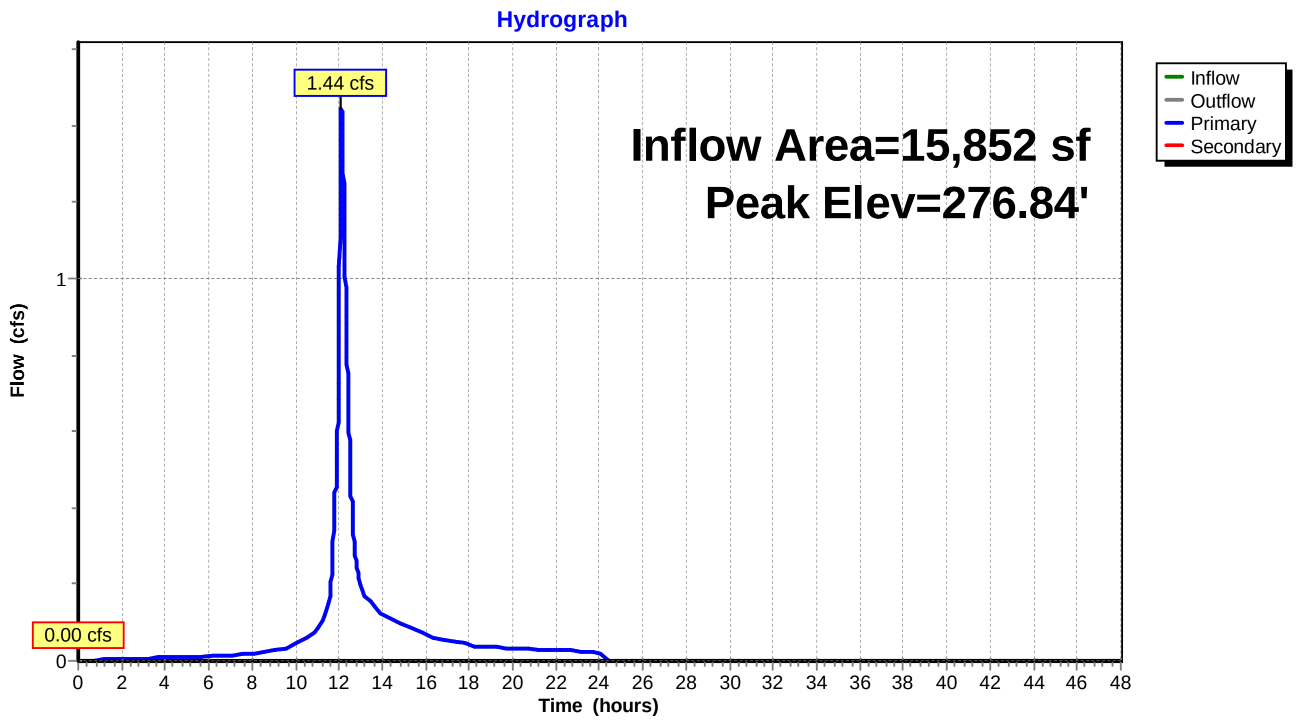
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 276.84' @ 12.11 hrs
Flood Elev= 280.40'

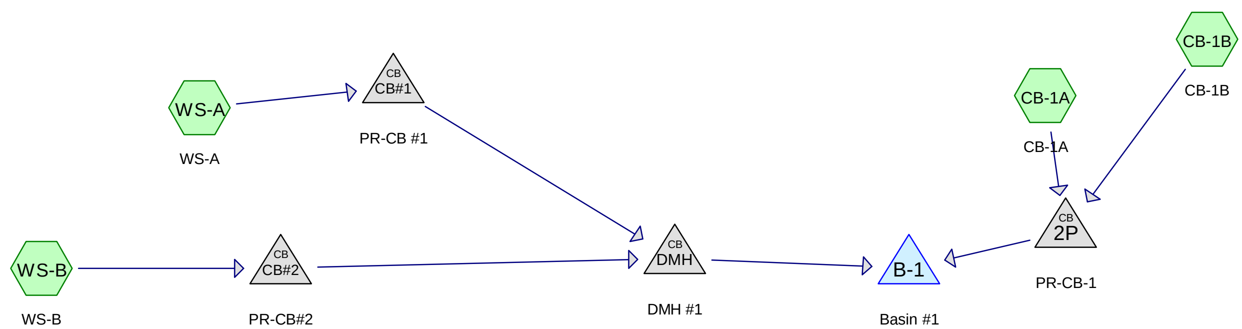
Device	Routing	Invert	Outlet Devices
#1	Secondary	280.40'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	276.20'	**12.0" Round Culvert** L= 37.4' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 276.20' / 275.00' S= 0.0321 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

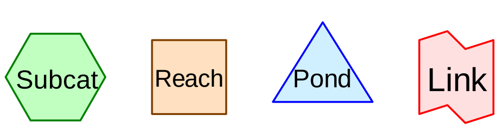
Primary OutFlow Max=1.44 cfs @ 12.11 hrs HW=276.84' (Free Discharge)
↑**2=Culvert** (Inlet Controls 1.44 cfs @ 2.72 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=276.20' (Free Discharge)
↑**1=CB Grate** (Controls 0.00 cfs)

Pond 2P: PR-CB-1







Routing Diagram for Proposed - Constr Rev-MODIFIED
Prepared by BETA Group, Inc., Printed 2/9/2023
HydroCAD® 10.00-22 s/n 01895 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
8,317	61	1/4 acre lots, 38% imp, HSG A (CB-1B)
31,179	98	Paved roads w/curbs & sewers, HSG A (CB-1A, WS-A, WS-B)

Summary for Subcatchment CB-1A: CB-1A

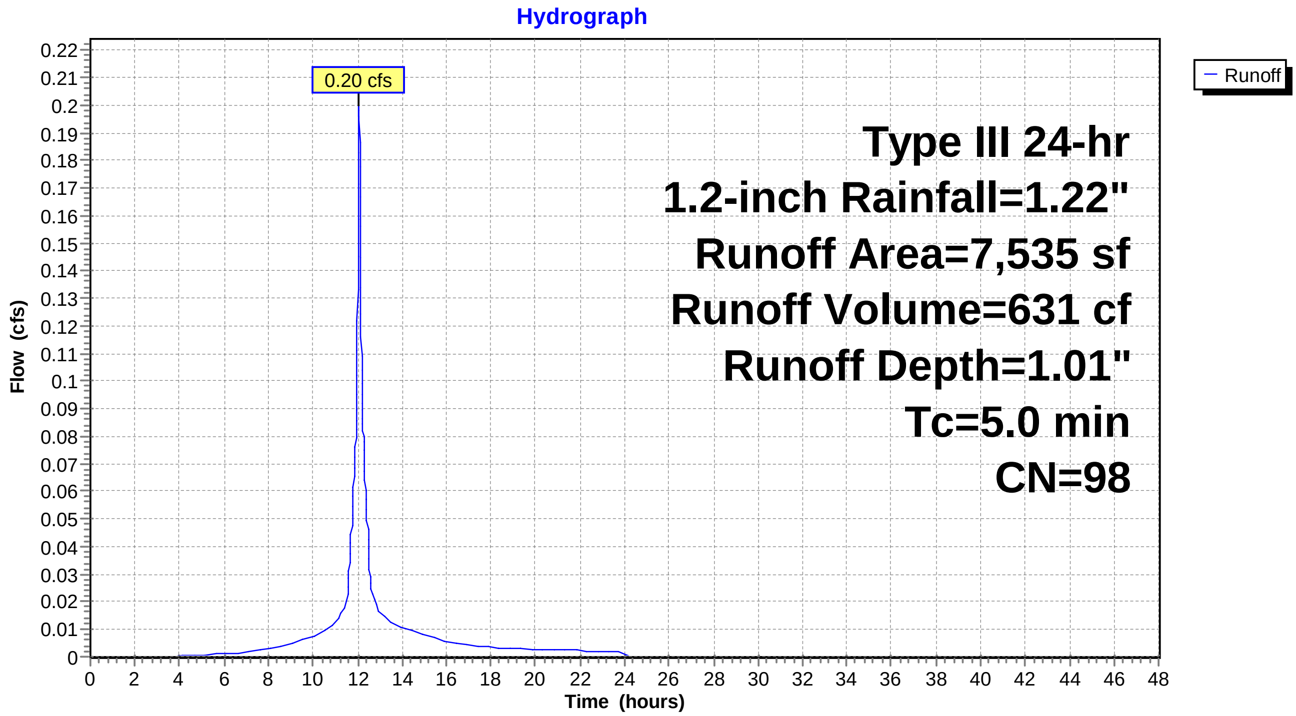
Runoff = 0.20 cfs @ 12.07 hrs, Volume= 631 cf, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1.2-inch Rainfall=1.22"

	Area (sf)	CN	Description
*	7,535	98	Paved roads w/curbs & sewers, HSG A
	7,535		100.00% Impervious Area

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

Subcatchment CB-1A: CB-1A



Summary for Subcatchment CB-1B: CB-1B

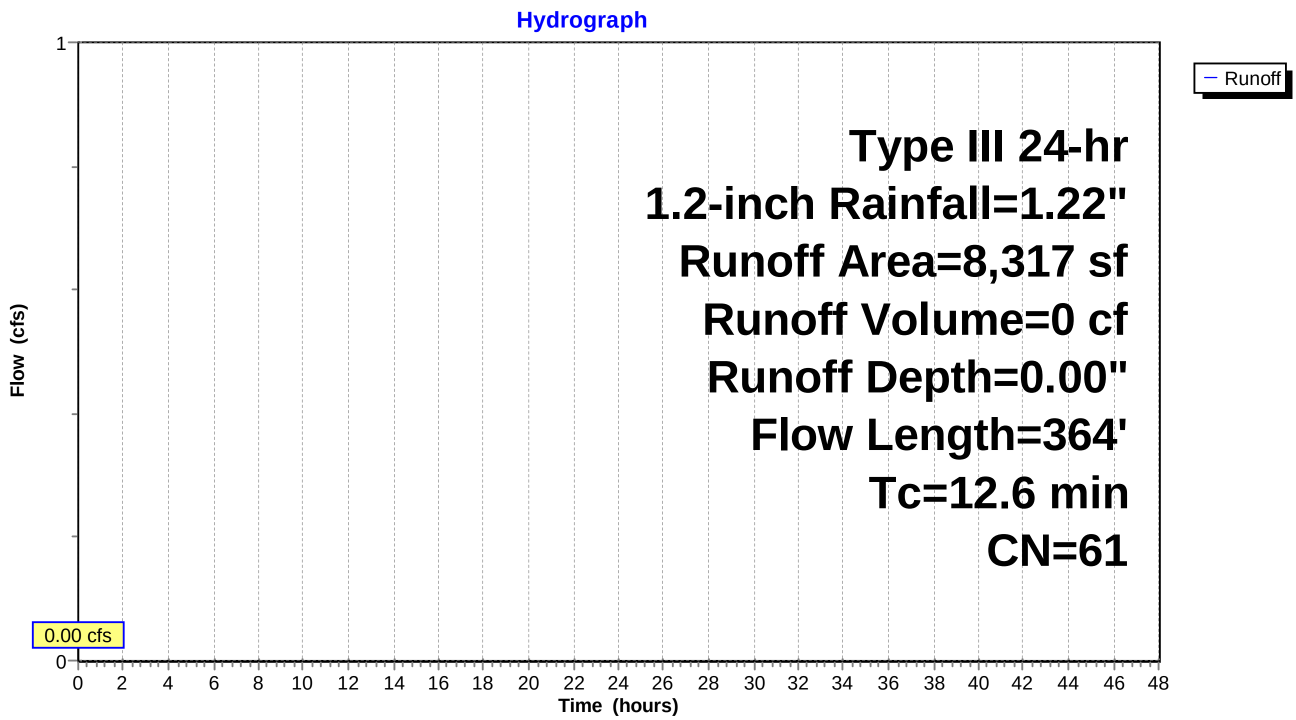
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1.2-inch Rainfall=1.22"

Area (sf)	CN	Description
8,317	61	1/4 acre lots, 38% imp, HSG A
5,157		62.00% Pervious Area
3,160		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	34	0.0153	0.06		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.60"
2.9	330	0.0090	1.93		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
12.6	364	Total			

Subcatchment CB-1B: CB-1B



Summary for Subcatchment WS-A: WS-A

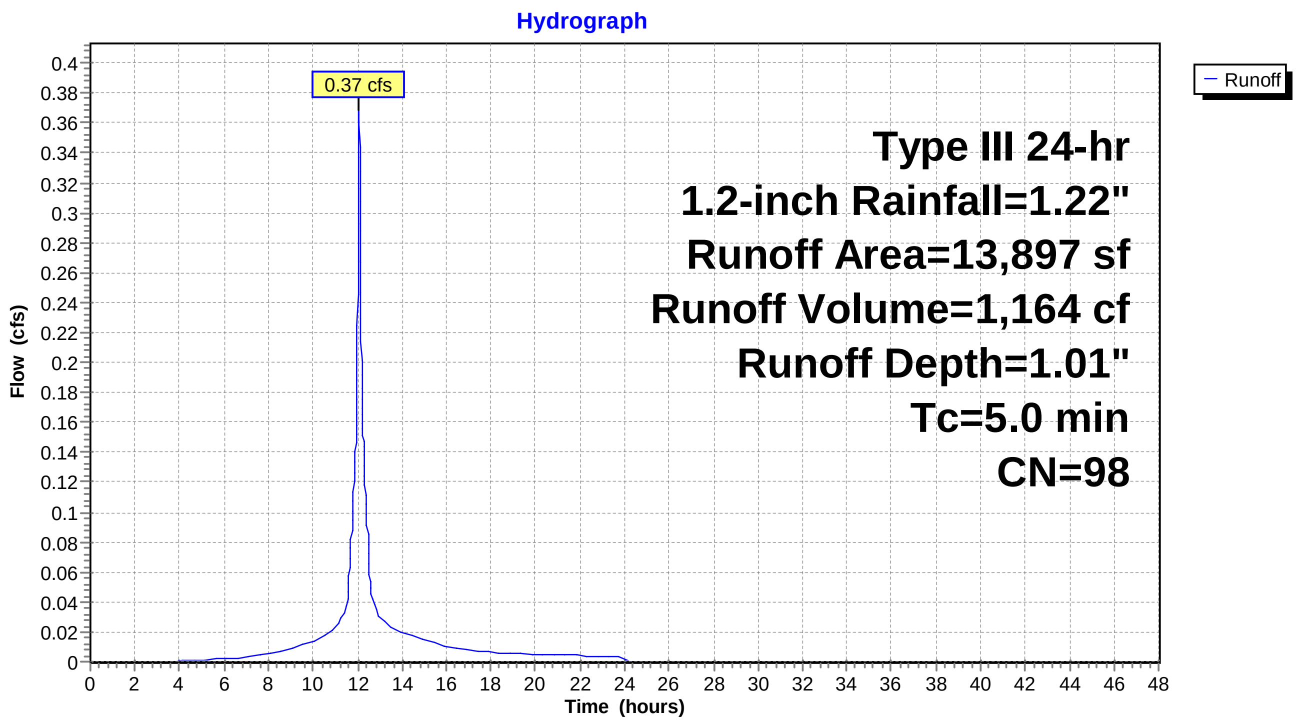
Runoff = 0.37 cfs @ 12.07 hrs, Volume= 1,164 cf, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1.2-inch Rainfall=1.22"

Area (sf)	CN	Description
13,897	98	Paved roads w/curbs & sewers, HSG A
13,897		100.00% Impervious Area

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

Subcatchment WS-A: WS-A



Summary for Subcatchment WS-B: WS-B

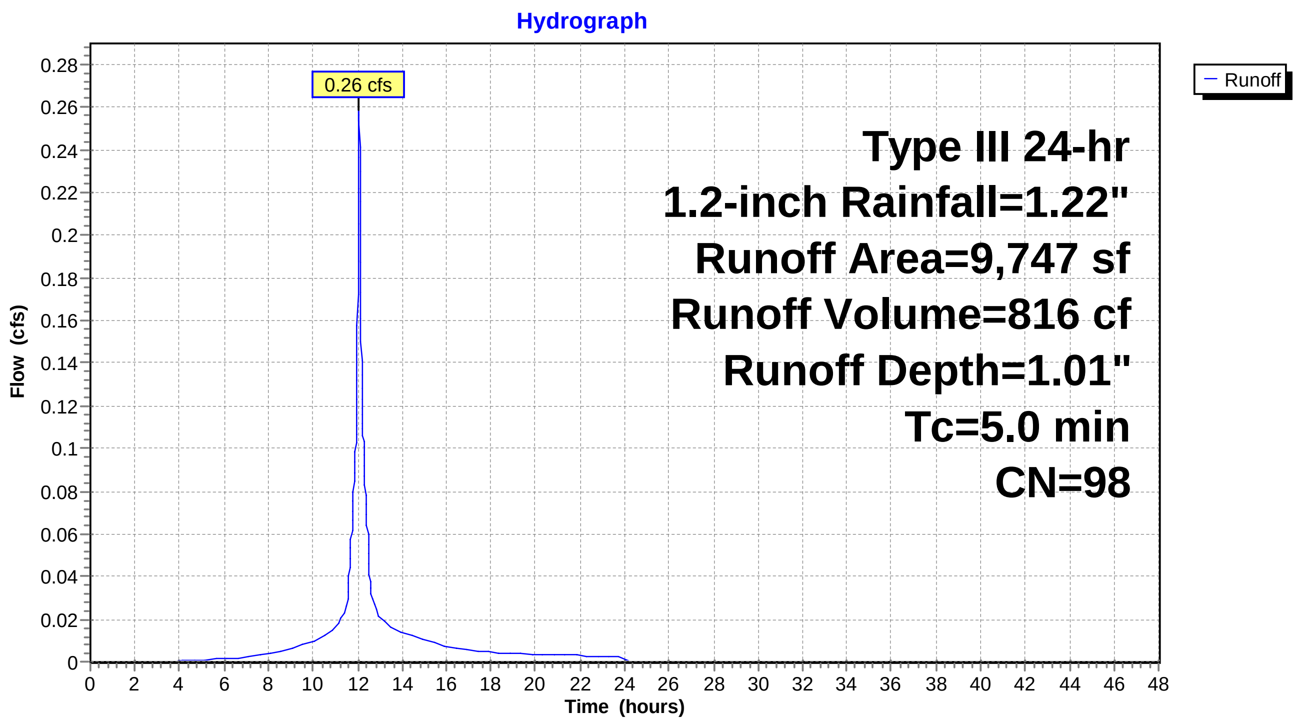
Runoff = 0.26 cfs @ 12.07 hrs, Volume= 816 cf, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1.2-inch Rainfall=1.22"

Area (sf)	CN	Description
9,747	98	Paved roads w/curbs & sewers, HSG A
9,747		100.00% Impervious Area

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

Subcatchment WS-B: WS-B



Summary for Pond 2P: PR-CB-1

Inflow Area =	15,852 sf,	67.47% Impervious,	Inflow Depth = 0.48"	for 1.2-inch event
Inflow =	0.20 cfs @	12.07 hrs, Volume=	631 cf	
Outflow =	0.20 cfs @	12.07 hrs, Volume=	631 cf,	Atten= 0%, Lag= 0.0 min
Primary =	0.18 cfs @	12.06 hrs, Volume=	625 cf	
Secondary =	0.02 cfs @	12.08 hrs, Volume=	6 cf	
Tertiary =	0.00 cfs @	0.00 hrs, Volume=	0 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 276.43' @ 12.08 hrs
Flood Elev= 280.40'

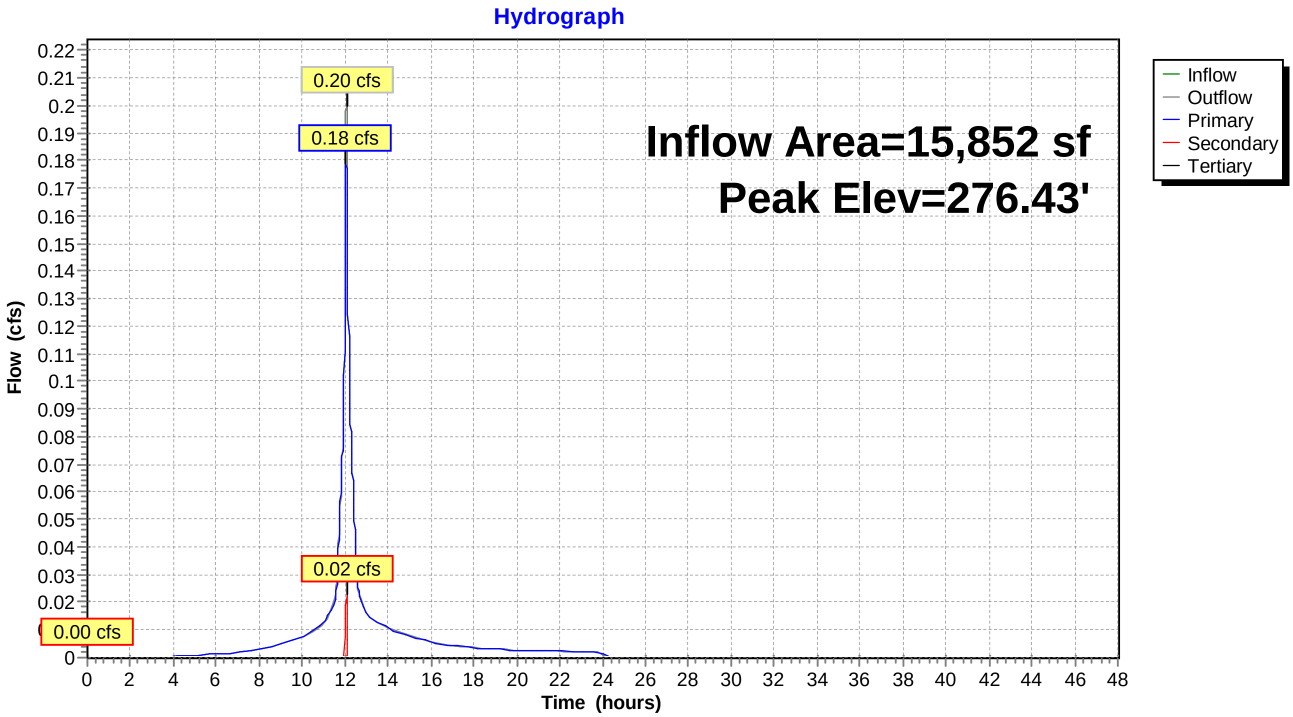
Device	Routing	Invert	Outlet Devices
#1	Primary	276.20'	**12.0" Round Culvert** L= 155.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 276.20' / 275.00' S= 0.0077 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Tertiary	280.40'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	276.20'	**12.0" Round Culvert** L= 37.4' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 276.20' / 275.00' S= 0.0321 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Device 3	276.42'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.18 cfs @ 12.06 hrs HW=276.43' TW=275.48' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.18 cfs @ 1.94 fps)

Secondary OutFlow Max=0.02 cfs @ 12.08 hrs HW=276.43' (Free Discharge)
└─**3=Culvert** (Passes 0.02 cfs of 0.23 cfs potential flow)
  └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 0.02 cfs @ 0.39 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=276.20' (Free Discharge)
└─**2=CB Grate** (Controls 0.00 cfs)

Pond 2P: PR-CB-1



Summary for Pond B-1: Basin #1

Inflow Area = 39,496 sf, 86.94% Impervious, Inflow Depth = 0.79" for 1.2-inch event
Inflow = 0.81 cfs @ 12.07 hrs, Volume= 2,606 cf
Outflow = 0.17 cfs @ 12.48 hrs, Volume= 2,606 cf, Atten= 79%, Lag= 24.7 min
Discarded = 0.17 cfs @ 12.48 hrs, Volume= 2,606 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 275.90' @ 12.48 hrs Surf.Area= 900 sf Storage= 671 cf
Flood Elev= 285.00' Surf.Area= 2,737 sf Storage= 7,952 cf

Plug-Flow detention time= 24.0 min calculated for 2,605 cf (100% of inflow)
Center-of-Mass det. time= 24.0 min (804.7 - 780.7)

Volume	Invert	Avail.Storage	Storage Description
#1	275.00'	7,952 cf	**Basin Storage (Prismatic)** Listed below (Recalc)

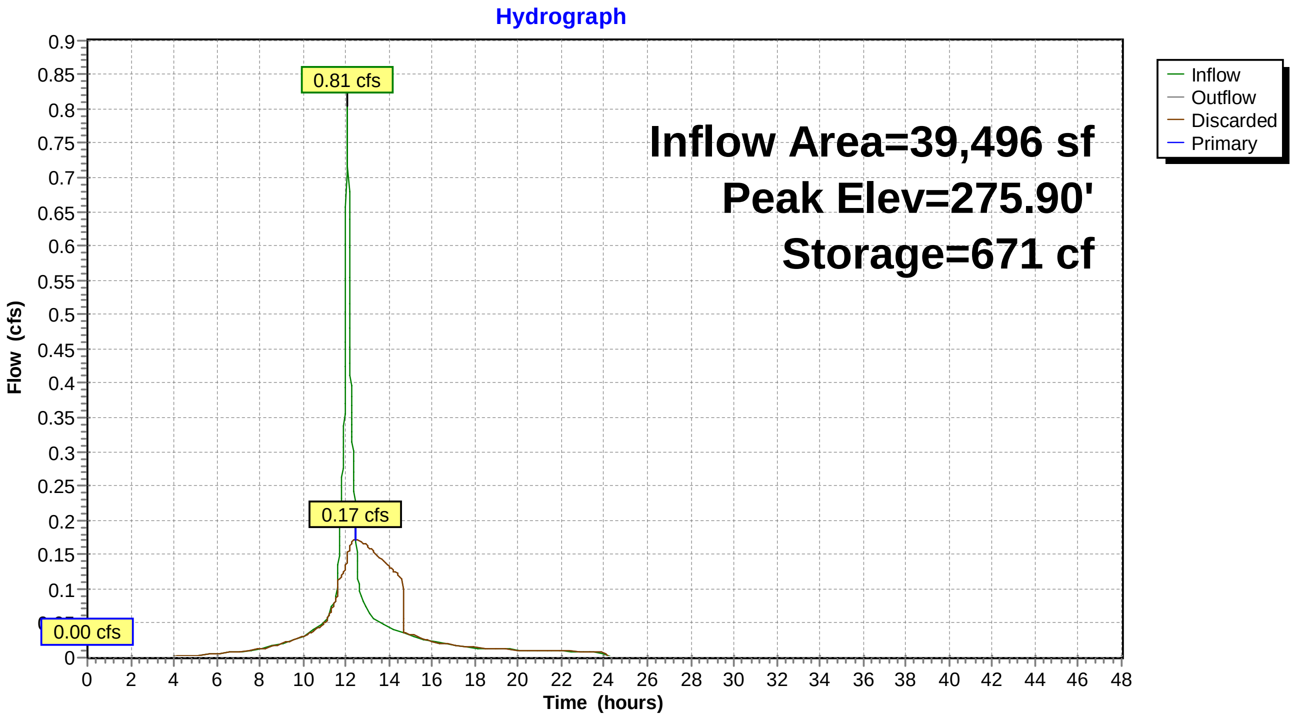
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
275.00	589	0	0
276.00	934	762	762
277.00	1,333	1,134	1,895
278.00	1,777	1,555	3,450
279.00	2,245	2,011	5,461
280.00	2,737	2,491	7,952

Device	Routing	Invert	Outlet Devices
#1	Discarded	275.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	279.50'	**88.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.17 cfs @ 12.48 hrs HW=275.90' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=275.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B-1: Basin #1



Summary for Pond CB#1: PR-CB #1

Inflow Area =	13,897 sf,100.00% Impervious,	Inflow Depth = 1.01" for 1.2-inch event		
Inflow =	0.37 cfs @	12.07 hrs, Volume=	1,164 cf	
Outflow =	0.37 cfs @	12.07 hrs, Volume=	1,164 cf,	Atten= 0%, Lag= 0.0 min
Primary =	0.37 cfs @	12.07 hrs, Volume=	1,164 cf	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0 cf	

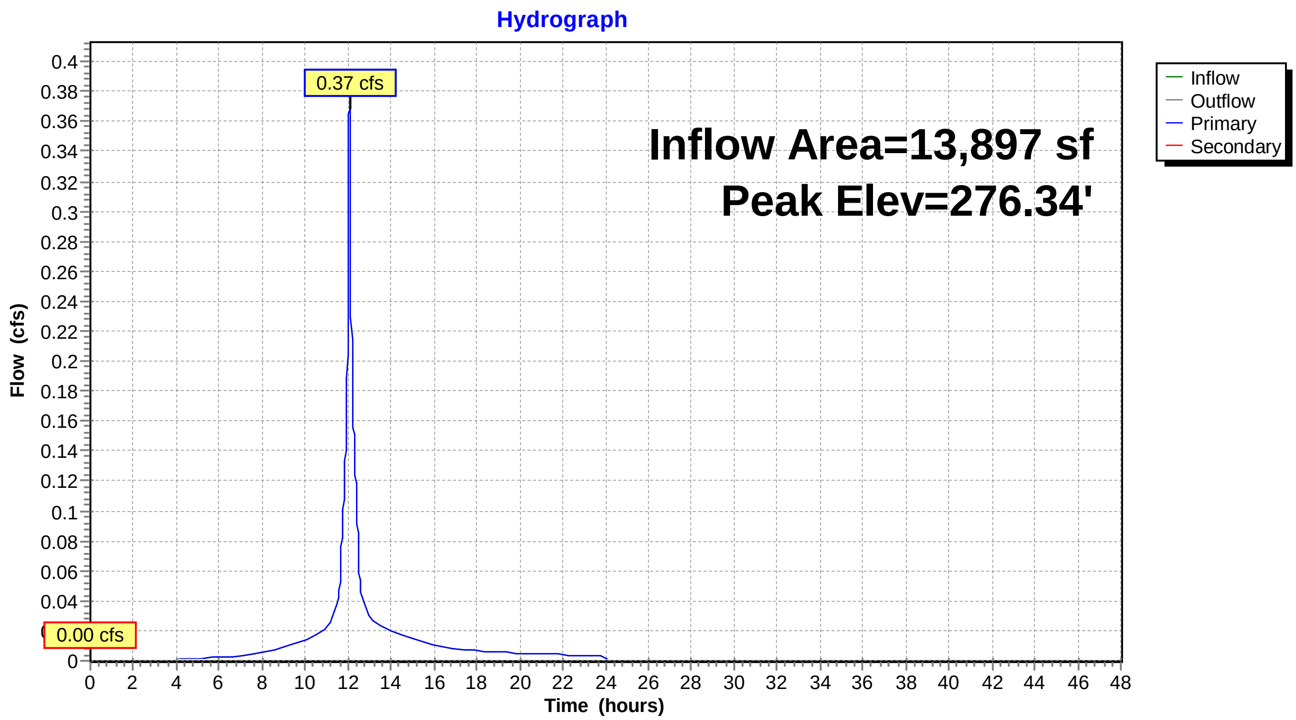
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 276.34' @ 12.07 hrs
Flood Elev= 278.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.90'	**12.0" Round RCP_Round 12"** L= 15.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 275.90' / 275.83' S= 0.0047 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Secondary	278.90'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.37 cfs @ 12.07 hrs HW=276.34' TW=276.19' (Dynamic Tailwater)
└─**1=RCP_Round 12"** (Outlet Controls 0.37 cfs @ 1.61 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=275.90' (Free Discharge)
└─**2=CB Grate** (Controls 0.00 cfs)

Pond CB#1: PR-CB #1



Summary for Pond CB#2: PR-CB#2

Inflow Area = 9,747 sf,100.00% Impervious, Inflow Depth = 1.01" for 1.2-inch event
Inflow = 0.26 cfs @ 12.07 hrs, Volume= 816 cf
Outflow = 0.26 cfs @ 12.07 hrs, Volume= 816 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.26 cfs @ 12.07 hrs, Volume= 816 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

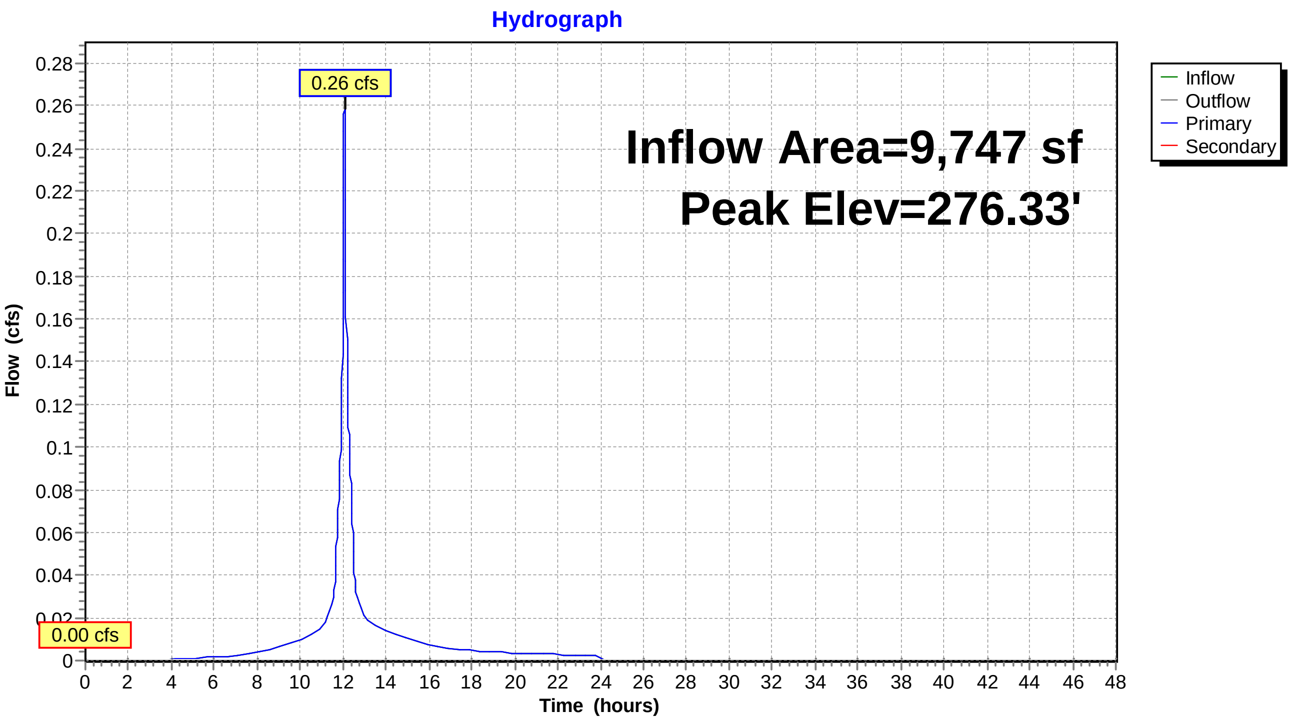
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 276.33' @ 12.07 hrs
Flood Elev= 278.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.90'	**12.0" Round RCP_Round 12"** L= 25.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 275.90' / 275.75' S= 0.0060 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Secondary	278.90'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600

Primary OutFlow Max=0.26 cfs @ 12.07 hrs HW=276.33' TW=276.19' (Dynamic Tailwater)
└**1=RCP_Round 12"** (Outlet Controls 0.26 cfs @ 1.18 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=275.90' (Free Discharge)
└**2=CB Grate** (Controls 0.00 cfs)

Pond CB#2: PR-CB#2



Summary for Pond DMH: DMH #1

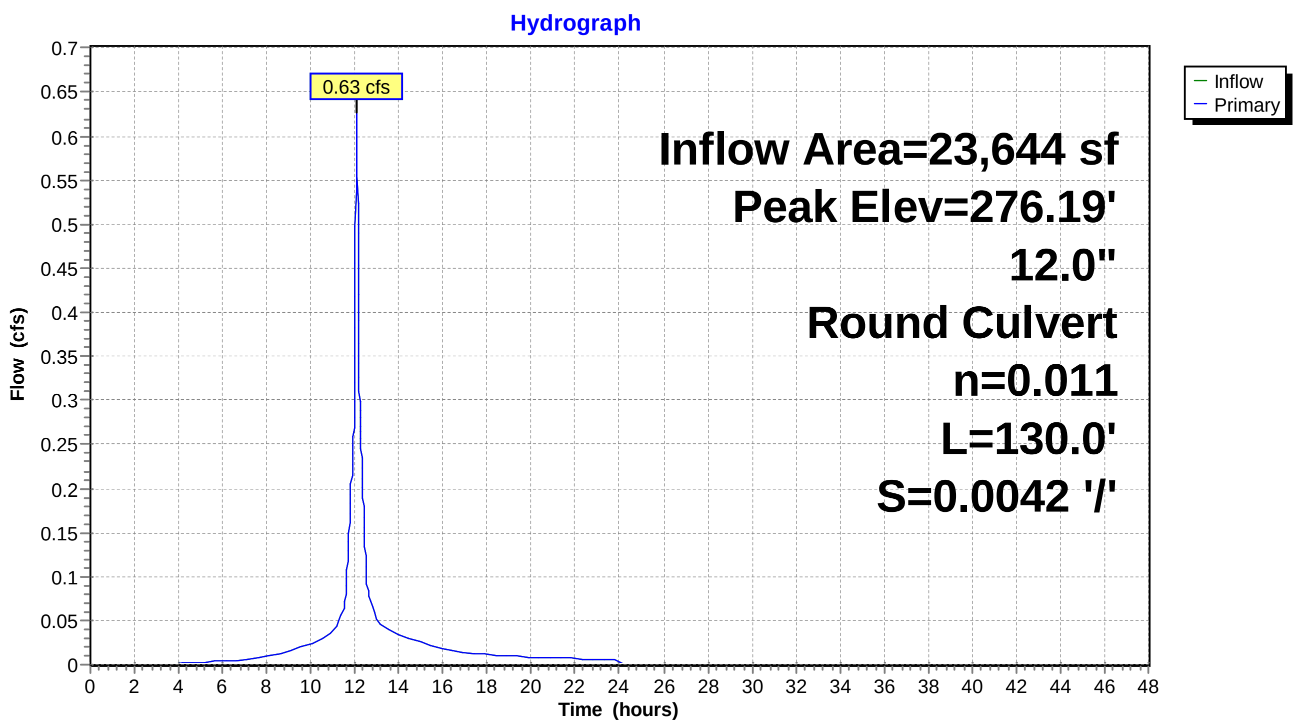
Inflow Area = 23,644 sf,100.00% Impervious, Inflow Depth = 1.01" for 1.2-inch event
Inflow = 0.63 cfs @ 12.07 hrs, Volume= 1,981 cf
Outflow = 0.63 cfs @ 12.07 hrs, Volume= 1,981 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.63 cfs @ 12.07 hrs, Volume= 1,981 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 276.19' @ 12.08 hrs
Flood Elev= 279.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.75'	**12.0" Round RCP_Round 12"** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 275.75' / 275.20' S= 0.0042 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.63 cfs @ 12.07 hrs HW=276.19' TW=275.51' (Dynamic Tailwater)
↑**1=RCP_Round 12"** (Barrel Controls 0.63 cfs @ 2.76 fps)

Pond DMH: DMH #1



Summary for Subcatchment CB-1A: CB-1A

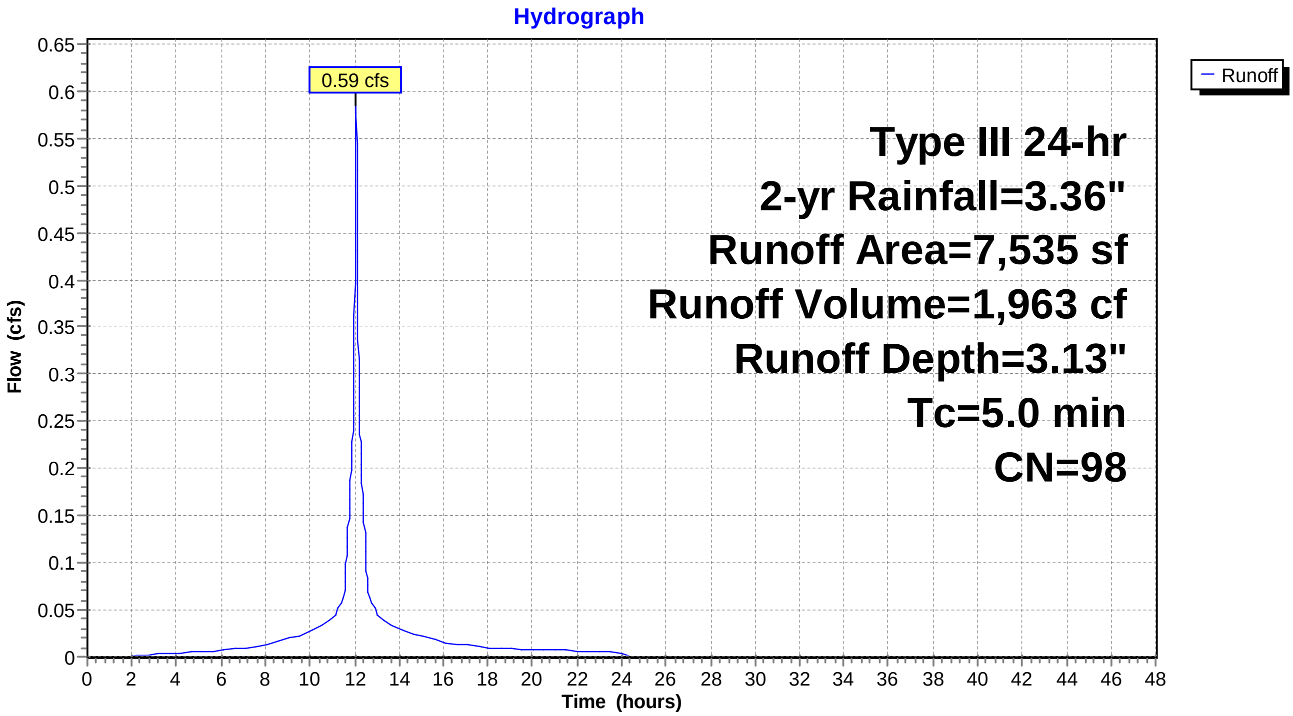
Runoff = 0.59 cfs @ 12.07 hrs, Volume= 1,963 cf, Depth= 3.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.36"

	Area (sf)	CN	Description
*	7,535	98	Paved roads w/curbs & sewers, HSG A
	7,535		100.00% Impervious Area

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

Subcatchment CB-1A: CB-1A



Summary for Subcatchment CB-1B: CB-1B

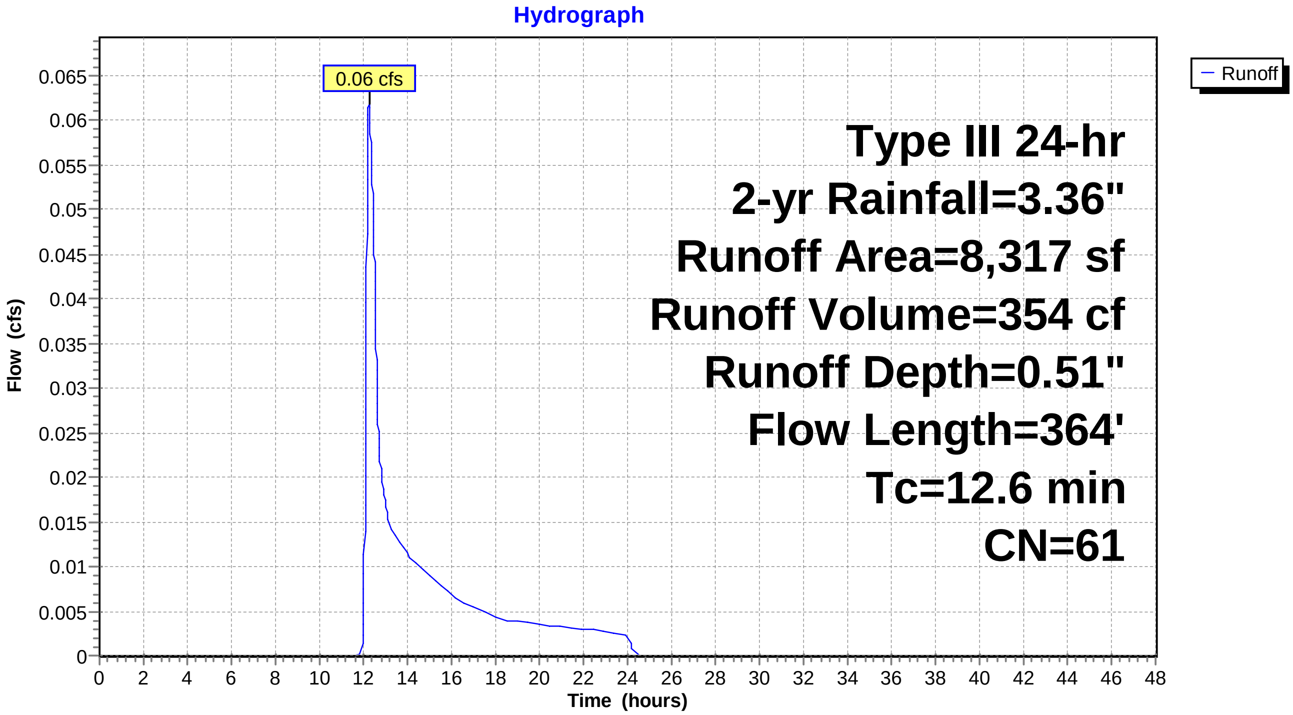
Runoff = 0.06 cfs @ 12.23 hrs, Volume= 354 cf, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
8,317	61	1/4 acre lots, 38% imp, HSG A
5,157		62.00% Pervious Area
3,160		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	34	0.0153	0.06		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.60"
2.9	330	0.0090	1.93		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
12.6	364	Total			

Subcatchment CB-1B: CB-1B



Summary for Subcatchment WS-A: WS-A

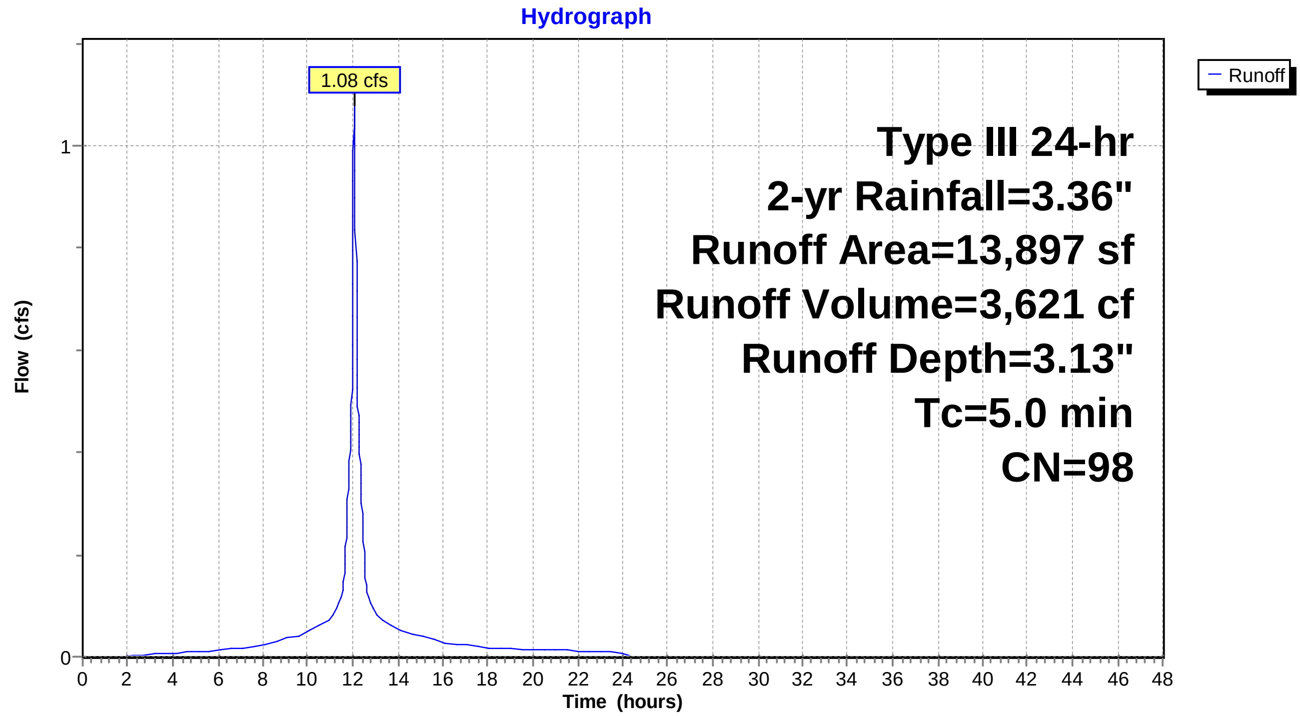
Runoff = 1.08 cfs @ 12.07 hrs, Volume= 3,621 cf, Depth= 3.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
13,897	98	Paved roads w/curbs & sewers, HSG A
13,897		100.00% Impervious Area

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

Subcatchment WS-A: WS-A



Summary for Subcatchment WS-B: WS-B

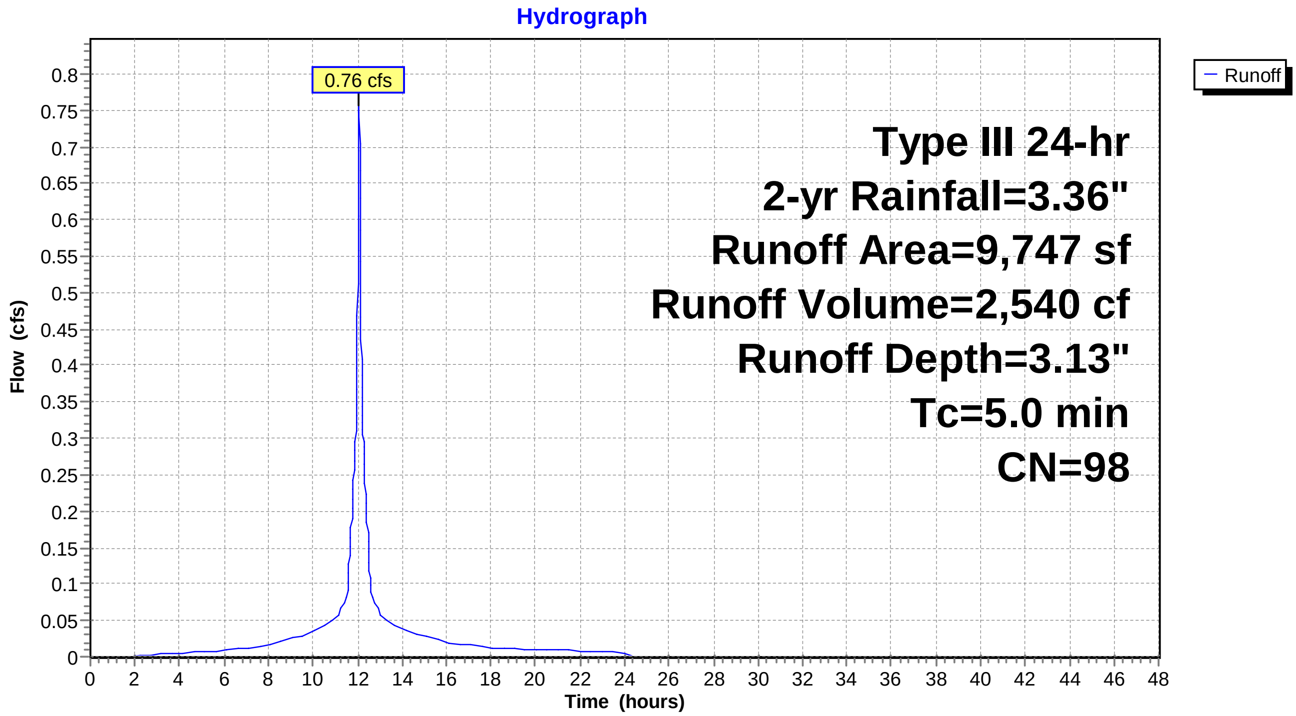
Runoff = 0.76 cfs @ 12.07 hrs, Volume= 2,540 cf, Depth= 3.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
9,747	98	Paved roads w/curbs & sewers, HSG A
9,747		100.00% Impervious Area

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

Subcatchment WS-B: WS-B



Summary for Pond 2P: PR-CB-1

Inflow Area = 15,852 sf, 67.47% Impervious, Inflow Depth = 1.75" for 2-yr event
Inflow = 0.61 cfs @ 12.07 hrs, Volume= 2,318 cf
Outflow = 0.61 cfs @ 12.07 hrs, Volume= 2,318 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.15 cfs @ 11.81 hrs, Volume= 1,178 cf
Secondary = 0.61 cfs @ 12.07 hrs, Volume= 1,140 cf
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 276.59' @ 12.07 hrs
Flood Elev= 280.40'

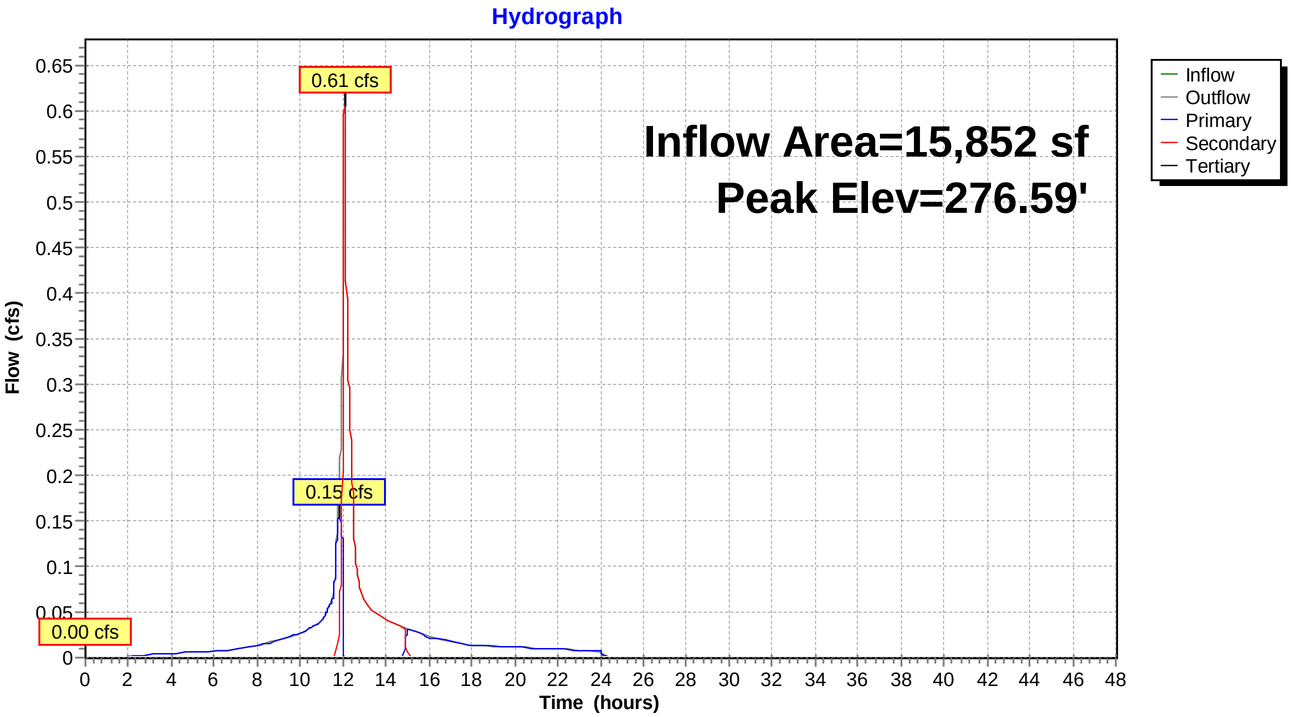
Device	Routing	Invert	Outlet Devices
#1	Primary	276.20'	**12.0" Round Culvert** L= 155.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 276.20' / 275.00' S= 0.0077 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Tertiary	280.40'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	276.20'	**12.0" Round Culvert** L= 37.4' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 276.20' / 275.00' S= 0.0321 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Device 3	276.42'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.15 cfs @ 11.81 hrs HW=276.44' TW=275.79' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.15 cfs @ 1.62 fps)

Secondary OutFlow Max=0.60 cfs @ 12.07 hrs HW=276.59' (Free Discharge)
└─**3=Culvert** (Inlet Controls 0.60 cfs @ 2.13 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Passes 0.60 cfs of 0.91 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=276.20' (Free Discharge)
└─**2=CB Grate** (Controls 0.00 cfs)

Pond 2P: PR-CB-1



Summary for Pond B-1: Basin #1

Inflow Area = 39,496 sf, 86.94% Impervious, Inflow Depth = 2.23" for 2-yr event
Inflow = 1.84 cfs @ 12.07 hrs, Volume= 7,339 cf
Outflow = 0.28 cfs @ 12.54 hrs, Volume= 7,339 cf, Atten= 85%, Lag= 28.1 min
Discarded = 0.28 cfs @ 12.54 hrs, Volume= 7,339 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 277.31' @ 12.54 hrs Surf.Area= 1,469 sf Storage= 2,324 cf
Flood Elev= 285.00' Surf.Area= 2,737 sf Storage= 7,952 cf

Plug-Flow detention time= 62.4 min calculated for 7,338 cf (100% of inflow)
Center-of-Mass det. time= 62.4 min (823.5 - 761.1)

Volume	Invert	Avail.Storage	Storage Description
#1	275.00'	7,952 cf	**Basin Storage (Prismatic)** Listed below (Recalc)

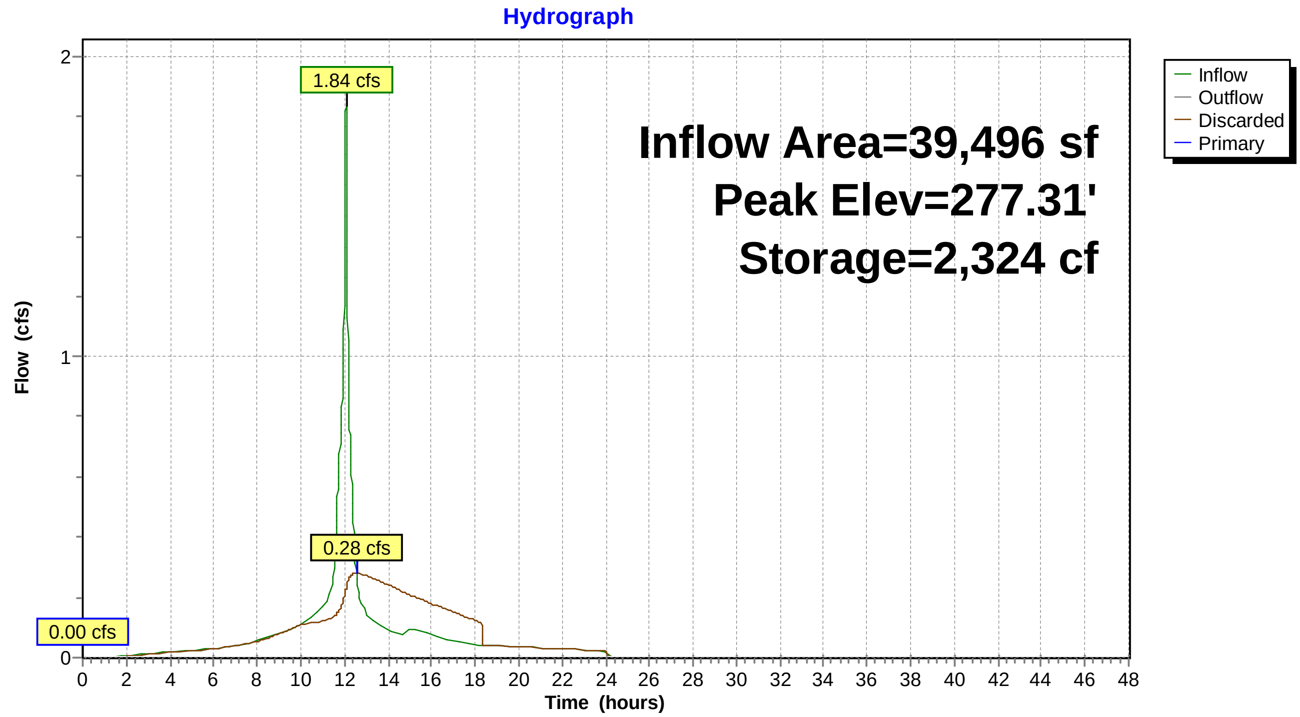
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
275.00	589	0	0
276.00	934	762	762
277.00	1,333	1,134	1,895
278.00	1,777	1,555	3,450
279.00	2,245	2,011	5,461
280.00	2,737	2,491	7,952

Device	Routing	Invert	Outlet Devices
#1	Discarded	275.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	279.50'	**88.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.28 cfs @ 12.54 hrs HW=277.31' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.28 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=275.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B-1: Basin #1



Summary for Pond CB#1: PR-CB #1

Inflow Area = 13,897 sf,100.00% Impervious, Inflow Depth = 3.13" for 2-yr event
Inflow = 1.08 cfs @ 12.07 hrs, Volume= 3,621 cf
Outflow = 1.08 cfs @ 12.07 hrs, Volume= 3,621 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.08 cfs @ 12.07 hrs, Volume= 3,621 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

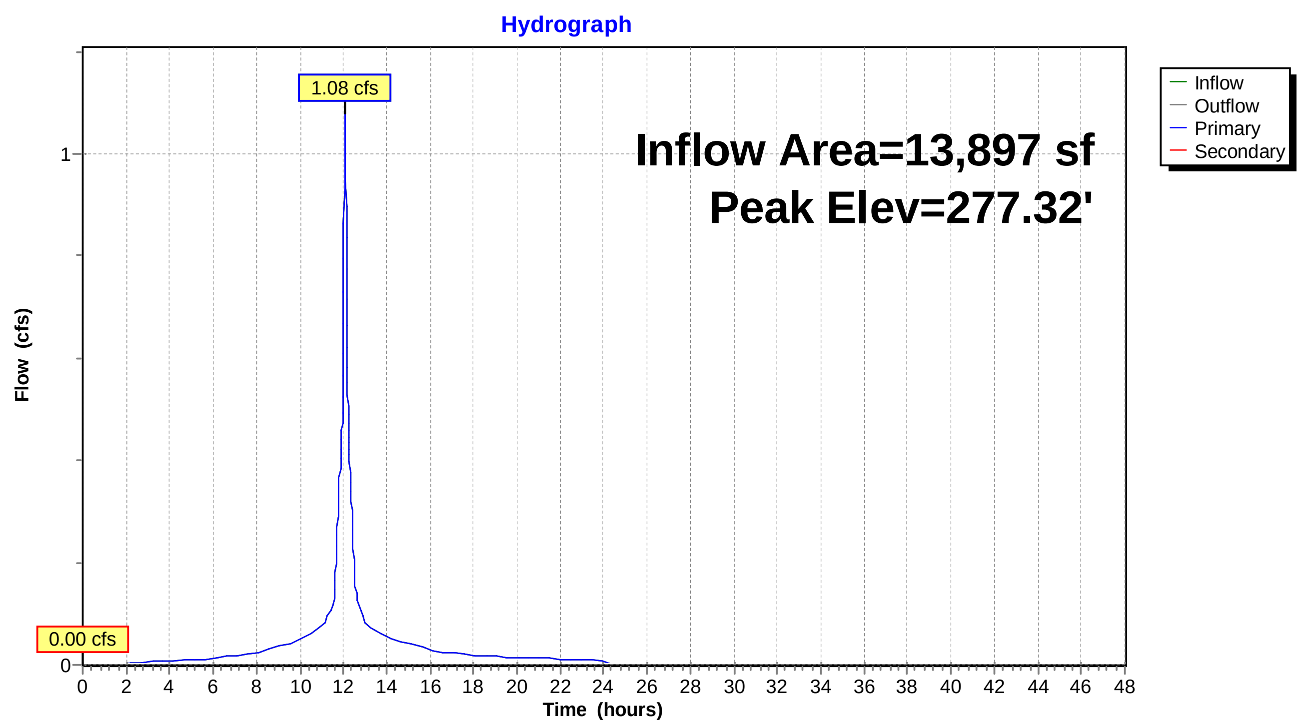
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 277.32' @ 12.50 hrs
Flood Elev= 278.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.90'	**12.0" Round RCP_Round 12"** L= 15.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 275.90' / 275.83' S= 0.0047 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Secondary	278.90'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.08 cfs @ 12.07 hrs HW=277.06' TW=276.97' (Dynamic Tailwater)
└─**1=RCP_Round 12"** (Outlet Controls 1.08 cfs @ 1.49 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=275.90' (Free Discharge)
└─**2=CB Grate** (Controls 0.00 cfs)

Pond CB#1: PR-CB #1



Summary for Pond CB#2: PR-CB#2

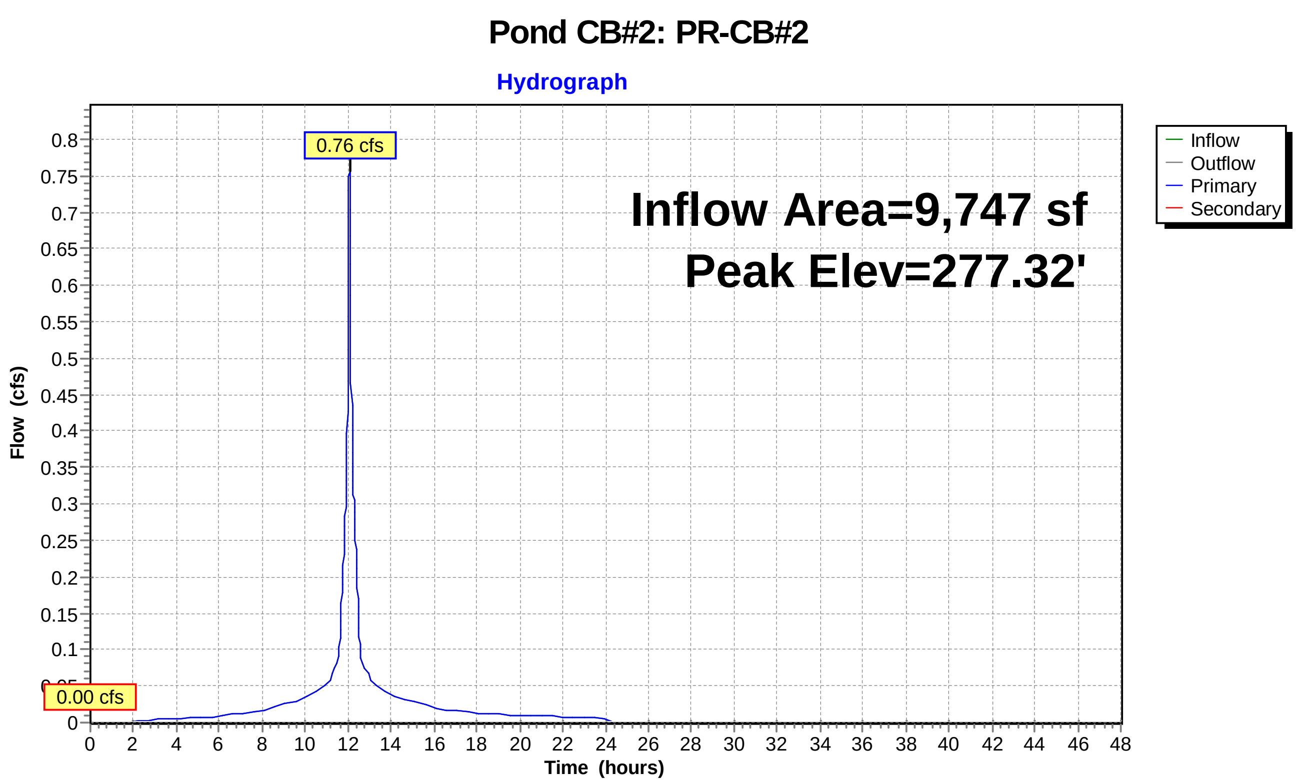
Inflow Area = 9,747 sf,100.00% Impervious, Inflow Depth = 3.13" for 2-yr event
Inflow = 0.76 cfs @ 12.07 hrs, Volume= 2,540 cf
Outflow = 0.76 cfs @ 12.07 hrs, Volume= 2,540 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.76 cfs @ 12.07 hrs, Volume= 2,540 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 277.32' @ 12.50 hrs
Flood Elev= 278.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.90'	**12.0" Round RCP_Round 12"** L= 25.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 275.90' / 275.75' S= 0.0060 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Secondary	278.90'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600

Primary OutFlow Max=0.76 cfs @ 12.07 hrs HW=277.05' TW=276.97' (Dynamic Tailwater)
└─1=RCP_Round 12" (Outlet Controls 0.76 cfs @ 1.05 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=275.90' (Free Discharge)
└─2=CB Grate (Controls 0.00 cfs)



Summary for Pond DMH: DMH #1

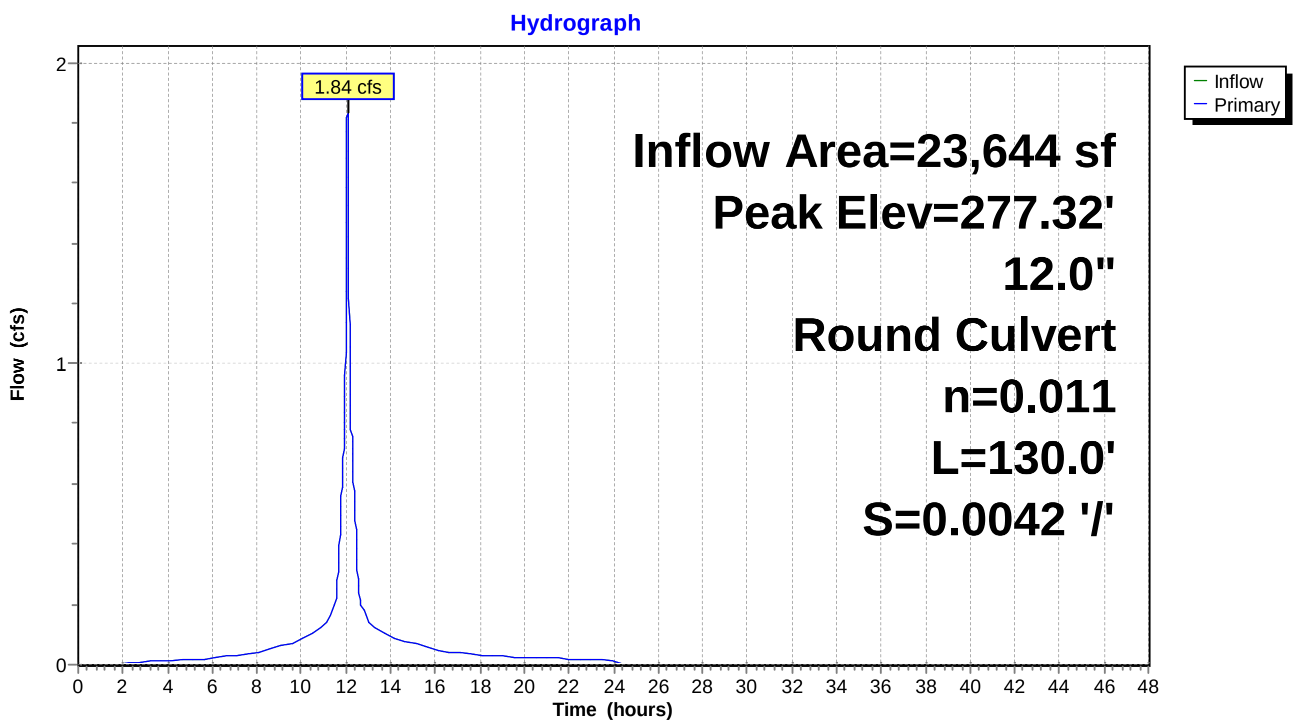
Inflow Area = 23,644 sf,100.00% Impervious, Inflow Depth = 3.13" for 2-yr event
Inflow = 1.84 cfs @ 12.07 hrs, Volume= 6,161 cf
Outflow = 1.84 cfs @ 12.07 hrs, Volume= 6,161 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.84 cfs @ 12.07 hrs, Volume= 6,161 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 277.32' @ 12.51 hrs
Flood Elev= 279.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.75'	**12.0" Round RCP_Round 12"** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 275.75' / 275.20' S= 0.0042 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=1.84 cfs @ 12.07 hrs HW=276.97' TW=276.65' (Dynamic Tailwater)
└─**1=RCP_Round 12"** (Outlet Controls 1.84 cfs @ 2.43 fps)

Pond DMH: DMH #1



Summary for Subcatchment CB-1A: CB-1A

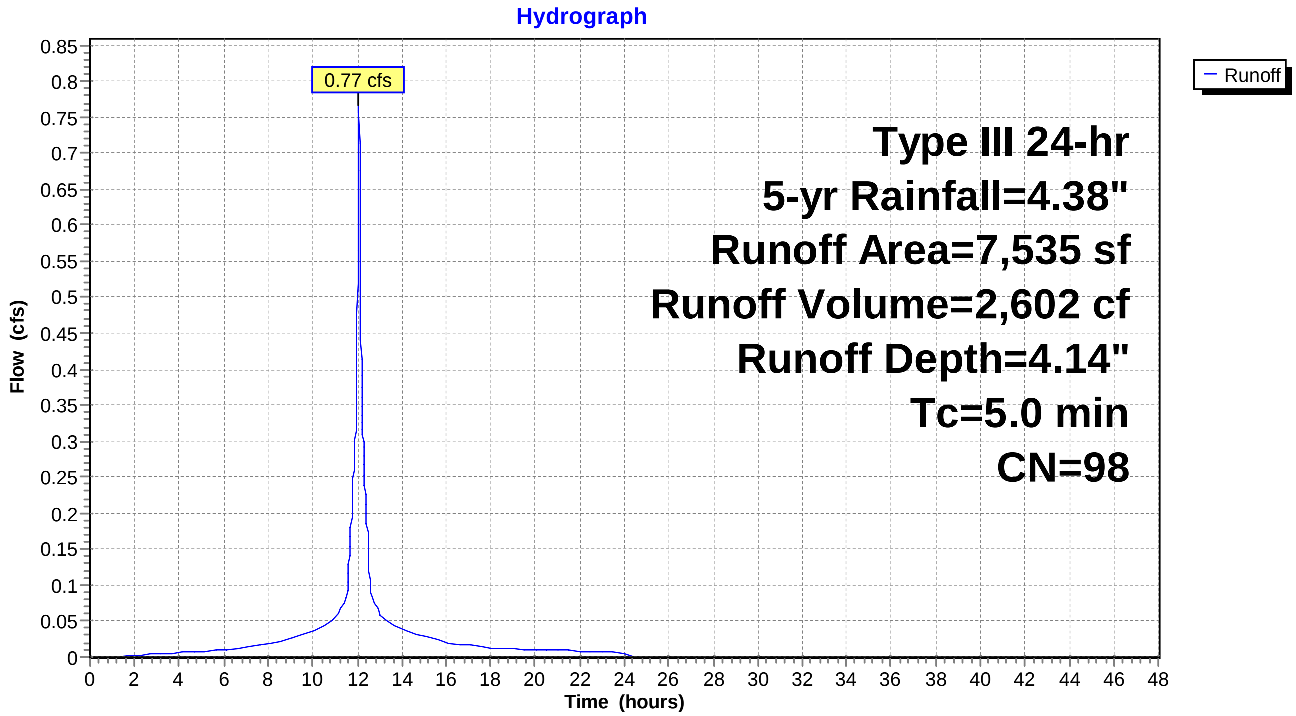
Runoff = 0.77 cfs @ 12.07 hrs, Volume= 2,602 cf, Depth= 4.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 5-yr Rainfall=4.38"

	Area (sf)	CN	Description
*	7,535	98	Paved roads w/curbs & sewers, HSG A
	7,535		100.00% Impervious Area

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

Subcatchment CB-1A: CB-1A



Summary for Subcatchment CB-1B: CB-1B

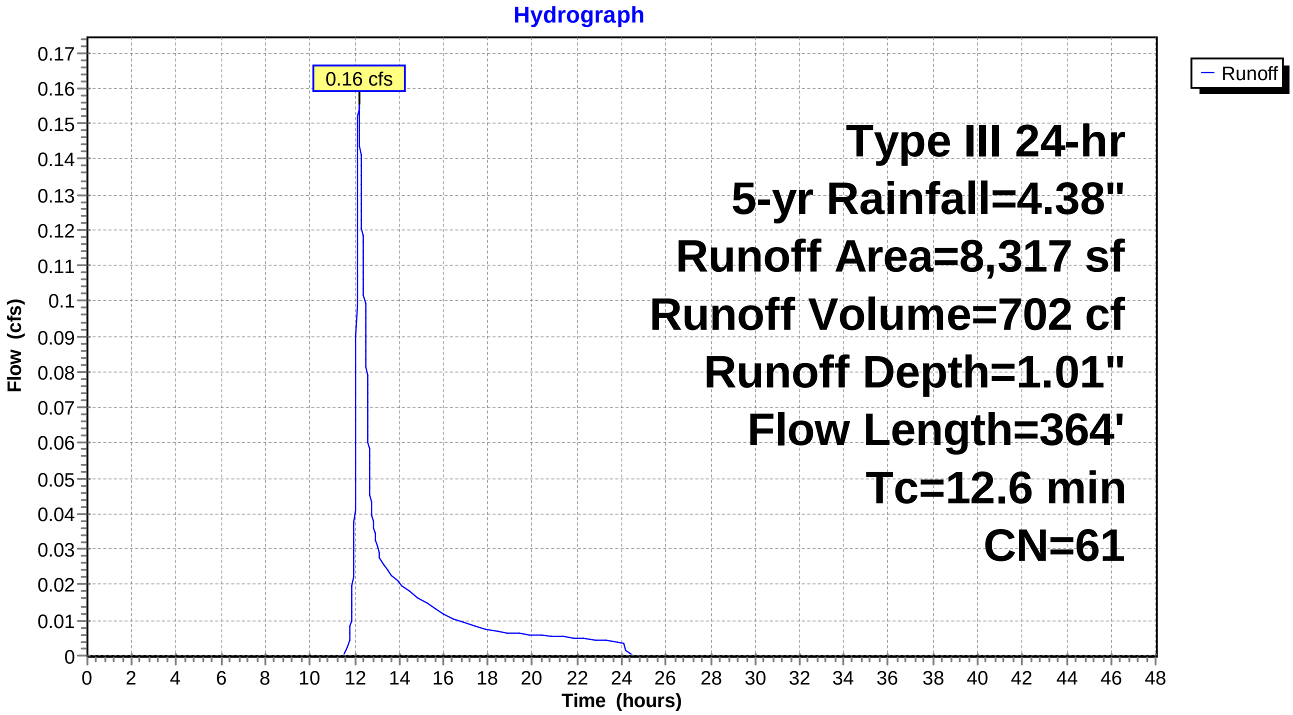
Runoff = 0.16 cfs @ 12.20 hrs, Volume= 702 cf, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 5-yr Rainfall=4.38"

Area (sf)	CN	Description
8,317	61	1/4 acre lots, 38% imp, HSG A
5,157		62.00% Pervious Area
3,160		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	34	0.0153	0.06		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.60"
2.9	330	0.0090	1.93		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
12.6	364	Total			

Subcatchment CB-1B: CB-1B



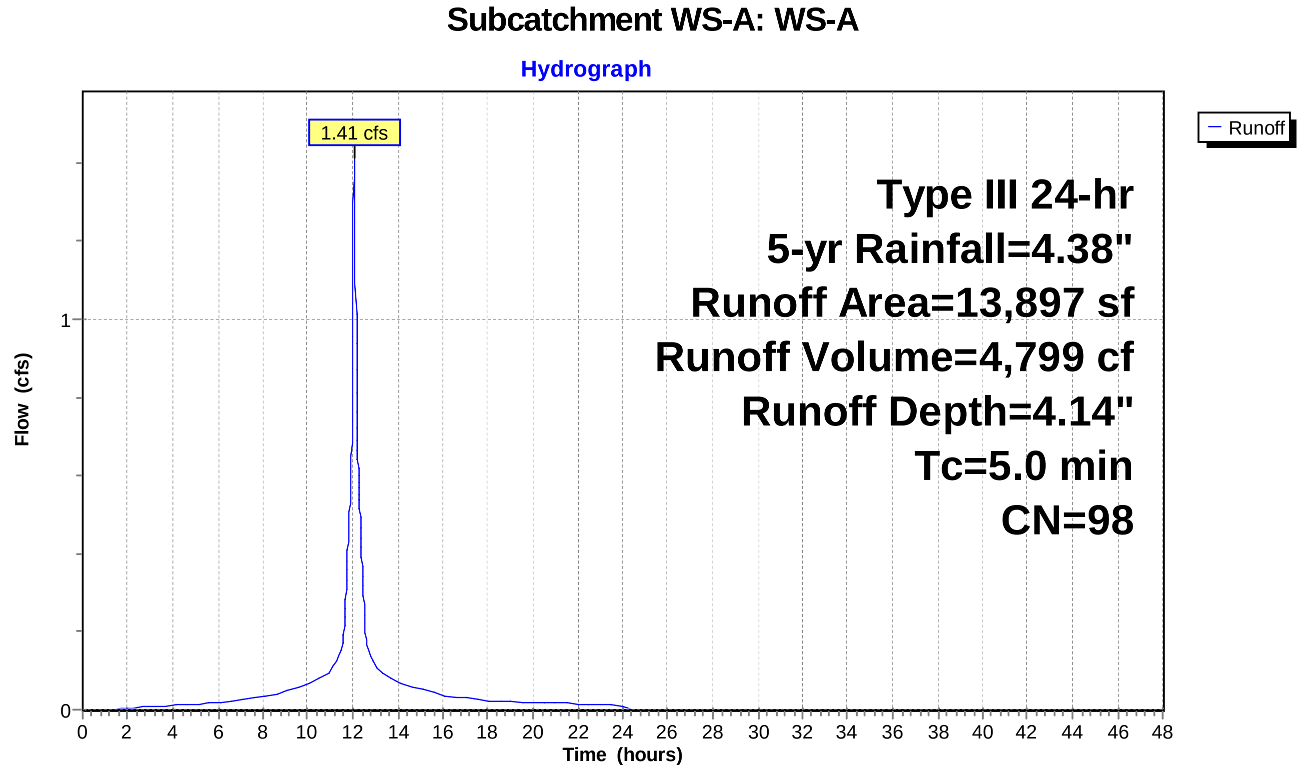
Summary for Subcatchment WS-A: WS-A

Runoff = 1.41 cfs @ 12.07 hrs, Volume= 4,799 cf, Depth= 4.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 5-yr Rainfall=4.38"

Area (sf)	CN	Description
13,897	98	Paved roads w/curbs & sewers, HSG A
13,897		100.00% Impervious Area

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



Summary for Subcatchment WS-B: WS-B

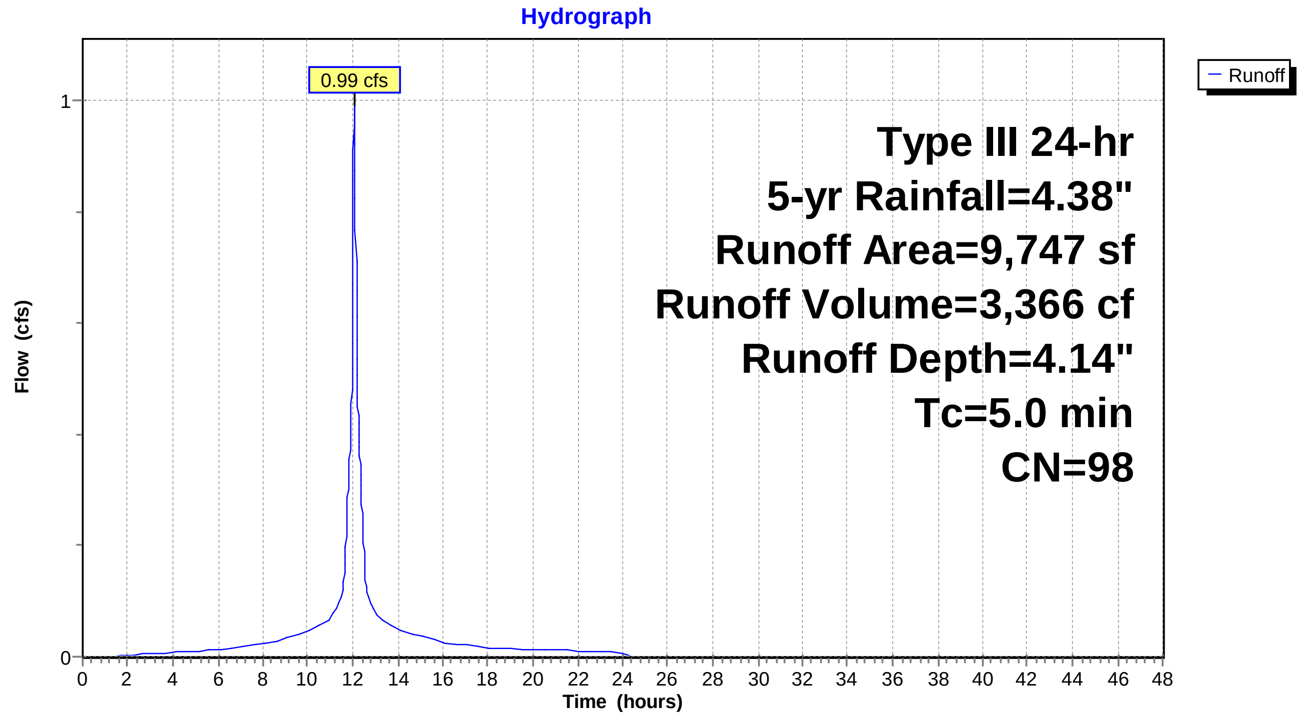
Runoff = 0.99 cfs @ 12.07 hrs, Volume= 3,366 cf, Depth= 4.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 5-yr Rainfall=4.38"

Area (sf)	CN	Description
9,747	98	Paved roads w/curbs & sewers, HSG A
9,747		100.00% Impervious Area

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

Subcatchment WS-B: WS-B



Summary for Pond 2P: PR-CB-1

Inflow Area =	15,852 sf,	67.47% Impervious,	Inflow Depth = 2.50"	for 5-yr event
Inflow =	0.85 cfs @	12.08 hrs, Volume=	3,304 cf	
Outflow =	0.85 cfs @	12.08 hrs, Volume=	3,304 cf,	Atten= 0%, Lag= 0.0 min
Primary =	0.14 cfs @	11.72 hrs, Volume=	1,313 cf	
Secondary =	0.85 cfs @	12.08 hrs, Volume=	1,993 cf	
Tertiary =	0.00 cfs @	0.00 hrs, Volume=	0 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 276.67' @ 12.08 hrs
Flood Elev= 280.40'

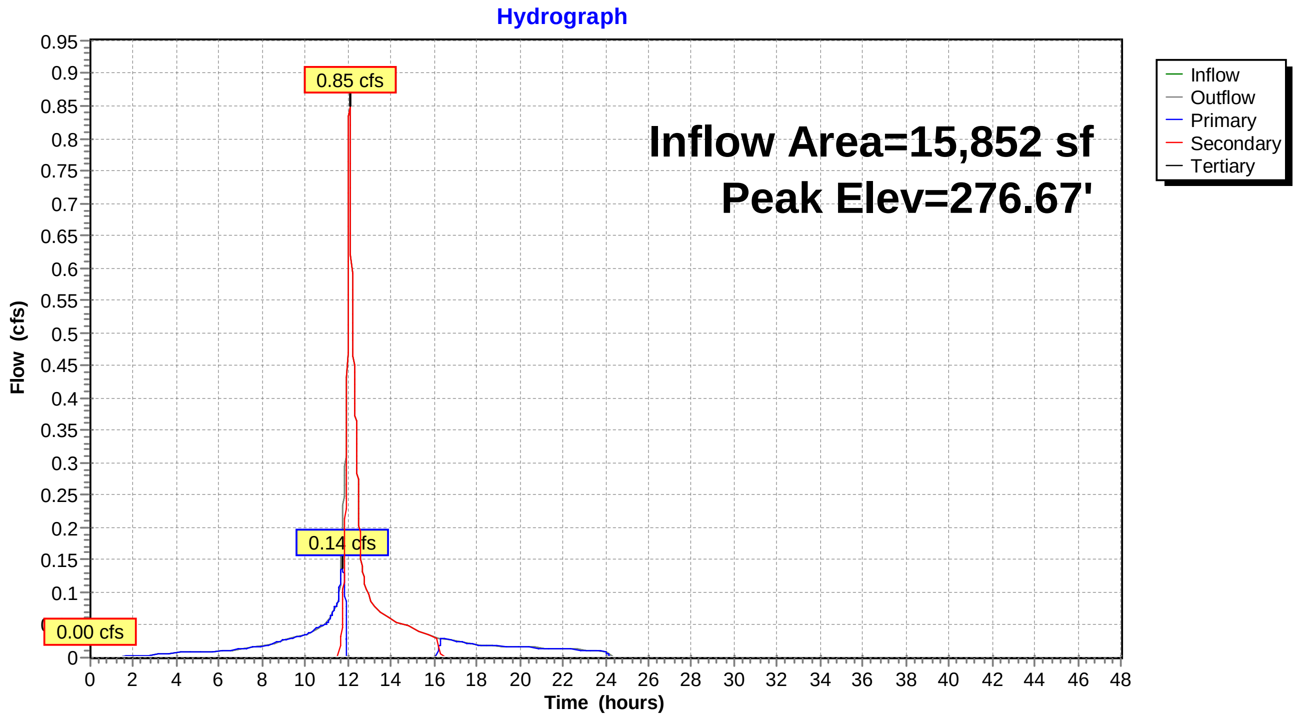
Device	Routing	Invert	Outlet Devices
#1	Primary	276.20'	**12.0" Round Culvert** L= 155.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 276.20' / 275.00' S= 0.0077 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Tertiary	280.40'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	276.20'	**12.0" Round Culvert** L= 37.4' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 276.20' / 275.00' S= 0.0321 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Device 3	276.42'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.14 cfs @ 11.72 hrs HW=276.44' TW=275.97' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.14 cfs @ 1.41 fps)

Secondary OutFlow Max=0.85 cfs @ 12.08 hrs HW=276.67' (Free Discharge)
└─**3=Culvert** (Inlet Controls 0.85 cfs @ 2.34 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Passes 0.85 cfs of 1.62 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=276.20' (Free Discharge)
└─**2=CB Grate** (Controls 0.00 cfs)

Pond 2P: PR-CB-1



Summary for Pond B-1: Basin #1

Inflow Area =	39,496 sf,	86.94% Impervious,	Inflow Depth = 2.88"	for 5-yr event	
Inflow =	2.41 cfs @	12.07 hrs,	Volume=	9,478 cf	
Outflow =	0.33 cfs @	12.56 hrs,	Volume=	9,478 cf,	Atten= 86%, Lag= 29.5 min
Discarded =	0.33 cfs @	12.56 hrs,	Volume=	9,478 cf	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 277.86' @ 12.56 hrs Surf.Area= 1,717 sf Storage= 3,214 cf
Flood Elev= 285.00' Surf.Area= 2,737 sf Storage= 7,952 cf

Plug-Flow detention time= 79.2 min calculated for 9,476 cf (100% of inflow)
Center-of-Mass det. time= 79.2 min (833.8 - 754.6)

Volume	Invert	Avail.Storage	Storage Description
#1	275.00'	7,952 cf	**Basin Storage (Prismatic)** Listed below (Recalc)

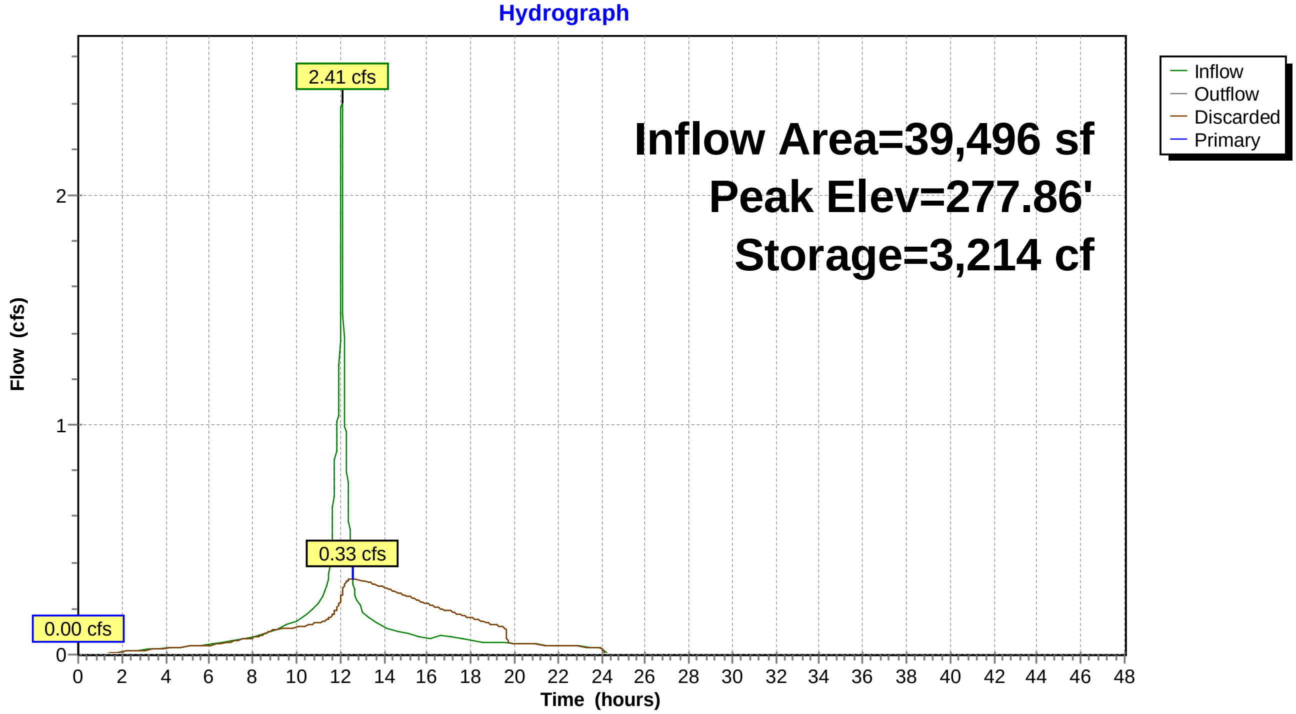
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
275.00	589	0	0
276.00	934	762	762
277.00	1,333	1,134	1,895
278.00	1,777	1,555	3,450
279.00	2,245	2,011	5,461
280.00	2,737	2,491	7,952

Device	Routing	Invert	Outlet Devices
#1	Discarded	275.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	279.50'	**88.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.33 cfs @ 12.56 hrs HW=277.86' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.33 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=275.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B-1: Basin #1



Summary for Pond CB#1: PR-CB #1

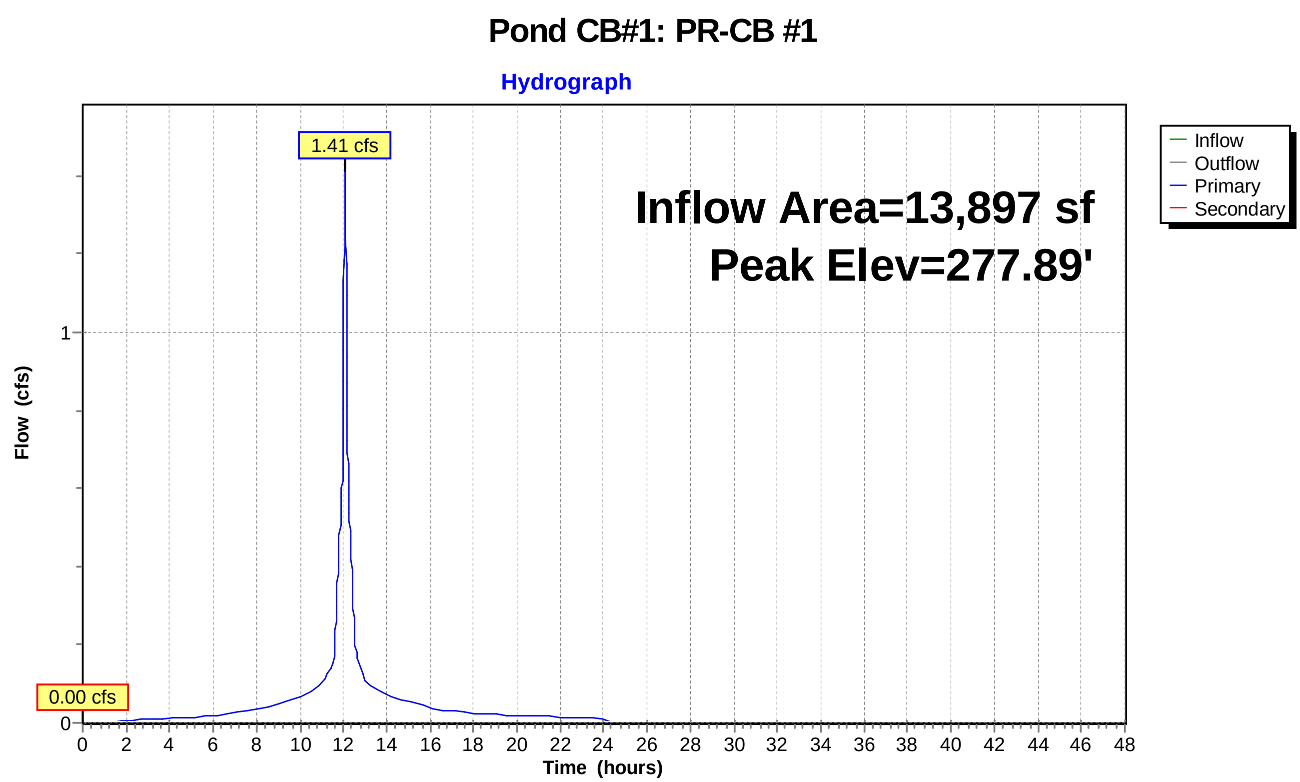
Inflow Area =	13,897 sf,100.00% Impervious,	Inflow Depth = 4.14" for 5-yr event		
Inflow =	1.41 cfs @	12.07 hrs, Volume=	4,799 cf	
Outflow =	1.41 cfs @	12.07 hrs, Volume=	4,799 cf,	Atten= 0%, Lag= 0.0 min
Primary =	1.41 cfs @	12.07 hrs, Volume=	4,799 cf	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 277.89' @ 12.09 hrs
Flood Elev= 278.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.90'	**12.0" Round RCP_Round 12"** L= 15.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 275.90' / 275.83' S= 0.0047 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Secondary	278.90'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.41 cfs @ 12.07 hrs HW=277.83' TW=277.68' (Dynamic Tailwater)
↑**1=RCP_Round 12"** (Outlet Controls 1.41 cfs @ 1.80 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=275.90' (Free Discharge)
↑**2=CB Grate** (Controls 0.00 cfs)



Summary for Pond CB#2: PR-CB#2

Inflow Area = 9,747 sf,100.00% Impervious, Inflow Depth = 4.14" for 5-yr event
Inflow = 0.99 cfs @ 12.07 hrs, Volume= 3,366 cf
Outflow = 0.99 cfs @ 12.07 hrs, Volume= 3,366 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.99 cfs @ 12.07 hrs, Volume= 3,366 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

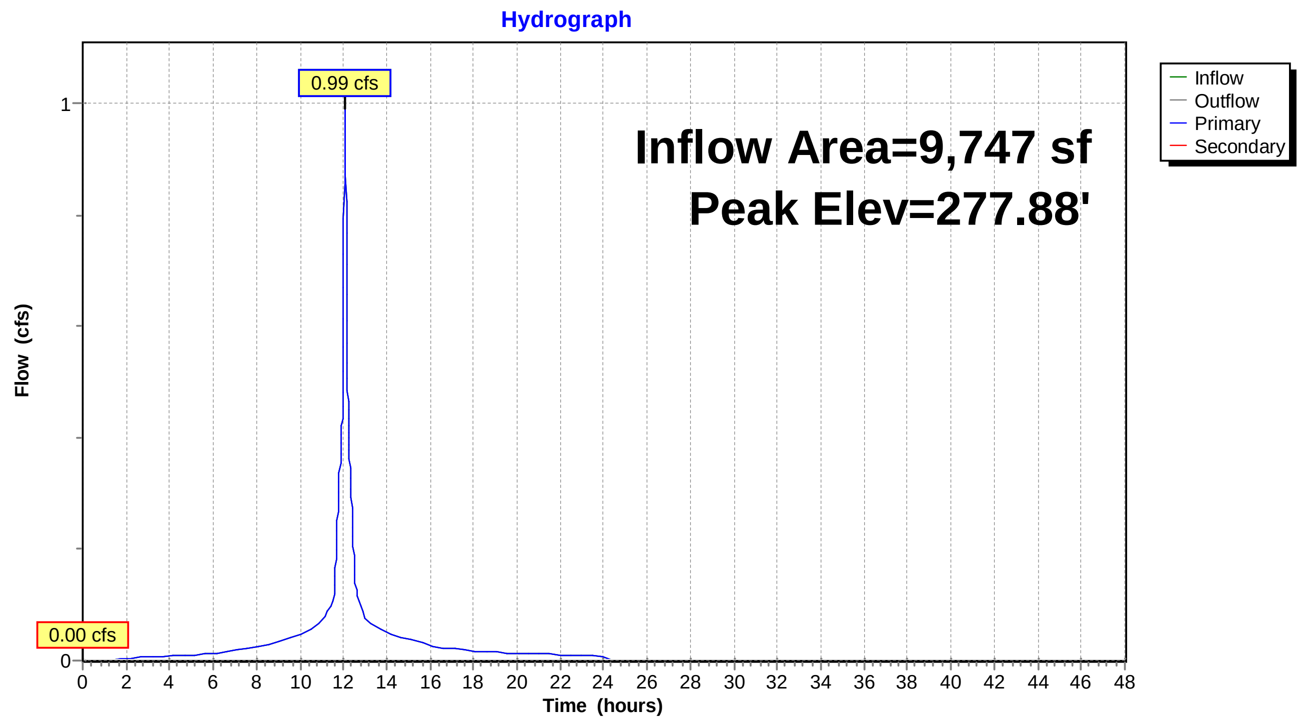
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 277.88' @ 12.50 hrs
Flood Elev= 278.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.90'	**12.0" Round RCP_Round 12"** L= 25.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 275.90' / 275.75' S= 0.0060 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Secondary	278.90'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600

Primary OutFlow Max=0.99 cfs @ 12.07 hrs HW=277.80' TW=277.68' (Dynamic Tailwater)
1=RCP_Round 12" (Outlet Controls 0.99 cfs @ 1.26 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=275.90' (Free Discharge)
2=CB Grate (Controls 0.00 cfs)

Pond CB#2: PR-CB#2



Summary for Pond DMH: DMH #1

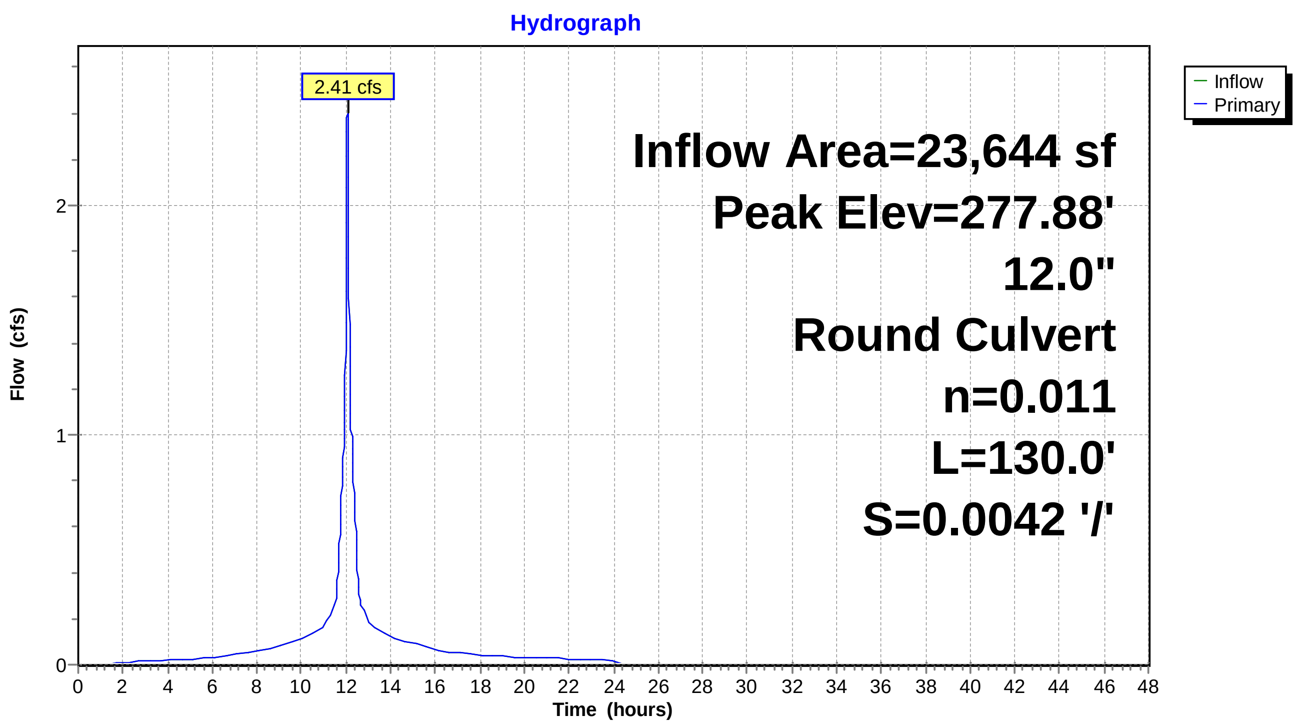
Inflow Area = 23,644 sf,100.00% Impervious, Inflow Depth = 4.14" for 5-yr event
Inflow = 2.41 cfs @ 12.07 hrs, Volume= 8,166 cf
Outflow = 2.41 cfs @ 12.07 hrs, Volume= 8,166 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.41 cfs @ 12.07 hrs, Volume= 8,166 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 277.88' @ 12.52 hrs
Flood Elev= 279.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.75'	**12.0" Round RCP_Round 12"** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 275.75' / 275.20' S= 0.0042 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=2.41 cfs @ 12.07 hrs HW=277.68' TW=277.08' (Dynamic Tailwater)
1=RCP_Round 12" (Outlet Controls 2.41 cfs @ 3.06 fps)

Pond DMH: DMH #1



Summary for Subcatchment CB-1A: CB-1A

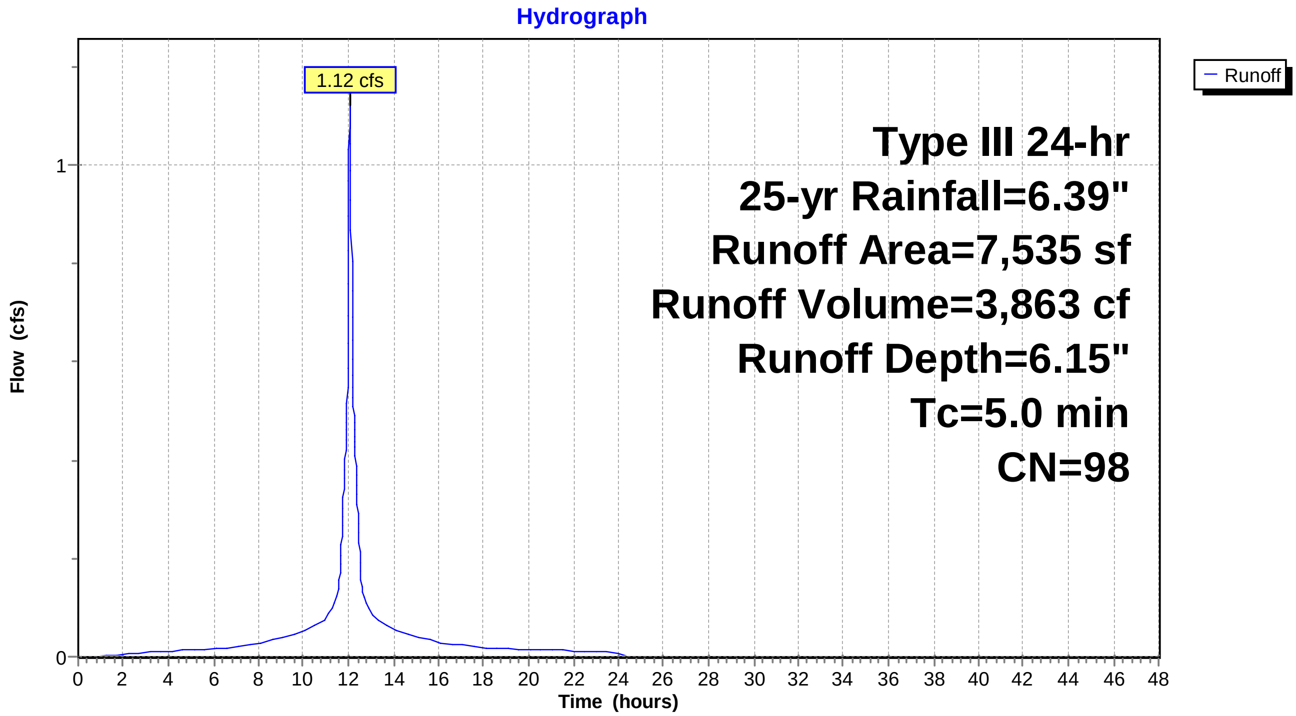
Runoff = 1.12 cfs @ 12.07 hrs, Volume= 3,863 cf, Depth= 6.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.39"

	Area (sf)	CN	Description
*	7,535	98	Paved roads w/curbs & sewers, HSG A
	7,535		100.00% Impervious Area

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

Subcatchment CB-1A: CB-1A



Summary for Subcatchment CB-1B: CB-1B

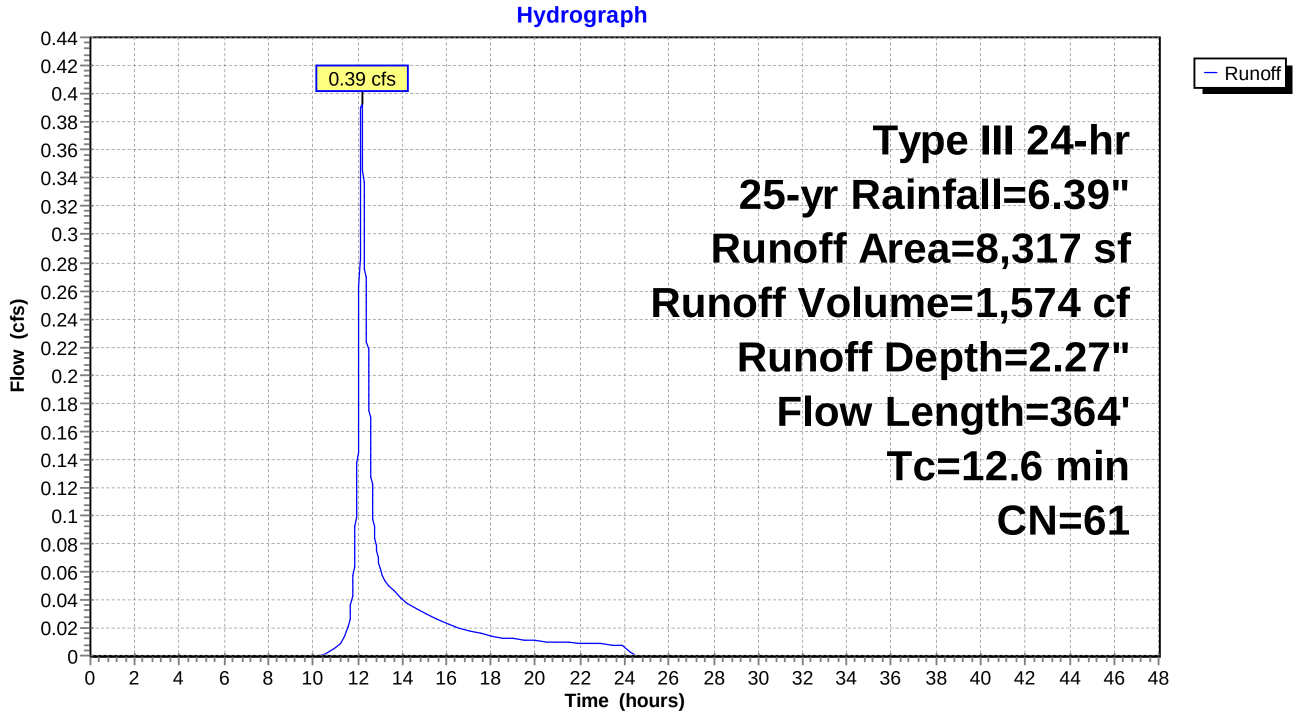
Runoff = 0.39 cfs @ 12.19 hrs, Volume= 1,574 cf, Depth= 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.39"

Area (sf)	CN	Description
8,317	61	1/4 acre lots, 38% imp, HSG A
5,157		62.00% Pervious Area
3,160		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	34	0.0153	0.06		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.60"
2.9	330	0.0090	1.93		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
12.6	364	Total			

Subcatchment CB-1B: CB-1B



Summary for Subcatchment WS-A: WS-A

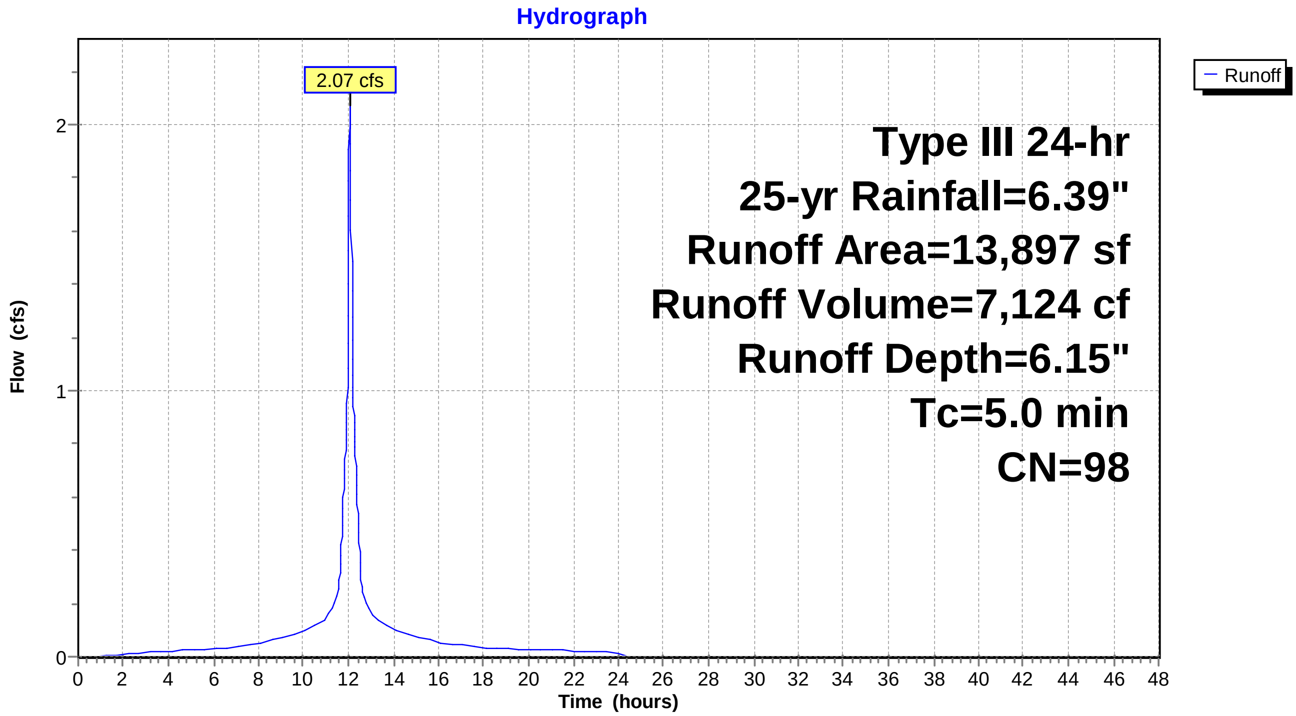
Runoff = 2.07 cfs @ 12.07 hrs, Volume= 7,124 cf, Depth= 6.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.39"

Area (sf)	CN	Description
13,897	98	Paved roads w/curbs & sewers, HSG A
13,897		100.00% Impervious Area

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

Subcatchment WS-A: WS-A



Summary for Subcatchment WS-B: WS-B

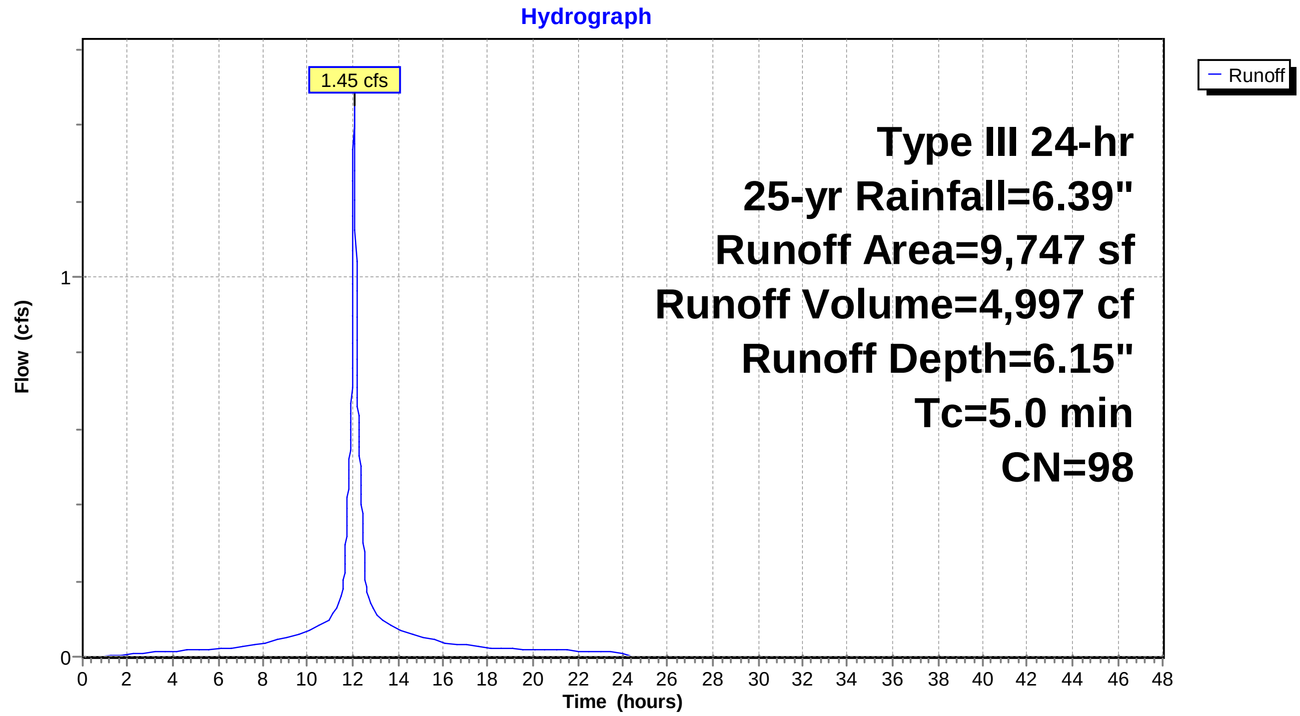
Runoff = 1.45 cfs @ 12.07 hrs, Volume= 4,997 cf, Depth= 6.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.39"

Area (sf)	CN	Description
9,747	98	Paved roads w/curbs & sewers, HSG A
9,747		100.00% Impervious Area

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

Subcatchment WS-B: WS-B



Summary for Pond 2P: PR-CB-1

Inflow Area = 15,852 sf, 67.47% Impervious, Inflow Depth = 4.12" for 25-yr event
Inflow = 1.38 cfs @ 12.08 hrs, Volume= 5,436 cf
Outflow = 1.38 cfs @ 12.08 hrs, Volume= 5,436 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.10 cfs @ 11.21 hrs, Volume= 1,531 cf
Secondary = 1.38 cfs @ 12.08 hrs, Volume= 3,906 cf
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 276.82' @ 12.08 hrs
Flood Elev= 280.40'

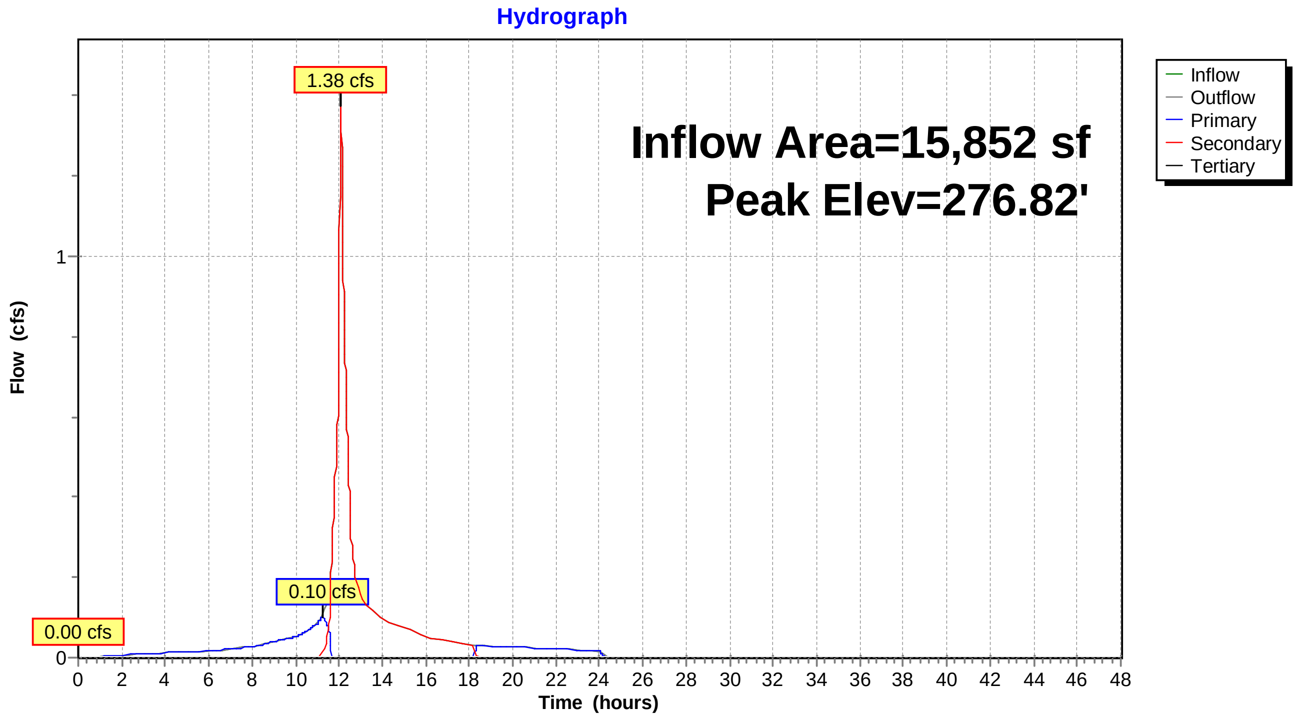
Device	Routing	Invert	Outlet Devices
#1	Primary	276.20'	**12.0" Round Culvert** L= 155.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 276.20' / 275.00' S= 0.0077 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Tertiary	280.40'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	276.20'	**12.0" Round Culvert** L= 37.4' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 276.20' / 275.00' S= 0.0321 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Device 3	276.42'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.10 cfs @ 11.21 hrs HW=276.42' TW=276.07' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.10 cfs @ 1.15 fps)

Secondary OutFlow Max=1.38 cfs @ 12.08 hrs HW=276.82' (Free Discharge)
└─**3=Culvert** (Inlet Controls 1.38 cfs @ 2.68 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Passes 1.38 cfs of 3.26 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=276.20' (Free Discharge)
└─**2=CB Grate** (Controls 0.00 cfs)

Pond 2P: PR-CB-1



Summary for Pond B-1: Basin #1

Inflow Area = 39,496 sf, 86.94% Impervious, Inflow Depth = 4.08" for 25-yr event
Inflow = 3.54 cfs @ 12.07 hrs, Volume= 13,437 cf
Outflow = 0.41 cfs @ 12.63 hrs, Volume= 13,437 cf, Atten= 89%, Lag= 33.7 min
Discarded = 0.41 cfs @ 12.63 hrs, Volume= 13,437 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 278.73' @ 12.63 hrs Surf.Area= 2,119 sf Storage= 4,875 cf
Flood Elev= 285.00' Surf.Area= 2,737 sf Storage= 7,952 cf

Plug-Flow detention time= 107.5 min calculated for 13,434 cf (100% of inflow)
Center-of-Mass det. time= 107.4 min (852.5 - 745.1)

Volume	Invert	Avail.Storage	Storage Description
#1	275.00'	7,952 cf	**Basin Storage (Prismatic)** Listed below (Recalc)

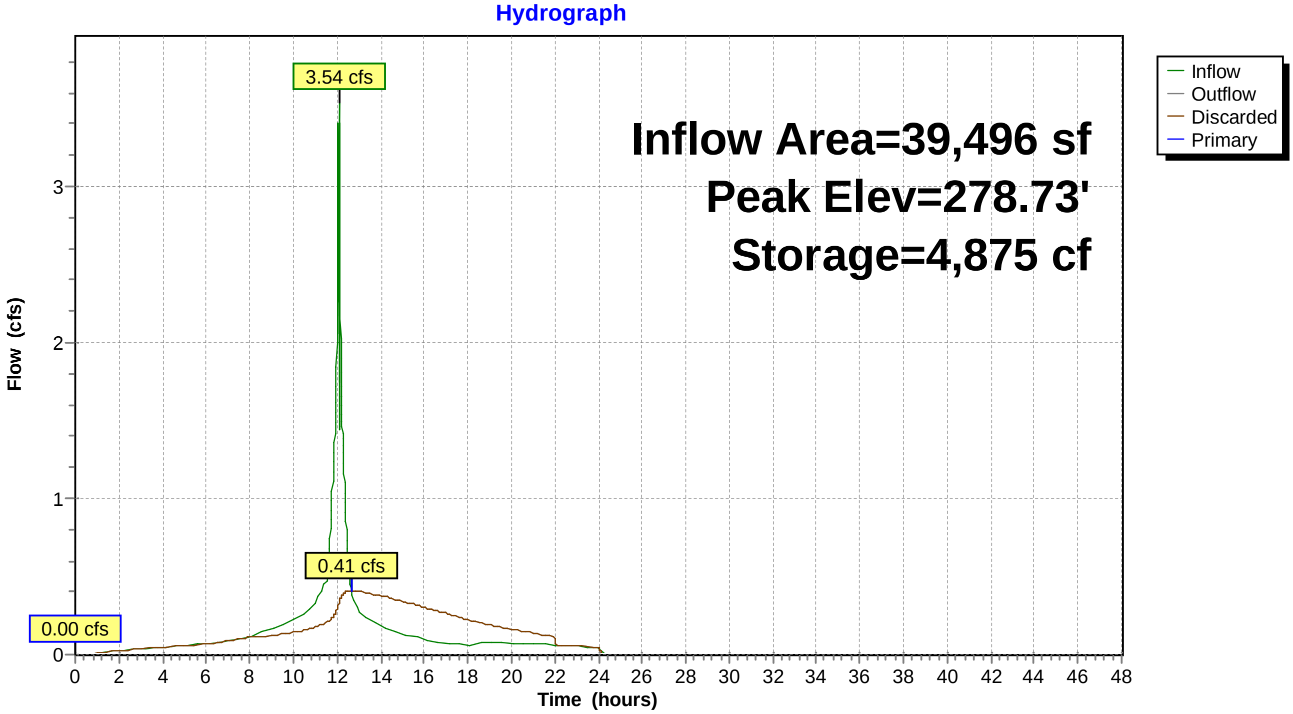
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
275.00	589	0	0
276.00	934	762	762
277.00	1,333	1,134	1,895
278.00	1,777	1,555	3,450
279.00	2,245	2,011	5,461
280.00	2,737	2,491	7,952

Device	Routing	Invert	Outlet Devices
#1	Discarded	275.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	279.50'	**88.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.41 cfs @ 12.63 hrs HW=278.73' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.41 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=275.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B-1: Basin #1



Summary for Pond CB#1: PR-CB #1

Inflow Area =	13,897 sf,100.00% Impervious,	Inflow Depth = 6.15"	for 25-yr event	
Inflow =	2.07 cfs @	12.07 hrs, Volume=	7,124 cf	
Outflow =	2.07 cfs @	12.07 hrs, Volume=	7,124 cf,	Atten= 0%, Lag= 0.0 min
Primary =	2.08 cfs @	12.07 hrs, Volume=	6,912 cf	
Secondary =	2.05 cfs @	12.08 hrs, Volume=	391 cf	

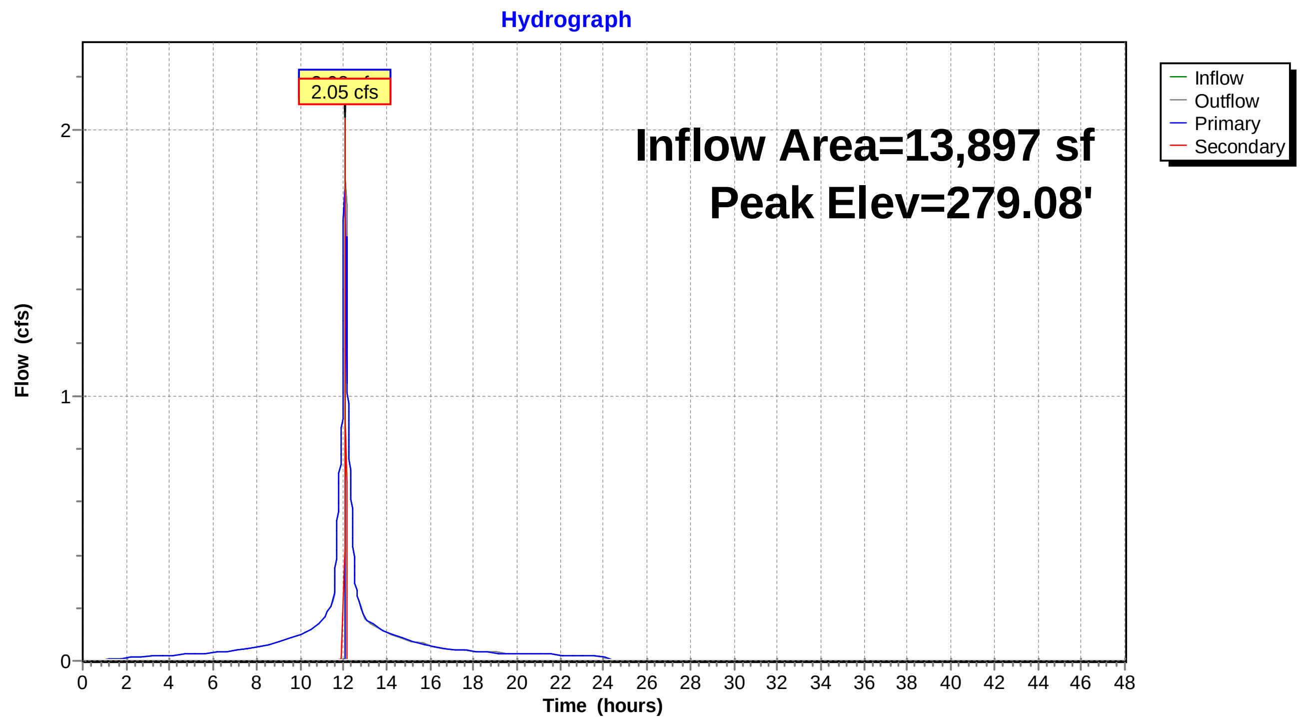
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 279.08' @ 12.08 hrs
Flood Elev= 278.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.90'	**12.0" Round RCP_Round 12"** L= 15.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 275.90' / 275.83' S= 0.0047 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Secondary	278.90'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=278.54' TW=279.01' (Dynamic Tailwater)
1=RCP_Round 12" (Controls 0.00 cfs)

Secondary OutFlow Max=1.55 cfs @ 12.08 hrs HW=279.05' (Free Discharge)
2=CB Grate (Weir Controls 1.55 cfs @ 1.27 fps)

Pond CB#1: PR-CB #1



Summary for Pond CB#2: PR-CB#2

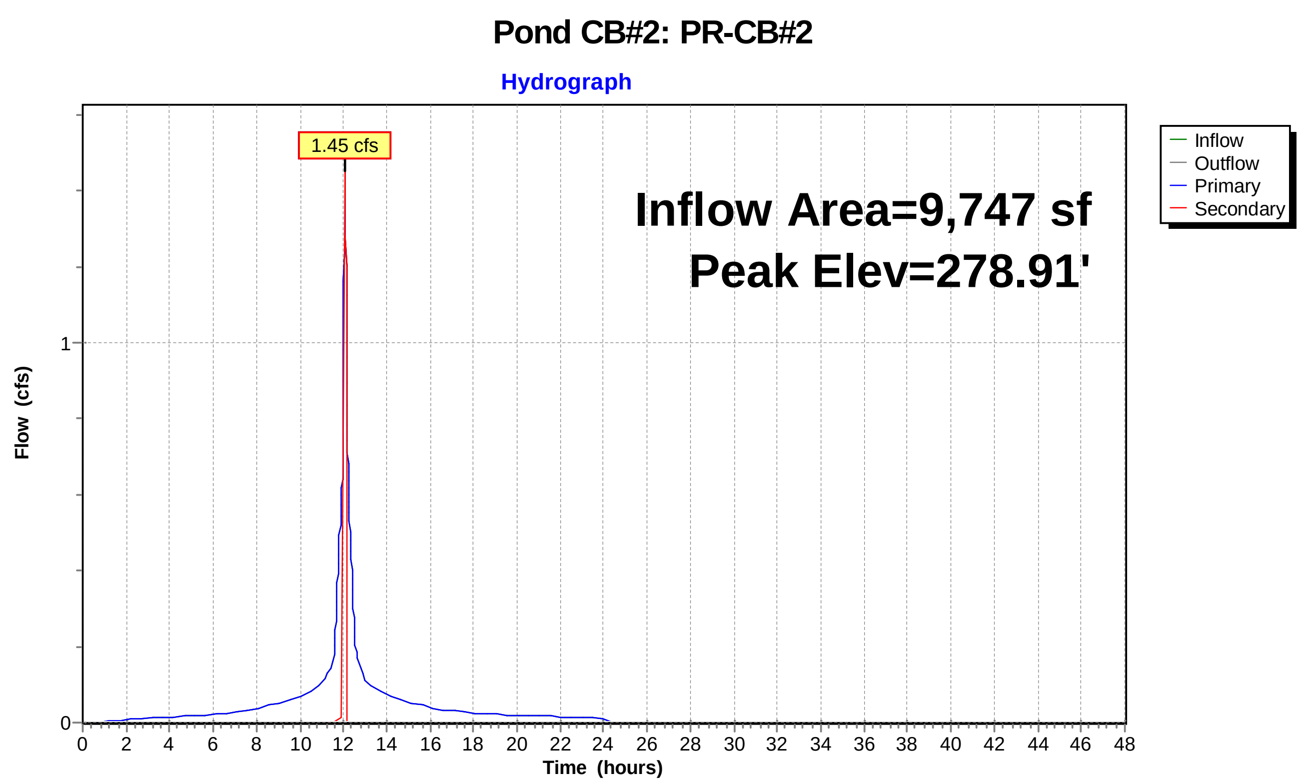
Inflow Area = 9,747 sf,100.00% Impervious, Inflow Depth = 6.15" for 25-yr event
Inflow = 1.45 cfs @ 12.07 hrs, Volume= 4,997 cf
Outflow = 1.45 cfs @ 12.07 hrs, Volume= 4,997 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.45 cfs @ 12.07 hrs, Volume= 4,995 cf
Secondary = 1.45 cfs @ 12.07 hrs, Volume= 370 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 278.91' @ 12.06 hrs
Flood Elev= 278.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.90'	**12.0" Round RCP_Round 12"** L= 25.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 275.90' / 275.75' S= 0.0060 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Secondary	278.90'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=278.43' TW=279.08' (Dynamic Tailwater)
└─**1=RCP_Round 12"** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 12.07 hrs HW=278.43' (Free Discharge)
└─**2=CB Grate** (Controls 0.00 cfs)



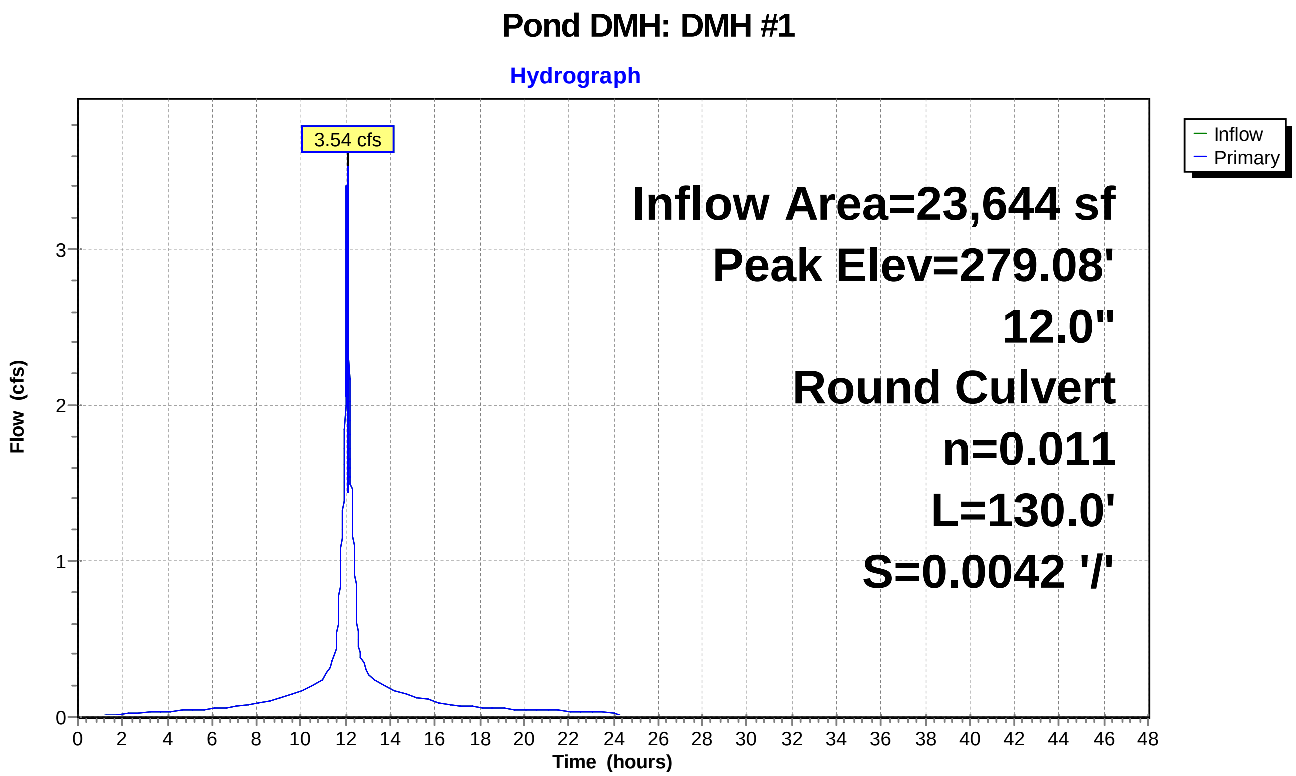
Summary for Pond DMH: DMH #1

Inflow Area = 23,644 sf,100.00% Impervious, Inflow Depth = 6.04" for 25-yr event
Inflow = 3.54 cfs @ 12.07 hrs, Volume= 11,907 cf
Outflow = 3.54 cfs @ 12.07 hrs, Volume= 11,907 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.54 cfs @ 12.07 hrs, Volume= 11,907 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 279.08' @ 12.09 hrs
Flood Elev= 279.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.75'	**12.0" Round RCP_Round 12"** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 275.75' / 275.20' S= 0.0042 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=3.40 cfs @ 12.07 hrs HW=279.01' TW=277.81' (Dynamic Tailwater)
└─**1=RCP_Round 12"** (Outlet Controls 3.40 cfs @ 4.33 fps)



Summary for Subcatchment CB-1A: CB-1A

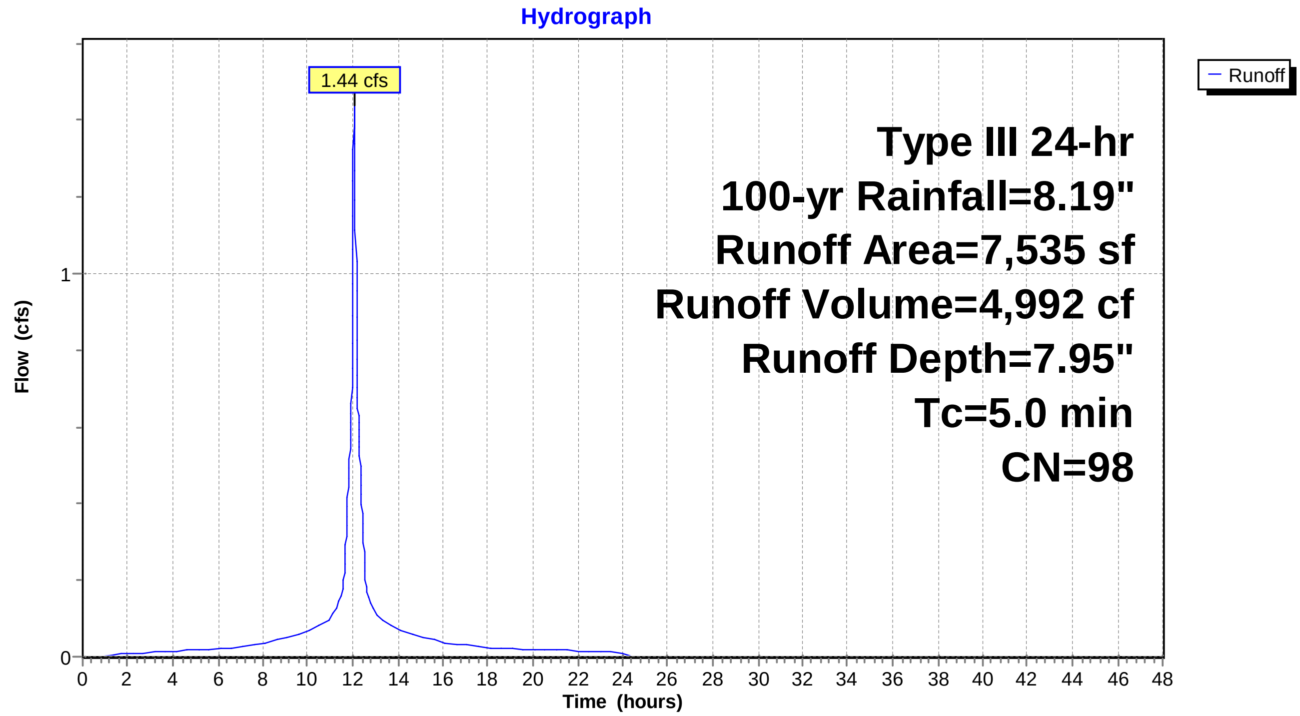
Runoff = 1.44 cfs @ 12.07 hrs, Volume= 4,992 cf, Depth= 7.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.19"

	Area (sf)	CN	Description
*	7,535	98	Paved roads w/curbs & sewers, HSG A
	7,535		100.00% Impervious Area

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

Subcatchment CB-1A: CB-1A



Summary for Subcatchment CB-1B: CB-1B

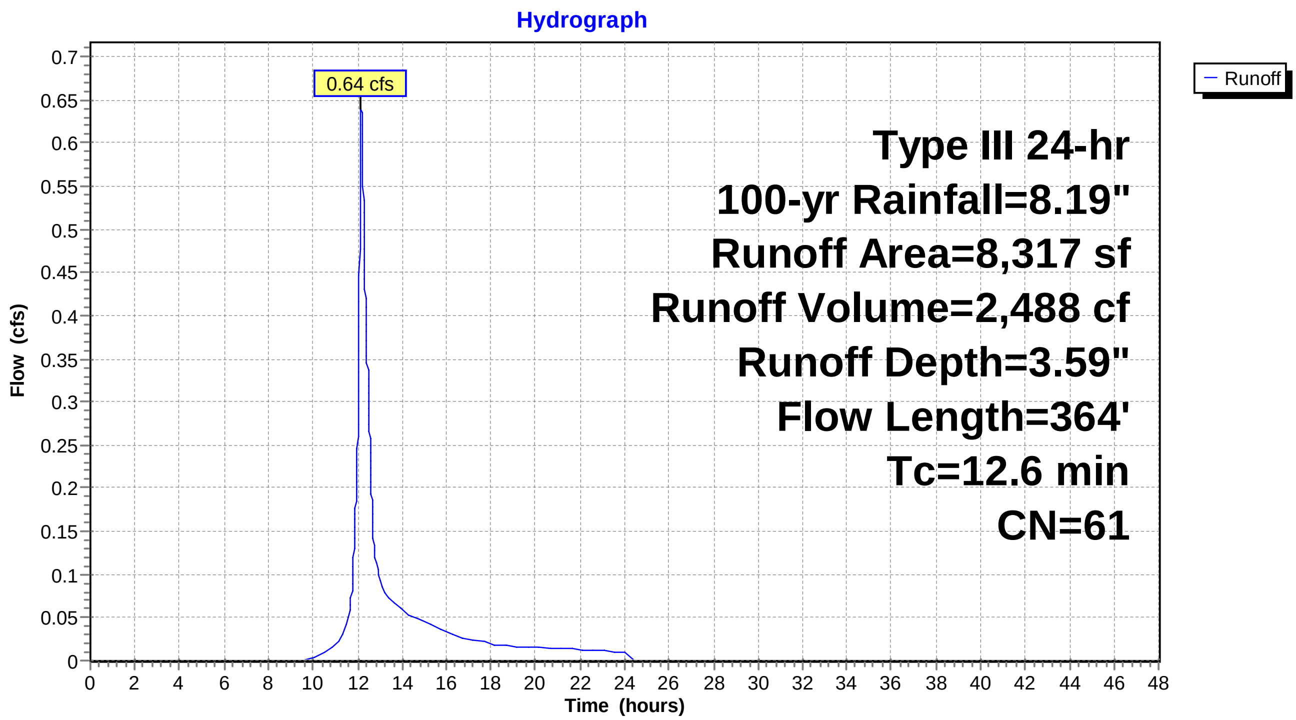
Runoff = 0.64 cfs @ 12.18 hrs, Volume= 2,488 cf, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
8,317	61	1/4 acre lots, 38% imp, HSG A
5,157		62.00% Pervious Area
3,160		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	34	0.0153	0.06		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.60"
2.9	330	0.0090	1.93		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
12.6	364	Total			

Subcatchment CB-1B: CB-1B



Summary for Subcatchment WS-A: WS-A

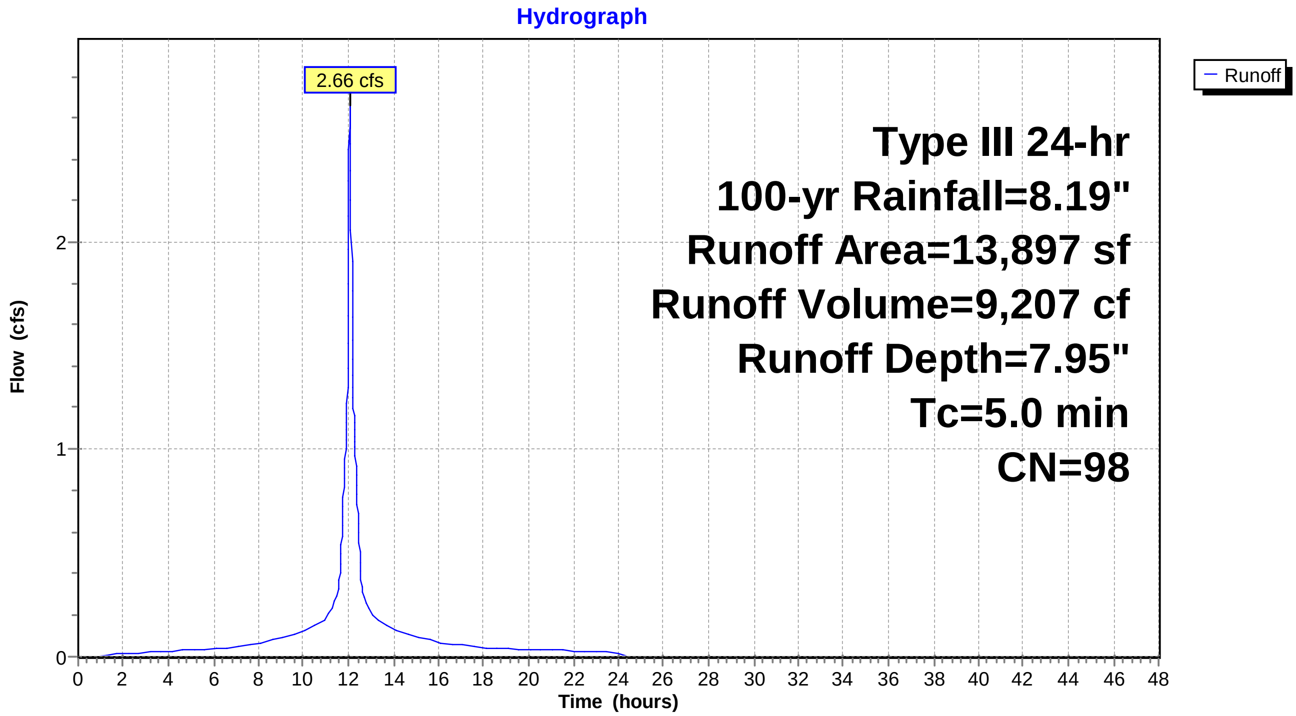
Runoff = 2.66 cfs @ 12.07 hrs, Volume= 9,207 cf, Depth= 7.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
13,897	98	Paved roads w/curbs & sewers, HSG A
13,897		100.00% Impervious Area

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

Subcatchment WS-A: WS-A



Summary for Subcatchment WS-B: WS-B

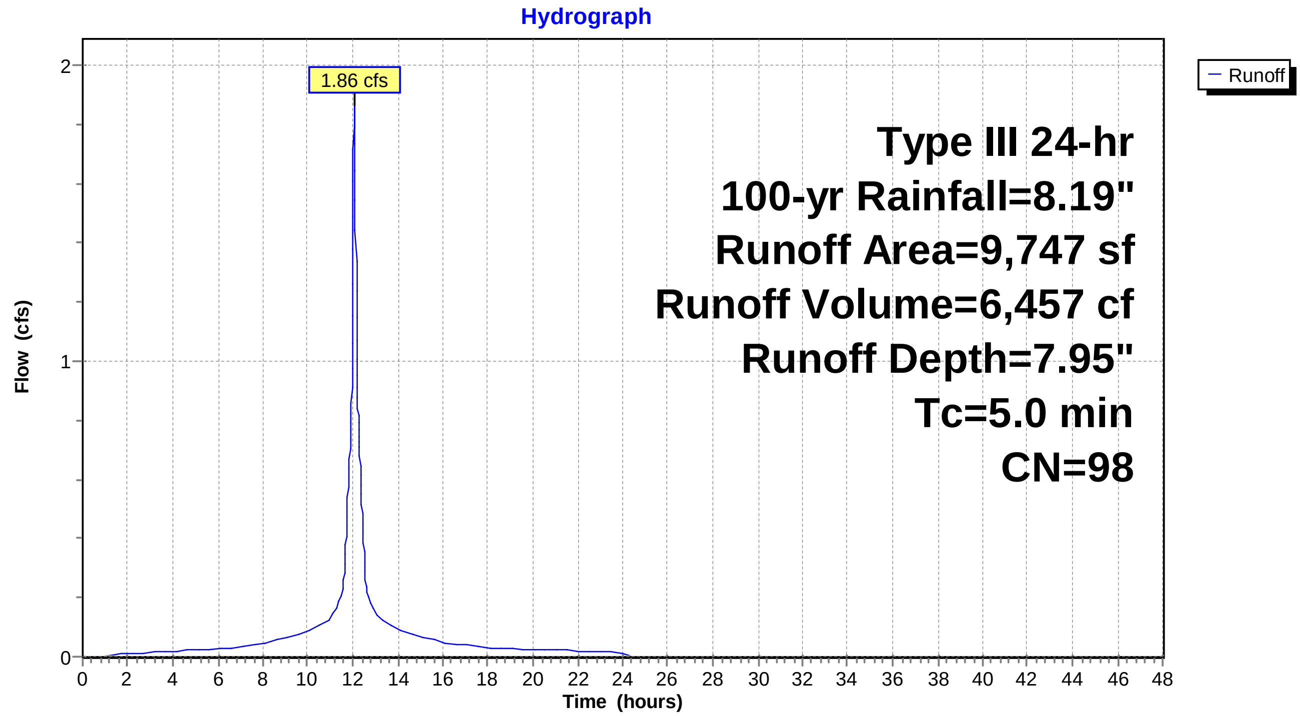
Runoff = 1.86 cfs @ 12.07 hrs, Volume= 6,457 cf, Depth= 7.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
9,747	98	Paved roads w/curbs & sewers, HSG A
9,747		100.00% Impervious Area

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

Subcatchment WS-B: WS-B



Summary for Pond 2P: PR-CB-1

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Inflow Area =      15,852 sf,  67.47% Impervious,  Inflow Depth =  5.66"   for  100-yr event
Inflow      =     1.88 cfs @  12.08 hrs,  Volume=          7,480 cf
Outflow     =     1.88 cfs @  12.08 hrs,  Volume=          7,480 cf,  Atten= 0%,  Lag= 0.0 min
Primary     =     0.09 cfs @  10.51 hrs,  Volume=          1,658 cf
Secondary   =     1.88 cfs @  12.08 hrs,  Volume=          5,822 cf
Tertiary    =     0.00 cfs @   0.00 hrs,  Volume=              0 cf
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 276.95' @ 12.08 hrs
Flood Elev= 280.40'

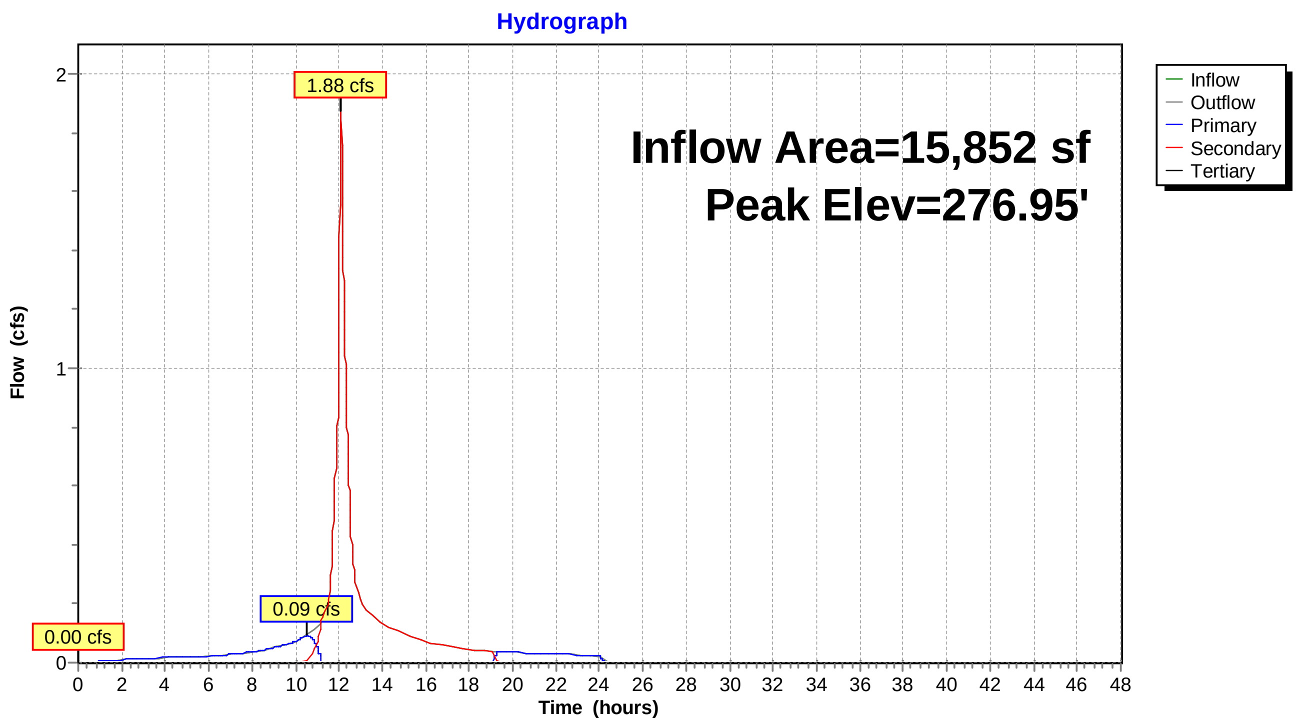
Device	Routing	Invert	Outlet Devices
#1	Primary	276.20'	**12.0" Round Culvert** L= 155.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 276.20' / 275.00' S= 0.0077 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Tertiary	280.40'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	276.20'	**12.0" Round Culvert** L= 37.4' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 276.20' / 275.00' S= 0.0321 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Device 3	276.42'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.09 cfs @ 10.51 hrs HW=276.42' TW=276.09' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.09 cfs @ 1.10 fps)

Secondary OutFlow Max=1.87 cfs @ 12.08 hrs HW=276.95' (Free Discharge)
└─**3=Culvert** (Inlet Controls 1.87 cfs @ 2.95 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Passes 1.87 cfs of 4.95 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=276.20' (Free Discharge)
└─**2=CB Grate** (Controls 0.00 cfs)

Pond 2P: PR-CB-1



Summary for Pond B-1: Basin #1

Inflow Area = 39,496 sf, 86.94% Impervious, Inflow Depth = 4.76" for 100-yr event
Inflow = 4.52 cfs @ 12.07 hrs, Volume= 15,673 cf
Outflow = 0.42 cfs @ 12.30 hrs, Volume= 15,673 cf, Atten= 91%, Lag= 13.9 min
Discarded = 0.42 cfs @ 12.30 hrs, Volume= 15,673 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 278.94' @ 12.30 hrs Surf.Area= 2,218 sf Storage= 5,331 cf
Flood Elev= 285.00' Surf.Area= 2,737 sf Storage= 7,952 cf

Plug-Flow detention time= 116.8 min calculated for 15,669 cf (100% of inflow)
Center-of-Mass det. time= 116.8 min (856.6 - 739.8)

Volume	Invert	Avail.Storage	Storage Description
#1	275.00'	7,952 cf	**Basin Storage (Prismatic)** Listed below (Recalc)

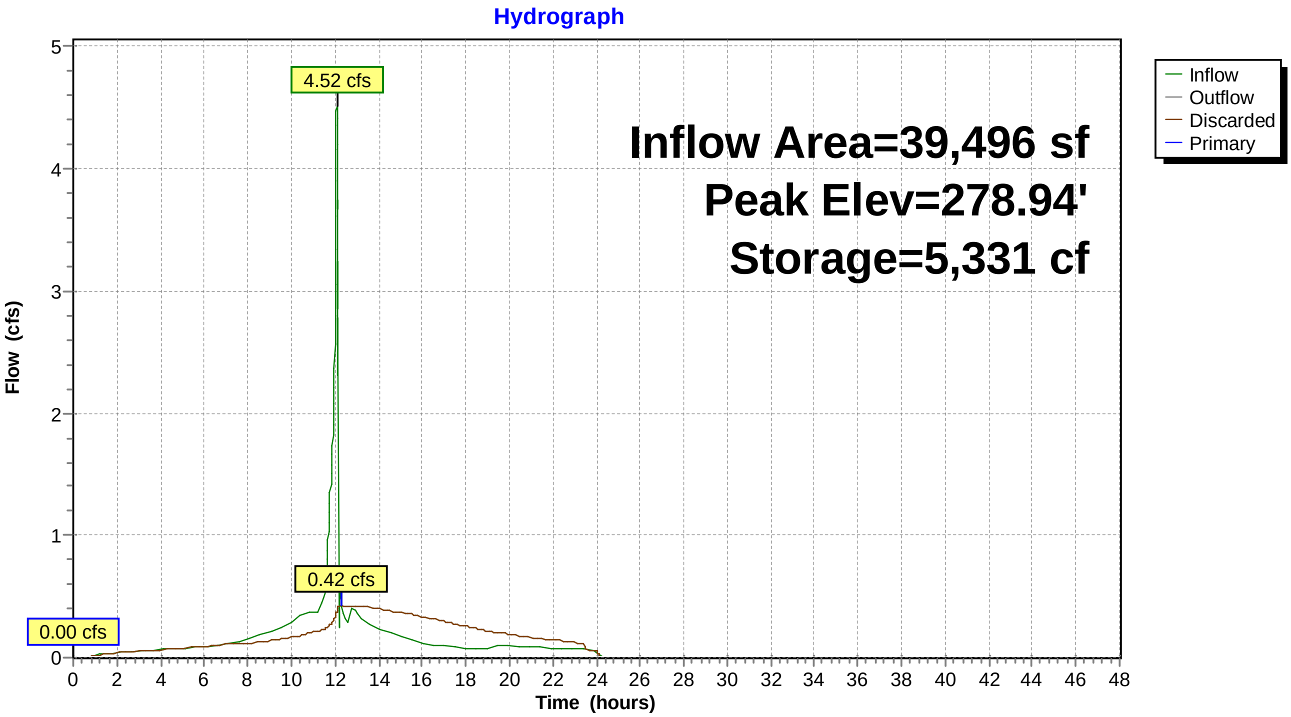
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
275.00	589	0	0
276.00	934	762	762
277.00	1,333	1,134	1,895
278.00	1,777	1,555	3,450
279.00	2,245	2,011	5,461
280.00	2,737	2,491	7,952

Device	Routing	Invert	Outlet Devices
#1	Discarded	275.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	279.50'	**88.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.42 cfs @ 12.30 hrs HW=278.94' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.42 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=275.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B-1: Basin #1



Summary for Pond CB#1: PR-CB #1

Inflow Area = 13,897 sf,100.00% Impervious, Inflow Depth = 7.95" for 100-yr event
Inflow = 2.66 cfs @ 12.07 hrs, Volume= 9,207 cf
Outflow = 2.66 cfs @ 12.07 hrs, Volume= 9,207 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.66 cfs @ 12.07 hrs, Volume= 8,497 cf
Secondary = 2.66 cfs @ 12.07 hrs, Volume= 1,993 cf

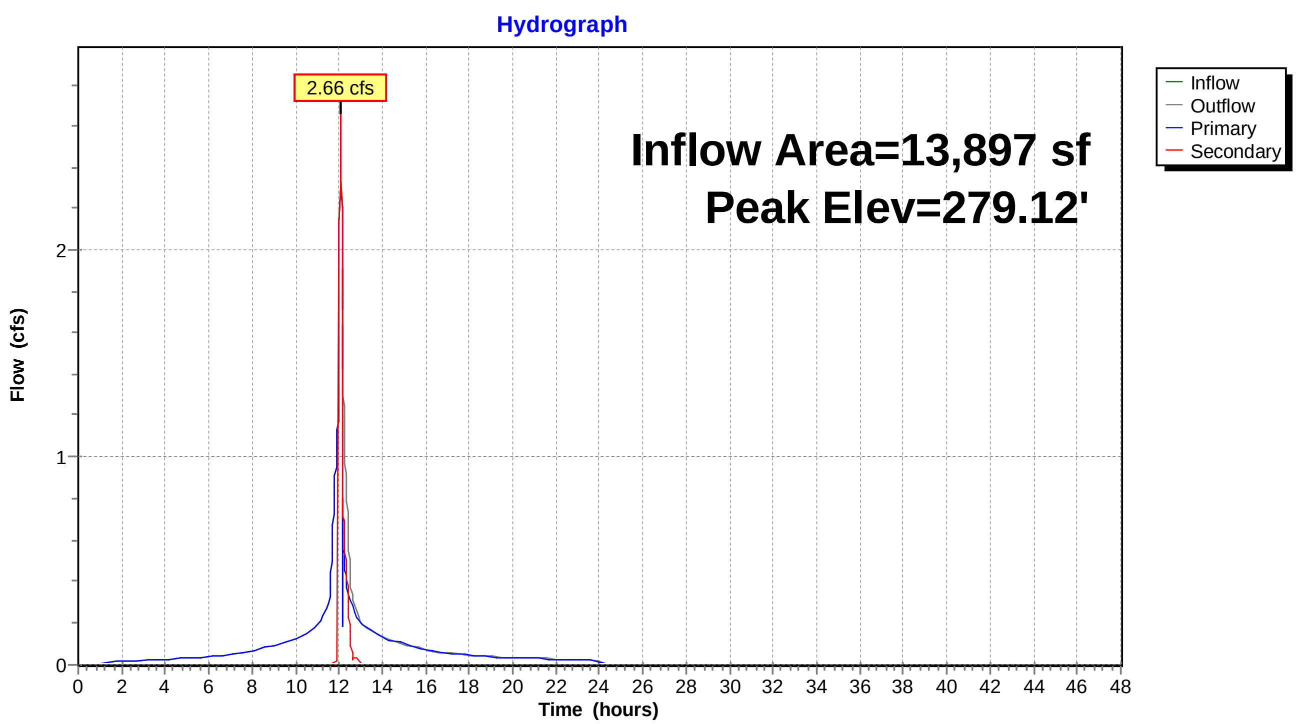
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 279.12' @ 12.07 hrs
Flood Elev= 278.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.90'	**12.0" Round RCP_Round 12"** L= 15.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 275.90' / 275.83' S= 0.0047 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Secondary	278.90'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=279.12' TW=280.53' (Dynamic Tailwater)
└─**1=RCP_Round 12"** (Controls 0.00 cfs)

Secondary OutFlow Max=2.66 cfs @ 12.07 hrs HW=279.12' (Free Discharge)
└─**2=CB Grate** (Weir Controls 2.66 cfs @ 1.53 fps)

Pond CB#1: PR-CB #1



Summary for Pond CB#2: PR-CB#2

Inflow Area = 9,747 sf,100.00% Impervious, Inflow Depth = 7.95" for 100-yr event
Inflow = 1.86 cfs @ 12.07 hrs, Volume= 6,457 cf
Outflow = 1.86 cfs @ 12.07 hrs, Volume= 6,457 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.86 cfs @ 12.07 hrs, Volume= 5,517 cf
Secondary = 1.86 cfs @ 12.07 hrs, Volume= 2,019 cf

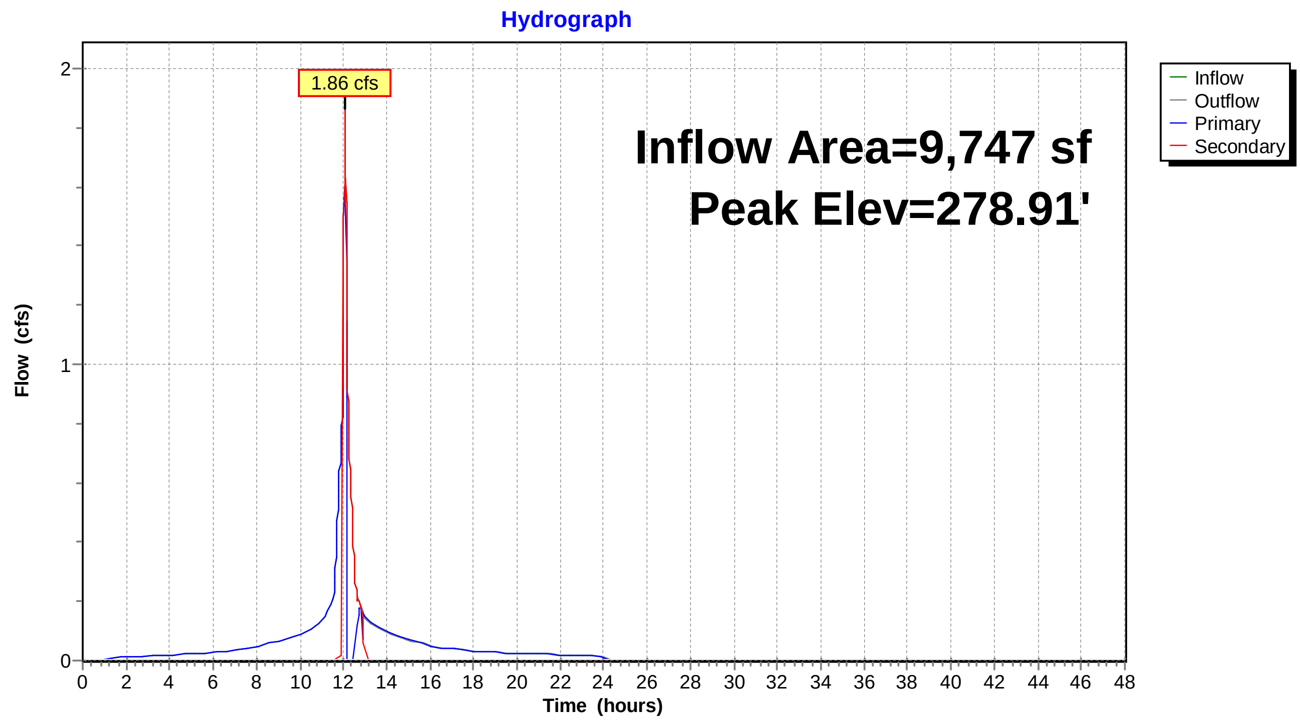
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 278.91' @ 12.07 hrs
Flood Elev= 278.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.90'	**12.0" Round RCP_Round 12"** L= 25.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 275.90' / 275.75' S= 0.0060 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Secondary	278.90'	**24.0" x 24.0" Horiz. CB Grate** C= 0.600

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=278.91' TW=280.53' (Dynamic Tailwater)
└**1=RCP_Round 12"** (Controls 0.00 cfs)

Secondary OutFlow Max=1.86 cfs @ 12.07 hrs HW=278.91' (Free Discharge)
└**2=CB Grate** (Orifice Controls 1.86 cfs @ 0.47 fps)

Pond CB#2: PR-CB#2



Summary for Pond DMH: DMH #1

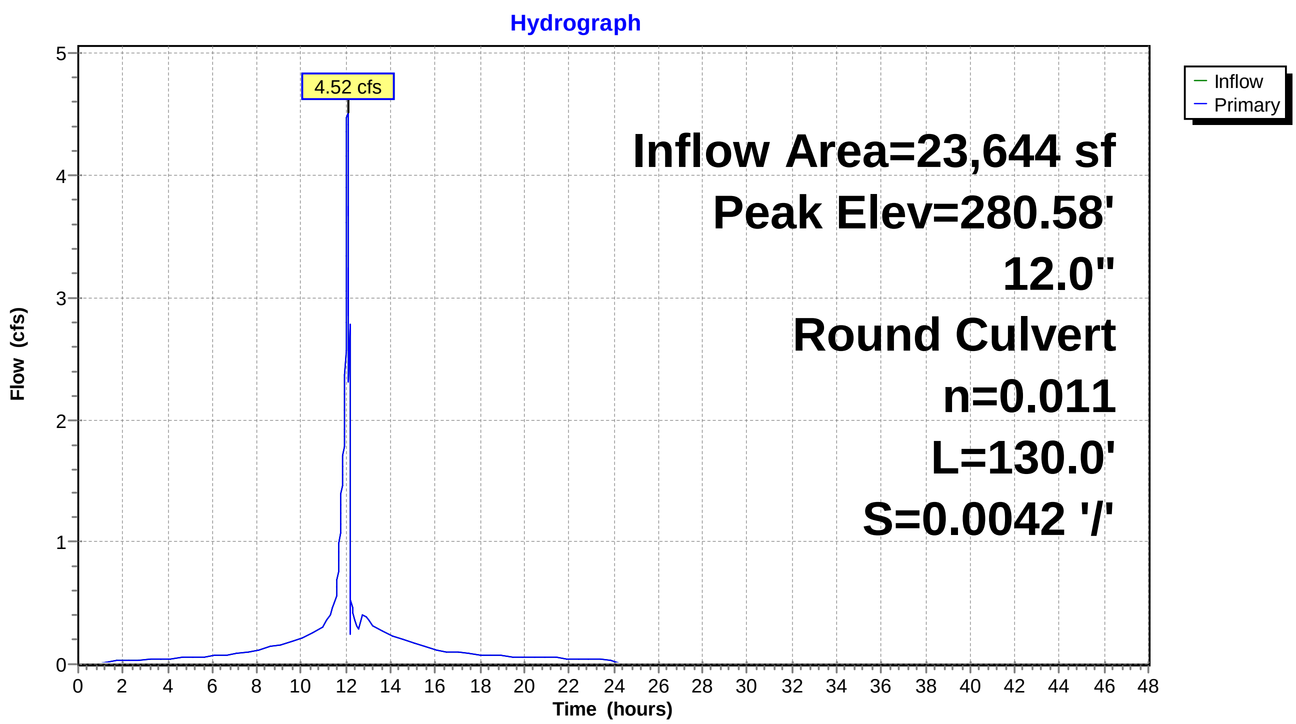
Inflow Area = 23,644 sf,100.00% Impervious, Inflow Depth = 7.11" for 100-yr event
Inflow = 4.52 cfs @ 12.07 hrs, Volume= 14,014 cf
Outflow = 4.52 cfs @ 12.07 hrs, Volume= 14,014 cf, Atten= 0%, Lag= 0.0 min
Primary = 4.52 cfs @ 12.07 hrs, Volume= 14,014 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 280.58' @ 12.08 hrs
Flood Elev= 279.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	275.75'	**12.0" Round RCP_Round 12"** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 275.75' / 275.20' S= 0.0042 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=4.52 cfs @ 12.07 hrs HW=280.53' TW=278.41' (Dynamic Tailwater)
└─1=RCP_Round 12" (Outlet Controls 4.52 cfs @ 5.76 fps)

Pond DMH: DMH #1



Autodesk® Storm and Sanitary Analysis 2016 - Version 13.2.165 (Build 0)

****
Project Description
****
File Name .... Grove_St_Ph2_r1-EX.SPF

****
Analysis Options
****
Flow Units .... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration...... SCS TR-55
Return Period.............. 2 years
Link Routing Method .... Kinematic Wave
Storage Node Exfiltration.. None
Starting Date DEC-20-2022 00:00:00
Ending Date DEC-21-2022 00:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 11
Number of nodes 21
Number of links 14

****
Subbasin Summary
****

Subbasin ID	Total Area acres
Sub-CB-1	0.36
Sub-CB-10-11	0.33
Sub-CB-12-14	1.61
Sub-CB-15-17	0.69
Sub-CB-18-19	0.95
Sub-CB-20	1.49
Sub-CB-2-5	3.91
Sub-CB-6	0.14
Sub-CB-7	0.11
Sub-CB-8W	0.22
Sub-CB-9	0.15

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Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
CIT-8	JUNCTION	254.80	259.42	0.00	
DH-10	JUNCTION	265.15	268.15	0.00	
DH-13	JUNCTION	259.80	265.60	0.00	
DH-20	JUNCTION	277.62	279.12	0.00	
EX-18	JUNCTION	266.00	273.24	0.00	
EX-7	JUNCTION	252.80	258.62	0.00	
Structure - (72)	JUNCTION	275.79	277.57	0.00	

DP-1	OUTFALL	275.00	276.00	0.00
DP-10	OUTFALL	264.78	265.78	0.00
DP-13	OUTFALL	259.60	260.60	0.00
DP-16	OUTFALL	252.66	252.66	0.00
DP-18	OUTFALL	264.36	265.86	0.00
DP-20	OUTFALL	274.20	275.70	0.00
DP-5	OUTFALL	248.00	248.00	0.00
DP-6	OUTFALL	246.50	246.50	0.00
DP-7	OUTFALL	252.60	253.60	0.00
Out-01	OUTFALL	281.22	281.50	0.00

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Inlet Summary
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Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation (ft)	Inlet Rim Elevation (ft)	Ponded Area (ft²)	Initial Water Elevation (ft)	Grate Clogging Factor (%)
CB-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	278.10	281.22	-	278.10	0.00
CB-18	FHWA HEC-22 GENERIC	N/A	On Sag	1	269.61	273.72	10.00	269.61	0.00
EX-CB15	FHWA HEC-22 GENERIC	N/A	On Grade	1	254.80	259.20	-	254.80	0.00
EX-CB-16	FHWA HEC-22 GENERIC	N/A	On Grade	1	257.40	262.30	-	257.40	0.00

****
Roadway and Gutter Summary
****

Inlet ID	Roadway Longitudinal Slope ft/ft	Roadway Cross Slope ft/ft	Roadway Manning's Roughness	Gutter Cross Slope ft/ft	Gutter Width ft	Gutter Depression in
CB-1	0.0100	0.0200	0.0160	0.0620	2.00	2.00
CB-18	-	0.0200	0.0160	0.0620	2.00	2.00
EX-CB15	0.0100	0.0200	0.0160	0.0620	2.00	2.00
EX-CB-16	0.0100	0.0200	0.0160	0.0620	2.00	2.00

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Link Summary
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Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
CB-1_Overflow	CB-1	Out-01	CHANNEL	241.8	0.2000	0.0130
CIT-9_Overflow	EX-CB-16	EX-CB15	CHANNEL	230.0	1.3478	0.0130
Link-17	EX-CB15	CIT-8	CONDUIT	8.9	0.2000	0.0150
Link-18	EX-CB15	DP-7	CHANNEL	220.5	2.9927	0.0130
Pipe - (21)	CIT-8	EX-7	CONDUIT	196.9	1.0156	0.0130
Pipe - (22)	EX-7	DP-7	CONDUIT	20.0	1.0000	0.0130
Pipe - (25)	EX-CB-16	CIT-8	CONDUIT	219.0	1.1872	0.0130
Pipe - (33)	DH-13	DP-13	CONDUIT	19.5	1.0000	0.0130
Pipe - (44)	CB-18	EX-18	CONDUIT	24.4	2.4990	0.0130
Pipe - (45)	EX-18	DP-18	CONDUIT	81.8	2.0000	0.0130

Pipe - (56)	DH-10	DP-10	CONDUIT	12.4	3.0000	0.0130
Pipe - (57)	DH-20	DP-20	CONDUIT	55.5	6.1644	0.0150
Pipe - (61)	CB-1	Structure - (72)	CONDUIT	79.8	2.7583	0.0130
Pipe - (62)	Structure - (72)	DP-1	CONDUIT	79.0	1.0000	0.0130

****
Cross Section Summary
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Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
CB-1_Overflow	TRIANGULAR	0.28	14.00	1	1.96	0.14	2.70
CIT-9_Overflow	TRIANGULAR	0.28	14.00	1	1.96	0.14	7.01
Link-17	CIRCULAR	1.50	1.50	1	1.77	0.38	4.07
Link-18	TRIANGULAR	0.28	14.00	1	1.96	0.14	10.44
Pipe - (21)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.59
Pipe - (22)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (25)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.88
Pipe - (33)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (44)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.63
Pipe - (45)	CIRCULAR	1.50	1.50	1	1.77	0.38	14.86
Pipe - (56)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.17
Pipe - (57)	CIRCULAR	1.50	1.50	1	1.77	0.38	22.60
Pipe - (61)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.92
Pipe - (62)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56

****
Transect Summary
****

Transect XS-L-Pipe - (13)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

```
Hrad:
             0.0139     0.0278     0.0418     0.0557     0.0696
             0.0835     0.0963     0.1080     0.1202     0.1329
             0.1459     0.1591     0.1724     0.1858     0.1994
             0.2130     0.2267     0.2404     0.2542     0.2680
             0.2818     0.2957     0.3095     0.3238     0.3512
             0.3784     0.4055     0.4326     0.4595     0.4863
             0.5130     0.5396     0.5660     0.5924     0.6187
             0.6448     0.6708     0.6968     0.7226     0.7483
             0.7740     0.7995     0.8249     0.8502     0.8754
             0.9005     0.9256     0.9505     0.9753     1.0000
Width:
             0.0355     0.0711     0.1066     0.1422     0.1777
             0.2132     0.2520     0.2961     0.3402     0.3842
             0.4283     0.4724     0.5164     0.5605     0.6046
             0.6487     0.6927     0.7368     0.7809     0.8249
             0.8690     0.9131     0.9572     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000

Transect XS-L-Pipe - (16)
Area:
             0.0005     0.0019     0.0043     0.0076     0.0118
             0.0170     0.0232     0.0305     0.0390     0.0487
             0.0595     0.0715     0.0847     0.0990     0.1145
             0.1312     0.1491     0.1682     0.1884     0.2098
             0.2323     0.2561     0.2810     0.3071     0.3338
             0.3604     0.3871     0.4137     0.4404     0.4670
             0.4937     0.5203     0.5470     0.5736     0.6003
             0.6269     0.6536     0.6802     0.7069     0.7335
             0.7602     0.7868     0.8135     0.8401     0.8668
             0.8934     0.9201     0.9467     0.9734     1.0000
Hrad:
             0.0139     0.0278     0.0418     0.0557     0.0696
             0.0835     0.0963     0.1080     0.1202     0.1329
             0.1459     0.1591     0.1724     0.1858     0.1994
             0.2130     0.2267     0.2404     0.2542     0.2680
             0.2818     0.2957     0.3095     0.3238     0.3512
             0.3784     0.4055     0.4326     0.4595     0.4863
             0.5130     0.5396     0.5660     0.5924     0.6187
             0.6448     0.6708     0.6968     0.7226     0.7483
             0.7740     0.7995     0.8249     0.8502     0.8754
             0.9005     0.9256     0.9505     0.9753     1.0000
Width:
             0.0355     0.0711     0.1066     0.1422     0.1777
             0.2132     0.2520     0.2961     0.3402     0.3842
             0.4283     0.4724     0.5164     0.5605     0.6046
             0.6487     0.6927     0.7368     0.7809     0.8249
             0.8690     0.9131     0.9572     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000

Transect XS-L-Pipe - (18)
Area:
             0.0005     0.0019     0.0043     0.0076     0.0118
             0.0170     0.0232     0.0305     0.0390     0.0487
             0.0595     0.0715     0.0847     0.0990     0.1145
             0.1312     0.1491     0.1682     0.1884     0.2098
             0.2323     0.2561     0.2810     0.3071     0.3338
             0.3604     0.3871     0.4137     0.4404     0.4670
```

	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (2)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (24)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487

	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (27)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (28)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (30)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (37)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (50)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046

```
            0.6487     0.6927     0.7368     0.7809     0.8249
            0.8690     0.9131     0.9572     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000

Transect XS-L-Pipe - (55)
Area:
            0.0005     0.0019     0.0043     0.0076     0.0118
            0.0170     0.0232     0.0305     0.0390     0.0487
            0.0595     0.0715     0.0847     0.0990     0.1145
            0.1312     0.1491     0.1682     0.1884     0.2098
            0.2323     0.2561     0.2810     0.3071     0.3338
            0.3604     0.3871     0.4137     0.4404     0.4670
            0.4937     0.5203     0.5470     0.5736     0.6003
            0.6269     0.6536     0.6802     0.7069     0.7335
            0.7602     0.7868     0.8135     0.8401     0.8668
            0.8934     0.9201     0.9467     0.9734     1.0000
Hrad:
            0.0139     0.0278     0.0418     0.0557     0.0696
            0.0835     0.0963     0.1080     0.1202     0.1329
            0.1459     0.1591     0.1724     0.1858     0.1994
            0.2130     0.2267     0.2404     0.2542     0.2680
            0.2818     0.2957     0.3095     0.3238     0.3512
            0.3784     0.4055     0.4326     0.4595     0.4863
            0.5130     0.5396     0.5660     0.5924     0.6187
            0.6448     0.6708     0.6968     0.7226     0.7483
            0.7740     0.7995     0.8249     0.8502     0.8754
            0.9005     0.9256     0.9505     0.9753     1.0000
Width:
            0.0355     0.0711     0.1066     0.1422     0.1777
            0.2132     0.2520     0.2961     0.3402     0.3842
            0.4283     0.4724     0.5164     0.5605     0.6046
            0.6487     0.6927     0.7368     0.7809     0.8249
            0.8690     0.9131     0.9572     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000


**************************        Volume         Depth
Runoff Quantity Continuity       acre-ft        inches
**************************     ---------       -------
Total Precipitation ......         0.731         0.880
Continuity Error (%) .....         0.706


**************************        Volume        Volume
Flow Routing Continuity          acre-ft      Mgallons
**************************     ---------     ---------
External Inflow ..........         0.000         0.000
External Outflow .........         0.215         0.070
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....        -0.045


**************************************
Runoff Coefficient Computations Report
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```

Subbasin Sub-CB-1

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.12	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.25	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.36		0.45

Subbasin Sub-CB-10-11

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.17	A (6%+)	0.79
Forest, 25 years or greater	0.16	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.33		0.48

Subbasin Sub-CB-12-14

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.39	A (6%+)	0.79
Forest, 25 years or greater	1.23	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.61		0.30

Subbasin Sub-CB-15-17

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.17	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.35	A (6%+)	0.29
Streets, 25 years or greater	0.16	B (0-2%)	0.80
Composite Area & Weighted Runoff Coeff.	0.69		0.54

Subbasin Sub-CB-18-19

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.44	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.51	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.95		0.52

Subbasin Sub-CB-20

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.45	A (6%+)	0.79
Forest, 25 years or greater	1.05	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.49		0.33

Subbasin Sub-CB-2-5

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

Streets, 25 years or greater	0.55	A (6%+)	0.79
Forest, 25 years or greater	3.36	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	3.91		0.23

Subbasin Sub-CB-6

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.09	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.05	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.14		0.59

Subbasin Sub-CB-7

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.08	A (0-2%)	0.76
Residential Lot Size 1 Acre, 25 years or greater	0.03	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.11		0.63

Subbasin Sub-CB-8W

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.16	A (2-6%)	0.77
Meadow, 25 years or greater	0.06	A (2-6%)	0.22
Composite Area & Weighted Runoff Coeff.	0.22		0.61

Subbasin Sub-CB-9

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.11	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.03	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.15		0.65

****

SCS TR-55 Time of Concentration Computations Report

****

Sheet Flow Equation

```
Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n  = Manning's Roughness
Lf = Flow Length (ft)
P  = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)
```

Shallow Concentrated Flow Equation

```
V  = 16.1345 * (Sf^0.5) (unpaved surface)
```

```
V  = 20.3282 * (Sf^0.5) (paved surface)
V  = 15.0 * (Sf^0.5) (grassed waterway surface)
V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V  = 7.0 * (Sf^0.5) (short grass pasture surface)
V  = 5.0 * (Sf^0.5) (woodland surface)
V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V  = Velocity (ft/sec)
Sf = Slope (ft/ft)
```

Channel Flow Equation

```
V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R  = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R  = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V  = Velocity (ft/sec)
Sf = Slope (ft/ft)
n  = Manning's Roughness
```

Subbasin Sub-CB-1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	33.69	0.00	0.00
Slope (%):	1.60	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	9.26	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	329.84	0.00	0.00
Slope (%):	0.77	0.00	0.00
Surface Type:	Paved	Paved	Paved
Velocity (ft/sec):	1.79	0.00	

0.00
Computed Flow Time (minutes): 3.08 0.00
0.00

==
Total TOC (minutes): 12.34

==

Subbasin Sub-CB-10-11

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	82.40	0.00	0.00
Slope (%):	22.88	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.21	0.00	0.00
Computed Flow Time (minutes):	6.54	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	332.66	0.00	0.00
Slope (%):	2.02	0.00	0.00
Surface Type:	Paved	Paved	Paved
Velocity (ft/sec):	2.89	0.00	0.00
Computed Flow Time (minutes):	1.92	0.00	0.00

==
Total TOC (minutes): 8.46

==

Subbasin Sub-CB-12-14

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	222.41	0.00	0.00
Slope (%):	10.60	0.00	0.00

```
         2 yr, 24 hr Rainfall (in):                 3.60                0.00
0.00
         Velocity (ft/sec):                         0.19                0.00
0.00
         Computed Flow Time (minutes):             19.69                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A           Subarea B           Subarea
C
         Flow Length (ft):                        430.84                0.00
0.00
         Slope (%):                                 3.53                0.00
0.00
         Surface Type:                             Paved               Paved
Paved
         Velocity (ft/sec):                         3.82                0.00
0.00
         Computed Flow Time (minutes):              1.88                0.00
0.00

================================================================================================
         Total TOC (minutes):                      21.57

================================================================================================


  ------------------------
  Subbasin Sub-CB-15-17
  ------------------------

         User-Defined TOC override (minutes):      5.00

  ------------------------
  Subbasin Sub-CB-18-19
  ------------------------

         User-Defined TOC override (minutes):      5.00

  ---------------------
  Subbasin Sub-CB-20
  ---------------------

  Sheet Flow Computations
  -----------------------
                                                Subarea A           Subarea B           Subarea
C
         Manning's Roughness:                       0.40                0.00
0.00
         Flow Length (ft):                        227.22                0.00
0.00
         Slope (%):                                 7.48                0.00
0.00
         2 yr, 24 hr Rainfall (in):                 3.60                0.00
0.00
         Velocity (ft/sec):                         0.16                0.00
0.00
         Computed Flow Time (minutes):             23.04                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A           Subarea B           Subarea
C
         Flow Length (ft):                        193.35                0.00
```

```
0.00
          Slope (%):                                  2.77            0.00
0.00
          Surface Type:                              Paved           Paved
Paved
          Velocity (ft/sec):                          3.38            0.00
0.00
          Computed Flow Time (minutes):               0.95            0.00
0.00

===============================================================================================
          Total TOC (minutes):                       23.99

===============================================================================================


  ----------------------
  Subbasin Sub-CB-2-5
  ----------------------

  Sheet Flow Computations
  -----------------------
                                                Subarea A       Subarea B        Subarea
C
          Manning's Roughness:                        0.40            0.00
0.00
          Flow Length (ft):                         526.06            0.00
0.00
          Slope (%):                                  1.65            0.00
0.00
          2 yr, 24 hr Rainfall (in):                  3.60            0.00
0.00
          Velocity (ft/sec):                          0.11            0.00
0.00
          Computed Flow Time (minutes):              82.52            0.00
0.00

  Shallow Concentrated Flow Computations
  -------------------------------------
                                                Subarea A       Subarea B        Subarea
C
          Flow Length (ft):                         591.37            0.00
0.00
          Slope (%):                                  2.70            0.00
0.00
          Surface Type:                            Unpaved           Paved
Paved
          Velocity (ft/sec):                          2.65            0.00
0.00
          Computed Flow Time (minutes):               3.72            0.00
0.00

===============================================================================================
          Total TOC (minutes):                       86.24

===============================================================================================


  --------------------
  Subbasin Sub-CB-6
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-7
```

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-8W

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-9

User-Defined TOC override (minutes): 5.00

****
Subbasin Runoff Summary
****

Subbasin ID	Accumulated Precip in	Rainfall Intensity in/hr	Total Runoff in	Peak Runoff cfs	Weighted Runoff Coeff	Time of Concentration days	Time of Concentration hh:mm:ss
Sub-CB-1	0.60	2.92	0.27	0.48	0.450	0	00:12:20
Sub-CB-10-11	0.51	3.57	0.24	0.56	0.480	0	00:08:27
Sub-CB-12-14	0.77	2.16	0.23	1.04	0.300	0	00:21:34
Sub-CB-15-17	0.39	4.72	0.21	1.76	0.540	0	00:05:00
Sub-CB-18-19	0.39	4.72	0.20	2.33	0.520	0	00:05:00
Sub-CB-20	0.81	2.03	0.27	1.00	0.330	0	00:23:59
Sub-CB-2-5	1.29	0.90	0.30	0.81	0.230	0	01:26:14
Sub-CB-6	0.39	4.72	0.23	0.40	0.590	0	00:05:00
Sub-CB-7	0.39	4.72	0.25	0.32	0.630	0	00:05:00
Sub-CB-8W	0.39	4.72	0.24	0.63	0.610	0	00:05:00
Sub-CB-9	0.39	4.72	0.26	0.45	0.650	0	00:05:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
CIT-8	0.00	0.36	255.16	0	00:05	0	0	0:00:00
DH-10	0.00	0.20	265.35	0	00:08	0	0	0:00:00
DH-13	0.01	0.37	260.17	0	00:21	0	0	0:00:00
DH-20	0.00	0.21	277.83	0	00:24	0	0	0:00:00
EX-18	3.00	3.45	269.45	0	00:05	0	0	0:00:00
EX-7	0.00	0.36	253.16	0	00:06	0	0	0:00:00
Structure - (72)	0.11	0.30	276.09	0	00:12	0	0	0:00:00
DP-1	0.00	0.24	275.24	0	00:12	0	0	0:00:00
DP-10	0.00	0.20	264.98	0	00:08	0	0	0:00:00
DP-13	0.01	0.37	259.97	0	00:21	0	0	0:00:00
DP-16	0.00	0.00	252.66	0	00:00	0	0	0:00:00
DP-18	0.01	0.40	264.76	0	00:05	0	0	0:00:00
DP-20	0.00	0.21	274.41	0	00:24	0	0	0:00:00
DP-5	0.00	0.00	248.00	0	00:00	0	0	0:00:00
DP-6	0.00	0.00	246.50	0	00:00	0	0	0:00:00
DP-7	0.00	0.36	252.96	0	00:06	0	0	0:00:00
Out-01	0.00	0.04	281.26	0	00:18	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days hh:mm
CIT-8	JUNCTION	0.63	1.00	0	00:05	0.00	
DH-10	JUNCTION	0.56	0.56	0	00:08	0.00	
DH-13	JUNCTION	1.04	1.04	0	00:21	0.00	
DH-20	JUNCTION	1.00	1.00	0	00:24	0.00	
EX-18	JUNCTION	0.00	2.32	0	00:05	0.00	
EX-7	JUNCTION	0.00	0.97	0	00:06	0.00	
Structure - (72)	JUNCTION	0.00	0.45	0	00:12	0.00	
DP-1	OUTFALL	0.00	0.45	0	00:12	0.00	
DP-10	OUTFALL	0.00	0.56	0	00:08	0.00	
DP-13	OUTFALL	0.00	1.04	0	00:21	0.00	
DP-16	OUTFALL	1.76	1.76	0	00:05	0.00	
DP-18	OUTFALL	0.00	2.30	0	00:05	0.00	
DP-20	OUTFALL	0.00	1.00	0	00:24	0.00	
DP-5	OUTFALL	0.81	0.81	0	01:26	0.00	
DP-6	OUTFALL	0.40	0.40	0	00:05	0.00	
DP-7	OUTFALL	0.32	1.24	0	00:05	0.00	
Out-01	OUTFALL	0.00	0.02	0	00:18	0.00	

****
Inlet Depth Summary
****

Inlet ID	Max Gutter Spread during Peak Flow ft	Max Gutter Water Elev during Peak Flow ft	Max Gutter Water Depth during Peak Flow ft	Time of Maximum Depth Occurrence days	Time of Maximum Depth Occurrence hh:mm
CB-1	4.02	281.38	0.16	0	00:12
CB-18	9.44	274.01	0.29	0	00:05
EX-CB15	0.79	259.25	0.05	0	00:08
EX-CB-16	3.88	262.46	0.16	0	00:05

****
Inlet Flow Summary
****

Inlet ID	Peak Flow cfs	Peak Lateral Flow cfs	Peak Flow Intercepted by Inlet cfs	Peak Flow Bypassing Inlet cfs	Inlet Efficiency during Peak Flow %	Total Flooding acre-in	Total Time Flooded minutes

-

CB-1	0.48	0.48	0.46	0.02	95.36	0.000	0
CB-18	2.33	2.33	-	-	-	0.000	0
EX-CB15	0.02	0.00	0.02	0.00	100.00	0.000	0
EX-CB-16	0.45	0.45	0.43	0.02	96.00	0.000	0

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
DP-1	1.89	0.20	0.45
DP-10	1.19	0.28	0.56
DP-13	3.00	0.52	1.04
DP-16	0.69	0.88	1.76
DP-18	0.87	0.92	2.30
DP-20	3.37	0.49	1.00
DP-5	11.95	0.40	0.81
DP-6	0.69	0.20	0.40
DP-7	1.88	0.26	1.24
Out-01	2.53	0.01	0.02
System	2.81	4.17	6.56

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
CB-1_Overflow	CHANNEL	0 00:18	1.53	1.00	0.02	2.70	0.01	0.15	0	Calculated
CIT-9_Overflow	CHANNEL	0 00:08	3.14	1.00	0.02	7.01	0.00	0.10	0	Calculated
Link-17	CONDUIT	0 00:08	0.56	1.00	0.02	4.07	0.00	0.05	0	Calculated
Link-18	CHANNEL	0 00:12	0.00	1.00	0.00	10.44	0.00	0.03	0	Calculated
Pipe - (21)	CONDUIT	0 00:06	3.99	1.00	0.97	3.59	0.27	0.35	0	Calculated
Pipe - (22)	CONDUIT	0 00:06	3.87	1.00	0.97	3.56	0.27	0.36	0	Calculated
Pipe - (25)	CONDUIT	0 00:05	6.24	1.00	0.41	3.88	0.10	0.22	0	Calculated

```
  Pipe - (33)          CONDUIT      0  00:21      3.94    1.00        1.04         3.56       0.29
0.37           0  Calculated
  Pipe - (44)          CONDUIT      0  00:05      6.84    1.00        2.32         5.63       0.41
0.45           0  Calculated
  Pipe - (45)          CONDUIT      0  00:05      6.15    1.00        2.30        14.86       0.15
0.27           0  Calculated
  Pipe - (56)          CONDUIT      0  00:08      4.88    1.00        0.56         6.17       0.09
0.20           0  Calculated
  Pipe - (57)          CONDUIT      0  00:24      6.46    1.00        1.00        22.60       0.04
0.14           0  Calculated
  Pipe - (61)          CONDUIT      0  00:12      5.10    1.00        0.45         5.92       0.08
0.19           0  Calculated
  Pipe - (62)          CONDUIT      0  00:12      3.13    1.00        0.45         3.56       0.13
0.24           0  Calculated


  ********************************
  Highest Flow Instability Indexes
  ********************************
  All links are stable.

  WARNING 108 : Surcharge elevation defined for Junction EX-18 is below junction maximum
elevation. Assumed surcharge elevation equal to maximum elevation.
  WARNING 139 : Ponded area defined for on sag Inlet CB-18 is zero. Assumed ponded area equal to
10 ft² (0.929 m²).
  WARNING 138 : Initial water surface elevation defined for Inlet EX-CB15 is below catchbasin
invert elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB-1_Overflow
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CIT-9_Overflow
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit CB-1_Overflow is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 004 : Minimum elevation drop used for Conduit CB-1_Overflow.
  WARNING 005 : Minimum slope used for Conduit CB-1_Overflow.
  WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CIT-9_Overflow is below
the storm drain inlet rim elevation.
                Assumed the upstream roadway link outlet invert elevation equal to the storm
drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain
inlet EX-CB15.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Link-17 is below upstream node
invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 004 : Minimum elevation drop used for Conduit Link-17.
  WARNING 005 : Minimum slope used for Conduit Link-17.

  Analysis began on:  Tue Jan 31 10:57:26 2023
  Analysis ended on:  Tue Jan 31 10:57:27 2023
  Total elapsed time: 00:00:01
```

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.2.165 (Build 0)

****
Project Description
****
File Name .... Grove_St_Ph2_r1-EX.SPF

****
Analysis Options
****
Flow Units .... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration...... SCS TR-55
Return Period............. 10 years
Link Routing Method .... Kinematic Wave
Storage Node Exfiltration.. None
Starting Date DEC-20-2022 00:00:00
Ending Date DEC-21-2022 00:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 11
Number of nodes 21
Number of links 14

****
Subbasin Summary
****

Subbasin ID	Total Area acres
Sub-CB-1	0.36
Sub-CB-10-11	0.33
Sub-CB-12-14	1.61
Sub-CB-15-17	0.69
Sub-CB-18-19	0.95
Sub-CB-20	1.49
Sub-CB-2-5	3.91
Sub-CB-6	0.14
Sub-CB-7	0.11
Sub-CB-8W	0.22
Sub-CB-9	0.15

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
CIT-8	JUNCTION	254.80	259.42	0.00	
DH-10	JUNCTION	265.15	268.15	0.00	
DH-13	JUNCTION	259.80	265.60	0.00	
DH-20	JUNCTION	277.62	279.12	0.00	
EX-18	JUNCTION	266.00	273.24	0.00	
EX-7	JUNCTION	252.80	258.62	0.00	
Structure - (72)	JUNCTION	275.79	277.57	0.00	

DP-1	OUTFALL	275.00	276.00	0.00
DP-10	OUTFALL	264.78	265.78	0.00
DP-13	OUTFALL	259.60	260.60	0.00
DP-16	OUTFALL	252.66	252.66	0.00
DP-18	OUTFALL	264.36	265.86	0.00
DP-20	OUTFALL	274.20	275.70	0.00
DP-5	OUTFALL	248.00	248.00	0.00
DP-6	OUTFALL	246.50	246.50	0.00
DP-7	OUTFALL	252.60	253.60	0.00
Out-01	OUTFALL	281.22	281.50	0.00

****
Inlet Summary
****

Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation	Inlet Rim Elevation	Ponded Area	Initial Water Elevation	Grate Clogging Factor
					ft	ft	ft²	ft	%
CB-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	278.10	281.22	-	278.10	0.00
CB-18	FHWA HEC-22 GENERIC	N/A	On Sag	1	269.61	273.72	10.00	269.61	0.00
EX-CB15	FHWA HEC-22 GENERIC	N/A	On Grade	1	254.80	259.20	-	254.80	0.00
EX-CB-16	FHWA HEC-22 GENERIC	N/A	On Grade	1	257.40	262.30	-	257.40	0.00

****
Roadway and Gutter Summary
****

Inlet ID	Roadway Longitudinal Slope ft/ft	Roadway Cross Slope ft/ft	Roadway Manning's Roughness	Gutter Cross Slope ft/ft	Gutter Width ft	Gutter Depression in
CB-1	0.0100	0.0200	0.0160	0.0620	2.00	2.00
CB-18	-	0.0200	0.0160	0.0620	2.00	2.00
EX-CB15	0.0100	0.0200	0.0160	0.0620	2.00	2.00
EX-CB-16	0.0100	0.0200	0.0160	0.0620	2.00	2.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
CB-1_Overflow	CB-1	Out-01	CHANNEL	241.8	0.2000	0.0130
CIT-9_Overflow	EX-CB-16	EX-CB15	CHANNEL	230.0	1.3478	0.0130
Link-17	EX-CB15	CIT-8	CONDUIT	8.9	0.2000	0.0150
Link-18	EX-CB15	DP-7	CHANNEL	220.5	2.9927	0.0130
Pipe - (21)	CIT-8	EX-7	CONDUIT	196.9	1.0156	0.0130
Pipe - (22)	EX-7	DP-7	CONDUIT	20.0	1.0000	0.0130
Pipe - (25)	EX-CB-16	CIT-8	CONDUIT	219.0	1.1872	0.0130
Pipe - (33)	DH-13	DP-13	CONDUIT	19.5	1.0000	0.0130
Pipe - (44)	CB-18	EX-18	CONDUIT	24.4	2.4990	0.0130
Pipe - (45)	EX-18	DP-18	CONDUIT	81.8	2.0000	0.0130

Pipe - (56)	DH-10	DP-10	CONDUIT	12.4	3.0000	0.0130
Pipe - (57)	DH-20	DP-20	CONDUIT	55.5	6.1644	0.0150
Pipe - (61)	CB-1	Structure - (72)	CONDUIT	79.8	2.7583	0.0130
Pipe - (62)	Structure - (72)	DP-1	CONDUIT	79.0	1.0000	0.0130

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
CB-1_Overflow	TRIANGULAR	0.28	14.00	1	1.96	0.14	2.70
CIT-9_Overflow	TRIANGULAR	0.28	14.00	1	1.96	0.14	7.01
Link-17	CIRCULAR	1.50	1.50	1	1.77	0.38	4.07
Link-18	TRIANGULAR	0.28	14.00	1	1.96	0.14	10.44
Pipe - (21)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.59
Pipe - (22)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (25)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.88
Pipe - (33)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (44)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.63
Pipe - (45)	CIRCULAR	1.50	1.50	1	1.77	0.38	14.86
Pipe - (56)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.17
Pipe - (57)	CIRCULAR	1.50	1.50	1	1.77	0.38	22.60
Pipe - (61)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.92
Pipe - (62)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56

****
Transect Summary
****

Transect XS-L-Pipe - (13)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000

Width:

	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (16)

Area:

	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000

Width:

	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (18)

Area:

	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670

	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (2)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (24)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487

0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (27)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (28)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (30)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (37)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (50)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046

```
             0.6487     0.6927     0.7368     0.7809     0.8249
             0.8690     0.9131     0.9572     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000

Transect XS-L-Pipe - (55)
Area:
             0.0005     0.0019     0.0043     0.0076     0.0118
             0.0170     0.0232     0.0305     0.0390     0.0487
             0.0595     0.0715     0.0847     0.0990     0.1145
             0.1312     0.1491     0.1682     0.1884     0.2098
             0.2323     0.2561     0.2810     0.3071     0.3338
             0.3604     0.3871     0.4137     0.4404     0.4670
             0.4937     0.5203     0.5470     0.5736     0.6003
             0.6269     0.6536     0.6802     0.7069     0.7335
             0.7602     0.7868     0.8135     0.8401     0.8668
             0.8934     0.9201     0.9467     0.9734     1.0000
Hrad:
             0.0139     0.0278     0.0418     0.0557     0.0696
             0.0835     0.0963     0.1080     0.1202     0.1329
             0.1459     0.1591     0.1724     0.1858     0.1994
             0.2130     0.2267     0.2404     0.2542     0.2680
             0.2818     0.2957     0.3095     0.3238     0.3512
             0.3784     0.4055     0.4326     0.4595     0.4863
             0.5130     0.5396     0.5660     0.5924     0.6187
             0.6448     0.6708     0.6968     0.7226     0.7483
             0.7740     0.7995     0.8249     0.8502     0.8754
             0.9005     0.9256     0.9505     0.9753     1.0000
Width:
             0.0355     0.0711     0.1066     0.1422     0.1777
             0.2132     0.2520     0.2961     0.3402     0.3842
             0.4283     0.4724     0.5164     0.5605     0.6046
             0.6487     0.6927     0.7368     0.7809     0.8249
             0.8690     0.9131     0.9572     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000
             1.0000     1.0000     1.0000     1.0000     1.0000


**************************        Volume         Depth
Runoff Quantity Continuity       acre-ft        inches
**************************     ---------       -------
Total Precipitation ......         1.116         1.344
Continuity Error (%) .....         0.706


**************************        Volume        Volume
Flow Routing Continuity          acre-ft      Mgallons
**************************     ---------     ---------
External Inflow ..........         0.000         0.000
External Outflow .........         0.328         0.107
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....        -0.044


**************************************
Runoff Coefficient Computations Report
**************************************

--------------------
```

Subbasin Sub-CB-1

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.12	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.25	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.36		0.45

Subbasin Sub-CB-10-11

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.17	A (6%+)	0.79
Forest, 25 years or greater	0.16	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.33		0.48

Subbasin Sub-CB-12-14

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.39	A (6%+)	0.79
Forest, 25 years or greater	1.23	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.61		0.30

Subbasin Sub-CB-15-17

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.17	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.35	A (6%+)	0.29
Streets, 25 years or greater	0.16	B (0-2%)	0.80
Composite Area & Weighted Runoff Coeff.	0.69		0.54

Subbasin Sub-CB-18-19

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.44	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.51	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.95		0.52

Subbasin Sub-CB-20

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.45	A (6%+)	0.79
Forest, 25 years or greater	1.05	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.49		0.33

Subbasin Sub-CB-2-5

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

Streets, 25 years or greater	0.55	A (6%+)	0.79
Forest, 25 years or greater	3.36	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	3.91		0.23

Subbasin Sub-CB-6

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.09	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.05	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.14		0.59

Subbasin Sub-CB-7

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.08	A (0-2%)	0.76
Residential Lot Size 1 Acre, 25 years or greater	0.03	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.11		0.63

Subbasin Sub-CB-8W

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.16	A (2-6%)	0.77
Meadow, 25 years or greater	0.06	A (2-6%)	0.22
Composite Area & Weighted Runoff Coeff.	0.22		0.61

Subbasin Sub-CB-9

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.11	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.03	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.15		0.65

SCS TR-55 Time of Concentration Computations Report

Sheet Flow Equation

```
Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n  = Manning's Roughness
Lf = Flow Length (ft)
P  = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)
```

Shallow Concentrated Flow Equation

```
V  = 16.1345 * (Sf^0.5) (unpaved surface)
```

```
V  = 20.3282 * (Sf^0.5) (paved surface)
V  = 15.0 * (Sf^0.5) (grassed waterway surface)
V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V  = 7.0 * (Sf^0.5) (short grass pasture surface)
V  = 5.0 * (Sf^0.5) (woodland surface)
V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V  = Velocity (ft/sec)
Sf = Slope (ft/ft)
```

Channel Flow Equation

```
V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R  = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R  = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V  = Velocity (ft/sec)
Sf = Slope (ft/ft)
n  = Manning's Roughness
```

Subbasin Sub-CB-1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	33.69	0.00	0.00
Slope (%):	1.60	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	9.26	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	329.84	0.00	0.00
Slope (%):	0.77	0.00	0.00
Surface Type:	Paved	Paved	Paved
Velocity (ft/sec):	1.79	0.00	

0.00
        Computed Flow Time (minutes):   3.08   0.00
0.00

==
        Total TOC (minutes):   12.34

==

  Subbasin Sub-CB-10-11

  Sheet Flow Computations

                                              Subarea A   Subarea B   Subarea
C
        Manning's Roughness: 0.40   0.00
0.00
        Flow Length (ft):   82.40   0.00
0.00
        Slope (%):   22.88   0.00
0.00
        2 yr, 24 hr Rainfall (in):   3.60   0.00
0.00
        Velocity (ft/sec):   0.21   0.00
0.00
        Computed Flow Time (minutes):   6.54   0.00
0.00

  Shallow Concentrated Flow Computations

                                              Subarea A   Subarea B   Subarea
C
        Flow Length (ft):   332.66   0.00
0.00
        Slope (%):   2.02   0.00
0.00
        Surface Type: Paved   Paved
Paved
        Velocity (ft/sec):   2.89   0.00
0.00
        Computed Flow Time (minutes):   1.92   0.00
0.00

==
        Total TOC (minutes):   8.46

==

  Subbasin Sub-CB-12-14

  Sheet Flow Computations

                                              Subarea A   Subarea B   Subarea
C
        Manning's Roughness: 0.40   0.00
0.00
        Flow Length (ft):   222.41   0.00
0.00
        Slope (%):   10.60   0.00
0.00

```
        2 yr, 24 hr Rainfall (in):                3.60             0.00
0.00
        Velocity (ft/sec):                        0.19             0.00
0.00
        Computed Flow Time (minutes):            19.69             0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                             Subarea A          Subarea B          Subarea
C
        Flow Length (ft):                       430.84             0.00
0.00
        Slope (%):                                3.53             0.00
0.00
        Surface Type:                            Paved            Paved
Paved
        Velocity (ft/sec):                        3.82             0.00
0.00
        Computed Flow Time (minutes):             1.88             0.00
0.00

================================================================================================
        Total TOC (minutes):                     21.57

================================================================================================


  ------------------------
  Subbasin Sub-CB-15-17
  ------------------------

        User-Defined TOC override (minutes):      5.00

  ------------------------
  Subbasin Sub-CB-18-19
  ------------------------

        User-Defined TOC override (minutes):      5.00

  ---------------------
  Subbasin Sub-CB-20
  ---------------------

  Sheet Flow Computations
  -----------------------
                                             Subarea A          Subarea B          Subarea
C
        Manning's Roughness:                      0.40             0.00
0.00
        Flow Length (ft):                       227.22             0.00
0.00
        Slope (%):                                7.48             0.00
0.00
        2 yr, 24 hr Rainfall (in):                3.60             0.00
0.00
        Velocity (ft/sec):                        0.16             0.00
0.00
        Computed Flow Time (minutes):            23.04             0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                             Subarea A          Subarea B          Subarea
C
        Flow Length (ft):                       193.35             0.00
```

```
0.00
          Slope (%):                                   2.77                0.00
0.00
          Surface Type:                               Paved               Paved
Paved
          Velocity (ft/sec):                           3.38                0.00
0.00
          Computed Flow Time (minutes):                0.95                0.00
0.00

================================================================================================
          Total TOC (minutes):                        23.99

================================================================================================


  ---------------------
  Subbasin Sub-CB-2-5
  ---------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                         0.40                0.00
0.00
          Flow Length (ft):                          526.06                0.00
0.00
          Slope (%):                                   1.65                0.00
0.00
          2 yr, 24 hr Rainfall (in):                   3.60                0.00
0.00
          Velocity (ft/sec):                           0.11                0.00
0.00
          Computed Flow Time (minutes):               82.52                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                 Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                          591.37                0.00
0.00
          Slope (%):                                   2.70                0.00
0.00
          Surface Type:                             Unpaved               Paved
Paved
          Velocity (ft/sec):                           2.65                0.00
0.00
          Computed Flow Time (minutes):                3.72                0.00
0.00

================================================================================================
          Total TOC (minutes):                        86.24

================================================================================================


  --------------------
  Subbasin Sub-CB-6
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-7
```

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-8W

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-9

User-Defined TOC override (minutes): 5.00

****
Subbasin Runoff Summary
****

Subbasin ID	Accumulated Precip in	Rainfall Intensity in/hr	Total Runoff in	Peak Runoff cfs	Weighted Runoff Coeff	Time of Concentration days	Time of Concentration hh:mm:ss
Sub-CB-1	0.91	4.45	0.41	0.73	0.450	0	00:12:20
Sub-CB-10-11	0.77	5.44	0.37	0.85	0.480	0	00:08:27
Sub-CB-12-14	1.18	3.28	0.35	1.59	0.300	0	00:21:34
Sub-CB-15-17	0.60	7.21	0.32	2.69	0.540	0	00:05:00
Sub-CB-18-19	0.60	7.21	0.31	3.55	0.520	0	00:05:00
Sub-CB-20	1.24	3.10	0.41	1.53	0.330	0	00:23:59
Sub-CB-2-5	1.97	1.37	0.45	1.23	0.230	0	01:26:14
Sub-CB-6	0.60	7.21	0.35	0.61	0.590	0	00:05:00
Sub-CB-7	0.60	7.21	0.38	0.49	0.630	0	00:05:00
Sub-CB-8W	0.60	7.21	0.37	0.97	0.610	0	00:05:00
Sub-CB-9	0.60	7.21	0.39	0.69	0.650	0	00:05:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
CIT-8	0.00	0.45	255.25	0	00:05	0	0	0:00:00
DH-10	0.00	0.25	265.40	0	00:08	0	0	0:00:00
DH-13	0.01	0.47	260.26	0	00:21	0	0	0:00:00
DH-20	0.01	0.27	277.89	0	00:24	0	0	0:00:00
EX-18	3.00	3.58	269.58	0	00:05	0	0	0:00:00
EX-7	0.00	0.45	253.25	0	00:05	0	0	0:00:00
Structure - (72)	0.11	0.33	276.12	0	00:12	0	0	0:00:00
DP-1	0.00	0.29	275.29	0	00:12	0	0	0:00:00
DP-10	0.00	0.25	265.03	0	00:08	0	0	0:00:00
DP-13	0.01	0.47	260.07	0	00:21	0	0	0:00:00
DP-16	0.00	0.00	252.66	0	00:00	0	0	0:00:00
DP-18	0.01	0.50	264.86	0	00:05	0	0	0:00:00
DP-20	0.01	0.26	274.46	0	00:24	0	0	0:00:00
DP-5	0.00	0.00	248.00	0	00:00	0	0	0:00:00
DP-6	0.00	0.00	246.50	0	00:00	0	0	0:00:00
DP-7	0.00	0.45	253.05	0	00:06	0	0	0:00:00
Out-01	0.00	0.07	281.29	0	00:16	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm
CIT-8	JUNCTION	0.97	1.51	0	00:05	0.00		
DH-10	JUNCTION	0.85	0.85	0	00:08	0.00		
DH-13	JUNCTION	1.59	1.59	0	00:21	0.00		
DH-20	JUNCTION	1.53	1.53	0	00:24	0.00		
EX-18	JUNCTION	0.00	3.54	0	00:05	0.00		
EX-7	JUNCTION	0.00	1.47	0	00:05	0.00		
Structure - (72)	JUNCTION	0.00	0.64	0	00:12	0.00		
DP-1	OUTFALL	0.00	0.64	0	00:12	0.00		
DP-10	OUTFALL	0.00	0.85	0	00:08	0.00		
DP-13	OUTFALL	0.00	1.59	0	00:21	0.00		
DP-16	OUTFALL	2.69	2.69	0	00:05	0.00		
DP-18	OUTFALL	0.00	3.51	0	00:05	0.00		
DP-20	OUTFALL	0.00	1.52	0	00:24	0.00		
DP-5	OUTFALL	1.23	1.23	0	01:26	0.00		
DP-6	OUTFALL	0.61	0.61	0	00:05	0.00		
DP-7	OUTFALL	0.49	1.89	0	00:05	0.00		
Out-01	OUTFALL	0.00	0.06	0	00:16	0.00		

****
Inlet Depth Summary
****

Inlet ID	Max Gutter Spread during Peak Flow ft	Max Gutter Water Elev during Peak Flow ft	Max Gutter Water Depth during Peak Flow ft	Time of Maximum Depth Occurrence days	hh:mm
CB-1	5.20	281.41	0.19	0	00:12
CB-18	12.89	274.08	0.36	0	00:05
EX-CB15	1.16	259.27	0.07	0	00:06
EX-CB-16	5.05	262.49	0.19	0	00:05

****
Inlet Flow Summary
****

Inlet ID	Peak Flow cfs	Peak Lateral Flow cfs	Peak Flow Intercepted by Inlet cfs	Peak Flow Bypassing Inlet cfs	Inlet Efficiency during Peak Flow %	Total Flooding acre-in	Total Time Flooded minutes

-

CB-1	0.73	0.73	0.65	0.08	89.27	0.000	0
CB-18	3.55	3.55	-	-	-	0.000	0
EX-CB15	0.05	0.00	0.05	0.00	100.00	0.000	0
EX-CB-16	0.69	0.69	0.62	0.07	90.11	0.000	0

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
DP-1	1.91	0.30	0.64
DP-10	1.19	0.42	0.85
DP-13	3.01	0.79	1.59
DP-16	0.69	1.35	2.69
DP-18	0.87	1.40	3.51
DP-20	3.38	0.75	1.52
DP-5	11.96	0.62	1.23
DP-6	0.69	0.30	0.61
DP-7	1.94	0.38	1.89
Out-01	2.76	0.02	0.06
System	2.84	6.33	10.06

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
CB-1_Overflow	CHANNEL	0 00:16	1.74	1.00	0.06	2.70	0.02	0.23	0	Calculated
CIT-9_Overflow	CHANNEL	0 00:06	3.57	1.00	0.05	7.01	0.01	0.15	0	Calculated
Link-17	CONDUIT	0 00:06	0.77	1.00	0.05	4.07	0.01	0.08	0	Calculated
Link-18	CHANNEL	0 00:11	0.63	1.00	0.00	10.44	0.00	0.04	0	Calculated
Pipe - (21)	CONDUIT	0 00:05	4.44	1.00	1.47	3.59	0.41	0.44	0	Calculated
Pipe - (22)	CONDUIT	0 00:06	4.32	1.00	1.47	3.56	0.41	0.45	0	Calculated
Pipe - (25)	CONDUIT	0 00:05	6.78	1.00	0.59	3.88	0.15	0.26	0	Calculated

Pipe - (33)	CONDUIT	0	00:21	4.41	1.00	1.59	3.56	0.45	0.47	0	Calculated
Pipe - (44)	CONDUIT	0	00:05	7.59	1.00	3.54	5.63	0.63	0.57	0	Calculated
Pipe - (45)	CONDUIT	0	00:05	6.92	1.00	3.51	14.86	0.24	0.33	0	Calculated
Pipe - (56)	CONDUIT	0	00:08	5.52	1.00	0.85	6.17	0.14	0.25	0	Calculated
Pipe - (57)	CONDUIT	0	00:24	7.25	1.00	1.52	22.60	0.07	0.18	0	Calculated
Pipe - (61)	CONDUIT	0	00:12	5.59	1.00	0.64	5.92	0.11	0.22	0	Calculated
Pipe - (62)	CONDUIT	0	00:12	3.44	1.00	0.64	3.56	0.18	0.29	0	Calculated

****
Highest Flow Instability Indexes
****
All links are stable.

WARNING 108 : Surcharge elevation defined for Junction EX-18 is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.
WARNING 139 : Ponded area defined for on sag Inlet CB-18 is zero. Assumed ponded area equal to 10 ft^2 (0.929 m^2).
WARNING 138 : Initial water surface elevation defined for Inlet EX-CB15 is below catchbasin invert elevation.
Assumed initial water surface elevation equal to catchbasin inlet invert elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB-1_Overflow is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CIT-9_Overflow is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 117 : Conduit outlet invert elevation defined for Conduit CB-1_Overflow is below downstream node invert elevation.
Assumed conduit outlet invert elevation equal to downstream node invert elevation.
WARNING 004 : Minimum elevation drop used for Conduit CB-1_Overflow.
WARNING 005 : Minimum slope used for Conduit CB-1_Overflow.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CIT-9_Overflow is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet EX-CB15.
WARNING 116 : Conduit inlet invert elevation defined for Conduit Link-17 is below upstream node invert elevation.
Assumed conduit inlet invert elevation equal to upstream node invert elevation.
WARNING 004 : Minimum elevation drop used for Conduit Link-17.
WARNING 005 : Minimum slope used for Conduit Link-17.

Analysis began on: Tue Jan 31 11:03:17 2023
Analysis ended on: Tue Jan 31 11:03:18 2023
Total elapsed time: 00:00:01

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.2.165 (Build 0)

****
Project Description
****
File Name .... Grove_St_Ph2_r1-EX.SPF

****
Analysis Options
****
Flow Units .... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration...... SCS TR-55
Return Period.............. 25 years
Link Routing Method .... Kinematic Wave
Storage Node Exfiltration.. None
Starting Date DEC-20-2022 00:00:00
Ending Date DEC-21-2022 00:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 11
Number of nodes 21
Number of links 14

****
Subbasin Summary
****

Subbasin ID	Total Area acres
Sub-CB-1	0.36
Sub-CB-10-11	0.33
Sub-CB-12-14	1.61
Sub-CB-15-17	0.69
Sub-CB-18-19	0.95
Sub-CB-20	1.49
Sub-CB-2-5	3.91
Sub-CB-6	0.14
Sub-CB-7	0.11
Sub-CB-8W	0.22
Sub-CB-9	0.15

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft^2	External Inflow
CIT-8	JUNCTION	254.80	259.42	0.00	
DH-10	JUNCTION	265.15	268.15	0.00	
DH-13	JUNCTION	259.80	265.60	0.00	
DH-20	JUNCTION	277.62	279.12	0.00	
EX-18	JUNCTION	266.00	273.24	0.00	
EX-7	JUNCTION	252.80	258.62	0.00	
Structure - (72)	JUNCTION	275.79	277.57	0.00	

DP-1	OUTFALL	275.00	276.00	0.00
DP-10	OUTFALL	264.78	265.78	0.00
DP-13	OUTFALL	259.60	260.60	0.00
DP-16	OUTFALL	252.66	252.66	0.00
DP-18	OUTFALL	264.36	265.86	0.00
DP-20	OUTFALL	274.20	275.70	0.00
DP-5	OUTFALL	248.00	248.00	0.00
DP-6	OUTFALL	246.50	246.50	0.00
DP-7	OUTFALL	252.60	253.60	0.00
Out-01	OUTFALL	281.22	281.50	0.00

****
Inlet Summary
****

Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation ft	Inlet Rim Elevation ft	Ponded Area ft^2	Initial Water Elevation ft	Grate Clogging Factor %
CB-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	278.10	281.22	-	278.10	0.00
CB-18	FHWA HEC-22 GENERIC	N/A	On Sag	1	269.61	273.72	10.00	269.61	0.00
EX-CB15	FHWA HEC-22 GENERIC	N/A	On Grade	1	254.80	259.20	-	254.80	0.00
EX-CB-16	FHWA HEC-22 GENERIC	N/A	On Grade	1	257.40	262.30	-	257.40	0.00

****
Roadway and Gutter Summary
****

Inlet ID	Roadway Longitudinal Slope ft/ft	Roadway Cross Slope ft/ft	Roadway Manning's Roughness	Gutter Cross Slope ft/ft	Gutter Width ft	Gutter Depression in
CB-1	0.0100	0.0200	0.0160	0.0620	2.00	2.00
CB-18	-	0.0200	0.0160	0.0620	2.00	2.00
EX-CB15	0.0100	0.0200	0.0160	0.0620	2.00	2.00
EX-CB-16	0.0100	0.0200	0.0160	0.0620	2.00	2.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
CB-1_Overflow	CB-1	Out-01	CHANNEL	241.8	0.2000	0.0130
CIT-9_Overflow	EX-CB-16	EX-CB15	CHANNEL	230.0	1.3478	0.0130
Link-17	EX-CB15	CIT-8	CONDUIT	8.9	0.2000	0.0150
Link-18	EX-CB15	DP-7	CHANNEL	220.5	2.9927	0.0130
Pipe - (21)	CIT-8	EX-7	CONDUIT	196.9	1.0156	0.0130
Pipe - (22)	EX-7	DP-7	CONDUIT	20.0	1.0000	0.0130
Pipe - (25)	EX-CB-16	CIT-8	CONDUIT	219.0	1.1872	0.0130
Pipe - (33)	DH-13	DP-13	CONDUIT	19.5	1.0000	0.0130
Pipe - (44)	CB-18	EX-18	CONDUIT	24.4	2.4990	0.0130
Pipe - (45)	EX-18	DP-18	CONDUIT	81.8	2.0000	0.0130

Pipe - (56)	DH-10	DP-10	CONDUIT	12.4	3.0000	0.0130
Pipe - (57)	DH-20	DP-20	CONDUIT	55.5	6.1644	0.0150
Pipe - (61)	CB-1	Structure - (72)	CONDUIT	79.8	2.7583	0.0130
Pipe - (62)	Structure - (72)	DP-1	CONDUIT	79.0	1.0000	0.0130

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
CB-1_Overflow	TRIANGULAR	0.28	14.00	1	1.96	0.14	2.70
CIT-9_Overflow	TRIANGULAR	0.28	14.00	1	1.96	0.14	7.01
Link-17	CIRCULAR	1.50	1.50	1	1.77	0.38	4.07
Link-18	TRIANGULAR	0.28	14.00	1	1.96	0.14	10.44
Pipe - (21)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.59
Pipe - (22)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (25)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.88
Pipe - (33)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (44)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.63
Pipe - (45)	CIRCULAR	1.50	1.50	1	1.77	0.38	14.86
Pipe - (56)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.17
Pipe - (57)	CIRCULAR	1.50	1.50	1	1.77	0.38	22.60
Pipe - (61)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.92
Pipe - (62)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56

****
Transect Summary
****

Transect XS-L-Pipe - (13)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (16)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (18)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670

	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (2)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (24)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487

	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (27)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (28)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (30)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (37)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (50)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046

```
            0.6487     0.6927     0.7368     0.7809     0.8249
            0.8690     0.9131     0.9572     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000

Transect XS-L-Pipe - (55)
Area:
            0.0005     0.0019     0.0043     0.0076     0.0118
            0.0170     0.0232     0.0305     0.0390     0.0487
            0.0595     0.0715     0.0847     0.0990     0.1145
            0.1312     0.1491     0.1682     0.1884     0.2098
            0.2323     0.2561     0.2810     0.3071     0.3338
            0.3604     0.3871     0.4137     0.4404     0.4670
            0.4937     0.5203     0.5470     0.5736     0.6003
            0.6269     0.6536     0.6802     0.7069     0.7335
            0.7602     0.7868     0.8135     0.8401     0.8668
            0.8934     0.9201     0.9467     0.9734     1.0000
Hrad:
            0.0139     0.0278     0.0418     0.0557     0.0696
            0.0835     0.0963     0.1080     0.1202     0.1329
            0.1459     0.1591     0.1724     0.1858     0.1994
            0.2130     0.2267     0.2404     0.2542     0.2680
            0.2818     0.2957     0.3095     0.3238     0.3512
            0.3784     0.4055     0.4326     0.4595     0.4863
            0.5130     0.5396     0.5660     0.5924     0.6187
            0.6448     0.6708     0.6968     0.7226     0.7483
            0.7740     0.7995     0.8249     0.8502     0.8754
            0.9005     0.9256     0.9505     0.9753     1.0000
Width:
            0.0355     0.0711     0.1066     0.1422     0.1777
            0.2132     0.2520     0.2961     0.3402     0.3842
            0.4283     0.4724     0.5164     0.5605     0.6046
            0.6487     0.6927     0.7368     0.7809     0.8249
            0.8690     0.9131     0.9572     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000


**************************        Volume         Depth
Runoff Quantity Continuity       acre-ft        inches
**************************     ---------       -------
Total Precipitation ......         1.354         1.630
Continuity Error (%) .....         0.706


**************************        Volume        Volume
Flow Routing Continuity          acre-ft      Mgallons
**************************     ---------     ---------
External Inflow ..........         0.000         0.000
External Outflow .........         0.398         0.130
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....        -0.043


**************************************
Runoff Coefficient Computations Report
**************************************

--------------------
```

Subbasin Sub-CB-1

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.12	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.25	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.36		0.45

Subbasin Sub-CB-10-11

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.17	A (6%+)	0.79
Forest, 25 years or greater	0.16	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.33		0.48

Subbasin Sub-CB-12-14

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.39	A (6%+)	0.79
Forest, 25 years or greater	1.23	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.61		0.30

Subbasin Sub-CB-15-17

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.17	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.35	A (6%+)	0.29
Streets, 25 years or greater	0.16	B (0-2%)	0.80
Composite Area & Weighted Runoff Coeff.	0.69		0.54

Subbasin Sub-CB-18-19

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.44	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.51	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.95		0.52

Subbasin Sub-CB-20

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.45	A (6%+)	0.79
Forest, 25 years or greater	1.05	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.49		0.33

Subbasin Sub-CB-2-5

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.55	A (6%+)	0.79
Forest, 25 years or greater	3.36	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	3.91		0.23

Subbasin Sub-CB-6

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.09	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.05	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.14		0.59

Subbasin Sub-CB-7

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.08	A (0-2%)	0.76
Residential Lot Size 1 Acre, 25 years or greater	0.03	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.11		0.63

Subbasin Sub-CB-8W

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.16	A (2-6%)	0.77
Meadow, 25 years or greater	0.06	A (2-6%)	0.22
Composite Area & Weighted Runoff Coeff.	0.22		0.61

Subbasin Sub-CB-9

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.11	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.03	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.15		0.65

SCS TR-55 Time of Concentration Computations Report

Sheet Flow Equation

```
Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n  = Manning's Roughness
Lf = Flow Length (ft)
P  = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)
```

Shallow Concentrated Flow Equation

```
V  = 16.1345 * (Sf^0.5) (unpaved surface)
```

```
        V  = 20.3282 * (Sf^0.5) (paved surface)
        V  = 15.0 * (Sf^0.5) (grassed waterway surface)
        V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
        V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
        V  = 7.0 * (Sf^0.5) (short grass pasture surface)
        V  = 5.0 * (Sf^0.5) (woodland surface)
        V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)

  Channel Flow Equation
  ---------------------

        V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
        R  = Aq / Wp
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        R  = Hydraulic Radius (ft)
        Aq = Flow Area (ft²)
        Wp = Wetted Perimeter (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)
        n  = Manning's Roughness

  --------------------
  Subbasin Sub-CB-1
  --------------------

  Sheet Flow Computations
  -----------------------
```

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	33.69	0.00	0.00
Slope (%):	1.60	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	9.26	0.00	0.00

```
  Shallow Concentrated Flow Computations
  --------------------------------------
```

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	329.84	0.00	0.00
Slope (%):	0.77	0.00	0.00
Surface Type:	Paved	Paved	Paved
Velocity (ft/sec):	1.79	0.00	

0.00
        Computed Flow Time (minutes):   3.08   0.00
0.00

==
        Total TOC (minutes):   12.34

==

  Subbasin Sub-CB-10-11

  Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	82.40	0.00	0.00
Slope (%):	22.88	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.21	0.00	0.00
Computed Flow Time (minutes):	6.54	0.00	0.00

  Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	332.66	0.00	0.00
Slope (%):	2.02	0.00	0.00
Surface Type:	Paved	Paved	Paved
Velocity (ft/sec):	2.89	0.00	0.00
Computed Flow Time (minutes):	1.92	0.00	0.00

==
        Total TOC (minutes):   8.46

==

  Subbasin Sub-CB-12-14

  Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	222.41	0.00	0.00
Slope (%):	10.60	0.00	0.00

```
          2 yr, 24 hr Rainfall (in):                 3.60                0.00
0.00
          Velocity (ft/sec):                         0.19                0.00
0.00
          Computed Flow Time (minutes):             19.69                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A           Subarea B            Subarea
C
          Flow Length (ft):                        430.84                0.00
0.00
          Slope (%):                                 3.53                0.00
0.00
          Surface Type:                             Paved               Paved
Paved
          Velocity (ft/sec):                         3.82                0.00
0.00
          Computed Flow Time (minutes):              1.88                0.00
0.00

==================================================================================================
          Total TOC (minutes):                      21.57

==================================================================================================


  ------------------------
  Subbasin Sub-CB-15-17
  ------------------------

          User-Defined TOC override (minutes):      5.00

  ------------------------
  Subbasin Sub-CB-18-19
  ------------------------

          User-Defined TOC override (minutes):      5.00

  ---------------------
  Subbasin Sub-CB-20
  ---------------------

  Sheet Flow Computations
  -----------------------
                                                Subarea A           Subarea B            Subarea
C
          Manning's Roughness:                       0.40                0.00
0.00
          Flow Length (ft):                        227.22                0.00
0.00
          Slope (%):                                 7.48                0.00
0.00
          2 yr, 24 hr Rainfall (in):                 3.60                0.00
0.00
          Velocity (ft/sec):                         0.16                0.00
0.00
          Computed Flow Time (minutes):             23.04                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A           Subarea B            Subarea
C
          Flow Length (ft):                        193.35                0.00
```

```
0.00
        Slope (%):                                   2.77              0.00
0.00
        Surface Type:                               Paved             Paved
Paved
        Velocity (ft/sec):                           3.38              0.00
0.00
        Computed Flow Time (minutes):                0.95              0.00
0.00

================================================================================================
        Total TOC (minutes):                        23.99

================================================================================================


  ----------------------
  Subbasin Sub-CB-2-5
  ----------------------

  Sheet Flow Computations
  -----------------------
                                                Subarea A         Subarea B            Subarea
C
        Manning's Roughness:                         0.40              0.00
0.00
        Flow Length (ft):                          526.06              0.00
0.00
        Slope (%):                                   1.65              0.00
0.00
        2 yr, 24 hr Rainfall (in):                   3.60              0.00
0.00
        Velocity (ft/sec):                           0.11              0.00
0.00
        Computed Flow Time (minutes):               82.52              0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A         Subarea B            Subarea
C
        Flow Length (ft):                          591.37              0.00
0.00
        Slope (%):                                   2.70              0.00
0.00
        Surface Type:                             Unpaved             Paved
Paved
        Velocity (ft/sec):                           2.65              0.00
0.00
        Computed Flow Time (minutes):                3.72              0.00
0.00

================================================================================================
        Total TOC (minutes):                        86.24

================================================================================================


  --------------------
  Subbasin Sub-CB-6
  --------------------

        User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-7
```

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-8W

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-9

User-Defined TOC override (minutes): 5.00

****
Subbasin Runoff Summary
****

Subbasin ID	Accumulated Precip in	Rainfall Intensity in/hr	Total Runoff in	Peak Runoff cfs	Weighted Runoff Coeff	Time of Concentration days	hh:mm:ss
Sub-CB-1	1.11	5.40	0.50	0.88	0.450	0	00:12:20
Sub-CB-10-11	0.94	6.60	0.45	1.03	0.480	0	00:08:27
Sub-CB-12-14	1.43	3.98	0.43	1.93	0.300	0	00:21:34
Sub-CB-15-17	0.73	8.75	0.39	3.26	0.540	0	00:05:00
Sub-CB-18-19	0.73	8.75	0.38	4.31	0.520	0	00:05:00
Sub-CB-20	1.50	3.75	0.50	1.85	0.330	0	00:23:59
Sub-CB-2-5	2.39	1.66	0.55	1.50	0.230	0	01:26:14
Sub-CB-6	0.73	8.75	0.43	0.74	0.590	0	00:05:00
Sub-CB-7	0.73	8.75	0.46	0.60	0.630	0	00:05:00
Sub-CB-8W	0.73	8.75	0.44	1.18	0.610	0	00:05:00
Sub-CB-9	0.73	8.75	0.47	0.84	0.650	0	00:05:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
CIT-8	0.00	0.50	255.30	0	00:05	0	0	0:00:00
DH-10	0.00	0.28	265.43	0	00:08	0	0	0:00:00
DH-13	0.01	0.52	260.32	0	00:21	0	0	0:00:00
DH-20	0.01	0.29	277.91	0	00:24	0	0	0:00:00
EX-18	3.00	3.65	269.65	0	00:05	0	0	0:00:00
EX-7	0.00	0.50	253.30	0	00:05	0	0	0:00:00
Structure - (72)	0.11	0.35	276.14	0	00:12	0	0	0:00:00
DP-1	0.00	0.31	275.31	0	00:12	0	0	0:00:00
DP-10	0.00	0.28	265.05	0	00:08	0	0	0:00:00
DP-13	0.01	0.52	260.12	0	00:21	0	0	0:00:00
DP-16	0.00	0.00	252.66	0	00:00	0	0	0:00:00
DP-18	0.01	0.55	264.91	0	00:05	0	0	0:00:00
DP-20	0.01	0.29	274.49	0	00:24	0	0	0:00:00
DP-5	0.00	0.00	248.00	0	00:00	0	0	0:00:00
DP-6	0.00	0.00	246.50	0	00:00	0	0	0:00:00
DP-7	0.00	0.50	253.10	0	00:06	0	0	0:00:00
Out-01	0.00	0.08	281.30	0	00:16	0	0	0:00:00

```
  *****************
  Node Flow Summary
  *****************

  ----------------------------------------------------------------------------------
  Node                 Element      Maximum     Peak      Time of  Maximum Time of Peak
  ID                      Type      Lateral   Inflow   Peak Inflow Flooding     Flooding
                                     Inflow             Occurrence Overflow   Occurrence
                                        cfs      cfs  days  hh:mm       cfs  days  hh:mm
  ----------------------------------------------------------------------------------
  CIT-8                 JUNCTION       1.18     1.82     0  00:05      0.00
  DH-10                 JUNCTION       1.03     1.03     0  00:08      0.00
  DH-13                 JUNCTION       1.93     1.93     0  00:21      0.00
  DH-20                 JUNCTION       1.85     1.85     0  00:24      0.00
  EX-18                 JUNCTION       0.00     4.30     0  00:05      0.00
  EX-7                  JUNCTION       0.00     1.78     0  00:05      0.00
  Structure - (72)      JUNCTION       0.00     0.75     0  00:12      0.00
  DP-1                  OUTFALL        0.00     0.75     0  00:12      0.00
  DP-10                 OUTFALL        0.00     1.03     0  00:08      0.00
  DP-13                 OUTFALL        0.00     1.92     0  00:21      0.00
  DP-16                 OUTFALL        3.26     3.26     0  00:05      0.00
  DP-18                 OUTFALL        0.00     4.27     0  00:05      0.00
  DP-20                 OUTFALL        0.00     1.85     0  00:24      0.00
  DP-5                  OUTFALL        1.50     1.50     0  01:26      0.00
  DP-6                  OUTFALL        0.74     0.74     0  00:05      0.00
  DP-7                  OUTFALL        0.60     2.28     0  00:05      0.00
  Out-01                OUTFALL        0.00     0.10     0  00:16      0.00


  *******************
  Inlet Depth Summary
  *******************

  -------------------------------------------------------------------------
  Inlet              Max Gutter    Max Gutter      Max Gutter        Time of
  ID                     Spread    Water Elev     Water Depth        Maximum
                         during        during          during          Depth
                      Peak Flow     Peak Flow       Peak Flow     Occurrence
                             ft            ft              ft    days  hh:mm
  -------------------------------------------------------------------------
  CB-1                     5.78        281.42            0.20       0  00:12
  CB-18                   14.81        274.12            0.40       0  00:05
  EX-CB15                  1.41        259.29            0.09       0  00:07
  EX-CB-16                 5.62        262.50            0.20       0  00:05


  ******************
  Inlet Flow Summary
  ******************


-----------------------------------------------------------------------------------------------
-
  Inlet                     Peak     Peak           Peak         Peak         Inlet      Total
Total
  ID                        Flow  Lateral           Flow         Flow    Efficiency   Flooding
Time
                                     Flow    Intercepted    Bypassing        during
Flooded
                                                by Inlet        Inlet     Peak Flow
                             cfs      cfs            cfs          cfs             %    acre-in
minutes

-----------------------------------------------------------------------------------------------
```

-

CB-1	0.88	0.88	0.76	0.12	86.02	0.000
0						
CB-18	4.31	4.31	-	-	-	0.000
0						
EX-CB15	0.08	0.00	0.08	0.00	100.00	0.000
0						
EX-CB-16	0.84	0.84	0.73	0.11	86.91	0.000
0						

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
DP-1	1.92	0.36	0.75
DP-10	1.19	0.51	1.03
DP-13	3.01	0.96	1.92
DP-16	0.69	1.63	3.26
DP-18	0.88	1.70	4.27
DP-20	3.39	0.91	1.85
DP-5	11.96	0.75	1.50
DP-6	0.69	0.37	0.74
DP-7	1.97	0.45	2.28
Out-01	2.79	0.03	0.10
System	2.85	7.66	12.21

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
CB-1_Overflow	CHANNEL	0 00:16	1.85	1.00	0.10	2.70	0.04	0.28	0	Calculated
CIT-9_Overflow	CHANNEL	0 00:07	3.83	1.00	0.08	7.01	0.01	0.18	0	Calculated
Link-17	CONDUIT	0 00:07	0.91	1.00	0.08	4.07	0.02	0.10	0	Calculated
Link-18	CHANNEL	0 00:10	0.99	1.00	0.00	10.44	0.00	0.04	0	Calculated
Pipe - (21)	CONDUIT	0 00:05	4.66	1.00	1.78	3.59	0.49	0.50	0	Calculated
Pipe - (22)	CONDUIT	0 00:06	4.53	1.00	1.78	3.56	0.50	0.50	0	Calculated
Pipe - (25)	CONDUIT	0 00:05	7.08	1.00	0.69	3.88	0.18	0.28	0	Calculated

```
  Pipe - (33)          CONDUIT      0  00:21      4.63    1.00        1.92        3.56       0.54
0.52          0  Calculated
  Pipe - (44)          CONDUIT      0  00:05      7.92    1.00        4.30        5.63       0.76
0.65          0  Calculated
  Pipe - (45)          CONDUIT      0  00:05      7.31    1.00        4.27       14.86       0.29
0.37          0  Calculated
  Pipe - (56)          CONDUIT      0  00:08      5.83    1.00        1.03        6.17       0.17
0.28          0  Calculated
  Pipe - (57)          CONDUIT      0  00:24      7.72    1.00        1.85       22.60       0.08
0.19          0  Calculated
  Pipe - (61)          CONDUIT      0  00:12      5.84    1.00        0.75        5.92       0.13
0.24          0  Calculated
  Pipe - (62)          CONDUIT      0  00:12      3.61    1.00        0.75        3.56       0.21
0.31          0  Calculated


  ********************************
  Highest Flow Instability Indexes
  ********************************
  All links are stable.

  WARNING 108 : Surcharge elevation defined for Junction EX-18 is below junction maximum
elevation. Assumed surcharge elevation equal to maximum elevation.
  WARNING 139 : Ponded area defined for on sag Inlet CB-18 is zero. Assumed ponded area equal to
10 ft² (0.929 m²).
  WARNING 138 : Initial water surface elevation defined for Inlet EX-CB15 is below catchbasin
invert elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB-1_Overflow
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CIT-9_Overflow
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit CB-1_Overflow is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 004 : Minimum elevation drop used for Conduit CB-1_Overflow.
  WARNING 005 : Minimum slope used for Conduit CB-1_Overflow.
  WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CIT-9_Overflow is below
the storm drain inlet rim elevation.
                Assumed the upstream roadway link outlet invert elevation equal to the storm
drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain
inlet EX-CB15.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Link-17 is below upstream node
invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 004 : Minimum elevation drop used for Conduit Link-17.
  WARNING 005 : Minimum slope used for Conduit Link-17.

  Analysis began on:  Tue Jan 31 11:03:56 2023
  Analysis ended on:  Tue Jan 31 11:03:58 2023
  Total elapsed time: 00:00:02
```

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.2.165 (Build 0)

****
Project Description
****

File Name .... Grove_St_Ph2_r1-EX.SPF

****
Analysis Options
****

Flow Units .... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration...... SCS TR-55
Return Period............. 100 years
Link Routing Method .... Kinematic Wave
Storage Node Exfiltration.. None
Starting Date DEC-20-2022 00:00:00
Ending Date DEC-21-2022 00:00:00
Report Time Step 00:00:10

****
Element Count
****

Number of subbasins 11
Number of nodes 21
Number of links 14

****
Subbasin Summary
****

Subbasin ID	Total Area acres
Sub-CB-1	0.36
Sub-CB-10-11	0.33
Sub-CB-12-14	1.61
Sub-CB-15-17	0.69
Sub-CB-18-19	0.95
Sub-CB-20	1.49
Sub-CB-2-5	3.91
Sub-CB-6	0.14
Sub-CB-7	0.11
Sub-CB-8W	0.22
Sub-CB-9	0.15

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
CIT-8	JUNCTION	254.80	259.42	0.00	
DH-10	JUNCTION	265.15	268.15	0.00	
DH-13	JUNCTION	259.80	265.60	0.00	
DH-20	JUNCTION	277.62	279.12	0.00	
EX-18	JUNCTION	266.00	273.24	0.00	
EX-7	JUNCTION	252.80	258.62	0.00	
Structure - (72)	JUNCTION	275.79	277.57	0.00	

DP-1	OUTFALL	275.00	276.00	0.00
DP-10	OUTFALL	264.78	265.78	0.00
DP-13	OUTFALL	259.60	260.60	0.00
DP-16	OUTFALL	252.66	252.66	0.00
DP-18	OUTFALL	264.36	265.86	0.00
DP-20	OUTFALL	274.20	275.70	0.00
DP-5	OUTFALL	248.00	248.00	0.00
DP-6	OUTFALL	246.50	246.50	0.00
DP-7	OUTFALL	252.60	253.60	0.00
Out-01	OUTFALL	281.22	281.50	0.00

****
Inlet Summary
****

Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation (ft)	Inlet Rim Elevation (ft)	Ponded Area (ft²)	Initial Water Elevation (ft)	Grate Clogging Factor (%)
CB-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	278.10	281.22	-	278.10	0.00
CB-18	FHWA HEC-22 GENERIC	N/A	On Sag	1	269.61	273.72	10.00	269.61	0.00
EX-CB15	FHWA HEC-22 GENERIC	N/A	On Grade	1	254.80	259.20	-	254.80	0.00
EX-CB-16	FHWA HEC-22 GENERIC	N/A	On Grade	1	257.40	262.30	-	257.40	0.00

****
Roadway and Gutter Summary
****

Inlet ID	Roadway Longitudinal Slope ft/ft	Roadway Cross Slope ft/ft	Roadway Manning's Roughness	Gutter Cross Slope ft/ft	Gutter Width ft	Gutter Depression in
CB-1	0.0100	0.0200	0.0160	0.0620	2.00	2.00
CB-18	-	0.0200	0.0160	0.0620	2.00	2.00
EX-CB15	0.0100	0.0200	0.0160	0.0620	2.00	2.00
EX-CB-16	0.0100	0.0200	0.0160	0.0620	2.00	2.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
CB-1_Overflow	CB-1	Out-01	CHANNEL	241.8	0.2000	0.0130
CIT-9_Overflow	EX-CB-16	EX-CB15	CHANNEL	230.0	1.3478	0.0130
Link-17	EX-CB15	CIT-8	CONDUIT	8.9	0.2000	0.0150
Link-18	EX-CB15	DP-7	CHANNEL	220.5	2.9927	0.0130
Pipe - (21)	CIT-8	EX-7	CONDUIT	196.9	1.0156	0.0130
Pipe - (22)	EX-7	DP-7	CONDUIT	20.0	1.0000	0.0130
Pipe - (25)	EX-CB-16	CIT-8	CONDUIT	219.0	1.1872	0.0130
Pipe - (33)	DH-13	DP-13	CONDUIT	19.5	1.0000	0.0130
Pipe - (44)	CB-18	EX-18	CONDUIT	24.4	2.4990	0.0130
Pipe - (45)	EX-18	DP-18	CONDUIT	81.8	2.0000	0.0130

Pipe - (56)	DH-10	DP-10	CONDUIT	12.4	3.0000	0.0130
Pipe - (57)	DH-20	DP-20	CONDUIT	55.5	6.1644	0.0150
Pipe - (61)	CB-1	Structure - (72)	CONDUIT	79.8	2.7583	0.0130
Pipe - (62)	Structure - (72)	DP-1	CONDUIT	79.0	1.0000	0.0130

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
CB-1_Overflow	TRIANGULAR	0.28	14.00	1	1.96	0.14	2.70
CIT-9_Overflow	TRIANGULAR	0.28	14.00	1	1.96	0.14	7.01
Link-17	CIRCULAR	1.50	1.50	1	1.77	0.38	4.07
Link-18	TRIANGULAR	0.28	14.00	1	1.96	0.14	10.44
Pipe - (21)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.59
Pipe - (22)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (25)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.88
Pipe - (33)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (44)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.63
Pipe - (45)	CIRCULAR	1.50	1.50	1	1.77	0.38	14.86
Pipe - (56)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.17
Pipe - (57)	CIRCULAR	1.50	1.50	1	1.77	0.38	22.60
Pipe - (61)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.92
Pipe - (62)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56

****
Transect Summary
****

Transect XS-L-Pipe - (13)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000

Width:

	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (16)
Area:

	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000

Width:

	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (18)
Area:

	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670

	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (2)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (24)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487

	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (27)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (28)
Area:

	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (30)
Area:

	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (37)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (50)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046

```
            0.6487     0.6927     0.7368     0.7809     0.8249
            0.8690     0.9131     0.9572     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000

Transect XS-L-Pipe - (55)
Area:
            0.0005     0.0019     0.0043     0.0076     0.0118
            0.0170     0.0232     0.0305     0.0390     0.0487
            0.0595     0.0715     0.0847     0.0990     0.1145
            0.1312     0.1491     0.1682     0.1884     0.2098
            0.2323     0.2561     0.2810     0.3071     0.3338
            0.3604     0.3871     0.4137     0.4404     0.4670
            0.4937     0.5203     0.5470     0.5736     0.6003
            0.6269     0.6536     0.6802     0.7069     0.7335
            0.7602     0.7868     0.8135     0.8401     0.8668
            0.8934     0.9201     0.9467     0.9734     1.0000
Hrad:
            0.0139     0.0278     0.0418     0.0557     0.0696
            0.0835     0.0963     0.1080     0.1202     0.1329
            0.1459     0.1591     0.1724     0.1858     0.1994
            0.2130     0.2267     0.2404     0.2542     0.2680
            0.2818     0.2957     0.3095     0.3238     0.3512
            0.3784     0.4055     0.4326     0.4595     0.4863
            0.5130     0.5396     0.5660     0.5924     0.6187
            0.6448     0.6708     0.6968     0.7226     0.7483
            0.7740     0.7995     0.8249     0.8502     0.8754
            0.9005     0.9256     0.9505     0.9753     1.0000
Width:
            0.0355     0.0711     0.1066     0.1422     0.1777
            0.2132     0.2520     0.2961     0.3402     0.3842
            0.4283     0.4724     0.5164     0.5605     0.6046
            0.6487     0.6927     0.7368     0.7809     0.8249
            0.8690     0.9131     0.9572     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000


**************************        Volume         Depth
Runoff Quantity Continuity       acre-ft        inches
**************************     ---------       -------
Total Precipitation ......         1.719         2.070
Continuity Error (%) .....         0.706


**************************        Volume        Volume
Flow Routing Continuity          acre-ft      Mgallons
**************************     ---------     ---------
External Inflow ..........         0.000         0.000
External Outflow .........         0.505         0.165
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....        -0.042


**************************************
Runoff Coefficient Computations Report
**************************************

--------------------
```

Subbasin Sub-CB-1

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.12	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.25	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.36		0.45

Subbasin Sub-CB-10-11

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.17	A (6%+)	0.79
Forest, 25 years or greater	0.16	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.33		0.48

Subbasin Sub-CB-12-14

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.39	A (6%+)	0.79
Forest, 25 years or greater	1.23	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.61		0.30

Subbasin Sub-CB-15-17

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.17	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.35	A (6%+)	0.29
Streets, 25 years or greater	0.16	B (0-2%)	0.80
Composite Area & Weighted Runoff Coeff.	0.69		0.54

Subbasin Sub-CB-18-19

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.44	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.51	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.95		0.52

Subbasin Sub-CB-20

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.45	A (6%+)	0.79
Forest, 25 years or greater	1.05	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.49		0.33

Subbasin Sub-CB-2-5

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

Streets, 25 years or greater	0.55	A (6%+)	0.79
Forest, 25 years or greater	3.36	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	3.91		0.23

Subbasin Sub-CB-6

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.09	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.05	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.14		0.59

Subbasin Sub-CB-7

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.08	A (0-2%)	0.76
Residential Lot Size 1 Acre, 25 years or greater	0.03	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.11		0.63

Subbasin Sub-CB-8W

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.16	A (2-6%)	0.77
Meadow, 25 years or greater	0.06	A (2-6%)	0.22
Composite Area & Weighted Runoff Coeff.	0.22		0.61

Subbasin Sub-CB-9

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.11	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.03	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.15		0.65

SCS TR-55 Time of Concentration Computations Report

Sheet Flow Equation

```
Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n  = Manning's Roughness
Lf = Flow Length (ft)
P  = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)
```

Shallow Concentrated Flow Equation

```
V  = 16.1345 * (Sf^0.5) (unpaved surface)
```

```
V  = 20.3282 * (Sf^0.5) (paved surface)
V  = 15.0 * (Sf^0.5) (grassed waterway surface)
V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V  = 7.0 * (Sf^0.5) (short grass pasture surface)
V  = 5.0 * (Sf^0.5) (woodland surface)
V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V  = Velocity (ft/sec)
Sf = Slope (ft/ft)
```

Channel Flow Equation

```
V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R  = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R  = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V  = Velocity (ft/sec)
Sf = Slope (ft/ft)
n  = Manning's Roughness
```

Subbasin Sub-CB-1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	33.69	0.00	0.00
Slope (%):	1.60	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	9.26	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	329.84	0.00	0.00
Slope (%):	0.77	0.00	0.00
Surface Type:	Paved	Paved	Paved
Velocity (ft/sec):	1.79	0.00	

```
0.00
          Computed Flow Time (minutes):                3.08                0.00
0.00

================================================================================================
          Total TOC (minutes):                        12.34

================================================================================================


  ------------------------
  Subbasin Sub-CB-10-11
  ------------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A           Subarea B            Subarea
C
          Manning's Roughness:                         0.40                0.00
0.00
          Flow Length (ft):                           82.40                0.00
0.00
          Slope (%):                                  22.88                0.00
0.00
          2 yr, 24 hr Rainfall (in):                   3.60                0.00
0.00
          Velocity (ft/sec):                           0.21                0.00
0.00
          Computed Flow Time (minutes):                6.54                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                 Subarea A           Subarea B            Subarea
C
          Flow Length (ft):                          332.66                0.00
0.00
          Slope (%):                                   2.02                0.00
0.00
          Surface Type:                               Paved               Paved
Paved
          Velocity (ft/sec):                           2.89                0.00
0.00
          Computed Flow Time (minutes):                1.92                0.00
0.00

================================================================================================
          Total TOC (minutes):                         8.46

================================================================================================


  ------------------------
  Subbasin Sub-CB-12-14
  ------------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A           Subarea B            Subarea
C
          Manning's Roughness:                         0.40                0.00
0.00
          Flow Length (ft):                          222.41                0.00
0.00
          Slope (%):                                  10.60                0.00
0.00
```

```
        2 yr, 24 hr Rainfall (in):                3.60              0.00
0.00
        Velocity (ft/sec):                        0.19              0.00
0.00
        Computed Flow Time (minutes):            19.69              0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                             Subarea A         Subarea B         Subarea
C
        Flow Length (ft):                       430.84              0.00
0.00
        Slope (%):                                3.53              0.00
0.00
        Surface Type:                            Paved             Paved
Paved
        Velocity (ft/sec):                        3.82              0.00
0.00
        Computed Flow Time (minutes):             1.88              0.00
0.00

================================================================================================
        Total TOC (minutes):                     21.57

================================================================================================


  ------------------------
  Subbasin Sub-CB-15-17
  ------------------------

        User-Defined TOC override (minutes):      5.00

  ------------------------
  Subbasin Sub-CB-18-19
  ------------------------

        User-Defined TOC override (minutes):      5.00

  ---------------------
  Subbasin Sub-CB-20
  ---------------------

  Sheet Flow Computations
  -----------------------
                                             Subarea A         Subarea B         Subarea
C
        Manning's Roughness:                      0.40              0.00
0.00
        Flow Length (ft):                       227.22              0.00
0.00
        Slope (%):                                7.48              0.00
0.00
        2 yr, 24 hr Rainfall (in):                3.60              0.00
0.00
        Velocity (ft/sec):                        0.16              0.00
0.00
        Computed Flow Time (minutes):            23.04              0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                             Subarea A         Subarea B         Subarea
C
        Flow Length (ft):                       193.35              0.00
```

```
0.00
         Slope (%):                               2.77          0.00
0.00
         Surface Type:                           Paved         Paved
Paved
         Velocity (ft/sec):                       3.38          0.00
0.00
         Computed Flow Time (minutes):            0.95          0.00
0.00

================================================================================================
         Total TOC (minutes):                    23.99

================================================================================================


  ---------------------
  Subbasin Sub-CB-2-5
  ---------------------

  Sheet Flow Computations
  -----------------------
                                             Subarea A     Subarea B     Subarea
C
         Manning's Roughness:                     0.40          0.00
0.00
         Flow Length (ft):                      526.06          0.00
0.00
         Slope (%):                               1.65          0.00
0.00
         2 yr, 24 hr Rainfall (in):               3.60          0.00
0.00
         Velocity (ft/sec):                       0.11          0.00
0.00
         Computed Flow Time (minutes):           82.52          0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                             Subarea A     Subarea B     Subarea
C
         Flow Length (ft):                      591.37          0.00
0.00
         Slope (%):                               2.70          0.00
0.00
         Surface Type:                         Unpaved         Paved
Paved
         Velocity (ft/sec):                       2.65          0.00
0.00
         Computed Flow Time (minutes):            3.72          0.00
0.00

================================================================================================
         Total TOC (minutes):                    86.24

================================================================================================


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  Subbasin Sub-CB-6
  --------------------

         User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-7
```

User-Defined TOC override (minutes):   5.00

Subbasin Sub-CB-8W

User-Defined TOC override (minutes):   5.00

Subbasin Sub-CB-9

User-Defined TOC override (minutes):   5.00

****
Subbasin Runoff Summary
****

Subbasin ID	Accumulated Precip in	Rainfall Intensity in/hr	Total Runoff in	Peak Runoff cfs	Weighted Runoff Coeff	Time of Concentration days	Time of Concentration hh:mm:ss
Sub-CB-1	1.41	6.86	0.63	1.12	0.450	0	00:12:20
Sub-CB-10-11	1.19	8.39	0.57	1.31	0.480	0	00:08:27
Sub-CB-12-14	1.82	5.07	0.54	2.45	0.300	0	00:21:34
Sub-CB-15-17	0.93	11.10	0.50	4.14	0.540	0	00:05:00
Sub-CB-18-19	0.93	11.10	0.48	5.47	0.520	0	00:05:00
Sub-CB-20	1.91	4.78	0.63	2.36	0.330	0	00:23:59
Sub-CB-2-5	3.03	2.11	0.70	1.90	0.230	0	01:26:14
Sub-CB-6	0.93	11.10	0.55	0.93	0.590	0	00:05:00
Sub-CB-7	0.93	11.10	0.58	0.76	0.630	0	00:05:00
Sub-CB-8W	0.93	11.10	0.56	1.49	0.610	0	00:05:00
Sub-CB-9	0.93	11.10	0.60	1.06	0.650	0	00:05:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
CIT-8	0.00	0.58	255.38	0	00:05	0	0	0:00:00
DH-10	0.00	0.31	265.46	0	00:08	0	0	0:00:00
DH-13	0.01	0.61	260.41	0	00:21	0	0	0:00:00
DH-20	0.01	0.33	277.95	0	00:24	0	0	0:00:00
EX-18	3.00	3.79	269.79	0	00:05	0	0	0:00:00
EX-7	0.00	0.58	253.38	0	00:05	0	0	0:00:00
Structure - (72)	0.11	0.38	276.17	0	00:12	0	0	0:00:00
DP-1	0.00	0.34	275.34	0	00:12	0	0	0:00:00
DP-10	0.00	0.31	265.09	0	00:08	0	0	0:00:00
DP-13	0.01	0.61	260.21	0	00:21	0	0	0:00:00
DP-16	0.00	0.00	252.66	0	00:00	0	0	0:00:00
DP-18	0.01	0.63	264.99	0	00:05	0	0	0:00:00
DP-20	0.01	0.33	274.53	0	00:24	0	0	0:00:00
DP-5	0.00	0.00	248.00	0	00:00	0	0	0:00:00
DP-6	0.00	0.00	246.50	0	00:00	0	0	0:00:00
DP-7	0.00	0.58	253.18	0	00:06	0	0	0:00:00
Out-01	0.00	0.10	281.32	0	00:16	0	0	0:00:00

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Node Flow Summary
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Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
CIT-8	JUNCTION	1.49	2.31	0	00:05	0.00		
DH-10	JUNCTION	1.31	1.31	0	00:08	0.00		
DH-13	JUNCTION	2.45	2.45	0	00:21	0.00		
DH-20	JUNCTION	2.36	2.36	0	00:24	0.00		
EX-18	JUNCTION	0.00	5.45	0	00:05	0.00		
EX-7	JUNCTION	0.00	2.27	0	00:05	0.00		
Structure - (72)	JUNCTION	0.00	0.91	0	00:12	0.00		
DP-1	OUTFALL	0.00	0.91	0	00:12	0.00		
DP-10	OUTFALL	0.00	1.31	0	00:08	0.00		
DP-13	OUTFALL	0.00	2.45	0	00:21	0.00		
DP-16	OUTFALL	4.14	4.14	0	00:05	0.00		
DP-18	OUTFALL	0.00	5.41	0	00:05	0.00		
DP-20	OUTFALL	0.00	2.35	0	00:24	0.00		
DP-5	OUTFALL	1.90	1.90	0	01:26	0.00		
DP-6	OUTFALL	0.93	0.93	0	00:05	0.00		
DP-7	OUTFALL	0.76	2.92	0	00:05	0.00		
Out-01	OUTFALL	0.00	0.16	0	00:16	0.00		

```
*******************
Inlet Depth Summary
*******************
```

Inlet ID	Max Gutter Spread during Peak Flow ft	Max Gutter Water Elev during Peak Flow ft	Max Gutter Water Depth during Peak Flow ft	Time of Maximum Depth Occurrence days	Time of Maximum Depth Occurrence hh:mm
CB-1	6.53	281.43	0.21	0	00:12
CB-18	17.55	274.18	0.46	0	00:05
EX-CB15	1.68	259.30	0.10	0	00:06
EX-CB-16	6.36	262.51	0.21	0	00:05

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******************
Inlet Flow Summary
******************
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Inlet ID	Peak Flow cfs	Peak Lateral Flow cfs	Peak Flow Intercepted by Inlet cfs	Peak Flow Bypassing Inlet cfs	Inlet Efficiency during Peak Flow %	Total Flooding acre-in	Total Time Flooded minutes

-

CB-1	1.12	1.12	0.92	0.21	81.74	0.000	0
CB-18	5.47	5.47	-	-	-	0.000	0
EX-CB15	0.14	0.00	0.14	0.00	100.00	0.000	0
EX-CB-16	1.06	1.06	0.88	0.18	82.70	0.000	0

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
DP-1	1.93	0.44	0.91
DP-10	1.19	0.65	1.31
DP-13	3.01	1.21	2.45
DP-16	0.69	2.07	4.14
DP-18	0.88	2.15	5.41
DP-20	3.39	1.16	2.35
DP-5	11.96	0.95	1.90
DP-6	0.69	0.47	0.93
DP-7	2.00	0.57	2.92
Out-01	2.83	0.04	0.16
System	2.86	9.71	15.51

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
CB-1_Overflow	CHANNEL	0 00:16	2.01	1.00	0.16	2.70	0.06	0.34	0	Calculated
CIT-9_Overflow	CHANNEL	0 00:06	4.18	1.00	0.14	7.01	0.02	0.22	0	Calculated
Link-17	CONDUIT	0 00:07	1.05	1.00	0.13	4.07	0.03	0.12	0	Calculated
Link-18	CHANNEL	0 00:09	1.16	1.00	0.01	10.44	0.00	0.06	0	Calculated
Pipe - (21)	CONDUIT	0 00:05	4.94	1.00	2.27	3.59	0.63	0.58	0	Calculated
Pipe - (22)	CONDUIT	0 00:06	4.81	1.00	2.27	3.56	0.64	0.58	0	Calculated
Pipe - (25)	CONDUIT	0 00:05	7.46	1.00	0.85	3.88	0.22	0.32	0	Calculated

```
  Pipe - (33)          CONDUIT      0  00:21      4.89    1.00        2.45        3.56       0.69
0.61          0  Calculated
  Pipe - (44)          CONDUIT      0  00:05      8.20    1.00        5.45        5.63       0.97
0.79          0  Calculated
  Pipe - (45)          CONDUIT      0  00:05      7.79    1.00        5.41       14.86       0.36
0.42          0  Calculated
  Pipe - (56)          CONDUIT      0  00:08      6.24    1.00        1.31        6.17       0.21
0.31          0  Calculated
  Pipe - (57)          CONDUIT      0  00:24      8.28    1.00        2.35       22.60       0.10
0.22          0  Calculated
  Pipe - (61)          CONDUIT      0  00:12      6.17    1.00        0.91        5.92       0.15
0.26          0  Calculated
  Pipe - (62)          CONDUIT      0  00:12      3.80    1.00        0.91        3.56       0.25
0.34          0  Calculated


  ********************************
  Highest Flow Instability Indexes
  ********************************
  All links are stable.

  WARNING 108 : Surcharge elevation defined for Junction EX-18 is below junction maximum
elevation. Assumed surcharge elevation equal to maximum elevation.
  WARNING 139 : Ponded area defined for on sag Inlet CB-18 is zero. Assumed ponded area equal to
10 ft² (0.929 m²).
  WARNING 138 : Initial water surface elevation defined for Inlet EX-CB15 is below catchbasin
invert elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB-1_Overflow
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CIT-9_Overflow
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit CB-1_Overflow is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 004 : Minimum elevation drop used for Conduit CB-1_Overflow.
  WARNING 005 : Minimum slope used for Conduit CB-1_Overflow.
  WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CIT-9_Overflow is below
the storm drain inlet rim elevation.
                Assumed the upstream roadway link outlet invert elevation equal to the storm
drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain
inlet EX-CB15.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Link-17 is below upstream node
invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 004 : Minimum elevation drop used for Conduit Link-17.
  WARNING 005 : Minimum slope used for Conduit Link-17.

  Analysis began on:  Tue Jan 31 11:04:37 2023
  Analysis ended on:  Tue Jan 31 11:04:39 2023
  Total elapsed time: 00:00:02
```

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.2.165 (Build 0)

****
Project Description
****
File Name .... Grove_St_Ph2_r1-PR.SPF

****
Analysis Options
****
Flow Units .... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration...... SCS TR-55
Return Period.............. 2 years
Link Routing Method .... Kinematic Wave
Storage Node Exfiltration.. None
Starting Date DEC-20-2022 00:00:00
Ending Date DEC-21-2022 00:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 17
Number of nodes 50
Number of links 52

****
Subbasin Summary
****

Subbasin ID	Total Area acres
Sub-CB-1	0.36
Sub-CB-10	0.13
Sub-CB-11	0.20
Sub-CB-12	1.28
Sub-CB-13-14	0.34
Sub-CB-15-16	0.40
Sub-CB-17	0.29
Sub-CB-18-19	0.95
Sub-CB-2	0.40
Sub-CB-20	1.49
Sub-CB-3	2.84
Sub-CB-4	0.34
Sub-CB-5	0.33
Sub-CB-6	0.14
Sub-CB-7	0.11
Sub-CB-8W	0.22
Sub-CB-9	0.15

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft^2	External Inflow
CB-8E	JUNCTION	257.54	259.20	0.00	

CIT-8	JUNCTION	254.80	259.42	0.00
CIT-9	JUNCTION	257.40	262.67	0.00
DH-10	JUNCTION	265.15	268.15	0.00
DH-13	JUNCTION	259.80	265.60	0.00
DH-20	JUNCTION	277.62	280.21	0.00
DH-6	JUNCTION	246.95	255.72	0.00
DMH-10	JUNCTION	265.32	267.86	0.00
DMH-11	JUNCTION	268.75	272.24	0.00
DMH-12	JUNCTION	267.70	271.08	0.00
DMH-13	JUNCTION	262.77	265.40	0.00
DMH-20	JUNCTION	277.65	280.22	0.00
DMH-3	JUNCTION	262.24	265.34	0.00
DMH-4N	JUNCTION	252.85	255.95	0.00
DMH-4S	JUNCTION	257.13	262.56	0.00
DMH-6	JUNCTION	247.40	257.58	0.00
DMH-7	JUNCTION	254.10	258.76	0.00
EX-18	JUNCTION	266.00	273.24	0.00
EX-7	JUNCTION	252.80	258.62	0.00
Structure - (72)	JUNCTION	275.79	277.57	0.00
STU-16	JUNCTION	252.70	255.49	0.00
STU-5	JUNCTION	248.63	251.88	0.00
DP-1	OUTFALL	275.00	276.00	0.00
DP-10	OUTFALL	264.78	265.78	0.00
DP-13	OUTFALL	259.60	260.60	0.00
DP-16	OUTFALL	252.66	253.66	0.00
DP-18	OUTFALL	264.36	265.86	0.00
DP-20	OUTFALL	274.20	275.70	0.00
DP-5	OUTFALL	248.00	249.00	0.00
DP-6	OUTFALL	246.50	247.50	0.00
DP-7	OUTFALL	252.60	253.60	0.00
OFFSITE1	OUTFALL	281.22	281.50	0.00
OFFSITE-1	OUTFALL	267.68	268.43	0.00

****
Inlet Summary
****

Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation (ft)	Inlet Rim Elevation (ft)	Ponded Area (ft^2)	Initial Water Elevation (ft)	Grate Clogging Factor (%)
CB-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	278.10	281.22	-	278.10	0.00
CB-10	FHWA HEC-22 GENERIC	N/A	On Grade	1	265.44	267.69	-	265.44	0.00
CB-11	FHWA HEC-22 GENERIC	N/A	On Grade	1	269.10	272.10	-	269.10	0.00
CB-12	FHWA HEC-22 GENERIC	N/A	On Grade	1	268.07	271.07	-	268.07	0.00
CB-13	FHWA HEC-22 GENERIC	N/A	On Sag	1	262.90	264.85	10.00	262.90	0.00
CB-16	FHWA HEC-22 GENERIC	N/A	On Sag	1	252.93	254.93	10.00	252.93	0.00
CB-17	FHWA HEC-22 GENERIC	N/A	On Grade	1	260.16	265.49	-	260.16	0.00
CB-18	FHWA HEC-22 GENERIC	N/A	On Sag	1	269.61	273.72	10.00	269.61	0.00
CB-2	FHWA HEC-22 GENERIC	N/A	On Grade	1	273.82	276.82	-	273.82	0.00

CB-20	FHWA HEC-22 GENERIC	N/A	On Sag	1	278.18	279.67	10.00	278.18	0.00
CB-3	FHWA HEC-22 GENERIC	N/A	On Grade	1	262.89	265.39	-	262.89	0.00
CB-4	FHWA HEC-22 GENERIC	N/A	On Grade	1	254.18	255.93	-	254.18	0.00
CB-5	FHWA HEC-22 GENERIC	N/A	On Sag	1	249.44	251.18	10.00	249.44	0.00
CB-6	FHWA HEC-22 GENERIC	N/A	On Grade	1	252.35	255.35	-	252.35	0.00
CB-7	FHWA HEC-22 GENERIC	N/A	On Grade	1	255.41	258.41	-	255.41	0.00
CB-8W	FHWA HEC-22 GENERIC	N/A	On Grade	1	257.08	260.08	-	257.08	0.00
CB-9	FHWA HEC-22 GENERIC	N/A	On Grade	1	259.82	262.82	-	259.82	0.00

****
Roadway and Gutter Summary
****

Inlet ID	Roadway Longitudinal Slope ft/ft	Roadway Cross Slope ft/ft	Roadway Manning's Roughness	Gutter Cross Slope ft/ft	Gutter Width ft	Gutter Depression in
CB-1	0.0100	0.0200	0.0160	0.0620	2.00	2.00
CB-10	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-11	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-12	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-13	-	0.0500	0.0130	0.0620	2.00	0.00
CB-16	-	0.0500	0.0130	0.0620	2.00	0.00
CB-17	0.0100	0.0200	0.0160	0.0620	2.00	2.00
CB-18	-	0.0200	0.0160	0.0620	2.00	2.00
CB-2	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-20	-	0.0500	0.0130	0.0620	2.00	0.00
CB-3	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-4	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-5	-	0.0500	0.0130	0.0620	2.00	0.00
CB-6	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-7	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-8W	0.0100	0.0200	0.0130	0.0620	2.00	2.00
CB-9	0.0200	0.0500	0.0130	0.0620	2.00	0.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
CB-1_Overflow	CB-1	OFFSITE1	CHANNEL	241.8	0.2000	0.0130
CB10-9_Gutter	CB-10	CB-9	CHANNEL	254.5	1.9133	0.0130
CB11-10_Gutter	CB-11	CB-10	CHANNEL	254.5	1.7326	0.0130
CB12-13_Gutter	CB-12	CB-13	CHANNEL	254.5	2.4437	0.0130
CB17-16_Gutter	CB-17	CB-16	CHANNEL	254.5	4.1501	0.0130
CB2-3_Gutter	CB-2	CB-3	CHANNEL	241.8	4.7276	0.0130
CB3-4_Gutter	CB-3	CB-4	CHANNEL	254.5	3.7167	0.0130
CB4-5_Gutter	CB-4	CB-5	CHANNEL	254.5	1.8662	0.0130
CB6-5_Gutter	CB-6	CB-5	CHANNEL	254.5	1.6383	0.0130
CB7-6_Gutter	CB-7	CB-6	CHANNEL	254.5	1.2022	0.0130
CB8-7_Gutter	CB-8W	CB-7	CHANNEL	254.5	0.6561	0.0130
CB9-8_Gutter	CB-9	CB-8W	CHANNEL	254.5	1.0765	0.0130
L-Pipe - (50)	CB-20	OFFSITE-1	CHANNEL	546.0	2.1967	0.0130
Pipe - (12)	DMH-6	DH-6	CONDUIT	13.3	3.0144	0.0130
Pipe - (13)	CB-6	DMH-6	CONDUIT	12.5	0.7995	0.0130

Pipe - (14)	CB-5	STU-5	CONDUIT	28.8	2.4635	0.0130
Pipe - (16)	CB-3	DMH-3	CONDUIT	11.9	4.6382	0.0130
Pipe - (18)	CB-7	DMH-7	CONDUIT	20.7	1.0000	0.0130
Pipe - (19)	DMH-7	EX-7	CONDUIT	6.9	1.4505	0.0130
Pipe - (2)	CB-2	DMH-3	CONDUIT	246.6	4.6555	0.0130
Pipe - (20)	CB-8E	CIT-8	CONDUIT	7.6	0.6131	0.0130
Pipe - (21)	CIT-8	EX-7	CONDUIT	196.9	1.0156	0.0130
Pipe - (22)	EX-7	DP-7	CONDUIT	20.0	1.0000	0.0130
Pipe - (23)	CB-8W	CIT-8	CONDUIT	20.5	3.2241	0.0130
Pipe - (24)	CB-9	CIT-9	CONDUIT	16.5	0.9092	0.0130
Pipe - (25)	CIT-9	CIT-8	CONDUIT	219.0	1.1872	0.0130
Pipe - (26)	DMH-10	DH-10	CONDUIT	14.0	0.5000	0.0130
Pipe - (27)	CB-10	DMH-10	CONDUIT	4.2	0.5000	0.0130
Pipe - (28)	CB-11	DMH-11	CONDUIT	4.9	5.1092	0.0130
Pipe - (29)	DMH-11	DH-10	CONDUIT	190.5	1.8369	0.0130
Pipe - (3)	DMH-4S	DMH-4N	CONDUIT	131.6	3.1757	0.0130
Pipe - (30)	CB-12	DMH-12	CONDUIT	3.6	1.0000	0.0130
Pipe - (31)	DMH-12	DH-13	CONDUIT	217.3	2.4045	0.0130
Pipe - (33)	DH-13	DP-13	CONDUIT	19.5	1.0000	0.0130
Pipe - (34)	CB-13	DMH-13	CONDUIT	5.9	0.5098	0.0130
Pipe - (35)	DMH-13	DH-13	CONDUIT	19.9	1.0989	0.0130
Pipe - (4)	DMH-4N	STU-5	CONDUIT	263.5	1.5634	0.0130
Pipe - (40)	CB-17	STU-16	CONDUIT	220.1	3.2621	0.0130
Pipe - (41)	STU-16	DP-16	CONDUIT	4.1	1.0000	0.0130
Pipe - (43)	CB-16	STU-16	CONDUIT	7.3	1.7930	0.0130
Pipe - (44)	CB-18	EX-18	CONDUIT	24.4	2.4990	0.0130
Pipe - (45)	EX-18	DP-18	CONDUIT	81.8	2.0000	0.0130
Pipe - (5)	STU-5	DP-5	CONDUIT	16.3	3.8608	0.0130
Pipe - (50)	CB-20	DMH-20	CONDUIT	6.5	8.1871	0.0130
Pipe - (51)	DMH-20	DH-20	CONDUIT	5.7	8.1142	0.0130
Pipe - (54)	DH-6	DP-6	CONDUIT	8.5	5.3000	0.0130
Pipe - (55)	CB-4	DMH-4N	CONDUIT	10.6	11.5699	0.0130
Pipe - (56)	DH-10	DP-10	CONDUIT	12.4	3.0000	0.0130
Pipe - (57)	DH-20	DP-20	CONDUIT	55.5	6.1646	0.0130
Pipe - (61)	CB-1	Structure - (72)	CONDUIT	79.8	2.7583	0.0130
Pipe - (62)	Structure - (72)	DP-1	CONDUIT	79.0	1.0000	0.0130
Pipe - (7)	DMH-3	DMH-4S	CONDUIT	124.6	4.0212	0.0130

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
CB-1_Overflow	TRIANGULAR	0.28	14.00	1	1.96	0.14	2.70
CB10-9_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	8.35
CB11-10_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	7.95
CB12-13_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	9.44
CB17-16_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	12.30
CB2-3_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	13.13
CB3-4_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	

							11.64
CB4-5_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	8.25
CB6-5_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	7.73
CB7-6_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	6.62
CB8-7_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	4.89
CB9-8_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	6.26
L-Pipe - (50)	IRREGULAR	0.75	6.80	1	3.82	0.50	41.01
Pipe - (12)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.19
Pipe - (13)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.19
Pipe - (14)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.59
Pipe - (16)	CIRCULAR	1.00	1.00	1	0.79	0.25	7.67
Pipe - (18)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (19)	CIRCULAR	1.00	1.00	1	0.79	0.25	4.29
Pipe - (2)	CIRCULAR	1.00	1.00	1	0.79	0.25	7.69
Pipe - (20)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.79
Pipe - (21)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.59
Pipe - (22)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (23)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.40
Pipe - (24)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.40
Pipe - (25)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.88
Pipe - (26)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.52
Pipe - (27)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.52
Pipe - (28)	CIRCULAR	1.00	1.00	1	0.79	0.25	8.05
Pipe - (29)	CIRCULAR	1.00	1.00	1	0.79	0.25	4.83
Pipe - (3)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.35
Pipe - (30)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (31)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.52
Pipe - (33)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (34)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.54
Pipe - (35)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.73
Pipe - (4)	CIRCULAR	1.00	1.00	1	0.79	0.25	4.45
Pipe - (40)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.43
Pipe - (41)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (43)	CIRCULAR	1.00	1.00	1	0.79	0.25	

							4.77
Pipe - (44)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.63
Pipe - (45)	CIRCULAR	1.50	1.50	1	1.77	0.38	14.86
Pipe - (5)	CIRCULAR	1.00	1.00	1	0.79	0.25	7.00
Pipe - (50)	CIRCULAR	1.50	1.50	1	1.77	0.38	30.06
Pipe - (51)	CIRCULAR	1.00	1.00	1	0.79	0.25	10.15
Pipe - (54)	CIRCULAR	1.00	1.00	1	0.79	0.25	8.20
Pipe - (55)	CIRCULAR	1.00	1.00	1	0.79	0.25	12.12
Pipe - (56)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.17
Pipe - (57)	CIRCULAR	1.50	1.50	1	1.77	0.38	26.08
Pipe - (61)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.92
Pipe - (62)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (7)	CIRCULAR	1.00	1.00	1	0.79	0.25	7.14

****
Transect Summary
****

Transect XS-L-Pipe - (13)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (16)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (18)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (2)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (24)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046

	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (27)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (28)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (30)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (37)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863

0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (50)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (55)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329

```
            0.1459     0.1591     0.1724     0.1858     0.1994
            0.2130     0.2267     0.2404     0.2542     0.2680
            0.2818     0.2957     0.3095     0.3238     0.3512
            0.3784     0.4055     0.4326     0.4595     0.4863
            0.5130     0.5396     0.5660     0.5924     0.6187
            0.6448     0.6708     0.6968     0.7226     0.7483
            0.7740     0.7995     0.8249     0.8502     0.8754
            0.9005     0.9256     0.9505     0.9753     1.0000
Width:
            0.0355     0.0711     0.1066     0.1422     0.1777
            0.2132     0.2520     0.2961     0.3402     0.3842
            0.4283     0.4724     0.5164     0.5605     0.6046
            0.6487     0.6927     0.7368     0.7809     0.8249
            0.8690     0.9131     0.9572     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000

**************************        Volume         Depth
Runoff Quantity Continuity       acre-ft        inches
**************************     ---------       -------
Total Precipitation ......         0.596         0.718
Continuity Error (%) .....         0.682

**************************        Volume        Volume
Flow Routing Continuity          acre-ft      Mgallons
**************************     ---------     ---------
External Inflow ..........         0.000         0.000
External Outflow .........         0.248         0.081
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....        -0.812

**************************************
Runoff Coefficient Computations Report
**************************************

--------------------
Subbasin Sub-CB-1
--------------------
                                                        Area          Soil        Runoff
Soil/Surface Description                              (acres)         Group        Coeff.
-----------------------------------------------------------------------------------------
Streets, 25 years or greater                             0.17       A (6%+)          0.79
Residential Lot Size 1 Acre, 25 years or greater         0.19       A (6%+)          0.29
Composite Area & Weighted Runoff Coeff.                  0.36                        0.53

---------------------
Subbasin Sub-CB-10
---------------------
                                                        Area          Soil        Runoff
Soil/Surface Description                              (acres)         Group        Coeff.
-----------------------------------------------------------------------------------------
Streets, 25 years or greater                             0.12       A (6%+)          0.79
Residential Lot Size 1 Acre, 25 years or greater         0.01       A (6%+)          0.29
Composite Area & Weighted Runoff Coeff.                  0.13                        0.75

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Subbasin Sub-CB-11
---------------------
                                                        Area          Soil        Runoff
```

Soil/Surface Description	(acres)	Group	Coeff.
Streets, 25 years or greater	0.11	A (6%+)	0.79
Forest, 25 years or greater	0.09	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.20		0.50

Subbasin Sub-CB-12

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.23	A (6%+)	0.79
Forest, 25 years or greater	1.05	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.28		0.26

Subbasin Sub-CB-13-14

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.25	A (6%+)	0.79
Forest, 25 years or greater	0.09	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.34		0.61

Subbasin Sub-CB-15-16

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.19	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.05	A (6%+)	0.29
Streets, 25 years or greater	0.16	B (0-2%)	0.80
Composite Area & Weighted Runoff Coeff.	0.40		0.73

Subbasin Sub-CB-17

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.15	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.13	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.29		0.56

Subbasin Sub-CB-18-19

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.47	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.47	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.95		0.54

Subbasin Sub-CB-2

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.17	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.23	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.40		0.50

Subbasin Sub-CB-20

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.49	A (6%+)	0.79
Forest, 25 years or greater	1.00	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.49		0.35

Subbasin Sub-CB-3

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.14	A (6%+)	0.79
Forest, 25 years or greater	2.69	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	2.84		0.17

Subbasin Sub-CB-4

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.15	A (6%+)	0.79
Forest, 25 years or greater	0.19	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.34		0.43

Subbasin Sub-CB-5

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.32	A (6%+)	0.79
Forest, 25 years or greater	0.01	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.33		0.78

Subbasin Sub-CB-6

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.14	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.00	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.14		0.76

Subbasin Sub-CB-7

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.10	A (0-2%)	0.76
Residential Lot Size 1 Acre, 25 years or greater	0.01	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.11		0.72

Subbasin Sub-CB-8W

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

Streets, 25 years or greater	0.17	A (2-6%)	0.77
Meadow, 25 years or greater	0.05	A (2-6%)	0.22
Composite Area & Weighted Runoff Coeff.	0.22		0.64

Subbasin Sub-CB-9

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.15	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.00	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.15		0.76

SCS TR-55 Time of Concentration Computations Report

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)

Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin Sub-CB-1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	33.69	0.00	0.00
Slope (%):	1.60	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	9.26	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	329.84	0.00	0.00
Slope (%):	0.77	0.00	0.00
Surface Type:	Paved	Paved	Paved
Velocity (ft/sec):	1.79	0.00	0.00
Computed Flow Time (minutes):	3.08	0.00	0.00

===
Total TOC (minutes): 12.34
===

Subbasin Sub-CB-10

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-11

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	73.91	0.00	0.00
Slope (%):	24.40	0.00	

```
0.00
          2 yr, 24 hr Rainfall (in):                    3.60              0.00
0.00
          Velocity (ft/sec):                            0.21              0.00
0.00
          Computed Flow Time (minutes):                 5.85              0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                   Subarea A         Subarea B         Subarea
C
          Flow Length (ft):                           147.74              0.00
0.00
          Slope (%):                                    2.17              0.00
0.00
          Surface Type:                                Paved             Paved
Paved
          Velocity (ft/sec):                            2.99              0.00
0.00
          Computed Flow Time (minutes):                 0.82              0.00
0.00
=================================================================================================
          Total TOC (minutes):                          6.67
=================================================================================================


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  Subbasin Sub-CB-12
  ---------------------

  Sheet Flow Computations
  -----------------------
                                                   Subarea A         Subarea B         Subarea
C
          Manning's Roughness:                          0.40              0.00
0.00
          Flow Length (ft):                           222.44              0.00
0.00
          Slope (%):                                   10.60              0.00
0.00
          2 yr, 24 hr Rainfall (in):                    3.60              0.00
0.00
          Velocity (ft/sec):                            0.19              0.00
0.00
          Computed Flow Time (minutes):                19.70              0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                   Subarea A         Subarea B         Subarea
C
          Flow Length (ft):                           185.02              0.00
0.00
          Slope (%):                                    4.77              0.00
0.00
          Surface Type:                                Paved             Paved
Paved
          Velocity (ft/sec):                            4.44              0.00
0.00
          Computed Flow Time (minutes):                 0.69              0.00
0.00
=================================================================================================
```

Total TOC (minutes): 20.39

==

Subbasin Sub-CB-13-14

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	80.13	0.00	0.00
Slope (%):	24.40	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.21	0.00	0.00
Computed Flow Time (minutes):	6.23	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	174.35	0.00	0.00
Slope (%):	2.45	0.00	0.00
Surface Type:	Paved	Paved	Paved
Velocity (ft/sec):	3.18	0.00	0.00
Computed Flow Time (minutes):	0.91	0.00	0.00

==

Total TOC (minutes): 7.15

==

Subbasin Sub-CB-15-16

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-17

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-18-19

User-Defined TOC override (minutes): 5.00

```
  Subbasin Sub-CB-2
  --------------------

          User-Defined TOC override (minutes):      5.00

  ---------------------
  Subbasin Sub-CB-20
  ---------------------

  Sheet Flow Computations
  -----------------------
                                               Subarea A           Subarea B            Subarea
C
          Manning's Roughness:                      0.40                0.00
0.00
          Flow Length (ft):                       227.22                0.00
0.00
          Slope (%):                                7.48                0.00
0.00
          2 yr, 24 hr Rainfall (in):                3.60                0.00
0.00
          Velocity (ft/sec):                        0.16                0.00
0.00
          Computed Flow Time (minutes):            23.04                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                               Subarea A           Subarea B            Subarea
C
          Flow Length (ft):                       193.35                0.00
0.00
          Slope (%):                                2.77                0.00
0.00
          Surface Type:                            Paved               Paved
Paved
          Velocity (ft/sec):                        3.38                0.00
0.00
          Computed Flow Time (minutes):             0.95                0.00
0.00

===============================================================================================
          Total TOC (minutes):                     23.99

===============================================================================================


  --------------------
  Subbasin Sub-CB-3
  --------------------

  Sheet Flow Computations
  -----------------------
                                               Subarea A           Subarea B            Subarea
C
          Manning's Roughness:                      0.40                0.00
0.00
          Flow Length (ft):                       492.34                0.00
0.00
          Slope (%):                                3.89                0.00
0.00
          2 yr, 24 hr Rainfall (in):                3.60                0.00
0.00
          Velocity (ft/sec):                        0.15                0.00
0.00
          Computed Flow Time (minutes):            55.54                0.00
```

```
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                              Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                       70.73                0.00
0.00
          Slope (%):                               4.87                0.00
0.00
          Surface Type:                         Unpaved               Paved
Paved
          Velocity (ft/sec):                       3.56                0.00
0.00
          Computed Flow Time (minutes):            0.33                0.00
0.00

==================================================================================================
          Total TOC (minutes):                    55.87

==================================================================================================


  --------------------
  Subbasin Sub-CB-4
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-5
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-6
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-7
  --------------------

          User-Defined TOC override (minutes):      5.00

  ---------------------
  Subbasin Sub-CB-8W
  ---------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-9
  --------------------

          User-Defined TOC override (minutes):      5.00

  ***********************
  Subbasin Runoff Summary
  ***********************

  ---------------------------------------------------------------------------------------
  Subbasin       Accumulated     Rainfall     Total      Peak  Weighted          Time of
  ID                  Precip    Intensity    Runoff    Runoff    Runoff     Concentration
```

	in	in/hr	in	cfs	Coeff	days	hh:mm:ss
Sub-CB-1	0.60	2.92	0.32	0.56	0.530	0	00:12:20
Sub-CB-10	0.39	4.72	0.29	0.45	0.750	0	00:05:00
Sub-CB-11	0.45	4.05	0.22	0.40	0.500	0	00:06:40
Sub-CB-12	0.75	2.22	0.20	0.74	0.260	0	00:20:23
Sub-CB-13-14	0.47	3.90	0.28	0.80	0.610	0	00:07:09
Sub-CB-15-16	0.39	4.72	0.29	1.39	0.730	0	00:05:00
Sub-CB-17	0.39	4.72	0.22	0.75	0.560	0	00:05:00
Sub-CB-18-19	0.39	4.72	0.21	2.42	0.540	0	00:05:00
Sub-CB-2	0.39	4.72	0.20	0.95	0.500	0	00:05:00
Sub-CB-20	0.81	2.03	0.28	1.06	0.350	0	00:23:59
Sub-CB-3	1.11	1.19	0.19	0.58	0.170	0	00:55:52
Sub-CB-4	0.39	4.72	0.17	0.70	0.430	0	00:05:00
Sub-CB-5	0.39	4.72	0.31	1.21	0.780	0	00:05:00
Sub-CB-6	0.39	4.72	0.30	0.51	0.760	0	00:05:00
Sub-CB-7	0.39	4.72	0.28	0.37	0.720	0	00:05:00
Sub-CB-8W	0.39	4.72	0.25	0.67	0.640	0	00:05:00
Sub-CB-9	0.39	4.72	0.30	0.53	0.760	0	00:05:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
CB-8E	0.00	0.00	257.54	0	00:00	0	0	0:00:00
CIT-8	2.69	2.69	257.49	0	00:00	0	0	0:00:00
CIT-9	2.27	2.53	259.93	0	00:05	0	0	0:00:00
DH-10	0.10	0.39	265.54	0	00:05	0	0	0:00:00
DH-13	2.76	3.07	262.87	0	00:07	0	0	0:00:00
DH-20	0.01	0.31	277.93	0	00:24	0	0	0:00:00
DH-6	0.05	0.24	247.19	0	00:05	0	0	0:00:00
DMH-10	0.10	0.39	265.71	0	00:05	0	0	0:00:00
DMH-11	0.10	0.25	269.00	0	00:06	0	0	0:00:00
DMH-12	0.34	0.64	268.34	0	00:20	0	0	0:00:00
DMH-13	0.10	0.49	263.26	0	00:07	0	0	0:00:00
DMH-20	0.44	0.74	278.39	0	00:24	0	0	0:00:00
DMH-3	0.11	0.33	262.57	0	00:05	0	0	0:00:00
DMH-4N	0.11	0.40	253.25	0	00:05	0	0	0:00:00
DMH-4S	0.11	0.35	257.48	0	00:05	0	0	0:00:00
DMH-6	4.85	5.12	252.52	0	00:05	0	0	0:00:00
DMH-7	1.10	1.32	255.42	0	00:05	0	0	0:00:00
EX-18	3.00	3.46	269.46	0	00:05	0	0	0:00:00
EX-7	1.20	1.40	254.20	0	00:05	0	0	0:00:00
Structure - (72)	0.11	0.31	276.10	0	00:12	0	0	0:00:00
STU-16	0.28	0.54	253.24	0	00:05	0	0	0:00:00
STU-5	0.11	0.50	249.13	0	00:06	0	0	0:00:00
DP-1	0.00	0.26	275.26	0	00:12	0	0	0:00:00
DP-10	0.00	0.23	265.01	0	00:05	0	0	0:00:00
DP-13	0.01	0.37	259.97	0	00:07	0	0	0:00:00
DP-16	0.00	0.54	253.20	0	00:05	0	0	0:00:00
DP-18	0.01	0.41	264.77	0	00:05	0	0	0:00:00
DP-20	0.01	0.29	274.49	0	00:24	0	0	0:00:00
DP-5	0.01	0.41	248.41	0	00:06	0	0	0:00:00
DP-6	0.00	0.17	246.67	0	00:05	0	0	0:00:00
DP-7	0.00	0.43	253.03	0	00:06	0	0	0:00:00
OFFSITE1	0.00	0.05	281.27	0	00:17	0	0	0:00:00
OFFSITE-1	0.00	0.17	267.85	0	00:25	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm
CB-8E	JUNCTION	0.00	0.00	0	00:00	0.00		
CIT-8	JUNCTION	0.00	1.05	0	00:05	0.00		
CIT-9	JUNCTION	0.00	0.50	0	00:05	0.00		
DH-10	JUNCTION	0.00	0.71	0	00:05	0.00		
DH-13	JUNCTION	0.00	1.04	0	00:07	0.00		
DH-20	JUNCTION	0.00	2.13	0	00:24	0.00		
DH-6	JUNCTION	0.00	0.51	0	00:05	0.00		
DMH-10	JUNCTION	0.00	0.45	0	00:05	0.00		
DMH-11	JUNCTION	0.00	0.40	0	00:06	0.00		
DMH-12	JUNCTION	0.00	0.72	0	00:20	0.00		
DMH-13	JUNCTION	0.00	0.80	0	00:07	0.00		
DMH-20	JUNCTION	0.00	2.13	0	00:24	0.00		
DMH-3	JUNCTION	0.00	0.95	0	00:05	0.00		
DMH-4N	JUNCTION	0.00	1.52	0	00:05	0.00		
DMH-4S	JUNCTION	0.00	0.95	0	00:05	0.00		
DMH-6	JUNCTION	0.00	0.51	0	00:05	0.00		
DMH-7	JUNCTION	0.00	0.37	0	00:05	0.00		
EX-18	JUNCTION	0.00	2.41	0	00:05	0.00		
EX-7	JUNCTION	0.00	1.35	0	00:06	0.00		
Structure - (72)	JUNCTION	0.00	0.52	0	00:12	0.00		
STU-16	JUNCTION	0.00	2.03	0	00:05	0.00		
STU-5	JUNCTION	0.00	2.47	0	00:06	0.00		
DP-1	OUTFALL	0.00	0.52	0	00:12	0.00		
DP-10	OUTFALL	0.00	0.71	0	00:05	0.00		
DP-13	OUTFALL	0.00	1.03	0	00:07	0.00		
DP-16	OUTFALL	0.00	2.03	0	00:05	0.00		
DP-18	OUTFALL	0.00	2.39	0	00:05	0.00		
DP-20	OUTFALL	0.00	2.12	0	00:24	0.00		
DP-5	OUTFALL	0.00	2.47	0	00:06	0.00		
DP-6	OUTFALL	0.00	0.51	0	00:05	0.00		
DP-7	OUTFALL	0.00	1.35	0	00:06	0.00		
OFFSITE1	OUTFALL	0.00	0.02	0	00:17	0.00		
OFFSITE-1	OUTFALL	0.00	0.69	0	00:25	0.00		

****
Inlet Depth Summary
****

Inlet ID	Max Gutter Spread during Peak Flow ft	Max Gutter Water Elev during Peak Flow ft	Max Gutter Water Depth during Peak Flow ft	Time of Maximum Depth Occurrence days	hh:mm
CB-1	4.47	281.39	0.17	0	00:12
CB-10	2.18	267.82	0.13	0	00:05
CB-11	2.07	272.23	0.13	0	00:06
CB-12	2.72	271.23	0.16	0	00:20
CB-13	3.27	264.98	0.13	0	00:07
CB-16	4.43	255.11	0.18	0	00:05
CB-17	5.30	265.68	0.19	0	00:05
CB-18	9.71	274.02	0.30	0	00:05
CB-2	3.03	277.00	0.18	0	00:05

CB-20	3.26	279.80	0.13	0 00:00
CB-3	2.44	265.54	0.15	0 00:56
CB-4	2.65	256.09	0.16	0 00:05
CB-5	4.06	251.35	0.17	0 00:05
CB-6	2.31	255.49	0.14	0 00:05
CB-7	1.99	258.53	0.12	0 00:05
CB-8W	4.37	260.25	0.17	0 00:05
CB-9	2.35	262.96	0.14	0 00:05

****
Inlet Flow Summary
****

Inlet ID	Peak Flow cfs	Peak Lateral Flow cfs	Peak Flow Intercepted by Inlet cfs	Peak Flow Bypassing Inlet cfs	Inlet Efficiency during Peak Flow %	Total Flooding acre-in	Total Time Flooded minutes
CB-1	0.56	0.56	0.52	0.04	93.21	0.000	0
CB-10	0.45	0.45	0.45	0.00	99.92	0.000	0
CB-11	0.40	0.40	0.40	0.00	99.99	0.000	0
CB-12	0.74	0.74	0.72	0.01	98.05	0.000	0
CB-13	0.80	0.80	-	-	-	0.000	0
CB-16	1.42	1.39	-	-	-	0.000	0
CB-17	0.75	0.75	0.67	0.09	88.70	0.000	0
CB-18	2.42	2.42	-	-	-	0.000	0
CB-2	0.95	0.95	0.91	0.04	95.99	0.000	0
CB-20	1.06	1.06	-	-	-	0.000	0
CB-3	0.58	0.58	0.57	0.00	99.34	0.000	0
CB-4	0.70	0.70	0.69	0.01	98.42	0.000	0
CB-5	1.21	1.21	-	-	-	0.000	0
CB-6	0.51	0.51	0.51	0.00	99.70	0.000	0
CB-7	0.37	0.37	0.37	0.00	100.00	0.000	0
CB-8W	0.67	0.67	0.62	0.05	93.01	0.000	0
CB-9	0.53	0.53	0.50	0.03	94.98	0.000	0

****

Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
DP-1	1.90	0.24	0.52
DP-10	1.33	0.26	0.71
DP-13	3.25	0.44	1.03
DP-16	1.27	0.59	2.03
DP-18	0.87	0.96	2.39
DP-20	3.39	1.05	2.12
DP-5	8.50	0.38	2.47
DP-6	0.73	0.24	0.51
DP-7	2.26	0.24	1.35
OFFSITE1	2.61	0.01	0.02
OFFSITE-1	4.47	0.27	0.69
System	2.78	4.67	10.74

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
CB-1_Overflow	CHANNEL	0 00:17	1.59	1.00	0.02	2.70	0.01	0.17	0	Calculated
CB10-9_Gutter	CHANNEL	0 00:10	0.00	1.00	0.00	8.35	0.00	0.03	0	Calculated
CB11-10_Gutter	CHANNEL	0 00:13	0.00	1.00	0.00	7.95	0.00	0.03	0	Calculated
CB12-13_Gutter	CHANNEL	0 00:23	1.81	1.00	0.02	9.44	0.00	0.09	0	Calculated
CB17-16_Gutter	CHANNEL	0 00:06	5.27	1.00	0.07	12.30	0.01	0.14	0	Calculated
CB2-3_Gutter	CHANNEL	0 00:06	3.39	1.00	0.03	13.13	0.00	0.10	0	Calculated
CB3-4_Gutter	CHANNEL	0 00:58	1.29	1.00	0.01	11.64	0.00	0.06	0	Calculated
CB4-5_Gutter	CHANNEL	0 00:06	1.77	1.00	0.01	8.25	0.00	0.07	0	Calculated
CB6-5_Gutter	CHANNEL	0 00:10	0.00	1.00	0.00	7.73	0.00	0.03	0	Calculated
CB7-6_Gutter	CHANNEL	0 00:10	0.00	1.00	0.00	6.62	0.00	0.03	0	Calculated
CB8-7_Gutter	CHANNEL	0 00:06	1.64	1.00	0.03	4.89	0.01	0.14	0	Calculated
CB9-8_Gutter	CHANNEL	0 00:10	2.41	1.00	0.02	6.26	0.00	0.10	0	Calculated
L-Pipe - (50)	CHANNEL	0 00:25	7.62	1.00	0.69	41.01	0.02			

```
0.22          0  Calculated
  Pipe - (12)        CONDUIT     0  00:05     4.76    1.00        0.51        6.19      0.08
0.19          0  Calculated
  Pipe - (13)        CONDUIT     0  00:05     2.97    1.00        0.51        3.19      0.16
0.27          0  Calculated
  Pipe - (14)        CONDUIT     0  00:05     5.70    1.00        1.21        5.59      0.22
0.32          0  Calculated
  Pipe - (16)        CONDUIT     0  00:56     5.73    1.00        0.57        7.67      0.07
0.18          0  Calculated
  Pipe - (18)        CONDUIT     0  00:05     2.93    1.00        0.37        3.56      0.10
0.22          0  Calculated
  Pipe - (19)        CONDUIT     0  00:05     3.34    1.00        0.37        4.29      0.09
0.20          0  Calculated
  Pipe - (2)         CONDUIT     0  00:05    11.06    1.00        0.88        7.69      0.11
0.23          0  Calculated
  Pipe - (20)        CONDUIT     0  00:00     0.00    1.00        0.00        2.79      0.00
0.00          0  Calculated
  Pipe - (21)        CONDUIT     0  00:06     4.06    1.00        1.03        3.59      0.29
0.36          0  Calculated
  Pipe - (22)        CONDUIT     0  00:06     4.23    1.00        1.35        3.56      0.38
0.43          0  Calculated
  Pipe - (23)        CONDUIT     0  00:05     5.15    1.00        0.61        6.40      0.10
0.21          0  Calculated
  Pipe - (24)        CONDUIT     0  00:05     3.10    1.00        0.50        3.40      0.15
0.26          0  Calculated
  Pipe - (25)        CONDUIT     0  00:05     4.58    1.00        0.48        3.88      0.12
0.24          0  Calculated
  Pipe - (26)        CONDUIT     0  00:05     2.43    1.00        0.45        2.52      0.18
0.29          0  Calculated
  Pipe - (27)        CONDUIT     0  00:05     2.42    1.00        0.45        2.52      0.18
0.29          0  Calculated
  Pipe - (28)        CONDUIT     0  00:06     5.35    1.00        0.40        8.05      0.05
0.15          0  Calculated
  Pipe - (29)        CONDUIT     0  00:07     5.37    1.00        0.39        4.83      0.08
0.19          0  Calculated
  Pipe - (3)         CONDUIT     0  00:06     5.86    1.00        0.94        6.35      0.15
0.26          0  Calculated
  Pipe - (30)        CONDUIT     0  00:20     3.55    1.00        0.72        3.56      0.20
0.30          0  Calculated
  Pipe - (31)        CONDUIT     0  00:20     5.20    1.00        0.71        5.52      0.13
0.24          0  Calculated
  Pipe - (33)        CONDUIT     0  00:07     3.93    1.00        1.03        3.56      0.29
0.37          0  Calculated
  Pipe - (34)        CONDUIT     0  00:07     2.87    1.00        0.80        2.54      0.31
0.39          0  Calculated
  Pipe - (35)        CONDUIT     0  00:07     3.79    1.00        0.80        3.73      0.21
0.31          0  Calculated
  Pipe - (4)         CONDUIT     0  00:06     5.26    1.00        1.50        4.45      0.34
0.40          0  Calculated
  Pipe - (40)        CONDUIT     0  00:05     9.18    1.00        0.64        6.43      0.10
0.21          0  Calculated
  Pipe - (41)        CONDUIT     0  00:05     4.68    1.00        2.03        3.56      0.57
0.54          0  Calculated
  Pipe - (43)        CONDUIT     0  00:05     5.30    1.00        1.42        4.77      0.30
0.37          0  Calculated
  Pipe - (44)        CONDUIT     0  00:05     6.91    1.00        2.41        5.63      0.43
0.46          0  Calculated
  Pipe - (45)        CONDUIT     0  00:05     6.22    1.00        2.39       14.86      0.16
0.27          0  Calculated
  Pipe - (5)         CONDUIT     0  00:06     8.14    1.00        2.47        7.00      0.35
0.41          0  Calculated
  Pipe - (50)        CONDUIT     0  00:24     9.84    1.00        2.13       30.06      0.07
0.18          0  Calculated
  Pipe - (51)        CONDUIT     0  00:24    10.22    1.00        2.13       10.15      0.21
0.31          0  Calculated
  Pipe - (54)        CONDUIT     0  00:05     5.79    1.00        0.51        8.20      0.06
```

0.17 0 Calculated

Pipe - (55)	CONDUIT	0	00:05	8.32	1.00	0.68	12.12	0.06	0.16	0	Calculated
Pipe - (56)	CONDUIT	0	00:05	5.23	1.00	0.71	6.17	0.12	0.23	0	Calculated
Pipe - (57)	CONDUIT	0	00:24	8.90	1.00	2.12	26.08	0.08	0.19	0	Calculated
Pipe - (61)	CONDUIT	0	00:12	5.28	1.00	0.52	5.92	0.09	0.20	0	Calculated
Pipe - (62)	CONDUIT	0	00:12	3.24	1.00	0.52	3.56	0.14	0.26	0	Calculated
Pipe - (7)	CONDUIT	0	00:05	6.36	1.00	0.95	7.14	0.13	0.25	0	Calculated

****
Highest Flow Instability Indexes
****
All links are stable.

WARNING 108 : Surcharge elevation defined for Junction EX-18 is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.
WARNING 139 : Ponded area defined for on sag Inlet CB-18 is zero. Assumed ponded area equal to 10 ft^2 (0.929 m^2).
WARNING 138 : Initial water surface elevation defined for Inlet CB-20 is below catchbasin invert elevation.
Assumed initial water surface elevation equal to catchbasin inlet invert elevation.
WARNING 138 : Initial water surface elevation defined for Inlet CB-4 is below catchbasin invert elevation.
Assumed initial water surface elevation equal to catchbasin inlet invert elevation.
WARNING 138 : Initial water surface elevation defined for Inlet CB-5 is below catchbasin invert elevation.
Assumed initial water surface elevation equal to catchbasin inlet invert elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB-1_Overflow is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB10-9_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB11-10_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB12-13_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB17-16_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB2-3_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB3-4_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB4-5_Gutter is below the storm drain inlet rim elevation.

Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB6-5_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB7-6_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB8-7_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB9-8_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 117 : Conduit outlet invert elevation defined for Conduit CB-1_Overflow is below downstream node invert elevation.
Assumed conduit outlet invert elevation equal to downstream node invert elevation.
WARNING 004 : Minimum elevation drop used for Conduit CB-1_Overflow.
WARNING 005 : Minimum slope used for Conduit CB-1_Overflow.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB10-9_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-9.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB11-10_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-10.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB12-13_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-13.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB17-16_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-16.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB2-3_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-3.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB3-4_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-4.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB4-5_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-5.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB6-5_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-5.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB7-6_Gutter is below the storm drain inlet rim elevation.

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               Assumed the upstream roadway link outlet invert elevation equal to the storm
drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain
inlet CB-6.
  WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB8-7_Gutter is below
the storm drain inlet rim elevation.
               Assumed the upstream roadway link outlet invert elevation equal to the storm
drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain
inlet CB-7.
  WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB9-8_Gutter is below
the storm drain inlet rim elevation.
               Assumed the upstream roadway link outlet invert elevation equal to the storm
drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain
inlet CB-8W.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (14) is below upstream
node invert elevation.
               Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (50) is below upstream
node invert elevation.
               Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (55) is below upstream
node invert elevation.
               Assumed conduit inlet invert elevation equal to upstream node invert elevation.

  Analysis began on:  Tue Jan 31 11:09:22 2023
  Analysis ended on:  Tue Jan 31 11:09:24 2023
  Total elapsed time: 00:00:02
```

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.2.165 (Build 0)

****
Project Description
****
File Name .... Grove_St_Ph2_r1-PR.SPF

****
Analysis Options
****
Flow Units .... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration...... SCS TR-55
Return Period.............. 10 years
Link Routing Method .... Kinematic Wave
Storage Node Exfiltration.. None
Starting Date DEC-20-2022 00:00:00
Ending Date DEC-21-2022 00:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 17
Number of nodes 50
Number of links 52

****
Subbasin Summary
****

Subbasin ID	Total Area acres
Sub-CB-1	0.36
Sub-CB-10	0.13
Sub-CB-11	0.20
Sub-CB-12	1.28
Sub-CB-13-14	0.34
Sub-CB-15-16	0.40
Sub-CB-17	0.29
Sub-CB-18-19	0.95
Sub-CB-2	0.40
Sub-CB-20	1.49
Sub-CB-3	2.84
Sub-CB-4	0.34
Sub-CB-5	0.33
Sub-CB-6	0.14
Sub-CB-7	0.11
Sub-CB-8W	0.22
Sub-CB-9	0.15

****
Node Summary
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Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
CB-8E	JUNCTION	257.54	259.20	0.00	

CIT-8	JUNCTION	254.80	259.42	0.00
CIT-9	JUNCTION	257.40	262.67	0.00
DH-10	JUNCTION	265.15	268.15	0.00
DH-13	JUNCTION	259.80	265.60	0.00
DH-20	JUNCTION	277.62	280.21	0.00
DH-6	JUNCTION	246.95	255.72	0.00
DMH-10	JUNCTION	265.32	267.86	0.00
DMH-11	JUNCTION	268.75	272.24	0.00
DMH-12	JUNCTION	267.70	271.08	0.00
DMH-13	JUNCTION	262.77	265.40	0.00
DMH-20	JUNCTION	277.65	280.22	0.00
DMH-3	JUNCTION	262.24	265.34	0.00
DMH-4N	JUNCTION	252.85	255.95	0.00
DMH-4S	JUNCTION	257.13	262.56	0.00
DMH-6	JUNCTION	247.40	257.58	0.00
DMH-7	JUNCTION	254.10	258.76	0.00
EX-18	JUNCTION	266.00	273.24	0.00
EX-7	JUNCTION	252.80	258.62	0.00
Structure - (72)	JUNCTION	275.79	277.57	0.00
STU-16	JUNCTION	252.70	255.49	0.00
STU-5	JUNCTION	248.63	251.88	0.00
DP-1	OUTFALL	275.00	276.00	0.00
DP-10	OUTFALL	264.78	265.78	0.00
DP-13	OUTFALL	259.60	260.60	0.00
DP-16	OUTFALL	252.66	253.66	0.00
DP-18	OUTFALL	264.36	265.86	0.00
DP-20	OUTFALL	274.20	275.70	0.00
DP-5	OUTFALL	248.00	249.00	0.00
DP-6	OUTFALL	246.50	247.50	0.00
DP-7	OUTFALL	252.60	253.60	0.00
OFFSITE1	OUTFALL	281.22	281.50	0.00
OFFSITE-1	OUTFALL	267.68	268.43	0.00

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Inlet Summary
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Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation (ft)	Inlet Rim Elevation (ft)	Ponded Area (ft^2)	Initial Water Elevation (ft)	Grate Clogging Factor (%)
CB-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	278.10	281.22	-	278.10	0.00
CB-10	FHWA HEC-22 GENERIC	N/A	On Grade	1	265.44	267.69	-	265.44	0.00
CB-11	FHWA HEC-22 GENERIC	N/A	On Grade	1	269.10	272.10	-	269.10	0.00
CB-12	FHWA HEC-22 GENERIC	N/A	On Grade	1	268.07	271.07	-	268.07	0.00
CB-13	FHWA HEC-22 GENERIC	N/A	On Sag	1	262.90	264.85	10.00	262.90	0.00
CB-16	FHWA HEC-22 GENERIC	N/A	On Sag	1	252.93	254.93	10.00	252.93	0.00
CB-17	FHWA HEC-22 GENERIC	N/A	On Grade	1	260.16	265.49	-	260.16	0.00
CB-18	FHWA HEC-22 GENERIC	N/A	On Sag	1	269.61	273.72	10.00	269.61	0.00
CB-2	FHWA HEC-22 GENERIC	N/A	On Grade	1	273.82	276.82	-	273.82	0.00

CB-20		FHWA HEC-22 GENERIC		N/A	On Sag	1
278.18	279.67	10.00	278.18	0.00		
CB-3		FHWA HEC-22 GENERIC		N/A	On Grade	1
262.89	265.39	-	262.89	0.00		
CB-4		FHWA HEC-22 GENERIC		N/A	On Grade	1
254.18	255.93	-	254.18	0.00		
CB-5		FHWA HEC-22 GENERIC		N/A	On Sag	1
249.44	251.18	10.00	249.44	0.00		
CB-6		FHWA HEC-22 GENERIC		N/A	On Grade	1
252.35	255.35	-	252.35	0.00		
CB-7		FHWA HEC-22 GENERIC		N/A	On Grade	1
255.41	258.41	-	255.41	0.00		
CB-8W		FHWA HEC-22 GENERIC		N/A	On Grade	1
257.08	260.08	-	257.08	0.00		
CB-9		FHWA HEC-22 GENERIC		N/A	On Grade	1
259.82	262.82	-	259.82	0.00		

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Roadway and Gutter Summary
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Inlet ID	Roadway Longitudinal Slope ft/ft	Roadway Cross Slope ft/ft	Roadway Manning's Roughness	Gutter Cross Slope ft/ft	Gutter Width ft	Gutter Depression in
CB-1	0.0100	0.0200	0.0160	0.0620	2.00	2.00
CB-10	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-11	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-12	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-13	-	0.0500	0.0130	0.0620	2.00	0.00
CB-16	-	0.0500	0.0130	0.0620	2.00	0.00
CB-17	0.0100	0.0200	0.0160	0.0620	2.00	2.00
CB-18	-	0.0200	0.0160	0.0620	2.00	2.00
CB-2	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-20	-	0.0500	0.0130	0.0620	2.00	0.00
CB-3	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-4	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-5	-	0.0500	0.0130	0.0620	2.00	0.00
CB-6	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-7	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-8W	0.0100	0.0200	0.0130	0.0620	2.00	2.00
CB-9	0.0200	0.0500	0.0130	0.0620	2.00	0.00

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Link Summary
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Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
CB-1_Overflow	CB-1	OFFSITE1	CHANNEL	241.8	0.2000	0.0130
CB10-9_Gutter	CB-10	CB-9	CHANNEL	254.5	1.9133	0.0130
CB11-10_Gutter	CB-11	CB-10	CHANNEL	254.5	1.7326	0.0130
CB12-13_Gutter	CB-12	CB-13	CHANNEL	254.5	2.4437	0.0130
CB17-16_Gutter	CB-17	CB-16	CHANNEL	254.5	4.1501	0.0130
CB2-3_Gutter	CB-2	CB-3	CHANNEL	241.8	4.7276	0.0130
CB3-4_Gutter	CB-3	CB-4	CHANNEL	254.5	3.7167	0.0130
CB4-5_Gutter	CB-4	CB-5	CHANNEL	254.5	1.8662	0.0130
CB6-5_Gutter	CB-6	CB-5	CHANNEL	254.5	1.6383	0.0130
CB7-6_Gutter	CB-7	CB-6	CHANNEL	254.5	1.2022	0.0130
CB8-7_Gutter	CB-8W	CB-7	CHANNEL	254.5	0.6561	0.0130
CB9-8_Gutter	CB-9	CB-8W	CHANNEL	254.5	1.0765	0.0130
L-Pipe - (50)	CB-20	OFFSITE-1	CHANNEL	546.0	2.1967	0.0130
Pipe - (12)	DMH-6	DH-6	CONDUIT	13.3	3.0144	0.0130
Pipe - (13)	CB-6	DMH-6	CONDUIT	12.5	0.7995	0.0130

Pipe - (14)	CB-5	STU-5	CONDUIT	28.8	2.4635	0.0130
Pipe - (16)	CB-3	DMH-3	CONDUIT	11.9	4.6382	0.0130
Pipe - (18)	CB-7	DMH-7	CONDUIT	20.7	1.0000	0.0130
Pipe - (19)	DMH-7	EX-7	CONDUIT	6.9	1.4505	0.0130
Pipe - (2)	CB-2	DMH-3	CONDUIT	246.6	4.6555	0.0130
Pipe - (20)	CB-8E	CIT-8	CONDUIT	7.6	0.6131	0.0130
Pipe - (21)	CIT-8	EX-7	CONDUIT	196.9	1.0156	0.0130
Pipe - (22)	EX-7	DP-7	CONDUIT	20.0	1.0000	0.0130
Pipe - (23)	CB-8W	CIT-8	CONDUIT	20.5	3.2241	0.0130
Pipe - (24)	CB-9	CIT-9	CONDUIT	16.5	0.9092	0.0130
Pipe - (25)	CIT-9	CIT-8	CONDUIT	219.0	1.1872	0.0130
Pipe - (26)	DMH-10	DH-10	CONDUIT	14.0	0.5000	0.0130
Pipe - (27)	CB-10	DMH-10	CONDUIT	4.2	0.5000	0.0130
Pipe - (28)	CB-11	DMH-11	CONDUIT	4.9	5.1092	0.0130
Pipe - (29)	DMH-11	DH-10	CONDUIT	190.5	1.8369	0.0130
Pipe - (3)	DMH-4S	DMH-4N	CONDUIT	131.6	3.1757	0.0130
Pipe - (30)	CB-12	DMH-12	CONDUIT	3.6	1.0000	0.0130
Pipe - (31)	DMH-12	DH-13	CONDUIT	217.3	2.4045	0.0130
Pipe - (33)	DH-13	DP-13	CONDUIT	19.5	1.0000	0.0130
Pipe - (34)	CB-13	DMH-13	CONDUIT	5.9	0.5098	0.0130
Pipe - (35)	DMH-13	DH-13	CONDUIT	19.9	1.0989	0.0130
Pipe - (4)	DMH-4N	STU-5	CONDUIT	263.5	1.5634	0.0130
Pipe - (40)	CB-17	STU-16	CONDUIT	220.1	3.2621	0.0130
Pipe - (41)	STU-16	DP-16	CONDUIT	4.1	1.0000	0.0130
Pipe - (43)	CB-16	STU-16	CONDUIT	7.3	1.7930	0.0130
Pipe - (44)	CB-18	EX-18	CONDUIT	24.4	2.4990	0.0130
Pipe - (45)	EX-18	DP-18	CONDUIT	81.8	2.0000	0.0130
Pipe - (5)	STU-5	DP-5	CONDUIT	16.3	3.8608	0.0130
Pipe - (50)	CB-20	DMH-20	CONDUIT	6.5	8.1871	0.0130
Pipe - (51)	DMH-20	DH-20	CONDUIT	5.7	8.1142	0.0130
Pipe - (54)	DH-6	DP-6	CONDUIT	8.5	5.3000	0.0130
Pipe - (55)	CB-4	DMH-4N	CONDUIT	10.6	11.5699	0.0130
Pipe - (56)	DH-10	DP-10	CONDUIT	12.4	3.0000	0.0130
Pipe - (57)	DH-20	DP-20	CONDUIT	55.5	6.1646	0.0130
Pipe - (61)	CB-1	Structure - (72)	CONDUIT	79.8	2.7583	0.0130
Pipe - (62)	Structure - (72)	DP-1	CONDUIT	79.0	1.0000	0.0130
Pipe - (7)	DMH-3	DMH-4S	CONDUIT	124.6	4.0212	0.0130

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Cross Section Summary
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Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft^2	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
CB-1_Overflow	TRIANGULAR	0.28	14.00	1	1.96	0.14	2.70
CB10-9_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	8.35
CB11-10_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	7.95
CB12-13_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	9.44
CB17-16_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	12.30
CB2-3_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	13.13
CB3-4_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	

							11.64
CB4-5_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	8.25
CB6-5_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	7.73
CB7-6_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	6.62
CB8-7_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	4.89
CB9-8_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	6.26
L-Pipe - (50)	IRREGULAR	0.75	6.80	1	3.82	0.50	41.01
Pipe - (12)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.19
Pipe - (13)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.19
Pipe - (14)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.59
Pipe - (16)	CIRCULAR	1.00	1.00	1	0.79	0.25	7.67
Pipe - (18)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (19)	CIRCULAR	1.00	1.00	1	0.79	0.25	4.29
Pipe - (2)	CIRCULAR	1.00	1.00	1	0.79	0.25	7.69
Pipe - (20)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.79
Pipe - (21)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.59
Pipe - (22)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (23)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.40
Pipe - (24)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.40
Pipe - (25)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.88
Pipe - (26)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.52
Pipe - (27)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.52
Pipe - (28)	CIRCULAR	1.00	1.00	1	0.79	0.25	8.05
Pipe - (29)	CIRCULAR	1.00	1.00	1	0.79	0.25	4.83
Pipe - (3)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.35
Pipe - (30)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (31)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.52
Pipe - (33)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (34)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.54
Pipe - (35)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.73
Pipe - (4)	CIRCULAR	1.00	1.00	1	0.79	0.25	4.45
Pipe - (40)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.43
Pipe - (41)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (43)	CIRCULAR	1.00	1.00	1	0.79	0.25	

4.77

Pipe - (44)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.63
Pipe - (45)	CIRCULAR	1.50	1.50	1	1.77	0.38	14.86
Pipe - (5)	CIRCULAR	1.00	1.00	1	0.79	0.25	7.00
Pipe - (50)	CIRCULAR	1.50	1.50	1	1.77	0.38	30.06
Pipe - (51)	CIRCULAR	1.00	1.00	1	0.79	0.25	10.15
Pipe - (54)	CIRCULAR	1.00	1.00	1	0.79	0.25	8.20
Pipe - (55)	CIRCULAR	1.00	1.00	1	0.79	0.25	12.12
Pipe - (56)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.17
Pipe - (57)	CIRCULAR	1.50	1.50	1	1.77	0.38	26.08
Pipe - (61)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.92
Pipe - (62)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (7)	CIRCULAR	1.00	1.00	1	0.79	0.25	7.14

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Transect Summary
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Transect XS-L-Pipe - (13)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (16)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (18)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (2)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (24)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046

```
            0.6487     0.6927     0.7368     0.7809     0.8249
            0.8690     0.9131     0.9572     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000

Transect XS-L-Pipe - (27)
Area:
            0.0005     0.0019     0.0043     0.0076     0.0118
            0.0170     0.0232     0.0305     0.0390     0.0487
            0.0595     0.0715     0.0847     0.0990     0.1145
            0.1312     0.1491     0.1682     0.1884     0.2098
            0.2323     0.2561     0.2810     0.3071     0.3338
            0.3604     0.3871     0.4137     0.4404     0.4670
            0.4937     0.5203     0.5470     0.5736     0.6003
            0.6269     0.6536     0.6802     0.7069     0.7335
            0.7602     0.7868     0.8135     0.8401     0.8668
            0.8934     0.9201     0.9467     0.9734     1.0000
Hrad:
            0.0139     0.0278     0.0418     0.0557     0.0696
            0.0835     0.0963     0.1080     0.1202     0.1329
            0.1459     0.1591     0.1724     0.1858     0.1994
            0.2130     0.2267     0.2404     0.2542     0.2680
            0.2818     0.2957     0.3095     0.3238     0.3512
            0.3784     0.4055     0.4326     0.4595     0.4863
            0.5130     0.5396     0.5660     0.5924     0.6187
            0.6448     0.6708     0.6968     0.7226     0.7483
            0.7740     0.7995     0.8249     0.8502     0.8754
            0.9005     0.9256     0.9505     0.9753     1.0000
Width:
            0.0355     0.0711     0.1066     0.1422     0.1777
            0.2132     0.2520     0.2961     0.3402     0.3842
            0.4283     0.4724     0.5164     0.5605     0.6046
            0.6487     0.6927     0.7368     0.7809     0.8249
            0.8690     0.9131     0.9572     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000

Transect XS-L-Pipe - (28)
Area:
            0.0005     0.0019     0.0043     0.0076     0.0118
            0.0170     0.0232     0.0305     0.0390     0.0487
            0.0595     0.0715     0.0847     0.0990     0.1145
            0.1312     0.1491     0.1682     0.1884     0.2098
            0.2323     0.2561     0.2810     0.3071     0.3338
            0.3604     0.3871     0.4137     0.4404     0.4670
            0.4937     0.5203     0.5470     0.5736     0.6003
            0.6269     0.6536     0.6802     0.7069     0.7335
            0.7602     0.7868     0.8135     0.8401     0.8668
            0.8934     0.9201     0.9467     0.9734     1.0000
Hrad:
            0.0139     0.0278     0.0418     0.0557     0.0696
            0.0835     0.0963     0.1080     0.1202     0.1329
            0.1459     0.1591     0.1724     0.1858     0.1994
            0.2130     0.2267     0.2404     0.2542     0.2680
            0.2818     0.2957     0.3095     0.3238     0.3512
            0.3784     0.4055     0.4326     0.4595     0.4863
            0.5130     0.5396     0.5660     0.5924     0.6187
            0.6448     0.6708     0.6968     0.7226     0.7483
            0.7740     0.7995     0.8249     0.8502     0.8754
            0.9005     0.9256     0.9505     0.9753     1.0000
```

Width:

	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (30)

Area:

	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000

Width:

	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (37)

Area:

	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863

	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (50)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (55)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329

```
              0.1459     0.1591     0.1724     0.1858     0.1994
              0.2130     0.2267     0.2404     0.2542     0.2680
              0.2818     0.2957     0.3095     0.3238     0.3512
              0.3784     0.4055     0.4326     0.4595     0.4863
              0.5130     0.5396     0.5660     0.5924     0.6187
              0.6448     0.6708     0.6968     0.7226     0.7483
              0.7740     0.7995     0.8249     0.8502     0.8754
              0.9005     0.9256     0.9505     0.9753     1.0000
  Width:
              0.0355     0.0711     0.1066     0.1422     0.1777
              0.2132     0.2520     0.2961     0.3402     0.3842
              0.4283     0.4724     0.5164     0.5605     0.6046
              0.6487     0.6927     0.7368     0.7809     0.8249
              0.8690     0.9131     0.9572     1.0000     1.0000
              1.0000     1.0000     1.0000     1.0000     1.0000
              1.0000     1.0000     1.0000     1.0000     1.0000
              1.0000     1.0000     1.0000     1.0000     1.0000
              1.0000     1.0000     1.0000     1.0000     1.0000
              1.0000     1.0000     1.0000     1.0000     1.0000

  **************************         Volume         Depth
  Runoff Quantity Continuity        acre-ft        inches
  **************************       ---------       -------
  Total Precipitation ......           0.909         1.095
  Continuity Error (%) .....           0.682

  **************************         Volume        Volume
  Flow Routing Continuity           acre-ft      Mgallons
  **************************       ---------     ---------
  External Inflow ..........           0.000         0.000
  External Outflow .........           0.378         0.123
  Initial Stored Volume ....           0.000         0.000
  Final Stored Volume ......           0.000         0.000
  Continuity Error (%) .....          -0.805

  **************************************
  Runoff Coefficient Computations Report
  **************************************

  --------------------
  Subbasin Sub-CB-1
  --------------------
                                                           Area          Soil      Runoff
  Soil/Surface Description                               (acres)         Group     Coeff.
  -----------------------------------------------------------------------------------------
  Streets, 25 years or greater                              0.17      A (6%+)        0.79
  Residential Lot Size 1 Acre, 25 years or greater          0.19      A (6%+)        0.29
  Composite Area & Weighted Runoff Coeff.                   0.36                     0.53

  ---------------------
  Subbasin Sub-CB-10
  ---------------------
                                                           Area          Soil      Runoff
  Soil/Surface Description                               (acres)         Group     Coeff.
  -----------------------------------------------------------------------------------------
  Streets, 25 years or greater                              0.12      A (6%+)        0.79
  Residential Lot Size 1 Acre, 25 years or greater          0.01      A (6%+)        0.29
  Composite Area & Weighted Runoff Coeff.                   0.13                     0.75

  ---------------------
  Subbasin Sub-CB-11
  ---------------------
                                                           Area          Soil      Runoff
```

Soil/Surface Description	(acres)	Group	Coeff.
Streets, 25 years or greater	0.11	A (6%+)	0.79
Forest, 25 years or greater	0.09	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.20		0.50

Subbasin Sub-CB-12

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.23	A (6%+)	0.79
Forest, 25 years or greater	1.05	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.28		0.26

Subbasin Sub-CB-13-14

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.25	A (6%+)	0.79
Forest, 25 years or greater	0.09	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.34		0.61

Subbasin Sub-CB-15-16

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.19	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.05	A (6%+)	0.29
Streets, 25 years or greater	0.16	B (0-2%)	0.80
Composite Area & Weighted Runoff Coeff.	0.40		0.73

Subbasin Sub-CB-17

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.15	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.13	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.29		0.56

Subbasin Sub-CB-18-19

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.47	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.47	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.95		0.54

Subbasin Sub-CB-2

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.17	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.23	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.40		0.50

Subbasin Sub-CB-20

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.49	A (6%+)	0.79
Forest, 25 years or greater	1.00	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.49		0.35

Subbasin Sub-CB-3

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.14	A (6%+)	0.79
Forest, 25 years or greater	2.69	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	2.84		0.17

Subbasin Sub-CB-4

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.15	A (6%+)	0.79
Forest, 25 years or greater	0.19	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.34		0.43

Subbasin Sub-CB-5

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.32	A (6%+)	0.79
Forest, 25 years or greater	0.01	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.33		0.78

Subbasin Sub-CB-6

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.14	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.00	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.14		0.76

Subbasin Sub-CB-7

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.10	A (0-2%)	0.76
Residential Lot Size 1 Acre, 25 years or greater	0.01	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.11		0.72

Subbasin Sub-CB-8W

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

Streets, 25 years or greater	0.17	A (2-6%)	0.77
Meadow, 25 years or greater	0.05	A (2-6%)	0.22
Composite Area & Weighted Runoff Coeff.	0.22		0.64

Subbasin Sub-CB-9

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.15	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.00	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.15		0.76

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

```
Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n  = Manning's Roughness
Lf = Flow Length (ft)
P  = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)
```

Shallow Concentrated Flow Equation

```
V  = 16.1345 * (Sf^0.5) (unpaved surface)
V  = 20.3282 * (Sf^0.5) (paved surface)
V  = 15.0 * (Sf^0.5) (grassed waterway surface)
V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V  = 7.0 * (Sf^0.5) (short grass pasture surface)
V  = 5.0 * (Sf^0.5) (woodland surface)
V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V  = Velocity (ft/sec)
Sf = Slope (ft/ft)
```

Channel Flow Equation

```
V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R  = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R  = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
```

Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin Sub-CB-1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	33.69	0.00	0.00
Slope (%):	1.60	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	9.26	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	329.84	0.00	0.00
Slope (%):	0.77	0.00	0.00
Surface Type:	Paved	Paved	Paved
Velocity (ft/sec):	1.79	0.00	0.00
Computed Flow Time (minutes):	3.08	0.00	0.00

===
Total TOC (minutes): 12.34
===

Subbasin Sub-CB-10

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-11

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	73.91	0.00	0.00
Slope (%):	24.40	0.00	

0.00

	Subarea A	Subarea B	Subarea C
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.21	0.00	0.00
Computed Flow Time (minutes):	5.85	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	147.74	0.00	0.00
Slope (%):	2.17	0.00	0.00
Surface Type:	Paved	Paved	Paved
Velocity (ft/sec):	2.99	0.00	0.00
Computed Flow Time (minutes):	0.82	0.00	0.00

Total TOC (minutes): 6.67

Subbasin Sub-CB-12

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	222.44	0.00	0.00
Slope (%):	10.60	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.19	0.00	0.00
Computed Flow Time (minutes):	19.70	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	185.02	0.00	0.00
Slope (%):	4.77	0.00	0.00
Surface Type:	Paved	Paved	Paved
Velocity (ft/sec):	4.44	0.00	0.00
Computed Flow Time (minutes):	0.69	0.00	0.00

```
         Total TOC (minutes):                      20.39

==============================================================================================


  ------------------------
  Subbasin Sub-CB-13-14
  ------------------------

  Sheet Flow Computations
  -----------------------
                                                Subarea A           Subarea B           Subarea
C
         Manning's Roughness:                        0.40                0.00
0.00
         Flow Length (ft):                          80.13                0.00
0.00
         Slope (%):                                 24.40                0.00
0.00
         2 yr, 24 hr Rainfall (in):                  3.60                0.00
0.00
         Velocity (ft/sec):                          0.21                0.00
0.00
         Computed Flow Time (minutes):               6.23                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A           Subarea B           Subarea
C
         Flow Length (ft):                         174.35                0.00
0.00
         Slope (%):                                  2.45                0.00
0.00
         Surface Type:                              Paved               Paved
Paved
         Velocity (ft/sec):                          3.18                0.00
0.00
         Computed Flow Time (minutes):               0.91                0.00
0.00

==============================================================================================
         Total TOC (minutes):                       7.15

==============================================================================================


  ------------------------
  Subbasin Sub-CB-15-16
  ------------------------

         User-Defined TOC override (minutes):      5.00

  ---------------------
  Subbasin Sub-CB-17
  ---------------------

         User-Defined TOC override (minutes):      5.00

  ------------------------
  Subbasin Sub-CB-18-19
  ------------------------

         User-Defined TOC override (minutes):      5.00

  --------------------
```

```
  Subbasin Sub-CB-2
  --------------------

          User-Defined TOC override (minutes):      5.00

  ---------------------
  Subbasin Sub-CB-20
  ---------------------

  Sheet Flow Computations
  -----------------------
                                               Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                      0.40                0.00
0.00
          Flow Length (ft):                       227.22                0.00
0.00
          Slope (%):                                7.48                0.00
0.00
          2 yr, 24 hr Rainfall (in):                3.60                0.00
0.00
          Velocity (ft/sec):                        0.16                0.00
0.00
          Computed Flow Time (minutes):            23.04                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                               Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                       193.35                0.00
0.00
          Slope (%):                                2.77                0.00
0.00
          Surface Type:                            Paved               Paved
Paved
          Velocity (ft/sec):                        3.38                0.00
0.00
          Computed Flow Time (minutes):             0.95                0.00
0.00

===============================================================================================
          Total TOC (minutes):                     23.99

===============================================================================================


  --------------------
  Subbasin Sub-CB-3
  --------------------

  Sheet Flow Computations
  -----------------------
                                               Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                      0.40                0.00
0.00
          Flow Length (ft):                       492.34                0.00
0.00
          Slope (%):                                3.89                0.00
0.00
          2 yr, 24 hr Rainfall (in):                3.60                0.00
0.00
          Velocity (ft/sec):                        0.15                0.00
0.00
          Computed Flow Time (minutes):            55.54                0.00
```

```
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                              Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                       70.73                0.00
0.00
          Slope (%):                               4.87                0.00
0.00
          Surface Type:                         Unpaved               Paved
Paved
          Velocity (ft/sec):                       3.56                0.00
0.00
          Computed Flow Time (minutes):            0.33                0.00
0.00

===============================================================================================
          Total TOC (minutes):                    55.87

===============================================================================================


  --------------------
  Subbasin Sub-CB-4
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-5
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-6
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-7
  --------------------

          User-Defined TOC override (minutes):      5.00

  ---------------------
  Subbasin Sub-CB-8W
  ---------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-9
  --------------------

          User-Defined TOC override (minutes):      5.00

  ***********************
  Subbasin Runoff Summary
  ***********************

  ---------------------------------------------------------------------------------------
  Subbasin       Accumulated     Rainfall     Total      Peak  Weighted          Time of
  ID                  Precip    Intensity    Runoff    Runoff    Runoff     Concentration
```

	in	in/hr	in	cfs	Coeff	days	hh:mm:ss
Sub-CB-1	0.91	4.45	0.48	0.86	0.530	0	00:12:20
Sub-CB-10	0.60	7.21	0.45	0.69	0.750	0	00:05:00
Sub-CB-11	0.69	6.18	0.34	0.61	0.500	0	00:06:40
Sub-CB-12	1.15	3.39	0.30	1.12	0.260	0	00:20:23
Sub-CB-13-14	0.71	5.96	0.43	1.22	0.610	0	00:07:09
Sub-CB-15-16	0.60	7.21	0.44	2.13	0.730	0	00:05:00
Sub-CB-17	0.60	7.21	0.34	1.15	0.560	0	00:05:00
Sub-CB-18-19	0.60	7.21	0.32	3.69	0.540	0	00:05:00
Sub-CB-2	0.60	7.21	0.30	1.45	0.500	0	00:05:00
Sub-CB-20	1.24	3.10	0.43	1.62	0.350	0	00:23:59
Sub-CB-3	1.70	1.82	0.29	0.88	0.170	0	00:55:52
Sub-CB-4	0.60	7.21	0.26	1.06	0.430	0	00:05:00
Sub-CB-5	0.60	7.21	0.47	1.85	0.780	0	00:05:00
Sub-CB-6	0.60	7.21	0.46	0.78	0.760	0	00:05:00
Sub-CB-7	0.60	7.21	0.43	0.56	0.720	0	00:05:00
Sub-CB-8W	0.60	7.21	0.38	1.02	0.640	0	00:05:00
Sub-CB-9	0.60	7.21	0.46	0.81	0.760	0	00:05:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
CB-8E	0.00	0.00	257.54	0	00:00	0	0	0:00:00
CIT-8	2.69	2.69	257.49	0	00:00	0	0	0:00:00
CIT-9	2.27	2.58	259.98	0	00:05	0	0	0:00:00
DH-10	0.10	0.45	265.60	0	00:05	0	0	0:00:00
DH-13	2.76	3.15	262.95	0	00:07	0	0	0:00:00
DH-20	0.01	0.39	278.01	0	00:24	0	0	0:00:00
DH-6	0.05	0.29	247.24	0	00:05	0	0	0:00:00
DMH-10	0.10	0.45	265.77	0	00:05	0	0	0:00:00
DMH-11	0.10	0.28	269.03	0	00:06	0	0	0:00:00
DMH-12	0.34	0.71	268.41	0	00:20	0	0	0:00:00
DMH-13	0.10	0.59	263.36	0	00:07	0	0	0:00:00
DMH-20	0.44	0.82	278.47	0	00:24	0	0	0:00:00
DMH-3	0.11	0.38	262.62	0	00:05	0	0	0:00:00
DMH-4N	0.11	0.51	253.36	0	00:05	0	0	0:00:00
DMH-4S	0.11	0.40	257.53	0	00:05	0	0	0:00:00
DMH-6	4.85	5.18	252.58	0	00:05	0	0	0:00:00
DMH-7	1.10	1.37	255.47	0	00:05	0	0	0:00:00
EX-18	3.00	3.59	269.59	0	00:05	0	0	0:00:00
EX-7	1.20	1.44	254.24	0	00:05	0	0	0:00:00
Structure - (72)	0.11	0.35	276.14	0	00:12	0	0	0:00:00
STU-16	0.28	0.72	253.42	0	00:05	0	0	0:00:00
STU-5	0.12	0.60	249.23	0	00:06	0	0	0:00:00
DP-1	0.00	0.31	275.31	0	00:12	0	0	0:00:00
DP-10	0.00	0.28	265.06	0	00:05	0	0	0:00:00
DP-13	0.01	0.47	260.07	0	00:07	0	0	0:00:00
DP-16	0.00	0.72	253.38	0	00:05	0	0	0:00:00
DP-18	0.01	0.51	264.87	0	00:05	0	0	0:00:00
DP-20	0.01	0.36	274.56	0	00:24	0	0	0:00:00
DP-5	0.01	0.52	248.52	0	00:05	0	0	0:00:00
DP-6	0.00	0.20	246.70	0	00:05	0	0	0:00:00
DP-7	0.00	0.54	253.14	0	00:06	0	0	0:00:00
OFFSITE1	0.00	0.08	281.30	0	00:16	0	0	0:00:00
OFFSITE-1	0.01	0.19	267.87	0	00:25	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm
CB-8E	JUNCTION	0.00	0.00	0	00:00	0.00		
CIT-8	JUNCTION	0.00	1.51	0	00:05	0.00		
CIT-9	JUNCTION	0.00	0.71	0	00:05	0.00		
DH-10	JUNCTION	0.00	1.08	0	00:05	0.00		
DH-13	JUNCTION	0.00	1.59	0	00:07	0.00		
DH-20	JUNCTION	0.00	3.24	0	00:24	0.00		
DH-6	JUNCTION	0.00	0.75	0	00:05	0.00		
DMH-10	JUNCTION	0.00	0.67	0	00:05	0.00		
DMH-11	JUNCTION	0.00	0.60	0	00:06	0.00		
DMH-12	JUNCTION	0.00	1.06	0	00:20	0.00		
DMH-13	JUNCTION	0.00	1.22	0	00:07	0.00		
DMH-20	JUNCTION	0.00	3.24	0	00:24	0.00		
DMH-3	JUNCTION	0.00	1.44	0	00:05	0.00		
DMH-4N	JUNCTION	0.00	2.30	0	00:05	0.00		
DMH-4S	JUNCTION	0.00	1.44	0	00:05	0.00		
DMH-6	JUNCTION	0.00	0.75	0	00:05	0.00		
DMH-7	JUNCTION	0.00	0.56	0	00:05	0.00		
EX-18	JUNCTION	0.00	3.67	0	00:05	0.00		
EX-7	JUNCTION	0.00	2.01	0	00:05	0.00		
Structure - (72)	JUNCTION	0.00	0.73	0	00:12	0.00		
STU-16	JUNCTION	0.00	3.10	0	00:05	0.00		
STU-5	JUNCTION	0.00	3.80	0	00:05	0.00		
DP-1	OUTFALL	0.00	0.73	0	00:12	0.00		
DP-10	OUTFALL	0.00	1.08	0	00:05	0.00		
DP-13	OUTFALL	0.00	1.58	0	00:07	0.00		
DP-16	OUTFALL	0.00	3.10	0	00:05	0.00		
DP-18	OUTFALL	0.00	3.65	0	00:05	0.00		
DP-20	OUTFALL	0.00	3.24	0	00:24	0.00		
DP-5	OUTFALL	0.00	3.79	0	00:05	0.00		
DP-6	OUTFALL	0.00	0.75	0	00:05	0.00		
DP-7	OUTFALL	0.00	2.01	0	00:06	0.00		
OFFSITE1	OUTFALL	0.00	0.09	0	00:16	0.00		
OFFSITE-1	OUTFALL	0.00	1.05	0	00:25	0.00		

****
Inlet Depth Summary
****

Inlet ID	Max Gutter Spread during Peak Flow ft	Max Gutter Water Elev during Peak Flow ft	Max Gutter Water Depth during Peak Flow ft	Time of Maximum Depth Occurrence days	hh:mm
CB-1	5.69	281.42	0.20	0	00:12
CB-10	2.64	267.85	0.16	0	00:05
CB-11	2.51	272.25	0.15	0	00:06
CB-12	3.25	271.26	0.19	0	00:20
CB-13	4.09	265.02	0.17	0	00:07
CB-16	5.72	255.18	0.25	0	00:05
CB-17	6.62	265.71	0.22	0	00:05
CB-18	13.24	274.09	0.37	0	00:05
CB-2	3.61	277.02	0.20	0	00:05

CB-20	4.07	279.84	0.17	0 00:00
CB-3	2.93	265.56	0.17	0 00:56
CB-4	3.18	256.11	0.18	0 00:05
CB-5	5.15	251.40	0.22	0 00:05
CB-6	2.79	255.51	0.16	0 00:05
CB-7	2.43	258.56	0.15	0 00:05
CB-8W	5.59	260.28	0.20	0 00:05
CB-9	2.83	262.99	0.17	0 00:05

****
Inlet Flow Summary
****

Inlet ID	Peak Flow cfs	Peak Lateral Flow cfs	Peak Flow Intercepted by Inlet cfs	Peak Flow Bypassing Inlet cfs	Inlet Efficiency during Peak Flow %	Total Flooding acre-in	Total Time Flooded minutes
CB-1	0.86	0.86	0.74	0.12	86.52	0.000	0
CB-10	0.69	0.69	0.68	0.01	98.49	0.000	0
CB-11	0.61	0.61	0.61	0.01	99.09	0.000	0
CB-12	1.12	1.12	1.06	0.07	94.20	0.000	0
CB-13	1.22	1.22	-	-	-	0.000	0
CB-16	2.22	2.13	-	-	-	0.000	0
CB-17	1.15	1.15	0.94	0.22	81.26	0.000	0
CB-18	3.69	3.69	-	-	-	0.000	0
CB-2	1.45	1.45	1.32	0.13	91.04	0.000	0
CB-20	1.62	1.62	-	-	-	0.000	0
CB-3	0.88	0.88	0.85	0.03	96.70	0.000	0
CB-4	1.06	1.06	1.01	0.06	94.82	0.000	0
CB-5	1.85	1.85	-	-	-	0.000	0
CB-6	0.78	0.78	0.76	0.02	97.64	0.000	0
CB-7	0.57	0.56	0.57	0.00	99.36	0.000	0
CB-8W	1.02	1.02	0.88	0.15	85.72	0.000	0
CB-9	0.81	0.81	0.72	0.09	89.23	0.000	0

****

Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
DP-1	1.92	0.35	0.73
DP-10	1.42	0.37	1.08
DP-13	3.30	0.67	1.58
DP-16	1.31	0.87	3.10
DP-18	0.87	1.46	3.65
DP-20	3.39	1.59	3.24
DP-5	8.53	0.57	3.79
DP-6	1.06	0.25	0.75
DP-7	2.45	0.34	2.01
OFFSITE1	2.82	0.02	0.09
OFFSITE-1	4.54	0.40	1.05
System	2.87	6.88	16.37

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
CB-1_Overflow	CHANNEL	0 00:16	1.84	1.00	0.09	2.70	0.03	0.27	0	Calculated
CB10-9_Gutter	CHANNEL	0 00:06	1.71	1.00	0.01	8.35	0.00	0.07	0	Calculated
CB11-10_Gutter	CHANNEL	0 00:08	1.14	1.00	0.01	7.95	0.00	0.06	0	Calculated
CB12-13_Gutter	CHANNEL	0 00:22	2.15	1.00	0.06	9.44	0.01	0.15	0	Calculated
CB17-16_Gutter	CHANNEL	0 00:06	6.01	1.00	0.17	12.30	0.01	0.20	0	Calculated
CB2-3_Gutter	CHANNEL	0 00:06	4.97	1.00	0.10	13.13	0.01	0.16	0	Calculated
CB3-4_Gutter	CHANNEL	0 00:57	1.52	1.00	0.03	11.64	0.00	0.11	0	Calculated
CB4-5_Gutter	CHANNEL	0 00:07	2.99	1.00	0.04	8.25	0.00	0.12	0	Calculated
CB6-5_Gutter	CHANNEL	0 00:07	2.23	1.00	0.02	7.73	0.00	0.09	0	Calculated
CB7-6_Gutter	CHANNEL	0 00:06	1.06	1.00	0.00	6.62	0.00	0.06	0	Calculated
CB8-7_Gutter	CHANNEL	0 00:07	2.15	1.00	0.11	4.89	0.02	0.22	0	Calculated
CB9-8_Gutter	CHANNEL	0 00:07	2.67	1.00	0.06	6.26	0.01	0.17	0	Calculated
L-Pipe - (50)	CHANNEL	0 00:25	8.50	1.00	1.05	41.01	0.03			

```
0.26          0  Calculated
  Pipe - (12)          CONDUIT      0  00:05       5.32     1.00         0.75         6.19        0.12
0.24          0  Calculated
  Pipe - (13)          CONDUIT      0  00:05       3.33     1.00         0.75         3.19        0.24
0.33          0  Calculated
  Pipe - (14)          CONDUIT      0  00:05       6.40     1.00         1.85         5.59        0.33
0.40          0  Calculated
  Pipe - (16)          CONDUIT      0  00:56       6.42     1.00         0.84         7.67        0.11
0.22          0  Calculated
  Pipe - (18)          CONDUIT      0  00:05       3.32     1.00         0.56         3.56        0.16
0.27          0  Calculated
  Pipe - (19)          CONDUIT      0  00:05       3.79     1.00         0.56         4.29        0.13
0.24          0  Calculated
  Pipe - (2)           CONDUIT      0  00:05      12.23     1.00         1.29         7.69        0.17
0.28          0  Calculated
  Pipe - (20)          CONDUIT      0  00:00       0.00     1.00         0.00         2.79        0.00
0.00          0  Calculated
  Pipe - (21)          CONDUIT      0  00:06       4.44     1.00         1.48         3.59        0.41
0.45          0  Calculated
  Pipe - (22)          CONDUIT      0  00:06       4.67     1.00         2.01         3.56        0.56
0.54          0  Calculated
  Pipe - (23)          CONDUIT      0  00:05       5.71     1.00         0.87         6.40        0.14
0.25          0  Calculated
  Pipe - (24)          CONDUIT      0  00:05       3.43     1.00         0.71         3.40        0.21
0.31          0  Calculated
  Pipe - (25)          CONDUIT      0  00:05       4.83     1.00         0.68         3.88        0.18
0.28          0  Calculated
  Pipe - (26)          CONDUIT      0  00:05       2.72     1.00         0.67         2.52        0.26
0.35          0  Calculated
  Pipe - (27)          CONDUIT      0  00:05       2.71     1.00         0.67         2.52        0.27
0.35          0  Calculated
  Pipe - (28)          CONDUIT      0  00:06       6.03     1.00         0.60         8.05        0.07
0.18          0  Calculated
  Pipe - (29)          CONDUIT      0  00:07       5.92     1.00         0.59         4.83        0.12
0.23          0  Calculated
  Pipe - (3)           CONDUIT      0  00:06       6.58     1.00         1.43         6.35        0.23
0.32          0  Calculated
  Pipe - (30)          CONDUIT      0  00:20       3.95     1.00         1.06         3.56        0.30
0.37          0  Calculated
  Pipe - (31)          CONDUIT      0  00:20       5.74     1.00         1.05         5.52        0.19
0.29          0  Calculated
  Pipe - (33)          CONDUIT      0  00:07       4.41     1.00         1.58         3.56        0.44
0.47          0  Calculated
  Pipe - (34)          CONDUIT      0  00:07       3.21     1.00         1.22         2.54        0.48
0.49          0  Calculated
  Pipe - (35)          CONDUIT      0  00:07       4.27     1.00         1.22         3.73        0.33
0.39          0  Calculated
  Pipe - (4)           CONDUIT      0  00:06       5.83     1.00         2.26         4.45        0.51
0.50          0  Calculated
  Pipe - (40)          CONDUIT      0  00:05      10.10     1.00         0.91         6.43        0.14
0.25          0  Calculated
  Pipe - (41)          CONDUIT      0  00:05       5.11     1.00         3.10         3.56        0.87
0.72          0  Calculated
  Pipe - (43)          CONDUIT      0  00:05       5.97     1.00         2.22         4.77        0.47
0.48          0  Calculated
  Pipe - (44)          CONDUIT      0  00:05       7.65     1.00         3.67         5.63        0.65
0.59          0  Calculated
  Pipe - (45)          CONDUIT      0  00:05       7.00     1.00         3.65        14.86        0.25
0.34          0  Calculated
  Pipe - (5)           CONDUIT      0  00:05       9.09     1.00         3.79         7.00        0.54
0.52          0  Calculated
  Pipe - (50)          CONDUIT      0  00:24      11.11     1.00         3.24        30.06        0.11
0.22          0  Calculated
  Pipe - (51)          CONDUIT      0  00:24      11.48     1.00         3.24        10.15        0.32
0.39          0  Calculated
  Pipe - (54)          CONDUIT      0  00:05       6.52     1.00         0.75         8.20        0.09
```

```
0.20            0  Calculated
  Pipe - (55)          CONDUIT      0  00:05      9.35    1.00        1.01       12.12      0.08
0.19            0  Calculated
  Pipe - (56)          CONDUIT      0  00:05      5.90    1.00        1.08        6.17      0.17
0.28            0  Calculated
  Pipe - (57)          CONDUIT      0  00:24     10.06    1.00        3.24       26.08      0.12
0.24            0  Calculated
  Pipe - (61)          CONDUIT      0  00:12      5.80    1.00        0.73        5.92      0.12
0.24            0  Calculated
  Pipe - (62)          CONDUIT      0  00:12      3.57    1.00        0.73        3.56      0.21
0.31            0  Calculated
  Pipe - (7)           CONDUIT      0  00:05      7.14    1.00        1.44        7.14      0.20
0.30            0  Calculated


  ********************************
  Highest Flow Instability Indexes
  ********************************
  All links are stable.

  WARNING 108 : Surcharge elevation defined for Junction EX-18 is below junction maximum
elevation. Assumed surcharge elevation equal to maximum elevation.
  WARNING 139 : Ponded area defined for on sag Inlet CB-18 is zero. Assumed ponded area equal to
10 ft² (0.929 m²).
  WARNING 138 : Initial water surface elevation defined for Inlet CB-20 is below catchbasin
invert elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB-4 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB-5 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB-1_Overflow
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB10-9_Gutter
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB11-10_Gutter
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB12-13_Gutter
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB17-16_Gutter
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB2-3_Gutter is
below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB3-4_Gutter is
below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB4-5_Gutter is
below the storm drain inlet rim elevation.
```

Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB6-5_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB7-6_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB8-7_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB9-8_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 117 : Conduit outlet invert elevation defined for Conduit CB-1_Overflow is below downstream node invert elevation.
Assumed conduit outlet invert elevation equal to downstream node invert elevation.
WARNING 004 : Minimum elevation drop used for Conduit CB-1_Overflow.
WARNING 005 : Minimum slope used for Conduit CB-1_Overflow.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB10-9_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-9.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB11-10_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-10.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB12-13_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-13.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB17-16_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-16.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB2-3_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-3.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB3-4_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-4.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB4-5_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-5.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB6-5_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-5.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB7-6_Gutter is below the storm drain inlet rim elevation.

Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-6.

WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB8-7_Gutter is below the storm drain inlet rim elevation.

Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-7.

WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB9-8_Gutter is below the storm drain inlet rim elevation.

Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-8W.

WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (14) is below upstream node invert elevation.

Assumed conduit inlet invert elevation equal to upstream node invert elevation.

WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (50) is below upstream node invert elevation.

Assumed conduit inlet invert elevation equal to upstream node invert elevation.

WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (55) is below upstream node invert elevation.

Assumed conduit inlet invert elevation equal to upstream node invert elevation.

Analysis began on: Tue Jan 31 11:10:46 2023
Analysis ended on: Tue Jan 31 11:10:49 2023
Total elapsed time: 00:00:03

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.2.165 (Build 0)

****
Project Description
****
File Name .... Grove_St_Ph2_r1-PR.SPF

****
Analysis Options
****
Flow Units .... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration...... SCS TR-55
Return Period.............. 25 years
Link Routing Method .... Kinematic Wave
Storage Node Exfiltration.. None
Starting Date DEC-20-2022 00:00:00
Ending Date DEC-21-2022 00:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 17
Number of nodes 50
Number of links 52

****
Subbasin Summary
****

Subbasin ID	Total Area acres
Sub-CB-1	0.36
Sub-CB-10	0.13
Sub-CB-11	0.20
Sub-CB-12	1.28
Sub-CB-13-14	0.34
Sub-CB-15-16	0.40
Sub-CB-17	0.29
Sub-CB-18-19	0.95
Sub-CB-2	0.40
Sub-CB-20	1.49
Sub-CB-3	2.84
Sub-CB-4	0.34
Sub-CB-5	0.33
Sub-CB-6	0.14
Sub-CB-7	0.11
Sub-CB-8W	0.22
Sub-CB-9	0.15

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
CB-8E	JUNCTION	257.54	259.20	0.00	

CIT-8	JUNCTION	254.80	259.42	0.00
CIT-9	JUNCTION	257.40	262.67	0.00
DH-10	JUNCTION	265.15	268.15	0.00
DH-13	JUNCTION	259.80	265.60	0.00
DH-20	JUNCTION	277.62	280.21	0.00
DH-6	JUNCTION	246.95	255.72	0.00
DMH-10	JUNCTION	265.32	267.86	0.00
DMH-11	JUNCTION	268.75	272.24	0.00
DMH-12	JUNCTION	267.70	271.08	0.00
DMH-13	JUNCTION	262.77	265.40	0.00
DMH-20	JUNCTION	277.65	280.22	0.00
DMH-3	JUNCTION	262.24	265.34	0.00
DMH-4N	JUNCTION	252.85	255.95	0.00
DMH-4S	JUNCTION	257.13	262.56	0.00
DMH-6	JUNCTION	247.40	257.58	0.00
DMH-7	JUNCTION	254.10	258.76	0.00
EX-18	JUNCTION	266.00	273.24	0.00
EX-7	JUNCTION	252.80	258.62	0.00
Structure - (72)	JUNCTION	275.79	277.57	0.00
STU-16	JUNCTION	252.70	255.49	0.00
STU-5	JUNCTION	248.63	251.88	0.00
DP-1	OUTFALL	275.00	276.00	0.00
DP-10	OUTFALL	264.78	265.78	0.00
DP-13	OUTFALL	259.60	260.60	0.00
DP-16	OUTFALL	252.66	253.66	0.00
DP-18	OUTFALL	264.36	265.86	0.00
DP-20	OUTFALL	274.20	275.70	0.00
DP-5	OUTFALL	248.00	249.00	0.00
DP-6	OUTFALL	246.50	247.50	0.00
DP-7	OUTFALL	252.60	253.60	0.00
OFFSITE1	OUTFALL	281.22	281.50	0.00
OFFSITE-1	OUTFALL	267.68	268.43	0.00

****
Inlet Summary
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Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation (ft)	Inlet Rim Elevation (ft)	Ponded Area (ft²)	Initial Water Elevation (ft)	Grate Clogging Factor (%)
CB-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	278.10	281.22	-	278.10	0.00
CB-10	FHWA HEC-22 GENERIC	N/A	On Grade	1	265.44	267.69	-	265.44	0.00
CB-11	FHWA HEC-22 GENERIC	N/A	On Grade	1	269.10	272.10	-	269.10	0.00
CB-12	FHWA HEC-22 GENERIC	N/A	On Grade	1	268.07	271.07	-	268.07	0.00
CB-13	FHWA HEC-22 GENERIC	N/A	On Sag	1	262.90	264.85	10.00	262.90	0.00
CB-16	FHWA HEC-22 GENERIC	N/A	On Sag	1	252.93	254.93	10.00	252.93	0.00
CB-17	FHWA HEC-22 GENERIC	N/A	On Grade	1	260.16	265.49	-	260.16	0.00
CB-18	FHWA HEC-22 GENERIC	N/A	On Sag	1	269.61	273.72	10.00	269.61	0.00
CB-2	FHWA HEC-22 GENERIC	N/A	On Grade	1	273.82	276.82	-	273.82	0.00

CB-20	FHWA HEC-22 GENERIC	N/A	On Sag	1	278.18	279.67	10.00	278.18	0.00
CB-3	FHWA HEC-22 GENERIC	N/A	On Grade	1	262.89	265.39	-	262.89	0.00
CB-4	FHWA HEC-22 GENERIC	N/A	On Grade	1	254.18	255.93	-	254.18	0.00
CB-5	FHWA HEC-22 GENERIC	N/A	On Sag	1	249.44	251.18	10.00	249.44	0.00
CB-6	FHWA HEC-22 GENERIC	N/A	On Grade	1	252.35	255.35	-	252.35	0.00
CB-7	FHWA HEC-22 GENERIC	N/A	On Grade	1	255.41	258.41	-	255.41	0.00
CB-8W	FHWA HEC-22 GENERIC	N/A	On Grade	1	257.08	260.08	-	257.08	0.00
CB-9	FHWA HEC-22 GENERIC	N/A	On Grade	1	259.82	262.82	-	259.82	0.00

****
Roadway and Gutter Summary
****

Inlet ID	Roadway Longitudinal Slope ft/ft	Roadway Cross Slope ft/ft	Roadway Manning's Roughness	Gutter Cross Slope ft/ft	Gutter Width ft	Gutter Depression in
CB-1	0.0100	0.0200	0.0160	0.0620	2.00	2.00
CB-10	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-11	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-12	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-13	-	0.0500	0.0130	0.0620	2.00	0.00
CB-16	-	0.0500	0.0130	0.0620	2.00	0.00
CB-17	0.0100	0.0200	0.0160	0.0620	2.00	2.00
CB-18	-	0.0200	0.0160	0.0620	2.00	2.00
CB-2	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-20	-	0.0500	0.0130	0.0620	2.00	0.00
CB-3	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-4	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-5	-	0.0500	0.0130	0.0620	2.00	0.00
CB-6	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-7	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-8W	0.0100	0.0200	0.0130	0.0620	2.00	2.00
CB-9	0.0200	0.0500	0.0130	0.0620	2.00	0.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
CB-1_Overflow	CB-1	OFFSITE1	CHANNEL	241.8	0.2000	0.0130
CB10-9_Gutter	CB-10	CB-9	CHANNEL	254.5	1.9133	0.0130
CB11-10_Gutter	CB-11	CB-10	CHANNEL	254.5	1.7326	0.0130
CB12-13_Gutter	CB-12	CB-13	CHANNEL	254.5	2.4437	0.0130
CB17-16_Gutter	CB-17	CB-16	CHANNEL	254.5	4.1501	0.0130
CB2-3_Gutter	CB-2	CB-3	CHANNEL	241.8	4.7276	0.0130
CB3-4_Gutter	CB-3	CB-4	CHANNEL	254.5	3.7167	0.0130
CB4-5_Gutter	CB-4	CB-5	CHANNEL	254.5	1.8662	0.0130
CB6-5_Gutter	CB-6	CB-5	CHANNEL	254.5	1.6383	0.0130
CB7-6_Gutter	CB-7	CB-6	CHANNEL	254.5	1.2022	0.0130
CB8-7_Gutter	CB-8W	CB-7	CHANNEL	254.5	0.6561	0.0130
CB9-8_Gutter	CB-9	CB-8W	CHANNEL	254.5	1.0765	0.0130
L-Pipe - (50)	CB-20	OFFSITE-1	CHANNEL	546.0	2.1967	0.0130
Pipe - (12)	DMH-6	DH-6	CONDUIT	13.3	3.0144	0.0130
Pipe - (13)	CB-6	DMH-6	CONDUIT	12.5	0.7995	0.0130

Pipe - (14)	CB-5	STU-5	CONDUIT	28.8	2.4635	0.0130
Pipe - (16)	CB-3	DMH-3	CONDUIT	11.9	4.6382	0.0130
Pipe - (18)	CB-7	DMH-7	CONDUIT	20.7	1.0000	0.0130
Pipe - (19)	DMH-7	EX-7	CONDUIT	6.9	1.4505	0.0130
Pipe - (2)	CB-2	DMH-3	CONDUIT	246.6	4.6555	0.0130
Pipe - (20)	CB-8E	CIT-8	CONDUIT	7.6	0.6131	0.0130
Pipe - (21)	CIT-8	EX-7	CONDUIT	196.9	1.0156	0.0130
Pipe - (22)	EX-7	DP-7	CONDUIT	20.0	1.0000	0.0130
Pipe - (23)	CB-8W	CIT-8	CONDUIT	20.5	3.2241	0.0130
Pipe - (24)	CB-9	CIT-9	CONDUIT	16.5	0.9092	0.0130
Pipe - (25)	CIT-9	CIT-8	CONDUIT	219.0	1.1872	0.0130
Pipe - (26)	DMH-10	DH-10	CONDUIT	14.0	0.5000	0.0130
Pipe - (27)	CB-10	DMH-10	CONDUIT	4.2	0.5000	0.0130
Pipe - (28)	CB-11	DMH-11	CONDUIT	4.9	5.1092	0.0130
Pipe - (29)	DMH-11	DH-10	CONDUIT	190.5	1.8369	0.0130
Pipe - (3)	DMH-4S	DMH-4N	CONDUIT	131.6	3.1757	0.0130
Pipe - (30)	CB-12	DMH-12	CONDUIT	3.6	1.0000	0.0130
Pipe - (31)	DMH-12	DH-13	CONDUIT	217.3	2.4045	0.0130
Pipe - (33)	DH-13	DP-13	CONDUIT	19.5	1.0000	0.0130
Pipe - (34)	CB-13	DMH-13	CONDUIT	5.9	0.5098	0.0130
Pipe - (35)	DMH-13	DH-13	CONDUIT	19.9	1.0989	0.0130
Pipe - (4)	DMH-4N	STU-5	CONDUIT	263.5	1.5634	0.0130
Pipe - (40)	CB-17	STU-16	CONDUIT	220.1	3.2621	0.0130
Pipe - (41)	STU-16	DP-16	CONDUIT	4.1	1.0000	0.0130
Pipe - (43)	CB-16	STU-16	CONDUIT	7.3	1.7930	0.0130
Pipe - (44)	CB-18	EX-18	CONDUIT	24.4	2.4990	0.0130
Pipe - (45)	EX-18	DP-18	CONDUIT	81.8	2.0000	0.0130
Pipe - (5)	STU-5	DP-5	CONDUIT	16.3	3.8608	0.0130
Pipe - (50)	CB-20	DMH-20	CONDUIT	6.5	8.1871	0.0130
Pipe - (51)	DMH-20	DH-20	CONDUIT	5.7	8.1142	0.0130
Pipe - (54)	DH-6	DP-6	CONDUIT	8.5	5.3000	0.0130
Pipe - (55)	CB-4	DMH-4N	CONDUIT	10.6	11.5699	0.0130
Pipe - (56)	DH-10	DP-10	CONDUIT	12.4	3.0000	0.0130
Pipe - (57)	DH-20	DP-20	CONDUIT	55.5	6.1646	0.0130
Pipe - (61)	CB-1	Structure - (72)	CONDUIT	79.8	2.7583	0.0130
Pipe - (62)	Structure - (72)	DP-1	CONDUIT	79.0	1.0000	0.0130
Pipe - (7)	DMH-3	DMH-4S	CONDUIT	124.6	4.0212	0.0130

****
Cross Section Summary
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Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
CB-1_Overflow	TRIANGULAR	0.28	14.00	1	1.96	0.14	2.70
CB10-9_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	8.35
CB11-10_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	7.95
CB12-13_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	9.44
CB17-16_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	12.30
CB2-3_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	13.13
CB3-4_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	

							11.64
CB4-5_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	8.25
CB6-5_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	7.73
CB7-6_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	6.62
CB8-7_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	4.89
CB9-8_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	6.26
L-Pipe - (50)	IRREGULAR	0.75	6.80	1	3.82	0.50	41.01
Pipe - (12)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.19
Pipe - (13)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.19
Pipe - (14)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.59
Pipe - (16)	CIRCULAR	1.00	1.00	1	0.79	0.25	7.67
Pipe - (18)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (19)	CIRCULAR	1.00	1.00	1	0.79	0.25	4.29
Pipe - (2)	CIRCULAR	1.00	1.00	1	0.79	0.25	7.69
Pipe - (20)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.79
Pipe - (21)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.59
Pipe - (22)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (23)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.40
Pipe - (24)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.40
Pipe - (25)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.88
Pipe - (26)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.52
Pipe - (27)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.52
Pipe - (28)	CIRCULAR	1.00	1.00	1	0.79	0.25	8.05
Pipe - (29)	CIRCULAR	1.00	1.00	1	0.79	0.25	4.83
Pipe - (3)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.35
Pipe - (30)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (31)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.52
Pipe - (33)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (34)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.54
Pipe - (35)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.73
Pipe - (4)	CIRCULAR	1.00	1.00	1	0.79	0.25	4.45
Pipe - (40)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.43
Pipe - (41)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (43)	CIRCULAR	1.00	1.00	1	0.79	0.25	

							4.77
Pipe - (44)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.63
Pipe - (45)	CIRCULAR	1.50	1.50	1	1.77	0.38	14.86
Pipe - (5)	CIRCULAR	1.00	1.00	1	0.79	0.25	7.00
Pipe - (50)	CIRCULAR	1.50	1.50	1	1.77	0.38	30.06
Pipe - (51)	CIRCULAR	1.00	1.00	1	0.79	0.25	10.15
Pipe - (54)	CIRCULAR	1.00	1.00	1	0.79	0.25	8.20
Pipe - (55)	CIRCULAR	1.00	1.00	1	0.79	0.25	12.12
Pipe - (56)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.17
Pipe - (57)	CIRCULAR	1.50	1.50	1	1.77	0.38	26.08
Pipe - (61)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.92
Pipe - (62)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (7)	CIRCULAR	1.00	1.00	1	0.79	0.25	7.14

****
Transect Summary
****

Transect XS-L-Pipe - (13)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (16)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (18)
Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (2)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (24)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046

0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (27)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (28)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (30)

Area:

	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000

Width:

	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (37)

Area:

	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863

	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (50)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (55)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329

	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

```
**************************        Volume         Depth
Runoff Quantity Continuity       acre-ft        inches
**************************     ---------       -------
Total Precipitation ......         1.103         1.328
Continuity Error (%) .....         0.682

**************************        Volume        Volume
Flow Routing Continuity          acre-ft      Mgallons
**************************     ---------     ---------
External Inflow ..........         0.000         0.000
External Outflow .........         0.458         0.149
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....        -0.802


**************************************
Runoff Coefficient Computations Report
**************************************

--------------------
Subbasin Sub-CB-1
--------------------
                                                          Area          Soil       Runoff
Soil/Surface Description                                (acres)         Group       Coeff.
-----------------------------------------------------------------------------------------
Streets, 25 years or greater                               0.17       A (6%+)         0.79
Residential Lot Size 1 Acre, 25 years or greater           0.19       A (6%+)         0.29
Composite Area & Weighted Runoff Coeff.                    0.36                       0.53

---------------------
Subbasin Sub-CB-10
---------------------
                                                          Area          Soil       Runoff
Soil/Surface Description                                (acres)         Group       Coeff.
-----------------------------------------------------------------------------------------
Streets, 25 years or greater                               0.12       A (6%+)         0.79
Residential Lot Size 1 Acre, 25 years or greater           0.01       A (6%+)         0.29
Composite Area & Weighted Runoff Coeff.                    0.13                       0.75

---------------------
Subbasin Sub-CB-11
---------------------
                                                          Area          Soil       Runoff
```

Soil/Surface Description	(acres)	Group	Coeff.
Streets, 25 years or greater	0.11	A (6%+)	0.79
Forest, 25 years or greater	0.09	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.20		0.50

Subbasin Sub-CB-12

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.23	A (6%+)	0.79
Forest, 25 years or greater	1.05	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.28		0.26

Subbasin Sub-CB-13-14

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.25	A (6%+)	0.79
Forest, 25 years or greater	0.09	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.34		0.61

Subbasin Sub-CB-15-16

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.19	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.05	A (6%+)	0.29
Streets, 25 years or greater	0.16	B (0-2%)	0.80
Composite Area & Weighted Runoff Coeff.	0.40		0.73

Subbasin Sub-CB-17

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.15	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.13	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.29		0.56

Subbasin Sub-CB-18-19

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.47	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.47	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.95		0.54

Subbasin Sub-CB-2

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.17	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.23	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.40		0.50

Subbasin Sub-CB-20

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.49	A (6%+)	0.79
Forest, 25 years or greater	1.00	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.49		0.35

Subbasin Sub-CB-3

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.14	A (6%+)	0.79
Forest, 25 years or greater	2.69	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	2.84		0.17

Subbasin Sub-CB-4

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.15	A (6%+)	0.79
Forest, 25 years or greater	0.19	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.34		0.43

Subbasin Sub-CB-5

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.32	A (6%+)	0.79
Forest, 25 years or greater	0.01	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.33		0.78

Subbasin Sub-CB-6

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.14	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.00	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.14		0.76

Subbasin Sub-CB-7

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.10	A (0-2%)	0.76
Residential Lot Size 1 Acre, 25 years or greater	0.01	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.11		0.72

Subbasin Sub-CB-8W

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

Streets, 25 years or greater	0.17	A (2-6%)	0.77
Meadow, 25 years or greater	0.05	A (2-6%)	0.22
Composite Area & Weighted Runoff Coeff.	0.22		0.64

Subbasin Sub-CB-9

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.15	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.00	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.15		0.76

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

```
        Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

        Where:

        Tc = Time of Concentration (hrs)
        n  = Manning's Roughness
        Lf = Flow Length (ft)
        P  = 2 yr, 24 hr Rainfall (inches)
        Sf = Slope (ft/ft)
```

Shallow Concentrated Flow Equation

```
        V  = 16.1345 * (Sf^0.5) (unpaved surface)
        V  = 20.3282 * (Sf^0.5) (paved surface)
        V  = 15.0 * (Sf^0.5) (grassed waterway surface)
        V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
        V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
        V  = 7.0 * (Sf^0.5) (short grass pasture surface)
        V  = 5.0 * (Sf^0.5) (woodland surface)
        V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)
```

Channel Flow Equation

```
        V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
        R  = Aq / Wp
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        R  = Hydraulic Radius (ft)
        Aq = Flow Area (ft²)
```

Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin Sub-CB-1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	33.69	0.00	0.00
Slope (%):	1.60	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	9.26	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	329.84	0.00	0.00
Slope (%):	0.77	0.00	0.00
Surface Type:	Paved	Paved	Paved
Velocity (ft/sec):	1.79	0.00	0.00
Computed Flow Time (minutes):	3.08	0.00	0.00

===
Total TOC (minutes): 12.34
===

Subbasin Sub-CB-10

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-11

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	73.91	0.00	0.00
Slope (%):	24.40	0.00	

```
0.00
          2 yr, 24 hr Rainfall (in):                 3.60          0.00
0.00
          Velocity (ft/sec):                         0.21          0.00
0.00
          Computed Flow Time (minutes):              5.85          0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A     Subarea B     Subarea
C
          Flow Length (ft):                        147.74          0.00
0.00
          Slope (%):                                 2.17          0.00
0.00
          Surface Type:                             Paved         Paved
Paved
          Velocity (ft/sec):                         2.99          0.00
0.00
          Computed Flow Time (minutes):              0.82          0.00
0.00

================================================================================================
          Total TOC (minutes):                       6.67

================================================================================================


  ---------------------
  Subbasin Sub-CB-12
  ---------------------

  Sheet Flow Computations
  -----------------------
                                                Subarea A     Subarea B     Subarea
C
          Manning's Roughness:                       0.40          0.00
0.00
          Flow Length (ft):                        222.44          0.00
0.00
          Slope (%):                                10.60          0.00
0.00
          2 yr, 24 hr Rainfall (in):                 3.60          0.00
0.00
          Velocity (ft/sec):                         0.19          0.00
0.00
          Computed Flow Time (minutes):             19.70          0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A     Subarea B     Subarea
C
          Flow Length (ft):                        185.02          0.00
0.00
          Slope (%):                                 4.77          0.00
0.00
          Surface Type:                             Paved         Paved
Paved
          Velocity (ft/sec):                         4.44          0.00
0.00
          Computed Flow Time (minutes):              0.69          0.00
0.00

================================================================================================
```

```
          Total TOC (minutes):                       20.39

================================================================================================


  ------------------------
  Subbasin Sub-CB-13-14
  ------------------------

  Sheet Flow Computations
  -----------------------
                                                Subarea A          Subarea B            Subarea
C
          Manning's Roughness:                        0.40               0.00
0.00
          Flow Length (ft):                          80.13               0.00
0.00
          Slope (%):                                 24.40               0.00
0.00
          2 yr, 24 hr Rainfall (in):                  3.60               0.00
0.00
          Velocity (ft/sec):                          0.21               0.00
0.00
          Computed Flow Time (minutes):               6.23               0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A          Subarea B            Subarea
C
          Flow Length (ft):                         174.35               0.00
0.00
          Slope (%):                                  2.45               0.00
0.00
          Surface Type:                              Paved              Paved
Paved
          Velocity (ft/sec):                          3.18               0.00
0.00
          Computed Flow Time (minutes):               0.91               0.00
0.00

================================================================================================
          Total TOC (minutes):                        7.15

================================================================================================


  ------------------------
  Subbasin Sub-CB-15-16
  ------------------------

          User-Defined TOC override (minutes):      5.00

  ---------------------
  Subbasin Sub-CB-17
  ---------------------

          User-Defined TOC override (minutes):      5.00

  ------------------------
  Subbasin Sub-CB-18-19
  ------------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
```

```
  Subbasin Sub-CB-2
  --------------------

          User-Defined TOC override (minutes):      5.00

  ---------------------
  Subbasin Sub-CB-20
  ---------------------

  Sheet Flow Computations
  -----------------------
                                                Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                       0.40                0.00
0.00
          Flow Length (ft):                        227.22                0.00
0.00
          Slope (%):                                 7.48                0.00
0.00
          2 yr, 24 hr Rainfall (in):                 3.60                0.00
0.00
          Velocity (ft/sec):                         0.16                0.00
0.00
          Computed Flow Time (minutes):             23.04                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                        193.35                0.00
0.00
          Slope (%):                                 2.77                0.00
0.00
          Surface Type:                             Paved               Paved
Paved
          Velocity (ft/sec):                         3.38                0.00
0.00
          Computed Flow Time (minutes):              0.95                0.00
0.00

===============================================================================================
          Total TOC (minutes):                      23.99

===============================================================================================


  --------------------
  Subbasin Sub-CB-3
  --------------------

  Sheet Flow Computations
  -----------------------
                                                Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                       0.40                0.00
0.00
          Flow Length (ft):                        492.34                0.00
0.00
          Slope (%):                                 3.89                0.00
0.00
          2 yr, 24 hr Rainfall (in):                 3.60                0.00
0.00
          Velocity (ft/sec):                         0.15                0.00
0.00
          Computed Flow Time (minutes):             55.54                0.00
```

0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	70.73	0.00	0.00
Slope (%):	4.87	0.00	0.00
Surface Type:	Unpaved	Paved	Paved
Velocity (ft/sec):	3.56	0.00	0.00
Computed Flow Time (minutes):	0.33	0.00	0.00

===

Total TOC (minutes): 55.87

===

Subbasin Sub-CB-4

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-5

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-6

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-7

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-8W

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-9

User-Defined TOC override (minutes): 5.00

****
Subbasin Runoff Summary
****

Subbasin ID	Accumulated Precip	Rainfall Intensity	Total Runoff	Peak Runoff	Weighted Runoff	Time of Concentration

	in	in/hr	in	cfs	Coeff	days	hh:mm:ss
Sub-CB-1	1.11	5.40	0.59	1.04	0.530	0	00:12:20
Sub-CB-10	0.73	8.75	0.55	0.84	0.750	0	00:05:00
Sub-CB-11	0.83	7.50	0.42	0.74	0.500	0	00:06:40
Sub-CB-12	1.39	4.11	0.36	1.36	0.260	0	00:20:23
Sub-CB-13-14	0.86	7.23	0.53	1.48	0.610	0	00:07:09
Sub-CB-15-16	0.73	8.75	0.53	2.58	0.730	0	00:05:00
Sub-CB-17	0.73	8.75	0.41	1.40	0.560	0	00:05:00
Sub-CB-18-19	0.73	8.75	0.39	4.48	0.540	0	00:05:00
Sub-CB-2	0.73	8.75	0.36	1.76	0.500	0	00:05:00
Sub-CB-20	1.50	3.75	0.53	1.96	0.350	0	00:23:59
Sub-CB-3	2.06	2.21	0.35	1.07	0.170	0	00:55:52
Sub-CB-4	0.73	8.75	0.31	1.29	0.430	0	00:05:00
Sub-CB-5	0.73	8.75	0.57	2.24	0.780	0	00:05:00
Sub-CB-6	0.73	8.75	0.55	0.95	0.760	0	00:05:00
Sub-CB-7	0.73	8.75	0.52	0.68	0.720	0	00:05:00
Sub-CB-8W	0.73	8.75	0.47	1.23	0.640	0	00:05:00
Sub-CB-9	0.73	8.75	0.55	0.98	0.760	0	00:05:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
CB-8E	0.00	0.00	257.54	0	00:00	0	0	0:00:00
CIT-8	2.69	2.69	257.49	0	00:00	0	0	0:00:00
CIT-9	2.27	2.61	260.01	0	00:05	0	0	0:00:00
DH-10	0.10	0.49	265.64	0	00:05	0	0	0:00:00
DH-13	2.76	3.19	262.99	0	00:07	0	0	0:00:00
DH-20	0.01	0.43	278.05	0	00:24	0	0	0:00:00
DH-6	0.05	0.31	247.26	0	00:05	0	0	0:00:00
DMH-10	0.10	0.49	265.81	0	00:05	0	0	0:00:00
DMH-11	0.10	0.30	269.05	0	00:06	0	0	0:00:00
DMH-12	0.34	0.74	268.44	0	00:20	0	0	0:00:00
DMH-13	0.11	0.65	263.42	0	00:07	0	0	0:00:00
DMH-20	0.44	0.86	278.51	0	00:24	0	0	0:00:00
DMH-3	0.11	0.40	262.64	0	00:05	0	0	0:00:00
DMH-4N	0.12	0.57	253.42	0	00:05	0	0	0:00:00
DMH-4S	0.11	0.44	257.57	0	00:05	0	0	0:00:00
DMH-6	4.85	5.21	252.61	0	00:05	0	0	0:00:00
DMH-7	1.11	1.40	255.50	0	00:05	0	0	0:00:00
EX-18	3.00	3.67	269.67	0	00:05	0	0	0:00:00
EX-7	1.20	1.47	254.27	0	00:05	0	0	0:00:00
Structure - (72)	0.11	0.37	276.16	0	00:12	0	0	0:00:00
STU-16	0.28	2.79	255.49	0	00:04	0.00	1	0:00:00
STU-5	0.12	0.67	249.30	0	00:06	0	0	0:00:00
DP-1	0.00	0.33	275.33	0	00:12	0	0	0:00:00
DP-10	0.00	0.31	265.09	0	00:05	0	0	0:00:00
DP-13	0.01	0.52	260.12	0	00:07	0	0	0:00:00
DP-16	0.00	0.86	253.52	0	00:05	0	0	0:00:00
DP-18	0.01	0.57	264.93	0	00:05	0	0	0:00:00
DP-20	0.01	0.39	274.59	0	00:24	0	0	0:00:00
DP-5	0.02	0.59	248.59	0	00:05	0	0	0:00:00
DP-6	0.00	0.22	246.72	0	00:05	0	0	0:00:00
DP-7	0.00	0.60	253.20	0	00:06	0	0	0:00:00
OFFSITE1	0.00	0.09	281.31	0	00:16	0	0	0:00:00
OFFSITE-1	0.01	0.21	267.89	0	00:25	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
CB-8E	JUNCTION	0.00	0.00	0	00:00	0.00		
CIT-8	JUNCTION	0.00	1.78	0	00:05	0.00		
CIT-9	JUNCTION	0.00	0.84	0	00:05	0.00		
DH-10	JUNCTION	0.00	1.30	0	00:05	0.00		
DH-13	JUNCTION	0.00	1.92	0	00:07	0.00		
DH-20	JUNCTION	0.00	3.92	0	00:24	0.00		
DH-6	JUNCTION	0.00	0.90	0	00:05	0.00		
DMH-10	JUNCTION	0.00	0.80	0	00:05	0.00		
DMH-11	JUNCTION	0.00	0.72	0	00:06	0.00		
DMH-12	JUNCTION	0.00	1.25	0	00:20	0.00		
DMH-13	JUNCTION	0.00	1.48	0	00:07	0.00		
DMH-20	JUNCTION	0.00	3.92	0	00:24	0.00		
DMH-3	JUNCTION	0.00	1.75	0	00:05	0.00		
DMH-4N	JUNCTION	0.00	2.76	0	00:05	0.00		
DMH-4S	JUNCTION	0.00	1.74	0	00:05	0.00		
DMH-6	JUNCTION	0.00	0.90	0	00:05	0.00		
DMH-7	JUNCTION	0.00	0.68	0	00:05	0.00		
EX-18	JUNCTION	0.00	4.46	0	00:05	0.00		
EX-7	JUNCTION	0.00	2.40	0	00:06	0.00		
Structure - (72)	JUNCTION	0.00	0.86	0	00:12	0.00		
STU-16	JUNCTION	0.00	3.76	0	00:05	0.20	0	00:05
STU-5	JUNCTION	0.00	4.64	0	00:05	0.00		
DP-1	OUTFALL	0.00	0.86	0	00:12	0.00		
DP-10	OUTFALL	0.00	1.30	0	00:05	0.00		
DP-13	OUTFALL	0.00	1.92	0	00:07	0.00		
DP-16	OUTFALL	0.00	3.70	0	00:05	0.00		
DP-18	OUTFALL	0.00	4.43	0	00:05	0.00		
DP-20	OUTFALL	0.00	3.92	0	00:24	0.00		
DP-5	OUTFALL	0.00	4.63	0	00:05	0.00		
DP-6	OUTFALL	0.00	0.90	0	00:05	0.00		
DP-7	OUTFALL	0.00	2.40	0	00:06	0.00		
OFFSITE1	OUTFALL	0.00	0.13	0	00:16	0.00		
OFFSITE-1	OUTFALL	0.00	1.27	0	00:25	0.00		

****
Inlet Depth Summary
****

Inlet ID	Max Gutter Spread during Peak Flow ft	Max Gutter Water Elev during Peak Flow ft	Max Gutter Water Depth during Peak Flow ft	Time of Maximum Depth Occurrence days	Time of Maximum Depth Occurrence hh:mm
CB-1	6.29	281.43	0.21	0	00:12
CB-10	2.87	267.86	0.17	0	00:05
CB-11	2.73	272.26	0.16	0	00:06
CB-12	3.52	271.27	0.20	0	00:20
CB-13	4.54	265.04	0.19	0	00:07
CB-16	6.46	255.22	0.29	0	00:05
CB-17	7.30	265.72	0.23	0	00:05
CB-18	15.22	274.13	0.41	0	00:05
CB-2	3.91	277.04	0.22	0	00:05

CB-20	4.52	279.86	0.19	0	00:00
CB-3	3.18	265.57	0.18	0	00:56
CB-4	3.44	256.13	0.20	0	00:05
CB-5	5.76	251.43	0.25	0	00:05
CB-6	3.03	255.53	0.18	0	00:05
CB-7	2.66	258.57	0.16	0	00:05
CB-8W	6.22	260.29	0.21	0	00:05
CB-9	3.07	263.00	0.18	0	00:05

****
Inlet Flow Summary
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Inlet ID	Peak Flow cfs	Peak Lateral Flow cfs	Peak Flow Intercepted by Inlet cfs	Peak Flow Bypassing Inlet cfs	Inlet Efficiency during Peak Flow %	Total Flooding acre-in	Total Time Flooded minutes
CB-1	1.04	1.04	0.86	0.18	83.12	0.000	0
CB-10	0.84	0.84	0.81	0.02	97.13	0.000	0
CB-11	0.74	0.74	0.73	0.01	98.00	0.000	0
CB-12	1.36	1.36	1.25	0.11	91.85	0.000	0
CB-13	1.48	1.48	-	-	-	0.000	0
CB-16	2.74	2.58	-	-	-	0.000	0
CB-17	1.40	1.40	1.09	0.31	77.60	0.000	0
CB-18	4.48	4.48	-	-	-	0.000	0
CB-2	1.76	1.76	1.55	0.21	88.28	0.000	0
CB-20	1.96	1.96	-	-	-	0.000	0
CB-3	1.07	1.07	1.01	0.06	94.80	0.000	0
CB-4	1.29	1.29	1.20	0.10	92.54	0.000	0
CB-5	2.25	2.24	-	-	-	0.000	0
CB-6	0.95	0.95	0.91	0.04	95.99	0.000	0
CB-7	0.71	0.68	0.69	0.01	98.34	0.000	0
CB-8W	1.25	1.23	1.03	0.23	81.85	0.000	0
CB-9	0.98	0.98	0.85	0.14	86.12	0.000	0

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Outfall Loading Summary
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Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
DP-1	1.92	0.41	0.86
DP-10	1.48	0.43	1.30
DP-13	3.32	0.80	1.92
DP-16	1.33	1.04	3.70
DP-18	0.88	1.76	4.43
DP-20	3.39	1.93	3.92
DP-5	8.54	0.70	4.63
DP-6	1.31	0.25	0.90
DP-7	2.53	0.40	2.40
OFFSITE1	2.80	0.04	0.13
OFFSITE-1	4.57	0.48	1.27
System	2.91	8.22	19.80

****
Link Flow Summary
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Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
CB-1_Overflow	CHANNEL	0 00:16	1.96	1.00	0.13	2.70	0.05	0.31	0	Calculated
CB10-9_Gutter	CHANNEL	0 00:07	2.31	1.00	0.02	8.35	0.00	0.09	0	Calculated
CB11-10_Gutter	CHANNEL	0 00:09	1.78	1.00	0.02	7.95	0.00	0.08	0	Calculated
CB12-13_Gutter	CHANNEL	0 00:22	2.30	1.00	0.11	9.44	0.01	0.18	0	Calculated
CB17-16_Gutter	CHANNEL	0 00:06	6.40	1.00	0.26	12.30	0.02	0.23	0	Calculated
CB2-3_Gutter	CHANNEL	0 00:06	5.43	1.00	0.17	13.13	0.01	0.19	0	Calculated
CB3-4_Gutter	CHANNEL	0 00:57	1.63	1.00	0.06	11.64	0.00	0.13	0	Calculated
CB4-5_Gutter	CHANNEL	0 00:06	3.40	1.00	0.06	8.25	0.01	0.15	0	Calculated
CB6-5_Gutter	CHANNEL	0 00:07	2.53	1.00	0.03	7.73	0.00	0.11	0	Calculated
CB7-6_Gutter	CHANNEL	0 00:07	1.56	1.00	0.01	6.62	0.00	0.09	0	Calculated
CB8-7_Gutter	CHANNEL	0 00:08	2.40	1.00	0.16	4.89	0.03	0.26	0	Calculated
CB9-8_Gutter	CHANNEL	0 00:07	2.84	1.00	0.10	6.26	0.02	0.20	0	Calculated
L-Pipe - (50)	CHANNEL	0 00:25	8.77	1.00	1.27	41.01	0.03			

0.28	0 Calculated							
Pipe - (12)	CONDUIT	0	00:05	5.63	1.00	0.90	6.19	0.15
0.26	0 Calculated							
Pipe - (13)	CONDUIT	0	00:05	3.50	1.00	0.90	3.19	0.28
0.36	0 Calculated							
Pipe - (14)	CONDUIT	0	00:05	6.74	1.00	2.24	5.59	0.40
0.44	0 Calculated							
Pipe - (16)	CONDUIT	0	00:56	6.77	1.00	1.01	7.67	0.13
0.24	0 Calculated							
Pipe - (18)	CONDUIT	0	00:05	3.50	1.00	0.68	3.56	0.19
0.30	0 Calculated							
Pipe - (19)	CONDUIT	0	00:05	4.00	1.00	0.68	4.29	0.16
0.27	0 Calculated							
Pipe - (2)	CONDUIT	0	00:05	12.72	1.00	1.51	7.69	0.20
0.30	0 Calculated							
Pipe - (20)	CONDUIT	0	00:00	0.00	1.00	0.00	2.79	0.00
0.00	0 Calculated							
Pipe - (21)	CONDUIT	0	00:06	4.63	1.00	1.75	3.59	0.49
0.49	0 Calculated							
Pipe - (22)	CONDUIT	0	00:06	4.87	1.00	2.40	3.56	0.67
0.60	0 Calculated							
Pipe - (23)	CONDUIT	0	00:05	5.96	1.00	1.02	6.40	0.16
0.27	0 Calculated							
Pipe - (24)	CONDUIT	0	00:05	3.59	1.00	0.84	3.40	0.25
0.34	0 Calculated							
Pipe - (25)	CONDUIT	0	00:05	4.89	1.00	0.81	3.88	0.21
0.31	0 Calculated							
Pipe - (26)	CONDUIT	0	00:05	2.85	1.00	0.80	2.52	0.32
0.39	0 Calculated							
Pipe - (27)	CONDUIT	0	00:05	2.85	1.00	0.80	2.52	0.32
0.39	0 Calculated							
Pipe - (28)	CONDUIT	0	00:06	6.36	1.00	0.72	8.05	0.09
0.20	0 Calculated							
Pipe - (29)	CONDUIT	0	00:07	6.22	1.00	0.70	4.83	0.15
0.26	0 Calculated							
Pipe - (3)	CONDUIT	0	00:06	6.92	1.00	1.73	6.35	0.27
0.36	0 Calculated							
Pipe - (30)	CONDUIT	0	00:20	4.13	1.00	1.25	3.56	0.35
0.41	0 Calculated							
Pipe - (31)	CONDUIT	0	00:20	5.99	1.00	1.24	5.52	0.22
0.32	0 Calculated							
Pipe - (33)	CONDUIT	0	00:07	4.63	1.00	1.92	3.56	0.54
0.52	0 Calculated							
Pipe - (34)	CONDUIT	0	00:07	3.36	1.00	1.48	2.54	0.58
0.55	0 Calculated							
Pipe - (35)	CONDUIT	0	00:07	4.49	1.00	1.48	3.73	0.40
0.44	0 Calculated							
Pipe - (4)	CONDUIT	0	00:06	6.12	1.00	2.73	4.45	0.61
0.56	0 Calculated							
Pipe - (40)	CONDUIT	0	00:05	10.58	1.00	1.06	6.43	0.16
0.27	0 Calculated							
Pipe - (41)	CONDUIT	0	00:05	5.27	1.00	3.70	3.56	1.04
0.93	0 > CAPACITY							
Pipe - (43)	CONDUIT	0	00:05	6.28	1.00	2.74	4.77	0.57
0.54	0 Calculated							
Pipe - (44)	CONDUIT	0	00:05	7.97	1.00	4.46	5.63	0.79
0.67	0 Calculated							
Pipe - (45)	CONDUIT	0	00:05	7.38	1.00	4.43	14.86	0.30
0.37	0 Calculated							
Pipe - (5)	CONDUIT	0	00:05	9.53	1.00	4.63	7.00	0.66
0.59	0 Calculated							
Pipe - (50)	CONDUIT	0	00:24	11.76	1.00	3.92	30.06	0.13
0.24	0 Calculated							
Pipe - (51)	CONDUIT	0	00:24	12.09	1.00	3.92	10.15	0.39
0.43	0 Calculated							
Pipe - (54)	CONDUIT	0	00:05	6.87	1.00	0.90	8.20	0.11

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0.22           0  Calculated
  Pipe - (55)          CONDUIT      0  00:05      9.83    1.00        1.19       12.12       0.10
0.21           0  Calculated
  Pipe - (56)          CONDUIT      0  00:05      6.22    1.00        1.30        6.17       0.21
0.31           0  Calculated
  Pipe - (57)          CONDUIT      0  00:24     10.63    1.00        3.92       26.08       0.15
0.26           0  Calculated
  Pipe - (61)          CONDUIT      0  00:12      6.07    1.00        0.86        5.92       0.15
0.26           0  Calculated
  Pipe - (62)          CONDUIT      0  00:12      3.74    1.00        0.86        3.56       0.24
0.33           0  Calculated
  Pipe - (7)           CONDUIT      0  00:05      7.53    1.00        1.74        7.14       0.24
0.34           0  Calculated


  ********************************
  Highest Flow Instability Indexes
  ********************************
  All links are stable.

  WARNING 108 : Surcharge elevation defined for Junction EX-18 is below junction maximum
elevation. Assumed surcharge elevation equal to maximum elevation.
  WARNING 139 : Ponded area defined for on sag Inlet CB-18 is zero. Assumed ponded area equal to
10 ft² (0.929 m²).
  WARNING 138 : Initial water surface elevation defined for Inlet CB-20 is below catchbasin
invert elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB-4 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB-5 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB-1_Overflow
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB10-9_Gutter
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB11-10_Gutter
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB12-13_Gutter
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB17-16_Gutter
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB2-3_Gutter is
below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB3-4_Gutter is
below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB4-5_Gutter is
below the storm drain inlet rim elevation.
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Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB6-5_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB7-6_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB8-7_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB9-8_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 117 : Conduit outlet invert elevation defined for Conduit CB-1_Overflow is below downstream node invert elevation.
Assumed conduit outlet invert elevation equal to downstream node invert elevation.
WARNING 004 : Minimum elevation drop used for Conduit CB-1_Overflow.
WARNING 005 : Minimum slope used for Conduit CB-1_Overflow.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB10-9_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-9.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB11-10_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-10.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB12-13_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-13.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB17-16_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-16.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB2-3_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-3.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB3-4_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-4.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB4-5_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-5.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB6-5_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-5.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB7-6_Gutter is below the storm drain inlet rim elevation.

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                Assumed the upstream roadway link outlet invert elevation equal to the storm
drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain
inlet CB-6.
  WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB8-7_Gutter is below
the storm drain inlet rim elevation.
                Assumed the upstream roadway link outlet invert elevation equal to the storm
drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain
inlet CB-7.
  WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB9-8_Gutter is below
the storm drain inlet rim elevation.
                Assumed the upstream roadway link outlet invert elevation equal to the storm
drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain
inlet CB-8W.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (14) is below upstream
node invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (50) is below upstream
node invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (55) is below upstream
node invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.

  Analysis began on:  Tue Jan 31 11:11:19 2023
  Analysis ended on:  Tue Jan 31 11:11:22 2023
  Total elapsed time: 00:00:03
```

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.2.165 (Build 0)

****
Project Description
****
File Name .... Grove_St_Ph2_r1-PR.SPF

****
Analysis Options
****
Flow Units .... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration...... SCS TR-55
Return Period.............. 100 years
Link Routing Method .... Kinematic Wave
Storage Node Exfiltration.. None
Starting Date DEC-20-2022 00:00:00
Ending Date DEC-21-2022 00:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 17
Number of nodes 50
Number of links 52

****
Subbasin Summary
****

Subbasin ID	Total Area acres
Sub-CB-1	0.36
Sub-CB-10	0.13
Sub-CB-11	0.20
Sub-CB-12	1.28
Sub-CB-13-14	0.34
Sub-CB-15-16	0.40
Sub-CB-17	0.29
Sub-CB-18-19	0.95
Sub-CB-2	0.40
Sub-CB-20	1.49
Sub-CB-3	2.84
Sub-CB-4	0.34
Sub-CB-5	0.33
Sub-CB-6	0.14
Sub-CB-7	0.11
Sub-CB-8W	0.22
Sub-CB-9	0.15

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
CB-8E	JUNCTION	257.54	259.20	0.00	

CIT-8	JUNCTION	254.80	259.42	0.00
CIT-9	JUNCTION	257.40	262.67	0.00
DH-10	JUNCTION	265.15	268.15	0.00
DH-13	JUNCTION	259.80	265.60	0.00
DH-20	JUNCTION	277.62	280.21	0.00
DH-6	JUNCTION	246.95	255.72	0.00
DMH-10	JUNCTION	265.32	267.86	0.00
DMH-11	JUNCTION	268.75	272.24	0.00
DMH-12	JUNCTION	267.70	271.08	0.00
DMH-13	JUNCTION	262.77	265.40	0.00
DMH-20	JUNCTION	277.65	280.22	0.00
DMH-3	JUNCTION	262.24	265.34	0.00
DMH-4N	JUNCTION	252.85	255.95	0.00
DMH-4S	JUNCTION	257.13	262.56	0.00
DMH-6	JUNCTION	247.40	257.58	0.00
DMH-7	JUNCTION	254.10	258.76	0.00
EX-18	JUNCTION	266.00	273.24	0.00
EX-7	JUNCTION	252.80	258.62	0.00
Structure - (72)	JUNCTION	275.79	277.57	0.00
STU-16	JUNCTION	252.70	255.49	0.00
STU-5	JUNCTION	248.63	251.88	0.00
DP-1	OUTFALL	275.00	276.00	0.00
DP-10	OUTFALL	264.78	265.78	0.00
DP-13	OUTFALL	259.60	260.60	0.00
DP-16	OUTFALL	252.66	253.66	0.00
DP-18	OUTFALL	264.36	265.86	0.00
DP-20	OUTFALL	274.20	275.70	0.00
DP-5	OUTFALL	248.00	249.00	0.00
DP-6	OUTFALL	246.50	247.50	0.00
DP-7	OUTFALL	252.60	253.60	0.00
OFFSITE1	OUTFALL	281.22	281.50	0.00
OFFSITE-1	OUTFALL	267.68	268.43	0.00

****
Inlet Summary
****

Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation (ft)	Inlet Rim Elevation (ft)	Ponded Area (ft²)	Initial Water Elevation (ft)	Grate Clogging Factor (%)
CB-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	278.10	281.22	-	278.10	0.00
CB-10	FHWA HEC-22 GENERIC	N/A	On Grade	1	265.44	267.69	-	265.44	0.00
CB-11	FHWA HEC-22 GENERIC	N/A	On Grade	1	269.10	272.10	-	269.10	0.00
CB-12	FHWA HEC-22 GENERIC	N/A	On Grade	1	268.07	271.07	-	268.07	0.00
CB-13	FHWA HEC-22 GENERIC	N/A	On Sag	1	262.90	264.85	10.00	262.90	0.00
CB-16	FHWA HEC-22 GENERIC	N/A	On Sag	1	252.93	254.93	10.00	252.93	0.00
CB-17	FHWA HEC-22 GENERIC	N/A	On Grade	1	260.16	265.49	-	260.16	0.00
CB-18	FHWA HEC-22 GENERIC	N/A	On Sag	1	269.61	273.72	10.00	269.61	0.00
CB-2	FHWA HEC-22 GENERIC	N/A	On Grade	1	273.82	276.82	-	273.82	0.00

CB-20	FHWA HEC-22 GENERIC	N/A	On Sag	1	278.18	279.67	10.00	278.18	0.00
CB-3	FHWA HEC-22 GENERIC	N/A	On Grade	1	262.89	265.39	-	262.89	0.00
CB-4	FHWA HEC-22 GENERIC	N/A	On Grade	1	254.18	255.93	-	254.18	0.00
CB-5	FHWA HEC-22 GENERIC	N/A	On Sag	1	249.44	251.18	10.00	249.44	0.00
CB-6	FHWA HEC-22 GENERIC	N/A	On Grade	1	252.35	255.35	-	252.35	0.00
CB-7	FHWA HEC-22 GENERIC	N/A	On Grade	1	255.41	258.41	-	255.41	0.00
CB-8W	FHWA HEC-22 GENERIC	N/A	On Grade	1	257.08	260.08	-	257.08	0.00
CB-9	FHWA HEC-22 GENERIC	N/A	On Grade	1	259.82	262.82	-	259.82	0.00

****

Roadway and Gutter Summary

****

Inlet ID	Roadway Longitudinal Slope ft/ft	Roadway Cross Slope ft/ft	Roadway Manning's Roughness	Gutter Cross Slope ft/ft	Gutter Width ft	Gutter Depression in
CB-1	0.0100	0.0200	0.0160	0.0620	2.00	2.00
CB-10	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-11	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-12	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-13	-	0.0500	0.0130	0.0620	2.00	0.00
CB-16	-	0.0500	0.0130	0.0620	2.00	0.00
CB-17	0.0100	0.0200	0.0160	0.0620	2.00	2.00
CB-18	-	0.0200	0.0160	0.0620	2.00	2.00
CB-2	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-20	-	0.0500	0.0130	0.0620	2.00	0.00
CB-3	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-4	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-5	-	0.0500	0.0130	0.0620	2.00	0.00
CB-6	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-7	0.0200	0.0500	0.0130	0.0620	2.00	0.00
CB-8W	0.0100	0.0200	0.0130	0.0620	2.00	2.00
CB-9	0.0200	0.0500	0.0130	0.0620	2.00	0.00

****

Link Summary

****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
CB-1_Overflow	CB-1	OFFSITE1	CHANNEL	241.8	0.2000	0.0130
CB10-9_Gutter	CB-10	CB-9	CHANNEL	254.5	1.9133	0.0130
CB11-10_Gutter	CB-11	CB-10	CHANNEL	254.5	1.7326	0.0130
CB12-13_Gutter	CB-12	CB-13	CHANNEL	254.5	2.4437	0.0130
CB17-16_Gutter	CB-17	CB-16	CHANNEL	254.5	4.1501	0.0130
CB2-3_Gutter	CB-2	CB-3	CHANNEL	241.8	4.7276	0.0130
CB3-4_Gutter	CB-3	CB-4	CHANNEL	254.5	3.7167	0.0130
CB4-5_Gutter	CB-4	CB-5	CHANNEL	254.5	1.8662	0.0130
CB6-5_Gutter	CB-6	CB-5	CHANNEL	254.5	1.6383	0.0130
CB7-6_Gutter	CB-7	CB-6	CHANNEL	254.5	1.2022	0.0130
CB8-7_Gutter	CB-8W	CB-7	CHANNEL	254.5	0.6561	0.0130
CB9-8_Gutter	CB-9	CB-8W	CHANNEL	254.5	1.0765	0.0130
L-Pipe - (50)	CB-20	OFFSITE-1	CHANNEL	546.0	2.1967	0.0130
Pipe - (12)	DMH-6	DH-6	CONDUIT	13.3	3.0144	0.0130
Pipe - (13)	CB-6	DMH-6	CONDUIT	12.5	0.7995	0.0130

Pipe - (14)	CB-5	STU-5	CONDUIT	28.8	2.4635	0.0130
Pipe - (16)	CB-3	DMH-3	CONDUIT	11.9	4.6382	0.0130
Pipe - (18)	CB-7	DMH-7	CONDUIT	20.7	1.0000	0.0130
Pipe - (19)	DMH-7	EX-7	CONDUIT	6.9	1.4505	0.0130
Pipe - (2)	CB-2	DMH-3	CONDUIT	246.6	4.6555	0.0130
Pipe - (20)	CB-8E	CIT-8	CONDUIT	7.6	0.6131	0.0130
Pipe - (21)	CIT-8	EX-7	CONDUIT	196.9	1.0156	0.0130
Pipe - (22)	EX-7	DP-7	CONDUIT	20.0	1.0000	0.0130
Pipe - (23)	CB-8W	CIT-8	CONDUIT	20.5	3.2241	0.0130
Pipe - (24)	CB-9	CIT-9	CONDUIT	16.5	0.9092	0.0130
Pipe - (25)	CIT-9	CIT-8	CONDUIT	219.0	1.1872	0.0130
Pipe - (26)	DMH-10	DH-10	CONDUIT	14.0	0.5000	0.0130
Pipe - (27)	CB-10	DMH-10	CONDUIT	4.2	0.5000	0.0130
Pipe - (28)	CB-11	DMH-11	CONDUIT	4.9	5.1092	0.0130
Pipe - (29)	DMH-11	DH-10	CONDUIT	190.5	1.8369	0.0130
Pipe - (3)	DMH-4S	DMH-4N	CONDUIT	131.6	3.1757	0.0130
Pipe - (30)	CB-12	DMH-12	CONDUIT	3.6	1.0000	0.0130
Pipe - (31)	DMH-12	DH-13	CONDUIT	217.3	2.4045	0.0130
Pipe - (33)	DH-13	DP-13	CONDUIT	19.5	1.0000	0.0130
Pipe - (34)	CB-13	DMH-13	CONDUIT	5.9	0.5098	0.0130
Pipe - (35)	DMH-13	DH-13	CONDUIT	19.9	1.0989	0.0130
Pipe - (4)	DMH-4N	STU-5	CONDUIT	263.5	1.5634	0.0130
Pipe - (40)	CB-17	STU-16	CONDUIT	220.1	3.2621	0.0130
Pipe - (41)	STU-16	DP-16	CONDUIT	4.1	1.0000	0.0130
Pipe - (43)	CB-16	STU-16	CONDUIT	7.3	1.7930	0.0130
Pipe - (44)	CB-18	EX-18	CONDUIT	24.4	2.4990	0.0130
Pipe - (45)	EX-18	DP-18	CONDUIT	81.8	2.0000	0.0130
Pipe - (5)	STU-5	DP-5	CONDUIT	16.3	3.8608	0.0130
Pipe - (50)	CB-20	DMH-20	CONDUIT	6.5	8.1871	0.0130
Pipe - (51)	DMH-20	DH-20	CONDUIT	5.7	8.1142	0.0130
Pipe - (54)	DH-6	DP-6	CONDUIT	8.5	5.3000	0.0130
Pipe - (55)	CB-4	DMH-4N	CONDUIT	10.6	11.5699	0.0130
Pipe - (56)	DH-10	DP-10	CONDUIT	12.4	3.0000	0.0130
Pipe - (57)	DH-20	DP-20	CONDUIT	55.5	6.1646	0.0130
Pipe - (61)	CB-1	Structure - (72)	CONDUIT	79.8	2.7583	0.0130
Pipe - (62)	Structure - (72)	DP-1	CONDUIT	79.0	1.0000	0.0130
Pipe - (7)	DMH-3	DMH-4S	CONDUIT	124.6	4.0212	0.0130

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
CB-1_Overflow	TRIANGULAR	0.28	14.00	1	1.96	0.14	2.70
CB10-9_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	8.35
CB11-10_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	7.95
CB12-13_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	9.44
CB17-16_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	12.30
CB2-3_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	13.13
CB3-4_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	

							11.64
CB4-5_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	8.25
CB6-5_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	7.73
CB7-6_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	6.62
CB8-7_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	4.89
CB9-8_Gutter	TRIANGULAR	0.28	14.00	1	1.96	0.14	6.26
L-Pipe - (50)	IRREGULAR	0.75	6.80	1	3.82	0.50	41.01
Pipe - (12)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.19
Pipe - (13)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.19
Pipe - (14)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.59
Pipe - (16)	CIRCULAR	1.00	1.00	1	0.79	0.25	7.67
Pipe - (18)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (19)	CIRCULAR	1.00	1.00	1	0.79	0.25	4.29
Pipe - (2)	CIRCULAR	1.00	1.00	1	0.79	0.25	7.69
Pipe - (20)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.79
Pipe - (21)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.59
Pipe - (22)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (23)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.40
Pipe - (24)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.40
Pipe - (25)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.88
Pipe - (26)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.52
Pipe - (27)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.52
Pipe - (28)	CIRCULAR	1.00	1.00	1	0.79	0.25	8.05
Pipe - (29)	CIRCULAR	1.00	1.00	1	0.79	0.25	4.83
Pipe - (3)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.35
Pipe - (30)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (31)	CIRCULAR	1.00	1.00	1	0.79	0.25	5.52
Pipe - (33)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (34)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.54
Pipe - (35)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.73
Pipe - (4)	CIRCULAR	1.00	1.00	1	0.79	0.25	4.45
Pipe - (40)	CIRCULAR	1.00	1.00	1	0.79	0.25	6.43
Pipe - (41)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.56
Pipe - (43)	CIRCULAR	1.00	1.00	1	0.79	0.25	

```
4.77
  Pipe - (44)      CIRCULAR           1.00         1.00            1         0.79         0.25
5.63
  Pipe - (45)      CIRCULAR           1.50         1.50            1         1.77         0.38
14.86
  Pipe - (5)       CIRCULAR           1.00         1.00            1         0.79         0.25
7.00
  Pipe - (50)      CIRCULAR           1.50         1.50            1         1.77         0.38
30.06
  Pipe - (51)      CIRCULAR           1.00         1.00            1         0.79         0.25
10.15
  Pipe - (54)      CIRCULAR           1.00         1.00            1         0.79         0.25
8.20
  Pipe - (55)      CIRCULAR           1.00         1.00            1         0.79         0.25
12.12
  Pipe - (56)      CIRCULAR           1.00         1.00            1         0.79         0.25
6.17
  Pipe - (57)      CIRCULAR           1.50         1.50            1         1.77         0.38
26.08
  Pipe - (61)      CIRCULAR           1.00         1.00            1         0.79         0.25
5.92
  Pipe - (62)      CIRCULAR           1.00         1.00            1         0.79         0.25
3.56
  Pipe - (7)       CIRCULAR           1.00         1.00            1         0.79         0.25
7.14


  ****************
  Transect Summary
  ****************

  Transect XS-L-Pipe - (13)
  Area:
            0.0005     0.0019     0.0043     0.0076     0.0118
            0.0170     0.0232     0.0305     0.0390     0.0487
            0.0595     0.0715     0.0847     0.0990     0.1145
            0.1312     0.1491     0.1682     0.1884     0.2098
            0.2323     0.2561     0.2810     0.3071     0.3338
            0.3604     0.3871     0.4137     0.4404     0.4670
            0.4937     0.5203     0.5470     0.5736     0.6003
            0.6269     0.6536     0.6802     0.7069     0.7335
            0.7602     0.7868     0.8135     0.8401     0.8668
            0.8934     0.9201     0.9467     0.9734     1.0000
  Hrad:
            0.0139     0.0278     0.0418     0.0557     0.0696
            0.0835     0.0963     0.1080     0.1202     0.1329
            0.1459     0.1591     0.1724     0.1858     0.1994
            0.2130     0.2267     0.2404     0.2542     0.2680
            0.2818     0.2957     0.3095     0.3238     0.3512
            0.3784     0.4055     0.4326     0.4595     0.4863
            0.5130     0.5396     0.5660     0.5924     0.6187
            0.6448     0.6708     0.6968     0.7226     0.7483
            0.7740     0.7995     0.8249     0.8502     0.8754
            0.9005     0.9256     0.9505     0.9753     1.0000
  Width:
            0.0355     0.0711     0.1066     0.1422     0.1777
            0.2132     0.2520     0.2961     0.3402     0.3842
            0.4283     0.4724     0.5164     0.5605     0.6046
            0.6487     0.6927     0.7368     0.7809     0.8249
            0.8690     0.9131     0.9572     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
```

Transect XS-L-Pipe - (16)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (18)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (2)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (24)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046

0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (27)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (28)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (30)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863
0.5130	0.5396	0.5660	0.5924	0.6187
0.6448	0.6708	0.6968	0.7226	0.7483
0.7740	0.7995	0.8249	0.8502	0.8754
0.9005	0.9256	0.9505	0.9753	1.0000

Width:

0.0355	0.0711	0.1066	0.1422	0.1777
0.2132	0.2520	0.2961	0.3402	0.3842
0.4283	0.4724	0.5164	0.5605	0.6046
0.6487	0.6927	0.7368	0.7809	0.8249
0.8690	0.9131	0.9572	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (37)

Area:

0.0005	0.0019	0.0043	0.0076	0.0118
0.0170	0.0232	0.0305	0.0390	0.0487
0.0595	0.0715	0.0847	0.0990	0.1145
0.1312	0.1491	0.1682	0.1884	0.2098
0.2323	0.2561	0.2810	0.3071	0.3338
0.3604	0.3871	0.4137	0.4404	0.4670
0.4937	0.5203	0.5470	0.5736	0.6003
0.6269	0.6536	0.6802	0.7069	0.7335
0.7602	0.7868	0.8135	0.8401	0.8668
0.8934	0.9201	0.9467	0.9734	1.0000

Hrad:

0.0139	0.0278	0.0418	0.0557	0.0696
0.0835	0.0963	0.1080	0.1202	0.1329
0.1459	0.1591	0.1724	0.1858	0.1994
0.2130	0.2267	0.2404	0.2542	0.2680
0.2818	0.2957	0.3095	0.3238	0.3512
0.3784	0.4055	0.4326	0.4595	0.4863

	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (50)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329
	0.1459	0.1591	0.1724	0.1858	0.1994
	0.2130	0.2267	0.2404	0.2542	0.2680
	0.2818	0.2957	0.3095	0.3238	0.3512
	0.3784	0.4055	0.4326	0.4595	0.4863
	0.5130	0.5396	0.5660	0.5924	0.6187
	0.6448	0.6708	0.6968	0.7226	0.7483
	0.7740	0.7995	0.8249	0.8502	0.8754
	0.9005	0.9256	0.9505	0.9753	1.0000
Width:					
	0.0355	0.0711	0.1066	0.1422	0.1777
	0.2132	0.2520	0.2961	0.3402	0.3842
	0.4283	0.4724	0.5164	0.5605	0.6046
	0.6487	0.6927	0.7368	0.7809	0.8249
	0.8690	0.9131	0.9572	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

Transect XS-L-Pipe - (55)

Area:					
	0.0005	0.0019	0.0043	0.0076	0.0118
	0.0170	0.0232	0.0305	0.0390	0.0487
	0.0595	0.0715	0.0847	0.0990	0.1145
	0.1312	0.1491	0.1682	0.1884	0.2098
	0.2323	0.2561	0.2810	0.3071	0.3338
	0.3604	0.3871	0.4137	0.4404	0.4670
	0.4937	0.5203	0.5470	0.5736	0.6003
	0.6269	0.6536	0.6802	0.7069	0.7335
	0.7602	0.7868	0.8135	0.8401	0.8668
	0.8934	0.9201	0.9467	0.9734	1.0000
Hrad:					
	0.0139	0.0278	0.0418	0.0557	0.0696
	0.0835	0.0963	0.1080	0.1202	0.1329

```
            0.1459     0.1591     0.1724     0.1858     0.1994
            0.2130     0.2267     0.2404     0.2542     0.2680
            0.2818     0.2957     0.3095     0.3238     0.3512
            0.3784     0.4055     0.4326     0.4595     0.4863
            0.5130     0.5396     0.5660     0.5924     0.6187
            0.6448     0.6708     0.6968     0.7226     0.7483
            0.7740     0.7995     0.8249     0.8502     0.8754
            0.9005     0.9256     0.9505     0.9753     1.0000
Width:
            0.0355     0.0711     0.1066     0.1422     0.1777
            0.2132     0.2520     0.2961     0.3402     0.3842
            0.4283     0.4724     0.5164     0.5605     0.6046
            0.6487     0.6927     0.7368     0.7809     0.8249
            0.8690     0.9131     0.9572     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000

**************************        Volume         Depth
Runoff Quantity Continuity       acre-ft        inches
**************************     ---------       -------
Total Precipitation ......         1.402         1.688
Continuity Error (%) .....         0.682

**************************        Volume        Volume
Flow Routing Continuity          acre-ft      Mgallons
**************************     ---------     ---------
External Inflow ..........         0.000         0.000
External Outflow .........         0.580         0.189
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....        -0.797

**************************************
Runoff Coefficient Computations Report
**************************************

--------------------
Subbasin Sub-CB-1
--------------------
                                                          Area          Soil      Runoff
Soil/Surface Description                                (acres)         Group      Coeff.
-----------------------------------------------------------------------------------------
Streets, 25 years or greater                               0.17       A (6%+)        0.79
Residential Lot Size 1 Acre, 25 years or greater           0.19       A (6%+)        0.29
Composite Area & Weighted Runoff Coeff.                    0.36                      0.53

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Subbasin Sub-CB-10
---------------------
                                                          Area          Soil      Runoff
Soil/Surface Description                                (acres)         Group      Coeff.
-----------------------------------------------------------------------------------------
Streets, 25 years or greater                               0.12       A (6%+)        0.79
Residential Lot Size 1 Acre, 25 years or greater           0.01       A (6%+)        0.29
Composite Area & Weighted Runoff Coeff.                    0.13                      0.75

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Subbasin Sub-CB-11
---------------------
                                                          Area          Soil      Runoff
```

Soil/Surface Description	(acres)	Group	Coeff.
Streets, 25 years or greater	0.11	A (6%+)	0.79
Forest, 25 years or greater	0.09	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.20		0.50

Subbasin Sub-CB-12

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.23	A (6%+)	0.79
Forest, 25 years or greater	1.05	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.28		0.26

Subbasin Sub-CB-13-14

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.25	A (6%+)	0.79
Forest, 25 years or greater	0.09	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.34		0.61

Subbasin Sub-CB-15-16

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.19	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.05	A (6%+)	0.29
Streets, 25 years or greater	0.16	B (0-2%)	0.80
Composite Area & Weighted Runoff Coeff.	0.40		0.73

Subbasin Sub-CB-17

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.15	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.13	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.29		0.56

Subbasin Sub-CB-18-19

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.47	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.47	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.95		0.54

Subbasin Sub-CB-2

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.17	A (6%+)	0.79
Residential Lot Size 1 Acre, 25 years or greater	0.23	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.40		0.50

Subbasin Sub-CB-20

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.49	A (6%+)	0.79
Forest, 25 years or greater	1.00	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	1.49		0.35

Subbasin Sub-CB-3

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.14	A (6%+)	0.79
Forest, 25 years or greater	2.69	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	2.84		0.17

Subbasin Sub-CB-4

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.15	A (6%+)	0.79
Forest, 25 years or greater	0.19	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.34		0.43

Subbasin Sub-CB-5

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.32	A (6%+)	0.79
Forest, 25 years or greater	0.01	A (6%+)	0.14
Composite Area & Weighted Runoff Coeff.	0.33		0.78

Subbasin Sub-CB-6

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.14	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.00	A (6%+)	0.29
Composite Area & Weighted Runoff Coeff.	0.14		0.76

Subbasin Sub-CB-7

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.10	A (0-2%)	0.76
Residential Lot Size 1 Acre, 25 years or greater	0.01	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.11		0.72

Subbasin Sub-CB-8W

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.17	A (2-6%)	0.77
Meadow, 25 years or greater	0.05	A (2-6%)	0.22
Composite Area & Weighted Runoff Coeff.	0.22		0.64

Subbasin Sub-CB-9

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Streets, 25 years or greater	0.15	A (2-6%)	0.77
Residential Lot Size 1 Acre, 25 years or greater	0.00	A (2-6%)	0.26
Composite Area & Weighted Runoff Coeff.	0.15		0.76

```
***************************************************
SCS TR-55 Time of Concentration Computations Report
***************************************************

Sheet Flow Equation
-------------------

        Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

        Where:

        Tc = Time of Concentration (hrs)
        n  = Manning's Roughness
        Lf = Flow Length (ft)
        P  = 2 yr, 24 hr Rainfall (inches)
        Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation
----------------------------------

        V  = 16.1345 * (Sf^0.5) (unpaved surface)
        V  = 20.3282 * (Sf^0.5) (paved surface)
        V  = 15.0 * (Sf^0.5) (grassed waterway surface)
        V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
        V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
        V  = 7.0 * (Sf^0.5) (short grass pasture surface)
        V  = 5.0 * (Sf^0.5) (woodland surface)
        V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)

Channel Flow Equation
---------------------

        V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
        R  = Aq / Wp
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        R  = Hydraulic Radius (ft)
        Aq = Flow Area (ft²)
```

```
         Wp = Wetted Perimeter (ft)
         V  = Velocity (ft/sec)
         Sf = Slope (ft/ft)
         n  = Manning's Roughness

  --------------------
  Subbasin Sub-CB-1
  --------------------

  Sheet Flow Computations
  -----------------------
                                              Subarea A          Subarea B          Subarea
C
         Manning's Roughness:                      0.40               0.00
0.00
         Flow Length (ft):                        33.69               0.00
0.00
         Slope (%):                                1.60               0.00
0.00
         2 yr, 24 hr Rainfall (in):                3.60               0.00
0.00
         Velocity (ft/sec):                        0.06               0.00
0.00
         Computed Flow Time (minutes):             9.26               0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                              Subarea A          Subarea B          Subarea
C
         Flow Length (ft):                       329.84               0.00
0.00
         Slope (%):                                0.77               0.00
0.00
         Surface Type:                            Paved              Paved
Paved
         Velocity (ft/sec):                        1.79               0.00
0.00
         Computed Flow Time (minutes):             3.08               0.00
0.00

=================================================================================================
         Total TOC (minutes):                     12.34

=================================================================================================


  ---------------------
  Subbasin Sub-CB-10
  ---------------------

         User-Defined TOC override (minutes):      5.00

  ---------------------
  Subbasin Sub-CB-11
  ---------------------

  Sheet Flow Computations
  -----------------------
                                              Subarea A          Subarea B          Subarea
C
         Manning's Roughness:                      0.40               0.00
0.00
         Flow Length (ft):                        73.91               0.00
0.00
         Slope (%):                               24.40               0.00
```

```
0.00
          2 yr, 24 hr Rainfall (in):                   3.60                0.00
0.00
          Velocity (ft/sec):                           0.21                0.00
0.00
          Computed Flow Time (minutes):                5.85                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                  Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                          147.74                0.00
0.00
          Slope (%):                                   2.17                0.00
0.00
          Surface Type:                               Paved               Paved
Paved
          Velocity (ft/sec):                           2.99                0.00
0.00
          Computed Flow Time (minutes):                0.82                0.00
0.00

===============================================================================================
          Total TOC (minutes):                         6.67

===============================================================================================


  ---------------------
  Subbasin Sub-CB-12
  ---------------------

  Sheet Flow Computations
  -----------------------
                                                  Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                         0.40                0.00
0.00
          Flow Length (ft):                          222.44                0.00
0.00
          Slope (%):                                  10.60                0.00
0.00
          2 yr, 24 hr Rainfall (in):                   3.60                0.00
0.00
          Velocity (ft/sec):                           0.19                0.00
0.00
          Computed Flow Time (minutes):               19.70                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                  Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                          185.02                0.00
0.00
          Slope (%):                                   4.77                0.00
0.00
          Surface Type:                               Paved               Paved
Paved
          Velocity (ft/sec):                           4.44                0.00
0.00
          Computed Flow Time (minutes):                0.69                0.00
0.00

===============================================================================================
```

Total TOC (minutes):	20.39

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Subbasin Sub-CB-13-14

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	80.13	0.00	0.00
Slope (%):	24.40	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.21	0.00	0.00
Computed Flow Time (minutes):	6.23	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	174.35	0.00	0.00
Slope (%):	2.45	0.00	0.00
Surface Type:	Paved	Paved	Paved
Velocity (ft/sec):	3.18	0.00	0.00
Computed Flow Time (minutes):	0.91	0.00	0.00

==

Total TOC (minutes):	7.15

==

Subbasin Sub-CB-15-16

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-17

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-18-19

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-2

User-Defined TOC override (minutes): 5.00

Subbasin Sub-CB-20

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	227.22	0.00	0.00
Slope (%):	7.48	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.16	0.00	0.00
Computed Flow Time (minutes):	23.04	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	193.35	0.00	0.00
Slope (%):	2.77	0.00	0.00
Surface Type:	Paved	Paved	Paved
Velocity (ft/sec):	3.38	0.00	0.00
Computed Flow Time (minutes):	0.95	0.00	0.00

===

Total TOC (minutes): 23.99

===

Subbasin Sub-CB-3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	492.34	0.00	0.00
Slope (%):	3.89	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.60	0.00	0.00
Velocity (ft/sec):	0.15	0.00	0.00
Computed Flow Time (minutes):	55.54	0.00	

```
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                              Subarea A          Subarea B          Subarea
C
          Flow Length (ft):                       70.73               0.00
0.00
          Slope (%):                               4.87               0.00
0.00
          Surface Type:                          Unpaved              Paved
Paved
          Velocity (ft/sec):                       3.56               0.00
0.00
          Computed Flow Time (minutes):            0.33               0.00
0.00

=================================================================================================
          Total TOC (minutes):                    55.87

=================================================================================================


  --------------------
  Subbasin Sub-CB-4
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-5
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-6
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-7
  --------------------

          User-Defined TOC override (minutes):      5.00

  ---------------------
  Subbasin Sub-CB-8W
  ---------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Sub-CB-9
  --------------------

          User-Defined TOC override (minutes):      5.00

  ***********************
  Subbasin Runoff Summary
  ***********************

  ---------------------------------------------------------------------------------------
  Subbasin       Accumulated     Rainfall     Total      Peak  Weighted          Time of
  ID                  Precip    Intensity    Runoff    Runoff    Runoff     Concentration
```

	in	in/hr	in	cfs	Coeff	days	hh:mm:ss
Sub-CB-1	1.41	6.86	0.75	1.32	0.530	0	00:12:20
Sub-CB-10	0.93	11.10	0.69	1.06	0.750	0	00:05:00
Sub-CB-11	1.06	9.52	0.53	0.94	0.500	0	00:06:40
Sub-CB-12	1.77	5.22	0.46	1.73	0.260	0	00:20:23
Sub-CB-13-14	1.10	9.17	0.67	1.88	0.610	0	00:07:09
Sub-CB-15-16	0.93	11.10	0.68	3.28	0.730	0	00:05:00
Sub-CB-17	0.93	11.10	0.52	1.77	0.560	0	00:05:00
Sub-CB-18-19	0.93	11.10	0.50	5.68	0.540	0	00:05:00
Sub-CB-2	0.93	11.10	0.46	2.23	0.500	0	00:05:00
Sub-CB-20	1.91	4.78	0.67	2.50	0.350	0	00:23:59
Sub-CB-3	2.61	2.81	0.44	1.35	0.170	0	00:55:52
Sub-CB-4	0.93	11.10	0.40	1.64	0.430	0	00:05:00
Sub-CB-5	0.93	11.10	0.72	2.85	0.780	0	00:05:00
Sub-CB-6	0.93	11.10	0.70	1.20	0.760	0	00:05:00
Sub-CB-7	0.93	11.10	0.67	0.87	0.720	0	00:05:00
Sub-CB-8W	0.93	11.10	0.59	1.56	0.640	0	00:05:00
Sub-CB-9	0.93	11.10	0.70	1.25	0.760	0	00:05:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
CB-8E	0.00	0.00	257.54	0	00:00	0	0	0:00:00
CIT-8	2.69	2.69	257.49	0	00:00	0	0	0:00:00
CIT-9	2.27	2.64	260.04	0	00:05	0	0	0:00:00
DH-10	0.10	0.54	265.69	0	00:05	0	0	0:00:00
DH-13	2.76	3.26	263.05	0	00:07	0	0	0:00:00
DH-20	0.01	0.50	278.12	0	00:24	0	0	0:00:00
DH-6	0.05	0.34	247.29	0	00:05	0	0	0:00:00
DMH-10	0.10	0.54	265.86	0	00:05	0	0	0:00:00
DMH-11	0.10	0.33	269.08	0	00:06	0	0	0:00:00
DMH-12	0.34	0.79	268.49	0	00:20	0	0	0:00:00
DMH-13	0.11	0.74	263.51	0	00:07	0	0	0:00:00
DMH-20	0.44	0.93	278.58	0	00:24	0	0	0:00:00
DMH-3	0.12	0.43	262.67	0	00:05	0	0	0:00:00
DMH-4N	0.12	0.66	253.51	0	00:05	0	0	0:00:00
DMH-4S	0.12	0.48	257.61	0	00:05	0	0	0:00:00
DMH-6	4.85	5.26	252.66	0	00:05	0	0	0:00:00
DMH-7	1.11	1.44	255.54	0	00:05	0	0	0:00:00
EX-18	3.00	3.89	269.89	0	00:05	0	0	0:00:00
EX-7	1.20	1.51	254.31	0	00:05	0	0	0:00:00
Structure - (72)	0.11	0.39	276.18	0	00:12	0	0	0:00:00
STU-16	0.29	2.79	255.49	0	00:04	0.03	3	0:00:00
STU-5	0.12	0.76	249.39	0	00:06	0	0	0:00:00
DP-1	0.00	0.37	275.37	0	00:12	0	0	0:00:00
DP-10	0.00	0.35	265.13	0	00:05	0	0	0:00:00
DP-13	0.01	0.61	260.21	0	00:07	0	0	0:00:00
DP-16	0.00	1.00	253.66	0	00:04	0	0	0:00:00
DP-18	0.01	0.65	265.01	0	00:05	0	0	0:00:00
DP-20	0.01	0.44	274.64	0	00:24	0	0	0:00:00
DP-5	0.02	0.70	248.70	0	00:05	0	0	0:00:00
DP-6	0.00	0.25	246.75	0	00:05	0	0	0:00:00
DP-7	0.00	0.70	253.30	0	00:06	0	0	0:00:00
OFFSITE1	0.00	0.11	281.33	0	00:15	0	0	0:00:00
OFFSITE-1	0.01	0.23	267.91	0	00:24	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm
CB-8E	JUNCTION	0.00	0.00	0	00:00	0.00		
CIT-8	JUNCTION	0.00	2.17	0	00:05	0.00		
CIT-9	JUNCTION	0.00	1.02	0	00:05	0.00		
DH-10	JUNCTION	0.00	1.63	0	00:05	0.00		
DH-13	JUNCTION	0.00	2.44	0	00:07	0.00		
DH-20	JUNCTION	0.00	5.00	0	00:24	0.00		
DH-6	JUNCTION	0.00	1.11	0	00:05	0.00		
DMH-10	JUNCTION	0.00	1.00	0	00:05	0.00		
DMH-11	JUNCTION	0.00	0.90	0	00:06	0.00		
DMH-12	JUNCTION	0.00	1.53	0	00:20	0.00		
DMH-13	JUNCTION	0.00	1.88	0	00:07	0.00		
DMH-20	JUNCTION	0.00	5.00	0	00:24	0.00		
DMH-3	JUNCTION	0.00	2.22	0	00:05	0.00		
DMH-4N	JUNCTION	0.00	3.45	0	00:05	0.00		
DMH-4S	JUNCTION	0.00	2.21	0	00:05	0.00		
DMH-6	JUNCTION	0.00	1.12	0	00:05	0.00		
DMH-7	JUNCTION	0.00	0.89	0	00:05	0.00		
EX-18	JUNCTION	0.00	5.97	0	00:05	0.00		
EX-7	JUNCTION	0.00	3.00	0	00:06	0.00		
Structure - (72)	JUNCTION	0.00	1.03	0	00:12	0.00		
STU-16	JUNCTION	0.00	4.78	0	00:05	1.22	0	00:05
STU-5	JUNCTION	0.00	5.86	0	00:05	0.00		
DP-1	OUTFALL	0.00	1.03	0	00:12	0.00		
DP-10	OUTFALL	0.00	1.63	0	00:05	0.00		
DP-13	OUTFALL	0.00	2.43	0	00:07	0.00		
DP-16	OUTFALL	0.00	3.82	0	00:06	0.00		
DP-18	OUTFALL	0.00	5.66	0	00:05	0.00		
DP-20	OUTFALL	0.00	4.99	0	00:24	0.00		
DP-5	OUTFALL	0.00	5.86	0	00:05	0.00		
DP-6	OUTFALL	0.00	1.11	0	00:05	0.00		
DP-7	OUTFALL	0.00	3.00	0	00:06	0.00		
OFFSITE1	OUTFALL	0.00	0.23	0	00:15	0.00		
OFFSITE-1	OUTFALL	0.00	1.62	0	00:25	0.00		

****
Inlet Depth Summary
****

Inlet ID	Max Gutter Spread during Peak Flow ft	Max Gutter Water Elev during Peak Flow ft	Max Gutter Water Depth during Peak Flow ft	Time of Maximum Depth Occurrence days	hh:mm
CB-1	7.11	281.45	0.23	0	00:12
CB-10	3.17	267.87	0.18	0	00:05
CB-11	3.02	272.27	0.17	0	00:06
CB-12	3.89	271.29	0.22	0	00:20
CB-13	5.20	265.07	0.22	0	00:07
CB-16	7.54	255.27	0.34	0	00:05
CB-17	8.14	265.74	0.25	0	00:05
CB-18	18.03	274.19	0.47	0	00:05
CB-2	4.30	277.06	0.24	0	00:05

CB-20	5.18	279.89	0.22	0	00:00
CB-3	3.51	265.59	0.20	0	00:56
CB-4	3.80	256.14	0.21	0	00:05
CB-5	6.65	251.47	0.29	0	00:05
CB-6	3.35	255.54	0.19	0	00:05
CB-7	2.99	258.58	0.17	0	00:05
CB-8W	7.07	260.31	0.23	0	00:05
CB-9	3.40	263.01	0.19	0	00:05

****
Inlet Flow Summary
****

Inlet ID	Peak Flow cfs	Peak Lateral Flow cfs	Peak Flow Intercepted by Inlet cfs	Peak Flow Bypassing Inlet cfs	Inlet Efficiency during Peak Flow %	Total Flooding acre-in	Total Time Flooded minutes
CB-1	1.32	1.32	1.04	0.28	78.64	0.000	0
CB-10	1.06	1.06	1.01	0.05	94.86	0.000	0
CB-11	0.94	0.94	0.91	0.04	96.04	0.000	0
CB-12	1.73	1.73	1.53	0.20	88.48	0.000	0
CB-13	1.88	1.88	-	-	-	0.000	0
CB-16	3.55	3.28	-	-	-	0.000	0
CB-17	1.77	1.77	1.30	0.48	73.16	0.000	0
CB-18	5.68	5.68	-	-	-	0.000	0
CB-2	2.23	2.23	1.89	0.34	84.58	0.000	0
CB-20	2.50	2.50	-	-	-	0.000	0
CB-3	1.35	1.35	1.24	0.11	91.94	0.000	0
CB-4	1.64	1.64	1.46	0.18	89.31	0.000	0
CB-5	2.88	2.85	-	-	-	0.000	0
CB-6	1.20	1.20	1.12	0.08	93.41	0.000	0
CB-7	0.92	0.87	0.89	0.03	96.24	0.000	0
CB-8W	1.61	1.56	1.24	0.37	76.84	0.000	0
CB-9	1.25	1.25	1.02	0.22	82.02	0.000	0

****

Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
DP-1	1.93	0.50	1.03
DP-10	1.55	0.51	1.63
DP-13	3.35	1.01	2.43
DP-16	1.35	1.20	3.82
DP-18	0.88	2.23	5.66
DP-20	3.40	2.45	4.99
DP-5	8.55	0.88	5.86
DP-6	1.49	0.28	1.11
DP-7	2.60	0.49	3.00
OFFSITE1	2.93	0.06	0.23
OFFSITE-1	4.61	0.60	1.62
System	2.97	10.21	23.93

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
CB-1_Overflow	CHANNEL	0 00:15	2.12	1.00	0.23	2.70	0.08	0.39	0	Calculated
CB10-9_Gutter	CHANNEL	0 00:07	2.67	1.00	0.04	8.35	0.00	0.12	0	Calculated
CB11-10_Gutter	CHANNEL	0 00:09	2.86	1.00	0.03	7.95	0.00	0.11	0	Calculated
CB12-13_Gutter	CHANNEL	0 00:21	2.50	1.00	0.19	9.44	0.02	0.23	0	Calculated
CB17-16_Gutter	CHANNEL	0 00:06	6.91	1.00	0.41	12.30	0.03	0.28	0	Calculated
CB2-3_Gutter	CHANNEL	0 00:06	6.02	1.00	0.29	13.13	0.02	0.23	0	Calculated
CB3-4_Gutter	CHANNEL	0 00:57	1.89	1.00	0.11	11.64	0.01	0.17	0	Calculated
CB4-5_Gutter	CHANNEL	0 00:06	3.91	1.00	0.12	8.25	0.02	0.20	0	Calculated
CB6-5_Gutter	CHANNEL	0 00:07	2.89	1.00	0.05	7.73	0.01	0.14	0	Calculated
CB7-6_Gutter	CHANNEL	0 00:08	2.18	1.00	0.03	6.62	0.01	0.12	0	Calculated
CB8-7_Gutter	CHANNEL	0 00:07	2.74	1.00	0.27	4.89	0.06	0.32	0	Calculated
CB9-8_Gutter	CHANNEL	0 00:07	3.07	1.00	0.16	6.26	0.03	0.24	0	Calculated
L-Pipe - (50)	CHANNEL	0 00:25	9.25	1.00	1.62	41.01	0.04			

```
0.30          0  Calculated
  Pipe - (12)          CONDUIT     0  00:05      5.96    1.00        1.11        6.19       0.18
0.29          0  Calculated
  Pipe - (13)          CONDUIT     0  00:05      3.70    1.00        1.12        3.19       0.35
0.41          0  Calculated
  Pipe - (14)          CONDUIT     0  00:05      7.17    1.00        2.86        5.59       0.51
0.51          0  Calculated
  Pipe - (16)          CONDUIT     0  00:56      7.17    1.00        1.24        7.67       0.16
0.27          0  Calculated
  Pipe - (18)          CONDUIT     0  00:05      3.76    1.00        0.89        3.56       0.25
0.34          0  Calculated
  Pipe - (19)          CONDUIT     0  00:05      4.30    1.00        0.89        4.29       0.21
0.31          0  Calculated
  Pipe - (2)           CONDUIT     0  00:05     13.26    1.00        1.84        7.69       0.24
0.33          0  Calculated
  Pipe - (20)          CONDUIT     0  00:00      0.00    1.00        0.00        2.79       0.00
0.00          0  Calculated
  Pipe - (21)          CONDUIT     0  00:06      4.85    1.00        2.13        3.59       0.59
0.55          0  Calculated
  Pipe - (22)          CONDUIT     0  00:06      5.08    1.00        3.00        3.56       0.84
0.70          0  Calculated
  Pipe - (23)          CONDUIT     0  00:05      6.29    1.00        1.23        6.40       0.19
0.30          0  Calculated
  Pipe - (24)          CONDUIT     0  00:05      3.78    1.00        1.02        3.40       0.30
0.37          0  Calculated
  Pipe - (25)          CONDUIT     0  00:05      5.00    1.00        0.98        3.88       0.25
0.34          0  Calculated
  Pipe - (26)          CONDUIT     0  00:05      3.03    1.00        1.00        2.52       0.40
0.44          0  Calculated
  Pipe - (27)          CONDUIT     0  00:05      3.03    1.00        1.00        2.52       0.40
0.44          0  Calculated
  Pipe - (28)          CONDUIT     0  00:06      6.78    1.00        0.90        8.05       0.11
0.23          0  Calculated
  Pipe - (29)          CONDUIT     0  00:07      6.44    1.00        0.88        4.83       0.18
0.29          0  Calculated
  Pipe - (3)           CONDUIT     0  00:06      7.38    1.00        2.20        6.35       0.35
0.41          0  Calculated
  Pipe - (30)          CONDUIT     0  00:20      4.36    1.00        1.53        3.56       0.43
0.46          0  Calculated
  Pipe - (31)          CONDUIT     0  00:20      6.27    1.00        1.52        5.52       0.28
0.36          0  Calculated
  Pipe - (33)          CONDUIT     0  00:07      4.88    1.00        2.43        3.56       0.68
0.61          0  Calculated
  Pipe - (34)          CONDUIT     0  00:07      3.55    1.00        1.88        2.54       0.74
0.64          0  Calculated
  Pipe - (35)          CONDUIT     0  00:07      4.77    1.00        1.88        3.73       0.50
0.50          0  Calculated
  Pipe - (4)           CONDUIT     0  00:06      6.42    1.00        3.42        4.45       0.77
0.65          0  Calculated
  Pipe - (40)          CONDUIT     0  00:05     11.06    1.00        1.27        6.43       0.20
0.30          0  Calculated
  Pipe - (41)          CONDUIT     0  00:06      5.27    1.00        3.82        3.56       1.07
1.00          2  SURCHARGED
  Pipe - (43)          CONDUIT     0  00:05      6.66    1.00        3.55        4.77       0.74
0.64          0  Calculated
  Pipe - (44)          CONDUIT     0  00:05      8.37    1.00        5.97        5.63       1.06
0.91          0  > CAPACITY
  Pipe - (45)          CONDUIT     0  00:05      8.03    1.00        5.66       14.86       0.38
0.43          0  Calculated
  Pipe - (5)           CONDUIT     0  00:05      9.98    1.00        5.86        7.00       0.84
0.70          0  Calculated
  Pipe - (50)          CONDUIT     0  00:24     12.59    1.00        5.00       30.06       0.17
0.28          0  Calculated
  Pipe - (51)          CONDUIT     0  00:24     12.87    1.00        5.00       10.15       0.49
0.50          0  Calculated
  Pipe - (54)          CONDUIT     0  00:05      7.30    1.00        1.11        8.20       0.14
```

```
0.25          0  Calculated
  Pipe - (55)        CONDUIT      0  00:05     10.40    1.00        1.46       12.12       0.12
0.23          0  Calculated
  Pipe - (56)        CONDUIT      0  00:05      6.63    1.00        1.63        6.17       0.26
0.35          0  Calculated
  Pipe - (57)        CONDUIT      0  00:24     11.39    1.00        4.99       26.08       0.19
0.30          0  Calculated
  Pipe - (61)        CONDUIT      0  00:12      6.41    1.00        1.03        5.92       0.17
0.28          0  Calculated
  Pipe - (62)        CONDUIT      0  00:12      3.94    1.00        1.03        3.56       0.29
0.37          0  Calculated
  Pipe - (7)         CONDUIT      0  00:05      8.05    1.00        2.21        7.14       0.31
0.38          0  Calculated


  ********************************
  Highest Flow Instability Indexes
  ********************************
  All links are stable.

  WARNING 108 : Surcharge elevation defined for Junction EX-18 is below junction maximum
elevation. Assumed surcharge elevation equal to maximum elevation.
  WARNING 139 : Ponded area defined for on sag Inlet CB-18 is zero. Assumed ponded area equal to
10 ft² (0.929 m²).
  WARNING 138 : Initial water surface elevation defined for Inlet CB-20 is below catchbasin
invert elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB-4 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB-5 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB-1_Overflow
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB10-9_Gutter
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB11-10_Gutter
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB12-13_Gutter
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB17-16_Gutter
is below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB2-3_Gutter is
below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB3-4_Gutter is
below the storm drain inlet rim elevation.
                Assumed the downstream bypass roadway link inlet invert elevation equal to the
storm drain inlet rim elevation.
  WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB4-5_Gutter is
below the storm drain inlet rim elevation.
```

Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB6-5_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB7-6_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB8-7_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 141 : Inlet invert elevation defined for downstream Bypass Roadway Link CB9-8_Gutter is below the storm drain inlet rim elevation.
Assumed the downstream bypass roadway link inlet invert elevation equal to the storm drain inlet rim elevation.
WARNING 117 : Conduit outlet invert elevation defined for Conduit CB-1_Overflow is below downstream node invert elevation.
Assumed conduit outlet invert elevation equal to downstream node invert elevation.
WARNING 004 : Minimum elevation drop used for Conduit CB-1_Overflow.
WARNING 005 : Minimum slope used for Conduit CB-1_Overflow.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB10-9_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-9.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB11-10_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-10.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB12-13_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-13.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB17-16_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-16.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB2-3_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-3.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB3-4_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-4.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB4-5_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-5.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB6-5_Gutter is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CB-5.
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB7-6_Gutter is below the storm drain inlet rim elevation.

```
                Assumed the upstream roadway link outlet invert elevation equal to the storm
drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain
inlet CB-6.
  WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB8-7_Gutter is below
the storm drain inlet rim elevation.
                Assumed the upstream roadway link outlet invert elevation equal to the storm
drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain
inlet CB-7.
  WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link CB9-8_Gutter is below
the storm drain inlet rim elevation.
                Assumed the upstream roadway link outlet invert elevation equal to the storm
drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain
inlet CB-8W.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (14) is below upstream
node invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (50) is below upstream
node invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (55) is below upstream
node invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.

  Analysis began on:  Tue Jan 31 11:11:57 2023
  Analysis ended on:  Tue Jan 31 11:11:59 2023
  Total elapsed time: 00:00:02
```

APPENDIX E

Test Pit Soil Log

Test Hole ID:	(See map for location)	Percolation Test:			Groundwater Data	Standing Water Depth, in.	Not observed	Sc
Weather	Cloudy; 45°	Depth of Perc	Not required		Sh = Sc - [(Sr/Owr)*(Owc-Owmax)]	or, Depth Weeping from Pit Face	Not observed	Sc
Date:	December 29, 2021	Start Pre-Soak			Frimpter Adjustment	USGS Index Well(s) Number/ID		per USGS
Soil Evaluator	Alan Gunnison- BETA Group, Inc.	End Pre-Soak				Reading Date		-
	Massachusetts License No. 13996	Time @ 12-in.				Index Well Max Level		Owmax
Project:	Grove Street Drainage, Franklin, MA	Time @ 9-in.				Index Well Level		Owc
Project / Number	7548	Time @ 6-in.				Max Range for well		Owr
		Time 9 - 6in.				Rage in levels for Similar Topography (5% exceedance, Figure 11)		Sr
Top Hole El. = 280.5+/-	(Based on assumed datum per Plan)	Rate (min./inch)				Predicted Adjusted Depth (Frimpter), ft	#VALUE!	Sh

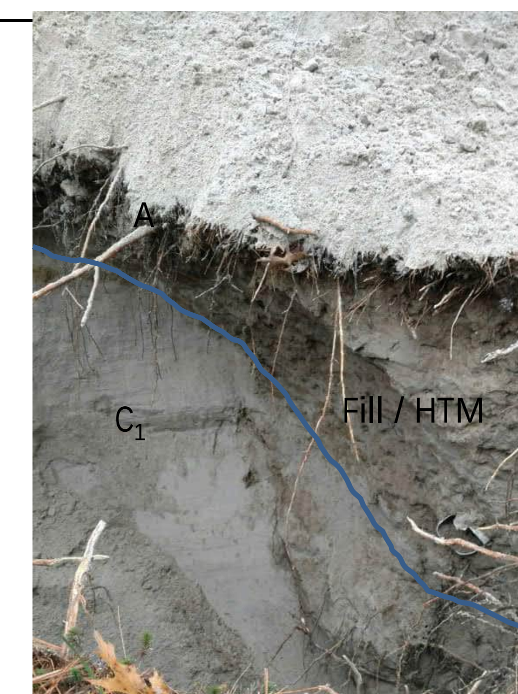
Test Hole Log

Depth (inches)	Soil Horizon (Layer)	Soil Matrix Color - Moist (Munsell)	Soil Texture (USDA) (USDA)	Coarse Fragments % by Volume: Gravel	Coarse Fragments % by Volume: Cobbles & Stones	Structure	Consistence	Redoximorphic Features (mottles): Depth	Redoximorphic Features (mottles): Color	Redoximorphic Features (mottles): Percent	Other
0-4"	Loam	--	--	--	--	--	--				
4-120"	C	2.5YR 8/1	Sand	0	0	GR	L	None observed			

Geologic Setting and Topography / Textural and Structure

Landform	Landscape Position	Parent Material	Texture (USDA)	Coarse Fragments		Structure	Consistence	Redox %
Drumlin	Summit (SU)	Dense Compact Glacial Till	Coarse Sand	Gravel = 2mm to 3"	Cobble = 3" to 10"	Granular (GR)	Loose (L)	Few (F) <2%
Till Ridge	Shoulder (SH)	Loose Ablation Till	Sand		Stone = 10" to 25"	Angular Blocky (ABK)	Very Friable (VFR)	Common 2 to <20%
Ground Moraine	Backslope (BS)	Shallow to Bedrock Area	Fine Sand		Boulder = >25"	Subangular Blocky (SBK)	Friable (FR)	Many >20%
Moraine (End / Recessional)	Footslope (FS)	Lacustrine	Loamy Sand			Platy (PL)	Firm (FI)	
Kettle	Toeslope (TS)	Ice-Contact Outwash	Sandy Loam			Structureless	Very Firm (VFI)	
Kame	Channel (CH)	Proglacial Outwash	Fine Sandy Loam			Single Grain (SG)	Extremely Firm (EF)	
Esker		Alluvium	Loam			Massive (MA)		
Outwash Plain		Organic Deposits	Silt Loam					
Lacustrine Plain		Eolian Deposits	Sandy Clay Loam					
Floodplain		Marine Silts & Clays	Silty Clay					
Swamp		Human-Made/Transported Materials (Fill)	Clay					
Other		Other						

Photo(s)



Comments:
Approximately 6-8 feet of overburden had been removed within the Grove Street alignment when the road was constructed. Evidence of the original existing grade was still present on both sides of Grove Street.
A PVC drain line encountered appear to be from a leaching basin associated with Rosewood Lane. The trench for installation of the drain line was observed on the sidewall of the test pit. The C layer appeared to be naturally occurring and was observed to a depth of 10-feet. Groundwater was not observed.

APPENDIX F

SOIL MAPS

United States Department of Agriculture

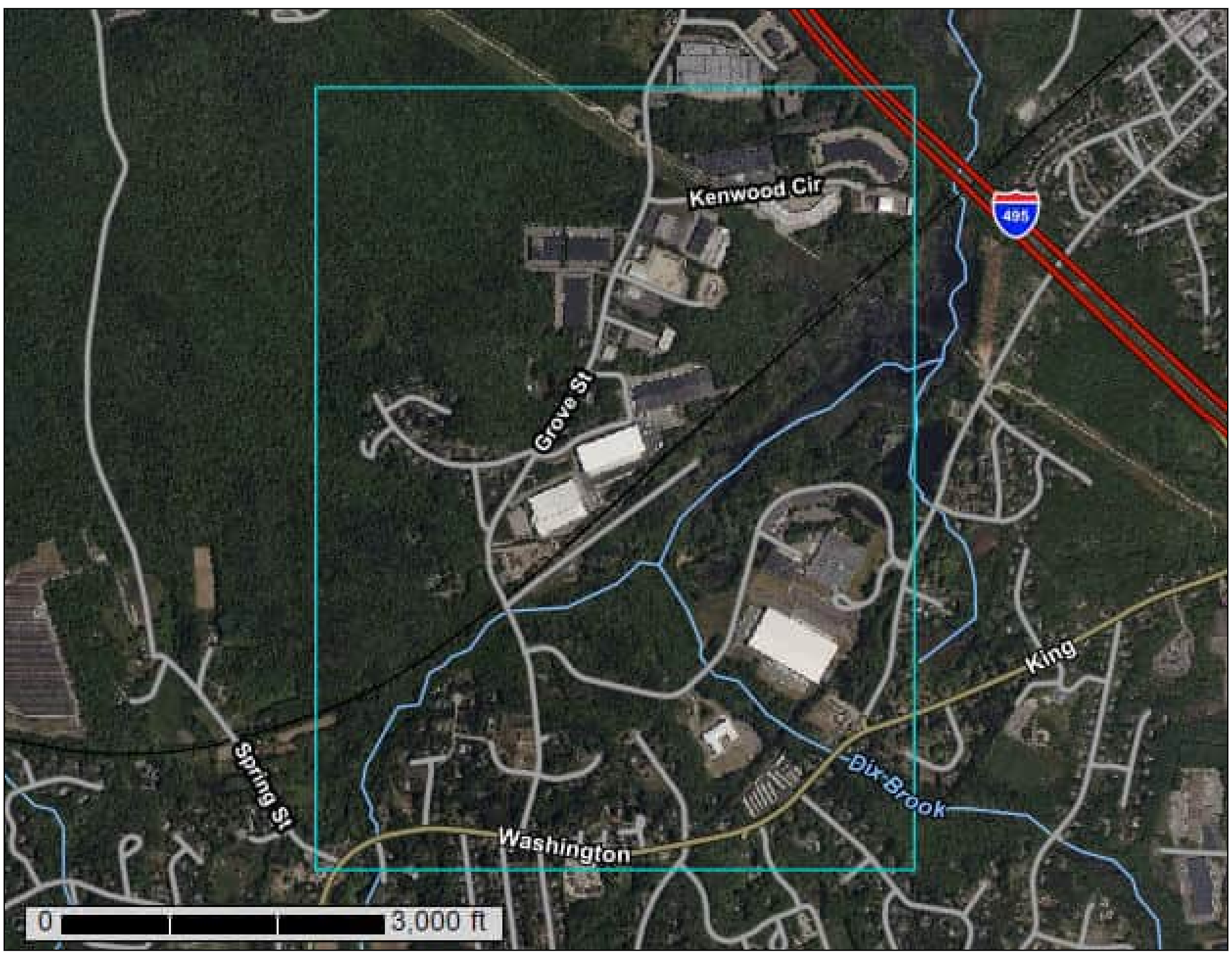
NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for

Norfolk and Suffolk Counties, Massachusetts



December 6, 2022

Preface

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

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

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

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

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

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

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Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

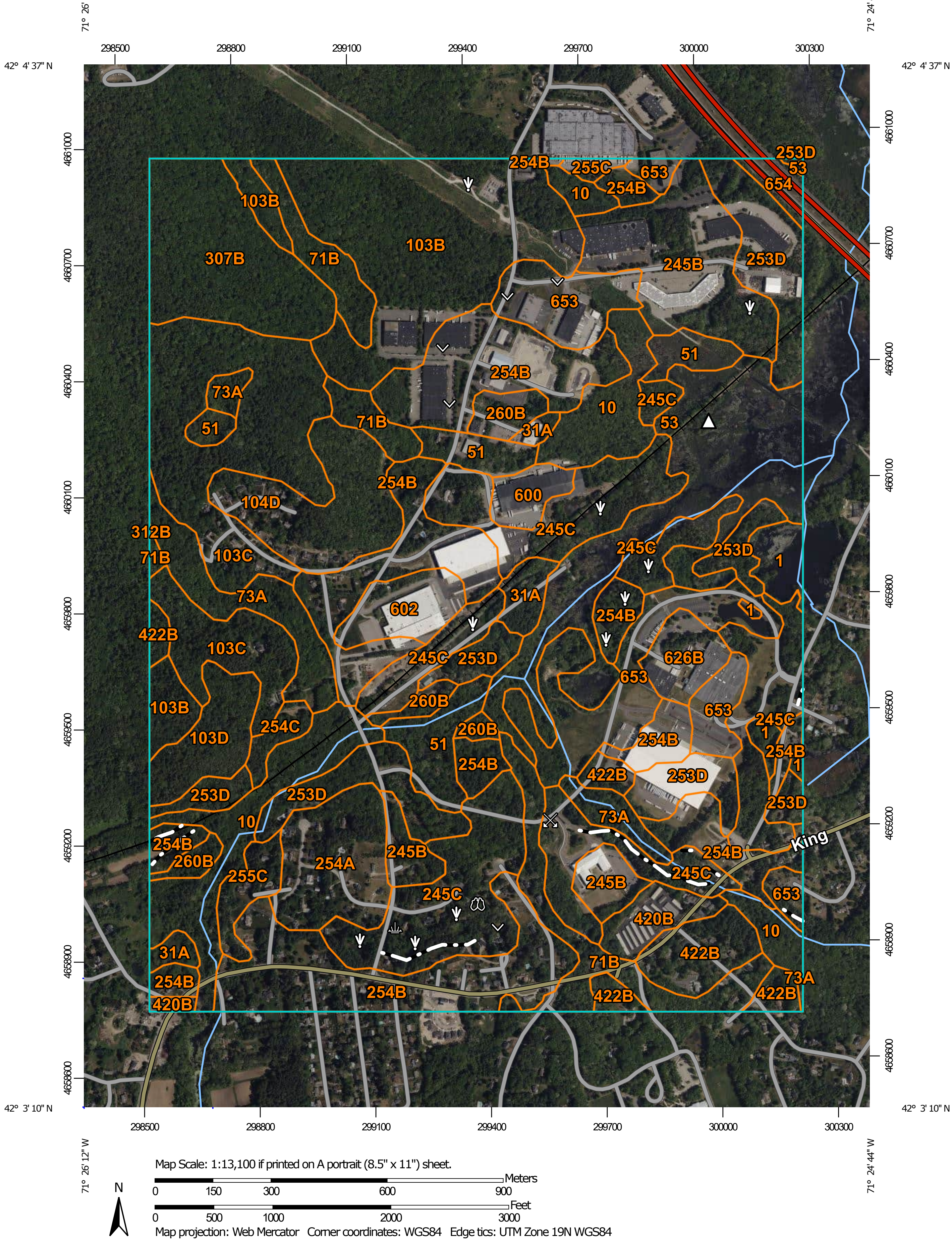
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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

Soil Map

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

Soil Map


71° 26' 12" W
71° 24' 44" W
42° 4' 37" N
42° 3' 10" N
298500
298800
299100
299400
299700
300000
300300
4661000
4660700
4660400
4660100
4659800
4659500
4659200
4658900
4658600
103B
307B
71B
73A
51
104D
312B
103C
422B
103D
254C
253D
10
254B
260B
255C
31A
420B
254A
245B
245C
602
600
31A
260B
653
255C
254B
254B
245C
53
51
1
626B
253D
73A
422B
71B
King
654
Map Scale: 1:13,100 if printed on A portrait (8.5" x 11") sheet.
Meters
0
150
300
600
900
Feet
0
500
1000
2000
3000
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

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

Soils
- Soil 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.

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 18, 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
1	Water	8.7	0.9%
10	Scarboro and Birdsall soils, 0 to 3 percent slopes	48.0	5.2%
31A	Walpole sandy loam, 0 to 3 percent slopes	8.6	0.9%
51	Swansea muck, 0 to 1 percent slopes	24.2	2.6%
53	Freetown muck, ponded, 0 to 1 percent slopes	57.0	6.2%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	35.0	3.8%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	24.5	2.6%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	76.6	8.3%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	67.9	7.3%
103D	Charlton-Hollis-Rock outcrop complex, 15 to 25 percent slopes	13.8	1.5%
104D	Hollis-Rock outcrop-Charlton complex, 15 to 35 percent slopes	27.0	2.9%
245B	Hinckley loamy sand, 3 to 8 percent slopes	45.4	4.9%
245C	Hinckley loamy sand, 8 to 15 percent slopes	107.2	11.6%
253D	Hinckley loamy sand, 15 to 35 percent slopes	55.7	6.0%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	22.8	2.5%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	128.4	13.9%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	3.9	0.4%
255C	Windsor loamy sand, 8 to 15 percent slopes	8.4	0.9%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	11.3	1.2%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	37.6	4.1%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	0.0	0.0%
420B	Canton fine sandy loam, 3 to 8 percent slopes	9.3	1.0%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	21.5	2.3%
600	Pits, sand and gravel	6.2	0.7%
602	Urban land, 0 to 15 percent slopes	11.3	1.2%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	8.8	1.0%
653	Udorthents, sandy	53.8	5.8%
654	Udorthents, loamy	3.6	0.4%
Totals for Area of Interest		**926.9**	**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.

Norfolk and Suffolk Counties, Massachusetts

1—Water

Map Unit Setting

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

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

10—Scarboro and Birdsall soils, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vkxw
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: Not prime farmland

Map Unit Composition

Scarboro and similar soils: 65 percent
Birdsall and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scarboro

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 9 inches: mucky fine sandy loam
H2 - 9 to 60 inches: stratified loamy fine sand to gravelly coarse sand

Properties and qualities

Slope: 0 to 3 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): High to very high (6.00 to 20.00 in/hr)

Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Description of Birdsall

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Soft coarse-silty glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: very fine sandy loam
H2 - 8 to 16 inches: very fine sandy loam
H3 - 16 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 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 moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 12.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 5 percent
Landform: Bogs
Hydric soil rating: Yes

Raynham

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Walpole

Percent of map unit: 2 percent
Landform: Terraces
Hydric soil rating: Yes

31A—Walpole sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svkl
Elevation: 0 to 1,020 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

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

Description of Walpole

Setting

Landform: Depressions, outwash plains, outwash terraces, depressions, deltas
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip, talf
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy glaciofluvial deposits derived from igneous, metamorphic and sedimentary rock

Typical profile

Oe - 0 to 1 inches: mucky peat
A - 1 to 7 inches: sandy loam
Bg - 7 to 21 inches: sandy loam
BC - 21 to 25 inches: gravelly sandy loam
C - 25 to 65 inches: very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
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 4 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: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Ecological site: F144AY028MA - Wet Outwash
Hydric soil rating: Yes

Minor Components

Scarboro

Percent of map unit: 10 percent
Landform: Outwash plains, deltas, outwash terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Sudbury

Percent of map unit: 10 percent
Landform: Outwash plains, deltas, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

51—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

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

53—Freetown muck, ponded, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2qc
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

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

Description of Freetown, Ponded

Setting

Landform: Kettles, marshes, depressions, depressions, bogs, swamps
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

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, ponded

Percent of map unit: 5 percent
Landform: Depressions on ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea, ponded

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

71B—Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w69c
Elevation: 0 to 1,290 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

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

Description of Ridgebury, Extremely Stony

Setting

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
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 6 inches: fine sandy loam
Bw - 6 to 10 inches: sandy loam
Bg - 10 to 19 inches: gravelly sandy loam
Cd - 19 to 66 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Poorly drained
Runoff class: Very high
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 0 to 6 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 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Woodbridge, extremely stony

Percent of map unit: 10 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Whitman, extremely stony

Percent of map unit: 8 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Paxton, extremely stony

Percent of map unit: 2 percent
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: Linear, convex
Hydric soil rating: No

73A—Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w695
Elevation: 0 to 1,580 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

Whitman, extremely stony, and similar soils: 81 percent
Minor components: 19 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Whitman, Extremely Stony

Setting

Landform: Drumlins, ground moraines, hills, drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 1 inches: peat
A - 1 to 10 inches: fine sandy loam
Bg - 10 to 17 inches: gravelly fine sandy loam
Cdg - 17 to 61 inches: fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 7 to 38 inches to densic material
Drainage class: Very poorly drained
Runoff class: Negligible
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 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY041MA - Very Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Ridgebury, extremely stony

Percent of map unit: 10 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
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions, outwash terraces, outwash deltas
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent
Landform: Marshes, bogs, swamps
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Woodbridge, extremely stony

Percent of map unit: 1 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

103B—Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: vktd
Elevation: 0 to 480 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton and similar soils: 40 percent
Hollis and similar soils: 25 percent
Rock outcrop: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable coarse-loamy ablation till derived from granite

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 36 inches: fine sandy loam
H3 - 36 to 60 inches: fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
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 7.8 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

Description of Hollis

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Shallow, friable loamy ablation till derived from igneous rock

Typical profile

H1 - 0 to 3 inches: fine sandy loam
H2 - 3 to 14 inches: gravelly fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
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 1.8 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: Igneous and metamorphic rock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Canton

Percent of map unit: 7 percent
Hydric soil rating: No

Chatfield

Percent of map unit: 5 percent
Hydric soil rating: No

Scituate

Percent of map unit: 2 percent
Hydric soil rating: No

Whitman

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

103C—Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2wzp1
Elevation: 0 to 1,390 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

Charlton, extremely stony, and similar soils: 50 percent
Hollis, extremely stony, and similar soils: 20 percent
Rock outcrop: 10 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton, Extremely Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
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: 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: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Hollis, Extremely Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: gravelly fine sandy loam
Bw - 7 to 16 inches: gravelly fine sandy loam
2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 23 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 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: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Ridges, hills
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 79 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock

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: No

Minor Components

Woodbridge, extremely stony

Percent of map unit: 8 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Chatfield, extremely stony

Percent of map unit: 5 percent
Landform: Ridges, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Canton, extremely stony

Percent of map unit: 5 percent
Landform: Moraines, hills, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 2 percent
Landform: Hills, drainageways, drumlins, depressions, ground moraines
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

103D—Charlton-Hollis-Rock outcrop complex, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: vktk
Elevation: 0 to 490 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton and similar soils: 35 percent
Hollis and similar soils: 25 percent
Rock outcrop: 20 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable coarse-loamy ablation till derived from granite

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 36 inches: fine sandy loam
H3 - 36 to 60 inches: fine sandy loam

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
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 7.8 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

Description of Hollis

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Shallow, friable loamy ablation till derived from igneous rock

Typical profile

H1 - 0 to 3 inches: fine sandy loam
H2 - 3 to 14 inches: gravelly 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: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
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 1.8 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: Igneous and metamorphic rock

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
Hydric soil rating: Unranked

Minor Components

Chatfield

Percent of map unit: 8 percent

Hydric soil rating: No

Canton

Percent of map unit: 8 percent
Hydric soil rating: No

Montauk

Percent of map unit: 4 percent
Hydric soil rating: No

104D—Hollis-Rock outcrop-Charlton complex, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: vkvh
Elevation: 20 to 610 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 120 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: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Shallow, friable loamy ablation till derived from igneous and metamorphic rock

Typical profile

H1 - 0 to 3 inches: fine sandy loam
H2 - 3 to 14 inches: gravelly fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high

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 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Parent material: Igneous and metamorphic rock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Description of Charlton

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable coarse-loamy ablation till derived from granite

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 36 inches: fine sandy loam
H3 - 36 to 60 inches: fine sandy loam

Properties and qualities

Slope: 15 to 35 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
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 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Chatfield

Percent of map unit: 5 percent
Hydric soil rating: No

Canton

Percent of map unit: 5 percent
Hydric soil rating: No

245B—Hinckley loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svm8
Elevation: 0 to 1,430 feet
Mean annual precipitation: 36 to 53 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Farmland of statewide importance

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: Outwash deltas, outwash terraces, kames, kame terraces, moraines, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread
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: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: 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
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 8 percent
Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Outwash deltas, outwash terraces, moraines, outwash plains, kame terraces
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Head slope, side slope, base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

245C—Hinckley loamy sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2svm9
Elevation: 0 to 1,480 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: Farmland of statewide importance

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: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
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: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: 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
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): 4e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 5 percent
Landform: Moraines, eskers, kames, outwash deltas, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
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: 5 percent
Landform: Outwash deltas, moraines, outwash plains, kame terraces, outwash terraces
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Landform: Kames, outwash plains, outwash terraces, moraines, eskers
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

253D—Hinckley loamy sand, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2svmd
Elevation: 0 to 860 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: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
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 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: 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
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

Windsor

Percent of map unit: 10 percent
Landform: Moraines, eskers, kames, outwash deltas, outwash terraces, outwash plains, kame terraces
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

Merrimac

Percent of map unit: 3 percent
Landform: Kame terraces, outwash plains, outwash terraces, moraines, eskers, kames
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: Outwash deltas, outwash plains, kame terraces, outwash terraces, moraines
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

254A—Merrimac fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tyqr
Elevation: 0 to 1,100 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: All areas are prime farmland

Map Unit Composition

Merrimac and similar soils: 85 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): Side slope, crest, 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 3 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): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

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, side slope, crest, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Agawam

Percent of map unit: 3 percent
Landform: Stream terraces, outwash terraces, outwash plains, moraines, eskers, kames
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex

Hydric soil rating: No

Windsor

Percent of map unit: 2 percent
Landform: Dunes, deltas, outwash terraces, outwash plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

254B—Merrimac fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyqs
Elevation: 0 to 1,290 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: All areas are prime farmland

Map Unit Composition

Merrimac and similar soils: 85 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): Side slope, crest, 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: 3 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): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

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, side slope, crest, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Windsor

Percent of map unit: 3 percent
Landform: Outwash plains, outwash terraces, dunes, deltas
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Outwash plains, outwash terraces, moraines, stream terraces, eskers, kames
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

254C—Merrimac fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2tyqt
Elevation: 0 to 1,030 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: Farmland of statewide importance

Map Unit Composition

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

Description of Merrimac

Setting

Landform: Eskers, outwash plains, moraines, kames, outwash terraces
Landform position (two-dimensional): Backslope, footslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, 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: 8 to 15 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): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

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, side slope, crest, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
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

Windsor

Percent of map unit: 5 percent
Landform: Outwash plains, dunes, deltas, outwash terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

255C—Windsor loamy sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2svkq
Elevation: 0 to 1,260 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: Farmland of statewide importance

Map Unit Composition

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

Description of Windsor

Setting

Landform: — error in exists on —
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, riser
Down-slope shape: Convex
Across-slope shape: Convex, linear
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
Ap - 1 to 11 inches: loamy sand
Bw - 11 to 31 inches: loamy sand
C - 31 to 65 inches: sand

Properties and qualities

Slope: 8 to 15 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 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Hinckley

Percent of map unit: 10 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

Deerfield

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear

Across-slope shape: Linear
Hydric soil rating: No

260B—Sudbury fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: vky4
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: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable coarse-loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 11 inches: sandy loam
H2 - 11 to 22 inches: sandy loam
H3 - 22 to 60 inches: gravelly coarse sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Drainage class: Moderately well drained
Runoff class: Low
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 4.0 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

Walpole

Percent of map unit: 5 percent
Landform: Terraces
Hydric soil rating: Yes

Merrimac

Percent of map unit: 5 percent
Hydric soil rating: No

Deerfield

Percent of map unit: 5 percent
Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

307B—Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w675
Elevation: 0 to 1,580 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

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

Description of Paxton, Extremely Stony

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: Linear, convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material

A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 43 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 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge, extremely stony

Percent of map unit: 10 percent
Landform: Hills, drumlins, ground moraines
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, extremely stony

Percent of map unit: 5 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

Ridgebury, extremely stony

Percent of map unit: 4 percent
Landform: Drumlins, drainageways, depressions, ground moraines, hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman, extremely stony

Percent of map unit: 1 percent

Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

312B—Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2t2qs
Elevation: 0 to 1,580 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

Woodbridge, extremely stony, and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Extremely Stony

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 9 inches: fine sandy loam
Bw1 - 9 to 20 inches: fine sandy loam
Bw2 - 20 to 32 inches: fine sandy loam
Cd - 32 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Moderately 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 19 to 27 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 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Paxton, extremely stony

Percent of map unit: 10 percent
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: Linear, convex
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 8 percent
Landform: Hills, drainageways, drumlins, depressions, ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

420B—Canton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w81b
Elevation: 0 to 1,180 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: All areas are prime farmland

Map Unit Composition

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

Description of Canton

Setting

Landform: Moraines, ridges, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest

Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam
2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 10 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Montauk

Percent of map unit: 5 percent
Landform: Moraines, 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
Hydric soil rating: No

Charlton

Percent of map unit: 4 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear

Across-slope shape: Convex
Hydric soil rating: No

Swansea

Percent of map unit: 1 percent
Landform: Marshes, depressions, bogs, swamps, kettles
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

422B—Canton fine sandy loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w818
Elevation: 0 to 1,180 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

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

Description of Canton, Extremely Stony

Setting

Landform: Moraines, hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 5 inches: fine sandy loam
Bw1 - 5 to 16 inches: fine sandy loam
Bw2 - 16 to 22 inches: gravelly fine sandy loam
2C - 22 to 67 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low

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: 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 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate, extremely stony

Percent of map unit: 6 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Charlton, extremely stony

Percent of map unit: 6 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Montauk, extremely stony

Percent of map unit: 4 percent
Landform: Recessional moraines, 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
Hydric soil rating: No

Swansea

Percent of map unit: 4 percent
Landform: Marshes, depressions, bogs, swamps, kettles
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

600—Pits, sand and gravel

Map Unit Setting

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

Map Unit Composition

Pits: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits

Setting

Parent material: Loose, excavated sandy and gravelly glaciofluvial deposits

602—Urban land, 0 to 15 percent slopes

Map Unit Setting

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

Map Unit Composition

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

Description of Urban Land

Setting

Parent material: Excavated and filled land

Minor Components

Rock outcrops

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

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): Side slope, crest, 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, side slope, crest, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

653—Udorthents, sandy

Map Unit Setting

National map unit symbol: vky8
Elevation: 0 to 3,000 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: Not prime farmland

Map Unit Composition

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

Description of Udorthents

Setting

Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Riser, tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Excavated and filled sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: variable
H2 - 6 to 60 inches: variable

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Urban land

Percent of map unit: 5 percent
Hydric soil rating: Unranked

Swansea

Percent of map unit: 2 percent
Landform: Bogs
Hydric soil rating: Yes

654—Udorthents, loamy

Map Unit Setting

National map unit symbol: vkyb
Elevation: 0 to 3,000 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: Not prime farmland

Map Unit Composition

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

Description of Udorthents

Setting

Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Riser, tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Excavated and filled coarse-loamy human transported material

Typical profile

H1 - 0 to 6 inches: variable
H2 - 6 to 60 inches: variable

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A

Hydric soil rating: Unranked

Minor Components

Udorthents,sandy

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Udorthents,wet substr.

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Urban land

Percent of map unit: 4 percent
Hydric soil rating: Unranked

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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

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

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

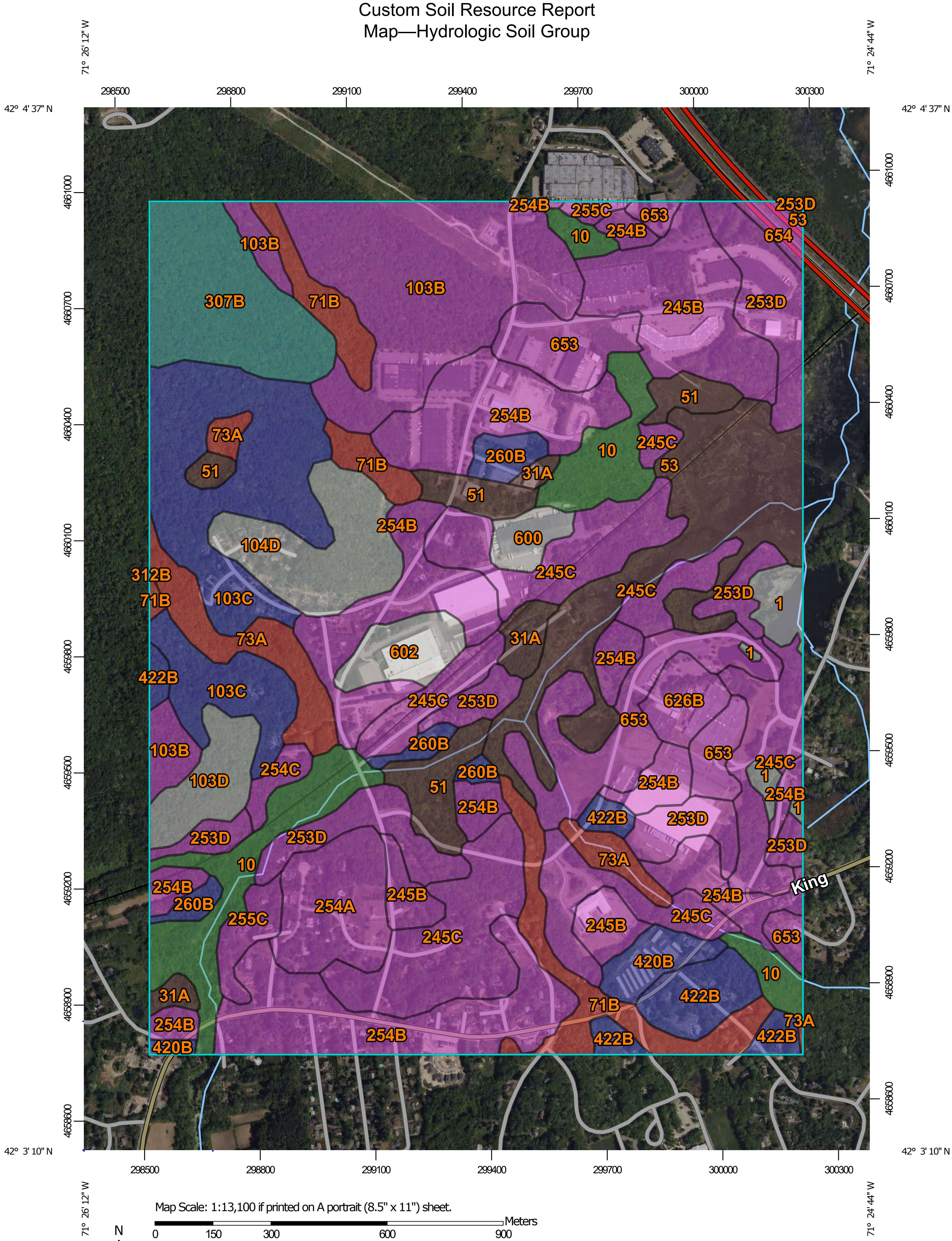
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

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

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

Map—Hydrologic Soil Group



Map Scale: 1:13,100 if printed on A portrait (8.5" x 11") sheet.

0 150 300 600 900 Meters

0 500 1000 2000 3000 Feet

N

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

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

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 18, 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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		8.7	0.9%
10	Scarboro and Birdsall soils, 0 to 3 percent slopes	A/D	48.0	5.2%
31A	Walpole sandy loam, 0 to 3 percent slopes	B/D	8.6	0.9%
51	Swansea muck, 0 to 1 percent slopes	B/D	24.2	2.6%
53	Freetown muck, ponded, 0 to 1 percent slopes	B/D	57.0	6.2%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	35.0	3.8%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	24.5	2.6%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	A	76.6	8.3%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	B	67.9	7.3%
103D	Charlton-Hollis-Rock outcrop complex, 15 to 25 percent slopes		13.8	1.5%
104D	Hollis-Rock outcrop-Charlton complex, 15 to 35 percent slopes		27.0	2.9%
245B	Hinckley loamy sand, 3 to 8 percent slopes	A	45.4	4.9%
245C	Hinckley loamy sand, 8 to 15 percent slopes	A	107.2	11.6%
253D	Hinckley loamy sand, 15 to 35 percent slopes	A	55.7	6.0%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	22.8	2.5%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	128.4	13.9%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	A	3.9	0.4%
255C	Windsor loamy sand, 8 to 15 percent slopes	A	8.4	0.9%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	B	11.3	1.2%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	C	37.6	4.1%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	C/D	0.0	0.0%
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	9.3	1.0%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	B	21.5	2.3%
600	Pits, sand and gravel		6.2	0.7%
602	Urban land, 0 to 15 percent slopes		11.3	1.2%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	8.8	1.0%
653	Udorthents, sandy	A	53.8	5.8%
654	Udorthents, loamy	A	3.6	0.4%
Totals for Area of Interest			**926.9**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

APPENDIX G

FEMA MAP

National Flood Hazard Layer FIRMette

FEMA

71°25'57"W 42°3'41"N

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

1:6,000

71°25'19"W 42°3'14"N

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

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/29/2022 at 10:35 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

National Flood Hazard Layer FIRMette

FEMA

71°26'2"W 42°4'4"N

71°25'25"W 42°3'37"N

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

1:6,000

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

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/29/2022 at 10:38 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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National Flood Hazard Layer FIRMette

FEMA

71°25'49"W 42°4'20"N

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

1:6,000

71°25'12"W 42°3'53"N

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

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/29/2022 at 10:36 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

APPENDIX H

O&M PLAN

TOWN OF FRANKLIN
LONG TERM POLLUTION PREVENTION PLAN
GROVE STREET IMPROVEMTNS
PHASE 2
FRANKLIN, MA
February 2023

The following provides protocols for the management and prevention of pollution related to the construction and long-term maintenance of improvements along Grove Street.

Good Housekeeping Best Management Practices (BMPS):

Waste Materials: Debris and trash will be collected in a metal dumpster. The dumpster will meet all Municipal requirements. Surplus soil material will be removed from the site and legally disposed of. Handling, sampling, manifesting, transportation, and disposal of waste material will be documented.

Hazardous Waste: Hazardous waste will be disposed of as required under local, state, and federal regulations. Site personnel will be instructed regarding proper management of hazardous waste. The individual in charge of this activity will be properly trained in hazardous waste management in accordance with OSHA regulations and MassDEP regulation 310 CMR 30 and 310 CMR 40.

Sanitary Waste: Temporary sanitary waste facilities will be provided onsite. Waste will be collected as required, and in any event as required by local regulation, by a sanitary waste management contractor.

Hazardous Products: The following practices will be used to reduce the risks associated with hazardous materials onsite:

a. All shipments will be promptly inspected to assure that products comply with requirements and items are undamaged.
b. Products will be stored and protected in accordance with the manufacturer’s instructions with seals and labels intact and legible.
c. Products will be stored in a secure location and access to the materials will be provided to authorize personnel only.

Establish Proper Building Material Staging Areas:

a. Material deliveries will be coordinated with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.
b. Delivers will be scheduled to reduce long-term onsite storage prior to installation unless written authorization is provided by the engineer.
c. Materials stored onsite will be stored in manufacturer’s original sealed containers or other packing systems complete with instruction for handling, storing, unpacking, protecting and installing.
d. Adequate equipment and personnel will be provided to ensure materials can be safely handled.
e. Cement and lime will be stored under a roof and off the ground to be kept completely dry at all times.
f. Petroleum products will be stored in a secure location under control of the site superintendent.
g. Mechanical and electrical equipment will be stored in a weatherproof structure.

Designated Washout Areas:

a. Concrete contractors should be encouraged where possible to use the washout facilities at their own plants.
b. Concrete washouts areas shall be established onsite with signs noting the locations. The washout area is to be inspected daily during concrete operations.
c. Provide adequate containment for the amount of wash water that will be used.
d. Dispose of materials properly. Concrete wash water can be highly polluted. It is not to be discharged to any surface water or storm drain system.

Establish Proper Vehicle / Equipment Maintenance Practices:

a. Train employees and subcontractor in proper fueling procedures (stay with vehicles during fueling, proper use of pumps, emergency shutoff valves, and such).
b. Inspect onsite vehicles and equipment daily for leaks, equipment damage and other service problems.
c. Clearly designate vehicle / equipment service areas away from drainage facilities and water course to prevent stormwater run-on and runoff.
d. Use drip pans, drip cloths, or absorbent pads when replacing spent fluids.
e. Collect all spent fluids, store in appropriate labeled containers in the proper storage areas and recycle fluids whenever possible.

Allowance for Non-Stormwater Discharges and Control Equipment/Vehicle Washing:

There will not be non-permitted non-stormwater discharges associated with this project. Specifically prohibited are the discharges of process water, non-contact cooling water, vehicle wash water and sanitary wastewater via stormwater drainage systems. Allowable non-stormwater discharges include discharges from fire-fighting activities, fire hydrant flushing, water used to control dust and uncontaminated air condition condensation.

Spill Prevention and Control Plan:

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and clean up:

a. Manufacturer’s recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies.
b. The contractor shall provide a 55-gallon spill containment kit and maintain it onsite throughout the construction period.
c. All spills will be cleaned up immediately after discovery.
d. The spill area will be kept well ventilated, and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
e. Spills of toxic or hazardous materials, at or greater than reportable quantities, will be reported to the appropriate state or local government agency.
f. The spill prevention plan will be adjusted to include measures to prevent this type of spill from reoccurring and how to clean up the spill if there is another one. A description of the spill, what caused it, and the cleanup measures will also be included.
g. The Site Superintendent is the designated responsible party for day-to-day operations and spill cleanup procedures.

Allowable Non-Stormwater Discharge Management:

The allowable non-stormwater discharges may include the following:

a. Discharges from fire-fighting activities.
b. Fire hydrant flushings.
c. Waters used to wash vehicles where detergents are not used.
d. Water used to control dust in accordance with EPA's CGP Part 3, Subpart 3.4 G.
e. Potable water including uncontaminated water line flushings.
f. Pavement wash where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents are not used.
g. Uncontaminated air conditioning or compressor condensate.
h. Uncontaminated ground water or spring water.
i. Foundation or footing drains where flows are not contaminated with process materials such as solvents.
j. Uncontaminated excavation dewatering.
k. Landscape irrigation.

Non-stormwater discharges should be eliminated or reduced to the extent feasible.

a. Water used to control dust:
Dust control will be implemented as needed once site grading has begun and during windy conditions (forecasted or actual wind conditions of 20 mph or greater) while site grading is occurring. Spraying of potable water at a rate of 300 gallons per acre or less will be performed by a mobile pressure-type distributor truck no more than three times a day during the months of May through September or whenever the dryness of the soil warrants it.

b. Uncontaminated Excavation Dewatering:
Dewatering activities are not anticipated for this project due to the depth of the groundwater. If dewatering does occur, the LTPPP will be revised to address the need for appropriate BMPs.

c. Landscape Irrigation:
Irrigation waters will not be sprayed onto impermeable surfaces such as paved driveways and roads. Waters will be directed onto soil and lawns by using hoses and correctly sized sprinklers with adjustable spray patterns. To avoid discharges or irrigation waters, the sprinkler will have low-flow rates and increased watering time. The irrigated area will be inspected for excess watering and to adjust watering times and schedules.

Inspection Personnel:

Inspections must be conducted by qualified personnel. "Qualified Personnel" means a person knowledgeable in the principals and practice of erosion and sediment controls who possesses the skills to assess conditions at the construction site that could impact stormwater quality and to assess the effectiveness of any sediment and erosion control measure selected to control the quality of stormwater discharges for the construction activity. Prior to construction the contractor shall submit the names of the personnel who will be responsible for the inspections.

Inspection Schedule and Procedures:

Inspections of the site will be performed once every 7 days and within 24 hours of the end of a storm event of <u>one-half inch</u> or greater. The inspections will verify that all BMPs are implemented, maintained, and effectively minimizing erosion and preventing stormwater contamination from construction materials.

Inspections must include all areas of the site disturbed by construction activity and areas used for storage of materials that are exposed to precipitation. Inspectors must look for evidence of, or the potential for, pollutants entering the stormwater conveyance system. Sedimentation and erosion control measures identified in the LTPPP must be observed to ensure proper operation. Discharge locations must be inspected to ascertain whether erosion control measures are effective. Where discharge locations are inaccessible, nearby downstream locations must be inspected to the extent that such inspections are practicable. Locations where vehicles enter or exit the site must be inspected for evidence of offsite sediment tracking.

If corrective actions are identified during the inspections, the construction managers will be notified, and a copy of the inspection report will be submitted to them. Corrective action is to be initiated within 24 hours of the report and the maintenance completed as soon as possible or before the next storm event. In addition, the LTPPP shall be modified as necessary to include the additional or modified BMPs designed to correct the problems identified. Revisions to the LTPPP must be completed within seven (7) calendar days following the inspection.

TOWN OF FRANKLIN
OPERATION & MAINTENANCE PLAN
GROVE STREET IMPROVEMENTS
PHASE 2
FRANKLIN, MA

February 2023

The following provides protocols for the prevention and management of erosion and sedimentation during construction of the proposed improvements, as well as, for long term maintenance of those improvements.

SILTATION CONTROLS

The first phase of construction will consist of the placement of siltation controls in accordance with the detail and at the location indicated on the plans. No further construction activity will take place until the siltation controls are inspected and approved. No encroachment or alteration shall occur beyond the erosion control barriers. Erosion control barriers shall be maintained and replaced, if necessary, throughout the course of construction.

SITE CONSTRUCTION

All unvegetated areas, including stockpiles, that will remain unvegetated for greater than 21 days should be mulched or seeded within 7 days of their grading. The perimeter sedimentation controls at the stockpiles should be in place at the end of each day and before rain events.

During the construction of the drainage system, care must be taken to prevent siltation from entering the system or flowing into the river. Drainage pipes in open excavations shall not remain open overnight. Hay bales shall be staked around the catch basins and/or a woven geotextile material shall be placed in the catch basins until the binder course has been placed. The silt and sand, which may accumulate around the drain inlets, shall be removed after every rainstorm.

Work shall commence as soon as practical on the perimeter disturbed areas not to be paved. Four inches (4") of topsoil is to be placed in these areas and the areas hydroseeded. All areas shall be stabilized within sixty (60) days of disturbance. When weather conditions do not permit stabilization by seeding, hay mulch, straw mats, jute netting or other approved means shall be used for temporary stabilization.

INSPECTION AND MAINTENANCE

Prior to construction, the Contractor shall formulate a schedule for inspection and maintenance of the erosion control measures. This schedule shall establish, at a minimum, the weekly inspections of the sedimentation controls, stockpiles, catch basins, water quality structures, unstabilized areas within the site and a report of any required maintenance. The schedule will also appoint an individual who will be responsible for performing the weekly inspections.

During the weekly inspection, and at any time during the course of construction, the Engineer, the Conservation Commission Agent, the Owner or the individual responsible for the erosion control measures may direct the Contractor to take immediate action to correct a deficiency or to increase the erosion control measures.

ADDITIONAL REQUIREMENTS

The contractor shall employ measures to control dust during construction. All debris shall be properly contained and disposed of.

Grove Street shall be swept clean of any soils tracked onto the pavement from vehicles exiting the site.

A supply of compost-filled silt sock and/or straw wattles shall be kept on site to provide for additional siltation control, as may be required. Any construction equipment observed leaking or dripping oil shall be removed from the site. No construction equipment shall be refueled within 100 feet of the resource area(s).

The above requirements are intended to be a minimum set of guidelines. The contractor shall be responsible for their implementation. Should additional controls be required, the contractor shall take whatever steps are necessary.

Temporary grass stabilization shall be applied at rate of 4-pounds/1,000 sf. and conform to the specifications outlined in Table 1.

Table 1 – Seed Mixture

Winter Rye	80%	Min.
Red Fescue (Creeping)	4%	Min.
Perennial Rye Grass	3%	Min.
Red Clover	3%	Min.
Other Crop Grass	0.5%	Min.
Noxious Weed Seed	0.5%	MAX.
Inert Matter	1%	MAX.

BMP MAINTENANCE SCHEDULE FOR CONSTRUCTED SITE

This maintenance schedule is intended for the entire project following completion of proposed improvements, including work previously completed at this project site.

1. Inspect catch basins, hydrodynamic separator, and water quality infiltration basin quarterly if all tributary areas are stabilized with vegetation or monthly if not. Clean out if more than 1/4 full of sediment (1 foot deep in a 4-foot sump). Inspect and clean as necessary after intense rainfall and as soon as practical after winter sanding.

2. Inspect drainage system discharge points (flared end sections) on a quarterly basis and remove any trash/debris. Verify flared end sections are structurally intact and no erosion is occurring after the aprons.

3. Keep all pervious site areas always stabilized. Keep any stockpiled earth covered. Leaves and trimmings shall be removed from the site and not discarded within the onsite wetland area.

4. Remove any visible trash or debris from within the onsite wetland resource area on an annual basis.

5. Sweep parking areas and site access roadways with vacuum sweeper on an annual basis, typically after the winter sanding season.

6. Hydrodynamic Separator Recommended Maintenance Procedure (CDS 2015)

Follow manufacturer recommendations.

At a minimum, inspections should be performed twice per year (e.g., spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated.

7. Snow from plowing operations shall not be stockpiled adjacent to or within any delineated wetland areas. Stockpiled snow shall be removed from the site and transported to an approved dumping area as needed following storm events.

8. The Town of Franklin is the Owner and solely responsible for the operation and maintenance of the onsite stormwater management system.

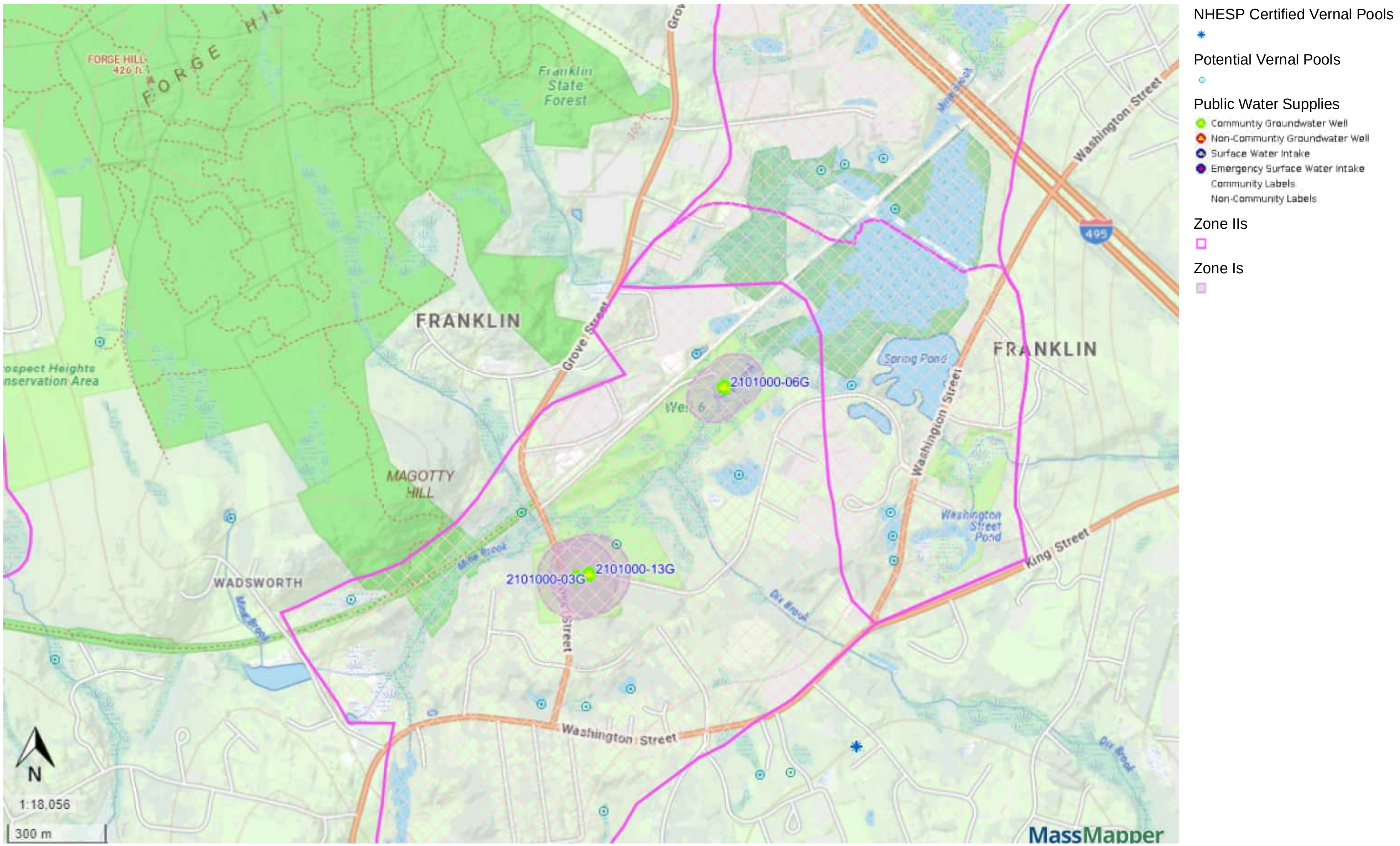
Their address is:

Town of Franklin
355 E Central Street
Franklin, MA 02038
Tel. 508-528-7900

APPENDIX I

Environmental Resources Maps

Environmental Resources Map



APPENDIX D – Project Plans

TOWN OF FRANKLIN, MA

GROVE STREET IMPROVEMENTS

PHASE 2

FEBRUARY 2023

TOWN OF FRANKLIN, MASSACHUSETTS · INCORPORATED MARCH 2, 1778 · "INDUSTRY NEED NOT WISH"

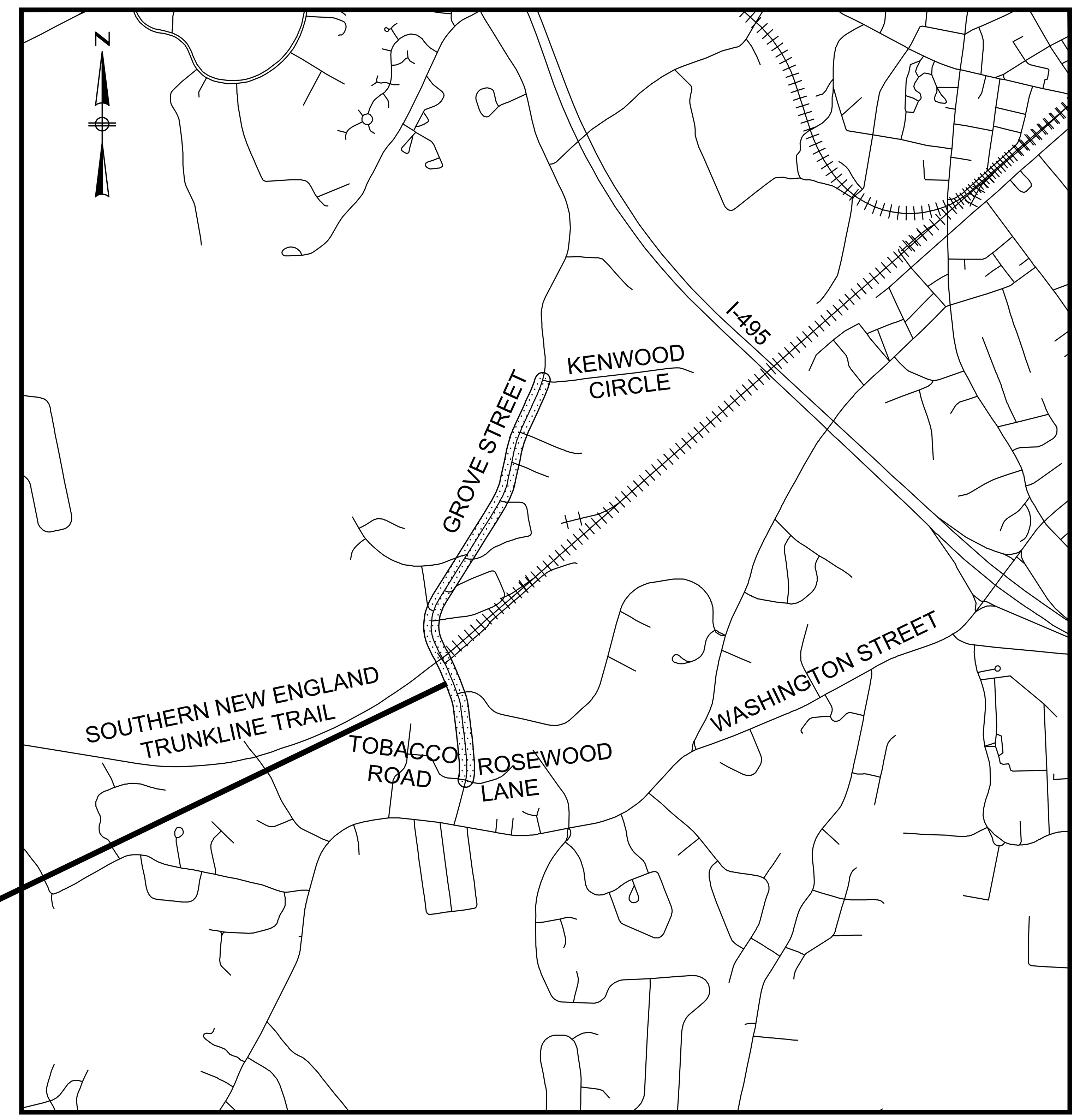
TOWN ADMINISTRATOR

JAMIE HELLEN

DEPARTMENT OF PUBLIC WORKS

ROBERT A. CANTOREGGI, DIRECTOR
MIKE MAGLIO, TOWN ENGINEER

Project Location



PROJECT LOCATION

LOCATION MAP
NOT TO SCALE

PLAN INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND & ABBREVIATIONS
3	GENERAL NOTES & TYPICAL SECTIONS
4-13	CONSTRUCTION PLANS & PROFILES
14-18	DRAINAGE AND UTILITY PLANS
19-28	RESOURCE AREA PLANS
29	WETLAND REPLICATION PLANS
30	DEWATERING PLANS
31-34	CONSTRUCTION DETAILS

PERMITTING SUBMISSION

PREPARED BY:

BETA
www.BETA-Inc.com

COMMONWEALTH OF MASSACHUSETTS · WILLIAM P McGRATH · CIVIL · No. 33716 · REGISTERED PROFESSIONAL ENGINEER

2/15/23

REGISTERED PROFESSIONAL DATE

ISSUE DATE: AUGUST 26, 2022

GENERAL SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
JB	JB	JERSEY BARRIER
CB	CB	CATCH BASIN
		CATCH BASIN CURB INLET
FP	FP	FLAG POLE
GP	GP	GAS PUMP
MB	MB	MAIL BOX
		POST SQUARE
		POST CIRCULAR
WELL	WELL	WELL
EHH	EHH	ELECTRIC HANDHOLE
		FENCE GATE POST
GG	GG	GAS GATE
BHL #	BHL #	BORING HOLE
MW #	MW #	MONITORING WELL
TP #	TP #	TEST PIT
		HYDRANT
		LIGHT POLE
CO.BD.		COUNTY BOUND
		GPS POINT
		CABLE MANHOLE
		DRAINAGE MANHOLE
		ELECTRIC MANHOLE
		GAS MANHOLE
		MISC MANHOLE
		SEWER MANHOLE
		TELEPHONE MANHOLE
		WATER MANHOLE
MHB	MHB	MASSACHUSETTS HIGHWAY BOUND
MON		MONUMENT
SB		STONE BOUND
TB		TOWN OR CITY BOUND
		TRAVERSE OR TRIANGULATION STATION
TPL or GUY	TPL or GUY	TROLLEY POLE OR GUY POLE
HTP		TRANSMISSION POLE
UFB	UFB	UTILITY POLE W/ FIREBOX
UPDL	UPDL	UTILITY POLE WITH DOUBLE LIGHT
ULT	ULT	UTILITY POLE W / 1 LIGHT
UPL	UPL	UTILITY POLE
		BUSH
SIZE & TYPE		TREE
		STUMP
		SWAMP / MARSH
WG	WG	WATER GATE
PM	PM	PARKING METER
		OVERHEAD CABLE/WIRE
		CURBING
100 99		CONTOURS (ON-THE-GROUND SURVEY DATA)
100 99		CONTOURS (PHOTOGRAMMETRIC DATA)
		UNDERGROUND DRAIN PIPE (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND ELECTRIC DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND GAS MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND SEWER MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND TELEPHONE DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND WATER MAIN (DOUBLE LINE 24 INCH AND OVER)
		BALANCED STONE WALL
		RETAINING WALL (TYPE AS NOTED)
		GUARD RAIL - STEEL POSTS
		GUARD RAIL - WOOD POSTS
		CHAIN LINK OR METAL FENCE
		WOOD FENCE
		HAY BALES/SILT FENCE
		TREE LINE or LIMIT OF CLEARING AND GRUBBING
		SAWCUT LINE
		TOP OR BOTTOM OF SLOPE
		LIMIT OF EDGE OF PAVEMENT OR COLD PLANE AND OVERLAY
		BANK OF RIVER OR STREAM
		BORDER OF WETLAND
		100 FT WETLAND BUFFER
		200 FT RIVERFRONT BUFFER
		STATE HIGHWAY LAYOUT
		TOWN OR CITY LAYOUT
		COUNTY LAYOUT
		TOWN OR CITY BOUNDARY LINE
℞		PROPERTY LINE OR APPROXIMATE PROPERTY LINE
		EASEMENT
ECB	ECB	EROSION CONTROL BARRIER/COMPOST FILTER TUBES
		SIGN AND POST
		CONSTRUCTION BASELINE
N00°00'00"E 000.00'		SURVEY LINE
		WHEELCHAIR RAMP
24" PINE		TREE (SIZE AND TYPE AS NOTED)

PAVEMENT MARKINGS SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
		PAVEMENT ARROW - WHITE
ONLY	ONLY	LEGEND "ONLY" - WHITE
STOP	STOP	LEGEND "STOP" - WHITE
AHEAD	AHEAD	LEGEND "AHEAD" - WHITE
SIGNAL	SIGNAL	LEGEND "SIGNAL" - WHITE
	SL	STOP LINE - 12" WHITE LINE
	CW	CROSSWALK - 12" WHITE LINES, 12" GAP
	SWL	SOLID WHITE LINE - 6"
	SYL	SOLID YELLOW LINE - 6"
	BWL	BROKEN WHITE LINE - 6" AT 3' LINE AND 9' GAP
	BYL	BROKEN YELLOW LINE - 6" AT 3' LINE AND 9' GAP
	DWLEx	DOTTED WHITE LINE EXTENSION - 6" AT 2' LINE AND 6' GAP
	DYLEx	DOTTED YELLOW LINE EXTENSION - 6" AT 2' LINE AND 6' GAP
	DBWL	DOUBLE WHITE LINE - 2-6" LINES
	DBYL	DOUBLE YELLOW LINE - 2-6" LINES

TRAFFIC SIGNAL SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
		CONTROL CABINET GROUND MOUNTED WITH FOUNDATION
		CONTROL CABINET POLE MOUNTED
	Ø2	CONTROLLER PHASE
	MA-1	MAST ARM, SHAFT & BASE (ARM LENGTH AS NOTED)
		VEHICULAR SIGNAL HEAD (ALPHA-NUMERIC DESIGNATION AS NOTED)
		VEHICULAR SIGNAL HEAD, OPTICALLY PROGRAMMED
		VEHICULAR SIGNAL HEAD (REMOVED & RESET)
		FLASHING BEACON
		PEDESTRIAN SIGNAL HEAD
		PEDESTRIAN SIGNAL HEAD, OPTICALLY PROGRAMMED
HH		PULL BOX 12"x12" OR 24"x24" HANDHOLE
		LOOP DETECTOR
		PEDESTRIAN PUSH BUTTON, SIGN (DIRECTIONAL ARROW AS SHOWN) AND SADDLE
		PRE-EMPTION DETECTOR
		PRE-EMPTION CONFIRMATION STROBE
		SIGNAL CONDUIT (SINGLE RUN)
		SIGNAL CONDUIT (DOUBLE RUN)
		SIGNAL POST & BASE
M	M	MAGNETIC DETECTOR
		SCHOOL ZONE SPEED LIMIT SIGN
		MICROWAVE OR ULTRASONIC DETECTOR
		VIDEO DETECTION CAMERA
		VIDEO DETECTION ZONE

TRAFFIC SIGNAL SYSTEMS

R	STEADY CIRCULAR RED
Y	STEADY CIRCULAR YELLO
G	STEADY CIRCULAR GREEN
FR	FLASHING CIRCULAR RED
FY	FLASHING CIRCULAR YELLOW
←FY	FLASHING YELLOW LEFT ARROW
R→	STEADY RED RIGHT ARROW
Y→	STEADY YELLOW RIGHT ARROW
G→	STEADY GREEN RIGHT ARROW
←R	STEADY RED LEFT ARROW
←Y	STEADY YELLOW LEFT ARROW
←G	STEADY GREEN LEFT ARROW
W	STEADY WALK (PERSON WALKING) - LUNAR WHITE
DW	STEADY DON'T WALK (HAND) - PORTLAND ORANGE
FDW	FLASHING DON'T WALK (FLASHING HAND) - PORTLAND ORANGE

TRAFFIC SIGNAL

CAB.	CABINET
CCVE	CLOSED CIRCUIT VIDEO EQUIPMENT
OL	OVERLAP
PED	PEDESTRIAN
PTZ	PAN, TILE, ZOOM
T.S.	TRAFFIC SIGNAL

ABBREVIATIONS

GENERAL

AADT	ANNUAL AVERAGE DAILY TRAFFIC
ABAN	ABANDON
ADJ	ADJUST
APPROX.	APPROXIMATE
A.C.	ASPHALT CONCRETE
ACCM PIPE	ASPHALT COATED CORRUGATED METAL PIPE
ALT	ALTERATION
BIT.	BITUMINOUS
BC	BOTTOM OF CURB
BD.	BOUND
BL (or ℄)	BASELINE
BLDG	BUILDING
BM	BENCHMARK
BO	BY OTHERS
BOS	BOTTOM OF SLOPE
BOW	BOTTOM OF WALL
BR.	BRIDGE
BSW	BACK OF SIDEWALK
CB	CATCH BASIN
CBCI	CATCH BASIN WITH CURB INLET
CC	CEMENT CONCRETE
CCM	CEMENT CONCRETE MASONRY
CEM	CEMENT
CI	CURB INLET
CIP	CAST IRON PIPE
CIT	CHANGE IN TYPE
CLF	CHAIN LINK FENCE
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CPP	CORRUGATED PLASTIC PIPE
CSP	CORRUGATED STEEL PIPE
CO.	COUNTY
CONC	CONCRETE
COND	CONDUIT
CONT	CONTINUOUS
CONST	CONSTRUCTION
CR GR	CROWN GRADE
DHV	DESIGN HOURLY VOLUME
DI	DROP INLET
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DW	STEADY DON'T WALK - PORTLAND ORANGE
DWY	DRIVEWAY
ELEV (or EL.)	ELEVATION
EMB	EMBANKMENT
EOP	EDGE OF PAVEMENT
EXIST (or EX)	EXISTING
EXC	EXCAVATION
F&C	FRAME AND COVER
F&G	FRAME AND GRATE
FDN.	FOUNDATION
FLDSTN	FIELDSTONE
FM	FORCE MAIN
GAR	GARAGE
GD	GROUND
GG	GAS GATE
GI	GUTTER INLET
GIP	GALVANIZED IRON PIPE
GRAN	GRANITE
GRAV	GRAVEL
GRD	GUARD
HDW	HEADWALL
HMA	HOT MIX ASPHALT
HOR	HORIZONTAL
HYD	HYDRANT
INV	INVERT
IP	IRON PIPE
JCT	JUNCTION
L	LENGTH OF CURVE
LB	LEACH BASIN
LP	LIGHT POLE or LOW POINT
LT	LEFT
MAX	MAXIMUM
MB	MAILBOX
MH	MANHOLE
MHB	MASSACHUSETTS HIGHWAY BOUND
MIN	MINIMUM
NIC	NOT IN CONTRACT
NO.	NUMBER
O.C.	ON CENTER
PC	POINT OF CURVATURE

ABBREVIATIONS (cont.)

GENERAL

PCC	POINT OF COMPOUND CURVATURE
PCR	PEDESTRIAN CURB RAMP
P.G.L.	PROFILE GRADE LINE
PI	POINT OF INTERSECTION
POC	POINT ON CURVE
POT	POINT ON TANGENT
PRC	POINT OF REVERSE CURVATURE
PROJ	PROJECT
PROP	PROPOSED
PSB	PLANTABLE SOIL BORROW
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL CURVATURE or POLY-VINYL -CHLORIDE-PIPE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
PVMT	PAVEMENT
PWW	PAVED WATER WAY
R	RADIUS OF CURVATURE
R&D	REMOVE AND DISPOSE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RDWY	ROADWAY
REM	REMOVE
RET	RETAIN
RET WALL	RETAINING WALL
ROW	RIGHT OF WAY
RR	RAILROAD
R&R	REMOVE AND RESET
R&S	REMOVE AND STACK
RT	RIGHT
SB	STONE BOUND
SD	SUBDRAIN
SHLD	SHOULDER
SHT	SHEET
SMH	SEWER MANHOLE
SP	STRAIN POLE
ST	STREET
STA	STATION
SSD	STOPPING SIGHT DISTANCE
SHLO	STATE HIGHWAY LAYOUT LINE
SW	SIDEWALK
T	TANGENT DISTANCE OF CURVE/TRUCK %
TAN	TANGENT
TEMP	TEMPORARY
TC	TOP OF CURB
TOS	TOP OF SLOPE
TOW	TOP OF WALL
TS	TRAFFIC SIGNAL
TSV&B	TAPPING SLEEVE, VALVE AND BOX
TYP	TYPICAL
UP	UTILITY POLE
UPL	UTILITY POLE w/ LIGHT
VAR	VARIES
VERT	VERTICAL
VC	VERTICAL CURVE
VCP	VITRIFIED CLAY PIPE
VGC	VERTICAL GRANITE CURB
WG	WATER GATE
WIP	WROUGHT IRON PIPE
WM	WATER METER/WATER MAIN
WQU	WATER QUALITY UNIT
WWM	WELDED WIRE MESH (10-GUAGE, 6"x6")
X-SECT	CROSS SECTION

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL
DESIGNED BY: BB
CHECKED BY: BM

REGISTERED PROFESSIONAL
COMMONWEALTH OF MASSACHUSETTS WILLIAM P. McGRATH CIVIL No. 33716 REGISTERED PROFESSIONAL ENGINEER
2/15/23

PREPARED BY
BETA
www.BETA-Inc.com

SUBCONSULTANT

SCALE
NONE
UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

TITLE
GROVE STREET IMPROVEMENTS
PHASE 2
LEGEND & ABBREVIATIONS
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 2

PAVEMENT NOTES

FULL DEPTH PAVEMENT BOX WIDENING

SURFACE COURSE:	1-1/2" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER ASPHALT EMULSION FOR TACK COAT OVER
INTERMEDIATE COURSE:	2" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5) OVER ASPHALT EMULSION FOR TACK COAT OVER
BASE COURSE:	4" SUPERPAVE BASE COURSE 37.5 (SBC-37.5) OVER
SUB-BASE:	12" GRAVEL BORROW, TYPE b

FULL DEPTH PAVEMENT BOX WIDENING ≤4' WIDE

SURFACE COURSE:	1-1/2" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER ASPHALT EMULSION FOR TACK COAT OVER
INTERMEDIATE COURSE:	2" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5) OVER ASPHALT EMULSION FOR TACK COAT OVER
BASE COURSE:	6" HES CEMENT CONCRETE BASE COURSE OVER
SUB-BASE:	8" GRAVEL BORROW, TYPE b

PAVEMENT MILLING AND OVERLAY

SURFACE COURSE:	1-1/2" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER ASPHALT EMULSION FOR TACK COAT OVER
PAVEMENT MILLING:	1-1/2" PAVEMENT MICROMILLING

CEMENT CONCRETE SIDEWALKS AND WHEELCHAIR RAMPS

SURFACE:	4" CEMENT CONCRETE WALK SURFACE 4000 PSI, 3/4", 610 OVER
BASE COURSE:	8" GRAVEL BORROW, TYPE b

HMA SIDEWALKS

SURFACE:	1-1/4" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 1-3/4" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5) OVER
BASE COURSE:	8" GRAVEL BORROW, TYPE b

HMA DRIVEWAYS

SURFACE:	2" SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5) OVER 2" SUPERPAVE INTERMEDIATE COURSE 12.5 (SIC-12.5) OVER
BASE COURSE:	8" GRAVEL BORROW, TYPE b

PAVEMENT NOTES

1. ALL HMA FOR PATCHING, ASPHALT EMULSION FOR TACK COAT AND HMA JOINT SEALANT SHALL BE INSTALLED PER SECTION 450.

2. TACK COAT SHALL BE APPLIED FOR UNIFORM COVERAGE OF 90% AT RATE OF 0.07 GALLONS PER SQUARE YARD FOR MILLED SURFACES AND 0.05 GALLONS PER SQUARE YARD FOR SMOOTH TIGHT PAVED SURFACES.

GENERAL NOTES

1. HORIZONTAL CONTROL, IN FEET, IS BASED ON THE MASSACHUSETTS STATE PLANE COORDINATE SYSTEM (NAD 83). THE VERTICAL CONTROL IS REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88). EXISTING 1-FT CONTOURS SHOWN WERE PROVIDED FROM NOAA LIDAR DATA.

2. SURVEY PLAN HAS BEEN PREPARED BY GUERRIERE & HALNON, INC ENGINEERING & LAND SURVEYING ON MARCH 23, 2021. SUPPLEMENTAL SURVEY BY GUERRIERE & HALNON ON SEPTEMBER 8, 2022. WETLAND FLAGS IDENTIFYING RESOURCE AREAS WERE PLACED AND LOCATED BY BETA GROUP, INC OTHERWISE NOTED. WETLAND DELINEATIONS WERE CONDUCTED ON MAY 13, 2021. THE CONTRACTOR SHALL VERIFY BASEPLAN INFORMATION SHOWN ON THE PLANS TO ENSURE THAT CONSTRUCTION CAN PROCEED AS INTENDED.

3. THE LOCATION OF SUBSURFACE UTILITIES SHOWN IS APPROXIMATE AND NOT GUARANTEED TO BE COMPLETE OR ACCURATE. THE CONTRACTOR SHALL VERIFY THE LOCATIONS AND ELEVATIONS OF EXISTING UTILITY LINES AND STRUCTURES PRIOR TO COMMENCEMENT OF WORK. THE CONTRACTOR MUST NOTIFY DIG SAFE 72 HOURS PRIOR TO ANY EXCAVATION, DEMOLITION OR EXPLOSIVE WORK IN PUBLIC OR PRIVATE WAYS OR UTILITY COMPANY RIGHT-OF-WAY OR EASEMENT.

4. DRAINAGE ELEVATIONS ARE PROVIDED FOR DESIGN PURPOSES ONLY. THE CONTRACTOR SHALL VERIFY BY TEST PIT, THE LOCATIONS OF EXISTING UTILITIES WHICH MAY CONFLICT WITH THE PROPOSED DRAINAGE DESIGN. ANY FIELD ADJUSTMENTS REQUIRED WILL BE MADE AS APPROVED OR DIRECTED BY THE ENGINEER. ONLY AFTER THE CONTRACTOR VERIFIES ELEVATIONS FOR THE CONSTRUCTABILITY OF THE DRAINAGE SYSTEM SHALL ANY STRUCTURES BE ORDERED.

5. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR, AND THE INFORMATION FURNISHED TO THE ENGINEER FOR THE RESOLUTION OF THE CONFLICT.

6. THE CONTRACTOR SHALL MAINTAIN ACCESS TO ABUTTING PROPERTIES AT ALL TIMES AND NOTIFY ALL ABUTTERS IN ADVANCE OF ANY INTERRUPTIONS TO ACCESS.

7. THE CONTRACTOR SHALL ALTER THE MASONRY OF THE TOP SECTION OF ALL EXISTING DRAINAGE AND SANITARY STRUCTURES AS NECESSARY FOR THE CHANGES IN GRADE, AND RESET ALL SANITARY AND DRAINAGE FRAMES, GRATES AND BOXES TO THE PROPOSED FINISH SURFACE GRADE. REQUIRED NEW MASONRY SHALL BE CLAY BRICK CONFORMING TO M4.05.2.

8. THE CONTRACTOR SHALL MAKE ALL ARRANGEMENTS FOR THE ALTERATION AND ADJUSTMENT OF GAS, ELECTRIC, TELEPHONE, CABLE TV, FIRE ALARM AND ANY OTHER PRIVATE UTILITIES BY THE UTILITY COMPANIES. ALL UTILITY CASTING SHALL BE ADJUSTED TO FINISH GRADE BY THEIR RESPECTIVE OWNERS.

9. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR TO THEIR ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.

10. THE TERM "PROPOSED" (PROP.) MEANS WORK TO BE CONSTRUCTED USING NEW MATERIALS OR, WHERE APPLICABLE, RE-USING EXISTING MATERIALS IDENTIFIED AS "REMOVE AND RESET" (R&R).

11. JOINTS BETWEEN NEW BITUMINOUS CONCRETE ROADWAY PAVEMENT AND SAWCUT EXISTING PAVEMENT SHALL BE SEALED WITH BITUMEN AND BACKSANDED.

12. DRAINAGE STRUCTURES SHALL BE RETAINED UNLESS NOTED OTHERWISE.

13. CATCH BASIN AND MANHOLE FRAMES AND GRATES/COVERS SHALL CLEARLY ALIGN WITH THE OPENINGS IN THE PRECAST STRUCTURES AND THE GRADE OF THE ROADWAY.

14. ALL CURB TIE DIMENSIONS ARE TO THE FACE OF THE CURB (GUTTER LINE) OR EDGE OF TRAVEL WAY.

15. CONSTRUCTION BASELINE TIES ARE SHOWN ON CONSTRUCTION PLANS.

16. THE LOCATION OF THE PROPOSED DRIVEWAY OPENINGS ARE SHOWN ON CONSTRUCTION PLANS. EXACT LOCATIONS MAY BE ADJUSTED IF NECESSARY OR AS REQUIRED BY THE ENGINEERS IN THE FIELD.

17. CONTRACTOR SHALL VERIFY EXISTING GRADES. IF ANY ADJUSTMENT IS REQUIRED DUE TO DIFFERENT EXISTING GRADES FOUND IN THE FIELD, THE CONTRACTOR SHALL NOTIFY AND SEEK THE APPROVAL OF THE ENGINEER PRIOR TO PERFORMING THE WORK.

18. IN FILL AREAS, TOP SOIL SHALL BE REMOVED FOR A DEPTH OF 12" (MIN.) OR AS DIRECTED BY THE ENGINEER. SUBGRADE AREAS WILL BE COMPACTED PRIOR TO THE PLACEMENT OF FILL MATERIAL.

19. ALL NEW GRANITE CURB SHALL BE MASSDOT TYPE VB, UNLESS OTHERWISE NOTED ON THE PLANS.

20. ALL NEW HMA CURB SHALL BE MASSDOT TYPE 2, UNLESS OTHERWISE NOTED ON THE PLANS.

21. ALL PROPOSED PAVEMENT MARKINGS ON ROADWAYS SHALL BE REFLECTORIZED WHITE AND YELLOW EPOXY.

22. SAFETY CONTROLS FOR CONSTRUCTION OPERATIONS SHALL BE IN ACCORDANCE WITH MASSDOT REQUIREMENTS AND THE LATEST VERSION OF THE MUTCD.

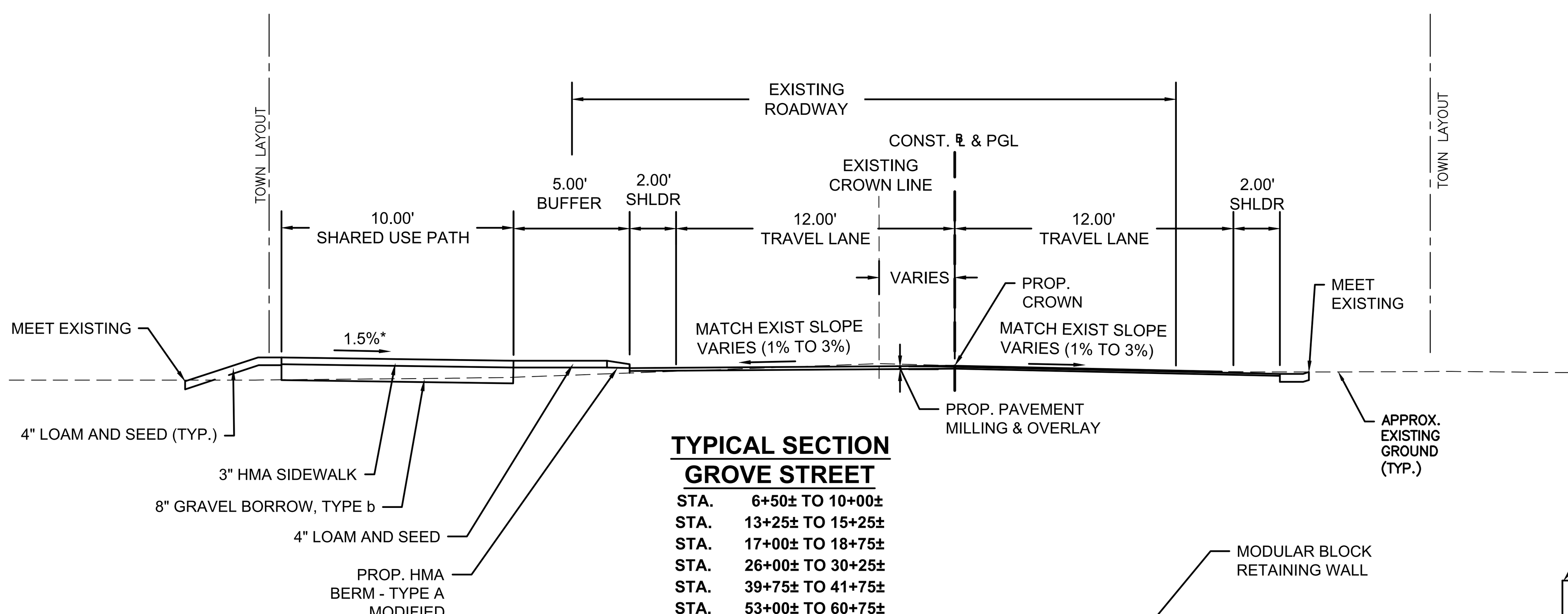
23. TREES TO BE RETAINED WHICH RESTRICT SIGHT DISTANCE OR RESTRICT HORIZONTAL OR VERTICAL CLEARANCES SHALL BE TRIMMED AS REQUIRED BY THE ENGINEER.

24. WHEN WORKING NEXT TO EXISTING WALLS, BERMS, AND OTHER STRUCTURES, CONTRACTOR SHALL EXERCISE EXTREME CAUTION NOT TO DISTURB THE EXISTING STRUCTURES. ANY DAMAGE TO THE EXISTING STRUCTURES SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.

25. ALL PAVEMENT MARKINGS AND/OR SIGN NOTES ARE SHOWN ON THE SIGNS AND PAVEMENT MARKING PLANS.

26. THE EXPOSED EDGES OF ALL LONGITUDINAL AND TRANSVERSE SAW CUT JOINTS SHALL BE TREATED WITH HOT POURED RUBBERIZED ASPHALT JOINT SEALANT MEETING MASSDOT SPECIFICATIONS.

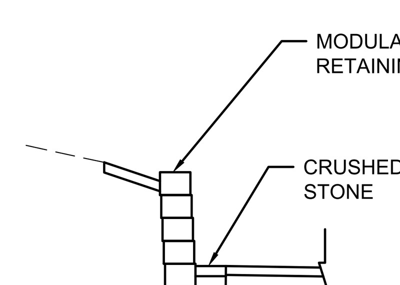
27. WHEN NEW CEMENT CONCRETE SIDEWALK MATCHES EXISTING CONCRETE SIDEWALK, SAWCUT EXISTING SIDEWALK AT NEAREST JOINT.



TYPICAL SECTION
GROVE STREET

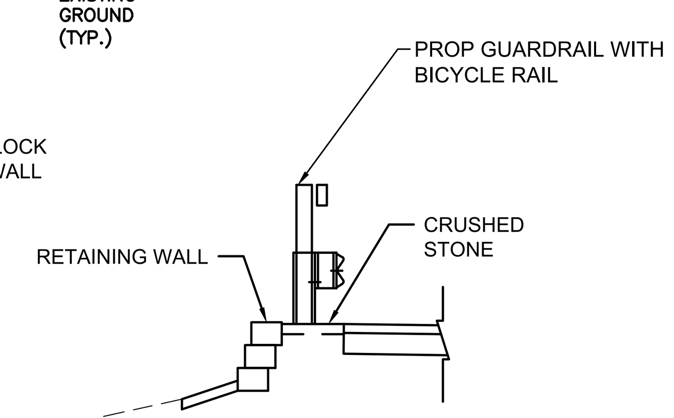
STA.	6+50± TO 10+00±
STA.	13+25± TO 15+25±
STA.	17+00± TO 18+75±
STA.	26+00± TO 30+25±
STA.	39+75± TO 41+75±
STA.	53+00± TO 60+75±
STA.	62+00± TO 64+50±

NOT TO SCALE



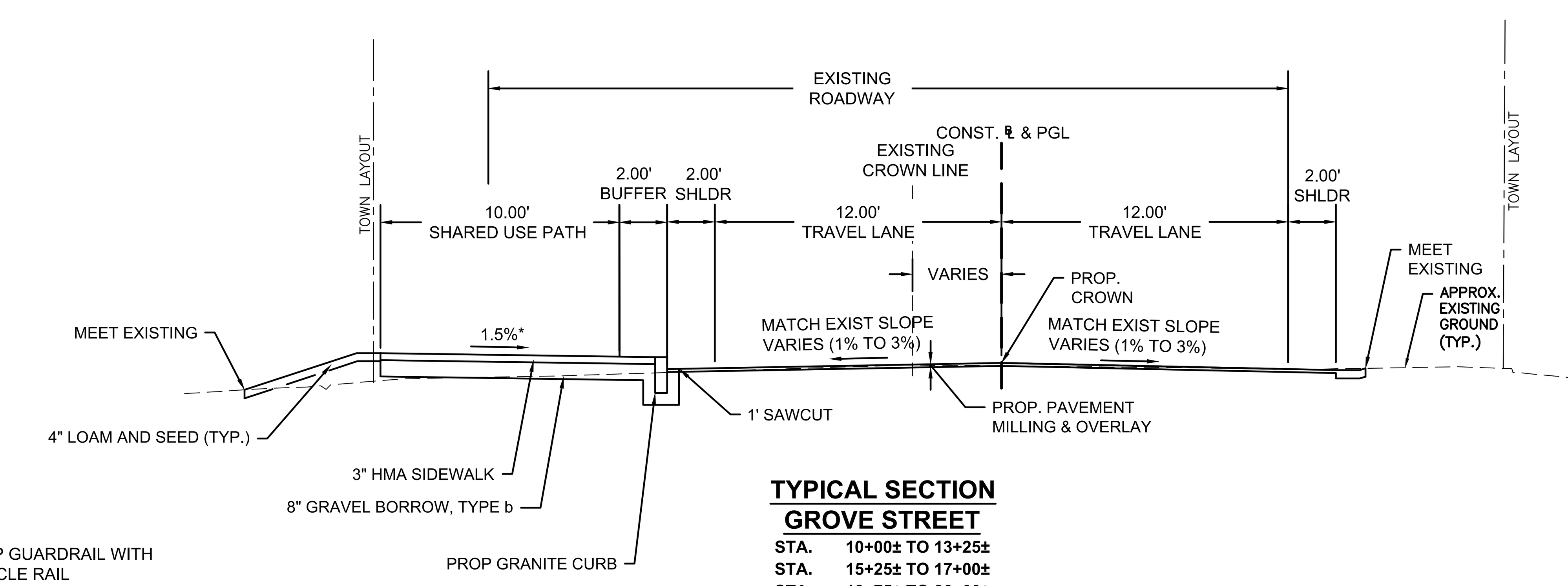
WALL TYPICAL SECTION - IN CUT

STA. 35+25± TO 36+75±



WALL TYPICAL SECTION - IN FILL

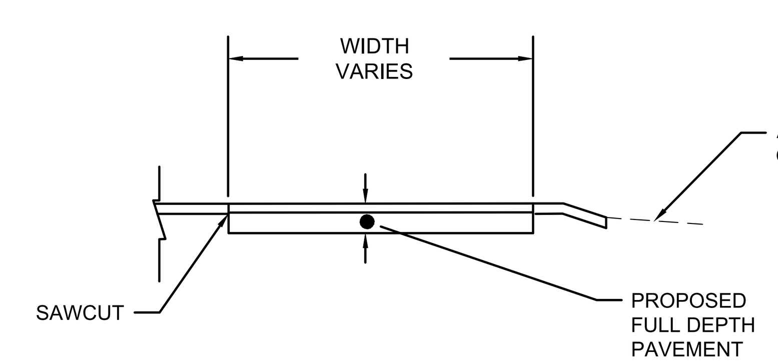
STA. 20+50± TO 21+25±
STA. 45+00± TO 48+50±



TYPICAL SECTION
GROVE STREET

STA.	10+00± TO 13+25±
STA.	15+25± TO 17+00±
STA.	18+75± TO 26+00±
STA.	30+25± TO 39+75±
STA.	41+75± TO 53+00±
STA.	60+75± TO 62+00±

NOT TO SCALE



FULL DEPTH BOX WIDENING

STA. 16+00± TO 20+50±
STA. 22+50± TO 51+50±
STA. 53+25± TO 59+25±

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

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CHECKED BY: BM

REGISTERED PROFESSIONAL: WILLIAM P. McGRATH CIVIL No. 33716 — 2/15/23

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SUBCONSULTANT:

SCALE: NONE

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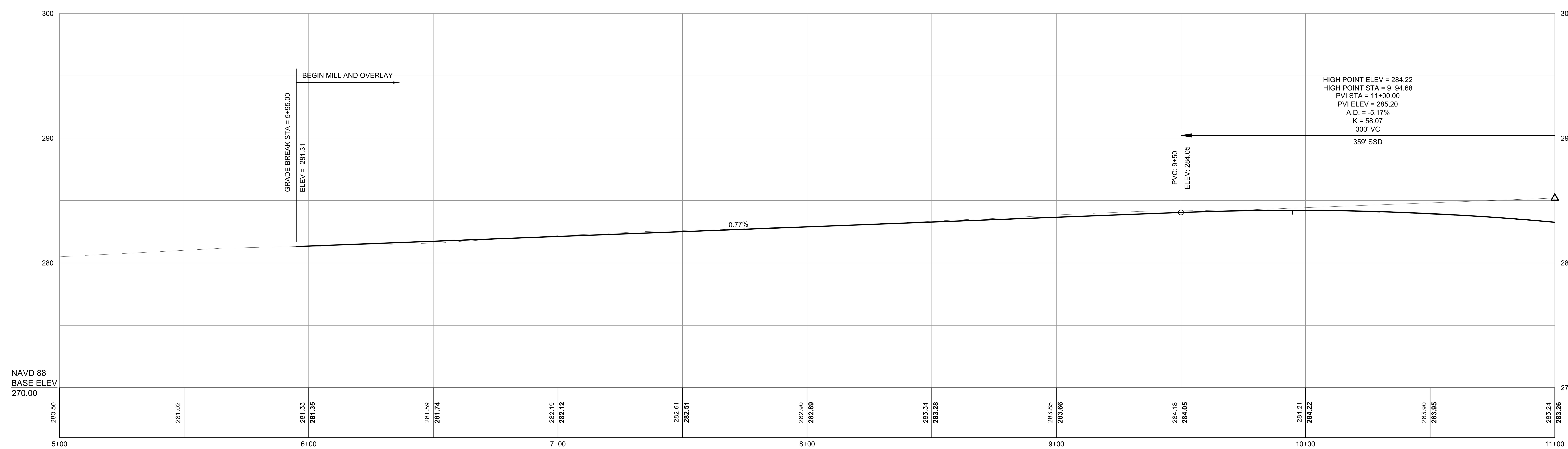
TITLE:

GROVE STREET IMPROVEMENTS
PHASE 2

GENERAL NOTES & TYPICAL SECTIONS

FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 3



NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL
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REGISTERED PROFESSIONAL: WILLIAM P. McGRATH, CIVIL, No. 33716 — 2/15/23

PREPARED BY: BETA — www.BETA-Inc.com

SUBCONSULTANT

SCALE: HOR. SCALE IN FEET: 1"=20' (0, 20, 40); VER. SCALE IN FEET: 1"=4' (0, 4, 8)
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TITLE

GROVE STREET IMPROVEMENTS

CONSTRUCTION PLAN & PROFILE - SHEET 1

FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
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SCALE: HOR. SCALE IN FEET: 1"=20' — VER. SCALE IN FEET: 1"=4'

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TITLE

GROVE STREET IMPROVEMENTS

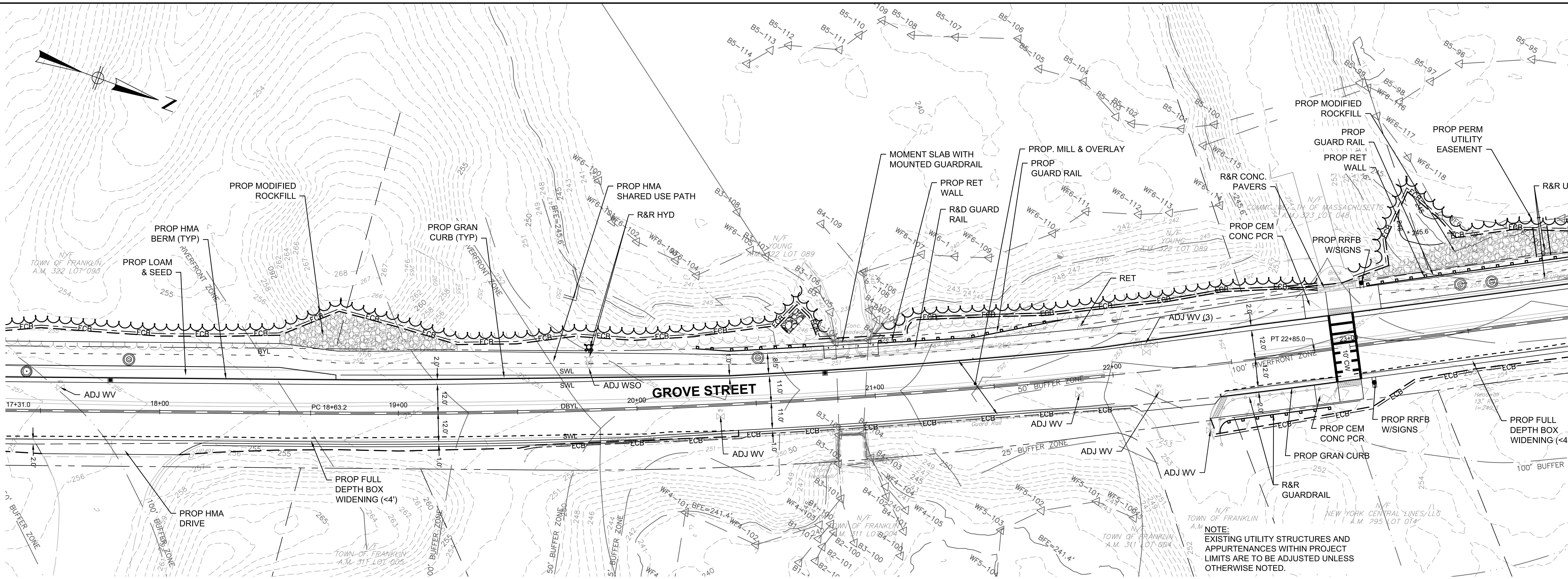
CONSTRUCTION PLAN & PROFILE - SHEET 2

FRANKLIN, MA

BETA JOB NO. 10613

ISSUE DATE 02/2023

SHEET NO. 5



NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL

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REGISTERED PROFESSIONAL: WILLIAM P McGRATH CIVIL No. 33716 — 2/15/23

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SCALE

HOR. SCALE IN FEET: 1"=20'

VER. SCALE IN FEET: 1"=4'

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TITLE

GROVE STREET IMPROVEMENTS

CONSTRUCTION PLAN & PROFILE - SHEET 3

FRANKLIN, MA

BETA JOB NO. 10613

ISSUE DATE 02/2023

SHEET NO. 6

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL

DESIGNED BY: RS

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REGISTERED PROFESSIONAL

PREPARED BY: BETA www.BETA-Inc.com

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SCALE: HOR. SCALE IN FEET: 1"=20' VER. SCALE IN FEET: 1"=4'

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TITLE

GROVE STREET IMPROVEMENTS

CONSTRUCTION PLAN & PROFILE - SHEET 4

FRANKLIN, MA

BETA JOB NO. 10613

ISSUE DATE 02/2023

SHEET NO. 7

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NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL
DESIGNED BY: RS
CHECKED BY: BB

REGISTERED PROFESSIONAL: WILLIAM P. McGRATH CIVIL No. 33716 — 2/15/23

PREPARED BY: BETA www.BETA-Inc.com

SUBCONSULTANT

SCALE
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VER. SCALE IN FEET: 1"=4'
UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

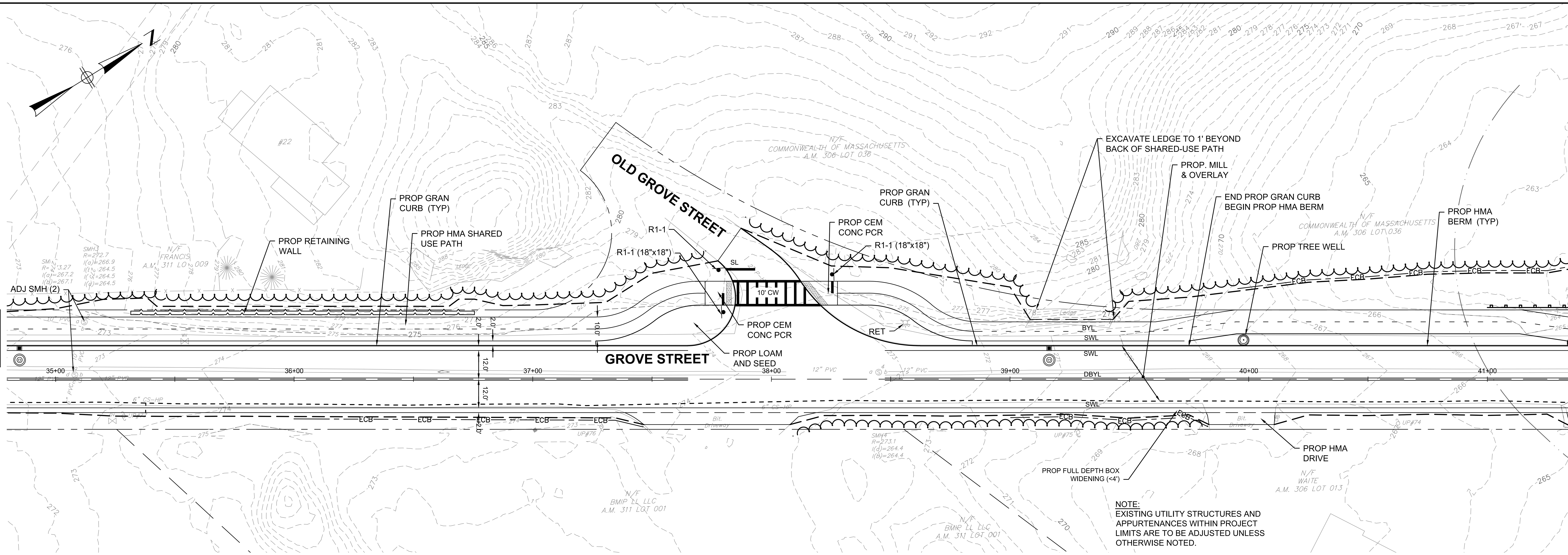
TITLE

GROVE STREET IMPROVEMENTS

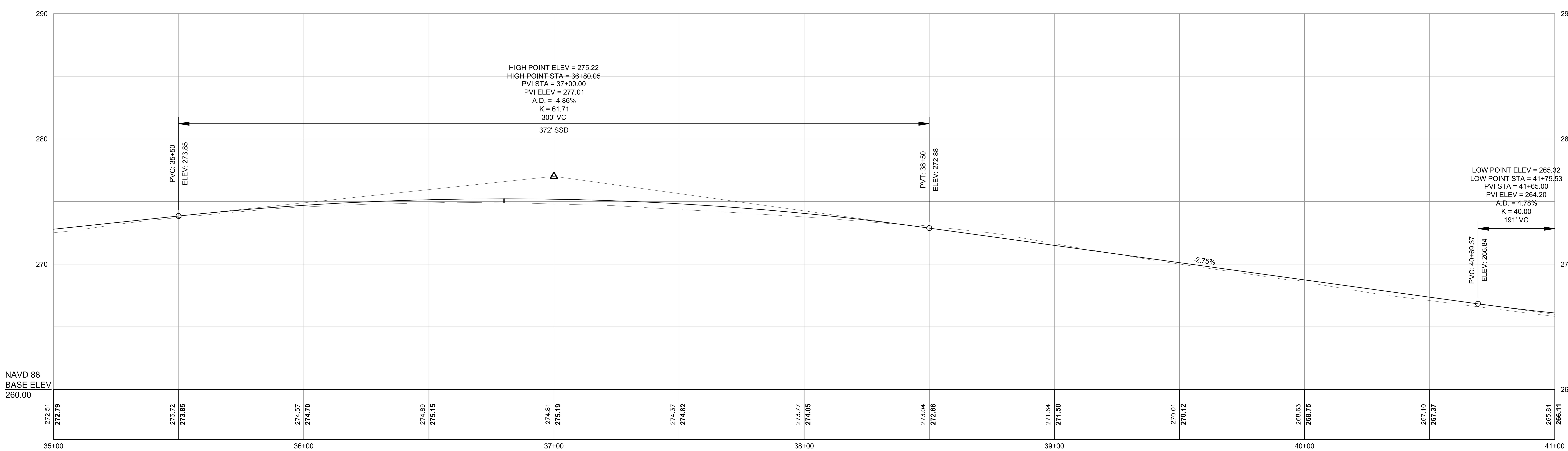
CONSTRUCTION PLAN & PROFILE - SHEET 5

FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 8



NOTE:
EXISTING UTILITY STRUCTURES AND APPURTENANCES WITHIN PROJECT LIMITS ARE TO BE ADJUSTED UNLESS OTHERWISE NOTED.



NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

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REGISTERED PROFESSIONAL: WILLIAM P. McGRATH, CIVIL, No. 33716 — 2/15/23

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SCALE: HOR. SCALE IN FEET: 1"=20' (20 0 20 40); VER. SCALE IN FEET: 1"=4' (4 0 4 8)
UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

TITLE
GROVE STREET IMPROVEMENTS
CONSTRUCTION PLAN & PROFILE - SHEET 6
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 9

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL

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CHECKED BY: BB

REGISTERED PROFESSIONAL

WILLIAM P. McGRATH CIVIL No. 33716

4/5/23

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SCALE

HOR. SCALE IN FEET: 1"=20'

VER. SCALE IN FEET: 1"=4'

UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

TITLE

GROVE STREET IMPROVEMENTS

CONSTRUCTION PLAN & PROFILE - SHEET 7

FRANKLIN, MA

BETA JOB NO. 10613

ISSUE DATE 02/2023

SHEET NO. 10

2/14/2023 11:25 AM \\BETA-INC.COM\MA\PROJECTS\10600S\10613 - FRANKLIN, MA - GROVE ST ROADWAY DESIGN PHASE 2\DRAWING FILES\PLANSET\7548_CONST_PH2.DWG (BETA STB BW.STB)

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL

DESIGNED BY: RS

CHECKED BY: BB

REGISTERED PROFESSIONAL

WILLIAM P. McGRATH CIVIL No. 33716

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SCALE

HOR. SCALE IN FEET: 1"=20'

VER. SCALE IN FEET: 1"=4'

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TITLE

GROVE STREET IMPROVEMENTS

CONSTRUCTION PLAN & PROFILE - SHEET 8

FRANKLIN, MA

BETA JOB NO. 10613

ISSUE DATE 02/2023

SHEET NO. 11

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY:	CL
DESIGNED BY:	RS
CHECKED BY:	BB
REGISTERED PROFESSIONAL	WILLIAM P. McGRATH CIVIL No. 33716 — 2/15/23
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SUBCONSULTANT	
SCALE	HOR. SCALE IN FEET: 1"=20' (20 0 20 40); VER. SCALE IN FEET: 1"=4' (4 0 4 8) — UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION
TITLE	GROVE STREET IMPROVEMENTS — CONSTRUCTION PLAN & PROFILE - SHEET 9 — FRANKLIN, MA
BETA JOB NO.	10613
ISSUE DATE	02/2023
SHEET NO.	12

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NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL

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CHECKED BY: BB

REGISTERED PROFESSIONAL: WILLIAM P. McGRATH CIVIL No. 33716

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TITLE

GROVE STREET IMPROVEMENTS

CONSTRUCTION PLAN & PROFILE - SHEET 10

FRANKLIN, MA

BETA JOB NO. 10613

ISSUE DATE 02/2023

SHEET NO. 13

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL
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SUBCONSULTANT

SCALE: 20 0 20 40 — SCALE IN FEET: 1"=20'
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TITLE:
GROVE STREET IMPROVEMENTS
DRAINAGE AND UTILITY PLAN 1
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 14

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NOTE:
EXISTING UTILITY STRUCTURES AND APPURTENANCES WITHIN PROJECT LIMITS ARE TO BE ADJUSTED UNLESS OTHERWISE NOTED.

CONTINUED ON SHEET NO. 16

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

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SUBCONSULTANT

SCALE: 20 0 20 40 — SCALE IN FEET: 1"=20'
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TITLE
GROVE STREET IMPROVEMENTS
DRAINAGE AND UTILITY PLAN 2
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 15

NOTE:
EXISTING UTILITY STRUCTURES AND APPURTENANCES WITHIN PROJECT LIMITS ARE TO BE ADJUSTED UNLESS OTHERWISE NOTED.

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL
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REGISTERED PROFESSIONAL
WILLIAM P. McGRATH CIVIL No. 33716
2/15/23

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BETA
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SUBCONSULTANT

SCALE
20 0 20 40
SCALE IN FEET: 1"=20'
UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

TITLE
GROVE STREET IMPROVEMENTS
DRAINAGE AND UTILITY PLAN 3
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 16

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL
DESIGNED BY: RS
CHECKED BY: BB

REGISTERED PROFESSIONAL: WILLIAM P. McGRATH, CIVIL, No. 33716, 2/15/23

PREPARED BY: BETA www.BETA-Inc.com

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SCALE: 20 0 20 40 SCALE IN FEET: 1"=20'
UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

TITLE

GROVE STREET IMPROVEMENTS

DRAINAGE AND UTILITY PLAN 4

FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 17

NOTE:
EXISTING UTILITY STRUCTURES AND APPURTENANCES WITHIN PROJECT LIMITS ARE TO BE ADJUSTED UNLESS OTHERWISE NOTED.

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

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DESIGNED BY: RS
CHECKED BY: BB

REGISTERED PROFESSIONAL: WILLIAM P. McGRATH, CIVIL, No. 33716, 2/15/23

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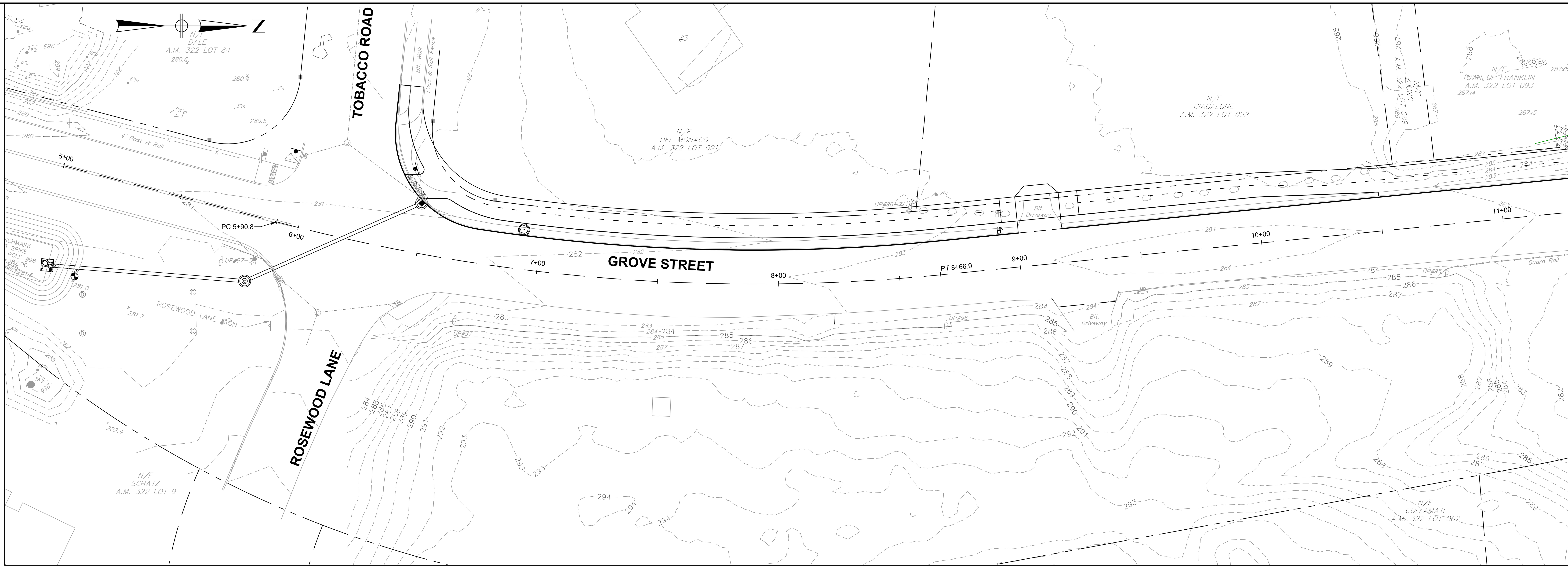
SUBCONSULTANT

SCALE: 20 0 20 40 SCALE IN FEET: 1"=20'
UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

TITLE:
GROVE STREET IMPROVEMENTS
DRAINAGE AND UTILITY PLAN 5
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 18



CONTINUED ON SHEET NO. 20

RESOURCE AREA LEGEND

LINETYPE/ HATCH	DESCRIPTION
WF	WETLAND BOUNDARY
BF	BANK BOUNDARY
	LIMIT OF 25 FT WETLAND BUFFER ZONE
	LIMIT OF 50 FT WETLAND BUFFER ZONE
	LIMIT OF 100 FT WETLAND BUFFER ZONE
	LIMIT OF 200 FT RIVERFRONT ZONE
	100 YEAR FLOOD ZONE
	100 YEAR FLOOD PLAIN IMPACT
	TEMPORARY WETLAND IMPACT
	PERMANENT WETLAND IMPACT
	WETLAND REPLICATION AREA
	PERMANENT DEGRADED 100' RIVERFRONT
	PERMANENT NON-DEGRADED 100' RIVERFRONT
	TEMPORARY NON-DEGRADED 100' RIVERFRONT
	PERMANENT DEGRADED 200' RIVERFRONT
	PERMANENT NON-DEGRADED 200' RIVERFRONT
	TEMPORARY NON-DEGRADED 200' RIVERFRONT

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL
DESIGNED BY: RS
CHECKED BY: BB

REGISTERED PROFESSIONAL: COMMONWEALTH OF MASSACHUSETTS, WILLIAM P. McGRATH, CIVIL, No. 33716, REGISTERED PROFESSIONAL ENGINEER, 2/15/23

PREPARED BY: BETA www.BETA-Inc.com

SUBCONSULTANT

SCALE: 20 0 20 40 SCALE IN FEET: 1"=20'
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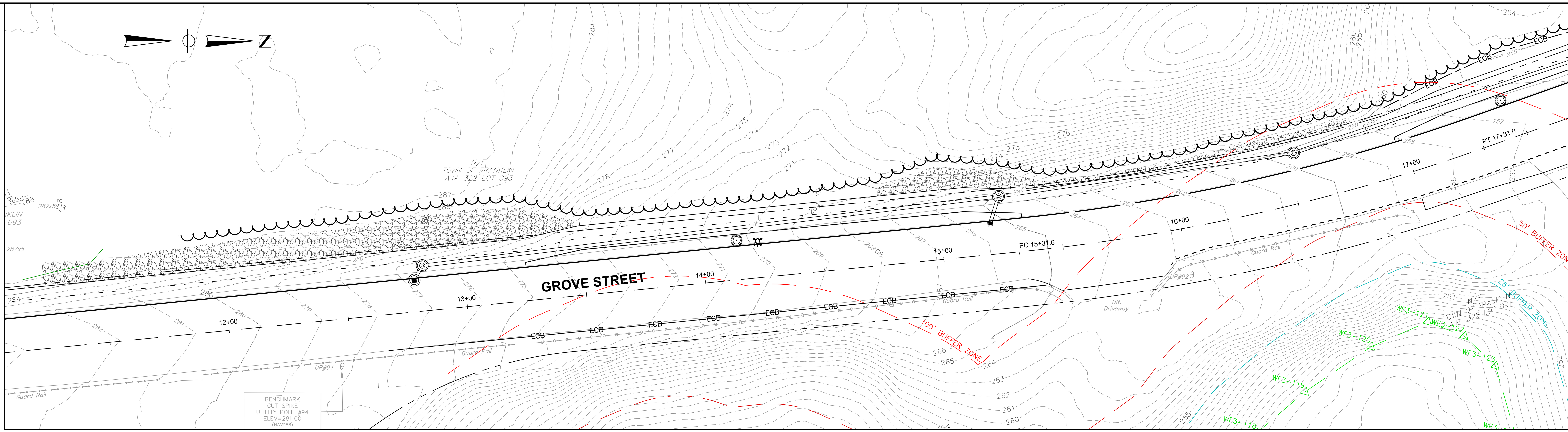
TITLE
GROVE STREET IMPROVEMENTS
RESOURCE AREA PLAN 1
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 19



CONTINUED ON SHEET NO. 19

CONTINUED ON SHEET NO. 21

RESOURCE AREA LEGEND

LINETYPE/ HATCH	DESCRIPTION
WF	WETLAND BOUNDARY
BF	BANK BOUNDARY
	LIMIT OF 25 FT WETLAND BUFFER ZONE
	LIMIT OF 50 FT WETLAND BUFFER ZONE
	LIMIT OF 100 FT WETLAND BUFFER ZONE
	LIMIT OF 200 FT RIVERFRONT ZONE
	100 YEAR FLOOD ZONE
	100 YEAR FLOOD PLAIN IMPACT
	TEMPORARY WETLAND IMPACT
	PERMANENT WETLAND IMPACT
	WETLAND REPLICATION AREA
	PERMANENT DEGRADED 100' RIVERFRONT
	PERMANENT NON-DEGRADED 100' RIVERFRONT
	TEMPORARY NON-DEGRADED 100' RIVERFRONT
	PERMANENT DEGRADED 200' RIVERFRONT
	PERMANENT NON-DEGRADED 200' RIVERFRONT
	TEMPORARY NON-DEGRADED 200' RIVERFRONT

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

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REGISTERED PROFESSIONAL: WILLIAM P. McGRATH CIVIL No. 33716 2/15/23

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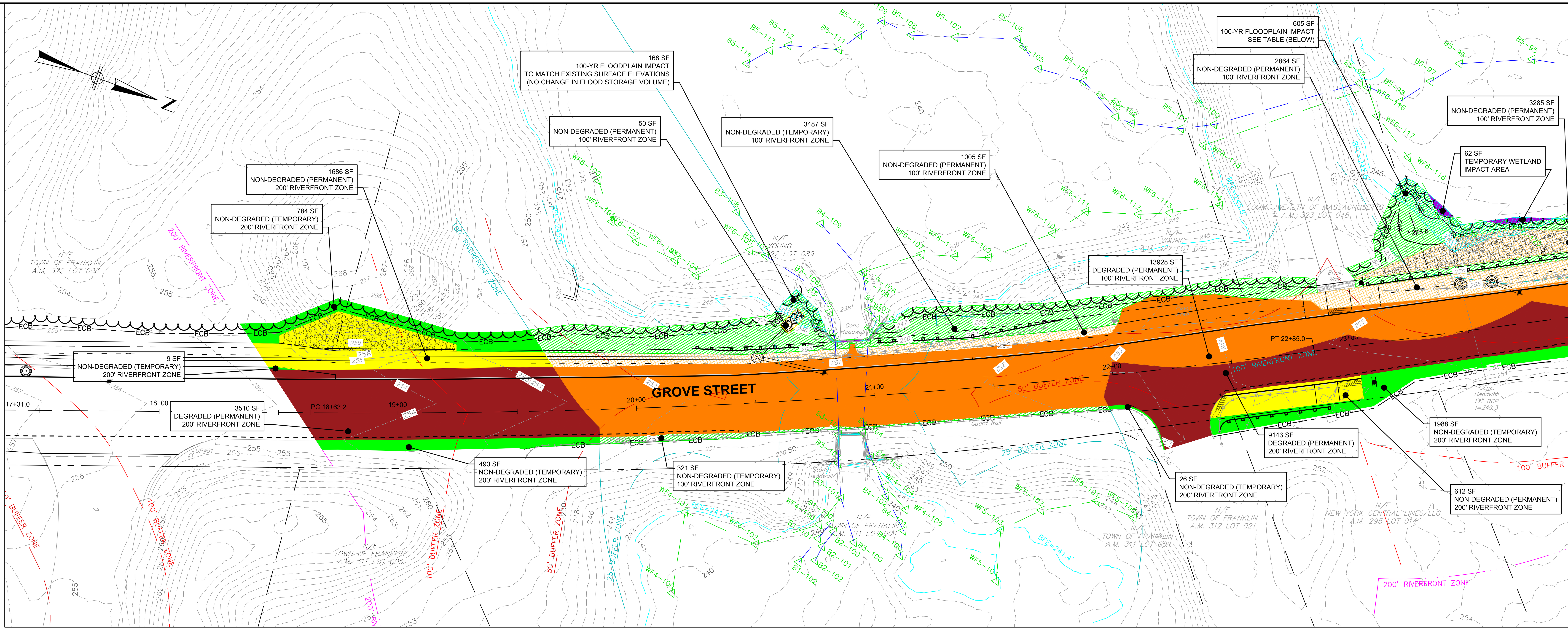
TITLE:
GROVE STREET IMPROVEMENTS
RESOURCE AREA PLAN 2
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 20



RESOURCE AREA LEGEND

LINETYPE/ HATCH	DESCRIPTION
WF	WETLAND BOUNDARY
BF	BANK BOUNDARY
	LIMIT OF 25 FT WETLAND BUFFER ZONE
	LIMIT OF 50 FT WETLAND BUFFER ZONE
	LIMIT OF 100 FT WETLAND BUFFER ZONE
	LIMIT OF 200 FT RIVERFRONT ZONE
	100 YEAR FLOOD ZONE
	100 YEAR FLOOD PLAIN IMPACT
	TEMPORARY WETLAND IMPACT
	PERMANENT WETLAND IMPACT
	WETLAND REPLICATION AREA
	PERMANENT DEGRADED 100' RIVERFRONT
	PERMANENT NON-DEGRADED 100' RIVERFRONT
	TEMPORARY NON-DEGRADED 100' RIVERFRONT
	PERMANENT DEGRADED 200' RIVERFRONT
	PERMANENT NON-DEGRADED 200' RIVERFRONT
	TEMPORARY NON-DEGRADED 200' RIVERFRONT

	Floodplain Impact Volumes	
Elevation Range	Fill (CF)	Cut (CF)
244'-245'	7	15
245'-245.6'	104	107

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

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DESIGNED BY: RS
CHECKED BY: BB

REGISTERED PROFESSIONAL
WILLIAM P. McGRATH CIVIL No. 33716
2/15/23

PREPARED BY
BETA
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SUBCONSULTANT

SCALE
20 0 20 40
SCALE IN FEET: 1"=20'
UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

TITLE
GROVE STREET IMPROVEMENTS
RESOURCE AREA PLAN 3
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 21

2/14/2023 11:35 AM \\BETA-INC.COM\MA\PROJECTS\10600S\10613 - FRANKLIN, MA - GROVE ST ROADWAY DESIGN PHASE 2\DRAWING FILES\PLANSET\7548_RESOURCE AREA PLANS.DWG (BETA STB BW.STB)

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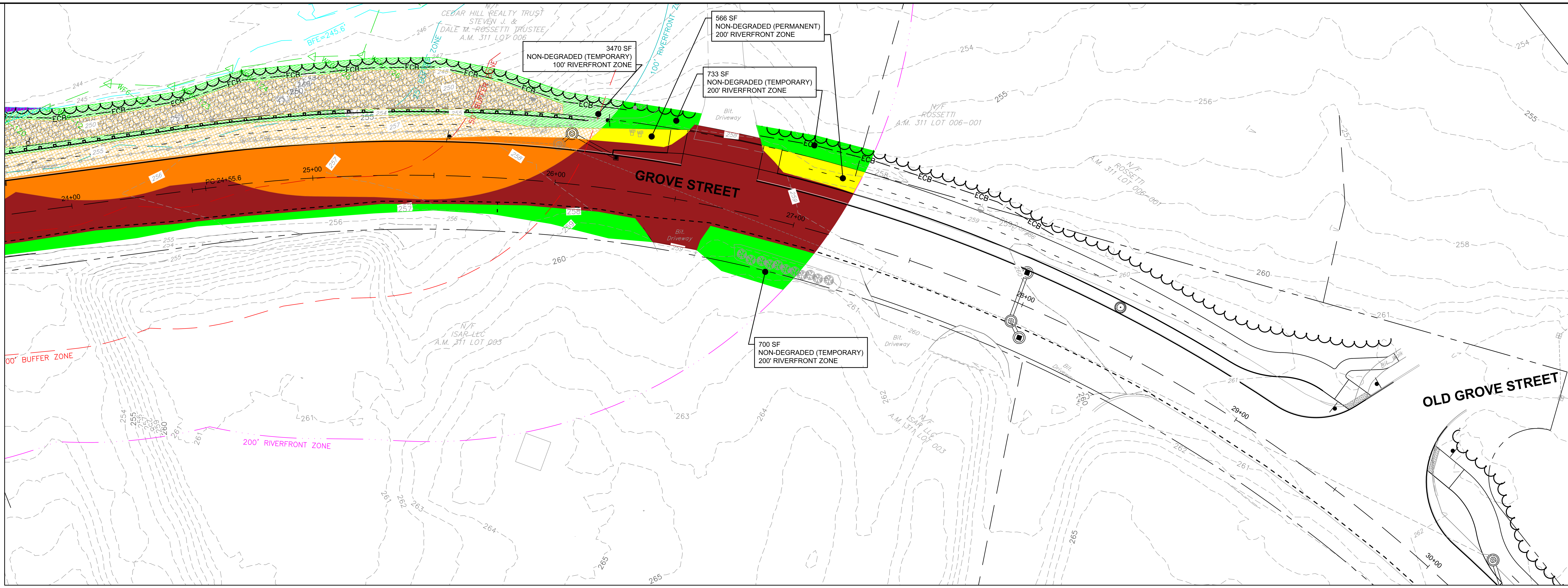

CONTINUED ON SHEET NO. 23

RESOURCE AREA LEGEND

LINETYPE/ HATCH	DESCRIPTION
WF	WETLAND BOUNDARY
BF	BANK BOUNDARY
	LIMIT OF 25 FT WETLAND BUFFER ZONE
	LIMIT OF 50 FT WETLAND BUFFER ZONE
	LIMIT OF 100 FT WETLAND BUFFER ZONE
	LIMIT OF 200 FT RIVERFRONT ZONE
	100 YEAR FLOOD ZONE
	100 YEAR FLOOD PLAIN IMPACT
	TEMPORARY WETLAND IMPACT
	PERMANENT WETLAND IMPACT
	WETLAND REPLICATION AREA
	PERMANENT DEGRADED 100' RIVERFRONT
	PERMANENT NON-DEGRADED 100' RIVERFRONT
	TEMPORARY NON-DEGRADED 100' RIVERFRONT
	PERMANENT DEGRADED 200' RIVERFRONT
	PERMANENT NON-DEGRADED 200' RIVERFRONT
	TEMPORARY NON-DEGRADED 200' RIVERFRONT

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DRAWN BY: CL
DESIGNED BY: RS
CHECKED BY: BB

REGISTERED PROFESSIONAL
WILLIAM P. McGRATH CIVIL No. 33716
2/15/23

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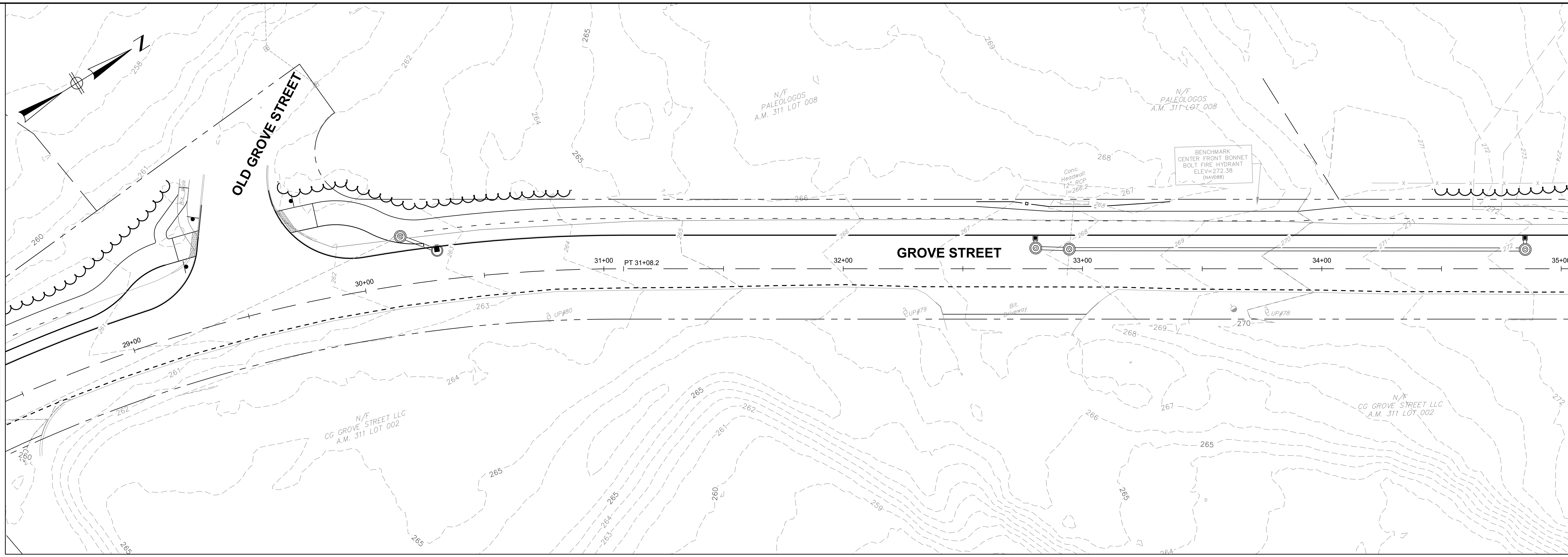
SUBCONSULTANT

SCALE
20 0 20 40
SCALE IN FEET: 1"=20'
UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

TITLE
GROVE STREET IMPROVEMENTS
RESOURCE AREA PLAN 4
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 22



RESOURCE AREA LEGEND

LINETYPE/ HATCH	DESCRIPTION
WF	WETLAND BOUNDARY
BF	BANK BOUNDARY
	LIMIT OF 25 FT WETLAND BUFFER ZONE
	LIMIT OF 50 FT WETLAND BUFFER ZONE
	LIMIT OF 100 FT WETLAND BUFFER ZONE
	LIMIT OF 200 FT RIVERFRONT ZONE
	100 YEAR FLOOD ZONE
	100 YEAR FLOOD PLAIN IMPACT
	TEMPORARY WETLAND IMPACT
	PERMANENT WETLAND IMPACT
	WETLAND REPLICATION AREA
	PERMANENT DEGRADED 100' RIVERFRONT
	PERMANENT NON-DEGRADED 100' RIVERFRONT
	TEMPORARY NON-DEGRADED 100' RIVERFRONT
	PERMANENT DEGRADED 200' RIVERFRONT
	PERMANENT NON-DEGRADED 200' RIVERFRONT
	TEMPORARY NON-DEGRADED 200' RIVERFRONT

2/14/2023 11:35 AM \\BETA-INC.COM\MA\PROJECTS\10600S\10613 - FRANKLIN, MA - GROVE ST ROADWAY DESIGN PHASE 2\DRAWING FILES\PLANSET\7548_RESOURCE AREA PLANS.DWG (BETA STB BW.STB)

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL
DESIGNED BY: RS
CHECKED BY: BB

REGISTERED PROFESSIONAL: COMMONWEALTH OF MASSACHUSETTS WILLIAM P. McGRATH CIVIL No. 33716 REGISTERED PROFESSIONAL ENGINEER 2/15/23

PREPARED BY: BETA www.BETA-Inc.com

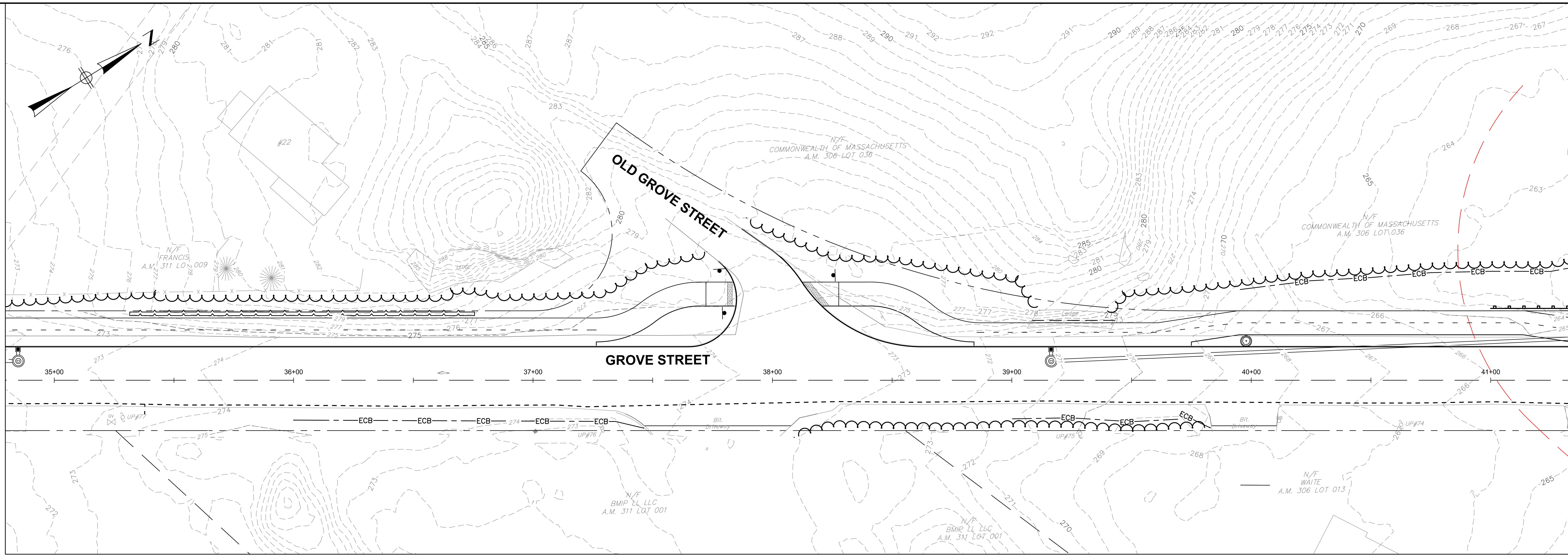
SUBCONSULTANT

SCALE: 20 0 20 40 SCALE IN FEET: 1"=20'
UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

TITLE
GROVE STREET IMPROVEMENTS
RESOURCE AREA PLAN 5
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 23

CONTINUED ON SHEET NO. 23



CONTINUED ON SHEET NO. 25

RESOURCE AREA LEGEND

LINETYPE/ HATCH	DESCRIPTION
WF	WETLAND BOUNDARY
BF	BANK BOUNDARY
	LIMIT OF 25 FT WETLAND BUFFER ZONE
	LIMIT OF 50 FT WETLAND BUFFER ZONE
	LIMIT OF 100 FT WETLAND BUFFER ZONE
	LIMIT OF 200 FT RIVERFRONT ZONE
	100 YEAR FLOOD ZONE
	100 YEAR FLOOD PLAIN IMPACT
	TEMPORARY WETLAND IMPACT
	PERMANENT WETLAND IMPACT
	WETLAND REPLICATION AREA
	PERMANENT DEGRADED 100' RIVERFRONT
	PERMANENT NON-DEGRADED 100' RIVERFRONT
	TEMPORARY NON-DEGRADED 100' RIVERFRONT
	PERMANENT DEGRADED 200' RIVERFRONT
	PERMANENT NON-DEGRADED 200' RIVERFRONT
	TEMPORARY NON-DEGRADED 200' RIVERFRONT

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL
DESIGNED BY: RS
CHECKED BY: BB

REGISTERED PROFESSIONAL: WILLIAM P. McGRATH CIVIL No. 33716 — 2/15/23

PREPARED BY: BETA www.BETA-Inc.com

SUBCONSULTANT

SCALE: 20 0 20 40 SCALE IN FEET: 1"=20'
UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

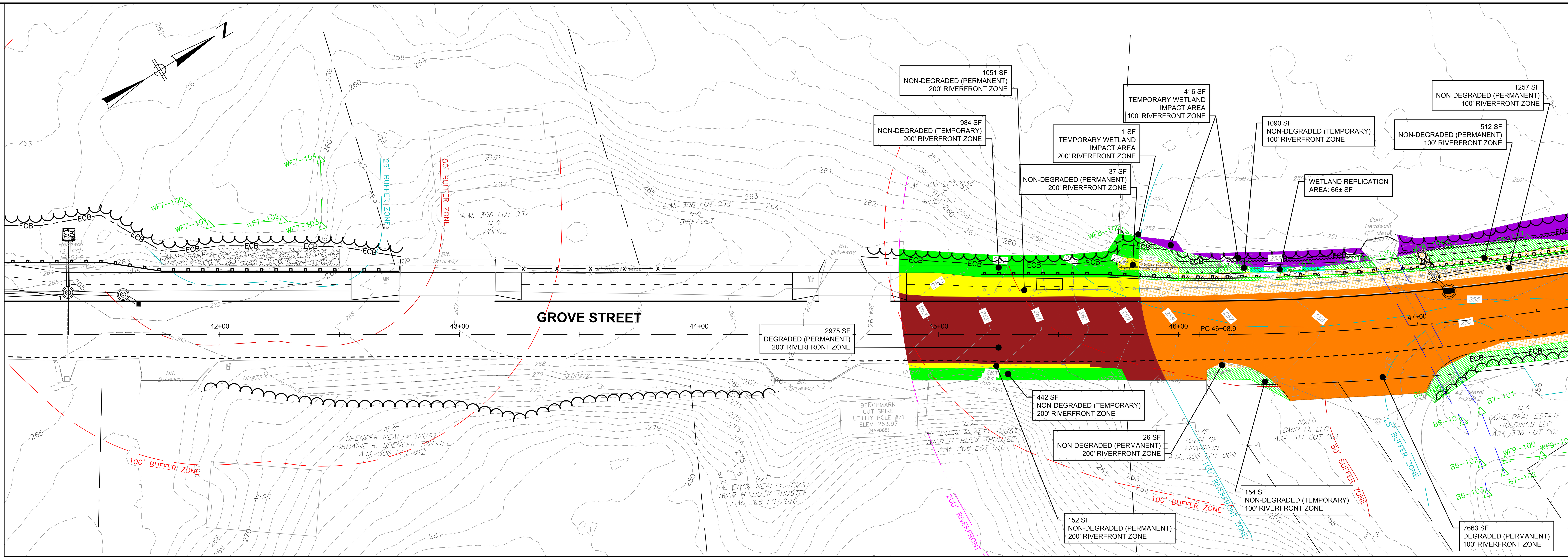
TITLE

GROVE STREET IMPROVEMENTS

RESOURCE AREA PLAN 6

FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 24



RESOURCE AREA LEGEND

LINETYPE/ HATCH	DESCRIPTION
WF	WETLAND BOUNDARY
BF	BANK BOUNDARY
	LIMIT OF 25 FT WETLAND BUFFER ZONE
	LIMIT OF 50 FT WETLAND BUFFER ZONE
	LIMIT OF 100 FT WETLAND BUFFER ZONE
	LIMIT OF 200 FT RIVERFRONT ZONE
	100 YEAR FLOOD ZONE
	100 YEAR FLOOD PLAIN IMPACT
	TEMPORARY WETLAND IMPACT
	PERMANENT WETLAND IMPACT
	WETLAND REPLICATION AREA
	PERMANENT DEGRADED 100' RIVERFRONT
	PERMANENT NON-DEGRADED 100' RIVERFRONT
	TEMPORARY NON-DEGRADED 100' RIVERFRONT
	PERMANENT DEGRADED 200' RIVERFRONT
	PERMANENT NON-DEGRADED 200' RIVERFRONT
	TEMPORARY NON-DEGRADED 200' RIVERFRONT

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

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DESIGNED BY: RS
CHECKED BY: BB

REGISTERED PROFESSIONAL: WILLIAM P. McGRATH CIVIL No. 33716 2/15/23

PREPARED BY: BETA www.BETA-Inc.com

SUBCONSULTANT

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TITLE
GROVE STREET IMPROVEMENTS
RESOURCE AREA PLAN 7
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 25

2/14/2023 11:35 AM \\BETA-INC.COM\MA\PROJECTS\10600S\10613 - FRANKLIN, MA - GROVE ST ROADWAY DESIGN PHASE 2\DRAWING FILES\PLANSET\7548_RESOURCE AREA PLANS.DWG (BETA STB BW.STB)

CONTINUED ON SHEET NO. 25

CONTINUED ON SHEET NO. 27

RESOURCE AREA LEGEND

LINETYPE/ HATCH	DESCRIPTION
WF	WETLAND BOUNDARY
BF	BANK BOUNDARY
	LIMIT OF 25 FT WETLAND BUFFER ZONE
	LIMIT OF 50 FT WETLAND BUFFER ZONE
	LIMIT OF 100 FT WETLAND BUFFER ZONE
	LIMIT OF 200 FT RIVERFRONT ZONE
	100 YEAR FLOOD ZONE
	100 YEAR FLOOD PLAIN IMPACT
	TEMPORARY WETLAND IMPACT
	PERMANENT WETLAND IMPACT
	WETLAND REPLICATION AREA
	PERMANENT DEGRADED 100' RIVERFRONT
	PERMANENT NON-DEGRADED 100' RIVERFRONT
	TEMPORARY NON-DEGRADED 100' RIVERFRONT
	PERMANENT DEGRADED 200' RIVERFRONT
	PERMANENT NON-DEGRADED 200' RIVERFRONT
	TEMPORARY NON-DEGRADED 200' RIVERFRONT

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

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CHECKED BY: BB

REGISTERED PROFESSIONAL: WILLIAM P. McGRATH, CIVIL, No. 33716, 2/15/23

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TITLE

GROVE STREET IMPROVEMENTS

RESOURCE AREA PLAN 8

FRANKLIN, MA

BETA JOB NO. 10613

ISSUE DATE 02/2023

SHEET NO. 26

RESOURCE AREA LEGEND

LINETYPE/ HATCH	DESCRIPTION
WF	WETLAND BOUNDARY
BF	BANK BOUNDARY
	LIMIT OF 25 FT WETLAND BUFFER ZONE
	LIMIT OF 50 FT WETLAND BUFFER ZONE
	LIMIT OF 100 FT WETLAND BUFFER ZONE
	LIMIT OF 200 FT RIVERFRONT ZONE
	100 YEAR FLOOD ZONE
	100 YEAR FLOOD PLAIN IMPACT
	TEMPORARY WETLAND IMPACT
	PERMANENT WETLAND IMPACT
	WETLAND REPLICATION AREA
	PERMANENT DEGRADED 100' RIVERFRONT
	PERMANENT NON-DEGRADED 100' RIVERFRONT
	TEMPORARY NON-DEGRADED 100' RIVERFRONT
	PERMANENT DEGRADED 200' RIVERFRONT
	PERMANENT NON-DEGRADED 200' RIVERFRONT
	TEMPORARY NON-DEGRADED 200' RIVERFRONT

2/14/2023 11:36 AM \\BETA-INC.COM\MA\PROJECTS\10600S\10613 - FRANKLIN, MA - GROVE ST ROADWAY DESIGN PHASE 2\DRAWING FILES\PLANSET\7548_RESOURCE AREA PLANS.DWG (BETA STB BW.STB)

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REGISTERED PROFESSIONAL

COMMONWEALTH OF MASSACHUSETTS WILLIAM P. McGRATH CIVIL No. 33716 REGISTERED PROFESSIONAL ENGINEER

2/15/23

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SCALE

20 0 20 40

SCALE IN FEET: 1"=20'

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TITLE

GROVE STREET IMPROVEMENTS

RESOURCE AREA PLAN 9

FRANKLIN, MA

BETA JOB NO. 10613

ISSUE DATE 02/2023

SHEET NO. 27

CONTINUED ON SHEET NO. 27

RESOURCE AREA LEGEND

LINETYPE/ HATCH	DESCRIPTION
WF	WETLAND BOUNDARY
BF	BANK BOUNDARY
	LIMIT OF 25 FT WETLAND BUFFER ZONE
	LIMIT OF 50 FT WETLAND BUFFER ZONE
	LIMIT OF 100 FT WETLAND BUFFER ZONE
	LIMIT OF 200 FT RIVERFRONT ZONE
	100 YEAR FLOOD ZONE
	100 YEAR FLOOD PLAIN IMPACT
	TEMPORARY WETLAND IMPACT
	PERMANENT WETLAND IMPACT
	WETLAND REPLICATION AREA
	PERMANENT DEGRADED 100' RIVERFRONT
	PERMANENT NON-DEGRADED 100' RIVERFRONT
	TEMPORARY NON-DEGRADED 100' RIVERFRONT
	PERMANENT DEGRADED 200' RIVERFRONT
	PERMANENT NON-DEGRADED 200' RIVERFRONT
	TEMPORARY NON-DEGRADED 200' RIVERFRONT

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

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CHECKED BY: BB

REGISTERED PROFESSIONAL: WILLIAM P. McGRATH CIVIL No. 33716 2/15/23

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SCALE: 20 0 20 40 SCALE IN FEET: 1"=20'
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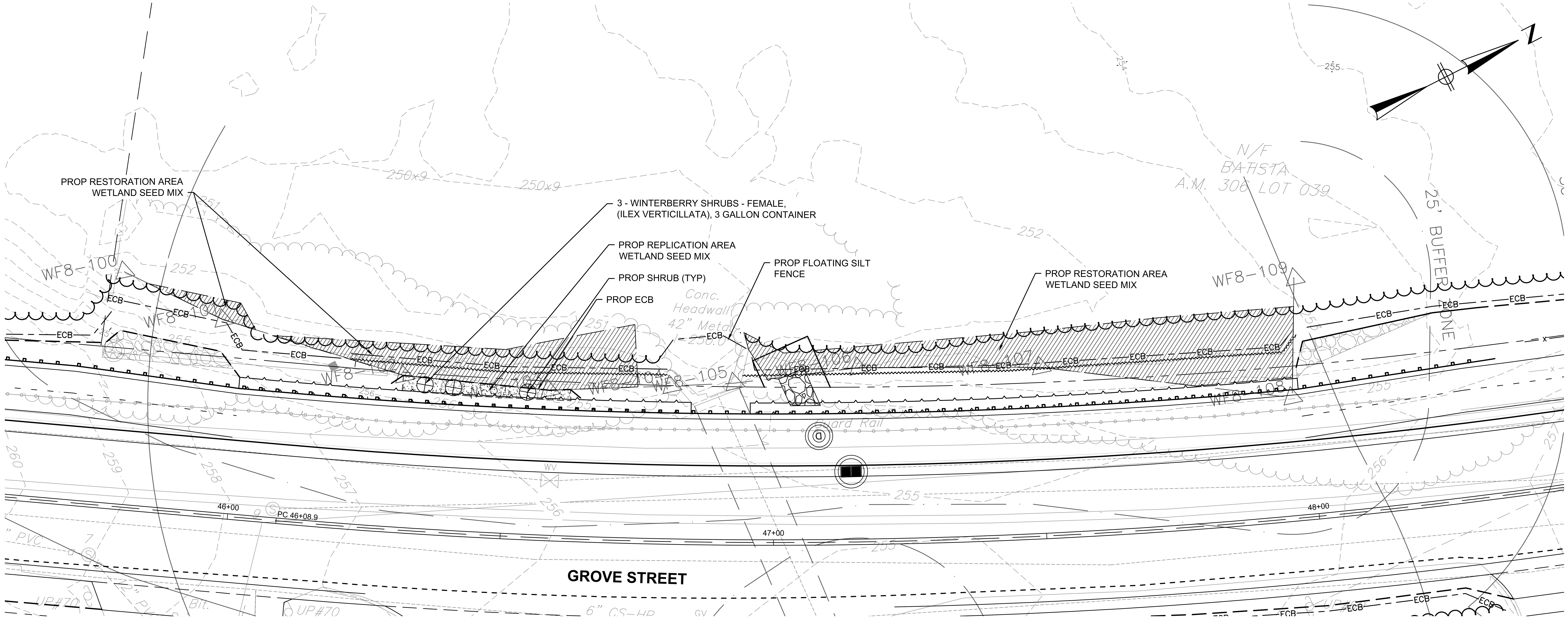
TITLE:
GROVE STREET IMPROVEMENTS
RESOURCE AREA PLAN 10
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 28

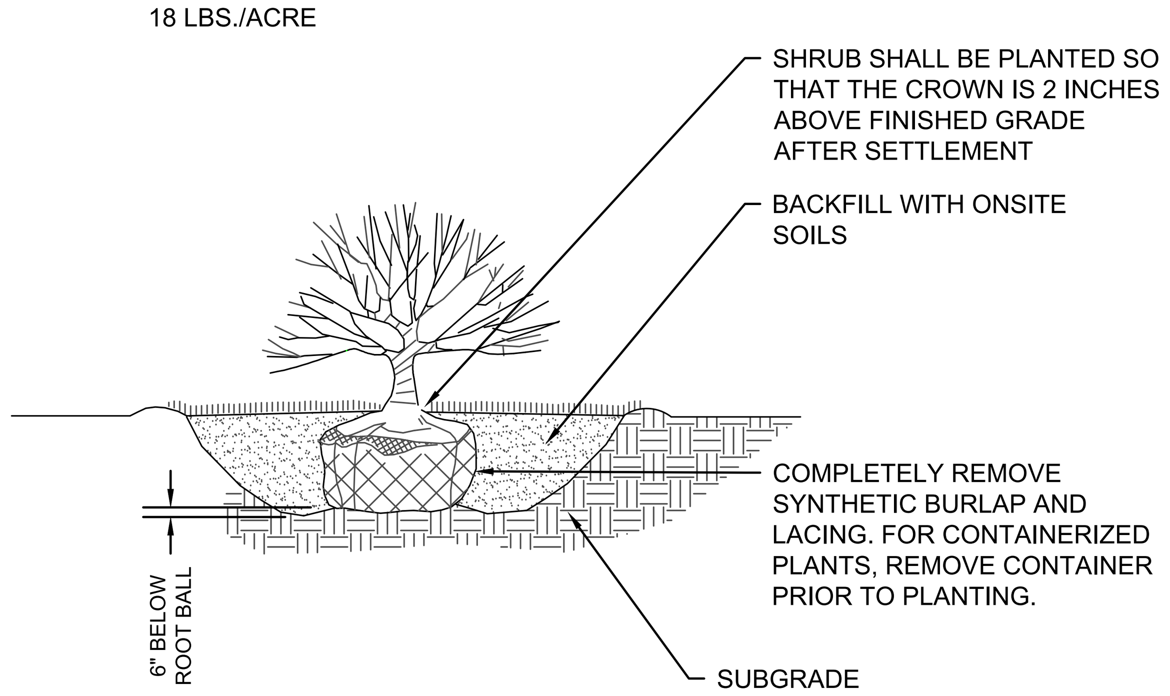


WETLAND REPLICATION & RESTORATION PLAN
SCALE: 1"= 10'

WETLAND SEED MIX SPECIFICATIONS:

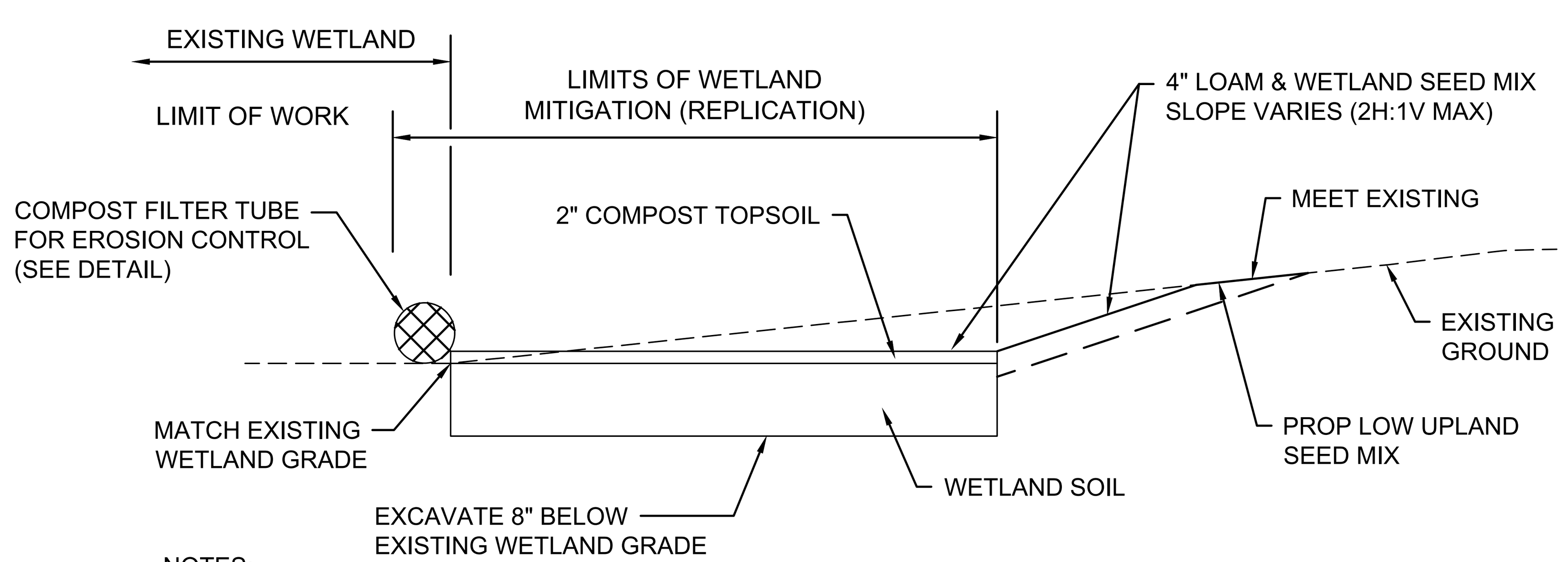
WETLAND SEED MIX SHALL BE COMPARABLE TO NEW ENGLAND WETLAND PLANTS WET MIX AND INCLUDE FOX SEDGE (CAREX VULPINOIDEA), LURID SEDGE (CAREX LURIDA), BLUNT BROOM SEDGE (CAREX SCOPARIA), BLUE VERVAIN (VERBENA HASTATA), FOWL BLUEGRASS (POA PALUSTRIS), HOP SEDGE (CAREX LUPULINA), GREEN BULRUSH (SCIRPUS ATROVIRENS), CREEPING SPIKE RUSH (ELEOCHARIS PALUSTRIS), FRINGED SEDGE (CAREX CRINITA), SOFT RUSH (JUNCUS EFFUSUS), SPOTTED JOE PYE WEED (EUPATORIUM MACULATUM), RATTLESNAKE GRASS (GLYCERIA CANADENSIS), SWAMP ASTER (ASTER PUNICEUS), BLUEFLAG (IRIS VERSICOLOR), SWAMP MILKWEED (ASCLEPIAS INCARNATA), AND SQUARE STEMMED MONKEY FLOWER (MIMULUS RINGENS).

APPLICATION RATE = 1 LB./2500 SQ. FT.
18 LBS./ACRE



NOTE:
LOOSE OR CRACKED ROOTBALLS WILL NOT BE ACCEPTED FOR PLANTING

SHRUB PLANTING
NOT TO SCALE



NOTES:

1. PROVIDE PLANTINGS AS DETAILED ON THIS SHEET.
2. ALL DISTURBED WETLAND AREAS SHALL BE RESTORED WITH WETLAND SEED MIX.

WETLAND REPLICATION AREA DETAIL
NOT TO SCALE

WETLAND REPLICATION NOTES:

1.) PRIOR TO GRADING THE REPLICATION AREA, EROSION CONTROLS SHALL BE INSTALLED ALONG THE DOWNGRADIENT AND UPGRADIENT EXTENTS.

2.) ALL SPECIES IDENTIFIED ON THIS PLAN SHALL BE USED UNLESS DIRECTED OTHERWISE BY THE FRANKLIN CONSERVATION COMMISSION. CULTIVARS SHALL NOT BE PLANTED.

3.) THE PLACEMENT OF PLANTINGS DEPICTED ON THIS PLAN SHALL BE USED AS A GUIDE AND IS NOT INTENDED TO DISCOURAGE FIELD ADJUSTMENTS BASED ON CONDITIONS. A QUALIFIED WETLAND PROFESSIONAL SHALL OVERSEE PLANTING WITHIN THE WETLAND REPLICATION AREA AND DIRECT THE CONTRACTOR ON EXACT PLACEMENT AND CLUSTERING OF PLANTS.

4.) A QUALIFIED PROFESSIONAL SHALL OVERSEE GRADING WITHIN THE WETLAND REPLICATION AREA AND DIRECT THE CONTRACTOR TO ACHIEVE THE APPROPRIATE GRADE FOR THE REPLICATION AREA.

5.) THE WETLAND REPLICATION AREA SHALL BE IMMEDIATELY SEEDED WITH NEW ENGLAND WETLAND PLANTS WET MIX OR A COMPARABLE BLEND OF NATIVE, HYDROPHYTIC SPECIES AS APPROVED BY THE FRANKLIN CONSERVATION COMMISSION. SHOULD FAVORABLE GROWING CONDITIONS NOT BE PRESENT, THE REPLICATION AREA SHALL BE COVERED WITH STRAW MULCH FREE OF SEED-HEADS AND SEEDED UPON COMMENCEMENT OF THE NEXT GROWING SEASON.

6.) SEE THE ACCOMPANYING NOTICE OF INTENT NARRATIVE FOR INFORMATION ON SEQUENCING OF ESTABLISHING THE REPLICATION AREAS.

7.) PLANTINGS SHALL BE SUFFICIENTLY IRRIGATED FOLLOWING INSTALLATION.

8.) WF 8 SERIES HYDROLOGY IS PRIMARILY PROVIDED THROUGH SURFACE WATER, THE SURFACE WATER ELEVATION WITHIN THE REPLICATION AREA WILL BE CONSISTENT WITH THE WF 8 SERIES.

9.) SOIL APPROPRIATE FOR THE REPLICATION AREA ME BE EITHER HYDRIC SOIL EXCAVATED AND STOCKPILED FROM THE IMPACTED WETLAND OR A MANUFACTURED MIX OF HALF COMPOST AND HALF CLEAN LOAM, OR A COMBINATION THEREOF, AS APPROVED BY A QUALIFIED WETLAND PROFESSIONAL. IF HYDRIC SOIL FROM THE IMPACTED WETLAND IS INFESTED WITH INVASIVE PLANT SPECIES, THE SOIL SHALL NOT BE USED IN THE REPLICATION AREA.

2/14/2023 11:40 AM \\BETA-INC.COM\MA\PROJECTS\10600S\10613 - FRANKLIN, MA - GROVE ST ROADWAY DESIGN PHASE 2\DRAWING FILES\PLANSET\7548_REPLICATION_PH2.DWG (BETA STB BW.STB)

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

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CHECKED BY: BB

REGISTERED PROFESSIONAL: WILLIAM P. McGRATH CIVIL No. 33716 2/15/23

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SUBCONSULTANT:

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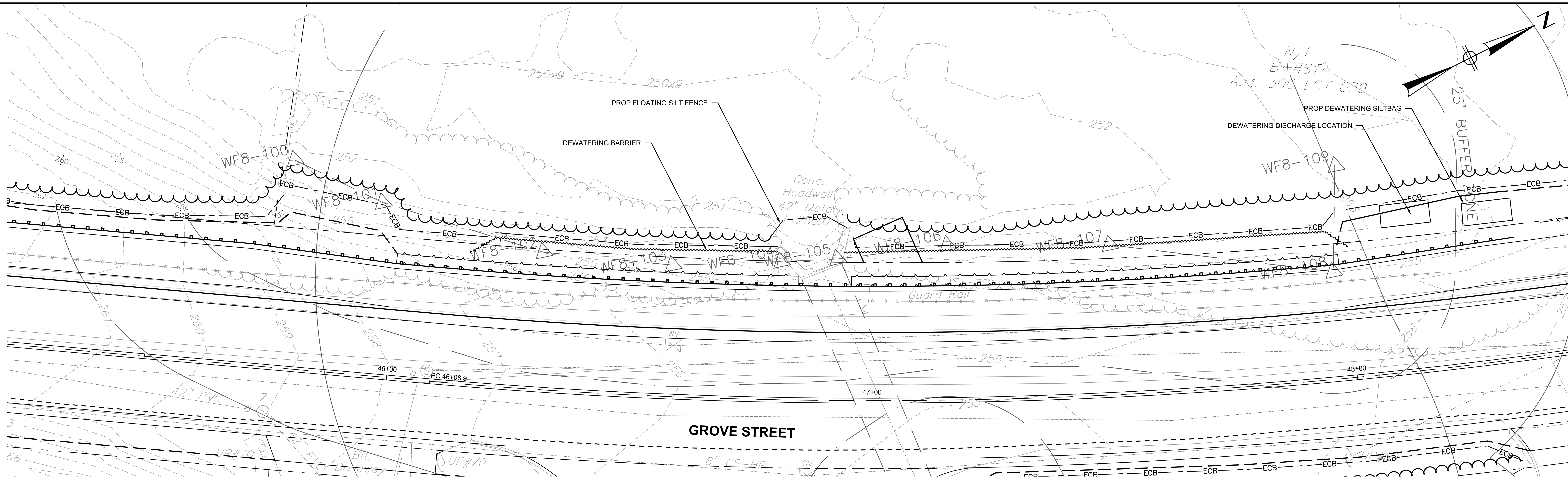
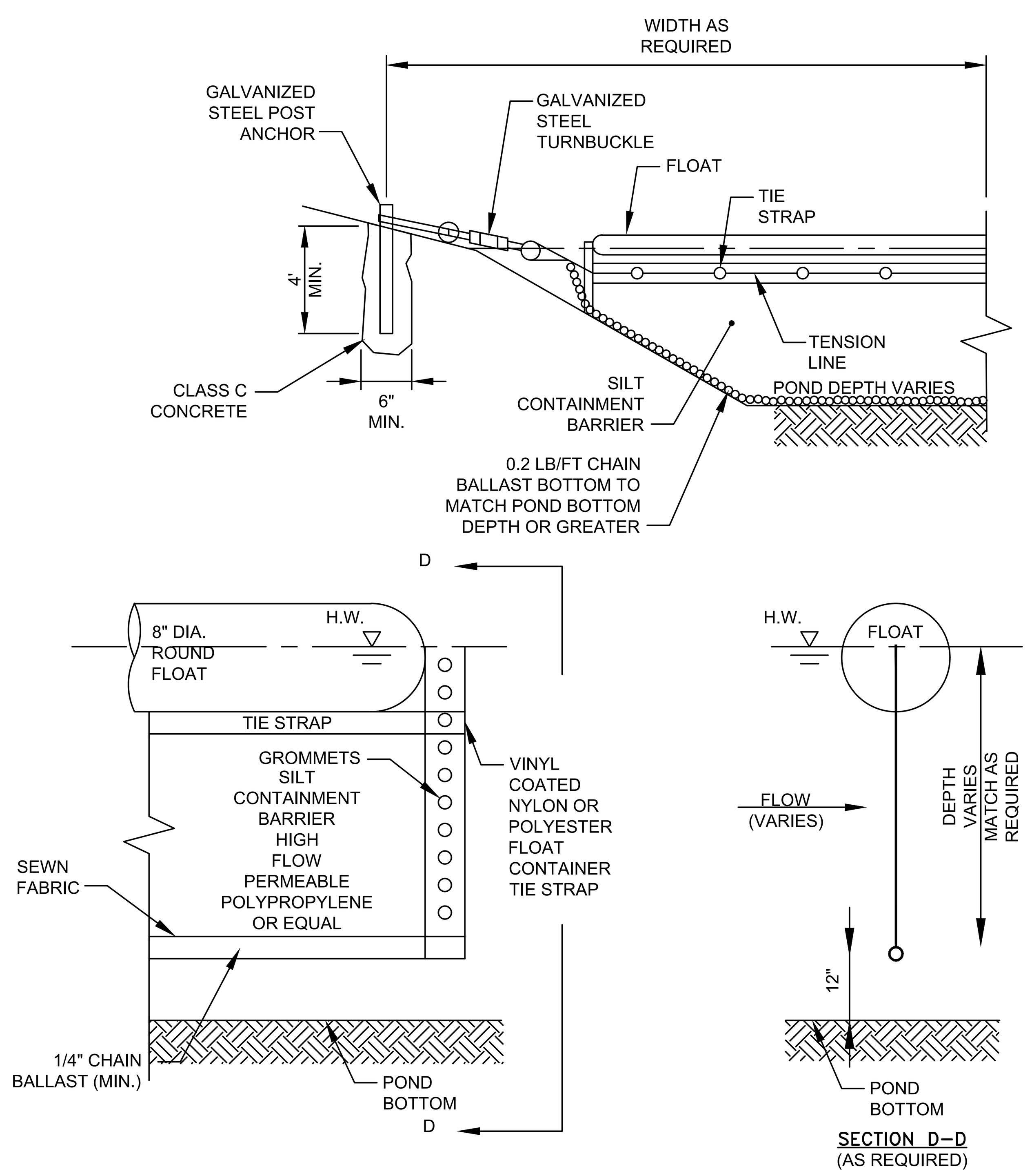
TITLE:
GROVE STREET IMPROVEMENTS
WETLAND REPLICATION PLAN
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 29



DEWATERING PLAN
SCALE: 1"= 10'



FLOATING SILT FENCE
NOT TO SCALE

NOTE:
-DEWATERING CONFIGURATION MAY CHANGE AFTER COORDINATION WITH THE CONTRACTOR.

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SUBCONSULTANT

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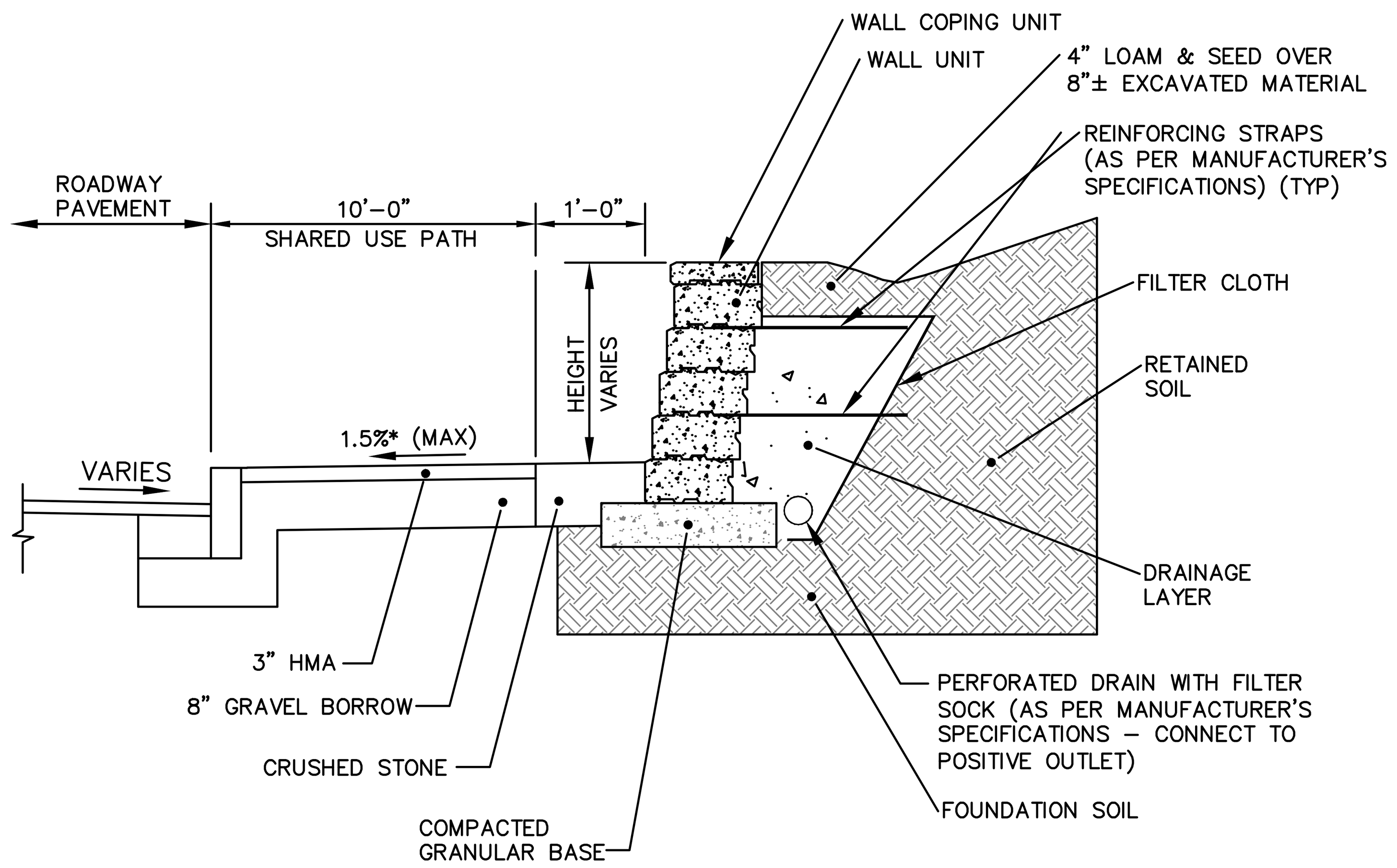
TITLE:
GROVE STREET IMPROVEMENTS
DEWATERING PLAN
FRANKLIN, MA

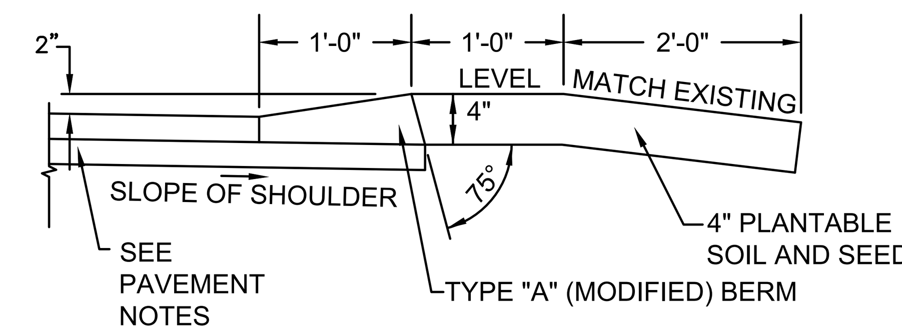
BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 30



* – TOLERANCE FOR CONSTRUCTION ±0.5% (TYPICAL)

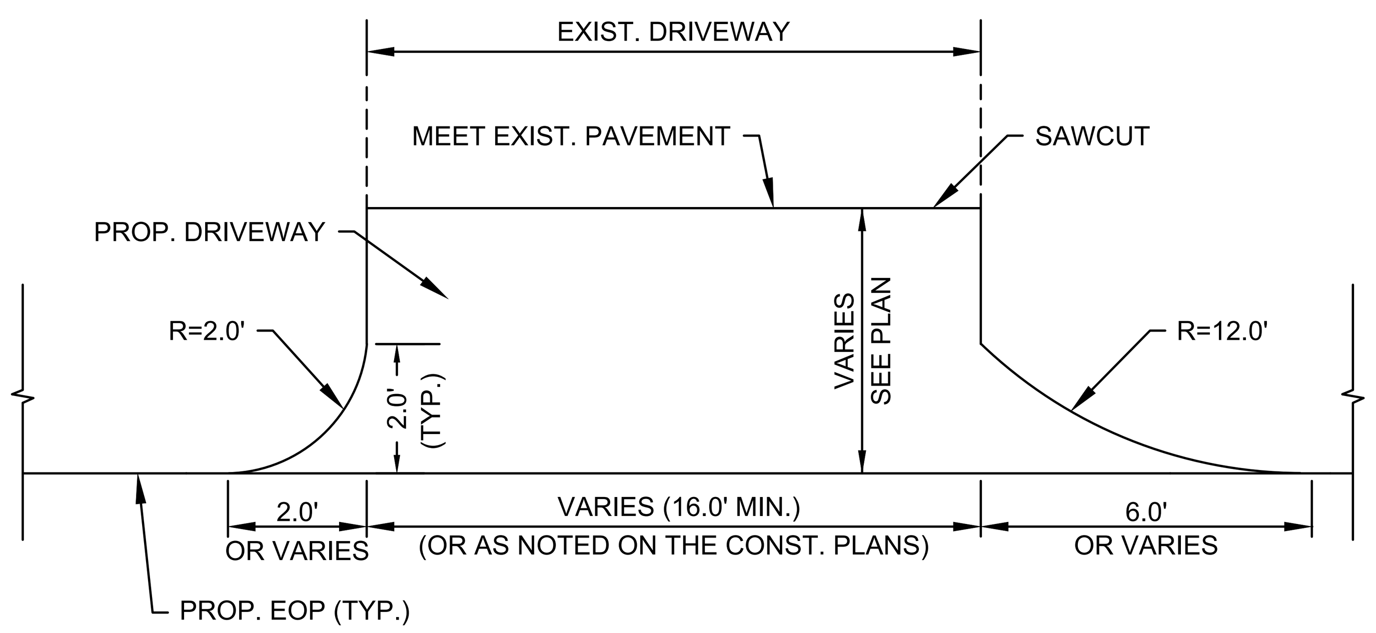
DETAIL FOR MODULAR BLOCK RETAINING WALL (INTERLOCKING) WITH SHARED USE PATH

NOT TO SCALE



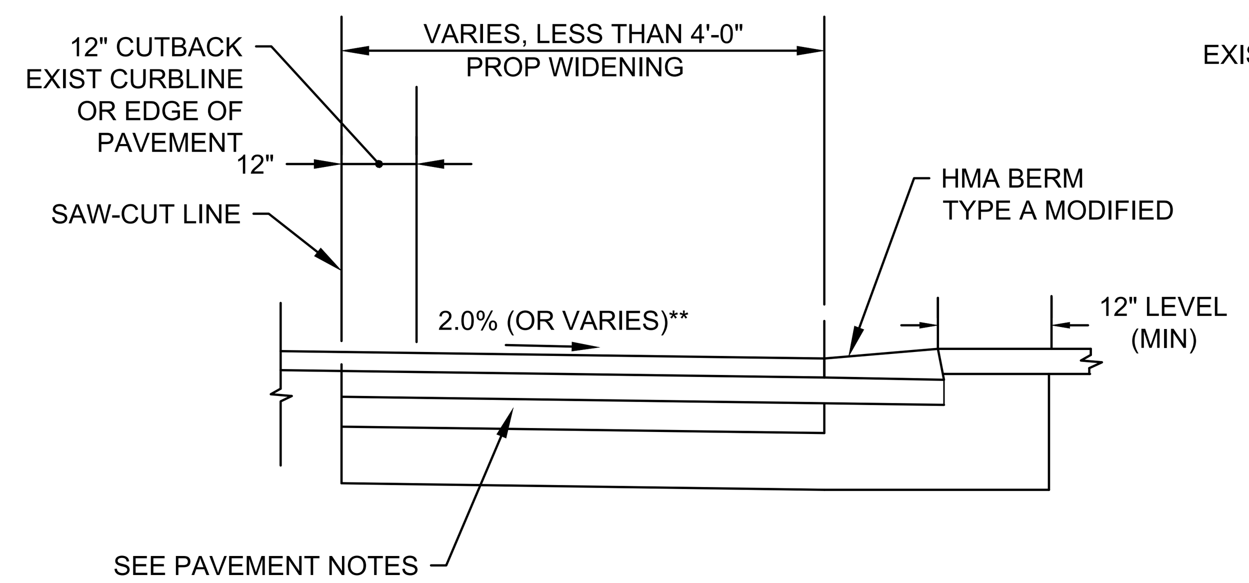
HMA BERM - TYPE "A" (MODIFIED) "CAPE COD BERM"

NOT TO SCALE



DETAIL FOR DRIVEWAY WITHOUT SIDEWALK (W/O BERM)

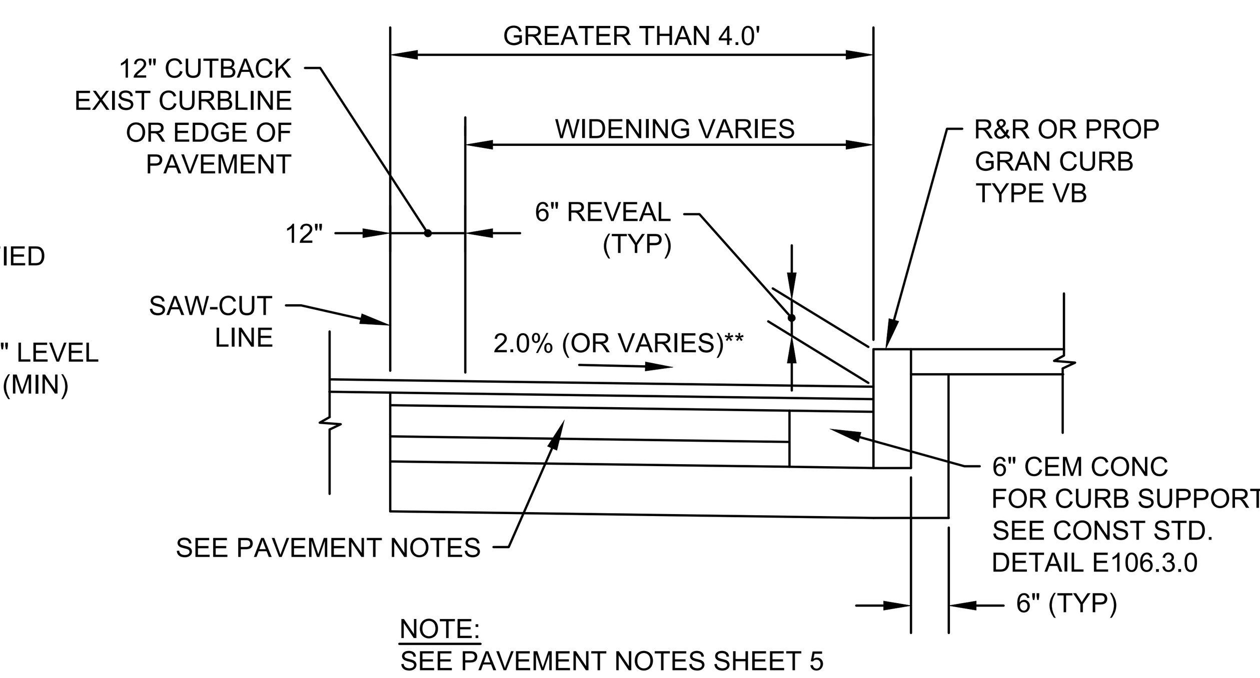
NOT TO SCALE



NOTE:
SEE PAVEMENT NOTES SHEET 5

DETAIL FOR BOX WIDENING 4.0' OR LESS

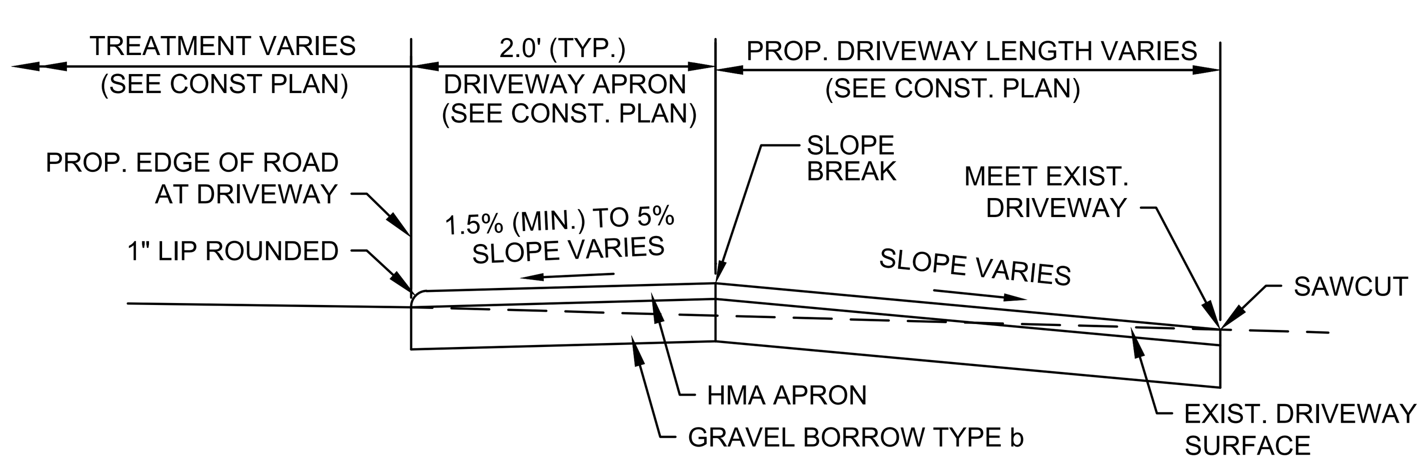
NOT TO SCALE



NOTE:
SEE PAVEMENT NOTES SHEET 5

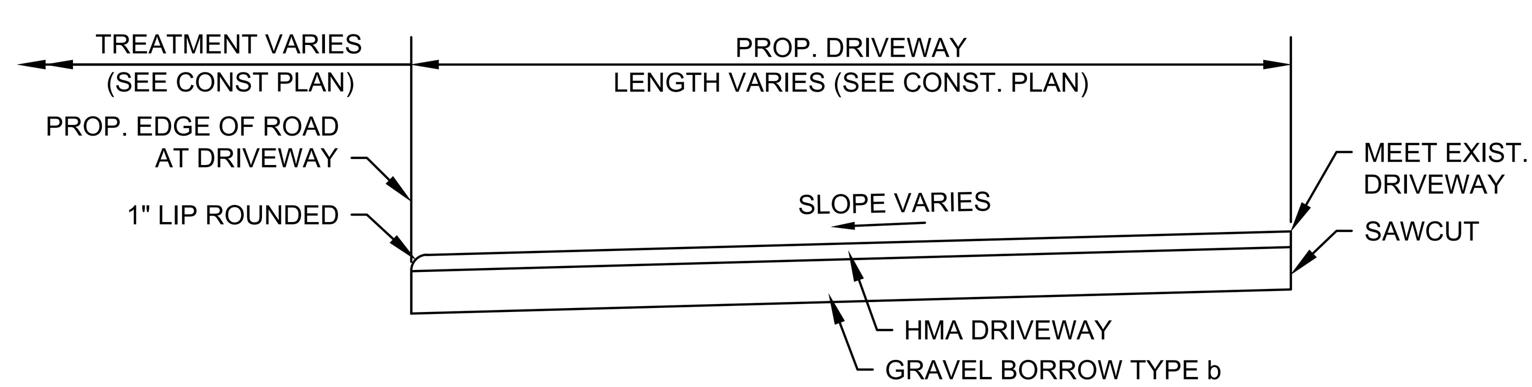
DETAIL FOR FULL DEPTH CONSTRUCTION

NOT TO SCALE



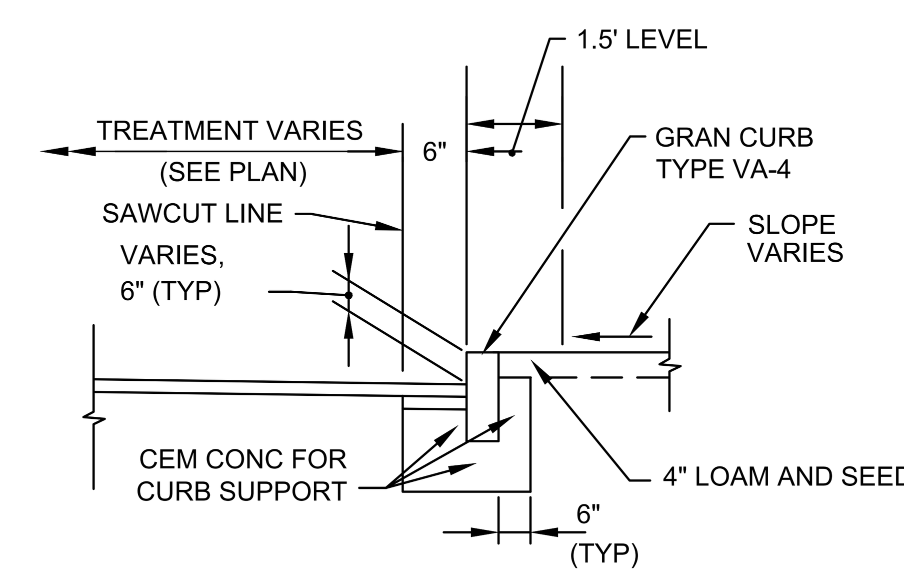
SECTION FOR DRIVEWAY WITHOUT SIDEWALK (EXIST. DRIVEWAY SLOPING AWAY FROM ROAD)

NOT TO SCALE



SECTION FOR DRIVEWAY WITHOUT SIDEWALK (EXIST. DRIVEWAY SLOPING TOWARD ROAD)

NOT TO SCALE



DETAIL FOR GRANITE CURB WITHOUT SIDEWALK

NOT TO SCALE

* TOLERANCE FOR CONSTRUCTION ±0.5%

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SUBCONSULTANT

SCALE: NONE
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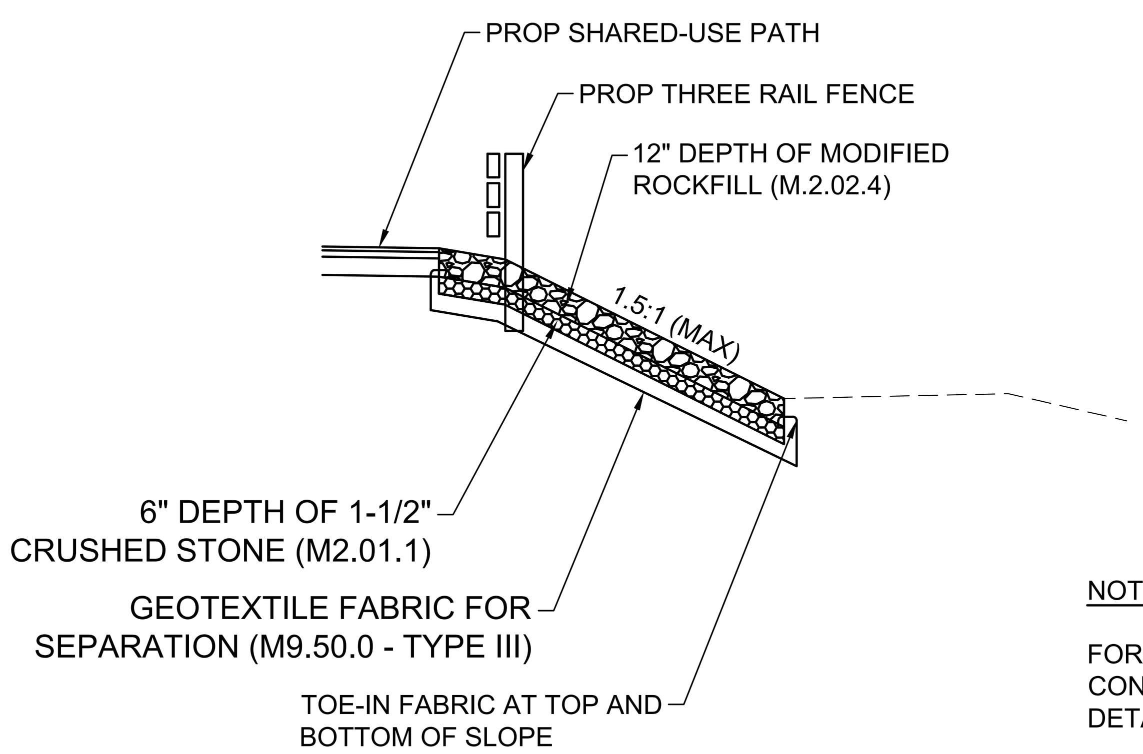
TITLE:
GROVE STREET IMPROVEMENTS PHASE 2
CONS. DETAILS 1
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 31

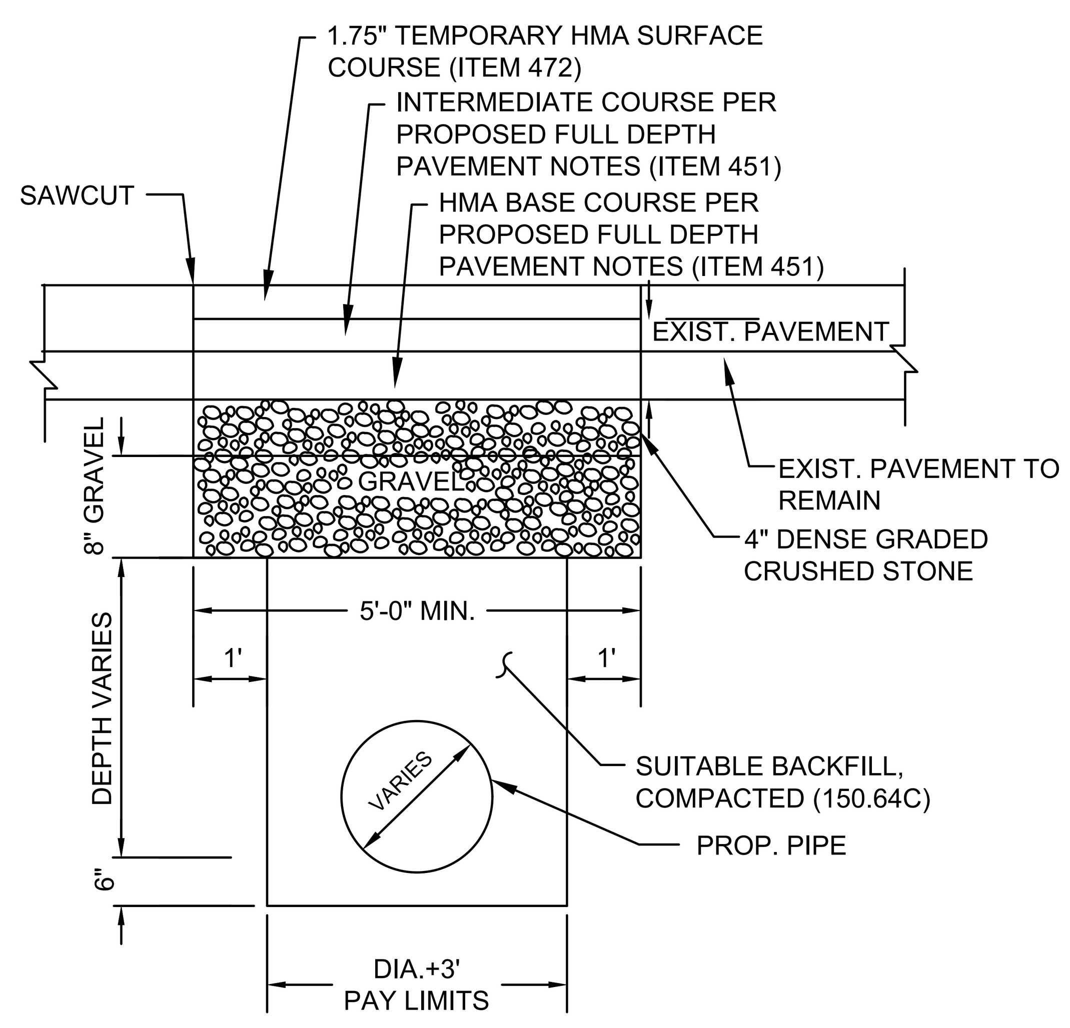


STA 1+00 LT TO 3+00 LT

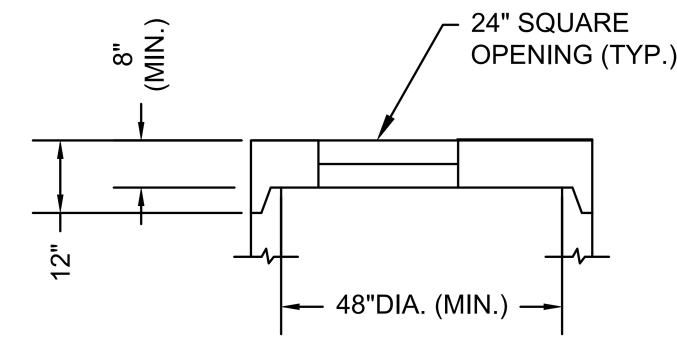
MODIFIED ROCKFILL
NOT TO SCALE

NOTES:

FOR TRAFFIC SIGNAL CONDUIT TRENCH DETAILS SEE SHEET 17



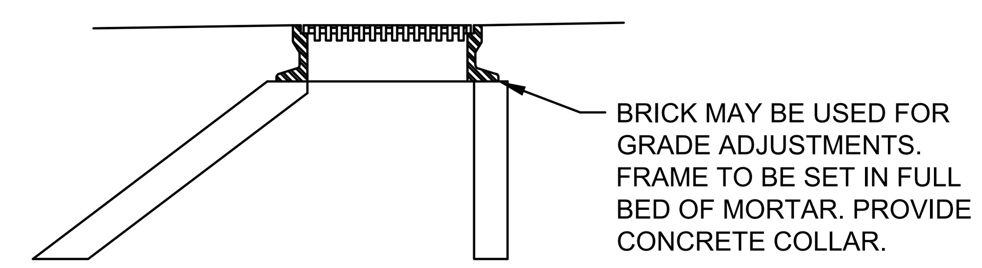
PERMANENT TRENCH PATCH DETAIL
IN MILLED AREAS
NOT TO SCALE



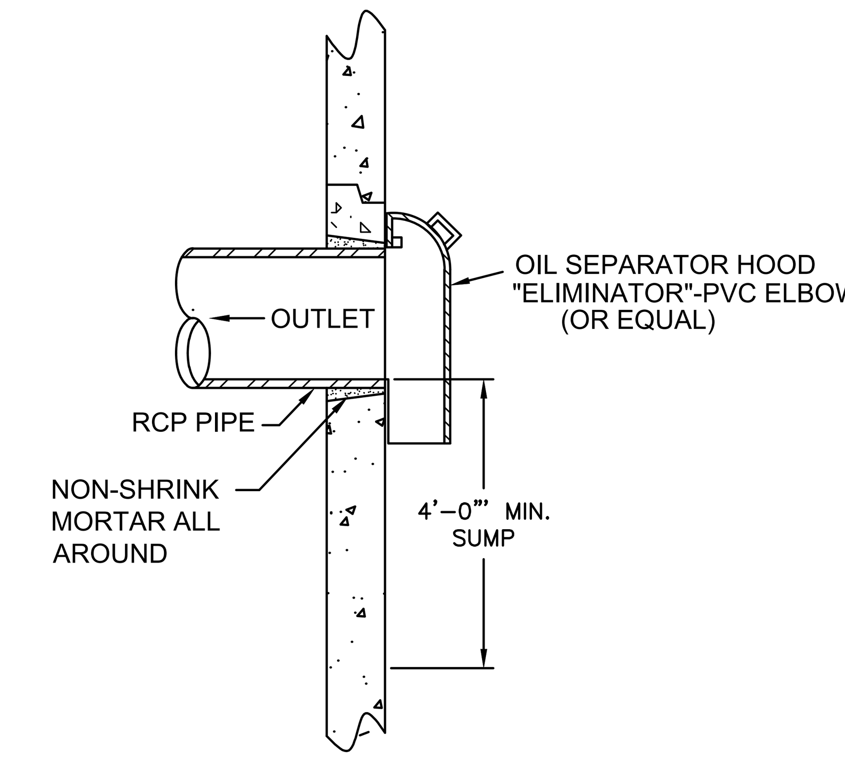
ALTERNATE TOP SLAB FOR CATCH BASIN
NOT TO SCALE

NOTES:

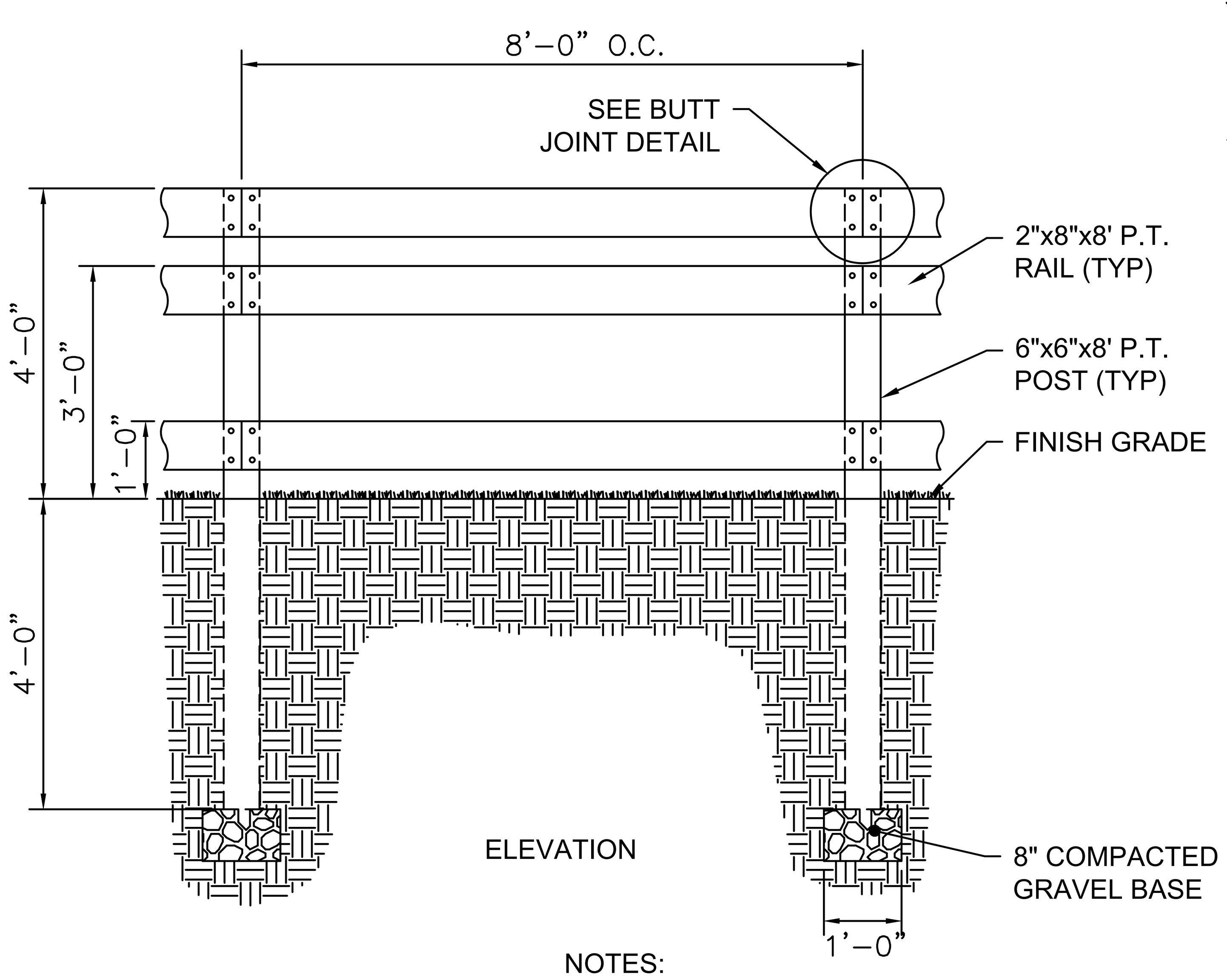
1. BASED ON ACTUAL FIELD CONDITIONS; THE CONTRACTOR SHALL DETERMINE WHICH STYLE OF TOP SECTION SHOULD BE USED.

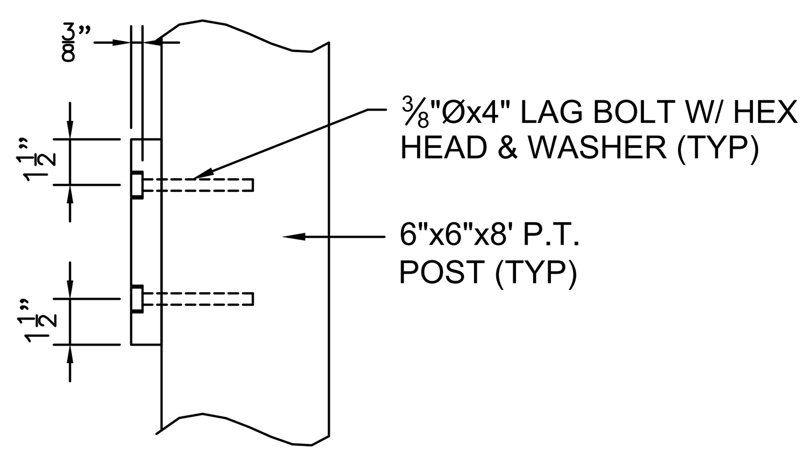


ALTERNATE ECCENTRIC CONE SECTION FOR CATCH BASIN
NOT TO SCALE

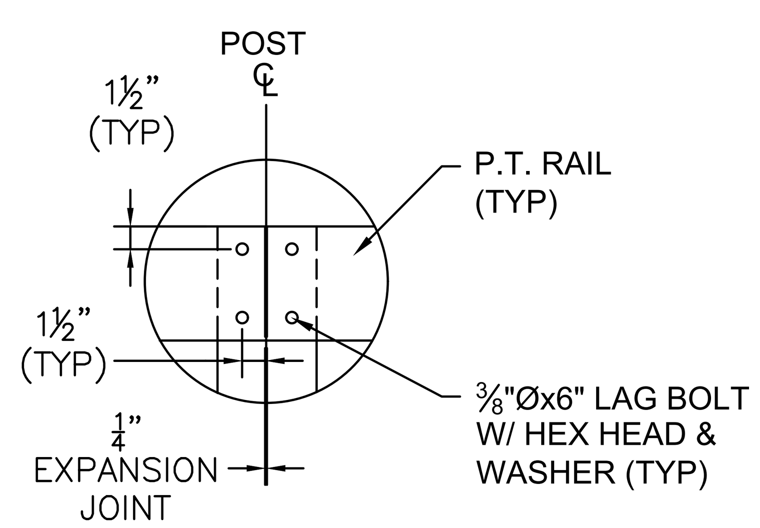


CATCH BASIN
HOOD DETAIL
NOT TO SCALE





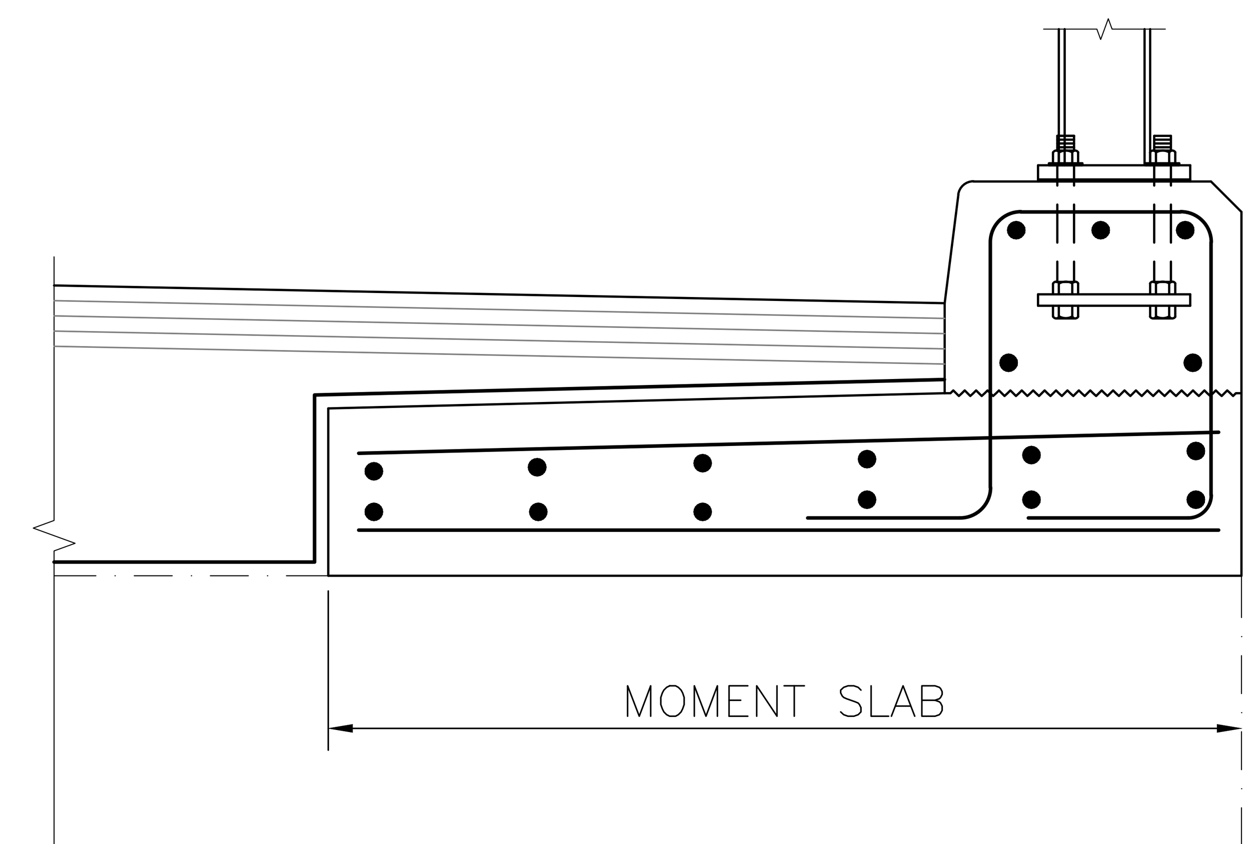
STEEL PLATE MOUNTING



BUTT JOINT
N.T.S.

NOTES:
1. AFTER SETTING POSTS, TAMP BACKFILL FIRMLY IN PLACE.
2. DO NOT BACKFILL WITH CONCRETE.

3 RAIL FENCE
SCALE: ½"=1'



MOMENT SLAB SECTION

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

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REGISTERED PROFESSIONAL: WILLIAM P. McGRATH, CIVIL, No. 33716, 2/15/23

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SUBCONSULTANT

SCALE: NONE
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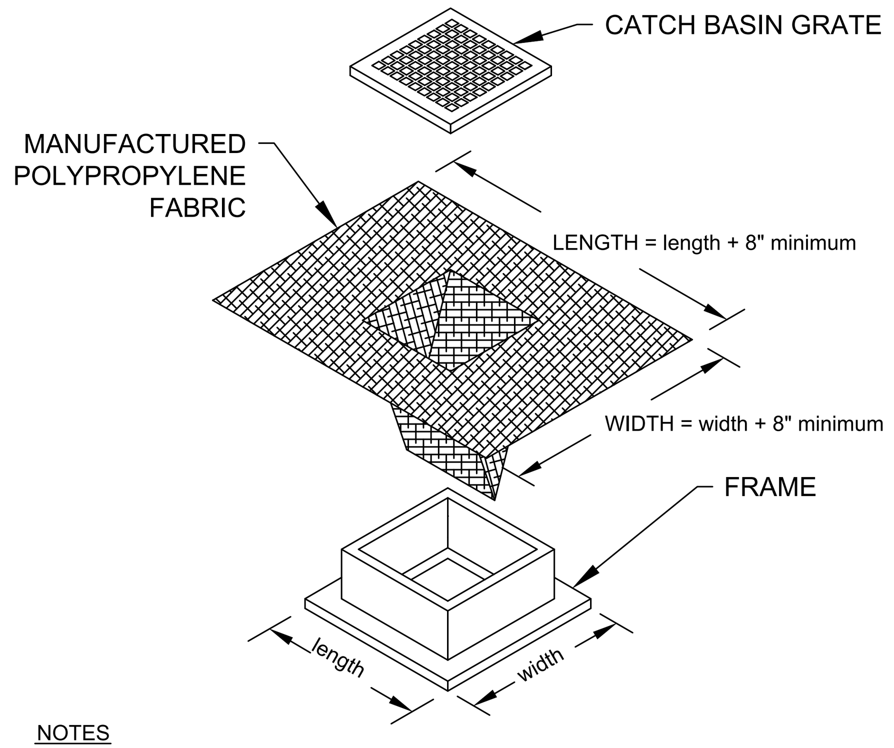
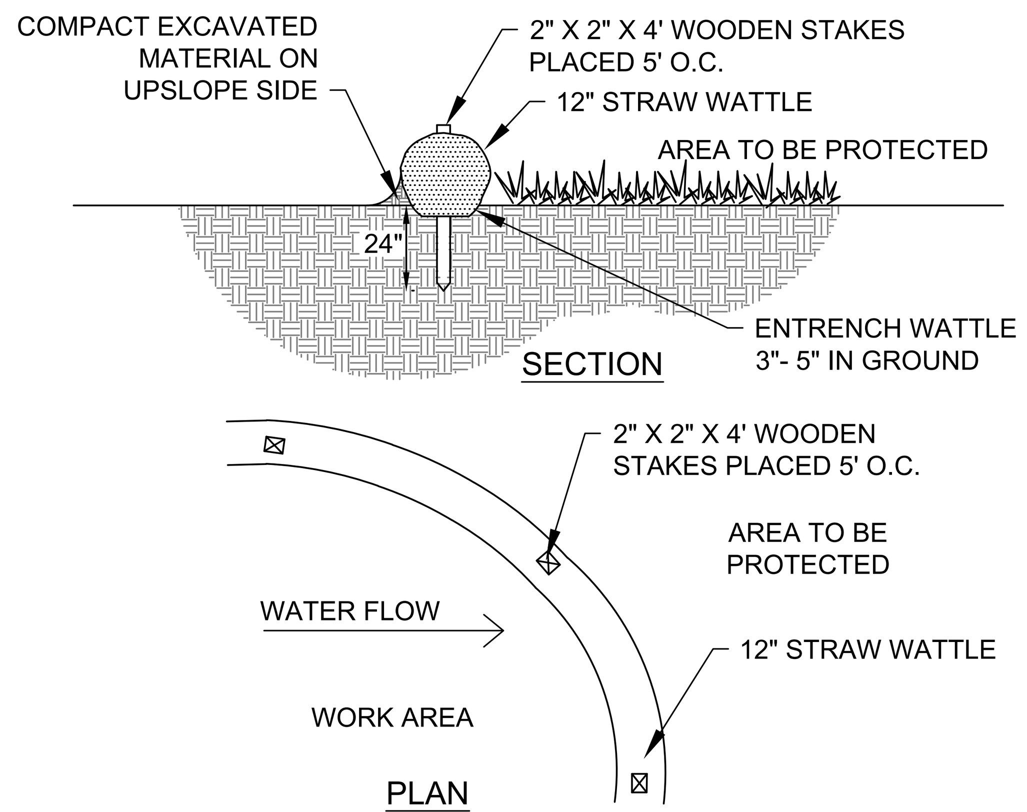
TITLE:
GROVE STREET IMPROVEMENTS
PHASE 2
CONS. DETAILS 2
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 32

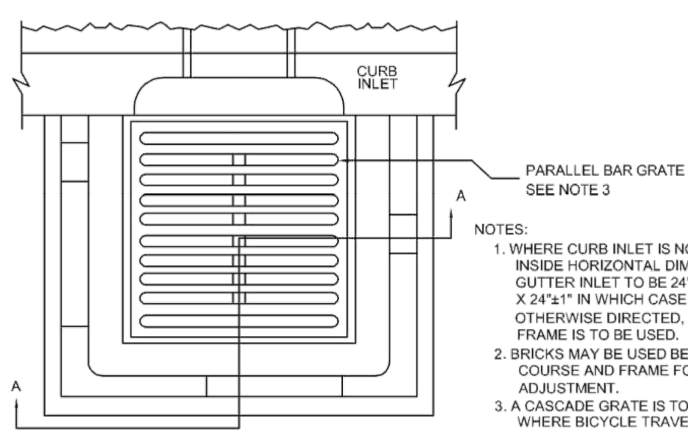


NOTES
1. LENGTH AND WIDTH OF POLYPROPYLENE FABRIC MUST EXCEED EXISTING CATCH BASIN FRAME DIMENSIONS BY A MINIMUM OF 8".
2. REMOVE CATCH BASIN GRATE AND INSTALL POLYPROPYLENE FABRIC OVER CATCH BASIN FRAME. REPLACE CATCH BASIN GRATE TO SECURE POLYPROPYLENE FABRIC IN PLACE.

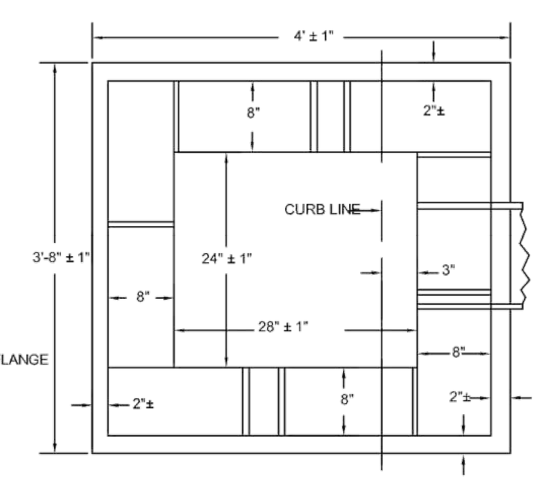
CATCH BASIN EROSION CONTROL PROTECTION (TYP)
NOT TO SCALE



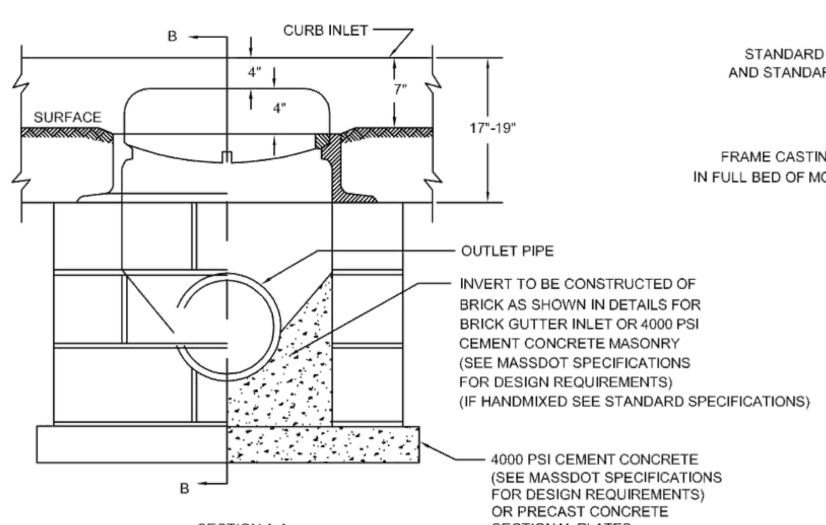
EROSION CONTROL BARRIER
NOT TO SCALE



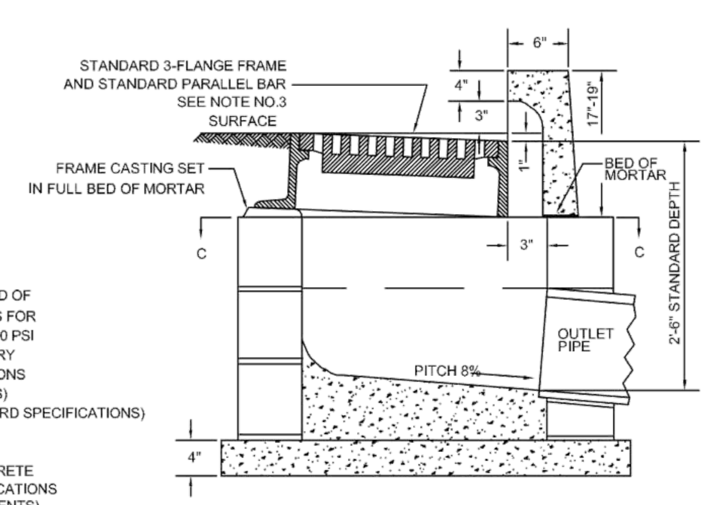
NOTES:
1. WHERE CURB INLET IS NOT USED THE INSIDE HORIZONTAL DIMENSIONS OF GUTTER INLET TO BE 24"±1" X 24"±1" IN WHICH CASE AND UNLESS OTHERWISE DIRECTED, A STANDARD 4-FLANGE FRAME IS TO BE USED.
2. BRICKS MAY BE USED BETWEEN TOP COURSE AND FRAME FOR GRADE ADJUSTMENT.
3. A CASCADE GRATE IS TO BE USED WHERE BICYCLE TRAVEL IS ALLOWED.
4. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.



SECTION C-C



SECTION A-A



SECTION B-B

GUTTER INLET
NOT TO SCALE

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL
DESIGNED BY: BB
CHECKED BY: BM

REGISTERED PROFESSIONAL: COMMONWEALTH OF MASSACHUSETTS WILLIAM P. McGRATH CIVIL No. 33716 REGISTERED PROFESSIONAL ENGINEER 2/15/23

PREPARED BY: BETA www.BETA-Inc.com

SUBCONSULTANT

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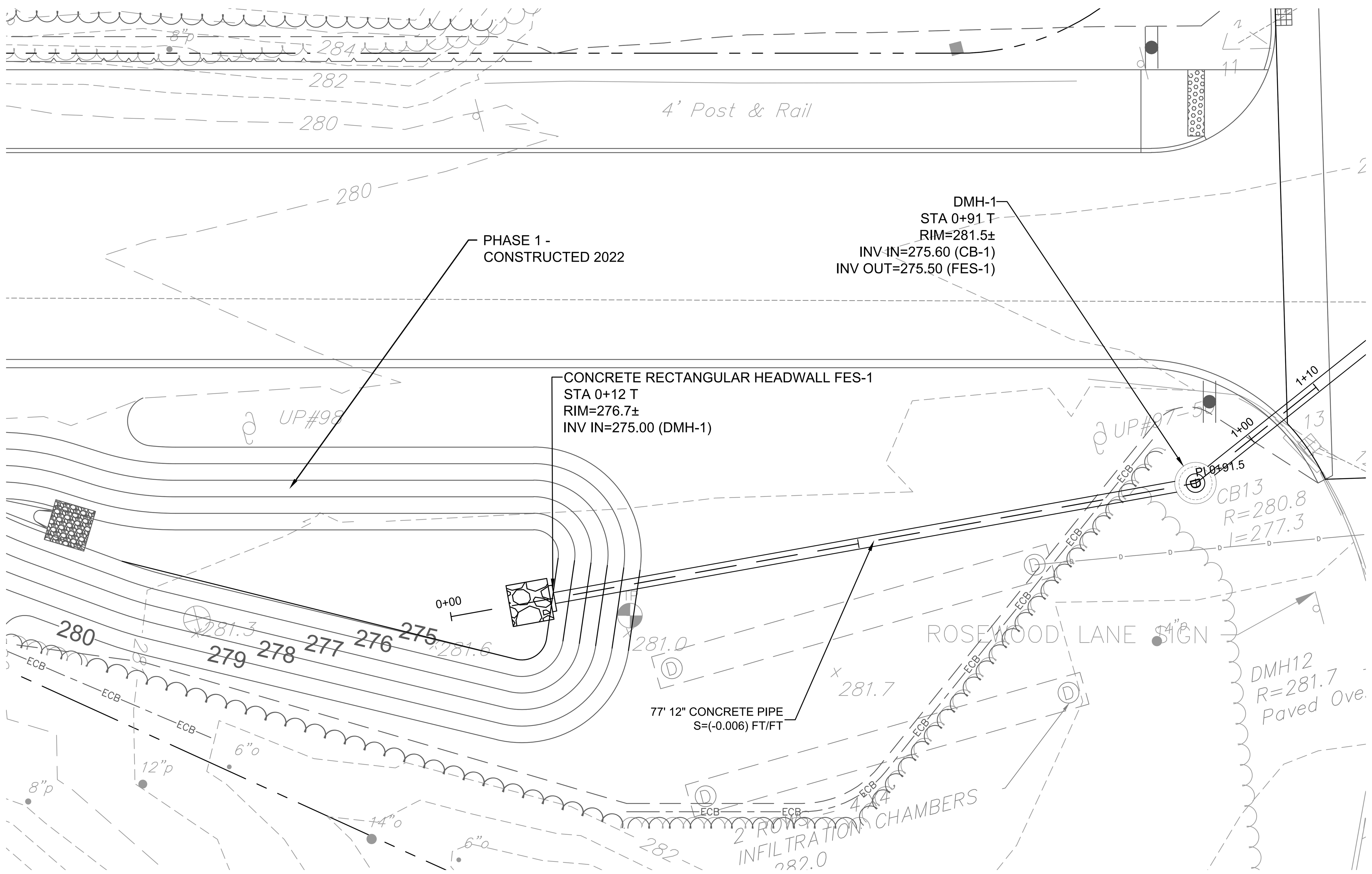
TITLE:
GROVE STREET IMPROVEMENTS
PHASE 2
CONS. DETAILS 3
FRANKLIN, MA

BETA JOB NO. 10613
ISSUE DATE 02/2023
SHEET NO. 33

2/14/2023 11:45 AM \\BETA-INC.COM\MA\PROJECTS\10600S\10613 - FRANKLIN, MA - GROVE ST ROADWAY DESIGN PHASE 2\DRAWING FILES\PLANSET\7548_TYP SEC & DETAILS.DWG (BETA STB BW.STB)

BMP - PHASE 2



PLAN: PROPOSED DRAINAGE NETWORK

SCALE = 1" = 10'

INFILTRATION BASIN

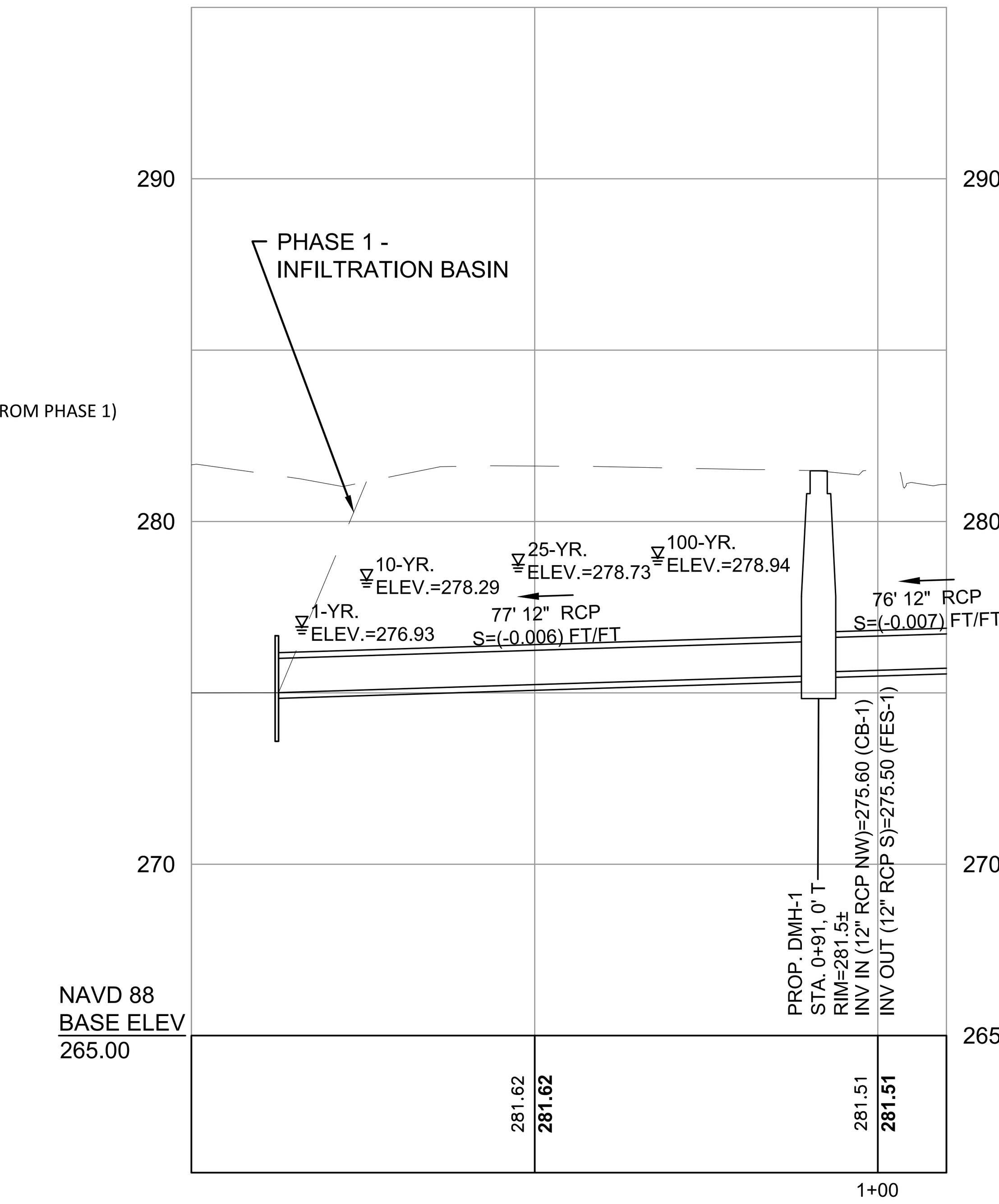
PRETEATMENT VOLUME REQ'D: 628 CF (3,198 CF PROJECT-WIDE)

PRETREATMENT VOLUME PROVIDED: 2,675 CF (EXCESS STORAGE FROM PHASE 1)

WQV PROVIDED: 2,675 CF

PEAK INFLOW RATES:
- 1-YEAR: 1.62 CFS
- 10-YEAR: 2.88 CFS
- 25-YEAR: 3.54 CFS
- 100-YEAR: 4.52 CFS

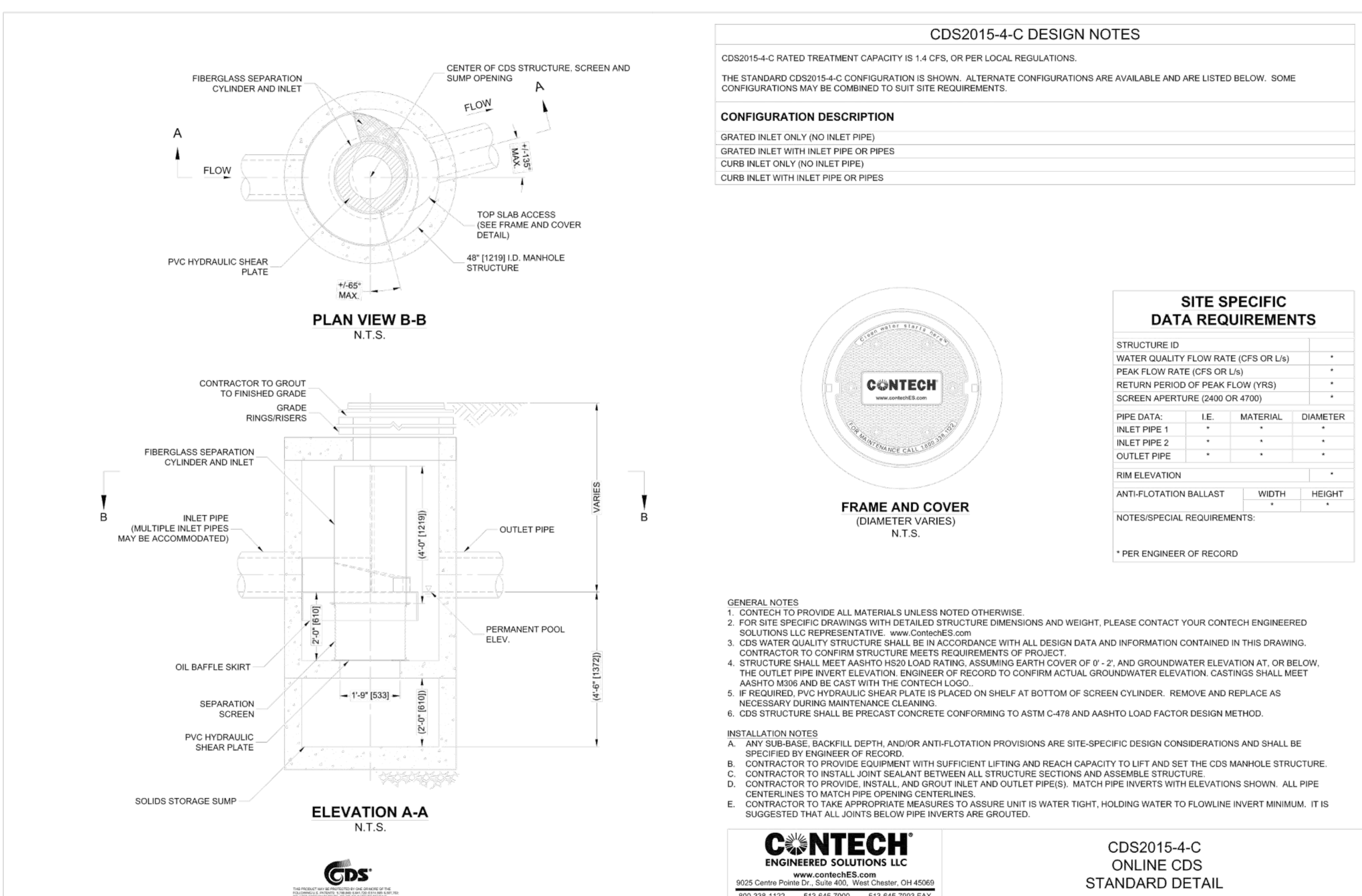
PEAK OUTFLOW RATES
- 1-YEAR: 0.25 CFS
- 10-YEAR: 0.37 CFS
- 25-YEAR: 0.41 CFS
- 100-YEAR: 0.42 CFS



PROFILE: PROPOSED DRAINAGE NETWORK

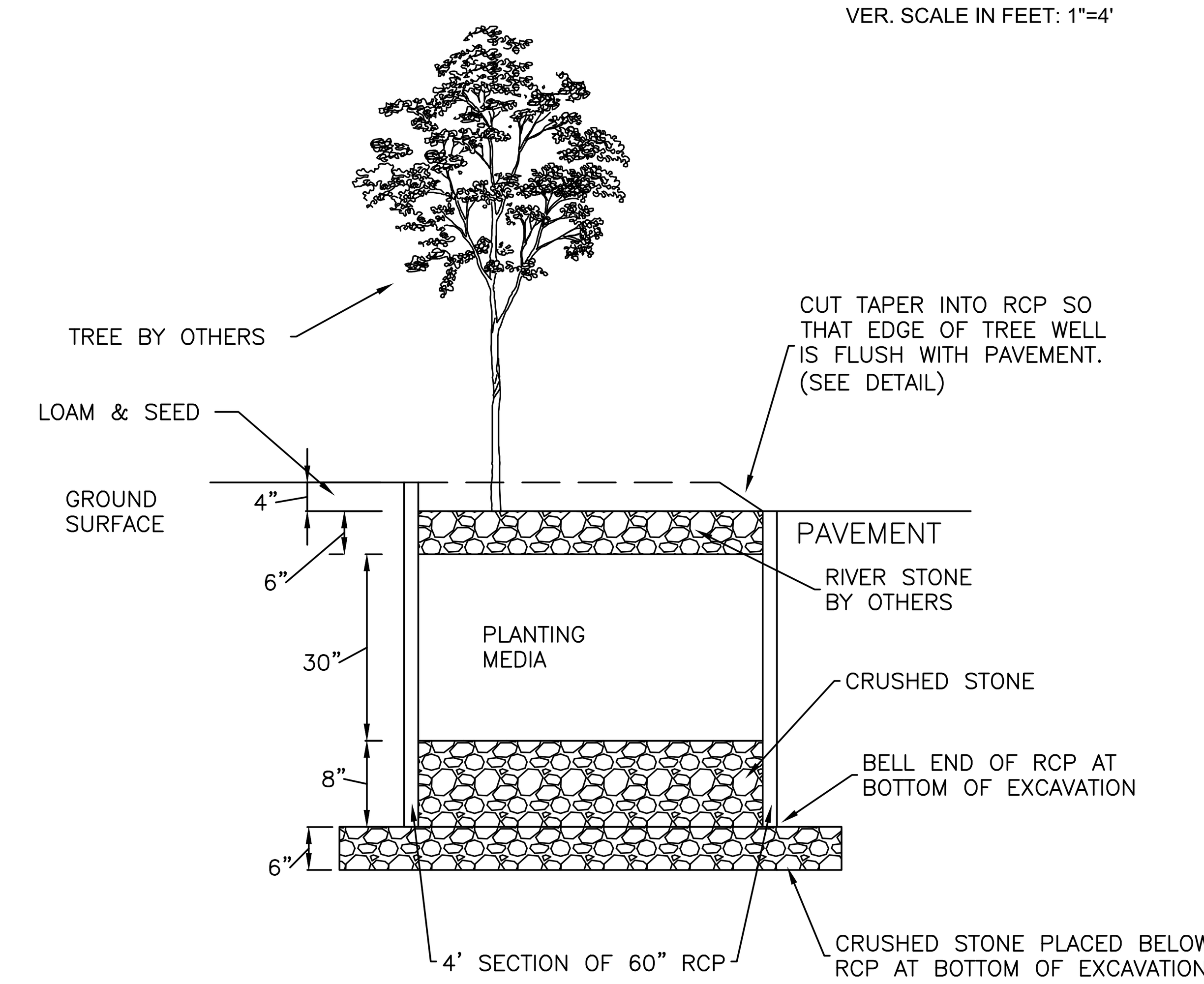
HOR. SCALE IN FEET: 1"=20'

VER. SCALE IN FEET: 1"=4'



CONTECH CDS2015-4-C

NOT TO SCALE



TREE WELL

N.T.S.

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY: CL/SR

DESIGNED BY: BB

CHECKED BY: BM

REGISTERED PROFESSIONAL: WILLIAM P. McGRATH CIVIL No. 33716 — 2/15/23

PREPARED BY: BETA www.BETA-Inc.com

SUBCONSULTANT

SCALE: AS SHOWN

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TITLE: **GROVE STREET IMPROVEMENTS PHASE 2**

CONS. DETAILS 4

FRANKLIN, MA

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