NOTICE OF INTENT

Massachusetts Wetlands Protection Act (M.G.L. Chapter 131, Section 40)
Town of Medway General Wetlands Protection Bylaw (Article XXI)

Medway Grid Energy Storage Project
Milford Street - Medway, MA

Medway Grid, LLC

Submitted to:
Medway Conservation Commission
Medway Town Hall
155 Village Street
Medway, MA 02053

Submitted by:
Medway Grid, LLC
988 Howard Avenue, Suite 200
Burlingame, CA 94010

Prepared by:
Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, Massachusetts 01754

June 8, 2023

Epsilon
ASSOCIATES INC.

Epsilon ASSOCIATES INC.

June 8, 2023

Medway Conservation Commission
155 Village Street
Medway, MA 02053

Subject: **Notice of Intent**
Medway Grid Energy Storage Project
Milford Street, Medway, Massachusetts

Dear Medway Conservation Commission:

On behalf of Medway Grid, LLC ("Medway Grid" or "the Proponent") please find enclosed a Notice of Intent ("NOI") for the proposed Medway Grid Energy Storage Project ("the Project").

The enclosed NOI has been prepared in accordance with the Massachusetts Wetlands Protection Act ("MWPA") (G.L. c. 131 § 40), its implementing Regulations (310 CMR 10.00), the Town of Medway Wetlands Protection Bylaw (Article XXI), and the Rules and Regulations of the Town of Medway Conservation Commission (amended June 25, 2020). Please note that the Proponent is concurrently filing a separate application for a Stormwater Management and Land Disturbance Permit with the Medway Conservation Commission in accordance with Section 26.5 of Medway General Bylaws Article XXVI. Much of the information contained in this NOI application is provided to support the Stormwater Management and Land Disturbance Permit filing.

The proposed Project consists of a 250 megawatt ("MW")/500 megawatt-hour ("MWh") standalone battery energy storage system ("BESS") and an ancillary structure (a new electric substation), on approximately 10.6 acres of land off Milford Street (Route 109) in Medway, Massachusetts. The Project will also involve installation of a new underground 345 kV transmission line interconnection approximately 1,420 feet from the proposed new electric substation on the Project Site to Eversource Energy's existing West Medway Substation to the south.

Enclosed please find all required state and local forms, as well as copies of the filing fee checks, including a separate check for the local bylaw fee.

This NOI is being submitted for the Commission's review during a public hearing at the next public meeting (June 22, 2023). If the Commission would like to conduct a site walk prior to that date or has any questions regarding this NOI, please do not hesitate to contact me at 978-461-6253 or via email at mbergeron@epsilonassociates.com. Thank you.

Sincerely,
EPSILON ASSOCIATES, INC.

Marc Bergeron

Marc Bergeron
Project Manager/Principal

Encl.
CC: MADEP, Central Region, 8 New Bond Street, Worcester, MA, 01606
Justin Adams, Medway Grid, LLC
Barry Fogle, Keegan Werlin
Andrew Kaplan, Pierce Atwood LLP

NOTICE OF INTENT

MASSACHUSETTS WETLANDS PROTECTION ACT AND
TOWN OF MEDWAY GENERAL WETLANDS PROTECTION BYLAW

Medway Grid Energy Storage Project
Milford Street
Medway, Massachusetts

Submitted to:

MEDWAY CONSERVATION COMMISSION
Medway Town Hall
155 Village Street
Medway, MA 02053

Submitted by:

MEDWAY GRID, LLC
988 Howard Avenue, Suite 200
Burlingame, CA 94010

Prepared by:

EPSILON ASSOCIATES, INC.
3 Mill & Main Place, Suite 250
Maynard, MA 01754

June 8, 2023

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WPA Form 3 – Notice of Intent
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Provided by MassDEP:

MassDEP File Number

Document Transaction Number

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):

49 Milford Street (Route 109) — a. Street Address
Medway — b. City/Town
02053 — c. Zip Code

Latitude and Longitude:
42.1445 — d. Latitude
-71.4477 — e. Longitude

Map 46, Parcels 55, 56, and 57 & Map 56, Parcel 6
f. Assessors Map/Plat Number — g. Parcel /Lot Number

2. Applicant:

Justin — a. First Name
Adams — b. Last Name
Medway Grid LLC — c. Organization
988 Howard Avenue, Suite 200 — d. Street Address
Burlingame — e. City/Town
CA — f. State
94010 — g. Zip Code
(860) 839-8373 — h. Phone Number
i. Fax Number
justin.adams@eolianenergy.com — j. Email Address

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

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

4. Representative (if any):

Marc — a. First Name
Bergeron — b. Last Name
Epsilon Associates — c. Company
3 Mill and Main Place, Suite 250 — d. Street Address
Maynard — e. City/Town
MA — f. State
01754 — g. Zip Code
(978) 461-6253 — h. Phone Number
(978) 897-0099 — i. Fax Number
mbergeron@epsilonassociates.com — j. Email address

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

$1,575 — a. Total Fee Paid
$775 — b. State Fee Paid
$800 — c. City/Town Fee Paid

A. General Information (continued)

6. General Project Description:

Battery energy storage facility and a new 345 kV electric substation on 10.6-acre site. Project also includes a 1,420 linear foot underground 345 kV buried transmission line interconnection (refer to Attachment A for detailed project description).

7a. Project Type Checklist:

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

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

1. ☐ Yes ☒ No If yes, describe which limited project applies to this project:

2. Limited Project

8. Property recorded at the Registry of Deeds for:

Norfolk
a. County

b. Certificate # (if registered land)

Book 34947/Pg 237, Book 10210, Pg 268, Book 34947, Pg 237, and Book 39596, Pg 495
c. Book
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.

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	1. square feet	2. square feet
c. ☐ Land Under Waterbodies and Waterways	1. linear feet 3. cubic yards dredged	2. linear feet

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

Resource Area		Size of Proposed Alteration	Proposed Replacement (if any)
d. ☐	Bordering Land Subject to Flooding	1. square feet	2. square feet
		3. cubic feet of flood storage lost	4. cubic feet replaced
e. ☐	Isolated Land Subject to Flooding	1. square feet	
		2. cubic feet of flood storage lost	3. cubic feet replaced
f. ☒	Riverfront Area	Center Brook 1. Name of Waterway (if available)	

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: 198,880 square feet

4. Proposed alteration of the Riverfront Area:

13,250	0	13,250
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)

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

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

		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

C. Other Applicable Standards and Requirements

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://www.mass.gov/dfwele/dfw/nhesp/nhregmap.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
Route 135, North Drive
Westborough, MA 01581

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.1.d, 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).*

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

City/Town

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

1. 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

3. ☐ 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)

(b) ☐ Photographs representative of the site

(c) ☐ MESA filing fee (fee information available at: http://www.mass.gov/dfwele/dfw/nhesp/nhenvmesa.htm)
Make check payable to "Natural Heritage & Endangered Species Fund" and ***mail to NHESP*** at above address

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

(d) ☐ Vegetation cover type map of site

(e) ☐ Project plans showing Priority & Estimated Habitat boundaries

d. OR Check One of the Following

1. ☐ Project is exempt from MESA review.
Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, http://www.mass.gov/dfwele/dfw/nhesp/nhenvexemptions.htm; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)

2. ☐ Separate MESA review ongoing.

a. NHESP Tracking Number ____________ b. Date submitted to NHESP ____________

3. ☐ Separate MESA review completed.
Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see www.nhesp.org regulatory review tab). 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.

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

2. 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 or hand delivery of NOI to either:

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

   Division of Marine Fisheries -
   Southeast Marine Fisheries Station
   Attn: Environmental Reviewer
   838 South Rodney French Blvd.
   New Bedford, MA 02744

   North Shore - Hull to New Hampshire:

   Division of Marine Fisheries -
   North Shore Office
   Attn: Environmental Reviewer
   30 Emerson Avenue
   Gloucester, MA 01930

   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.

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

   a. ☐ Yes ☒ No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.

   b. ACEC

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 designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?

   a. ☐ Yes ☒ No

5. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?

   a. ☐ Yes ☒ No

6. Is this project subject to provisions of the MassDEP Stormwater Management Standards?

   a. ☒ Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:

      1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)

      2. ☐ A portion of the site constitutes redevelopment

      3. ☐ Proprietary BMPs are included in the Stormwater Management System.

   b. ☐ No. 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

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 to the boundaries of each affected resource area.

3. ☒ Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4. ☒ List the titles and dates for all plans and other materials submitted with this NOI.

Medway Battery Energy Storage System - NOI Plan Set
a. Plan Title

Langan Engineering
b. Prepared By

Frank Holmes
c. Signed and Stamped by

June 8, 2023
d. Final Revision Date

1" = 20'
e. Scale

Stormwater Management Report
f. Additional Plan or Document Title

June 2023
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:

53476
2. Municipal Check Number

05/03/2023
3. Check date

53473
4. State Check Number

05/03/2023
5. Check date

Epsilon Associates
6. Payor name on check: First Name

7. Payor name on check: Last Name

F. Signatures and Submittal Requirements

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

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

1. Signature of Applicant	June 8, 2023 2. Date
3. Signature of Property Owner (if different)	4. Date
Marc Bergeron 5. Signature of Representative (if any)	June 8, 2023 6. Date

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 Forms

FILING A “NOTICE OF INTENT”

The following forms and information should be included when filing with the Medway Conservation Commission.

1. The original NOI pack plus 2 to Medway ConCom
2. 1 copy of NOI pack to DEP Central Region (627 Main Street Worcester, MA 01608)
3. 1 copy of NOI pack to Medway Town Clerk’s office
4. Electronic copy (required)
5. Any shapefiles or CAD files of wetland resources shown on the plans (optional)

NOI pack must include the following:

X ____ Notice of Intent Form (WPA Form 3 from DEP)

X ____ Plans

X ____ DEP Filing Fees

X ____ Abutter Notification

X ____ Supporting documents for utilities, replication, drainage calculations, sewer system, grading etc. (if applicable)

X ____ Summary of proposed work and how it meets the provision of the state and local wetlands laws and regulations

X ____ Town By-law Fee (if applicable)

N/A ____ Natural Heritage Notification (if applicable)

INCOMPLETE FILINGS WILL DELAY THE PROCESS

Appendix A: Wetlands Filing Fee Calculation Worksheets

Form A-1: Project Categories and Fees

for Notice of Intent (NOI) filed under the Medway General Bylaws Article XXI

The By-Law filing fees are in addition to State filing fees outlined by MA DEP in WPA Form 3 - Notice of Intent and its instructions. Two separate checks must be made payable to the Town of Medway: (1) the town share of the State fee and (2) the By-Law fee charged by the Town. As in DEP WPA Form 3, a separate check for the state share of the State filing fee is made payable to the Commonwealth of MA and sent to the MA DEP.

NOTE: At both the State and Town levels, a separate fee is charged for each proposed activity (and such activities are defined by the State regulations). For example, an NOI seeking an Order of Conditions for an addition to a single family dwelling and for a swimming pool, both in jurisdictional areas and Category 1 activities would have a By-Law fee to Medway of $500.00 for two Category 1 activities.

Category 1
For each activity, By-Law fee is $250.00
plus State fee as per WPA Form 3 ($110)

a. Work on single family lot; addition, pool, etc.
b. Site work without a house
c. Control vegetation
d. Resource improvement
e. Work on septic system separate from house
f. Monitoring well activities minus roadway
g. New agricultural or aquaculture projects

Category 2
For each activity, By-Law fee is $1,000.00
plus State fee as per WPA Form 3 ($500)

a. Construction of single family house
b. Parking lot
c. Beach nourishment
d. Electric generating facility activities
e. Inland limited projects minus road crossings and agriculture
f. Each crossing for driveway to single family house
g. Each project source (storm drain) discharge
h. Control vegetation in development
i. Water level variations
j. Any other activity not in Category 1, 3, 4, 5 or 6
k. Water supply exploration

Category 3
For each activity, By-Law Fee is $2,000.00
plus State fee as per WPA Form 3 ($1,050)

a Site preparation (for development) beyond Notice of Intent scope
b. Each building (for development) including site
c. Road construction, not crossing or driveway
d. Hazardous cleanup
e. Water supply development

Category 4
For each activity, By-Law fee is $3,000.00
plus State fee as per WPA Form 3 ($1,450)

a. Each crossing for development or commercial road
b. Dam, sluiceway, tidegate (safety) work
c. Landfills, operations/closures
d. Sand and gravel operations
e. Railroad line construction
f. Bridge
g. Hazardous waste alterations to resource areas
h. Dredging
i. Package treatment plant and discharge
j. Airport tree clearing
k. Oil and/or hazardous material release response actions

Category 5
By-Law Fee for each activity is $1,500.00
plus State fee as per WPA Form 3

a. Docks, piers, revetments, dikes, etc. (costal or inland)

Category 6
By-Law Fee is $1.50 per linear foot for a single family house project (no maximum) and a maximum of $2,000.00 for any other activity
plus State fee as per WPA Form 3

a. Boundary delineations for wetlands resources

Conservation Commission

155 VILLAGE STREET
MEDWAY, MASSACHUSETTS 02053
PHONE (508) 533-3292
bgraziano@townofmedway.org

"Please complete this form, sign at the bottom and return by mail or fax to the address indicated above."

Date: May 25, 2023

I, Justin Adams, Medway Grid, LLC **hereby give the Medway Conservation Commission and/or it's Agent permission**

Name of Property Owner

to enter my property in order to complete the site visit which is required for the review of one of the following applications;

- ☒ **Notice of Intent**
- ☐ **Request for Determination of Applicability**
- ☐ **Other ________________________________**

by the Medway Conservation Commission under Massachusetts General Laws, Ch. 131, sec. 40, and/or under Medway General Bylaws, Article XXI and its regulation . The request is made by - Medway Grid, LLC**, who is the applicant for this project and/or the rightful property owner.**

The request was submitted on: **June 8, 2023** **for work at:** **49 Milford Street**

Date Received in Conservation Dept. **Location / Address of where work will be done**

Please be advised that you will be notified of the meeting date, once this application has been assigned to a Conservation Meeting Agenda.

I am the: ☒ **Property Owner**

____
(Signature)

May 25, 2023
(Date)

Filing Fee Transmittal Form

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

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

tab

return

A. Applicant Information

1. Location of Project:

49 Milford Street (Route 109)	Medway
a. Street Address	b. City/Town
	$1,575
c. Check number	d. Fee amount

2. Applicant Mailing Address:

Justin		Adams	
a. First Name		b. Last Name	
Medway Grid, LLC			
c. Organization			
988 Howard Avenue, Suite 200			
d. Mailing Address			
Burlingame		CA	94010
e. City/Town		f. State	g. Zip Code
(860) 839-8373		justin.adams@eolianenergy.com	
h. Phone Number	i. Fax Number	j. Email Address	

3. Property Owner (if different):

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

To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).

B. Fees

Fee should be calculated using the following process & worksheet. ***Please see Instructions before filling out worksheet.***

Step 1/Type of Activity: Describe each type of activity that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories listed in the instructions.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract $12.50. To calculate the city/town share of the fee, divide the total fee in half and add $12.50.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
NOI Wetland Fee Transmittal Form
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Fees (continued)

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee
3(b) Construction of industrial facility	1	$1,050 (1.5)	$1,575

Step 5/Total Project Fee: $1,575

Step 6/Fee Payments:

Total Project Fee: $1,575
a. Total Fee from Step 5

State share of filing Fee: $775
b. 1/2 Total Fee **less $**12.50

City/Town share of filling Fee: $800
c. 1/2 Total Fee **plus** $12.50

C. Submittal Requirements

a.) Complete pages 1 and 2 and send with a check or money order for the state share of the fee, payable to the Commonwealth of Massachusetts.

Department of Environmental Protection
Box 4062
Boston, MA 02211

b.) **To the Conservation Commission:** Send the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and the city/town fee payment.

To MassDEP Regional Office (see Instructions): Send a copy of the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and a **copy** of the state fee payment. (E-filers of Notices of Intent may submit these electronically.)

WARNING - THIS CHECK IS PROTECTED BY SPECIAL SECURITY FEATURES

Epsilon ASSOCIATES INC.

Epsilon Associates, Inc
3 Mil & Main; Suite 250
MAYNARD, MA 01754
(978) 897-7100

MIDDLESEX SAVING BANK
CONCORD, MA 01742

53-7122
2113

53474

Two Thousand and no/100

DATE		AMOUNT
05/03/23	53474	$2,000.00

PAY TO THE ORDER OF

TOWN OF MEDWAY

Robert D. O'Neal

SECURITY FEATURES INCLUDE FOIL HOLOGRAM • HEAT SENSITIVE ICON • MICROPRINT • MULTI-COLOR BACKGROUND

[redacted]

WARNING - THIS CHECK IS PROTECTED BY SPECIAL SECURITY FEATURES

Epsilon ASSOCIATES INC.

Epsilon Associates, Inc
3 Mil & Main; Suite 250
MAYNARD, MA 01754
(978) 897-7100

MIDDLESEX SAVING BANK
CONCORD, MA 01742

53-7122
2113

53476

Eight Hundred and no/100

DATE		AMOUNT
05/03/23	53476	$800.00

PAY TO THE ORDER OF

TOWN OF MEDWAY

Robert D. O'Neal

SECURITY FEATURES INCLUDE FOIL HOLOGRAM • HEAT SENSITIVE ICON • MICROPRINT • MULTI-COLOR BACKGROUND

[redacted]

WARNING - THIS CHECK IS PROTECTED BY SPECIAL SECURITY FEATURES

Epsilon ASSOCIATES INC.

Epsilon Associates, Inc
3 Mil & Main; Suite 250
MAYNARD, MA 01754
(978) 897-7100

MIDDLESEX SAVING BANK
CONCORD, MA 01742

53-7122
2113

53473

Seven Hundred Seventy Five and no/100

DATE		AMOUNT
05/03/23	53473	$775.00

PAY TO THE ORDER OF

COMMONWEALTH OF MASSACHUSETTS
P.O. BOX 419272
BOSTON MA 02441-9272

Robert D. O'Neal

SECURITY FEATURES INCLUDE FOIL HOLOGRAM • HEAT SENSITIVE ICON • MICROPRINT • MULTI-COLOR BACKGROUND

[redacted]

Abutter Notification

Notification to Abutters

Medway Grid Energy Storage Project

This is a notification required by law. You are receiving this notification because you have been identified as the owner of land abutting another parcel of land for which certain activities are proposed. Those activities require a permit under the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40) and the Town of Medway Wetlands Protection Bylaw (Article XXI).

In accordance with the second paragraph of the Massachusetts Wetlands Protection Act, and 310 CMR 10.05(4)(a) of the Wetlands Regulations and Section 21.4(a) of the Medway Wetlands Protection Bylaw, you are hereby notified that:

A. A Notice of Intent was filed with the Medway Conservation Commission on June 8, 2023 seeking permission to remove, fill, dredge, or alter an area subject to protection under M.G.L. c. 131 §40 and Article XXI. The following is a description of the proposed activity/activities:

   Construction of a new battery energy storage facility and a new 345 kV electric substation on a 10.6-acre Project Site off Milford Street (Route 109). The Project also includes installation of a 1,420 linear foot underground 345 kV buried transmission line interconnection from the new project substation to an existing Eversource substation to the south.

B. The name of the applicant is: Medway Grid, LLC

C. The address of the land where the activity is proposed is: Milford Street (Route 109) (Assessors Map 46, Parcels 55, 56, and 57 & Assessors Map 56, Parcel 6)

D. Copies of the Notice of Intent may be examined or obtained at the office of the Medway Conservation Commission, located at Medway Town Hall, 155 Village Street, Medway. The regular business hours of the Commission are Monday through Thursday 7:30 am -4:30 pm and Friday 7:30 am -12:30 pm, and the Commission may be reached at (508) 533-3292.

E. Copies of the Notice of Intent may be obtained from the applicant or their representative by calling Marc Bergeron of Epsilon Associates at (978) 461-6253.

F. Information regarding the date and time of the public hearing for the Notice of Intent may be obtained from the Medway Conservation Commission. Note that the Medway Conservation Commission meetings are virtual unless requiring special assistance and all information regarding the meeting will be available on the posted agendas with the Town of Medway. In addition, a notice of the public hearing will be published at least five business days in advance in the Milford Daily News.

TOWN OF MEDWAY
BOARD OF ASSESSORS
155 VILLAGE STREET
MEDWAY, MA 02053
PHONE: 508-533-3203 FAX: 508-321-4981
www.townofmedway.org

RECEIVED
MAR 29 2023
MEDWAY ASSESSORS
MEDWAY, MA 02053

REQUEST FOR ABUTTERS

Date of Request: 3/29/23

Property owner: Exelon West Medway LLC

Property location: 34 West St

Parcel (property) ID(S): 66-012

Please specify 100', 300' or 500' from subject parcel: 56-012

THIS LIST IS REQUESTED FOR:

_____ Planning & Economic Development Board
_____ Zoning Board of Appeals
X Conservation Commission
_____ Historical Commission

REQUESTER INFORMATION:

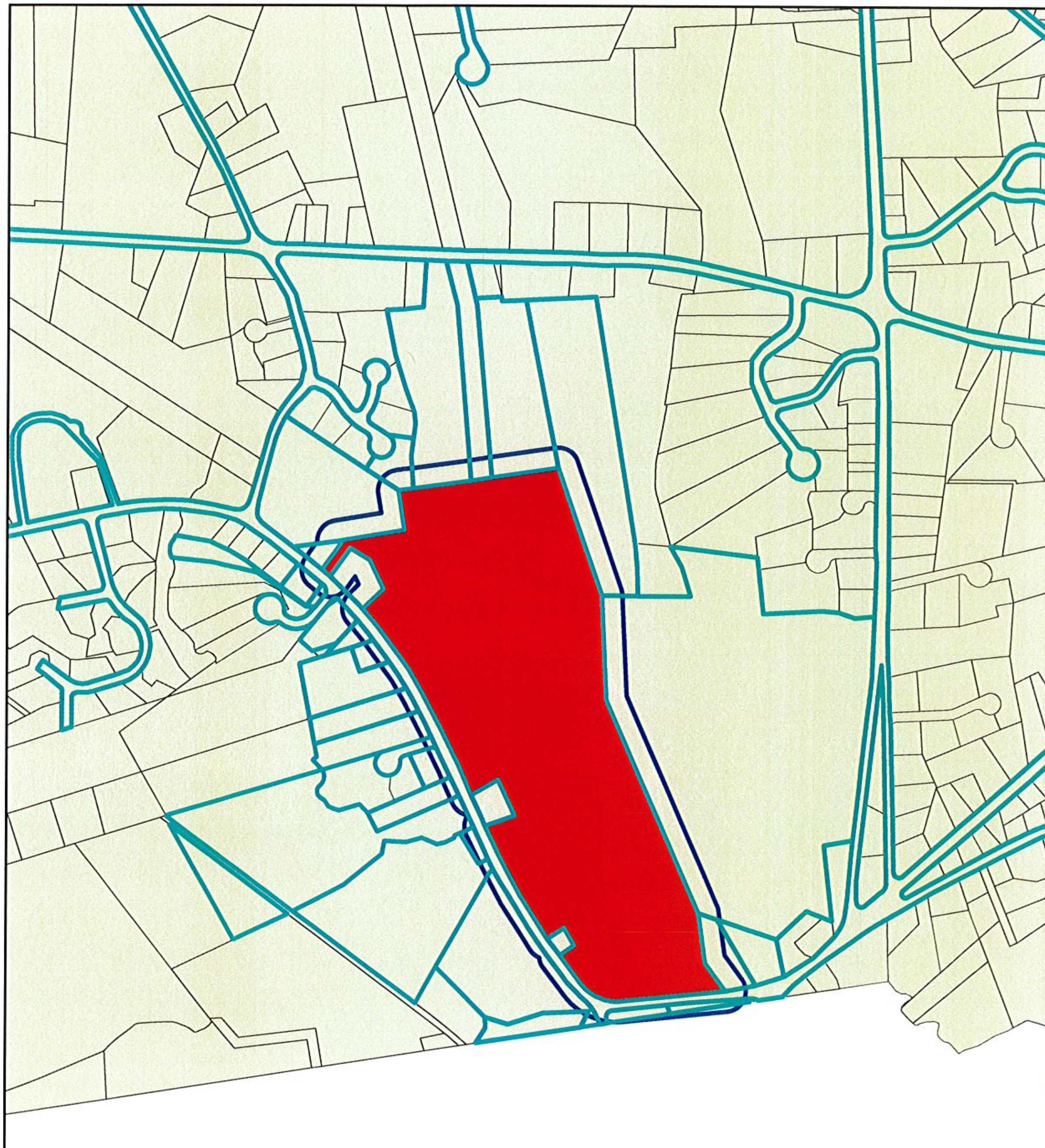
Name: Marc Bergeron Email address: mbergeron@epsilonassociates.com

Address: Epsilon Associates

Phone: 508-212-0420

THERE IS A FEE OF $15.00 PER PARCEL DUE AT THE TIME OF REQUEST. THE LIST IS VALID FOR 90 DATE OF CERTIFICATION DATE. THE BOARD OF ASSESSORS RESERVES 10 WORKING DAYS TO PROVIDE ALL CERTIFIED LISTS OF ABUTTERS. ***IF YOU WISH TO HAVE THE LISTS MAILED BACK TO YOU, YOU MUST PROVIDE A SELF ADDRESSED STAMPED ENVELOPE LARGE ENOUGH FOR THREE SETS OF LABELS.***

July 2014



6 PINE MEADOW RD 55-021
LUC: 101
BONCI JEFFREY
BONCI HOLLY
6 PINE MEADOW RD
MEDWAY. MA 02053

53 R MILFORD ST 56-004
LUC: 423
BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

61 R MILFORD ST 56-003
LUC: 423
BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

0 MILFORD ST 56-002
LUC: 423
BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

65 MILFORD ST 56-001
LUC: 423
BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

0 WEST ST 55-026
LUC: 423
BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

45 WEST ST 55-048
LUC: 423
BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

43 WEST ST 55-049
LUC: 423
BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

41 WEST ST 55-050
LUC: 423
BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

39 WEST ST 55-051
LUC: 101
BRODY STEVEN GREGORY
39 WEST STREET
MEDWAY. MA 02053

46 WEST ST 55-028
LUC: 101
COLLARI DAVID A
COLLARI KATELYN
46 WEST ST
MEDWAY. MA 02053

50 WEST ST 55-027
LUC: 101
DEL MONTE THOMAS M
50 WEST ST.
MEDWAY. MA 02053

34 WEST ST 66-012
LUC: 423
EXELON WEST MEDWAY LLC
C/O NSTAR SERVICES CO.
PO BOX 340014
NASHVILLE. TN 37203

12 WEST ST 66-010
LUC: 424
EXELON WEST MEDWAY LLC
C/O NSTAR SERVICES CO.
PO BOX 340014
NASHVILLE. TN 37203

9 SUMMER ST 66-013
LUC: 450
EXELON WEST MEDWAY LLC
REAL ESTATE PROPERTY TAX
PO BOX 340014
NASHVILLE. TN 37203

37 WEST ST 65-024
LUC: 101
GBW SENIOR APARTMENTS LLC
79 B CHAPEL ST
NEWTON. MA 02458

31 WEST ST 66-003
LUC: 112
GBW SENIOR APARTMENTS LLC
79 B CHAPEL ST
NEWTON. MA 02458-1010

47 WEST ST 55-045
LUC: 101
GILMAN GERARD C
47 WEST ST.
MEDWAY. MA 02053

33 WEST ST 66-002
LUC: 112
GLEN BROOK WAY APARTMENTS LLC
79 B CHAPEL ST
NEWTON. MA 02458

2 WEST ST 66-017
LUC: 109
HOLLINGSWORTH JON B
HOLLINGSWORTH LORRE
59 STANDISH ROAD
WELLESLEY. MA 02481

6 WEST ST 66-017-C002
LUC: 102
MARUTHUMOHAN SIBBI MARUTHU NONDISONAI
6 WEST ST
MEDWAY. MA 02053

5 WEST ST 66-052
LUC: 930
MEDWAY TOWN OF
155 VILLAGE ST
MEDWAY. MA 02053

29 WEST ST 65-027
LUC: 423
NEW ENGLAND POWER COMPANY
PROPERTY TAX DEPT.
40 SYLVAN ROAD
WALTHAM. MA 02451

27 WEST ST 66-004
LUC: 423
NEW ENGLAND POWER COMPANY
PROPERTY TAX DEPT.
40 SYLVAN ROAD
WALTHAM. MA 02451

23 WEST ST 65-028
LUC: 423
NEW ENGLAND POWER COMPANY
PROPERTY TAX DEPT.
40 SYLVAN ROAD
WALTHAM. MA 02451

30 WEST ST 66-011
LUC: 423
NEW ENGLAND POWER COMPANY
PROPERTY TAX DEPT.
40 SYLVAN ROAD
WALTHAM. MA 02451

49 WEST ST 55-037
LUC: 101
OLSEN KENNETH G.
OLSEN JACQUELINE
49 WEST ST.
MEDWAY. MA 02053

3 WEST ST 66-053
LUC: 132
PETRUCCI MICHAEL
3 WEST ST
MEDWAY. MA 02053

11 MILLBROOK RD 55-038
LUC: 101
VIALL ANDREW
VIALL GEMANIQUE
11 MILLBROOK RD.
MEDWAY. MA 02053

4 WEST ST 66-017-C001
LUC: 102
YUDINA DARIYA S
GEGENHEIMER ANDREW J
4 WEST ST
MEDWAY. MA 02053

THIS IS A CERTIFIED ABUTTERS LIST FROM THE TOWN OF MEDWAY.
WE CERTIFY THAT AT TIME OF [illegible] THE NAMES AND
ADDRESSES OF PROPERTY OWNERS ARE ACCURATE.
Office of the Board of Assessors
Date 3-30-23

TOWN OF MEDWAY
BOARD OF ASSESSORS
155 VILLAGE STREET
MEDWAY, MA 02053
PHONE: 508-533-3203 FAX: 508-321-4981
www.townofmedway.org

RECEIVED
MAR 29 2023
MEDWAY ASSESSORS
MEDWAY, MA 02053

REQUEST FOR ABUTTERS

Date of Request: 3/28/23

Property owner: Boston Edison Co

Property location: 53 R Millford St

Parcel (property) ID(S): 56-004

Please specify 100' 300' or 500' from subject parcel: 56-004

THIS LIST IS REQUESTED FOR:

____ Planning & Economic Development Board
____ Zoning Board of Appeals
X Conservation Commission
____ Historical Commission

REQUESTER INFORMATION:

Name: Marc Bergeron

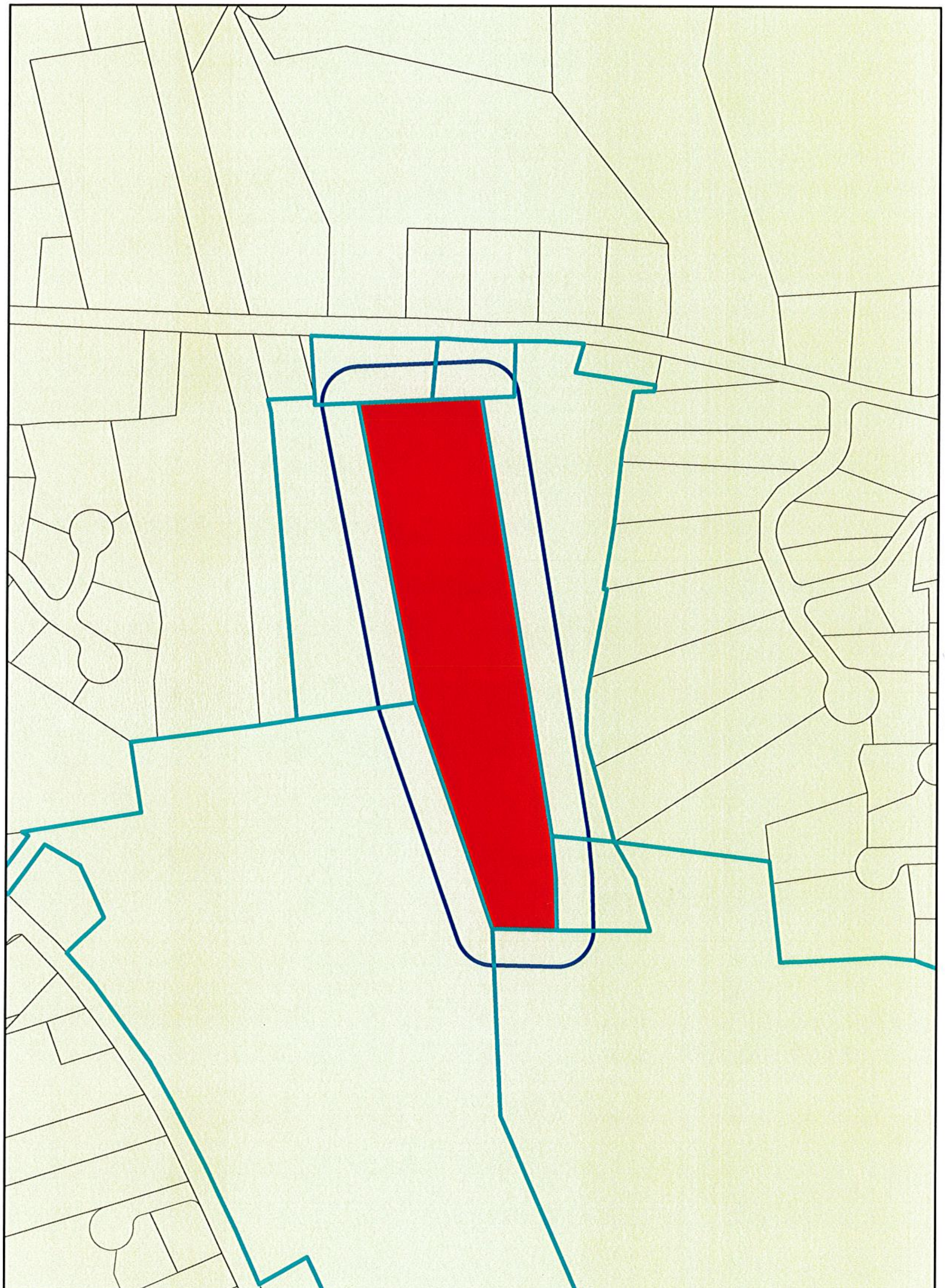
Email address: mbergeron@epsilonassociates.com

Address: Epsilon Associates

Phone: 508-212-0420

THERE IS A FEE OF $15.00 PER PARCEL DUE AT THE TIME OF REQUEST. THE LIST IS VALID FOR 90 DATE OF CERTIFICATION DATE. THE BOARD OF ASSESSORS RESERVES 10 WORKING DAYS TO PROVIDE ALL CERTIFIED LISTS OF ABUTTERS. ***IF YOU WISH TO HAVE THE LISTS MAILED BACK TO YOU, YOU MUST PROVIDE A SELF ADDRESSED STAMPED ENVELOPE LARGE ENOUGH FOR THREE SETS OF LABELS.***

July 2014



53 MILFORD ST	46-056
	LUC: 332

53 MILFORD STREET LLC
53 MILFORD ST
MEDWAY. MA 02053

53 R MILFORD ST	56-004
	LUC: 423

BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

61 R MILFORD ST	56-003
	LUC: 423

BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

49 MILFORD ST	56-006
	LUC: 101

CHAFFEE ALLAN H
49 MILFORD ST.
MEDWAY. MA 02053

49 MILFORD ST	56-005
	LUC: 423

EXELON WEST MEDWAY LLC
EXELON CORPORATION
PO BOX 340014
NASHVILLE. TN 37203

34 WEST ST	66-012
	LUC: 423

EXELON WEST MEDWAY LLC
C/O NSTAR SERVICES CO.
PO BOX 340014
NASHVILLE. TN 37203

9 SUMMER ST	66-013
	LUC: 450

EXELON WEST MEDWAY LLC
REAL ESTATE PROPERTY TAX
PO BOX 340014
NASHVILLE. TN 37203

55 MILFORD ST	46-057
	LUC: 101

NELSON TRUSTEE DENNIS W
TERESE A NELSON TRUST
20 STONEY BROOK LANE
WRENTHAM. MA 02093

THIS IS A CERTIFIED ABUTTERS LIST FROM THE TOWN OF MEDWAY.
WE CERTIFY THAT AT TIME OF LAST ASSESSMENT, THE NAMES AND ADDRESSES OF ALL PROPERTY OWNERS, ARE ACCURATE.
Office of the Board of Assessors 3-29-23
Date

TOWN OF MEDWAY
BOARD OF ASSESSORS
155 VILLAGE STREET
MEDWAY, MA 02053
PHONE: 508-533-3203 FAX: 508-321-4981
www.townofmedway.org

RECEIVED
MAR 29 2023
MEDWAY ASSESSORS
MEDWAY, MA 02053

REQUEST FOR ABUTTERS

Date of Request: 3/29/23

Property owner: Dennis W. Nelson Trustee

Property location: 55 Milford St

Parcel (property) ID(S): 46-057

Please specify: 100', 300' or 500' from subject parcel: 46-057

THIS LIST IS REQUESTED FOR:

____ Planning & Economic Development Board
____ Zoning Board of Appeals
X Conservation Commission
____ Historical Commission

REQUESTER INFORMATION:

Name: Marc Bergeron

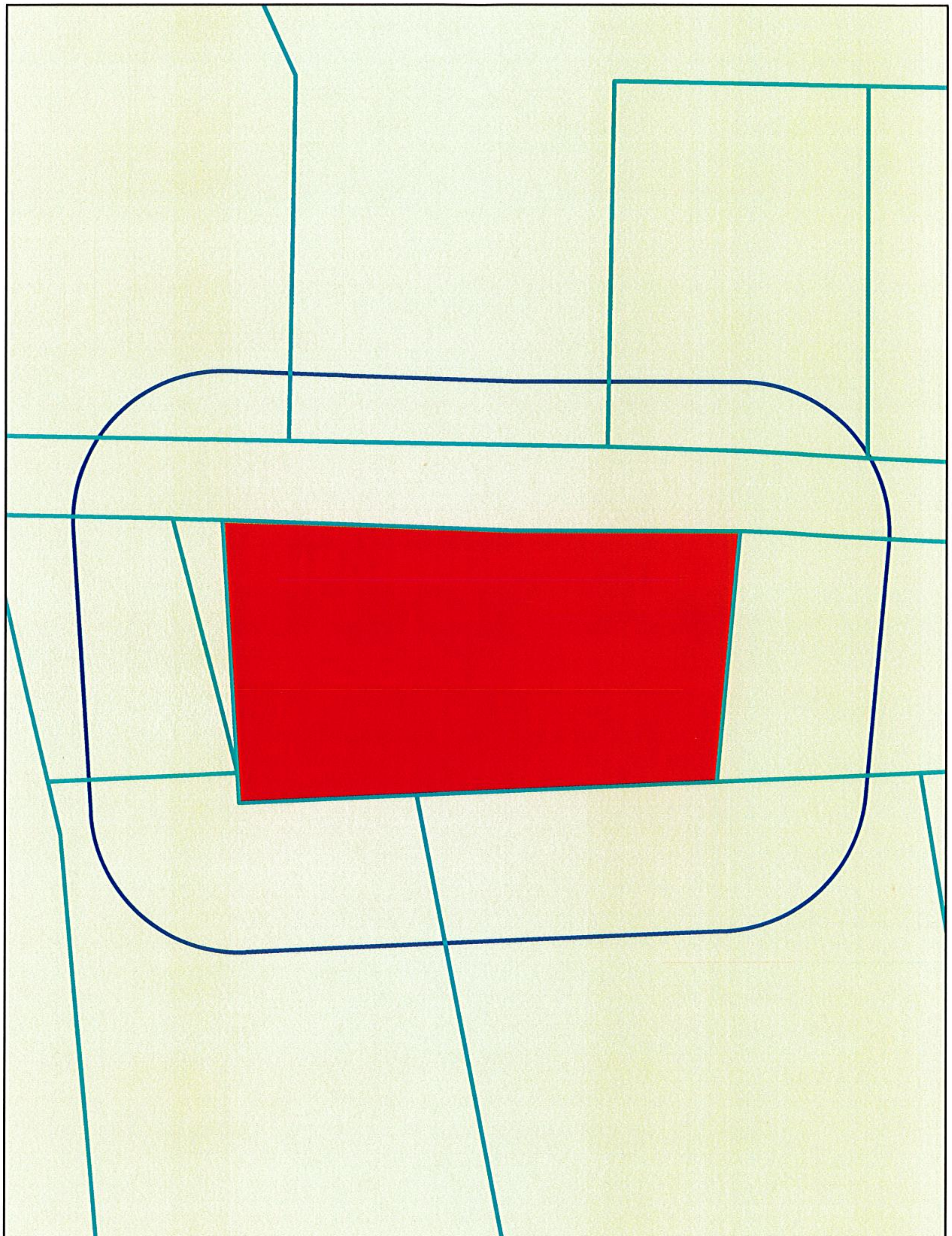
Email address: mbergeron@epsilonassociates.com

Address: Epsilon Associates

Phone: 508-212-0420

THERE IS A FEE OF $15.00 PER PARCEL DUE AT THE TIME OF REQUEST. THE LIST IS VALID FOR 90 DATE OF CERTIFICATION DATE. THE BOARD OF ASSESSORS RESERVES 10 WORKING DAYS TO PROVIDE ALL CERTIFIED LISTS OF ABUTTERS. ***IF YOU WISH TO HAVE THE LISTS MAILED BACK TO YOU, YOU MUST PROVIDE A SELF ADDRESSED STAMPED ENVELOPE LARGE ENOUGH FOR THREE SETS OF LABELS.***

July 2014



53 MILFORD ST — 46-056
LUC: 332

53 MILFORD STREET LLC
53 MILFORD ST
MEDWAY. MA 02053

11 BAYBERRY LN — 46-005
LUC: 957

AMEGO INC
33 PERRY AVE
ATTLEBORO. MA 02703

53 R MILFORD ST — 56-004
LUC: 423

BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

61 R MILFORD ST — 56-003
LUC: 423

BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

61 MILFORD ST — 46-059
LUC: 423

BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

61 A MILFORD ST — 46-059-0001
LUC: 423

BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

10 BAYBERRY LN — 46-004
LUC: 101

LAMSON ROBERT C
LAMSON ALYSON B.
10 BAYBERRY LN.
MEDWAY. MA 02053

54 MILFORD ST — 46-019
LUC: 101

MACLEOD KENNETH J
APPLEMAN LIFE ESTATE CHARLENE CERIER
54 MILFORD ST.
MEDWAY. MA 02053

55 MILFORD ST — 46-057
LUC: 101

NELSON TRUSTEE DENNIS W
TERESE A NELSON TRUST
20 STONEY BROOK LANE
WRENTHAM. MA 02093

56 MILFORD ST — 46-020
LUC: 101

WILLIAMS ANN
LEARY HANNAH
56 MILFORD ST.
MEDWAY. MA 02053

THIS IS A CERTIFIED ABUTTERS LIST FROM THE TOWN OF MEDWAY.
WE CERTIFY THAT AT TIME OF LAST ASSESSMENT, THE NAMES AND ADDRESSES OF ALL PROPERTY OWNERS ARE ACCURATE.

[signature] 3-23-23
Office of the Board of Assessors — Date

TOWN OF MEDWAY
BOARD OF ASSESSORS
155 VILLAGE STREET
MEDWAY, MA 02053
PHONE: 508-533-3203 FAX: 508-321-4981
www.townofmedway.org

RECEIVED
MAR 29 2023
MEDWAY ASSESSORS
MEDWAY, MA 02053

REQUEST FOR ABUTTERS

Date of Request: 3/29/23

Property owner: 53 Milford St LLC

Property location: 53 Milford St

Parcel (property) ID(S): 46-056

Please specify 100', 300' or 500' from subject parcel: ______

THIS LIST IS REQUESTED FOR:

___ Planning & Economic Development Board
___ Zoning Board of Appeals
_X_ Conservation Commission
___ Historical Commission

REQUESTER INFORMATION:

Name: Marc Bergeron

Email address: mbergeron@epsilonassociates.com

Address: Epsilon Associates

Phone: 508-212-0420

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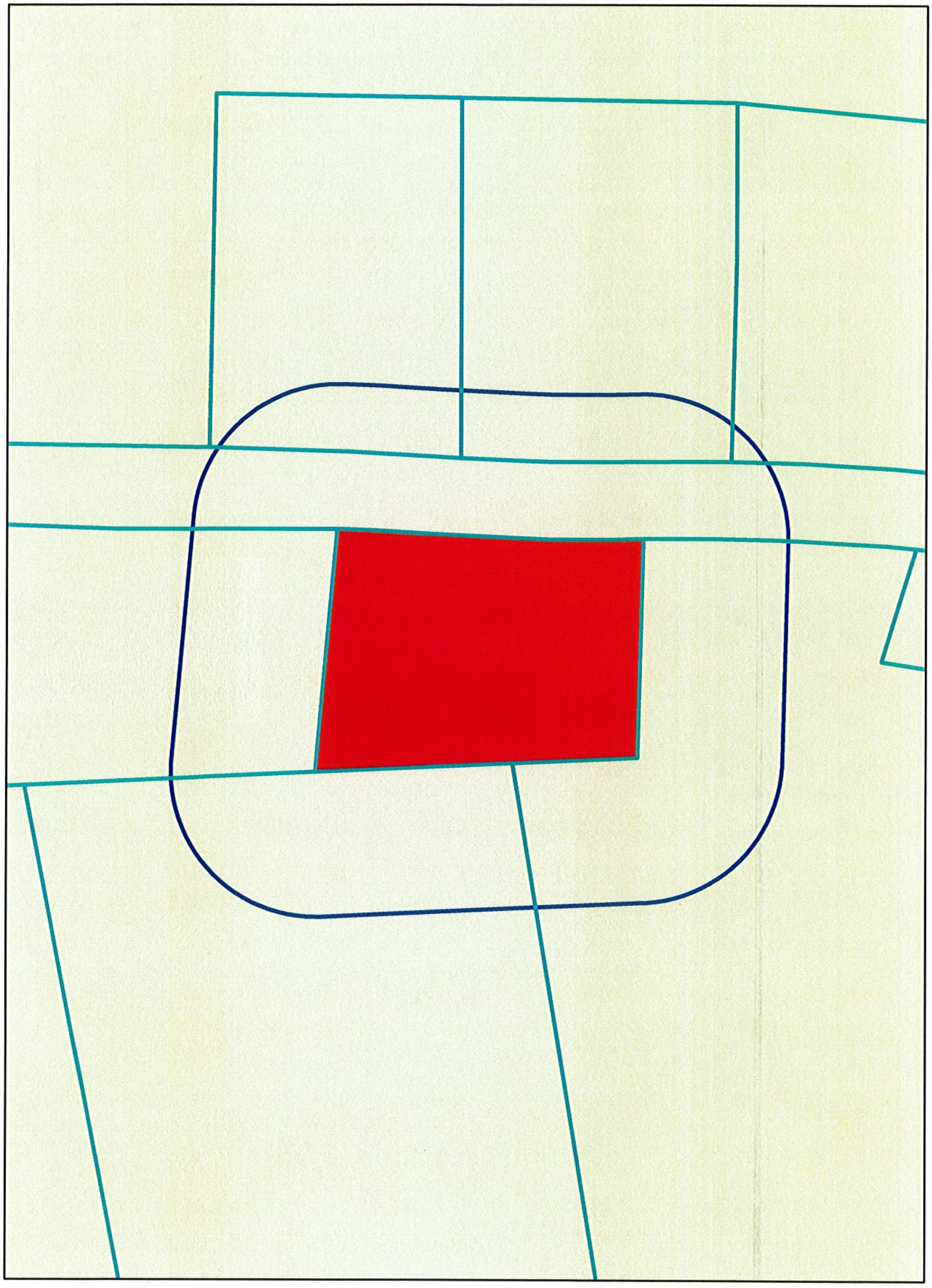
July 2014



53 MILFORD ST 46-056

LUC: 332

53 MILFORD STREET LLC
53 MILFORD ST
MEDWAY. MA 02053

53 R MILFORD ST 56-004

LUC: 423

BOSTON EDISON CO
NSTAR SERVICES CO/PROP TAX DEP
PO BOX 270
HARTFORD. CT 06141-0270

49 MILFORD ST 56-006

LUC: 101

CHAFFEE ALLAN H
49 MILFORD ST.
MEDWAY. MA 02053

54 MILFORD ST 46-019

LUC: 101

MACLEOD KENNETH J
APPLEMAN LIFE ESTATE CHARLENE CERIER
54 MILFORD ST.
MEDWAY. MA 02053

55 MILFORD ST 46-057

LUC: 101

NELSON TRUSTEE DENNIS W
TERESE A NELSON TRUST
20 STONEY BROOK LANE
WRENTHAM. MA 02093

52 MILFORD ST 46-018

LUC: 101

ROBINSON JASON L
52 MILFORD ST.
MEDWAY. MA 02053

56 MILFORD ST 46-020

LUC: 101

WILLIAMS ANN
LEARY HANNAH
56 MILFORD ST.
MEDWAY. MA 02053

THIS IS A CERTIFIED ABUTTERS LIST FROM THE TOWN OF MEDWAY. WE CERTIFY THAT AT TIME OF LAST ASSESSMENT, THE NAMES AND ADDRESSES OF ALL PROPERTY OWNERS ARE ACCURATE.

Melissa Sinard 3-29-23

Office of the Board of Assessors Date

TOWN OF MEDWAY
BOARD OF ASSESSORS
155 VILLAGE STREET
MEDWAY, MA 02053
PHONE: 508-533-3203 FAX: 508-321-4981
www.townofmedway.org

RECEIVED
MAR 29 2023
MEDWAY ASSESSORS
MEDWAY, MA 02053

REQUEST FOR ABUTTERS

Date of Request: 3/24/23

Property owner: Allan Chaffee

Property location: 49 Milford St

Parcel (property) ID(S): 46-055

Please specify 100', 300' or 500' from subject parcel: 46-055

THIS LIST IS REQUESTED FOR:

____ Planning & Economic Development Board
____ Zoning Board of Appeals
_X_ Conservation Commission
____ Historical Commission

REQUESTER INFORMATION:

Name: Marc Bergeron

Email address: mbergeron@epsilonassociates.com

Address: Epsilon Associates

Phone: 508-212-0420

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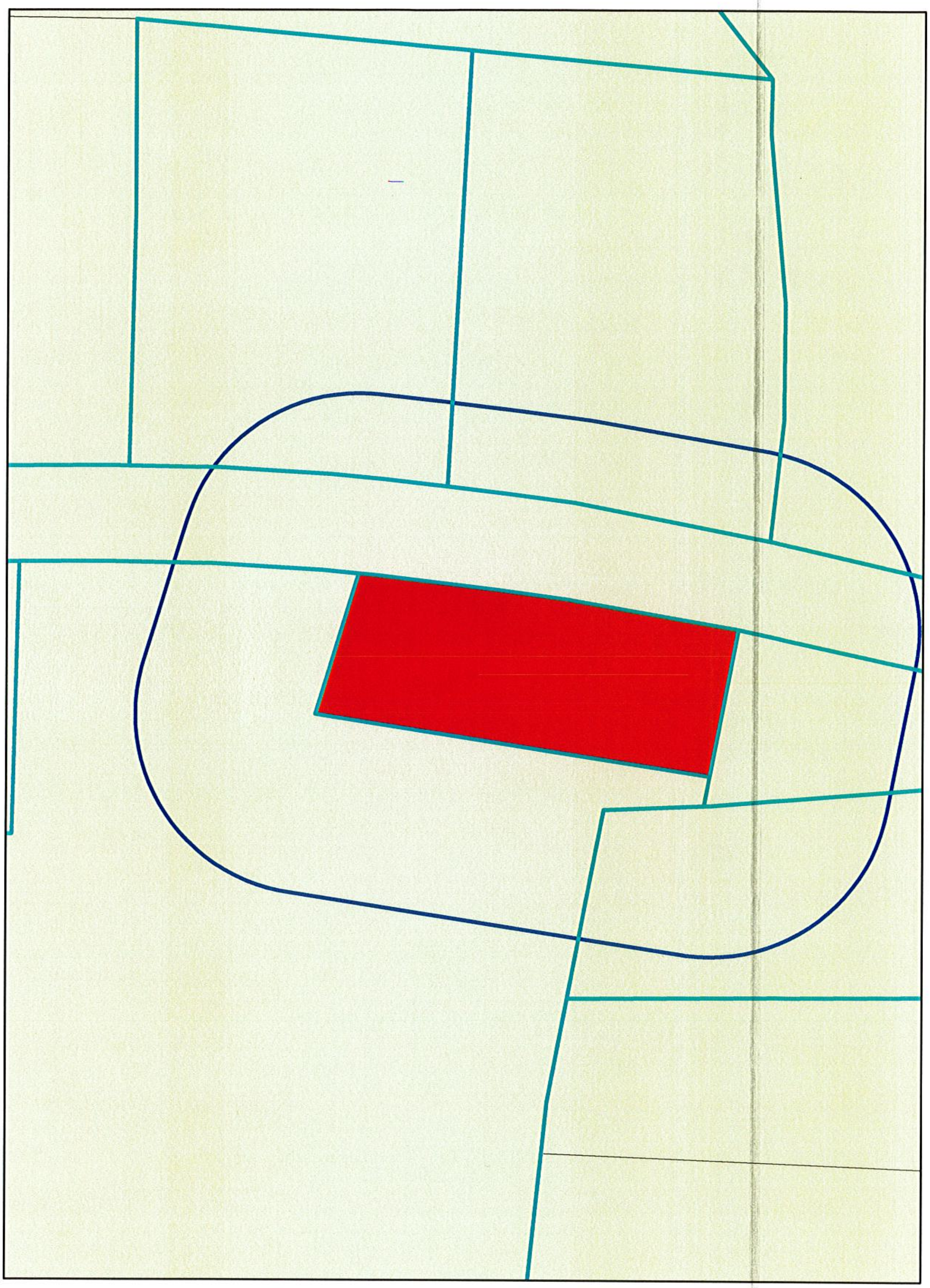
July 2014



2 LITTLE TREE RD 46-053

LUC: 101

ARAYA MATTHEW E
ARAYA AHSLEY A
2 LITTLE TREE RD
MEDWAY. MA 02053

49 MILFORD ST 46-055

LUC: 130

CHAFFEE ALLAN H
49 MILFORD ST.
MEDWAY. MA 02053

49 MILFORD ST 56-006

LUC: 101

CHAFFEE ALLAN H
49 MILFORD ST.
MEDWAY. MA 02053

48 MILFORD ST 46-016

LUC: 932

MEDWAY TOWN OF CONSERVATION
155 VILLAGE ST.
MEDWAY. MA 02053

52 MILFORD ST 46-018

LUC: 101

ROBINSON JASON L
52 MILFORD ST.
MEDWAY. MA 02053

50 MILFORD ST 46-017

LUC: 101

SMITH FRANCIS E
SMITH CAROLYN M
50 MILFORD ST.
MEDWAY. MA 02053

47 A MILFORD ST 46-054

LUC: 132

UNKNOWN OWNER
155 VILLAGE ST.
MEDWAY. MA 02053

THIS IS A CERTIFIED ABUTTERS LIST FROM THE TOWN OF MEDWAY.
WE CERTIFY THAT AT TIME OF LAST ASSESSMENT, THE NAMES AND ADDRESSES OF ALL PROPERTY OWNERS ARE ACCURATE.

Millina Smaid 3-29-23

Office of the Board of Assessors Date

TOWN OF MEDWAY
BOARD OF ASSESSORS
155 VILLAGE STREET
MEDWAY, MA 02053
PHONE: 508-533-3203 FAX: 508-321-4981
www.townofmedway.org

RECEIVED
MAR 29 2023
MEDWAY ASSESSORS
MEDWAY, MA 02053

REQUEST FOR ABUTTERS

Date of Request: 3/29/23

Property owner: Allan Chaffee

Property location: 49 Milford St

Parcel (property) ID(S): ~~[illegible]~~ 56-006

Please specify: 100' 300' or 500' from subject parcel: ~~56~~ 46 -056

THIS LIST IS REQUESTED FOR:

_____ Planning & Economic Development Board
_____ Zoning Board of Appeals
_____ Conservation Commission
_____ Historical Commission

REQUESTER INFORMATION:

Name: Marc Bergeron   Email address: mbergeron@epsilonassociates.com

Address: Epsilon Associates

Phone: 508-212-0420

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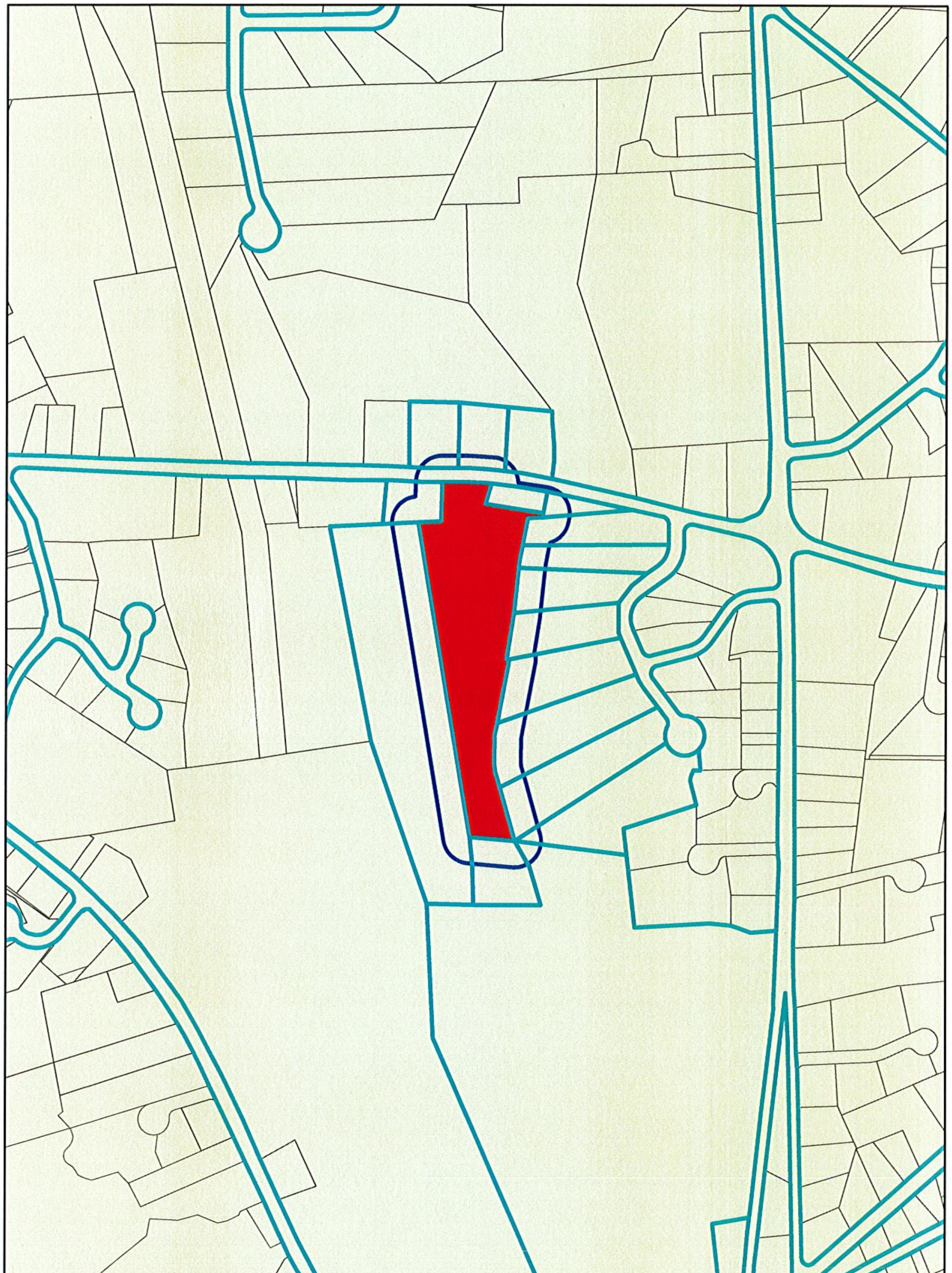

53 MILFORD ST 46-056
LUC: 332

53 MILFORD STREET LLC
53 MILFORD ST
MEDWAY. MA 02053

14 LITTLE TREE RD 56-011
LUC: 101

HOUSER ADAM A
HOUSER SARA L
14 LITTLE TREE RD.
MEDWAY. MA 02053

2 LITTLE TREE RD 46-053
LUC: 101

ARAYA MATTHEW E
ARAYA AHSLEY A
2 LITTLE TREE RD
MEDWAY. MA 02053

54 MILFORD ST 46-019
LUC: 101

MACLEOD KENNETH J
APPLEMAN LIFE ESTATE CHARLENE CERIER
54 MILFORD ST.
MEDWAY. MA 02053

8 LITTLE TREE RD 56-008
LUC: 101

BELL CHRISTOPHER J
BELL TERESA R
8 LITTLE TREE RD.
MEDWAY. MA 02053

10 LITTLE TREE RD 56-009
LUC: 101

MATHEW MANOJ V
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53 R MILFORD ST 56-004
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49 MILFORD ST 46-055
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16 LITTLE TREE RD 56-012
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MUNISAMY THIRUVENGADAM
MUNISAMY SHARON
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49 MILFORD ST 56-006
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52 MILFORD ST 46-018
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FLANNAGAN JOHN J
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6 LITTLE TREE RD 56-007
LUC: 101

HENRY MICHAEL R
THOMAS ASHLEY D
6 LITTLE TREE RD.
MEDWAY. MA 02053

THIS IS A CERTIFIED ABUTTERS LIST FROM THE TOWN OF MEDWAY.
WE CERTIFY THAT AT TIME OF LAST ASSESSMENT, THE NAMES AND ADDRESSES OF ALL PROPERTY OWNERS, ARE ACCURATE.
Office of the Board of Assessors 3-29-23
Date

Attachment A

Project Narrative

ATTACHMENT A – PROJECT NARRATIVE

1.0 Introduction

Medway Grid LLC ("the Proponent") is proposing to construct and operate a 250 megawatt ("MW") / 500 megawatt-hour ("MWh") standalone battery energy storage system ("BESS") and a new 345kV/34.5kV electric substation ("the BESS Substation") on property located off Milford Street, also identified as Route 109, in Medway, Massachusetts ("the Project Site"). The Proponent also plans the construction of a new underground 345 kV transmission line interconnection to extend approximately 1,420 feet from the proposed BESS Substation to Eversource Energy's existing West Medway Substation ("the Eversource Substation") to the south ("the Proposed Transmission Line Interconnection").

The BESS and associated facilities will add a reliable electric resource to the regional electrical grid that can provide multiple products and services interchangeably, including capacity, peak load shaving or shifting, managing renewable energy intermittency, transmission support functions, and ancillary services, all within a region that ISO-NE has identified as deficient and in need of additional capacity to support overall grid reliability. The BESS is proposed in furtherance of the Commonwealth of Massachusetts' goal to achieve 1,000 MWh of battery storage by 2025. This BESS would provide 500 MWh towards that goal. The project was awarded a capacity contract in the Southeastern New England ("SENE") capacity zone, via the Forward Capacity Auction ("FCA") 15, for operations commencing on June 1, 2024.

This Notice of Intent ("NOI") focuses on those activities that are located within areas subject to the Massachusetts Wetlands Protection Act ("MWPA") (G.L. c. 131 § 40), its implementing Regulations (310 CMR 10.00), the Town of Medway Wetlands Protection Bylaw (Article XXI), and the Rules and Regulations of the Town of Medway Conservation Commission (amended June 25, 2020).

All proposed activities located in areas subject to the jurisdiction of the Medway Conservation Commission are within the limits of the Project Site. These include work proposed within the 100-foot Buffer Zone of a Bordering Vegetated Wetland and within the 200-Foot Riverfront Area of a perennial waterbody (Center Brook). Additional information describing the proposed work and how it is designed to comply with applicable local and state performance standards is provided in Section 4.0 of this narrative.

With this NOI, the Proponent is filing a separate application for a Stormwater Management and Land Disturbance Permit with the Medway Conservation Commission in accordance with Section 26.5 of Medway General Bylaws Article XXVI.

2.0 Existing Site Conditions

The Project Site is approximately 10.6 acres in size and as per the Town of Medway Assessor's maps consists of four parcels (Parcels 46-057, 46-056, 46-055, and 56-006). Each parcel has been previously cleared and developed, to varying degrees, for residential and commercial use, and other clearing related to energy transmission and timber harvesting has taken place previously.

According to Massachusetts Natural Heritage and Endangered Species Program ("NHESP") Atlas (August 1, 2021, 15th Edition), the Project Site is not located within areas mapped for Estimated Habitats of Rare Wildlife or for Priority Habitats of Rare Species. Nor are there any mapped certified or potential vernal pools located on the Project Site. There are also no Outstanding Resource Waters ("ORWs"), Areas of Critical Environmental Concern ("ACECs"), or 100-year floodplain areas located on the Project Site. Figure B-1 of Attachment B provides a site locus map (USGS base) for the Project Site, while Figure B-2 of Attachment B presents the four parcels that comprise the Project Site on an aerial photo base.

Figure B-3 of Attachment B presents the existing vegetative cover types mapped on the Project Site and along the transmission interconnection corridor. Table 2-1 presents a summary of the vegetative cover types present on the Project Site along with the proposed limits of work within these areas. Note that Table 2-1 presents the proposed limits of work for the entire Project Site, including areas outside of the Commission's jurisdiction. Table 2-2 presents the proposed work associated with the transmission interconnection corridor on adjacent parcels, none of which include any areas subject to the Commission's jurisdiction.

Table 2-1 Summary of Proposed Work on the Project Site by Existing Cover Type

Vegetative Cover Type	Total Existing Area on Project Site (acres)	Total Area Within Limits of Work on Project Site (acres)	Total Area Outside of Limits of Work on Project Site (acres)
Managed Public Utility Right-of-Way	0.50	0.30	0.20
Early Successional (previously cut areas)	2.20	1.80	0.40
Pine/Oak Forest	1.40	1.40	0.0
Oak/Maple Forest	2.30	0.20	2.10
Previously Developed Areas	3.10	2.90	0.20
Forested Wetland	1.10	0.00	1.10
Total	**10.6**	**6.6**	**4.0**

Table 2-2 Summary of Proposed Work for the Transmission Interconnection on Adjacent Properties by Existing Cover Type

Vegetative Cover Type	Area Within Limits of Work (acres)
Managed Public Utility Right-of-Way	0.40
Oak/Maple Forest	0.30
Total	**0.7**

2.1 Upland Habitats

Staff ecologists from Epsilon Associates completed a site visit on June 2, 2022, to map existing vegetation cover types on the Project Site and within the Proposed Transmission Line Interconnection corridor. A hand-held GPS unit was used to map the extent of each distinct cover type unit and the transitions between them. In summary, existing cover types identified on the Project Site include Managed Public Utility Right-of-Way, Early Successional (previously cut areas), Pine/Oak Forest, Oak/Maple Forest, and Previously Developed Areas. Below are descriptions of these cover types. Refer to Figure B-3 in Attachment B for the results of the vegetation cover type mapping. This figure also shows areas subject to the Commission's jurisdiction. These upland habitats occupy a total of 9.5 acres or 90% of the Project Site. As discussed in Section 2.2 below, the Bordering Vegetated Wetland (BVW) occupies the remaining 1.1 acres or 10% of the Project Site, while the Riverfront Area and Buffer Zone to BVW overlap portions of these upland habitats.

Managed Public Utility Right-of-Way

This cover type is associated with an existing public utility right-of-way that contains both electric and natural transmission lines and associated facilities (gas meter station). A small portion of the Project Site (0.5 acres or 5%) extends into the right-of way. The right-of-way is subject to routine vegetation management such as mowing and select tree trimming along the edges and contains a well-developed gravel access road that facilitates maintenance of the electric and gas facilities. The managed right-of-way consists of a combination of woody and herbaceous low growing plant species. Common shrub/herbaceous species documented within this cover type include Elderberry, bayberry, sweet fern, gray birch, green brier, European buckthorn, northern arrowwood, goldenrods, indigo, bracken fern, bristly dewberry, yarrow, cinquefoil, and bush clover.

Early Successional (Previously Cut Areas)

This cover type is located on the portion of the Project Site (2.2 acres or approximately 20%) behind the existing residence at 49 Milford Street. Based upon a review of Google Earth historic mapping, this area, which was formerly an oak/maple forest, was selectively cut in approximately 2010. The Early Successional cover type predominantly lacks mature trees but has a thick sapling layer mixed with some open areas associated with existing paths and contains young trees interspersed throughout. Given the thick density of the sapling layer the herbaceous and shrub layer is sparse in this cover type, except for those open areas along existing paths. Common species within this cover type include witch hazel, gray birch, maple-leaved viburnum, red maple, beech, white oak, poplar, red oak, hay scented fern, bristly dewberry, poison ivy, and low bush blueberry.

Pine/Oak Forest

This cover type is located on the portion of the Project Site (1.4 acres or approximately 13%) around and behind the existing automotive repair shop and the adjacent residence at 55 Milford Street. As can be seen on Figure B-3 in Attachment B, this cover type extends off the Project Site onto the area of land between the Project Site and the managed public utility right-of-way. The Pine/Oak Forest cover type is dominated by mature white pine trees with red oak interspersed sparsely throughout with a sparse and open understory. Common species within this cover type include white pine, red oak, lowbush blueberry, huckleberry, and white oak.

Oak/Maple Forest

This cover type is located on the southern portion of the Project Site (2.3 acres or approximately 22%) beyond the limits of the previously cut areas and near the existing Exelon power plant and adjacent to the managed right-of-way. The Oak/Maple Forest cover type is a mixed hardwood forest with various oak species and red maple dominant in the overstory. The understory is well developed with a mix of shrub and herbaceous species. Common species within this cover type include white oak, red oak, horse chestnut, white ash, red maple, white pine, gray birch, green brier, lowbush blueberry, huckleberry, hay scented fern, sarsaparilla, poison ivy, Canada mayflower, starflower, and club moss.

Previously Developed

This cover type is located on the northern portion of the Project Site (3.1 acres or approximately 30%) adjacent to Milford Street (Route 109) and is associated with the existing residences and automotive repair facility. Based on a review of historic photography, the residences date back to the 1950's and the auto repair shop appears to be in existence since the 1970's. The Previously Developed cover type contains the existing structures, impervious surfaces, managed lawn areas, as well as other areas that have been previously used as gardens and lawn area but are not currently managed on a regular basis. There are some young and mature trees in this area that were left around the residences, and which are within and around managed lawn areas and herbaceous species such as goldenrods, dewberry, and poison ivy are prevalent throughout in areas that are not currently being managed.

2.2 *Wetland Resource Areas*

State and local wetland resource areas located on the Project Site and along/adjacent to the proposed transmission interconnection corridor include Bordering Vegetated Wetland("BVW"), Riverfront Area ("RFA"), and the 100-foot Buffer Zone to BVW. The boundaries of the wetland resource areas on the Project Site have been verified and approved by the Medway Conservation Commission through an Order of Resource Area Delineation ("ORAD"), issued on February 27, 2020. The boundaries of the wetland resource areas on the adjacent parcels were verified and approved by the Medway Conservation Commission through an ORAD issued on September 10, 2015. Wetland scientists from Epsilon Associates completed a field assessment on March 29, 2023, to review the vegetated wetland boundary and to confirm that the boundaries approved in 2020 and 2015 accurately depict the current conditions on the Project Site and on the adjacent parcels, respectively. Epsilon determined that the wetland boundaries previously reviewed and approved by the Commission still accurately represent the upland/wetland boundary on the Project Site and on the adjacent parcels.

The following paragraphs provide a brief description of the Riverfront Area, the Bordering Vegetated Wetland, and the 100-foot Buffer Zone on the Project Site.

Riverfront Area

Center Brook, a perennial stream, flows southward near the eastern perimeter of the Project Site toward Hopping Brook, which is itself a tributary of the Charles River. Center Brook has a 200-foot Riverfront Area associated with it. The 200-foot Riverfront Area occupies approximately 198,880 square feet (4.56 acres) of the Project Site and consists of the following cover types; Previously Developed Areas, Early Successional, Oak/Maple Forest, and Forested Wetland.

Of the total area of RFA on the Project Site, approximately 59,570 square feet (1.37 acres) is the inner riparian (0-100 foot) zone, while the remaining 139,310 square feet (3.19 acres) is the outer riparian (100-200 foot) zone. The 200-foot RFA boundary is shown on the Project Plans in Attachment E and on Figure B-3 in Attachment B.

Bordering Vegetated Wetland

There is a bordering vegetated wetland associated with Center Brook located on the eastern portion of the Project Site. The vegetated wetland occupies 1.1 acres or approximately 10% of the Project Site. This BVW is best characterized as a forested wetland system. Common vegetation within this wetland area includes green ash, red maple, white pine, winterberry, Japanese barberry, multiflora rose, tussock sedge, and skunk cabbage. The BVW boundary is shown on the Project Plans in Attachment E and on Figure B-3 in Attachment B.

100-Foot Buffer Zone

There is a 100-foot Buffer Zone associated with the BVW on the Project Site. The 100-foot Buffer Zone occupies approximately 194,752 square feet (4.47 acres) of the Project Site and has some overlap with the 200-foot RFA. The 100-foot Buffer Zone consists of the following cover types on the Project Site; Previously Developed Areas, Early Successional Areas, and Oak/Maple Forest.

The 100-foot Buffer Zone boundary is shown on the Project Plans in Attachment E and on Figure B-3 in Attachment B.

3.0 Project Description and Anticipated Impacts to Wetland Resource Areas

Section 3.1 provides an overview of the entire Project, including activities subject to the Commission's wetlands jurisdiction and activities subject to the Commissions land disturbance jurisdiction. Section 3.2 presents a specific discussion of the activities proposed within the areas subject to the Commission's wetlands jurisdiction.

3.1 Project Overview

The following paragraphs provide a description of the BESS, the new BESS Substation, and the Proposed Transmission Interconnection to the Eversource Substation.

3.1.1 Battery Energy Storage System

The BESS will consist of 142 Tesla Megapack ("Megapack") enclosures. Each Megapack is a standalone modular system with integrated lithium-ion batteries, a bi-directional inverter, a thermal management system, and a Tesla Site Controller with intelligent software. Each Megapack is approximately 28.9 feet long, 5.4 feet wide, 9.2 feet tall, and will be shipped to the site pre-assembled with a maximum weight of 84,000 pounds. The Megapacks will be arranged on the Project Site in a back-to-back orientation and spaced in compliance with the manufacturer's installation requirements. Each set of "coupled" Megapacks are placed adjacent to a medium voltage transformer, so the Project Site will have 71 medium voltage transformers. Each Megapack and medium voltage transformer will be supported on a concrete slab or pier foundation and surrounded by crushed stone. Once operational, the internal sensors and communications system will allow a remote operations team to continuously monitor the systems and battery performance, as well as control the BESS facility. As such, the facility will not need to be staffed daily, and the only personnel required to be present at the site will conduct periodic site inspections and maintenance visits.

The BESS also includes other supporting features such as a stormwater management system, security fencing, sound attenuation barrier, an access roadway system, and a landscaped vegetated buffer. These features are depicted on the plans provided as Attachment E.

3.1.2 Proposed Project Substation

The proposed BESS Substation is an ancillary structure to the BESS and will include new substation equipment, a graveled yard area, and surrounding security fencing. The BESS Substation will be located entirely on the Project Site to the south of the BESS and includes equipment such as a 345kV/34.5 kV main power transformer, switchgear, circuit breakers, disconnect switches, low and high buses, with a maximum height of 65 feet for the static mast. The function of this BESS Substation is to take the routed power output from the BESS to a 34.5 kV collection switchgear and step it up to a transmission voltage of 345 kV to allow the power from the BESS to be connected to the Eversource Substation via the proposed Transmission Interconnection. During charging (i.e., delivery of electricity to the BESS for storage), the proposed Transmission Interconnection will carry electricity from the Eversource Substation back to the BESS Substation where it will be "stepped down" to 34.5 kV and routed to the BESS for storage.

3.1.3 Proposed Transmission Interconnection

Electricity will be transported to and from the BESS Substation to the Eversource Substation via a 345 kV underground transmission line, owned by the Proponent, which will cross from the Project Site to land owned and/or controlled by Eversource. The Transmission Interconnection will consist of three, 8-inch 345 kV solid dielectric cables within a duct bank conduit system. These cables will be installed in a single duct bank that will be approximately 4-feet wide by 5-feet deep, with the cables buried a minimum of 3-feet below the existing ground surface. At the BESS Substation, the Transmission Interconnection will terminate underground within the fenced substation yard. To connect to the Eversource Substation, three steel monopoles will be installed just outside the existing Eversource Substation wall to transition the underground line to overhead for the purpose of making the necessary connection to the Eversource Substation.

The proposed underground transmission line will be located within a generally 25-foot-wide corridor along its 1,420-foot alignment. No portion of this corridor is located within a wetland resource area or buffer zone. Along the length of the proposed transmission interconnection, an approximately 12-foot-wide gravel roadway will be installed over the underground transmission line to provide access to the transmission line. The remaining areas within the 25-foot-wide corridor outside of the gravel roadway will be seeded with a conservation seed mix containing native herbaceous and woody species and/or allowed to revegetate with low growing vegetation like the existing utility right-of-way. Areas along the edges of the 12-foot-wide gravel access road would be mowed on a routine basis.

Attachment E provides detailed plans for the proposed transmission interconnection following the existing contours of the land. Following removal of vegetation within the transmission interconnection corridor in areas where necessary, the underground transmission line will be installed using heavy equipment and the access road will be developed over the transmission line.

3.1.4 Stormwater Management System Overview

The Project will result in a net increase of approximately 1.3 acres of impervious surfaces on the Project Site. Approximately 2.2 acres of new impervious surfaces are proposed, with 1.4 acres associated with the BESS structures and foundations, and 0.8 acres associated with the paved access drives internal to the Project Site. Approximately 0.9 acres of current impervious surfaces on the Project Site will be converted to permeable areas.

The proposed stormwater management system has been designed in accordance with the Massachusetts Stormwater Management Handbook, the Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas, and the Town of Medway's Stormwater Management and Land Disturbance Bylaw, as well as per MEPA's Interim Protocol on Climate Change Adaptation and Resiliency ("the Interim Protocol"). The Interim Protocol ensures consistency with the statewide climate change initiatives and develops strategies to promote climate change resilience and adaptation measures into proposed actions/projects. The Interim Protocol includes the efforts of the Resilient Massachusetts Action Team ("RMAT"), which is an inter-agency steering committee responsible for implementation, monitoring, and maintenance of the Massachusetts Integrated State Hazard Mitigation and Climate Adaptation Plan. The RMAT has developed a Climate Resilience Design Standards Tool ("RMAT Tool") and associated guidance for state-funded projects to enhance how the Commonwealth assesses climate resilience as part of its capital planning process. The Tool outputs are grounded in scientific methodology using available climate science data for Massachusetts and will be enhanced over time to incorporate new science, additional or changing climate hazards, and ongoing stakeholder feedback. The RMAT Tool prompts users to input project information and determines a preliminary climate exposure rating for the overall project by climate hazard (sea level rise/storm surge, precipitation, temperature). The RMAT Tool also outputs which recommended standards should be considered for each project from the *Climate Resilience Design Guidelines* ("the Guidelines"). The Project has been designed implementing all applicable *Climate Resilience Design Guidelines* to be consistent and fully compliant with the *MEPA Interim Protocol on Climate Change Adaptation and Resiliency*. Medway Grid designed the Project to include the applicable recommended design standards from the *Climate Resilience Design Guidelines* for a Tier 3 Project and has designed the Project in consideration of Extreme Precipitation. The Stormwater Report, included as Attachment X, provides a detailed explanation of how the Project design considered and implemented the current design standards for Extreme Precipitation

Stormwater runoff generated on the Project Site will be captured through a system of dry wells connected to a perforated and closed pipe network system and routed to an infiltration basin prior to discharging to riprap outlet protection upstream of the existing BVW on the Project Site. Details regarding the stormwater management system are contained within Attachment F of this NOI.

3.2 Proposed Impacts to Wetland Resource Areas

The Project will involve construction activities within the 100-Foot Buffer Zone of a Bordering Vegetated Wetland and within the Riverfront Area ("RFA") of Center Brook. Both areas are subject to the jurisdiction of the Massachusetts Wetlands Protection Act ("MWPA") (M.G.L. Chapter 131, Section 40) and its implementing Regulations (310 CMR 10.00). In addition, both areas are considered wetland resource areas protected by the Town of Medway General Wetlands Protection Bylaw ("the local wetland bylaw") (Article XXI) and the Rules and Regulations of the Town of Medway Conservation Commission (Amended June 25, 2020) ("the local wetland regulations").

The Project has been designed to concentrate activities and structures within the previously developed and disturbed areas on the Project Site and to ensure there is no potential for an adverse effect to occur to BVW. Refer to Attachment E for a detailed plan set that clearly depicts the proposed limits of work and project components in relation to existing wetland resource areas.

Tables 3-1 to 3-3 present a summary of the proposed activities within wetland resource areas associated with the Project.

Table 3-1 Summary of Proposed Buffer Zone and Riverfront Area Net Alterations

Wetland Resource Area	Proposed Area of Alteration (square feet)	Total Area on Project Site (square feet)
100- Foot Buffer Zone	19,210(1)	194,752
200-Foot Riverfront Area	26,610(2)	198,880

(1) Of the proposed 19,210 sf of proposed alteration within the 100-ft BZ, 8,700 sf are within previously developed areas, 9,310 sf are within the early successional (previously cut areas), and 1,200 sf are within the oak/maple forest cover type. In addition, the Project will result in the restoration of 8,800 square feet of previously developed buffer zone on the Project Site. The area of the proposed restoration is not included as part of the "proposed area of alteration" presented in this table.

(2) Of the proposed 26,610 sf of proposed alteration within the 200-foot RFA, 18,900 sf are within previously developed areas and 17,710 sf are within early successional (previously cut areas). In addition, the Project will result in the restoration of 13,360 sf of previously developed RFA on the Project Site. The area of the proposed restoration is not included as part of the "proposed area of alteration" presented in this table.

Table 3-2 Detailed Breakdown of All Proposed Activities Within the 100-Ft Buffer Zone

Activity	Proposed Area (square feet)
Stormwater Infiltration Basin	12,120
Site Grading	7,090
Buffer Zone Restoration	8,800
Net Alteration	**10,410**

Table 3-3 Detailed Breakdown of All Proposed Activities Within the 200-Ft Riverfront Area

Activity	Proposed Area (square feet)
Stormwater Infiltration Basin	20,410
Site Grading	6,200
Riverfront Area Restoration	13,360
Net Alteration	**13,250**

4.0 Regulatory Compliance

As described in the following sections, the Project has been designed to comply with all applicable regulatory performance standards for Riverfront Area and Buffer Zone prescribed under the Massachusetts Wetlands Protection Act Regulations and the Medway Wetlands Protection Bylaw and Regulations

4.1 Compliance with Massachusetts Wetland Protection Act Regulations

4.1.1 Activities within the Buffer Zone (310 CMR 10.02 (2) (b))

The Project has been designed such that the majority of proposed activities within the Buffer Zone are within either previously developed or early successional (previously cut areas) cover types. As presented in more detail in Section 5.0 and as shown on the Project Plans in Attachment E, a detailed erosion and sediment control plan will be implemented to ensure there are no direct or indirect impacts to the BVW on the Project Site from construction of the Project. All proposed activities within the 100-foot BZ are 50 feet or greater from any portion of the BVW boundary, with the closest limit of work approximately 50 feet from the BVW.

Also, a shadow study has been completed to demonstrate that the proposed retaining/sound wall will not cause any harm to areas within the buffer zone. The study simulated the shading effects from the retaining/sound wall during the spring (March), summer (June), fall (September), and winter (December) seasons and during several intervals of the daytime period (9 am, 12 pm, and 3 pm). The shadow study is included as Attachment C. As demonstrated in this study, during all seasons, shade from the retaining wall/sound wall is cast into the interior of the BESS facility from daybreak through sometime between 12 pm and 3 pm. The vegetation on the outward facing side of the retaining/sound wall will receive at least 6 hours of full sun each day throughout all seasons, allowing them to continue to thrive and will not suffer any harm from the presence of the retaining wall/sound wall.

4.1.2 Activities within the Riverfront Area (310 CMR 10.58 (4))

The performance standards applicable to proposed activities within the Riverfront Area are found at 310 CMR 10.58(4)(a) through (d) and the following paragraphs provide an overview of how the Project will comply with each applicable standard.

(a) Protection of Other Resource Areas. The work shall meet the performance standards for all other resource areas within the riverfront area, as identified in 310 CMR 10.30 (Coastal Bank), 10.32 (Salt Marsh), 10.55 (Bordering Vegetated Wetland), and 10.57 (Land Subject to Flooding). When work in the riverfront area is also within the buffer zone to another resource area, the performance standards for the riverfront area shall contribute to the protection of the interests of M.G.L. c. 131, § 40 in lieu of any additional requirements that might otherwise be imposed on work in the buffer zone within the riverfront area.

A BVW extends from the west bank of Center Brook and into the Riverfront Area. No work is proposed within the BVW and there are no other MWPA wetland resource areas in the RFA.

(b) Protection of Rare Species. No project may be permitted within the riverfront area which will have any adverse effect on specified habitat sites of rare wetland or upland, vertebrate or invertebrate species, as identified by the procedures established under 310 CMR 10.59 or 10.37, or which will have any adverse effect on vernal pool habitat certified prior to the filing of the Notice of Intent.

The Project Site is not located within any areas mapped as documented habitat for state-listed rare species.

(c) Practicable and Substantially Equivalent Economic Alternatives. 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.

<u>Project Purpose</u>

The proposed Project will add a reliable electric resource that can provide multiple products and services interchangeably, including capacity, peak load shaving or shifting, managing renewable energy intermittency, transmission support functions, and ancillary services all within a region that ISO-NE has identified as deficient and in need of additional capacity to support overall grid reliability. Moreover, the Project is being proposed in furtherance of the Commonwealth of Massachusetts' goal to achieve 1,000 MWh of battery storage by 2025. This Project would provide 500 MWh towards that goal.

The Project was awarded a capacity contract in the Southeastern New England ("SENE") capacity zone, via the Forward Capacity Auction ("FCA") 15, for operations commencing on June 1, 2024. The SENE capacity zone is a region comprised of Northeastern Massachusetts, Greater Boston, Southeastern Massachusetts, and Rhode Island. Capacity contracts support electric grid reliability and can be especially important to serve customer load during periods of high demand, such as a hot summer afternoon with significant air conditioning load. Medway Grid has been designed to participate in ISO-NE's Forward Capacity Market ("FCM") and will contribute to system reliability with its 250 MW capacity within ISO-NE's SENE capacity zone.

<u>Alternatives Considered</u>

The Proponent considered the following alternatives to the Project to reduce proposed activities within the RFA of Center Brook on the Project Site.

- The Proponent considered whether it was possible to use other types of commercially available battery cabinets from other manufacturers to reduce the Project's required footprint. All commercially available battery cabinets are roughly the same size and use of another manufacturer's battery cabinets would not result in reductions of the Project footprint within the RFA.

- The Proponent considered alternative project layouts to minimize proposed work in the 200-foot RFA on the Project Site. The design proposed for the BESS as presented herein locates activities outside of the riverfront area on the Project Site to the maximum extent feasible. Specifically, during design, the project components were shifted as far west as possible on the Project Site, such that zoning relief is required from side yard setbacks. As outlined herein, the proposed design seeks to avoid the RFA on the Project Site and/or to locate necessary project component's within previously developed areas or areas previously harvested for timber within the RFA.

- The Proponent considered alternative stormwater management features, such as underground infiltration basins, to treat stormwater and to locate stormwater management features outside of the RFA. The proposed design presents the most effective stormwater management system for the Project Site that will allow for compliance with state and local standards, including the RMAT Climate Resilience Design Guidelines.

- The Proponent considered the potential size of the stormwater management basin to comply with the current state and local standards, but to eliminate consideration and factoring in the RMAT Climate Resilience Design Guidelines. If the Project were designed for the current NOAA Atlas 14 rainfall data (local standard) and not the Future Projected 2050 data (MEPA Policy- RMAT Standards) the size of the basin would be reduced by approximately 25% or approximately 5,400 square feet in the Riverfront Area.

(d) No Significant Adverse Impact. The work, including proposed mitigation measures, must have no significant adverse impact on the riverfront area to protect the interests identified in M.G.L. c. 131, § 40.

1. Within 200 foot riverfront areas, the issuing authority may allow the alteration of up to 5000 square feet or 10% of the riverfront area within the lot, whichever is greater, on a lot recorded on or before October 6, 1997 or lots recorded after October 6, 1997 subject to the restrictions of 310 CMR 10.58(4)(c)2.b.vi., or up to 10% of the riverfront area within a lot recorded after October 6, 1997, provided that:

a. At a minimum, a 100-foot-wide area of undisturbed vegetation is provided. This area shall extend from mean annual high-water along the river unless another location would better protect the interests identified in M.G.L. c. 131 § 40. If there is not a 100-foot-wide area of undisturbed vegetation within the riverfront area, existing vegetative cover shall be preserved or extended to the maximum extent feasible to approximate a 100-foot-wide corridor of natural vegetation. Replication and compensatory storage required to meet other resource area performance standards are allowed within this area; structural stormwater management measures may be allowed only when there is no practicable alternative. Temporary impacts where necessary for installation of linear site-related utilities are allowed, provided the area is restored to its natural conditions. Proposed work which does not meet the requirement of 310 CMR 10.58(4)(d)1.a. may be allowed only if an applicant demonstrates by a preponderance of evidence from a competent source that an area of undisturbed vegetation with an overall average width of 100 feet will provide equivalent protection of the riverfront area, or that a partial rebuttal of the presumptions of significance is sufficient to justify a lesser area of undisturbed vegetation;

As presented in Table 3-1, the Project includes 26,610 square feet of activities within the 198,880 square feet of RFA on the Project Site. However, as presented in Table 3-3, approximately 20,410 square feet of this total is associated with a structural stormwater management measure and an area of approximately 13,360 square feet of previously developed RFA will be restored. There are no proposed alterations within currently undisturbed areas of the 100-foot Inner Riparian Zone of the RFA. In addition, all proposed alterations within the RFA are either within previously developed areas or within the early successional (previously cut areas) cover types. There are no proposed activities within RFA areas characterized as undisturbed or mature forest. Project features proposed within the RFA include the infiltration basin, site grading and retaining walls. For the most part, these features will replace existing residences and other structures currently present in these areas. In summary, the net alteration of RFA on the Project Site is 13,250 square feet or 6.6% of the total RFA on the Project Site.

As mentioned above, the Project will result in an improvement to the existing RFA on the Project Site by restoring and/or enhancing approximately 13,360 square feet of previously developed portions of the RFA of Center Brook. This area is shown on the project plans submitted in Attachment E. A detailed planting plan has been developed for this area, which includes native trees, shrubs, and herbaceous vegetation. This RFA restoration/enhancement area is depicted on the landscape plan that is included in the attached plan set in Attachment E.

b. Stormwater is managed according to standards established by the Department in its Stormwater Policy.

The proposed stormwater management system has been designed in accordance with the Massachusetts Stormwater Management Handbook, the Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas, and the Town of Medway's Stormwater Management and Land Disturbance Bylaw, as well as in consideration of the Resilient Massachusetts Action Team (RMAT) *Climate Resilience Design Guidelines* for a Tier 3 project. Attachment F provides details.

c. Proposed work does not impair the capacity of the riverfront area to provide important wildlife habitat functions. Work shall not result in an impairment of the capacity to provide vernal pool habitat identified by evidence from a competent source, but not yet certified. For work within an undeveloped riverfront area which exceeds 5,000 square feet, the issuing authority may require a wildlife habitat evaluation study under 310 CMR 10.60.

Staff ecologists from Epsilon Associates evaluated the Project Site and the surrounding area for potential wildlife use during a site visit on June 2, 2022. In summary, and as illustrated in Figure B-3 in Attachment B and presented in Table 2-1, the BESS and its associated facilities are proposed predominantly within previously developed areas associated with the existing residences and automotive repair facility on the Project Site. The remainder of the proposed BESS facility, not within previously developed areas, is near existing residences and/or the automotive repair facility. The residences and auto repair facility both have had longstanding human activity that limited wildlife use of these areas, and which directed wildlife movement around them. Figure B-3 shows the existing wildlife corridors documented by Epsilon Associates ecologists in June 2022. Based upon field observations of tracks and other signs, wildlife currently appears to move around the developed areas of the existing residences and the automotive repair shop. They use the existing utility corridor to the west, and the riparian corridor associated with Center Brook to the east as travel corridors and as feeding and cover habitat. The proposed Project will not change or affect these patterns as the proposed walls will be in or within proximity to the existing residences and automotive repair shop and retain the corridors for wildlife to move through the area in the same manner as they do now. In addition, as demonstrated in Table 2-1, over 3.2 acres of mature upland/wetland forested areas will be preserved and left undeveloped allowing continued use by wildlife in the area. In conclusion, the Project will have no adverse effect on wildlife habitat in the RFA.

Staff ecologists from Epsilon Associates completed a Simplified Wildlife Habitat Evaluation, as per Mass DEP's Wildlife Habitat Protection Guidance for Inland Wetlands, on March 29, 2023. The purpose of this evaluation is to document the presence of important wildlife habitat features within the RFA and to consider if the proposed Project will have an adverse effect on these features, if any exist. The Simplified Wildlife Habitat Evaluation form is included as Attachment D. None of the important habitat features listed on the Appendix A-Simplified Wildlife Habitat Evaluation Form are present in areas of activities proposed in the RFA. The Project includes the construction of a retaining wall within the RFA, however, as explained above, this will not restrict wildlife movement. The areas where the retaining wall is proposed are currently developed as part of a single-family residence or have previously been harvested for timber. In addition, the retaining wall will not block any existing wildlife travel corridors and is oriented such that wildlife will be able to move unimpeded around the site and within the areas of the RFA to be restored or left undisturbed on the Project Site.

d. Proposed work shall not impair groundwater or surface water quality by incorporating erosion and sedimentation controls and other measures to attenuate nonpoint source pollution.

Attachment E provides these details.

4.2 Compliance with Medway Wetland Protection Bylaw and Regulations

The following sections of the local wetland regulations apply to the Project and are in addition to the MWPA regulation performance standards discussed in Section 4.1. Note that under Section 28 of the local regulations, the Medway Conservation Commission accepts and adopts the definitions, requirements, and performance standards for Riverfront Area as specified in the Massachusetts Department of Environmental Protection's Wetlands Regulations in 310 CMR 10.58. Also, under Section 30 of the local regulations, the Medway Conservation Commission accepts and adopts the definitions, requirements, and performance standards for Wildlife Habitat as specified in the Massachusetts Department of Environmental Protection's Wetlands Regulations in 310 CMR 10.00.

4.2.1 Activities within the Buffer Zone

SECTION 26 – REGULATION GOVERNING ACTIVITY IN THE 100 FOOT BUFFER ZONE

26.06 MINIMUM PERFORMANCE STANDARDS

As set forth more specifically below, it is the intent of the Commission to protect, either by condition or by legal restriction, as much of the 100-foot buffer zone as possible. Regardless, the first 25 feet of the buffer zone closest to the wetland line will be considered by the Commission to be of primary concern within the buffer.

a. <u>No Disturb Setback</u>. Except as permitted by the Commission, no work shall be allowed within 25 feet of wetland resource areas identified in these rules and regulations (exclusive of the 100-foot buffer zone). This provision shall establish a permanent vegetative buffer between wetland resource areas and developed areas. No removal of vegetation will be permitted within this 25-foot setback except as specifically waived by the Commission under Section 29.

b. No Build Setback. No structure shall be built within 25 feet from any Resource Area. (Exclusive of the 100-foot buffer zone) without a waiver by the Commission under Section 7. Structures are discouraged between 25 and 50 feet from any Resource Area (exclusive of the 100-foot buffer zone). A 75-foot minimum No Build Setback shall apply under any of the following circumstances: 1. the Commission identifies critical wildlife, fish or plant habitat; 2. The Resource Area is located within a Water Resource Protection Overlay District, Zone II, or an ACEC; 3. the Buffer Zone includes a slope that cannot be conditioned to protect the Resource Area; 4. the Commission otherwise identifies a sensitive receptor Resource Area.

This local regulation requires a 25-foot No Disturbance Setback from the BVW. The Project has been designed to comply with this local setback requirement. The closest limit of work within the 100-foot Buffer Zone is approximately 50 feet from the BVW edge.

4.2.2 Vegetation Removal and Replacement

SECTION 23 - VEGETATION REMOVAL AND REPLACEMENT

23.b. No vegetation in a resource area protected by the Bylaw shall be damaged, extensively pruned, or removed without written approval by the Commission and in-kind replacement.

23.e. Application for Removal. For all projects, the application for vegetation removal shall be submitted as part of the application for permit or Notice of Intent as described by the Bylaw and these regulations.

These sections of the local regulations prescribe the process for removal and in-kind replacement for vegetation. For trees, the replacement quantity is based upon the diameter at breast height of the existing tree to be removed. For shrubs, the replacement quantity is based upon the approximate density of shrubs to be removed.

Staff ecologists from Epsilon Associates completed an inventory of all the trees to be removed within the limits of work on the Project Site. In addition, the overall density of shrub species within the limits of work was also assessed. Table 4-1 presents a summary of trees to be removed along with the in-kind replacement quantities required as per Section 23 of the local regulations. Based on the inventory completed by Epsilon, there are a total of 20 trees to be removed within the limits of work that would require 30 trees to be planted. The trees to be removed, as well as the proposed location of the mitigation plantings, are provided in the plan set included as Attachment E.

Table 4-1 Tree Removal and In-Kind Replacement

Species (Common Name)	Existing Diameter at Breast Height (inches)	Required In-Kind Replacement Ratio (specimens to be planted)
Red Oak	18	2
Red Maple	12	2
White Pine	30	3
Red Maple	12	2
White Oak	12	2
Red Maple	18	2
Poplar	5	1
Grey Birch	6	1
Poplar	5	1
Poplar	6	1
Red Maple	5	1
Poplar	5	1
Poplar	5	1
Red Oak	7	1
Black Oak	6	1
Red Maple	10	2
Red Maple	6	1
Red Maple	6	1
Shagbark Hickory	8	2
White Pine	10	2
Total Tree Specimens Required for Replacement		**30**

For the most part, within the proposed limits of work on the Project Site within the Commission's jurisdiction, the shrub layer presently is sparse either due to the thick sapling understory or the presence of existing lawn areas. The proposed restoration area includes planting shrub species at the same low-density ratio as within the proposed limits of work.

4.3 Consistency with Town of Medway Stormwater and Land Disturbance Bylaw

With this NOI, the Proponent is filing a separate application for a Stormwater Management and Land Disturbance Permit with the Medway Conservation Commission in accordance with Section 26.5 of Medway General Bylaws Article XXVI. The following bullets provide an overview of the Project's compliance with the local stormwater and land disturbance bylaw. Attachments E and F of this NOI, provides all the specific plans and details required to demonstrate consistency with the Town of Medway Stormwater and Land Disturbance Bylaw.

- The Project will not create any illicit connection to the Town's Municipal Separate Stormwater Sewer System ("MS4").
- The stormwater management system for the Project has been designed using the most current Massachusetts Stormwater Management Standards and the NOAA Atlas 14 precipitation rates (see Attachment F).
- A Stormwater Operations and Maintenance Plan for Construction is presented in Attachment F.
- An Erosion and Sediment Control Plan (see Attachment E) has been developed and is included in this application.
- A Post-Construction Management Plan is presented in Attachment F.

5.0 Avoidance, Minimization and Mitigation Measures

The following sections outline the Best Management Practices (BMPs) to be implemented during the construction phase of the Project to ensure that potential impacts to adjacent wetland resource areas are avoided, minimized, and mitigated to the extent feasible.

5.1 Construction Phase Methods and Considerations

5.1.1 Soil Erosion and Sediment Controls

Sediment control barriers will be installed between the limits of work and adjacent wetland resource areas as shown on the Project Plans in Attachment E. Where installed, erosion and sediment control barriers will also serve the function of demarcating the limits of work. In addition:

- The Contractor will be required to maintain a reserve supply of Erosion and & Sediment (E&S) controls to make repairs, as necessary;
- E&S controls will be inspected prior to and after significant precipitation events and repaired as necessary;
- Following completion of the work, disturbed areas will be restored; and
- Erosion and sediment controls will be maintained until their removal is authorized by the Medway Conservation Commission unless they are designed to remain in place.

In addition, the Project qualifies for coverage under the USEPA Construction General Permit ("CGP") for Stormwater Discharges from Construction Sites, which requires a proponent to develop and maintain a Stormwater Pollution Prevention Plan ("SWPPP") for the Project that will identify controls to be implemented to mitigate the potential for erosion and sedimentation from soil disturbance during construction. Proposed work within the 100-foot Buffer Zone will include the use of BMP's such as erosion control barriers to establish limits of work and to ensure that there are no short or long-term impacts to adjacent wetland resource areas. In addition, all stockpiles (if necessary) will be located outside of the 100-foot Buffer Zone.

The SWPPP will include a construction personnel contact list, a description of the proposed work, stormwater controls and spill prevention measures, and inspection practices to be implemented for the management of construction-related storm water discharges from the Project. The SWPPP will be adhered to by the contractor during all phases of Project construction. The Proponent will require that the construction contractor designate a construction supervisor or equivalent to be responsible for coordinating regular inspections and compliance with CGP and Order of Conditions requirements. This person will be responsible for providing appropriate training and direction to the other members of the construction crew regarding work methods as they relate to permit compliance and construction mitigation commitments. Additionally, construction personnel will undergo pre-construction training on appropriate environmental protection and compliance obligations prior to the start of construction of the Project. Regular construction progress meetings will be held to reinforce contractor awareness of these mitigation measures.

All proposed soil erosion and sediment control details are provided in Attachment E.

5.1.2 Spill Prevention and Containment

During construction, a spill containment kit will be kept on site at all times. Personnel will be available to respond quickly in the case of a leak or spill. Equipment will be kept in a condition that prevents leakage or discharge of pollutants. Fuel, oil, hydraulic fluids, petroleum products and/or other chemicals will be stored in water-tight containers to minimize their exposure to precipitation and storm water. Refueling and storage of equipment/chemicals will not be permitted within 100-feet of vegetated wetland resource areas. If there is an accidental release of petroleum product during construction, the Medway Conservation Commission will be notified after the appropriate emergency response agencies.

Attachment B

Figures

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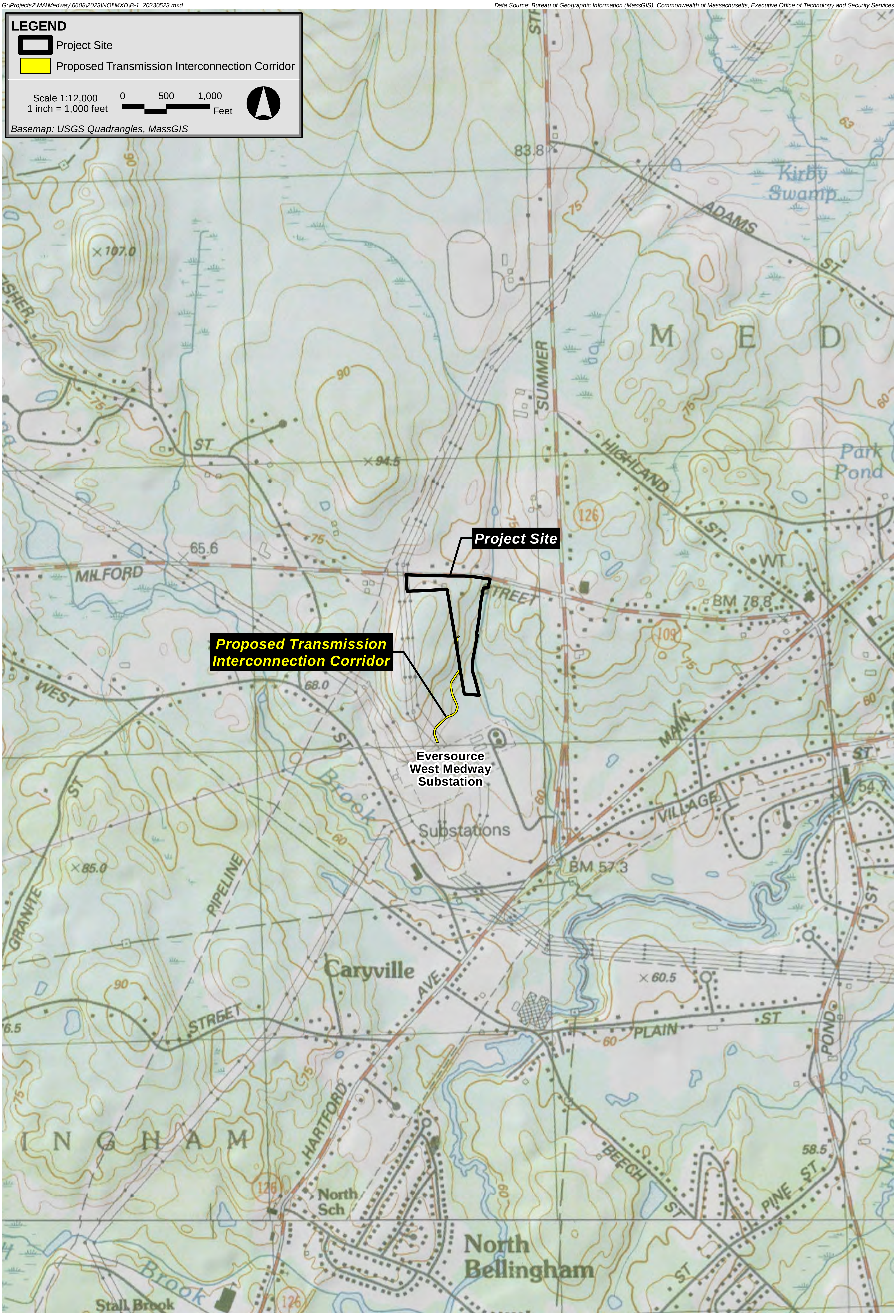
Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services



Medway Grid Energy Storage Project   **Medway, Massachusetts**

Epsilon ASSOCIATES INC.

Figure B-1

Site Locus Map

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Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

Medway Grid Energy Storage Project **Medway, Massachusetts**

Epsilon
ASSOCIATES INC.

Figure B-2

Site Locus Map (Tax Parcels)

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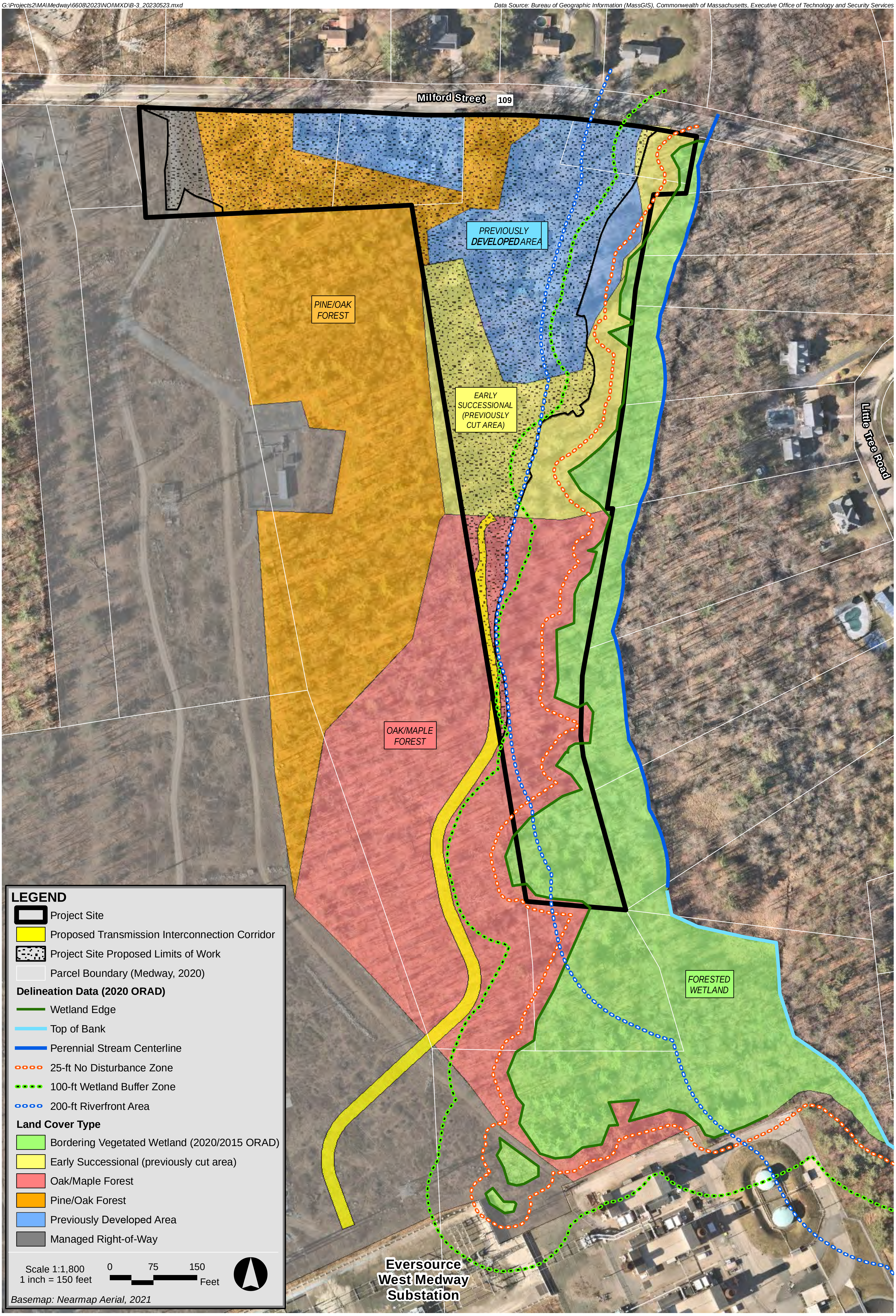
Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services



Medway Grid Energy Storage Project **Medway, Massachusetts**

Epsilon ASSOCIATES INC.

Figure B-3

Existing Vegetative Cover Type Map

Attachment C

Shadow Study

ENERGY STORAGE

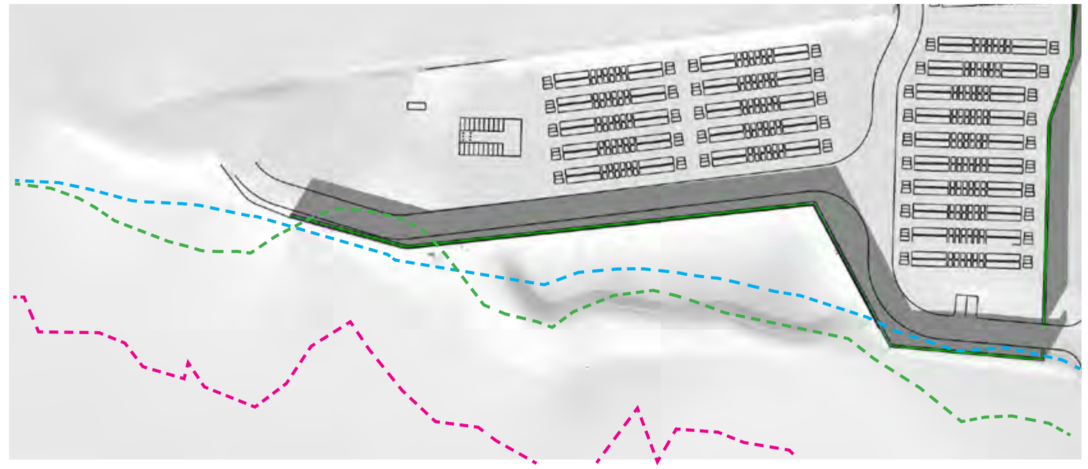
MEDWAY, MA

SHADE STUDY

MAY 2023

MARCH 22

09:00 AM



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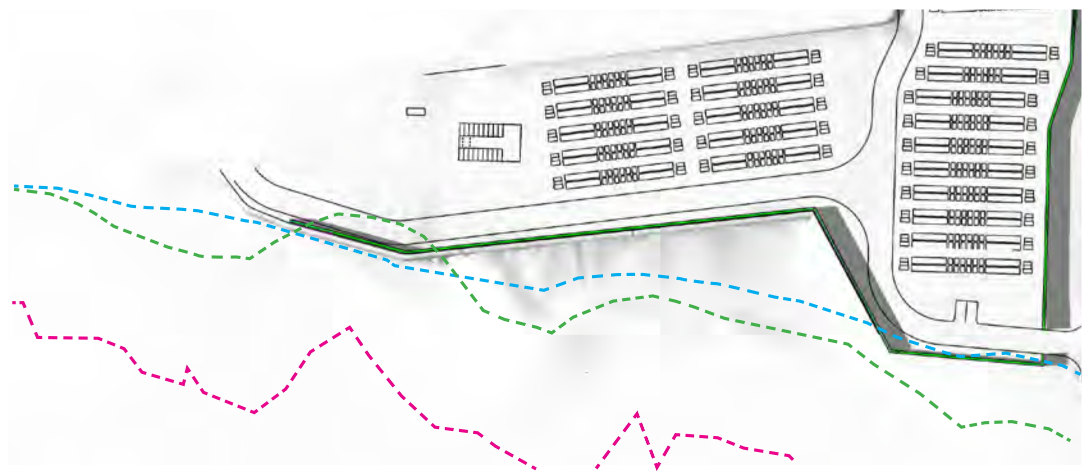

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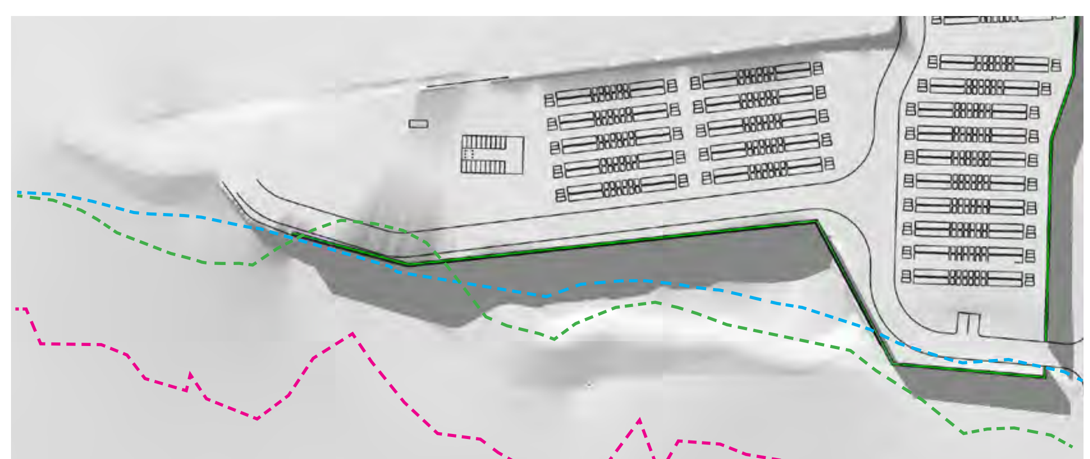

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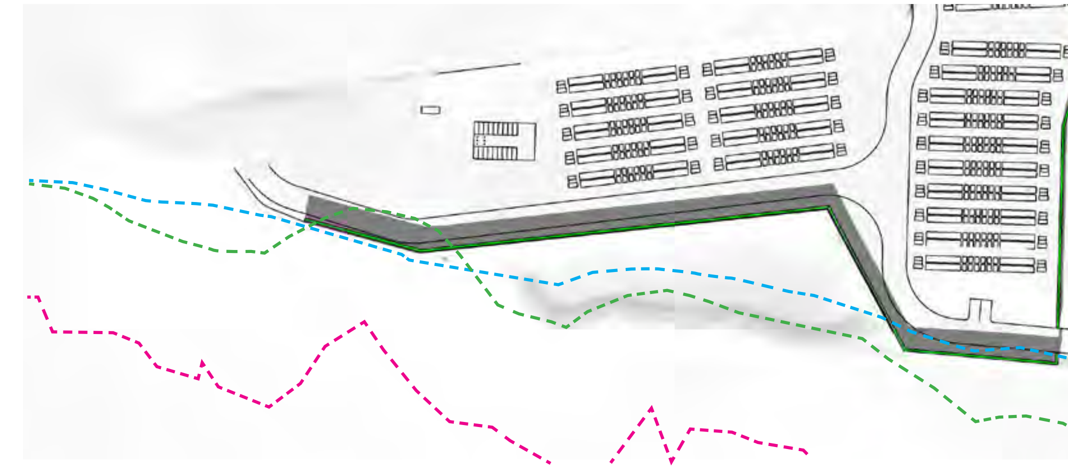

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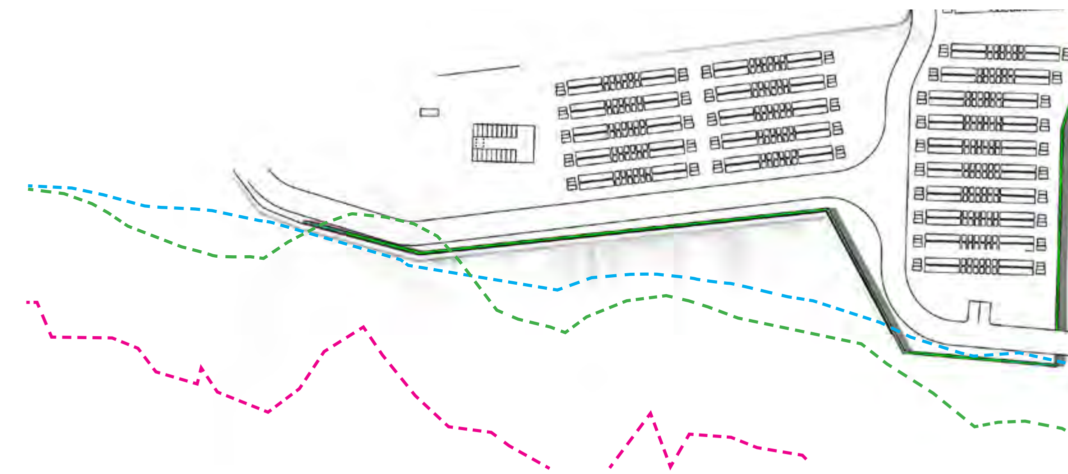

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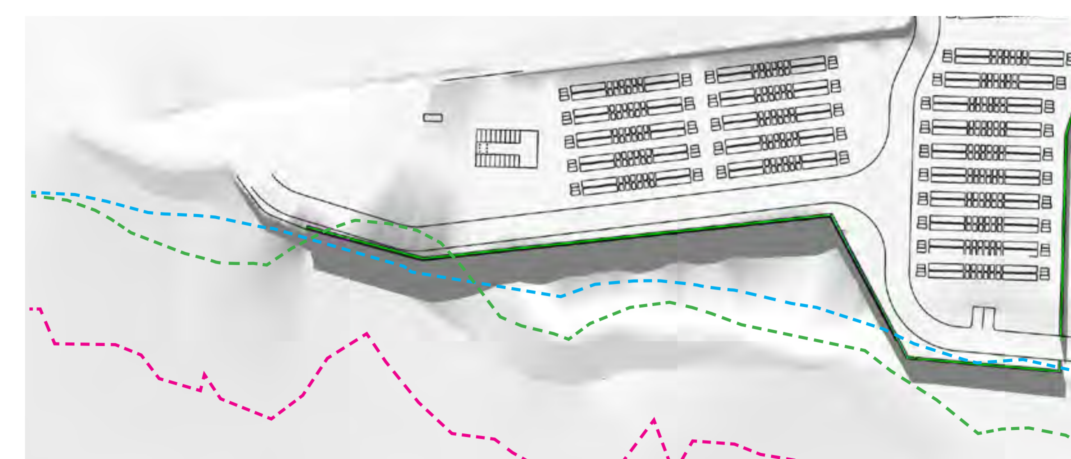

- - - - Wetland Boundary
- - - - 100' Buffer Zone
- - - - 200' Riverfront Area

NORTH

ENERGY STORAGE

SHADE STUDY

MEDWAY, MA

LANGAN

SEPTEMBER 22

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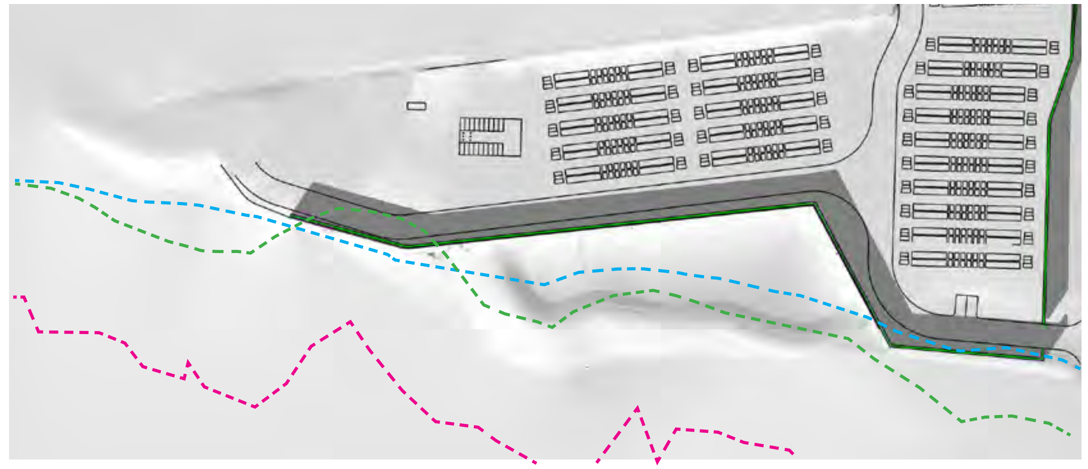

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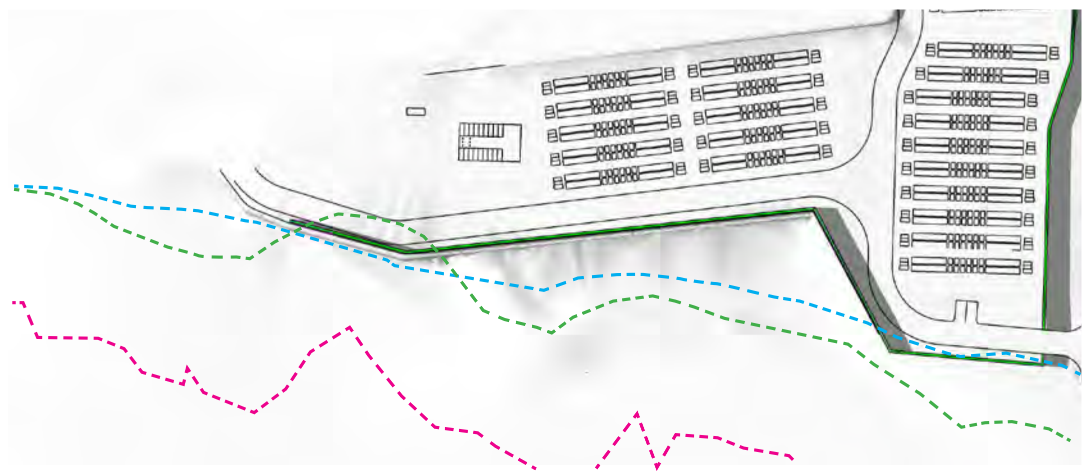

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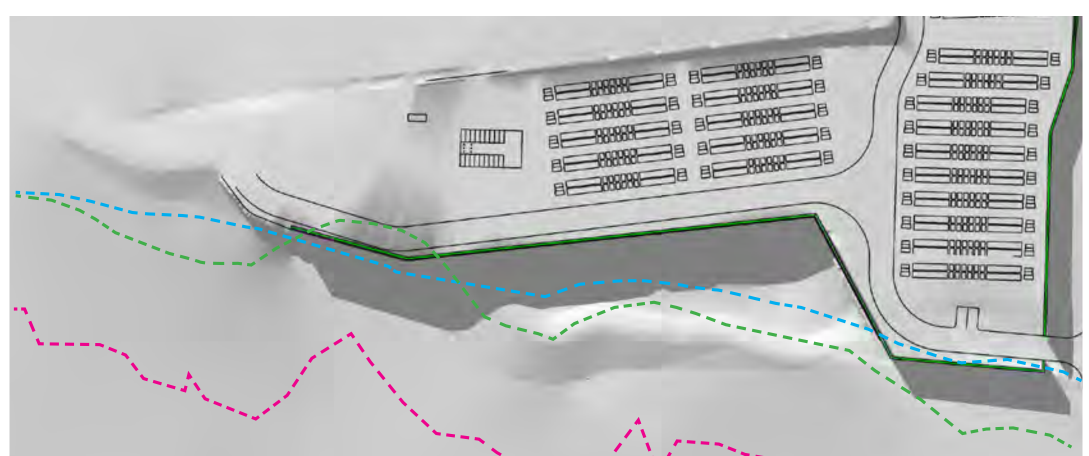

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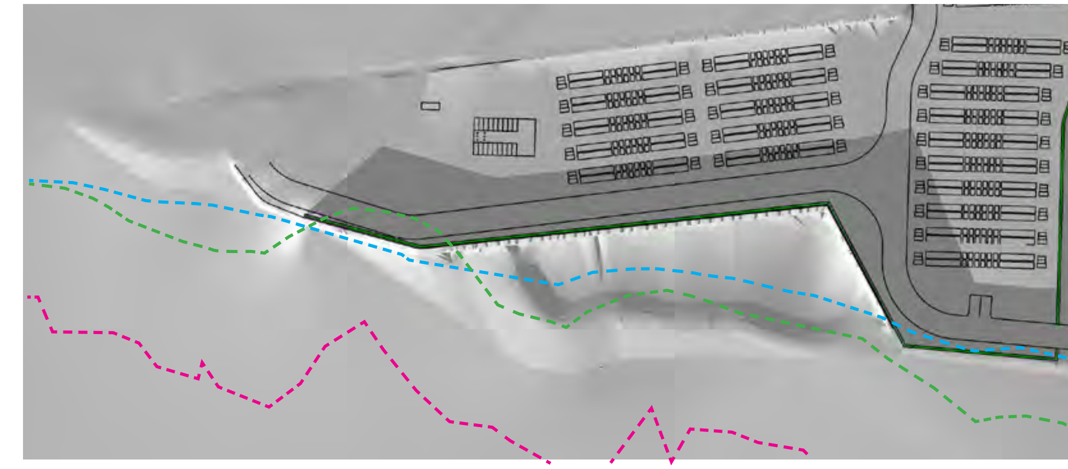

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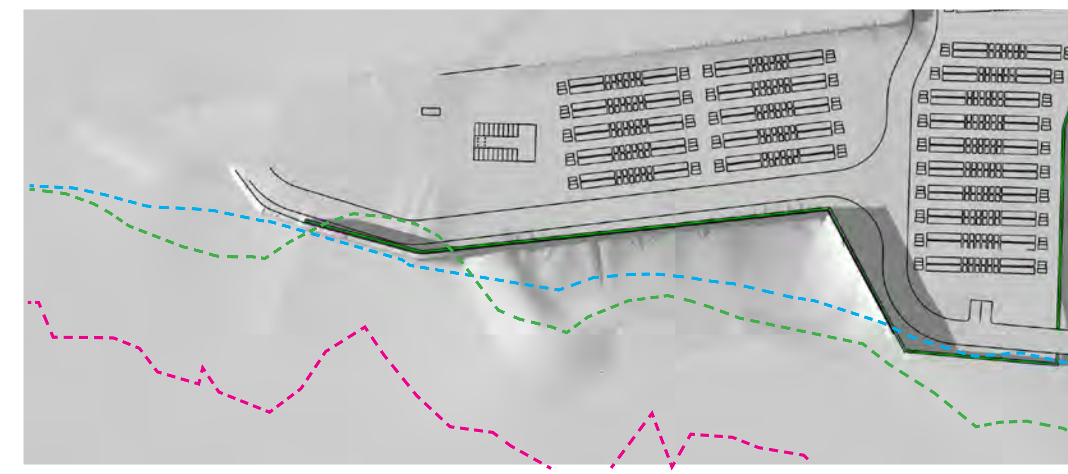

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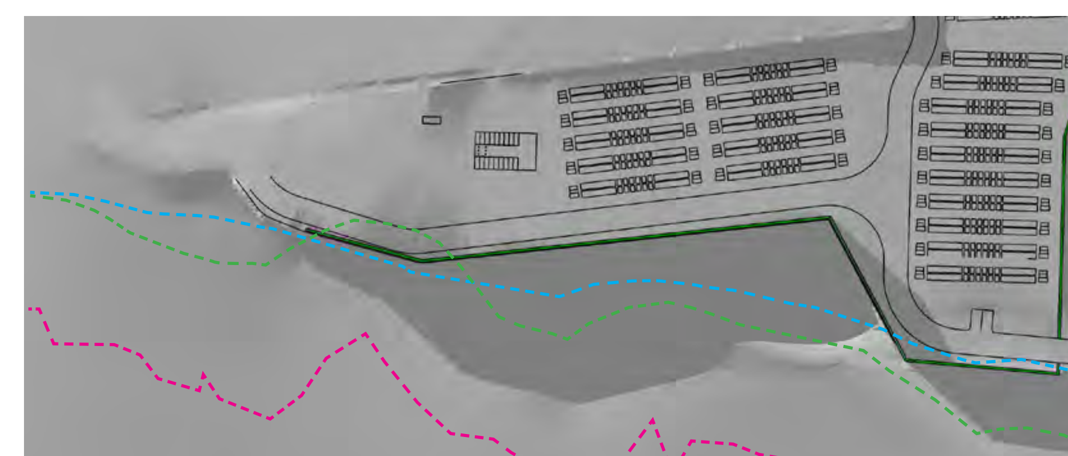


Wetland Boundary
100' Buffer Zone
200' Riverfront Area

NORTH

ENERGY STORAGE

SHADE STUDY

MEDWAY, MA

LANGAN

Attachment D

Wildlife Habitat Evaluation

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wetlands program

Wildlife Habitat Protection Guidance

Appendix A: Simplified Wildlife Habitat Evaluation

Project Information

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

Medway Grid Energy Storage Project - 49 Milford Street (Route 109), Medway, MA
Project Location (from NOI)

Marc Bergeron
Name of Person Completing Form

March 29, 2023
Date

Important Habitat Features

Direct alterations to the following important habitat features in resource areas may be permitted only if they will have no adverse effect (refer to Section V).

- ☐ Habitat for state-listed animal species (receipt of a positive opinion or permit from MNHESP shall be presumed to be correct. Do not refer to Section V).
- ☐ Sphagnum hummocks and pools suitable to serve as nesting habitat for four-toed salamanders
- ☐ Trees with large cavities (≥18" tree diameter at cavity entrance)
- ☐ Existing beaver, mink or otter dens
- ☐ Areas within 100 feet of existing beaver, mink or otter dens (if significant disturbance)
- ☐ Existing nest trees for birds that traditionally reuse nests (bald eagle, osprey, great blue heron)
- ☐ Land containing freshwater mussel beds
- ☐ Wetlands and waterbodies known to contain open water in winter with the capacity to serve as waterfowl winter habitat
- ☐ Turtle nesting areas
- ☐ Vertical sandy banks (bank swallows, rough-winged swallows or kingfishers)

The following habitat characteristics when not commonly encountered in the surrounding area:

- ☐ Stream bed riffle zones (e.g. in eastern MA)
- ☐ Springs
- ☐ Gravel stream bottoms (trout and salmon nesting substrate)
- ☐ Plunge pools (deep holes) in rivers or streams
- ☐ Medium to large, flat rock substrates in streams

None of the important habitat features listed above are present in the areas proposed for alteration. In addition, none of the habitat characteristics are in the immediate area of the Project Site or are commonly present in the surrounding area. Refer to Attachment A, Section 4.1.2 for more details regarding wildlife habitat features on the Project Site and within proposed alteration areas.

Wildlife Habitat Protection Guidance

Appendix A: Simplified Wildlife Habitat Evaluation

Activities

When any one of the following activities is proposed within resource areas, applicants should complete a Detailed Wildlife Habitat Evaluation (refer to Appendix B).

- ☐ Activities located in mapped “Habitat of Potential Regional or Statewide Importance”
- ☐ Activities affecting certified or documented vernal pool habitat, including habitat within 100’ of a certified or documented vernal pool when within a resource area
- ☐ Activities in bank, land under water, bordering land subject to flooding (presumed significant) where alterations are more than twice the size of thresholds
- ☐ Activities affecting vegetated wetlands >5000 sq. ft. occurring in resource areas other than Bordering Vegetated Wetland
- ☐ Activities affecting the sole connector between habitats >50 acres in size
- ☐ Installation of structures that prevent animal movement
- ☐ Activities for the purpose of bank stabilization using hard structure solutions that significantly affect ability of stream channel to shift and meander, or disrupt continuity in cover that would inhibit animal passage
- ☐ Dredging (greater than 5,000 sf)

The Project includes the installation of fencing and walls, however, as explained in more detail in Attachment A, Section 4.1.2 will not prevent animal movement on and around the Project Site.

Attachment E

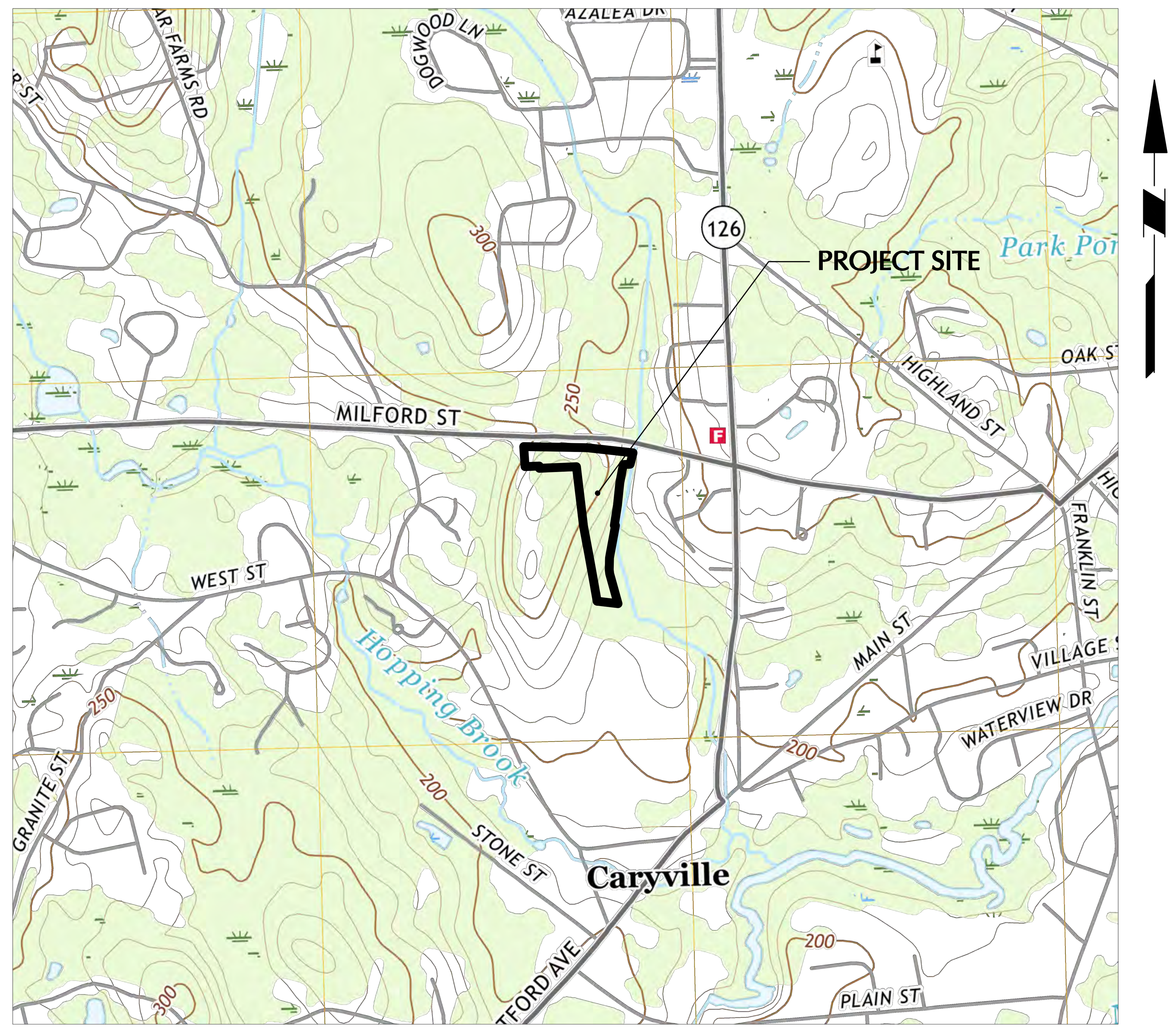
Engineering Plans

MEDWAY BATTERY ENERGY STORAGE SYSTEM
NOI PLAN SET
PARCELS: 046-005, 046-0056, 046-0057, 0056-0006
TOWN OF MEDWAY, NORFOLK COUNTY, MASSACHUSETTS

PROJECT NO. 151033401

CIVIL DRAWING INDEX

SHEET NUMBER	DRAWING TITLE	DATE	LAST REVISED
CS001	SITE COVER SHEET	06/08/2023	06/08/2023
CS002	MASTER LEGEND & NOTES	06/08/2023	06/08/2023
CS101	OVERALL SITE PLAN	06/08/2023	06/08/2023
CS102	UNDERGROUND TRANSMISSION LINE SITE PLAN	06/08/2023	06/08/2023
CS501	SITE DETAILS	06/08/2023	06/08/2023
CD101	SITE PREPARATION PLAN	06/08/2023	06/08/2023
CG101	GRADING & DRAINAGE PLAN	06/08/2023	06/08/2023
CG501	GRADING & DRAINAGE DETAILS I	06/08/2023	06/08/2023
CG502	GRADING & DRAINAGE DETAILS II	06/08/2023	06/08/2023
CG503	GRADING & DRAINAGE DETAILS III	06/08/2023	06/08/2023
CE101	SOIL & EROSION CONTROL PLAN – PHASE I	06/08/2023	06/08/2023
CE102	SOIL & EROSION CONTROL PLAN – PHASE II	06/08/2023	06/08/2023
CE501	SOIL & EROSION CONTROL DETAILS I	06/08/2023	06/08/2023
CE502	SOIL & EROSION CONTROL DETAILS II	06/08/2023	06/08/2023
CU101	UTILITY PLAN	06/08/2023	06/08/2023
CU501	UTILITY DETAILS	06/08/2023	06/08/2023
LL101	SITE LIGHTING PLAN	06/08/2023	06/08/2023
LL501	SITE LIGHTING DETAILS	06/08/2023	06/08/2023
LP101	PLANTING PLAN	06/08/2023	06/08/2023
LP501	PLANTING DETAILS	06/08/2023	06/08/2023



MAP REFERENCE: USGS 2021 HOLLISTON, MA QUADRANGLES (7.5 MINUTE SERIES)

LOCATION MAP

SCALE: 1" = 1000'

RELEASE DATES

DATE	ISSUED FOR
06/08/2023	NOTICE OF INTENT

OWNER/APPLICANT
MEDWAY GRID, LLC.
C/O: JUSTIN ADAMS
988 HOWARD AVE. SUITE 200
BURLINGAME, CA 94010
EMAIL:
JUSTIN.ADAMS@EOLIANENERGY.COM

WETLANDS & NATURAL RESOURCES
EPSILON ASSOCIATES, INC.
C/O: MARC BERGERON
3 MILL & MAIN PLACE, SUITE 250
MAYNARD, MA 01754
PHONE: 978-461-6253
EMAIL:
MBERGERON@EPSILONASSOCIATES.COM

CIVIL ENGINEER & LANDSCAPE ARCHITECT
LANGAN ENGINEERING & ENVIRONMENTAL SERVICES, INC
C/O: FRANK HOLMES
100 CAMBRIDGE STREET
BOSTON, MA 02116
PHONE: 617-824-9100
EMAIL: FHOLMES@LANGAN.COM

GEOTECHNICAL ENGINEER
GZA GEOENVIRONMENTAL, INC.
C/O: BRUCE FAIRLESS
249 VANDERBILT AVENUE
NORWOOD, MA 02062
PHONE: 781-248-3700
EMAIL: BRUCE.FAIRLESS@GZA.COM

LAND SURVEYOR
LAND PLANNING, INC.
C/O: NORMAN G. HILL
1115 MAIN STREET
HANSON, MA 02341
PHONE: 781-294-4144

LANGAN

GENERAL NOTES

1. PLANIMETRIC AND TOPOGRAPHIC INFORMATION SHOWN HEREON HAS BEEN OBTAINED FROM GROUND SURVEYS BY "LAND PLANNING, INC." CONDUCTED ON NOVEMBER 12, 2021.
2. THE SITE LIES IN FLOOD ZONE X AS SHOWN ON THE FLOOD INSURANCE RATE MAP NORFOLK COUNTY, FEMA MAP NUMBER 25021C0139E, EFFECTIVE 7/17/2012.
3. WETLAND BOUNDARIES ON THE PROJECT SITE HAVE BEEN VERIFIED AND APPROVED BY THE MEDWAY CONSERVATION COMMISSION THROUGH AN ORDER OF RESOURCE AREA DELINEATION (ORAD) ISSUED ON FEBRUARY 27, 2020. WETLAND BOUNDARIES ON THE ADJACENT PARCELS HAVE BEEN VERIFIED AND APPROVED BY THE MEDWAY CONSERVATION COMMISSION THROUGH AN ORAD ISSUED ON SEPTEMBER 10, 2015. EPSILON ASSOCIATES COMPLETED A FIELD ASSESSMENT ON MARCH 29, 2023, TO REVIEW THE WETLAND BOUNDARIES AND TO CONFIRM THAT THE BOUNDARIES APPROVED IN 2020 AND 2015 ACCURATELY DEPICT THE CURRENT CONDITIONS ON THE PROJECT SITE AND ON THE ADJACENT PARCELS, RESPECTIVELY.
4. THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING DIG SAFE (WWW.DIGSAFE.COM), EXCAVATION TEST HOLES, PERFORMING TEST BORINGS, AND PERFORMING WHATEVER ADDITIONAL INVESTIGATION NECESSARY TO PROTECT AND MAINTAIN ALL EXISTING UTILITIES TO REMAIN THROUGHOUT THE CONSTRUCTION PERIOD. ANY CONFLICTS BETWEEN EXISTING UTILITIES AND PROPOSED UTILITIES DISCOVERED DURING CONSTRUCTION SHALL BE PROMPTLY REPORTED TO THE PROJECT ENGINEER.
5. CONTRACTOR SHALL PREVENT DUST, SEDIMENT AND DEBRIS FROM EXITING THE SITE AND SHALL BE RESPONSIBLE FOR CLEANUP, REPAIRS AND CORRECTIVE ACTION IF SUCH OCCURS. ADJOINING STREETS AND PROPERTIES TO BE KEPT FREE OF DEBRIS RESULTING FROM DEMOLITION AND SHALL BE CLEANED ON A DAILY BASIS OR AS NEEDED.
6. DUST CONTROL TREATMENTS SHALL BE APPLIED AS NECESSARY TO CONTROL AND REDUCE THE AMOUNT OF DUST WHICH MAY CAUSE OFF-SITE DAMAGE, BE A HEALTH HAZARD TO HUMANS, WILDLIFE AND PLANT LIFE, OR POSE A HAZARD TO TRAFFIC SAFETY.
7. PROPOSED SITE WORK IMPROVEMENTS SHALL CONFORM TO THE STANDARD DETAILS AND SPECIFICATIONS OF THE TOWN OF MEDWAY. IN THE ABSENCE OF LOCAL STANDARDS, SITE WORK SHALL CONFORM TO THE REQUIREMENTS OF MASSACHUSETTS DOT STANDARD DETAILS.
8. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES, AND WHERE POSSIBLE MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED UPON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE APPROPRIATE UTILITY COMPANY AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATION OF UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS. ANY DISCREPANCIES DISCOVERED DURING THE COURSE OF CONSTRUCTION SHALL BE PROMPTLY REPORTED TO THE PROJECT ENGINEER.
9. ANY UTILITY EASEMENTS REQUIRED BY ANY OF THE VARIOUS UTILITY COMPANIES, THE CONTRACTOR SHALL OBTAIN, EXECUTE, AND RECORD PRIOR TO ANY OF THE AFFECTED UTILITY WORK BEING PERFORMED.
10. ALL IMPROVEMENTS CONSTRUCTED IN THE TOWN PUBLIC RIGHT-OF-WAY SHALL CONFORM TO TOWN OF MEDWAY STANDARD DETAILS. IN THE ABSENCE OF LOCAL DETAILS & REQUIREMENTS AND WORK IN THE STATE RIGHT-OF-WAY SHALL COMPLY WITH THE STATE OF MASSACHUSETTS DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES, THE COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS (2021 EDITION) AND THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION OF TRANSPORTATION SUPPLEMENTAL SPECIFICATIONS (DATED SEPTEMBER 30, 2021).
11. FOR AREAS OUTSIDE THE PROPERTY LINES, REPAIR AND/OR REPLACE ALL DAMAGE DONE TO EXISTING ELEMENTS (SIDEWALKS, PAVING, LANDSCAPING, ETC) AS REQUIRED BY OWNER AND/OR GOVERNING AUTHORITY.
12. ALL SIGNS AND PAVEMENT MARKINGS SHALL CONFORM TO THE LATEST EDITION OF THE MUTCD AND MASSACHUSETTS DEPARTMENT OF TRANSPORTATION REGULATIONS.
13. THE LOCATION OF EXISTING UNDERGROUND UTILITIES SHOWN HEREON IS TAKEN FROM DESIGN PLANS, AS-BUILT SKETCHES, EXISTING UTILITY COMPANY RECORDS, AND OTHER SOURCES OF INFORMATION AND IS NOT TO BE CONSTRUED AS AN ACCURATE "AS-BUILT" SURVEY AND IS SUBJECT TO SUCH CORRECTIONS THAT A MORE ACCURATE SURVEY MAY DISCLOSE.IN ADDITION, OTHER UTILITIES NOT SHOWN HEREON MAY BE PRESENT. ANY DISCREPANCIES DISCOVERED DURING THE COURSE OF CONSTRUCTION SHALL BE PROMPTLY REPORTED TO THE PROJECT ENGINEER.
14. ALL UTILITY WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS AND SPECIFICATIONS/DETAILS OF THE UTILITY COMPANY HAVING AUTHORITY OVER THE PROPOSED WORK. ALL PROPOSED UTILITY WORK SHALL BE PERFORMED IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL ORDINANCES/REQUIREMENTS GOVERNING THE PROPOSED WORK.
15. ALL PROPOSED UTILITIES WILL BE LOCATED UNDERGROUND UNLESS OTHERWISE NOTED.
16. RESET ALL EXISTING SANITARY AND DRAINAGE STRUCTURES TO MASSACHUSETTS STATE STANDARDS AND AS REQUIRED BY REPAIRING, MILLING OR OVERLAYING.
17. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL PAVEMENT REPAIRS REQUIRED AS A RESULT OF ANY UTILITY WORK.
18. CONCRETE JOINTS ON SITE ARE TO BE FILLED WITH HOT-APPLIED JOINT FILLER, TO INCLUDE CONCRETE PAVEMENTS, MONOLITHIC CURBING AND MONOLITHIC SIDEWALKS.
19. BOTTOM AND TOP OF RETAINING WALL ELEVATION SPOT SHOTS REPRESENT THE BASE OF THE WALL AT FINISHED GROUND LEVEL AND THE TOP OF THE FACE OF THE WALL RESPECTIVELY.
20. ALL ON-SITE CONCRETE TO BE 4,500 PSI WITH 5% TO 7% AIR ENTRAPMENT UNLESS OTHERWISE NOTED.

DEMOLITION NOTES

1. DEMOLITION CONTRACTOR SHALL COORDINATE ALL DEMOLITION SEQUENCING WITH THE GENERAL CONTRACTOR FOR TEMPORARY CONDITIONS AND PHASING.
2. THE CONTRACTOR IS TO REFER TO THE REMAINING CONSTRUCTION DRAWING SET FOR REMOVAL LIMIT COORDINATION WITH OTHER DESIGN ELEMENTS.
3. THE CONTRACTOR IS TO REMOVE AND DISPOSE OR RECYCLE ALL SITE FEATURES WITHIN THE LIMITS OF CLEARING, UNLESS OTHERWISE DIRECTED IN THE PLANS, SPECIFICATIONS AND THE SITE CONSTRUCTION DRAWINGS.
4. THE CONTRACTOR SHALL NOTIFY AND OBTAIN ALL SHUTOFFS FOR ALL APPLICABLE UTILITIES PRIOR TO THE COMMENCEMENT OF DEMOLITION.
5. THE CONTRACTOR SHALL LOCATE/CONFIRM ALL DRAINAGE INFRASTRUCTURE AND MAINTAIN ADEQUATE STORM DRAINAGE THROUGHOUT CONSTRUCTION.
6. THE CONTRACTOR SHALL COORDINATE ANY PARTIAL DEMOLITION OF DRAINAGE OR UTILITY INFRASTRUCTURE WITH THE FINAL CONDITION. SEE CONSTRUCTION DRAWINGS.
7. THE CONTRACTOR SHALL FIELD LOCATE AND PROPERLY DISCONNECT APPROPRIATE LATERALS TO LIVE MAINS PRIOR TO DEMOLITION AND IN ACCORDANCE WITH UTILITY COMPANY STANDARDS.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY DEMOLITION ASSOCIATED PERMITS.
9. THE CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF ALL STRUCTURES WITHIN THE PROJECT LIMITS UNLESS INDICATED TO REMAIN.
10. THE CONTRACTOR SHALL INCLUDE IN HIS BID ALL TEMPORARY FACILITIES AND SERVICES NECESSARY TO SATISFY FEDERAL, STATE & LOCAL REQUIREMENTS INCLUDING BUT NOT NECESSARILY LIMITED TO BRACING, SHORING, PAVEMENT REPAIR, FENCING, PEDESTRIAN AND VEHICLE ACCESS, CONCRETE PADS, ETC.
11. THE CONTRACTOR SHALL REFER TO THE SOIL EROSION & SEDIMENT CONTROL PLANS PROVIDED BY LANGAN INCLUDED AS PART OF THIS PLAN SET.
12. ALL SIGNS WITHIN LIMIT OF CLEARING TO BE REMOVED UNLESS OTHERWISE NOTED.
13. EXISTING FOUNDATIONS/BUILDING SLABS TO BE LEFT IN PLACE IF DEEPER THAN 3 VERTICAL FEET BELOW PROPOSED BUILDING SLAB, FOOTINGS, HARDSCAPE FEATURES, OR UTILITIES. ANY SLABS LEFT IN PLACE SHALL BE BROKEN UP TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER.
14. BASEMENTS AND BELOW GRADE STRUCTURES EXIST IN VARIOUS LOCATIONS ON SITE, INCLUDING BELOW EXISTING SLABS AND PAVED AREAS.
15. IF GROUNDWATER IS ENCOUNTERED ACROSS THE EXISTING SITE. DEWATERING OF EXCAVATIONS MAY BE REQUIRED. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ANY NECESSARY PERMITS.

GRADING & DRAINAGE NOTES

1. ALL PROPOSED STORM DRAINAGE PIPING TO UTILIZE WATER-TIGHT JOINTS.
2. CLEANOUTS SHALL BE PROVIDED FLUSH TO GRADE AT ALL LOCATIONS OF ROOF DRAIN INTERSECTIONS, BENDS AND UPSTREAM ENDS.
3. CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE APPROPRIATE SIZES OF THE DRAINAGE STRUCTURES (CATCH BASINS, MANHOLES, YARD DRAINS, ETC.) TO ACCOMMODATE THE PIPING SHOWN.
4. STORM DRAINAGE PIPING INSTALLATION SHALL COMMENCE AT THE FURTHEST DOWNSTREAM POINT AND PROCEED UPSTREAM "IN THE DRY".
5. THE CONTRACTOR WILL BE REQUIRED TO CLEAN THE ENTIRE DRAINAGE SYSTEM OF ALL DEBRIS AND OBSTRUCTIONS BOTH DURING CONSTRUCTION AND AT THE END OF CONSTRUCTION PRIOR TO ACCEPTANCE. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO, REMOVAL OF ALL FORMWORK FROM STRUCTURES, CONCRETE AND MORTAR DROPPINGS, CONSTRUCTION DEBRIS, AND DIRT. THE SYSTEM SHALL BE THOROUGHLY FLUSHED CLEAN AND THE CONTRACTOR SHALL FURNISH ALL NECESSARY HOSE, PUMPS, PIPE, AND OTHER EQUIPMENT THAT MAY BE REQUIRED FOR THIS PURPOSE. NO DEBRIS SHALL BE FLUSHED INTO EXISTING STORM DRAINS, WETLANDS, OR WATERCOURSES; ALL DEBRIS SHALL BE REMOVED FROM THE SYSTEM AND DISPOSED OF IN ACCORDANCE WITH ALL GOVERNING AGENCIES.
6. ALL MANHOLE COVERS, GRATES, INLETS, AND RIMS TO REMAIN SHALL BE ADJUSTED TO PROPOSED GRADE.
7. CONTRACTOR TO PROVIDE ALL FITTINGS AND BENDS NECESSARY TO ACCOMPLISH WORK.
8. REFER TO THE "STORMWATER OPERATION AND MAINTENANCE PLAN – MEDWAY BATTERY ENERGY STORAGE SYSTEM" FOR OPERATION OF THE STORMWATER MANAGEMENT SYSTEM.

UTILITY NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLATION OF THE FIRE SERVICE LINE CONNECTIONS TO EXISTING MAINS.
2. TEST PITS ARE TO BE PERFORMED PRIOR TO INSTALLATION OF FIRE SERVICE LINE CONNECTIONS TO CONFIRM THE SIZE AND MATERIAL OF THE MAIN.
3. TAPPING SLEEVES AND GATE VALVE ASSEMBLIES SHALL BE INSTALLED AT EACH FIRE SERVICE LINE CONNECTION AND SHALL BE MANUFACTURED BY CLOW VALVE CO., MUELLER CO., OR AMERICAN VALVE AND HYDRANT.
4. SCHEDULING OF ALL FIRE SERVICE LINE CONNECTION WORK SHALL BE COORDINATED WITH THE TOWN OF MEDWAY TO ALLOW FOR A REPRESENTATIVE FROM THE AGENCY TO BE ONSITE TO OVERSEE THE CONNECTIONS AND PERFORM A WATER SHUTDOWN AS NEEDED.
5. THE DEPARTMENT SHALL APPROVE ALL MATERIALS USED IN MAKING A SERVICE CONNECTION AND SHALL INSPECT ALL WORK UPON COMPLETION AND PRIOR TO BACKFILL OF TRENCH. ALL PIPE FITTINGS, AND APPURTENANCES SHALL MEET AWWA AND DEPARTMENT STANDARDS.
6. ALL MAINS SHALL BE AT LEAST EIGHT (8) INCHES IN DIAMETER AT A DEPTH OF FIVE (5) FEET AND SHALL BE CEMENT LINED DUCTILE IRON THICKNESS CLASS 52. ALL MAINS OR SERVICES SHALL BE INSTALLED NO CLOSER THAN THREE (3) FEET VERTICALLY OR TEN (10) FEET HORIZONTALLY FROM SEWER LINE OR ENCASED IN CONCRETE OR SLEEVE SEGMENTS NOT MEETING THESE CRITERIA.
7. VALVE BOXES SHALL BE MANUFACTURED IN THE UNITED STATES AND BE CAST IRON, TAR COATED, SLIDING, HEAVY PATTERN TYPE, CONSISTING OF THREE (3) PIECES; A FLANGED BOTTOM PIECE, A FLANGED TOP PIECE, AND A COVER WITH TOW (2) LIFTING HOLES AND THE WORD "WATER" CAST ON THE TOP. A MINIMUM 6 INCH OVERLAP IS REQUIRED BETWEEN SLIDING SECTIONS. THE INSIDE DIAMETER OF BOXES SHALL BE AT LEAST 5-1/4 INCHES AND LENGTHS SHALL BE AS NECESSARY TO SUIT GROUND ELEVATION.
8. WATER SHUT-OFF BOX AND CURB STOP BOX SHALL BE ERIE STYLE.
9. ALL HYDRANTS SHALL BE STANDARDIZED TYPE AND SPECIFICATIONS OF OF THE MEDWAY WATER DIVISION. HYDRANTS SHALL BE LOCATED AT PROPERTY LINES WHEN POSSIBLE AND SHALL NOT BE SPACED MORE THAN FIVE HUNDRED (500) FEET APART. THERE SHALL ALSO BE A GATE VALVE FOR EVERY HYDRANT. ALL HYDRANTS SHALL BE BACKED WITH 0.25 CUBIC YARDS OF CONCRETE OR APPROVED THRUST BLOCK AGAINST TRENCH WALL. HYDRANTS SHALL ALSO BE SURROUNDED WITH 1 CUBIC YARD OF 3/4-INCH STONE FOR DRAINAGE. SEE CONSTRUCTION DETAIL.
10. ALL FIRE HYDRANTS SHALL RECEIVE AN ISOLATION VALVE ALONG THE HYDRANT LATERAL AND A MINIMUM OF TWO PROTECTIVE BOLLARDS.
11. HYDRANTS – AMERICAN, DARLING MODEL B-84B, OPEN LEFT. FACTORY PAINTED IN TOWN OF MEDWAY STANDARD COLOR WITH NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) STANDARD THREADS AND TWO 2-1/2 INCH NOZZLES AND ONE 4-1/2 INCH NOZZLE.
12. THE DEVELOPER SHALL PROVIDE AS-BUILT RECORD DRAWINGS OF ALL NEW AND EXISTING WATER INFRASTRUCTURE TO THE TOWN OF MEDWAY AT THE COMPLETION OF CONSTRUCTION.
13. WATER MAINS SHALL BE PRESSURE AND LEAK TESTED AS PER AMERICAN WATER WORKS ASSOCIATION (AWWA) SPECIFICATIONS AT 50 PSI OVER STATIC PRESSURE OR 150 PSI, WHICHEVER IS GREATER, FOR A PERIOD OF TWO (2) HOURS.
14. THE DEVELOPER SHALL SUBMIT AN AS-BUILT PLAN, GATE TIE CARDS, AND WATER SERVICE CARDS, PREPARED BY A REGISTERED CIVIL ENGINEER IN THE STATE OF MASSACHUSETTS TO THE MEDWAY ENGINEERING DIVISION AT THE CONCLUSION OF THE PROJECT.
15. ALL NEW CONSTRUCTION OR ALL CEMENT LINED DUCTILE IRON JOINTS AT FITTINGS (CLASS 52), VALVES AND HYDRANT LATERALS SHALL BE MECHANICAL WITH NEOPRENE GASKETS. JOINTS AT OTHER LOCATIONS SHALL BE PUSH-ON TYPE WITH NEOPRENE OR SYNTHETIC RUBBER GASKETS. ALL WATER GATES SHALL OPEN PER MUNICIPAL REQUIREMENTS. ALL WATER LINES SHALL HAVE A MINIMUM OF 5' OF GROUND COVER AND A MINIMUM HORIZONTAL SEPARATION OF 10' FROM THE SEWER SYSTEM. AT WATER AND SEWER CROSSINGS, THE SEWER LINE SHALL BE ENCASED IN 6" OF CONCRETE FOR A DISTANCE OF 10' ON EITHER SIDE OF THE CROSSING IF A MINIMUM VERTICAL SEPARATION OF 18" IS NOT MAINTAINED.
16. ENSURE ALL EXISTING (TO REMAIN) AND PROPOSED MANHOLES PROPERLY IDENTIFY UTILITIES SERVICED.
17. WHERE AN EXISTING UTILITY IS FOUND TO BE IN CONFLICT WITH THE PROPOSED WORK, THE CONTRACTOR SHALL ACCURATELY DETERMINE THE LOCATION, ELEVATION, AND SIZE OF THE UTILITY AND TRANSMIT THIS INFORMATION TO THE ENGINEER WITHOUT DELAY.
18. THE LOCATIONS OF EXISTING ELECTRICAL LINES AND GAS MAINS ARE APPROXIMATE. THE CONTRACTOR MUST CONSULT THE LOCAL UTILITY COMPANIES FOR ADDITIONAL INFORMATION. ALL PROPOSED GAS AND ELECTRICAL WORK SHALL BE IN CONFORMANCE WITH LOCAL COUNTY, STATE AND FEDERAL GUIDELINES AND REQUIREMENTS.

LEGEND

	EXISTING	PROPOSED
PROPERTY LINE		
SETBACK LINE		
WETLAND LIMITS		
FLOOD ZONE LINE		
25' WETLAND BUFFER ZONE		
100' WETLAND BUFFER ZONE		
100' RIVERFRONT AREA		
200' RIVERFRONT AREA		
LIMITS OF STREAM		
BUILDING LINE		
PEDESTRIAN DOOR LOCATION		
SIGN		
BOLLARD		
CONCRETE		
ASPHALT		
GRAVEL		
STORMWATER MANAGEMENT FEATURE		
WATER LINE	W	
FIRE SERVICE LOOP	UFW	FW
UNDERGROUND TELECOMMUNICATIONS		
UNDERGROUND ELECTRIC	E	UE
STORM PIPE		
STORM CURBLESS CATCH BASIN		
STORM MANHOLE		
CONTOUR	137	135
SPOT ELEVATION	×192.54	×135.19
CHAIN LINK FENCE		
RETAINING WALL		
SOUND WALL		
LIMIT OF DISTURBANCE		LOD
SILT FENCE & SILT SOCK		
SILT FENCE		
STOCKPILE AREA		
INLET PROTECTION		
SEDIMENT BASIN/TRAP		
TEMPORARY DRAINAGE AREA		
STABILIZED DIVERSION CHANNEL WITH STONE CHECK DAMS		
WOODEN GUARDRAIL		
TREELINE		
TREE		
PARKING ROW COUNT		5
MANHOLES		
STORM FLARED END SECTION		
CLEANOUT		C.O.
FIRE HYDRANT		
GATE VALVE		
FIRE DEPARTMENT CONNECTION		
TRANSFORMER		T
OVERHEAD WIRE		
POWER POLE		
GUY WIRE		
LIGHT POLE		
TELECOMMUNICATION LINE		
GAS LINE		G
TEMPORARY STOCKPILE AREA		
SNOW STORAGE AREA		
BORING LOCATION		

ABBREVIATIONS

BC	BOTTOM OF CURB
BIT.	BITUMINOUS
BW	BOTTOM OF WALL
CB	CATCHBASIN
CC	CONCRETE CURB
CO	CLEAN OUT
CONC.	CONCRETE
CP	CONCRETE PAD
CPY	CANOPY DRAIN
DIP	DUCTILE IRON PIPE
DW	DETECTABLE WARNING
DYL	DOUBLE YELLOW LINE
EL	ELEVATION
EP	EDGE OF PAVEMENT
EX	EXISTING
FES	FLARED END SECTION
GR	GRADE
HDPE	HIGH DENSITY POLYETHYLENE PIPE
HP	HIGHPOINT
INV	INVERT
LA	LANDSCAPED AREA
LF	LINEAR FEET
MH	MANHOLE
N.T.S.	NOT TO SCALE
OCS	OUTLET CONTROL STRUCTURE
PR	PROPOSED
PVC	POLYVINYL CHLORIDE PIPE
RCP	REINFORCED CONCRETE PIPE
RET.	RETAINING
R.O.W	RIGHT OF WAY
R&D	REMOVE & DISPOSE
R&R	REMOVE & REPLACE
SD	STORM DRAIN
TC	TOP OF CURB
TD	TRENCH DRAIN
TF	TOP OF FRAME
TW	TOP OF WALL
TYP.	TYPICAL
WQU	WATER QUALITY UNIT
YD	YARD DRAIN

SOIL EROSION-SEDIMENT CONTROL NOTES

PROPOSED DEVELOPMENT

1. CONSTRUCTION WILL INCLUDE EARTHWORK, CURBING, PAVING, UTILITY INSTALLATION, LANDSCAPING AND BUILDING CONSTRUCTION. ALL DEMOLITION DEBRIS AND SOIL REMOVAL RELATED TO CONSTRUCTION SHALL BE REMOVED AND DISPOSED OF IN ACCORDANCE WITH APPLICABLE STATE AND LOCAL LAWS GOVERNING SUCH ACTIVITIES.
2. THE DETAILED EROSION AND SEDIMENT CONTROL MEASURES ARE SHOWN ON DRAWINGS CE101 AND CE102. THE PROPOSED MEASURES HAVE BEEN DESIGNED TO LIMIT THE MIGRATION OF SOIL SEDIMENT FROM THE SITE. HOWEVER, THE SITE CONTRACTOR IS RESPONSIBLE FOR ALL EROSION AND SEDIMENT CONTROLS AND SHALL SUPPLEMENT AND ADJUST THE PLAN AS NEEDED TO PREVENT SOIL EROSION TO THE MAXIMUM EXTENT FEASIBLE. TEMPORARY SEDIMENT BASINS ARE NOT SHOWN ON THE PLANS AS THE EXACT LOCATIONS ARE TO BE DETERMINED IN THE FIELD. THE CONTRACTOR SHALL CONSTRUCT AND IMPLEMENT TEMPORARY SEDIMENT BASINS THROUGHOUT THE SITE AS NEEDED TO CONTROL SITE RUNOFF AND PREVENT SEDIMENT MIGRATION.

SOIL EROSION AND SEDIMENT CONTROL NOTES

1. THE SOIL AND SEDIMENT CONTROL PRACTICES MUST BE INSTALLED IN ACCORDANCE WITH THE LOCAL GOVERNING AUTHORITY, THE MASSACHUSETTS EROSION AND SEDIMENT CONTROL GUIDELINES AND THE MASSACHUSETTS STORMWATER STANDARDS.
2. EROSION AND SEDIMENT CONTROL DEVICES MUST BE INSTALLED PRIOR TO START OF DEMOLITION AND CONSTRUCTION AND DISTURBANCE OF SITE CONTRIBUTORY DRAINAGE AREAS. THE OWNER OR ITS CONTRACTOR SHALL INSPECT, REPAIR AND REMOVE ALL SEDIMENT AND EROSION CONTROL DEVICES, AS INDICATED HEREIN. ALL EARTH CHANGES SHALL BE DESIGNED, CONSTRUCTED, AND COMPLETED IN SUCH A MANNER SO THAT THE EXPOSED AREA OF ANY DISTURBED LAND SHALL BE LIMITED TO THE SHORTEST POSSIBLE PERIOD OF TIME. CLEARING SHALL BE PHASED TO THE EXTENT FEASIBLE TO LIMIT POTENTIAL FOR SOIL EROSION.
3. DISPOSAL OF COLLECTED SEDIMENT SHALL BE MADE TO AREA DESIGNATED BY THE OWNER'S SOIL ENGINEER.
4. FILTER FABRIC/SILT FENCE WILL BE INSTALLED ALONG THE TOE OF ALL CRITICAL CUT AND FILL SLOPES.
5. EROSION CONTROL BLANKET BIONET SC150BN OR APPROVED EQUAL AND SEEDING AS SPECIFIED ON THE PLANTING PLAN MUST BE PROVIDED ON ALL SLOPES 4H:1V TO 3:1V. FOR SLOPES 2.5H:1V TO 3H:1V, SLOPES SHALL BE STABILIZED WITH A 12-INCH THICK LAYER OF MODIFIED ROCK FILL (MASSDOT M2.02.4) PLACED ON A 6-INCH THICK BEDDING LAYER OF 3/4-INCH CRUSHED STONE OVER MIRAFI FW700 WOVEN GEOTEXTILE. ALL SITE SLOPES SHALL BE LESS THAN 2.5H:1V.
6. ALL TOPSOIL NOT TO BE USED FOR FINAL GRADING/LANDSCAPED AREAS SHALL BE REMOVED FROM THE SITE IMMEDIATELY, IN ACCORDANCE WITH APPLICABLE STATE AND LOCAL LAW. ALL TOPSOIL TO BE USED IN LANDSCAPED AREAS SHALL BE STORED/STOCKPILED IN ACCORDANCE WITH APPLICABLE STATE AND LOCAL LAW STANDARDS.
7. THE SITE SHALL BE WETTED AS NECESSARY TO PROVIDE DUST CONTROL.
8. PAVEMENT BASE COURSE MUST BE PLACED IN ALL NEW ROADWAY AREAS UPON COMPLETION OF FINE GRADING.
9. THE CONTRACTOR IS RESPONSIBLE FOR ALL PAVED ROADWAYS, ON AND OFF-SITE, WHICH MUST BE KEPT FREE OF SITE GENERATED SEDIMENT AT ALL TIMES. DUST SHALL BE CONTROLLED BY SPRINKLING OR OTHER APPROVED METHOD.
10. ALL STORM DRAINAGE OUTLETS MUST BE STABILIZED, AS REQUIRED, BEFORE THE DISCHARGE POINTS BECOME OPERATIONAL.
11. SILT FENCES AND BARRIERS MUST BE CLEANED OR REPLACED PERIODICALLY TO REMOVE BUILT-UP SILT.
12. ALL EROSION AND SEDIMENT CONTROL DEVICES MUST BE INSPECTED WEEKLY AND WITHIN 24 HOURS AFTER EACH RAINFALL EVENT THAT PRODUCES 0.25 INCHES OR MORE OF RAIN.
13. ANY TEMPORARY OR PERMANENT FACILITY DESIGNED FOR THE CONVEYANCE OF WATER AROUND, THROUGH, OR FROM DISTURBED AREAS SHALL BE DESIGNED TO LIMIT THE WATER FLOW TO A NON-EROSIVE VELOCITY.
14. THE CONTRACTOR SHALL CORRECT ANY OMISSIONS, ERRORS, OR FIELD OPERATIONS IMMEDIATELY AND IN ACCORDANCE WITH THE GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL.
15. THE PROPERTY OWNER AND/OR HIS/HER AGENTS MUST MAINTAIN (REPAIR/REPLACE), WHEN NECESSARY, THE SILTATION CONTROL UNTIL ALL DEVELOPMENT ACTIVITY IS COMPLETED AND ALL DISTURBED AREAS ARE PERMANENTLY STABILIZED.

TEMPORARY STABILIZATION

SEDIMENT DISPOSAL AREAS AND TOPSOIL STOCKPILES NOT SCHEDULED FOR CONSTRUCTION ACTIVITIES WITHIN FOURTEEN (14) DAYS OF DISTURBANCE SHALL BE STABILIZED AS FOLLOWS:

A. SOIL AMENDMENTS AS NECESSARY.
B. ANNUAL RYE GRASS SEEDING APPLIED AT A RATE OF NOT LESS THAN 1 LB. PER 1,000 SF.
C. MULCH ALL NEWLY SEEDED AREAS WITHIN 80 LBS. OF SALT HAY OR SMALL GRAIN STRAW PER 1,000 SF.
D. WHEN DISTURBED AREAS ARE SCHEDULED FOR IMMEDIATE LANDSCAPING THEY MAY BE MULCHED AND SEEDED PER ITEM C ABOVE.

PERMANENT STABILIZATION

REFER TO PLANS FOR PERMANENT STABILIZATION METHODS + PROPOSED SEED MIXES.

A. PERMANENT VEGETATION IS TO BE SEEDED OR SODDED ON ALL DISTURBED LAND AREAS WITHIN SEVEN (7) DAYS AFTER FINAL GRADING. MULCH AS NECESSARY FOR SEED PROTECTION AND ESTABLISHMENT. AMEND SOIL AS NEEDED PRIOR TO PERMANENT SEEDING. WHEN IT IS NOT POSSIBLE TO PERMANENTLY STABILIZE A DISTURBED AREA AFTER COMPLETION OF AN EARTH CHANGE OR WHEN SIGNIFICANT EARTH CHANGE ACTIVITY CEASES, TEMPORARY SOIL EROSION CONTROL MEASURES SHALL BE IMPLEMENTED. ALL TEMPORARY SOIL EROSION CONTROL MEASURES SHALL BE MAINTAINED UNTIL PERMANENT SOIL EROSION CONTROL MEASURES SHALL BE IMPLEMENTED. ALL DISTURBED AREAS, STOCKPILES OF FILL OR EXCAVATED MATERIAL SHALL BE STABILIZED IN SUCH A MANNER AS NOT TO CAUSE UNREASONABLE HAZARD TO PERSONS OR PROPERTY.
B. MATERIALS SPECIFICATION: LAWN + MEADOW AREAS

(I) ANY SOIL HAVING A pH OF FOUR OR LESS CONTAINING IRON SULFIDES SHALL BE COVERED WITH A MINIMUM OF TWELVE INCHES OF SOIL HAVING A pH OF FIVE OR MORE PRIOR TO SEED BED PREPARATION.

C. MULCHING SHALL BE DONE AT THE RATE OF SEVENTY TO NINETY POUNDS (70-90 LBS) PER 1,000 SQUARE FEET WITH UNROTTED SALT HAY.
D. LIQUID MULCH BINDERS MUST BE USED TO ANCHOR SALT HAY, HAY OR STRAY MULCHES.
   (i) APPLICATIONS SHOULD BE HEAVIER AT EDGES WHERE WIND CATCHES THE MULCH IN VALLEYS AND AT CREATED BANKS. REMAINDER OF AREA SHOULD BE UNIFORM IN APPEARANCE.
   (ii) USE ONE OF THE FOLLOWING: SYNTHETIC OR ORGANIC BINDERS. BINDERS SUCH AS CURASOL DCA-70, PETRO SET, TERRA TACH, HYDRO MULCH AND AEROSPRAY MAY BE USED AT RATES RECOMMENDED BY THE MANUFACTURER OF ANCHOR MULCH MATERIALS. BINDERS CONTAINING PETROLEUM PRODUCTS SHALL NOT BE USED.

   NOTE: ALL NAMES GIVEN ABOVE ARE REGISTERED TRADE NAMES. THIS DOES NOT CONSTITUTE A RECOMMENDATION OF THESE TO THE EXCLUSION OF OTHER PRODUCTS.
D. FILL MATERIAL SHALL BE FREE FROM DEBRIS, PERISHABLE OR COMBUSTIBLE MATERIAL AND FROZEN OR WET EARTH OR STONES LARGER THAN THREE INCHES IN MAXIMUM DIMENSION.
E. CONSTRUCTION AREAS SHALL BE PERIODICALLY SPRAYED WITH WATER UNTIL THE SURFACE IS WET TO CONTROL THE GENERATION OF DUST.
F. ALL REVISIONS AFTER APPROVAL HAS BEEN GRANTED SHALL BE FORWARDED TO THE APPROPRIATE DISTRICT FOR REVIEW.
G. THE LOCAL GOVERNING AUTHORITY SHALL RECEIVE WRITTEN NOTIFICATION SEVENTY TWO HOURS BEFORE THE START OF ANY CONSTRUCTION.
H. SEEDBED PREPARATION:
   (i) TOPSOIL SHOULD BE A MINIMUM OF SIX INCHES DEEP (LIGHTLY COMPACTED) BEFORE SEEDING.
   (ii) TOPSOIL SHALL BE TESTED PRIOR TO SEEDING.
   (iii) WORK SOIL AMENDMENTS INTO SOIL AS NECESSARY AS NEARLY AS PRACTICAL TO A DEPTH OF FOUR INCHES WITH A DISC, SPRINGTOOTH HARROW OR OTHER SUITABLE EQUIPMENT. THE FINAL HARROWING OR DISCING OPERATION SHOULD BE ON THE GENERAL CONTOUR. CONTINUE ALL CLAY OR SILTY SOIL AND COARSE SANDS SHOULD BE ROLLED TO FIRM THE SEED BED WHEREVER FEASIBLE.
   (iv) REMOVE FROM THE SURFACE ALL STONES ONE INCH OR LARGER IN ANY DIMENSION. REMOVE ALL OTHER DEBRIS, SUCH AS WIRE, CABLE, TREE ROOTS, PIECES OF CONCRETE, CLODS, LUMPS, OR OTHER UNSUITABLE MATERIAL.
   (v) INSPECT SEED BED JUST BEFORE SEEDING. IF TRAFFIC HAS LEFT SOIL COMPACT, THE AREA MUST BE RETILLED AND FIRMED AS ABOVE.

CONTINGENCY SOIL EROSION AND SEDIMENT CONTROL NARRATIVE

1. THE GENERAL CONTRACTOR WILL DESIGNATE PERSONNEL FOR 24 HOUR EMERGENCY RESPONSE IN THE EVENT OF SEVERE WEATHER AND INCREASED POTENTIAL FOR SEVERE EROSION.
2. THE GENERAL CONTRACTOR IS REQUIRED TO MAINTAIN ON SITE OR HAVE THE ABILITY TO RETRIEVE WITHIN 12 HOURS THE FOLLOWING MATERIALS IN THE EVENT THAT THERE ARE DEFICIENCIES IN THE SESC MEASURES:
   A. 25% OF THE INSTALLED LENGTH OF SILT FENCE
   B. EQUIVALENT TONNAGE OF STONE FOR STABILIZATION OF 2 STABILIZATION ENTRANCES. STONE COULD BE USED FOR SLOPE REPAIRS, ENERGY DISSIPATER ENHANCEMENTS, ETC.
   C. HEAVY EQUIPMENT CAPABLE OF TRENCHING/EXCAVATING LARGE AREAS TO DIVERT AND CONTROL RUNOFF IN A CONTROLLED MANNER.
   D. HAVE DESIGNATED A HYDRO-SEED CONTRACTOR CAPABLE OF RESPONDING TO THE SITE WITHIN 12 HOURS
3. ANY STUMP GRINDINGS OR WOOD CHIPS GENERATED ON-SITE SHOULD BE RETAINED FOR USE TO BACK UP SILT FENCES.

Date	Description	No.

Revisions

COMMONWEALTH OF MASSACHUSETTS
FRANK HOLMES
CIVIL
No. 40203
REGISTERED
PROFESSIONAL ENGINEER

Frank Holmes

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Project

MEDWAY BATTERY ENERGY STORAGE SYSTEM

MEDWAY

NORFOLK COUNTY MASSACHUSETTS

Drawing Title

MASTER LEGEND AND NOTES

Project No. 151033401

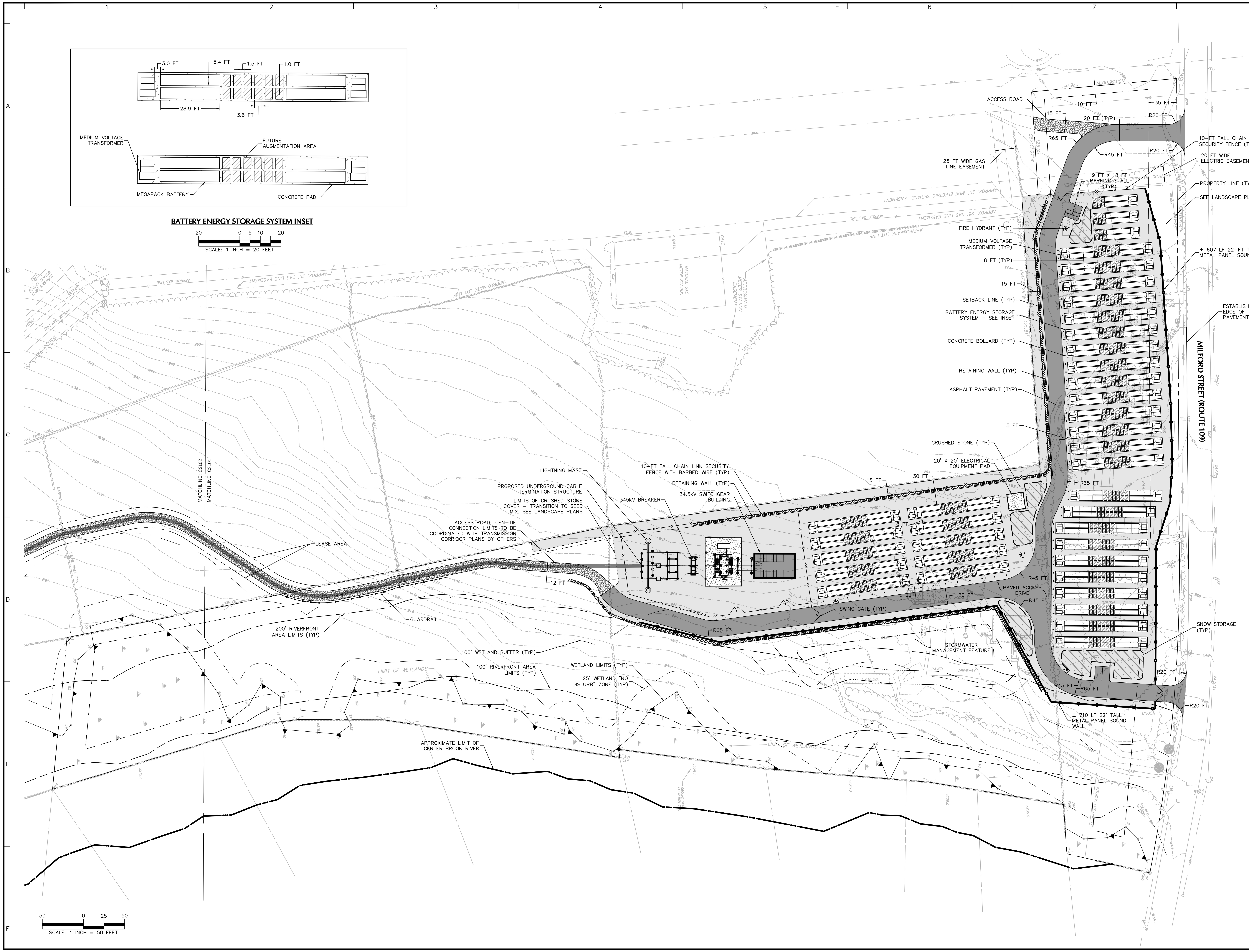
Date 06/08/2023

Drawn By JNW

Checked By FH

Drawing No. CS002

Project No. 151033401



Date	Description	No.
Revisions		

COMMONWEALTH OF MASSACHUSETTS
FRANK HOLMES
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Project

MEDWAY BATTERY ENERGY STORAGE SYSTEM

MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title

SITE PLAN

Project No. 151033401
Date 06/08/2023
Drawn By JNW
Checked By FH
Drawing No. CS101

Project No. 151033401

NOTE: PLEASE REFER TO POWER ENGINEER'S PROPOSED 345kV UNDERGROUND TRANSMISSION LINE PLANS FOR ADDITIONAL INFORMATION.

Date	Description	No.

Revisions

COMMONWEALTH OF MASSACHUSETTS
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Project

MEDWAY BATTERY ENERGY STORAGE SYSTEM

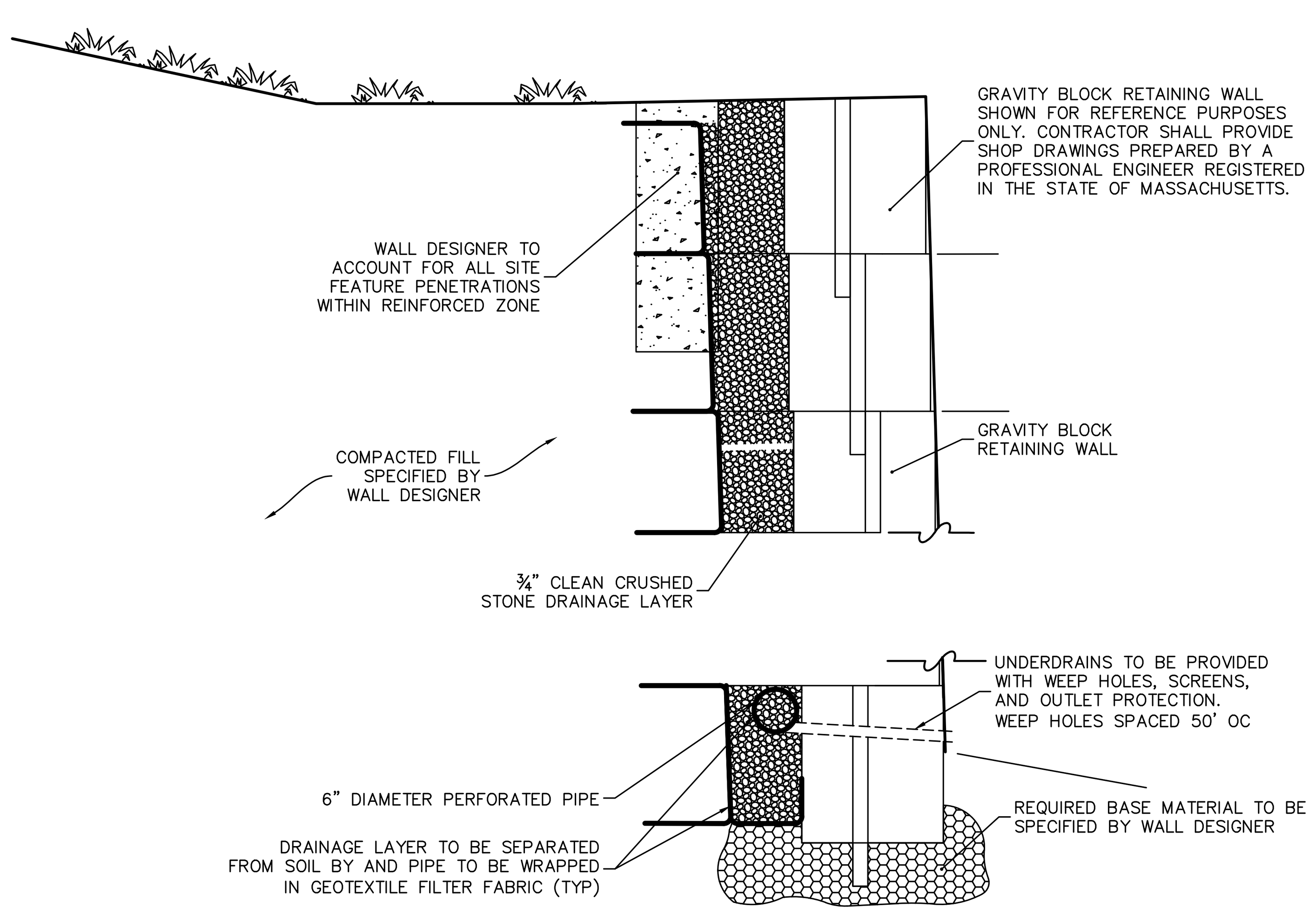
MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title

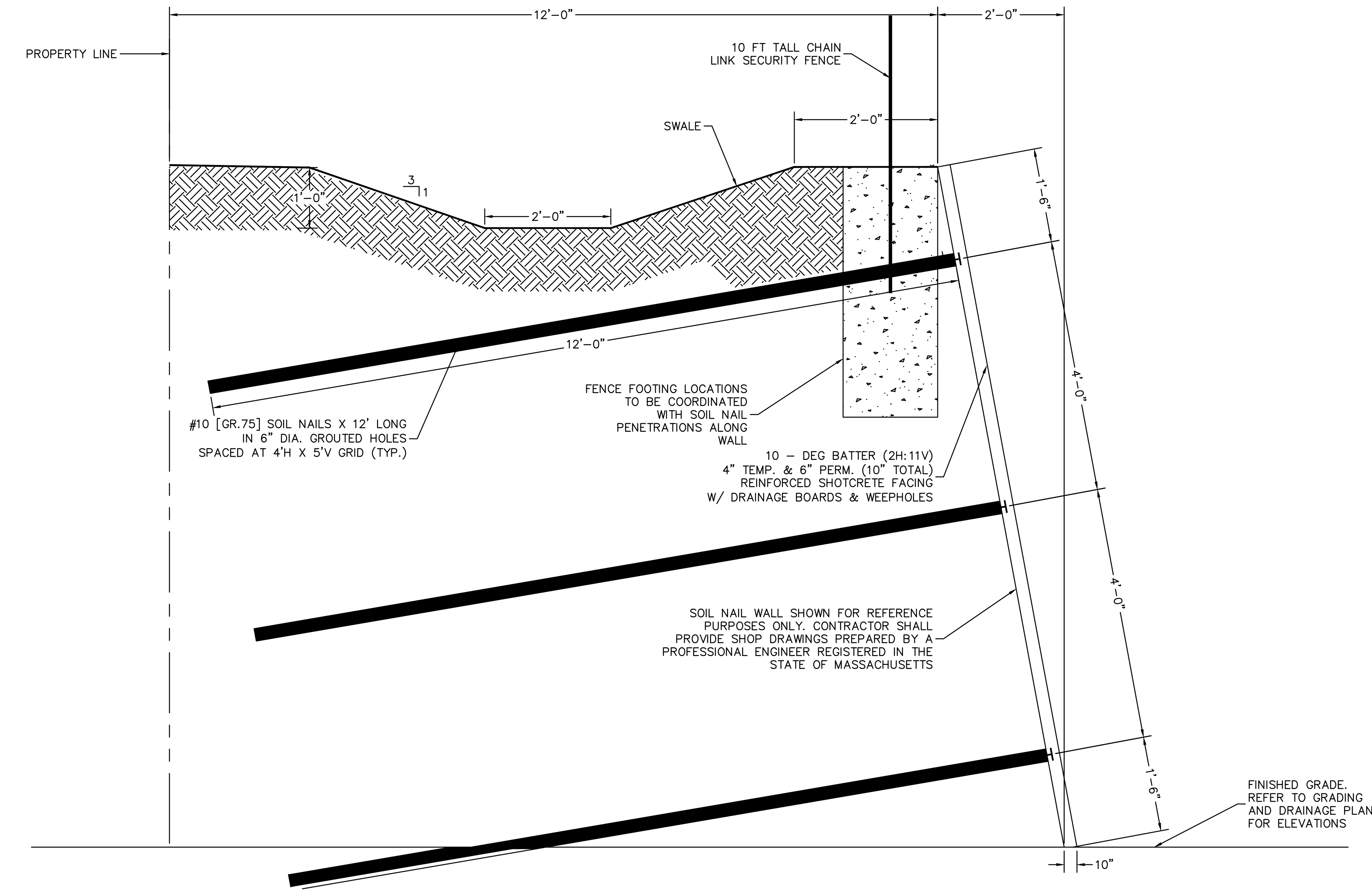
UNDERGROUND TRANSMISSION LINE SITE PLAN

Project No. 151033401
Date 06/08/2023
Drawn By JSP
Checked By FH
Drawing No. CS102

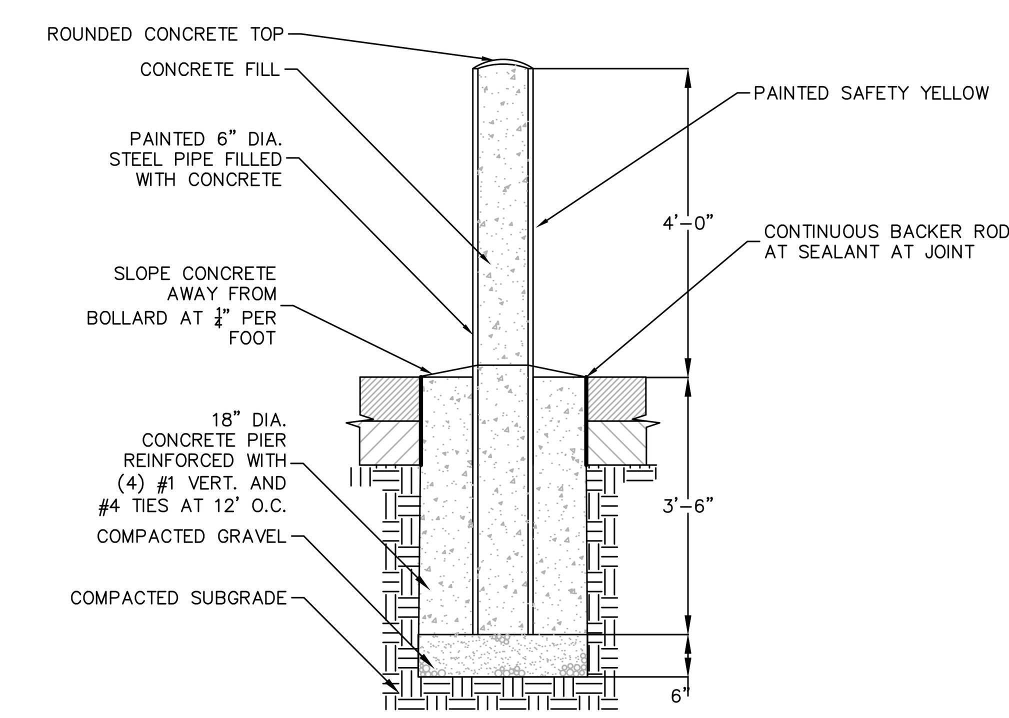
Project No. 151033401



1 TYPICAL RETAINING WALL SECTION (FOR REFERENCE ONLY)
N.T.S.

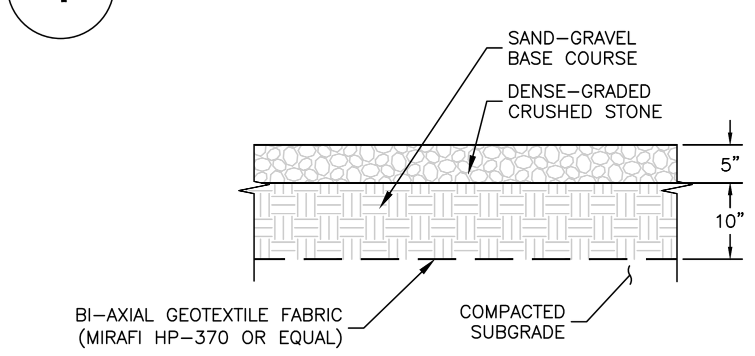


2 SOIL NAIL WALL (FOR REFERENCE ONLY)
N.T.S.

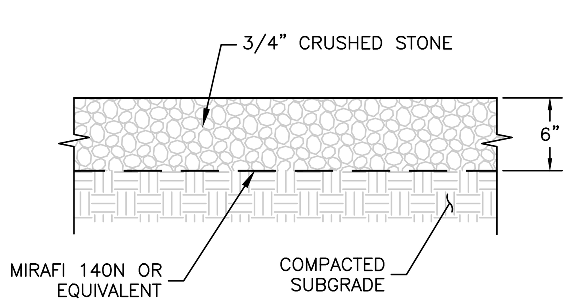


NOTES:
1. COLOR TO BE SAFETY YELLOW WITH REFLECTIVE STRIPES.

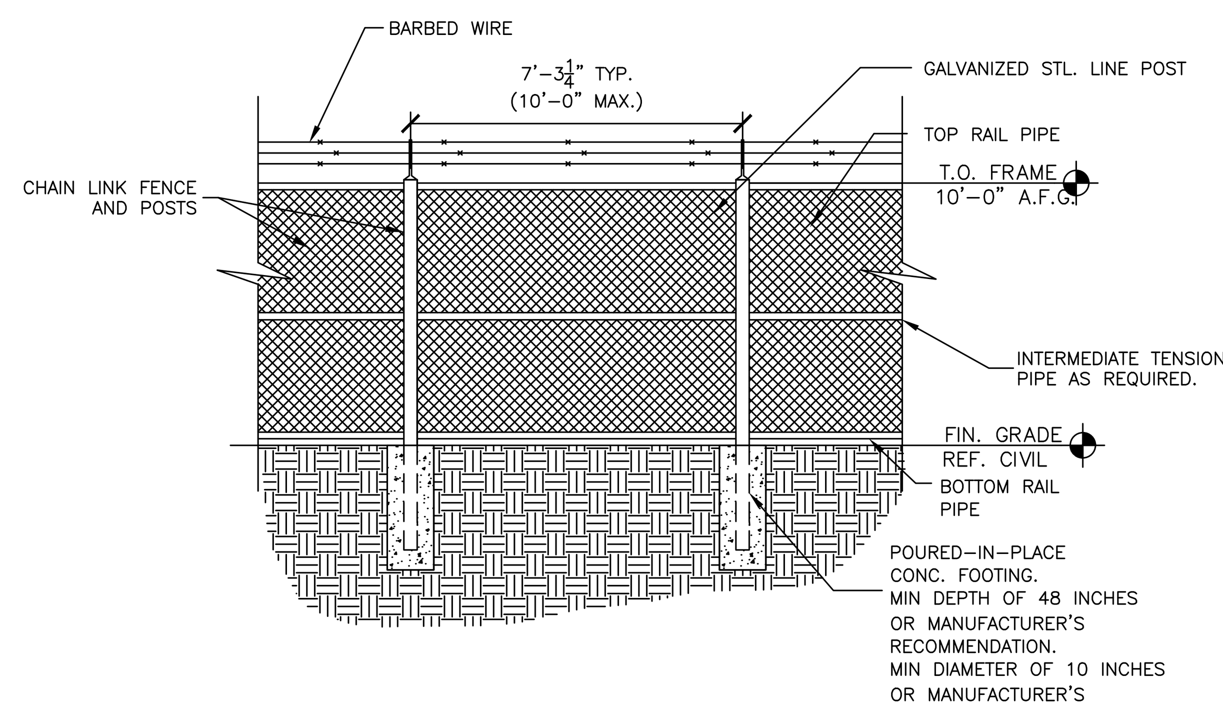
3 CONCRETE BOLLARD
N.T.S.



4 CRUSHED STONE ACCESS ROAD
N.T.S.

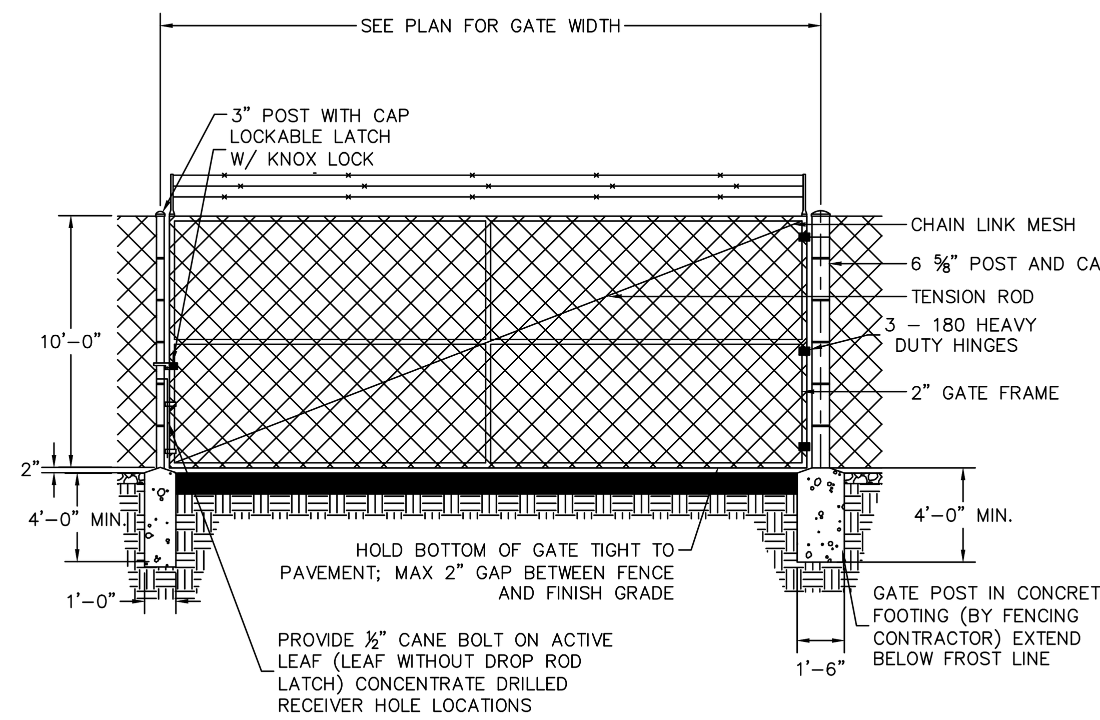


5 CRUSHED STONE SECTION
N.T.S.



NOTES:
1. FENCE AND POSTS TO BE GALVANIZED AND BLACK VINYL COATED.

6 10 FT TALL CHAIN LINK SECURITY FENCE WITH BARBED WIRE
N.T.S.



NOTES:
1. ALL MATERIALS TO BE BLACK VINYL COATED

7 CHAIN LINK SWING GATE
N.T.S.

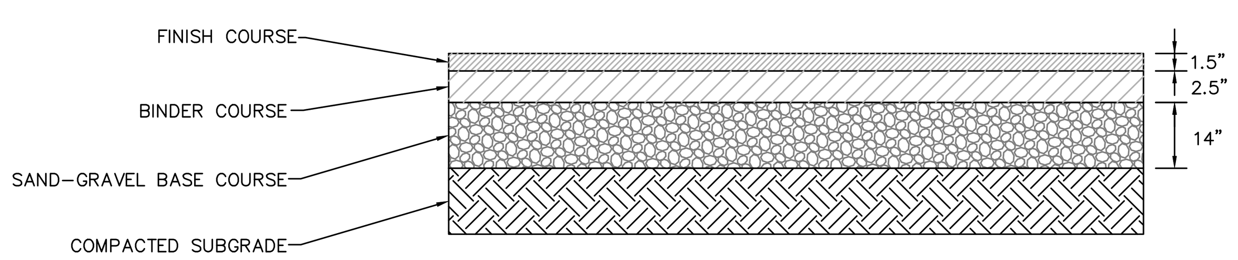
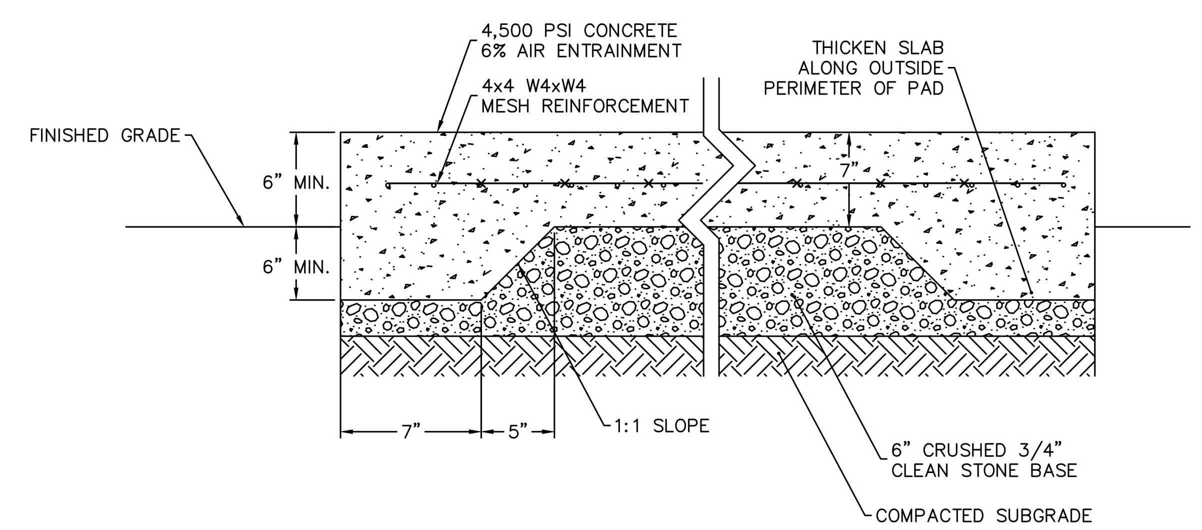


TABLE 1: GRADATION REQUIREMENTS	
SIEVE SIZE	% FINER BY WEIGHT
SAND–GRAVEL	
3 INCH	10
½ INCH	50 – 85
No. 4	40 – 75
No. 40	10 – 35
No. 200	0 – 8

NOTES:
1. PAVING COURSES SHALL BE CONSTRUCTED IN LAYERS NOT LESS THAN 1.5 INCHES THICK PER LIFT.
2. ALL FILL MATERIALS SHALL BE FREE FROM ICE AND SNOW, ROOTS, SOD, RUBBISH AND OTHER DELETERIOUS OR ORGANIC MATTER. STRUCTURAL FILL SHALL CONFORM TO THE GRADATION REQUIREMENTS.
3. ALL AREAS TO BE PAVED SHALL BE PROOFROLLED WITH AT LEAST 4 PASSES OF A SMOOTH ROLLER HAVING A MINIMUM STATIC DRUM WEIGHT OF 10 TONS. ANY SOFT AREAS SHALL BE REMOVED AND REPLACED WITH CLEAN, GRANULAR, FREE–DRAINING SOIL. FILL SHALL BE PLACED IN LOOSE LIFTS NOT TO EXCEED 12–INCHES AND SHALL BE COMPACTED TO AT LEAST 95% OF ITS MAXIMUM DRY DENSITY AS DETERMINED BY THE GEOTECHNICAL REPORT.
4. REFER TO GEOTECHNICAL REPORT TITLED, "UPDATED GEOTECHNICAL REPORT PROPOSED ENERGY STORAGE INSTALLATION 50–53 MILFORD STREET MEDWAY, MASSACHUSETTS" BY GZA GEOENVIROMENTAL, INC. FOR FURTHER DETAIL.
5. REFER TO TABLE 1: GRADATION REQUIREMENTS FOR RECOMMENDED BASE COURSE.

8 ASPHALT PAVEMENT
N.T.S.



9 CONCRETE PAD
N.T.S.

Date	Description	No.
Revisions		

COMMONWEALTH OF MASSACHUSETTS
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Project
MEDWAY BATTERY ENERGY STORAGE SYSTEM
MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title
SITE DETAILS

Project No. 151033401
Date 06/08/2023
Drawn By JNW
Checked By FH
Drawing No. CS501

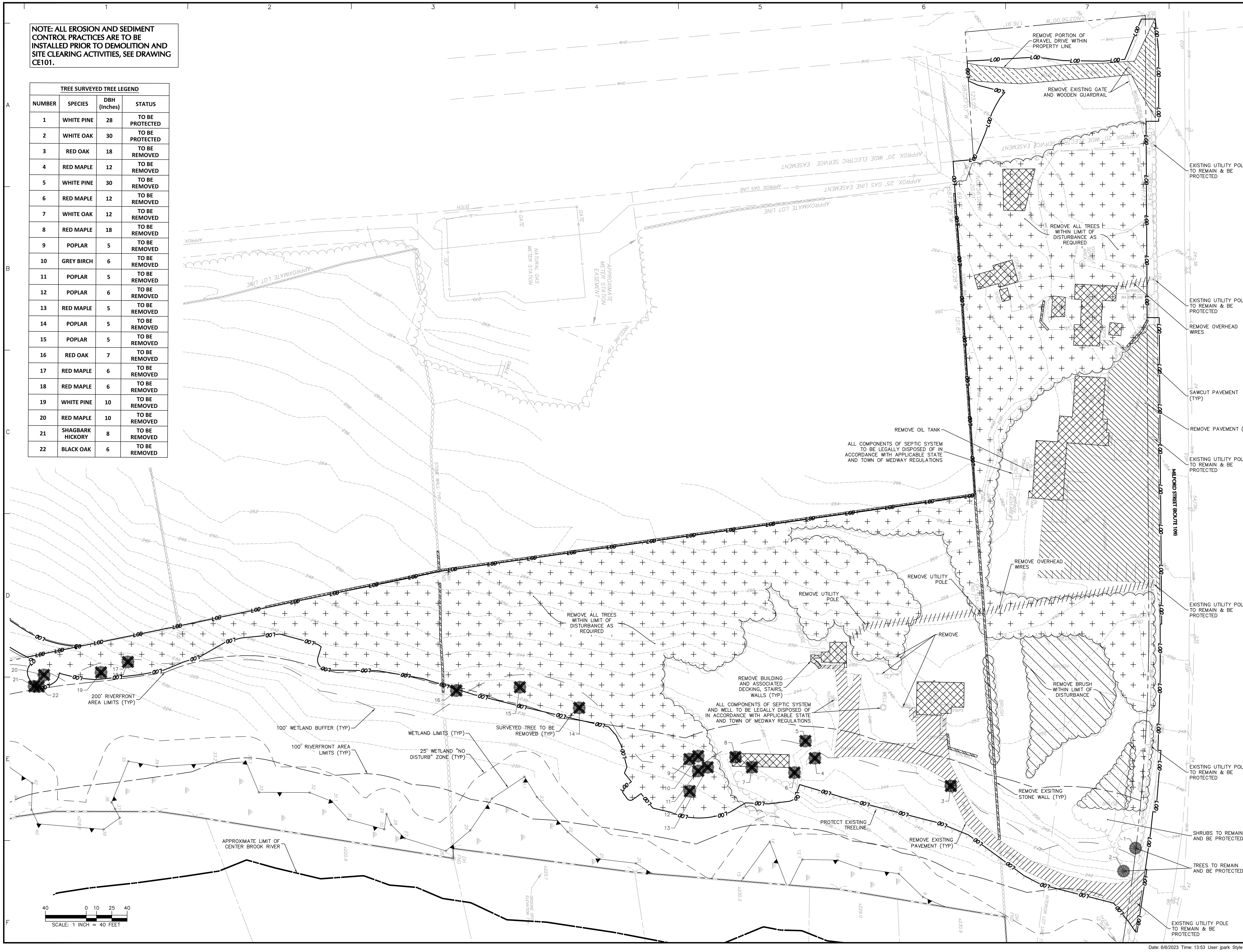
LANGAN
Project No. 151033401

Date: 6/6/2023 Time: 13:53 User: jpark Style Table: Langan.stb Layout: CS501 Document Code: 151033401-0501-CS501-0101

NOTE: ALL EROSION AND SEDIMENT CONTROL PRACTICES ARE TO BE INSTALLED PRIOR TO DEMOLITION AND SITE CLEARING ACTIVITIES, SEE DRAWING CE101.

TREE SURVEYED TREE LEGEND

NUMBER	SPECIES	DBH (Inches)	STATUS
1	WHITE PINE	28	TO BE PROTECTED
2	WHITE OAK	30	TO BE PROTECTED
3	RED OAK	18	TO BE REMOVED
4	RED MAPLE	12	TO BE REMOVED
5	WHITE PINE	30	TO BE REMOVED
6	RED MAPLE	12	TO BE REMOVED
7	WHITE OAK	12	TO BE REMOVED
8	RED MAPLE	18	TO BE REMOVED
9	POPLAR	5	TO BE REMOVED
10	GREY BIRCH	6	TO BE REMOVED
11	POPLAR	5	TO BE REMOVED
12	POPLAR	6	TO BE REMOVED
13	RED MAPLE	5	TO BE REMOVED
14	POPLAR	5	TO BE REMOVED
15	POPLAR	5	TO BE REMOVED
16	RED OAK	7	TO BE REMOVED
17	RED MAPLE	6	TO BE REMOVED
18	RED MAPLE	6	TO BE REMOVED
19	WHITE PINE	10	TO BE REMOVED
20	RED MAPLE	10	TO BE REMOVED
21	SHAGBARK HICKORY	8	TO BE REMOVED
22	BLACK OAK	6	TO BE REMOVED



Date	Description	No.

Revisions

COMMONWEALTH OF MASSACHUSETTS FRANK HOLMES CIVIL No. 40203 REGISTERED PROFESSIONAL ENGINEER

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Project

MEDWAY BATTERY ENERGY STORAGE SYSTEM

MEDWAY

NORFOLK COUNTY MASSACHUSETTS

Drawing Title

SITE PREPARATION PLAN

Project No. 151033401

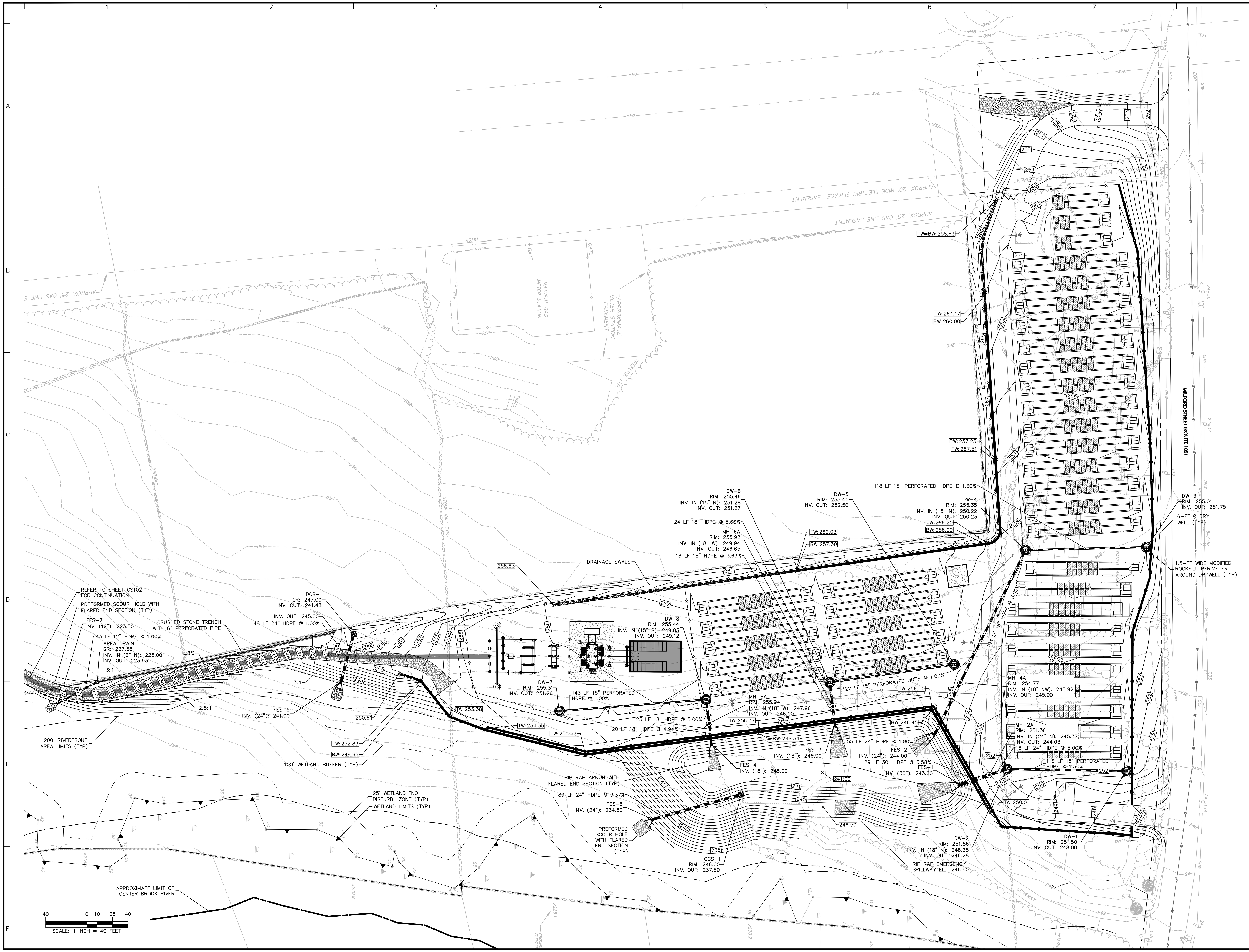
Date 06/08/2023

Drawn By JNW

Checked By FH

Drawing No. CD101

Project No. 151033401



Date	Description	No.

Revisions

COMMONWEALTH OF MASSACHUSETTS
FRANK HOLMES
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Project

MEDWAY BATTERY ENERGY STORAGE SYSTEM

MEDWAY
NORFOLK COUNTY MASSACHUSETTS

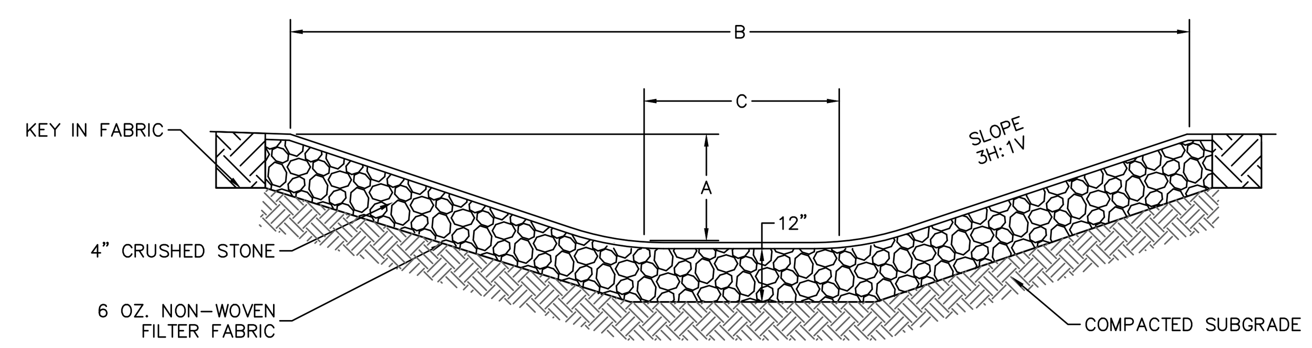
Drawing Title

GRADING & DRAINAGE PLAN

Project No. 151033401
Date 06/08/2023
Drawn By JNW
Checked By FH

Drawing No. CG101

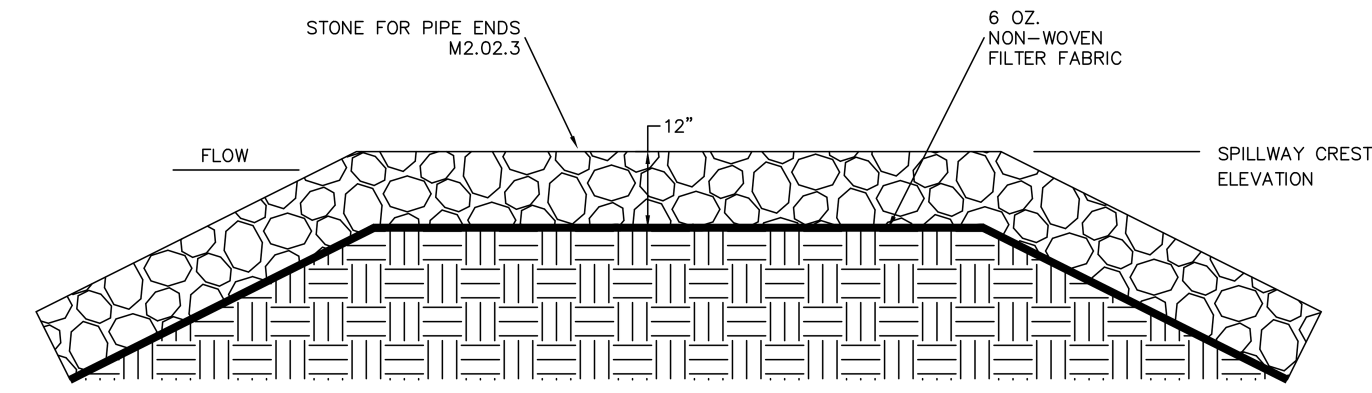
Project No. 151033401



NOTE:
1. SWALE SHALL BE CRUSHED STONE.

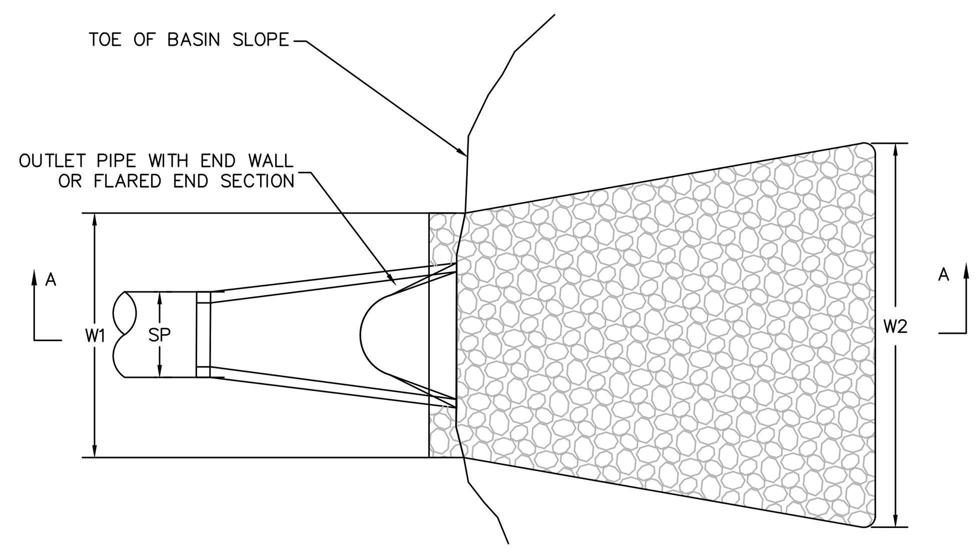
SWALE DESIGN SCHEDULE				
SWALE LOCATION	LENGTH (FT)	A MIN. DEPTH (FT)	B MIN. TOP WIDTH (FT)	C BOTTOM WIDTH (FT)
WESTERN PROPERTY LINE	PER PLAN	1.0	8.0	2.0

1 SWALE
N.T.S.

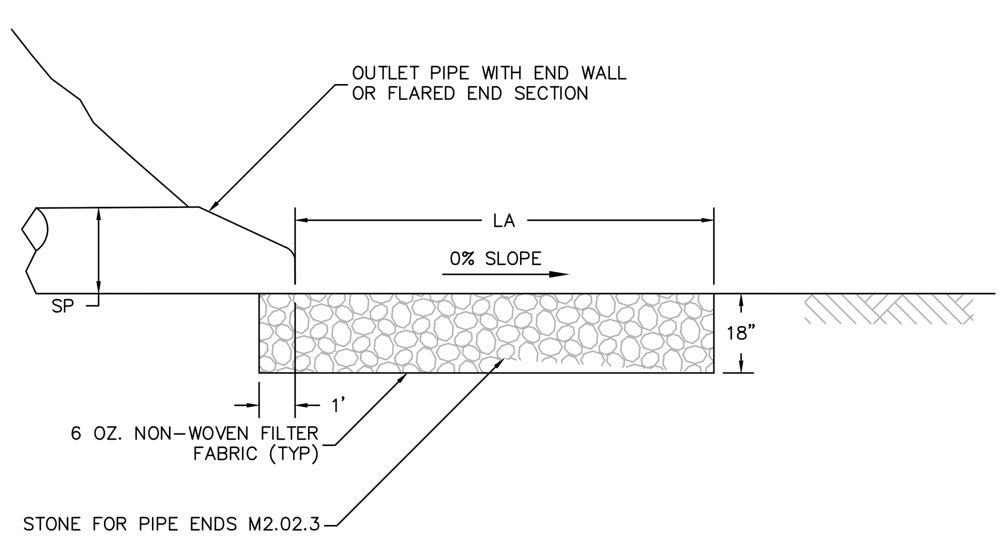


RIP-RAP SPILLWAY SCHEDULE					
LOCATION	SPILLWAY CREST ELEVATION (FT)	SPILLWAY CREST ELEVATION WIDTH (FT)	SPILLWAY TOP WIDTH (FT)	SPILLWAY SIDE SLOPES	SPILLWAY LENGTH (FT)
INFILTRATION BASIN	246	20	23	3:1	36

2 RIP RAP EMERGENCY SPILLWAY
N.T.S.



PLAN

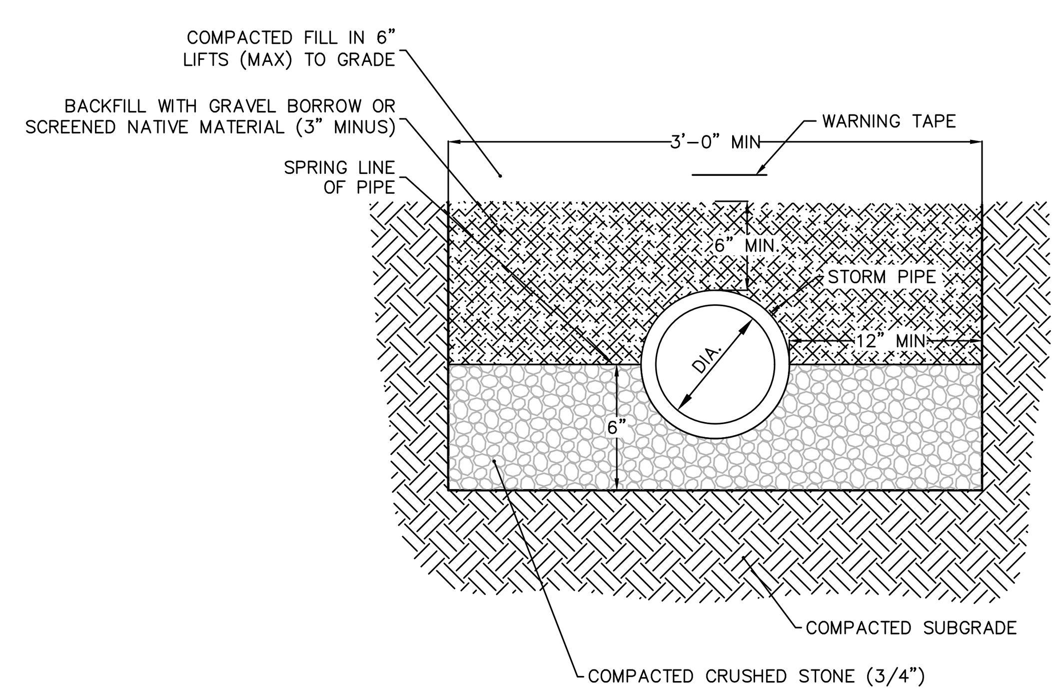


SECTION A-A

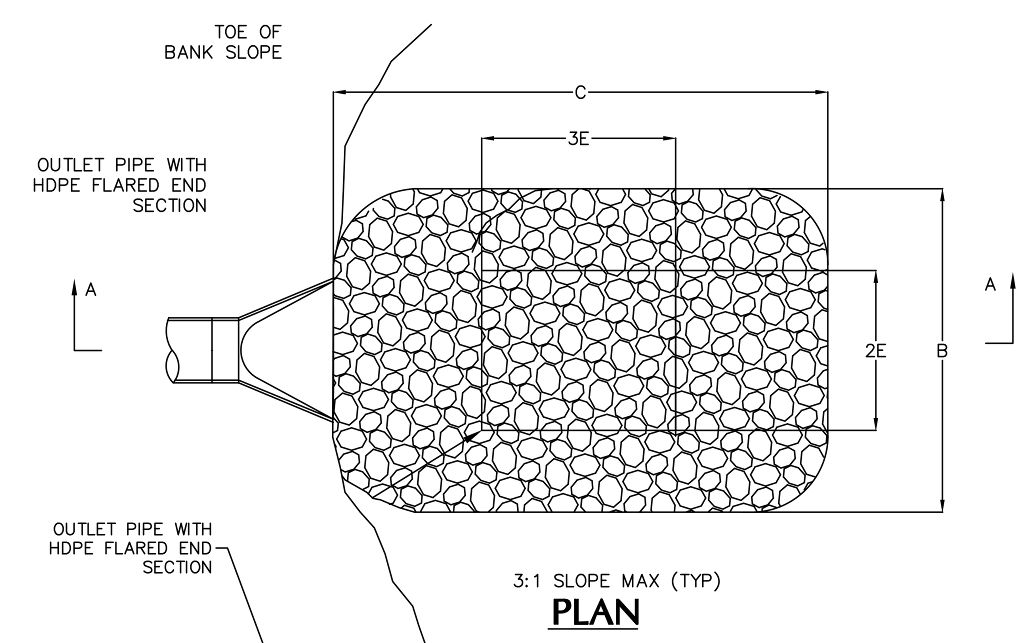
NOTES:
1. SEE GRADING AND DRAINAGE PLAN FOR SIZES/DIMENSIONS

STRUCTURE	LA [FT]	W1 [FT]	W2 [FT]	SP [FT]
FES-1	35	8	21	2.5
FES-2	21	6	21	2
FES-3	18	5	18	1.5
FES-4	18	5	13	1.5

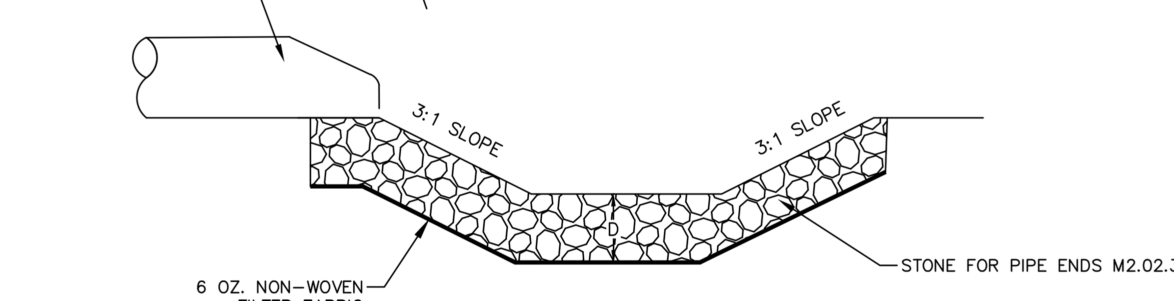
3 RIPRAP APRON WITH FLARED END SECTION
N.T.S.



4 STORM PIPE BEDDING
N.T.S.



PLAN



SECTION A - A

NOTE:
1. SIDE SLOPES SHALL BE 3:1 OR FLATTER.

STRUCTURE	E [FT]	2E [FT]	3E [FT]	DEPTH [FT]	B [FT]	C [FT]	D [FT]
FES-5	2	4	6	1	10	12	1
FES-6	2.5	5	7.5	1.25	12.5	15	1
FES-7	1.5	3	4.5	0.75	7.5	9	1

5 PREFORMED SCOUR HOLE WITH FLARED END SECTION
N.T.S.

Date	Description	No.

Revisions

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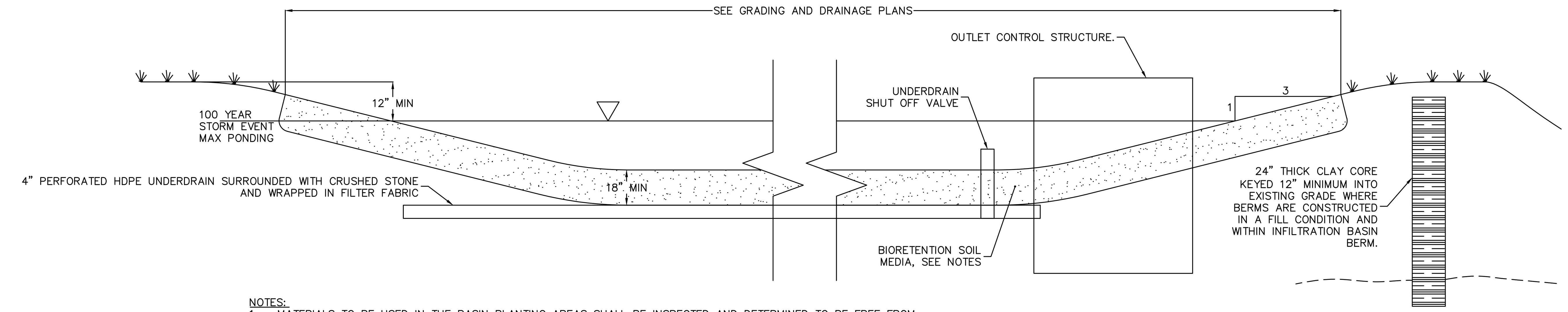
Project
MEDWAY BATTERY ENERGY STORAGE SYSTEM
MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title
GRADING & DRAINAGE DETAILS

Project No. 151033401
Date 06/08/2023
Drawn By JNW
Checked By FH
Drawing No. CG501

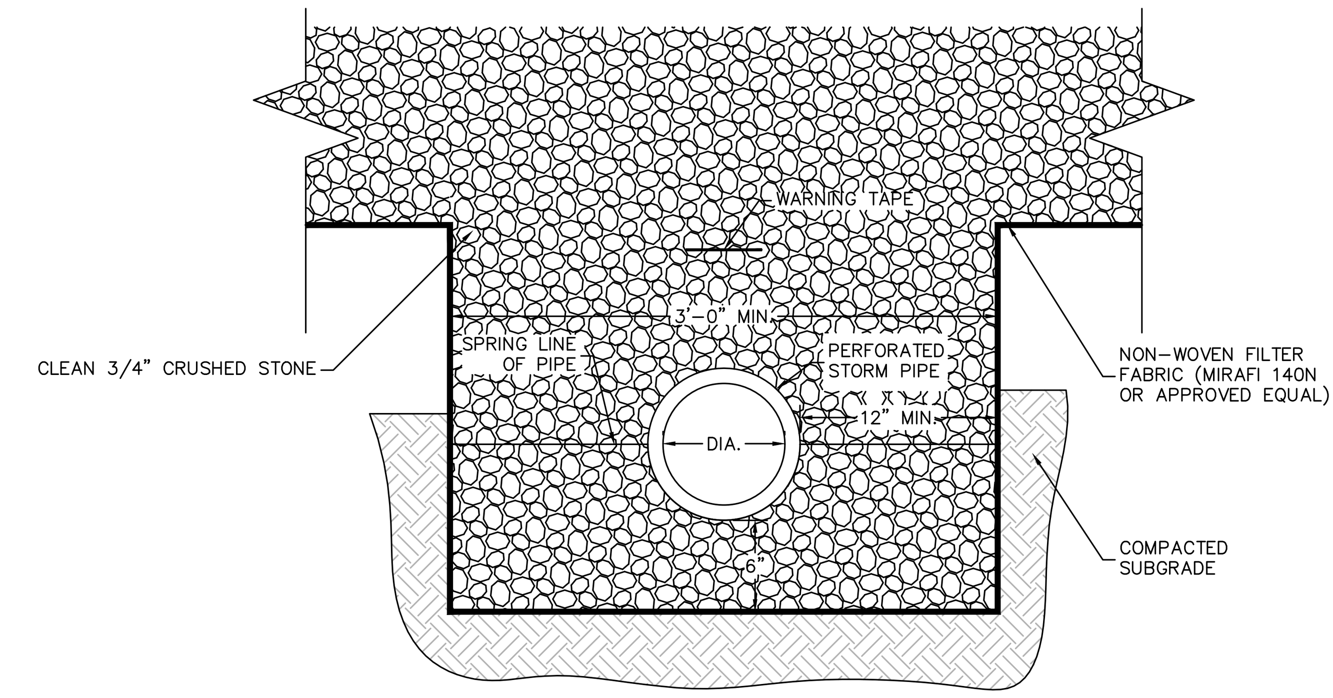
Project No. 151033401



NOTES:
1. MATERIALS TO BE USED IN THE BASIN PLANTING AREAS SHALL BE INSPECTED AND DETERMINED TO BE FREE FROM PURPLE LOOSESTRIFE (LYTHRUM SALICARIA), COMMON REED (PHRAGMITES AUSTRALIS), OR REED CANARYGRASS (PHALARIS ARUNDINACEA).
2. BASIN SOIL MIX SHALL BE PLACED A MINIMUM OF 18" DEEP.
3. ENGINEER TO OBSERVE INFILTRATION BASIN SOILS DURING EXCAVATION TO ENSURE ALL UNSUITABLE SOILS HAVE BEEN REMOVE PRIOR TO FINAL GRADING.
4. COMPACTION OF BASINS AREAS AND REQUIRED BACKFILL SHALL BE MINIMIZED TO THE MAXIMUM EXTENT FEASIBLE BY THE USE OF EXCAVATION HOES, LIGHT EQUIPMENT WITH TURF TYPE TIRES, OR WIDE TRACK EQUIPMENT.
5. IF COMPACTION DOES OCCUR IN BASIN, THE COMPACTED ZONE SHALL BE TILLED TO REFRACTURE AT LEAST 12" OF NATURAL SOIL BEFORE BACKFILLED WITH SOIL MIX.
6. WHEN BACKFILLING BASIN, PLACE SOIL IN LIFTS OF 12–18" AND USE LIGHT EQUIPMENT ONLY WHEN GRADING WITHIN THE BASIN. HEAVY EQUIPMENT CAN BE USED AROUND THE PERIMETER OF THE BASIN.
7. ALLOW SOIL MIXTURE TO SETTLE NATURALLY THROUGH RAIN EVENTS OR PRESOAK AFTER PLACEMENT.
8. BIORETENTION SOIL MIX SHALL BE PER SHEET LP501.
9. SEED BASIN WITH MEADOW MIX A PER SHEET LP501.
10. SEED SHOULDERS OF BASINS WITH MEADOW MIX B PER SHEET LP501.
11. PLANTS AND SEED MIXES SHALL BE FIELD LOCATED BY A WETLAND SCIENTIST.

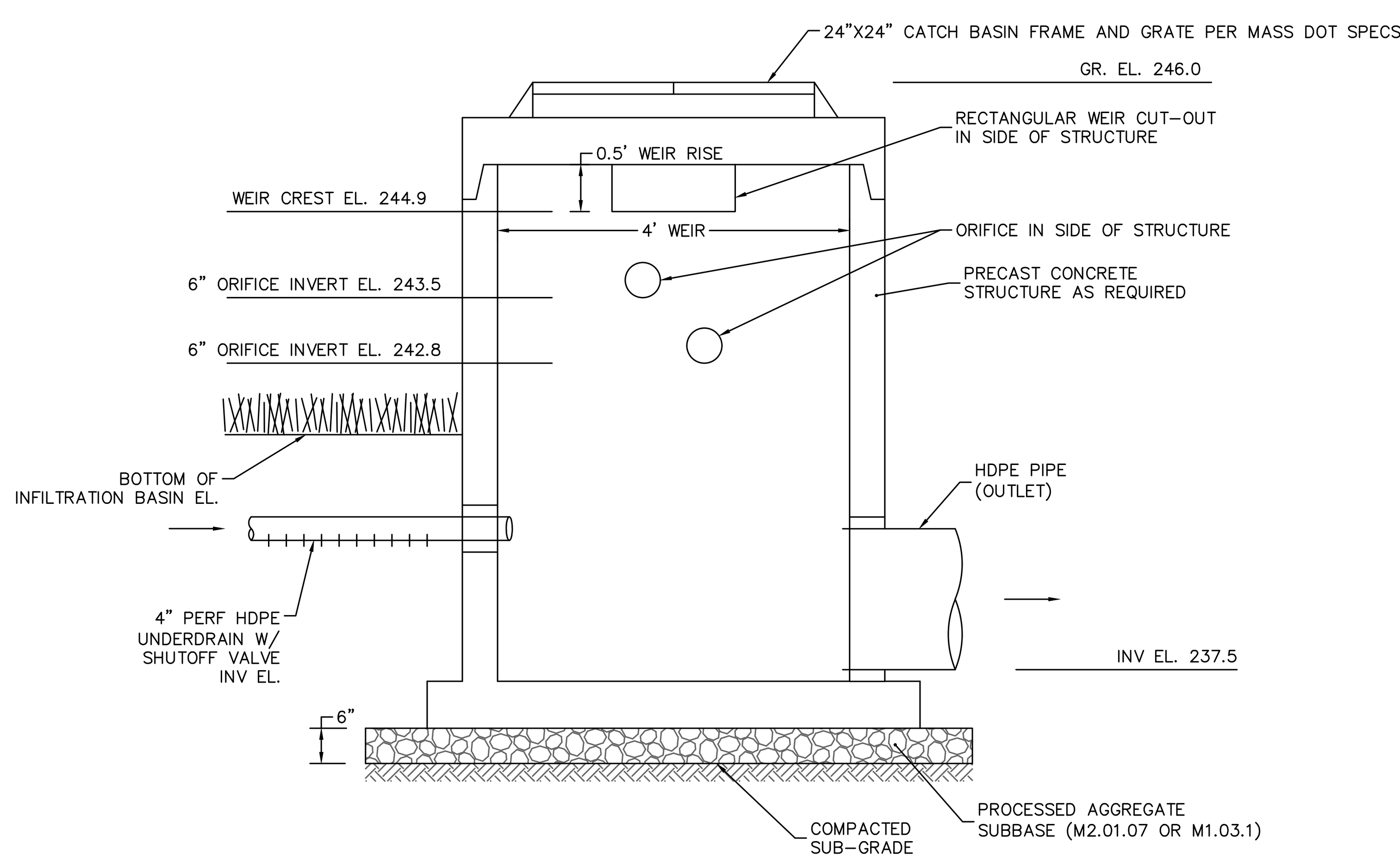
1 INFILTRATION BASIN

N.T.S.



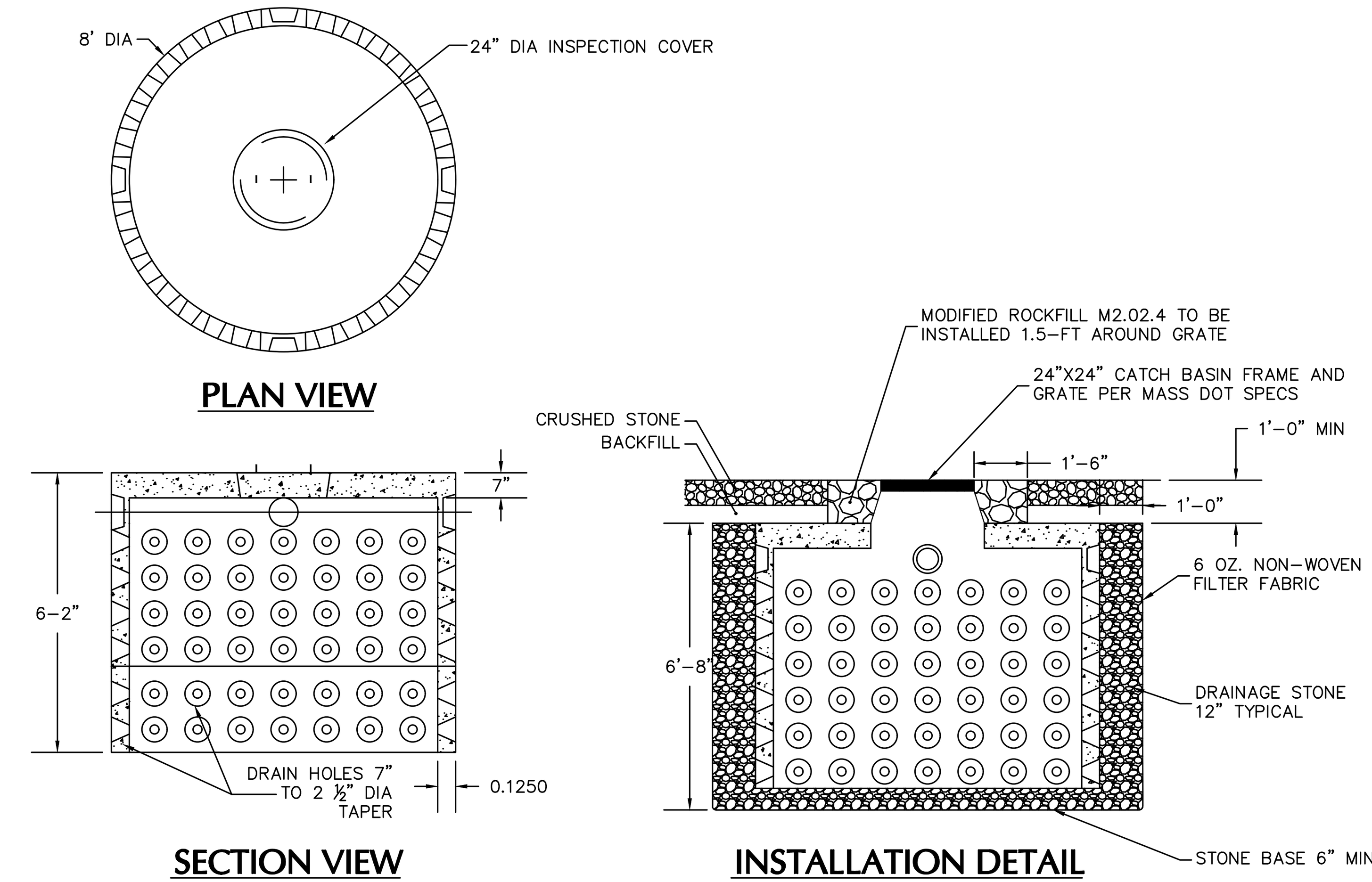
2 PERFORATED PIPE

N.T.S.



3 OUTLET CONTROL STRUCTURE - INFILTRATION BASIN

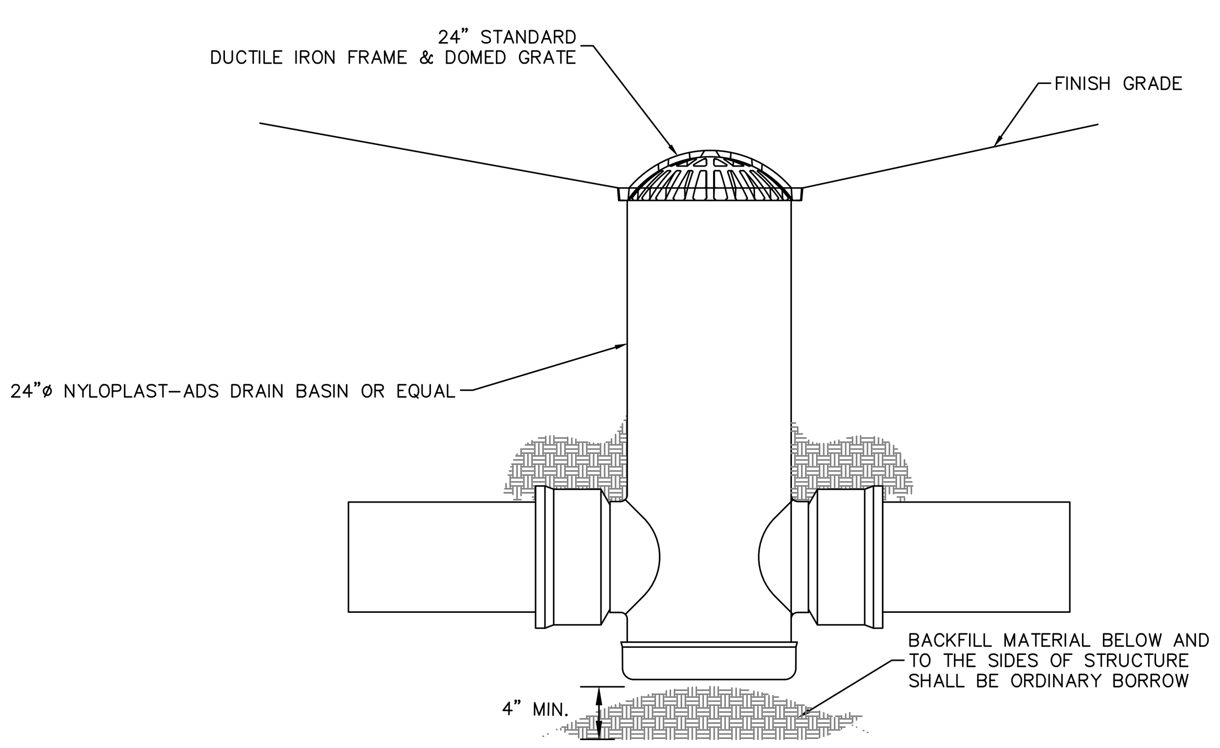
N.T.S.



NOTES:
1. CONCRETE: 5,000 PSI MINIMUM AFTER 28 DAYS.
2. DESIGNED FOR H-20 LOADING, 1 TO 5 FEET OF COVER.

4 DRY WELL

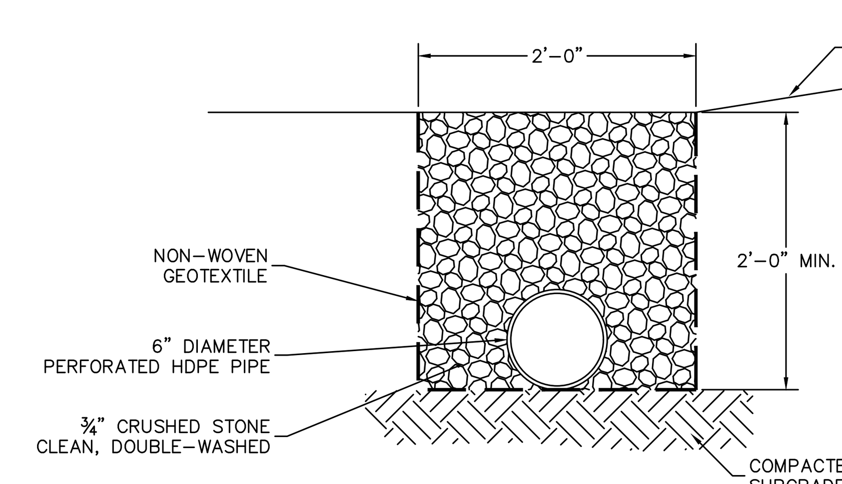
N.T.S.



NOTES:
1. GRATE SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05.2
2. DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS. RISERS ARE NEEDED FOR BASINS OVER 84" DUE TO SHIPPING RESTRICTIONS.
3. DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS N-12/HANCOR DUAL WALL), N-12 HP, & PVC SEWER.
5 ADAPTERS CAN BE MOUNTED ON ANY ANGLE 0° TO 360°.

5 AREA DRAIN

N.T.S



6 STONE TRENCH WITH PERFORATED PIPE

N.T.S.

Date	Description	No.

Revisions

FRANK HOLMES CIVIL No. 40203 REGISTERED PROFESSIONAL ENGINEER COMMONWEALTH OF MASSACHUSETTS

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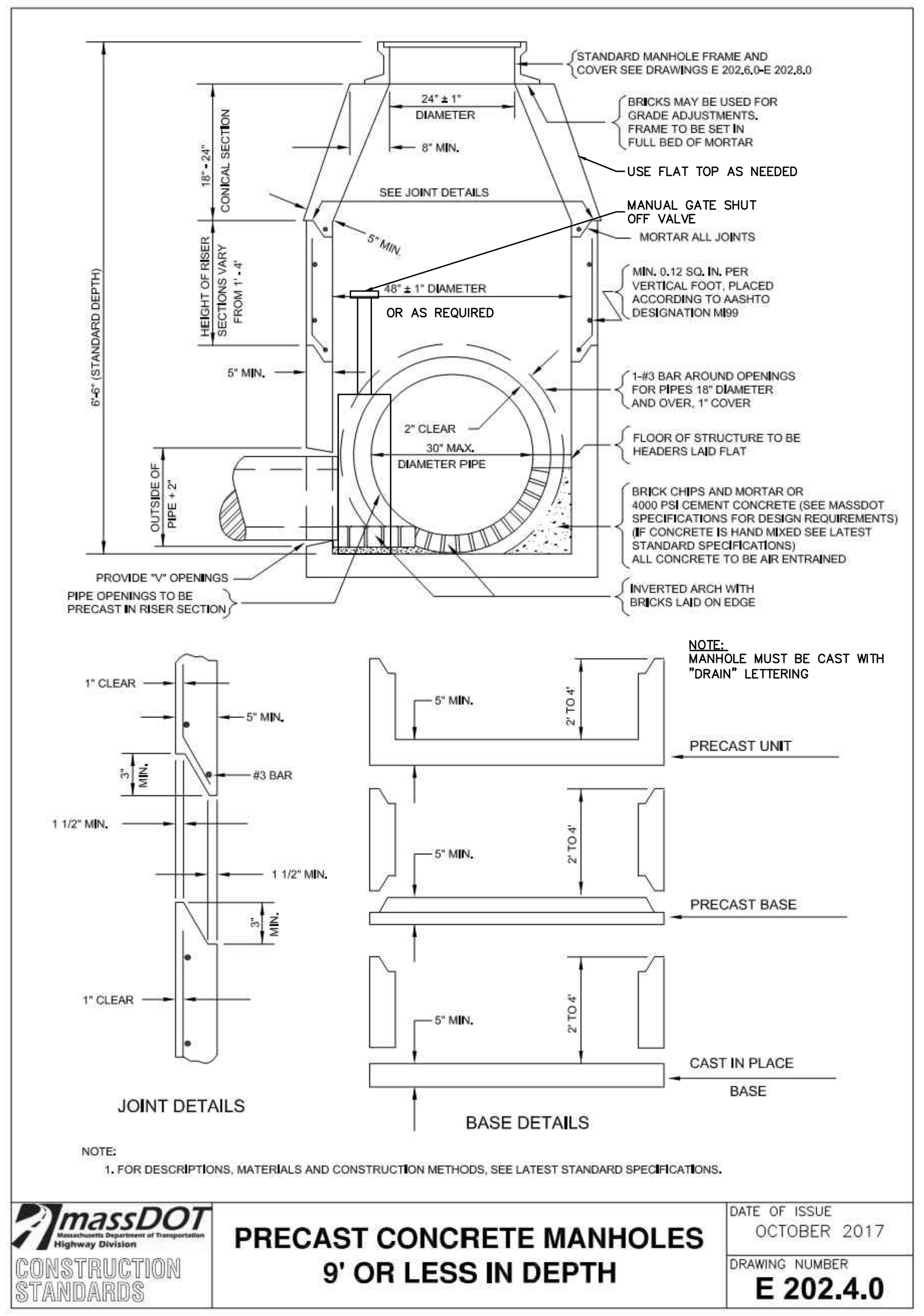
Project
MEDWAY BATTERY ENERGY STORAGE SYSTEM
MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title
GRADING & DRAINAGE DETAILS II

Project No. 151033401
Date 06/08/2023
Drawn By JNW
Checked By FH
Drawing No. CG502

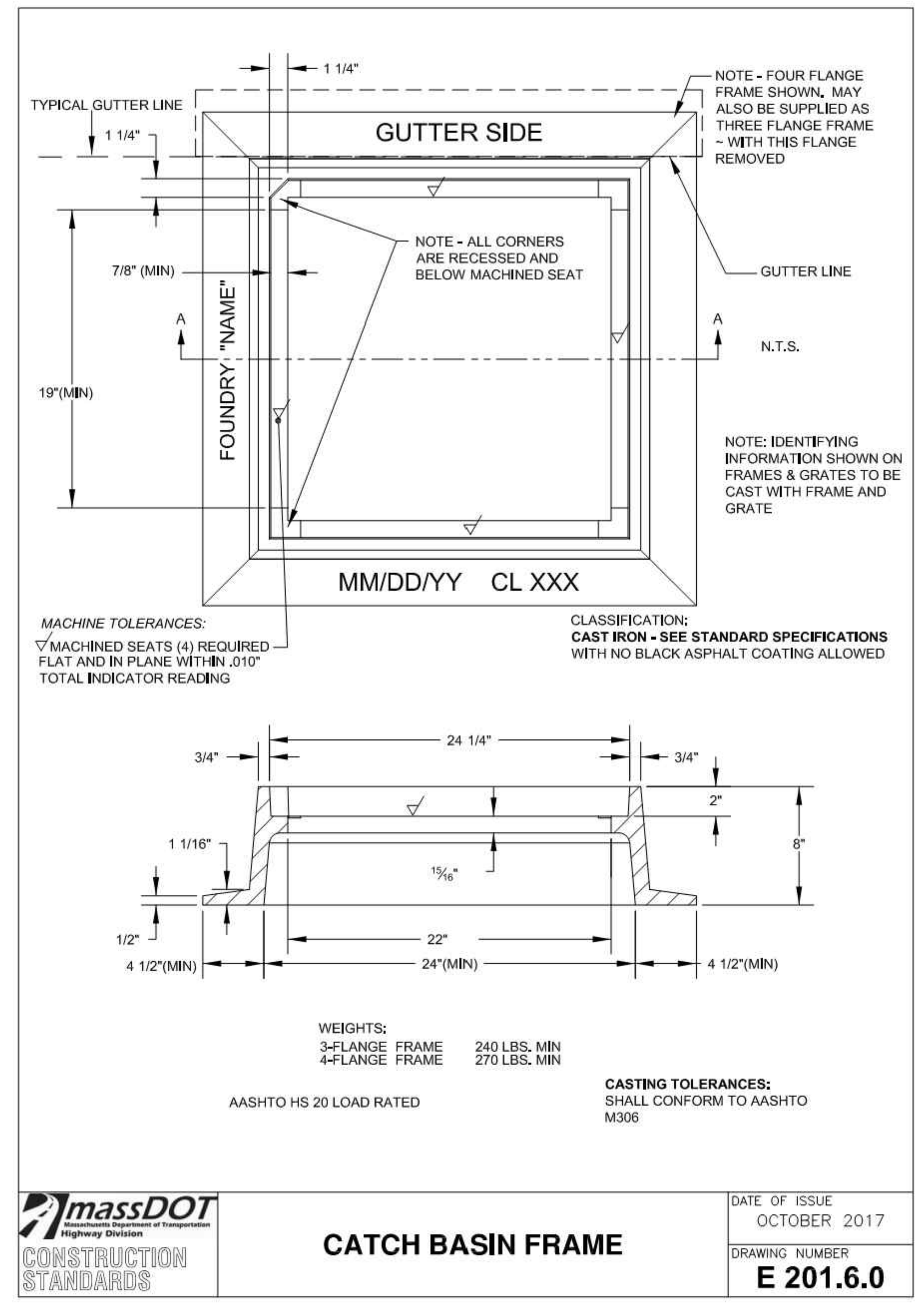
Project No. 151033401

Date: 6/7/2023 Time: 09:53 User: jpark Style Table: Langan.stb Layout: CG502 Document Code: 151033401-0501-CG501-0102

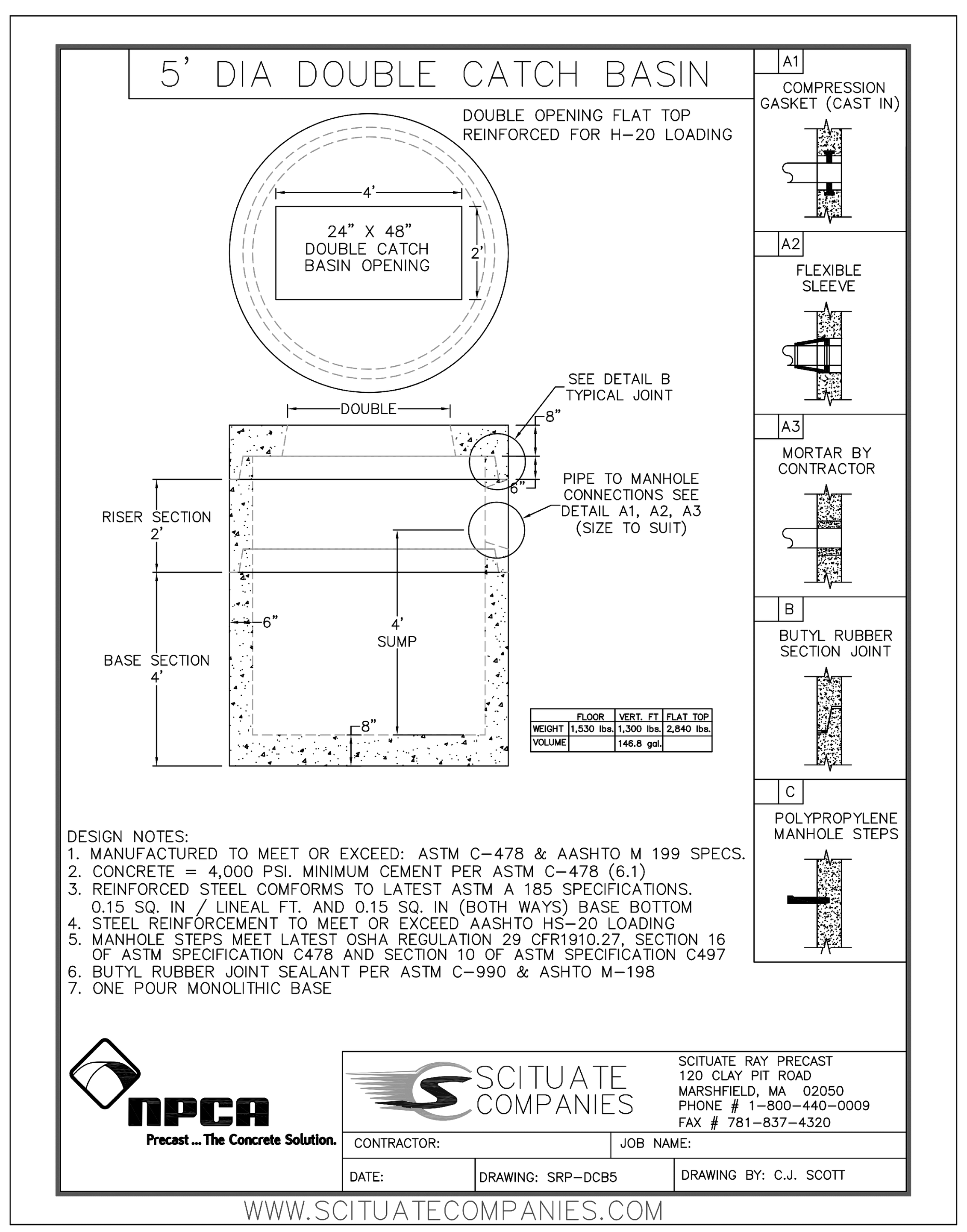


CONTRACTOR SHALL BE RESPONSIBLE FOR CHECKING MANHOLES AND PIPE PENETRATIONS PRIOR TO ISSUING SHOP DRAWINGS FOR REVIEW TO ENSURE CONSTRUCTABILITY.

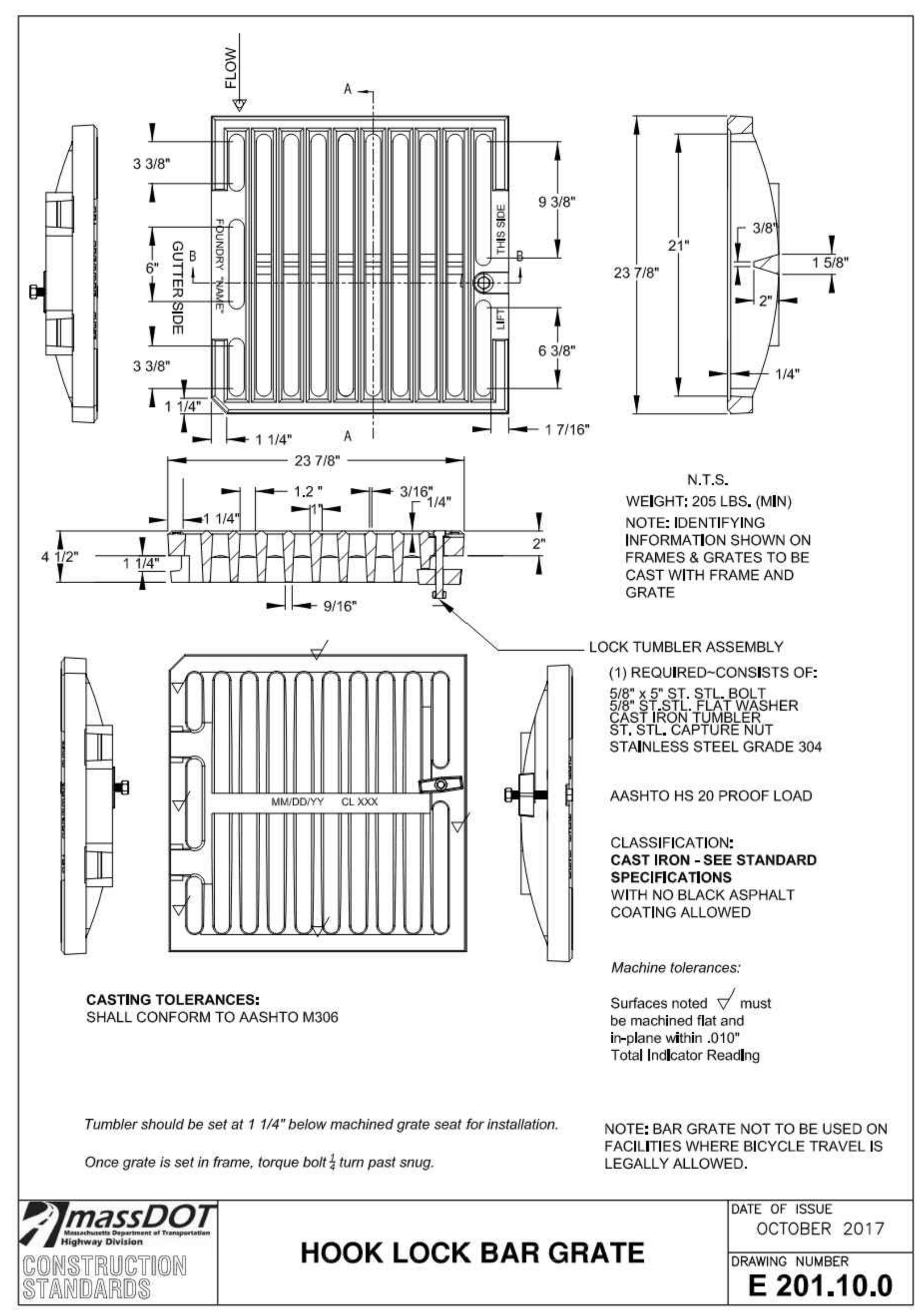
1 PRECAST CONCRETE MANHOLES 9' OR LESS IN DEPTH
N.T.S.



2 CATCH BASIN FRAME
N.T.S



3 5' DIA DOUBLE CATCH BASIN
N.T.S.



4 CATCH BASIN LOCK BAR GRATE
N.T.S.

Date	Description	No.
Revisions		

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Project
MEDWAY BATTERY ENERGY STORAGE SYSTEM
MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title
GRADING & DRAINAGE DETAILS III

Project No. 151033401
Date 06/08/2023
Drawn By JNW
Checked By FH
Drawing No. CG503

Project No. 151033401

Date: 6/6/2023 Time: 13:55 User: jpark Style Table: Langan.stb Layout: CG503 Document Code: 151033401-0501-CG501-0103

CONSTRUCTION SEQUENCE

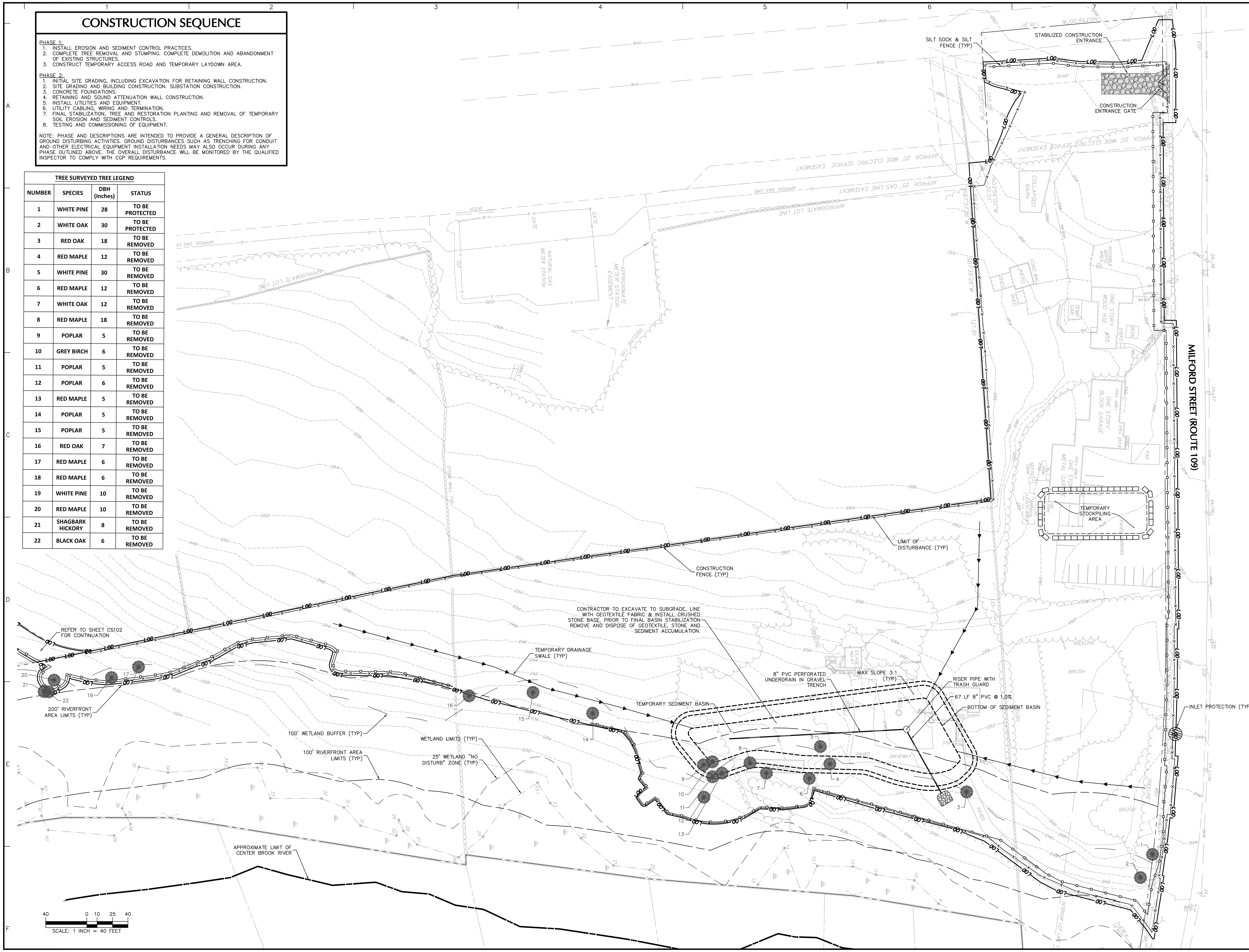
PHASE 1:
1. INSTALL EROSION AND SEDIMENT CONTROL PRACTICES.
2. COMPLETE TREE REMOVAL AND STUMPING. COMPLETE DEMOLITION AND ABANDONMENT OF EXISTING STRUCTURES.
3. CONSTRUCT TEMPORARY ACCESS ROAD AND TEMPORARY LAYDOWN AREA.

PHASE 2:
1. INITIAL SITE GRADING, INCLUDING EXCAVATION FOR RETAINING WALL CONSTRUCTION.
2. SITE GRADING AND BUILDING CONSTRUCTION. SUBSTATION CONSTRUCTION.
3. CONCRETE FOUNDATIONS.
4. RETAINING AND SOUND ATTENUATION WALL CONSTRUCTION.
5. INSTALL UTILITIES AND EQUIPMENT.
6. UTILITY CABLING, WIRING AND TERMINATION.
7. FINAL STABILIZATION, TREE AND RESTORATION PLANTING AND REMOVAL OF TEMPORARY SOIL EROSION AND SEDIMENT CONTROLS.
8. TESTING AND COMMISSIONING OF EQUIPMENT.

NOTE: PHASE AND DESCRIPTIONS ARE INTENDED TO PROVIDE A GENERAL DESCRIPTION OF GROUND DISTURBING ACTIVITIES. GROUND DISTURBANCES SUCH AS TRENCHING FOR CONDUIT AND OTHER ELECTRICAL EQUIPMENT INSTALLATION NEEDS MAY ALSO OCCUR DURING ANY PHASE OUTLINED ABOVE. THE OVERALL DISTURBANCE WILL BE MONITORED BY THE QUALIFIED INSPECTOR TO COMPLY WITH CGP REQUIREMENTS.

TREE SURVEYED TREE LEGEND

NUMBER	SPECIES	DBH (Inches)	STATUS
1	WHITE PINE	28	TO BE PROTECTED
2	WHITE OAK	30	TO BE PROTECTED
3	RED OAK	18	TO BE REMOVED
4	RED MAPLE	12	TO BE REMOVED
5	WHITE PINE	30	TO BE REMOVED
6	RED MAPLE	12	TO BE REMOVED
7	WHITE OAK	12	TO BE REMOVED
8	RED MAPLE	18	TO BE REMOVED
9	POPLAR	5	TO BE REMOVED
10	GREY BIRCH	6	TO BE REMOVED
11	POPLAR	5	TO BE REMOVED
12	POPLAR	6	TO BE REMOVED
13	RED MAPLE	5	TO BE REMOVED
14	POPLAR	5	TO BE REMOVED
15	POPLAR	5	TO BE REMOVED
16	RED OAK	7	TO BE REMOVED
17	RED MAPLE	6	TO BE REMOVED
18	RED MAPLE	6	TO BE REMOVED
19	WHITE PINE	10	TO BE REMOVED
20	RED MAPLE	10	TO BE REMOVED
21	SHAGBARK HICKORY	8	TO BE REMOVED
22	BLACK OAK	6	TO BE REMOVED



Date	Description	No.

Revisions

FRANK HOLMES CIVIL No. 40203 REGISTERED PROFESSIONAL ENGINEER — COMMONWEALTH OF MASSACHUSETTS

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Project
MEDWAY BATTERY ENERGY STORAGE SYSTEM
MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title
SOIL EROSION & SEDIMENT CONTROL PLAN PHASE I

Project No. 151033401	Drawing No. CE101
Date 06/08/2023	
Drawn By JNW	
Checked By FH	

Project No. 151033401

Date: 6/6/2023 Time: 13:53 User: jpark Style Table: Langan.stb Layout: CE101 Document Code: 151033401-0501-CE101-0101

CONSTRUCTION SEQUENCE

PHASE 1:
1. INSTALL EROSION AND SEDIMENT CONTROL PRACTICES.
2. COMPLETE TREE REMOVAL AND STUMPING. COMPLETE DEMOLITION AND ABANDONMENT OF EXISTING STRUCTURES.
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PHASE 2:
1. INITIAL SITE GRADING, INCLUDING EXCAVATION FOR RETAINING WALL CONSTRUCTION.
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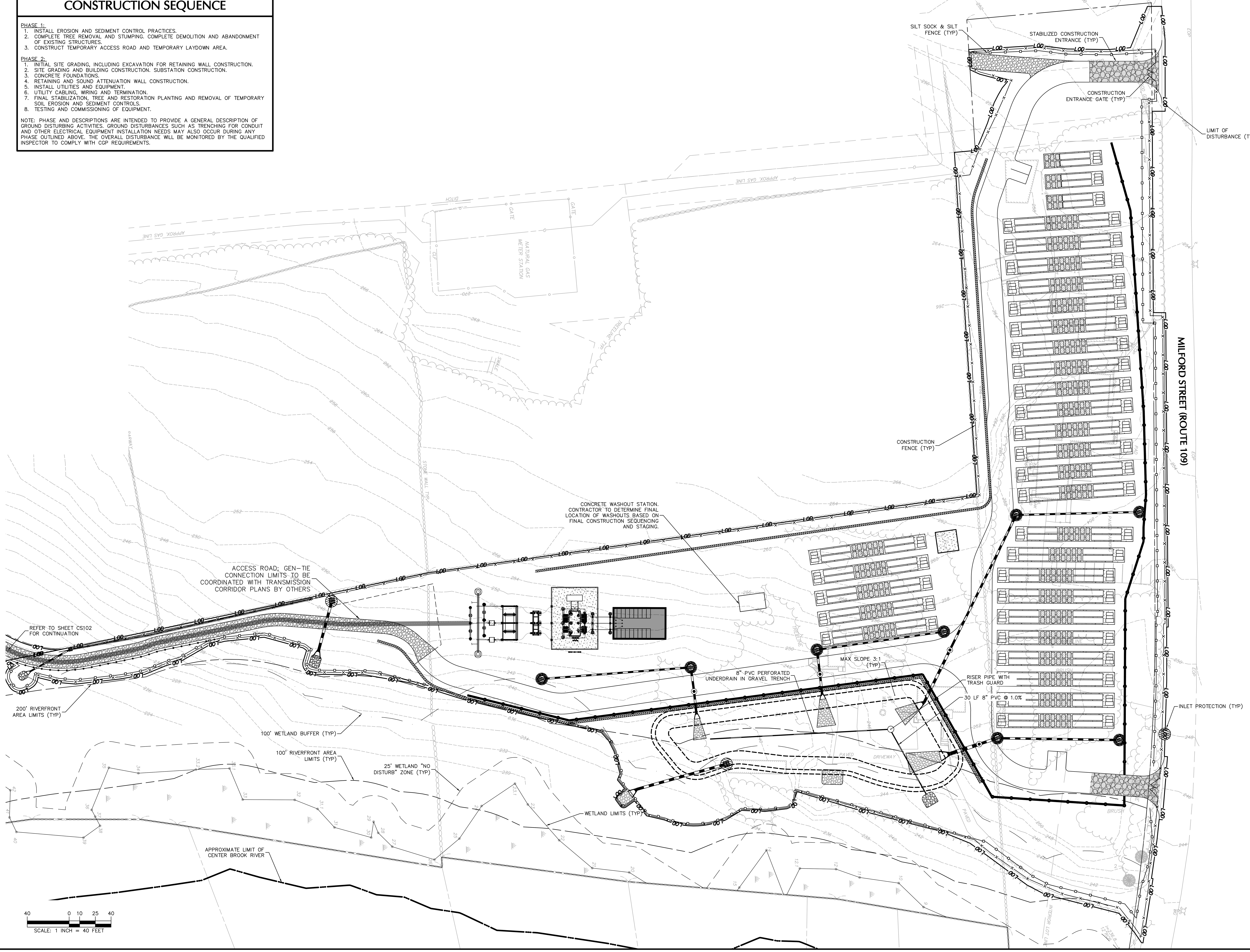
8. TESTING AND COMMISSIONING OF EQUIPMENT.

NOTE: PHASE AND DESCRIPTIONS ARE INTENDED TO PROVIDE A GENERAL DESCRIPTION OF GROUND DISTURBING ACTIVITIES. GROUND DISTURBANCES SUCH AS TRENCHING FOR CONDUIT AND OTHER ELECTRICAL EQUIPMENT INSTALLATION NEEDS MAY ALSO OCCUR DURING ANY PHASE OUTLINED ABOVE. THE OVERALL DISTURBANCE WILL BE MONITORED BY THE QUALIFIED INSPECTOR TO COMPLY WITH CGP REQUIREMENTS.



Date	Description	No.
Revisions		

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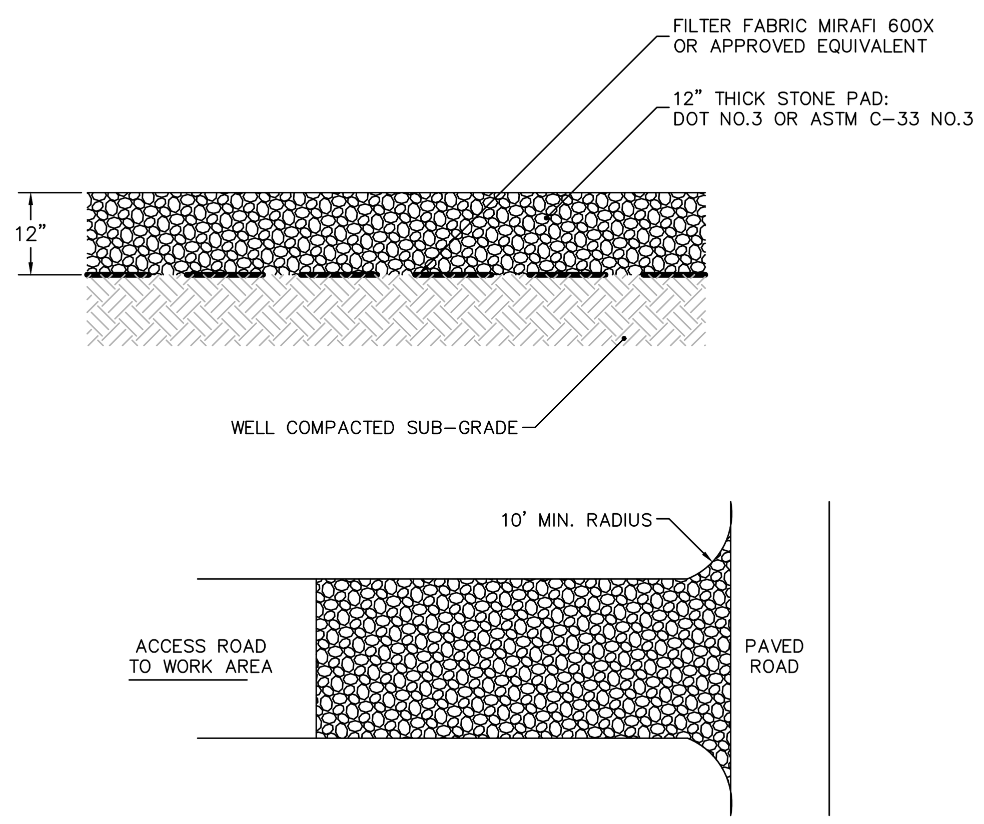
Project
MEDWAY BATTERY ENERGY STORAGE SYSTEM
MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title
SOIL EROSION & SEDIMENT CONTROL PLAN PHASE II

Project No. 151033401	Drawing No. CE102
Date 06/08/2023	
Drawn By JNW	
Checked By FH	

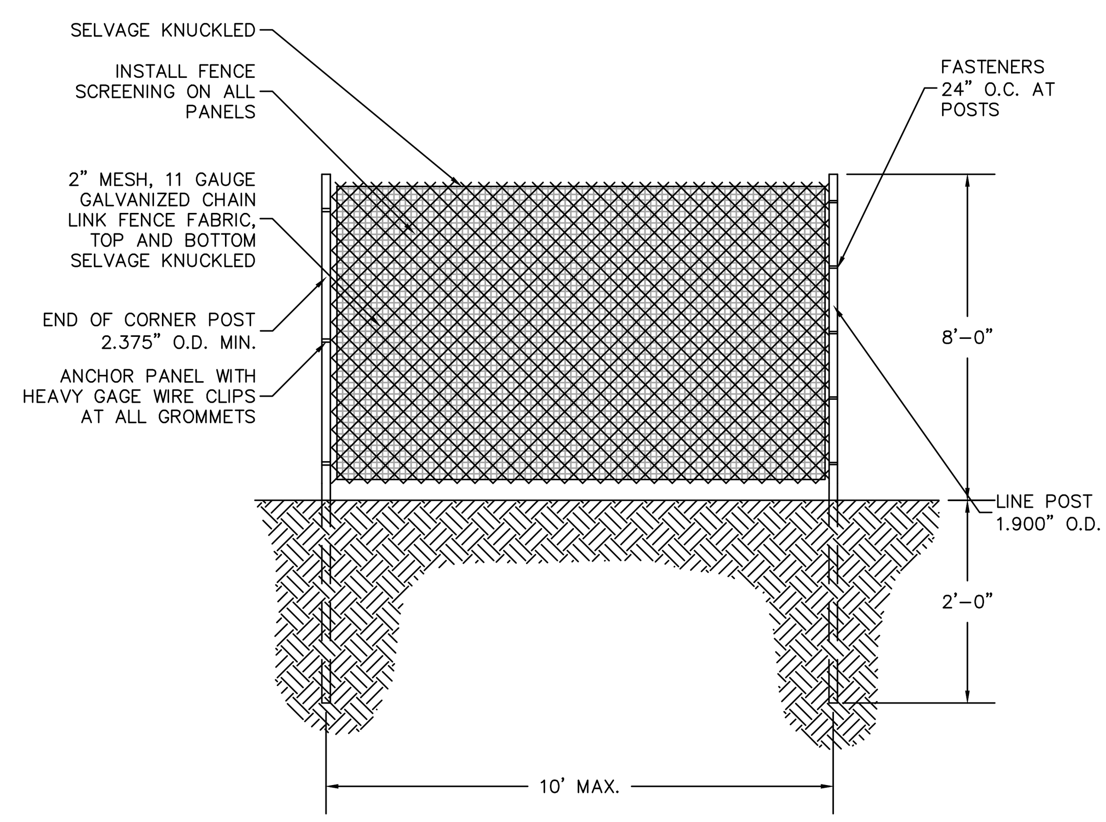
Project No. 151033401

Date: 6/6/2023 Time: 13:54 User: jpark Style Table: Langan.stb Layout: CE102 Document Code: 151033401-0501-CE101-0102



NOTES:
1. CONSTRUCTION PAD LOCATION TO BE SET BY CONTRACTOR AND LOCATED AS REQUIRED FOR CONSTRUCTION SEQUENCING
2. SEE SOIL EROSION & SEDIMENT CONTROL PLAN FOR DIMENSIONS

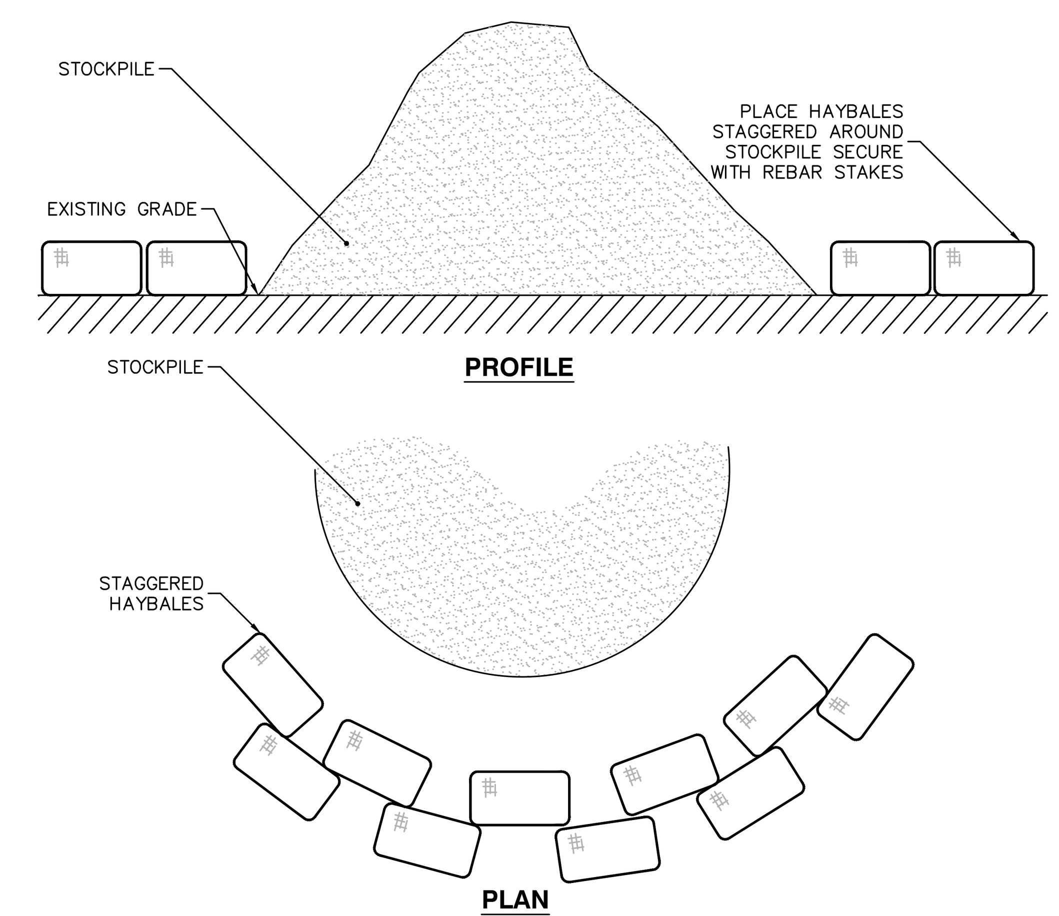
1 CONSTRUCTION ENTRANCE
N.T.S.



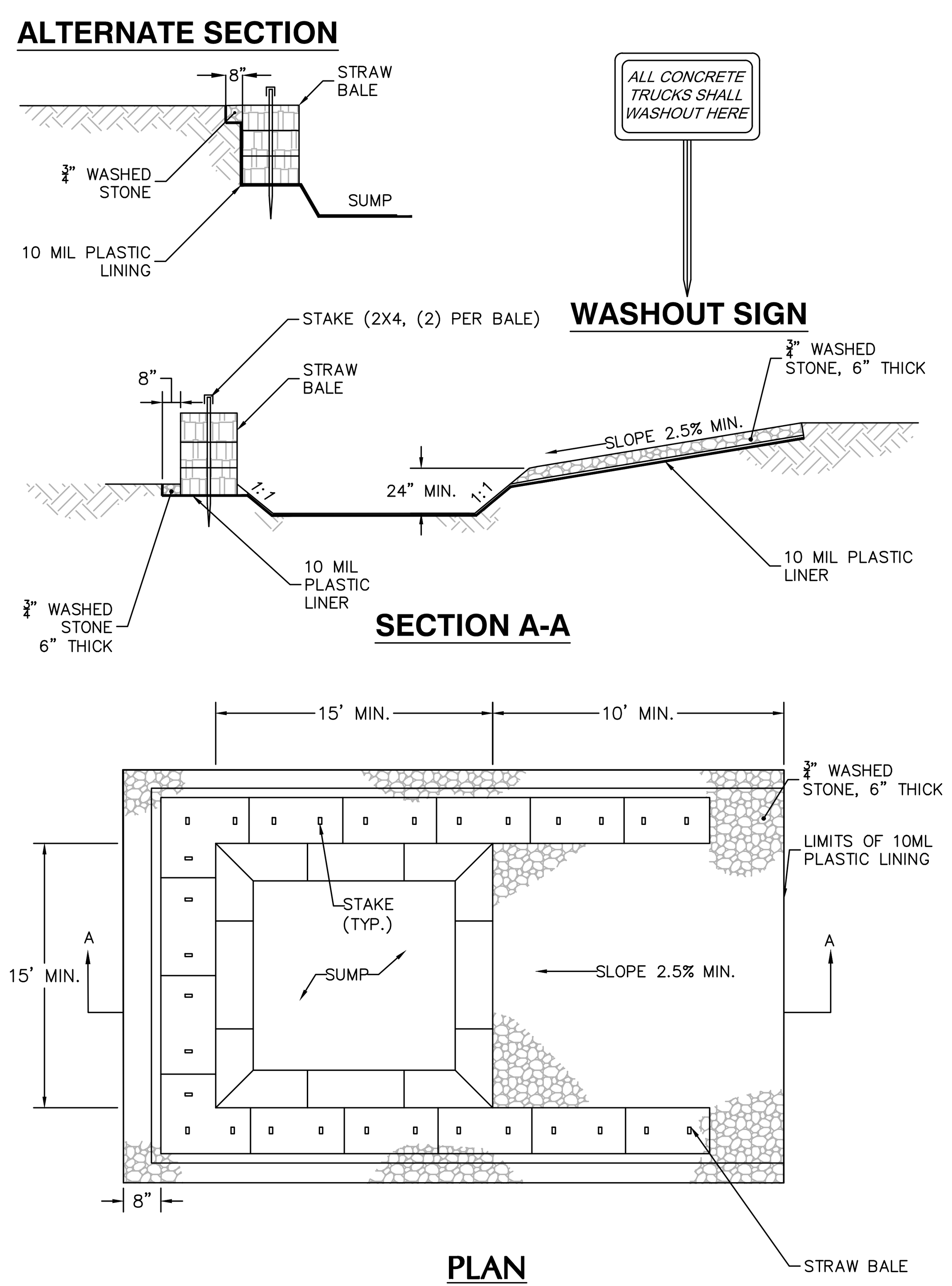
NOTES:
1. PIPE POSTS SHALL BE IMBEDDED INTO THE GROUND. PEDESTAL MOUNTED FENCING WILL ONLY BE ALLOWED AT AREAS APPROVED BY THE PROJECT MANAGER. WHEN ALLOWED, PROVIDE CONCRETE OR GALVANIZED-STEEL BASES FOR SUPPORTING POSTS. PROVIDE BLUE REINFORCED SCRIM SHEETING ON ALL FENCING.

2 TEMPORARY CONSTRUCTION FENCE
N.T.S.

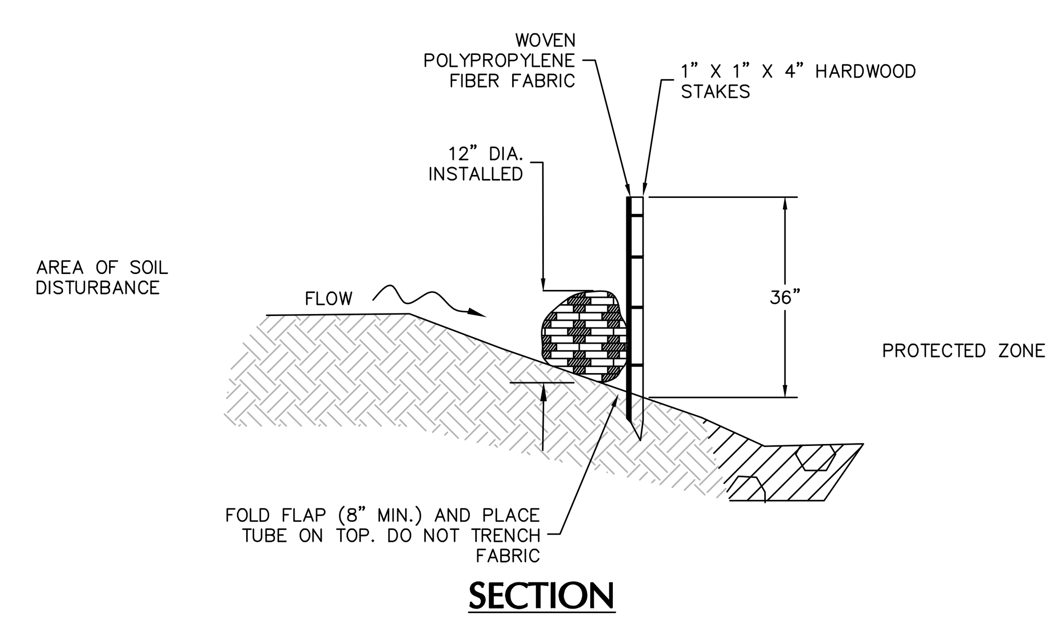
NOTES:
1. SEE SOIL EROSION & SEDIMENT CONTROL PLAN FOR LOCATION OF HAYBALE BARRIER



3 TEMPORARY STOCKPILE
N.T.S.



4 CONCRETE WASHOUT AREA
N.T.S.



5 COMPOST FILTER TUBE & SILT FENCE
N.T.S.

Date	Description	No.
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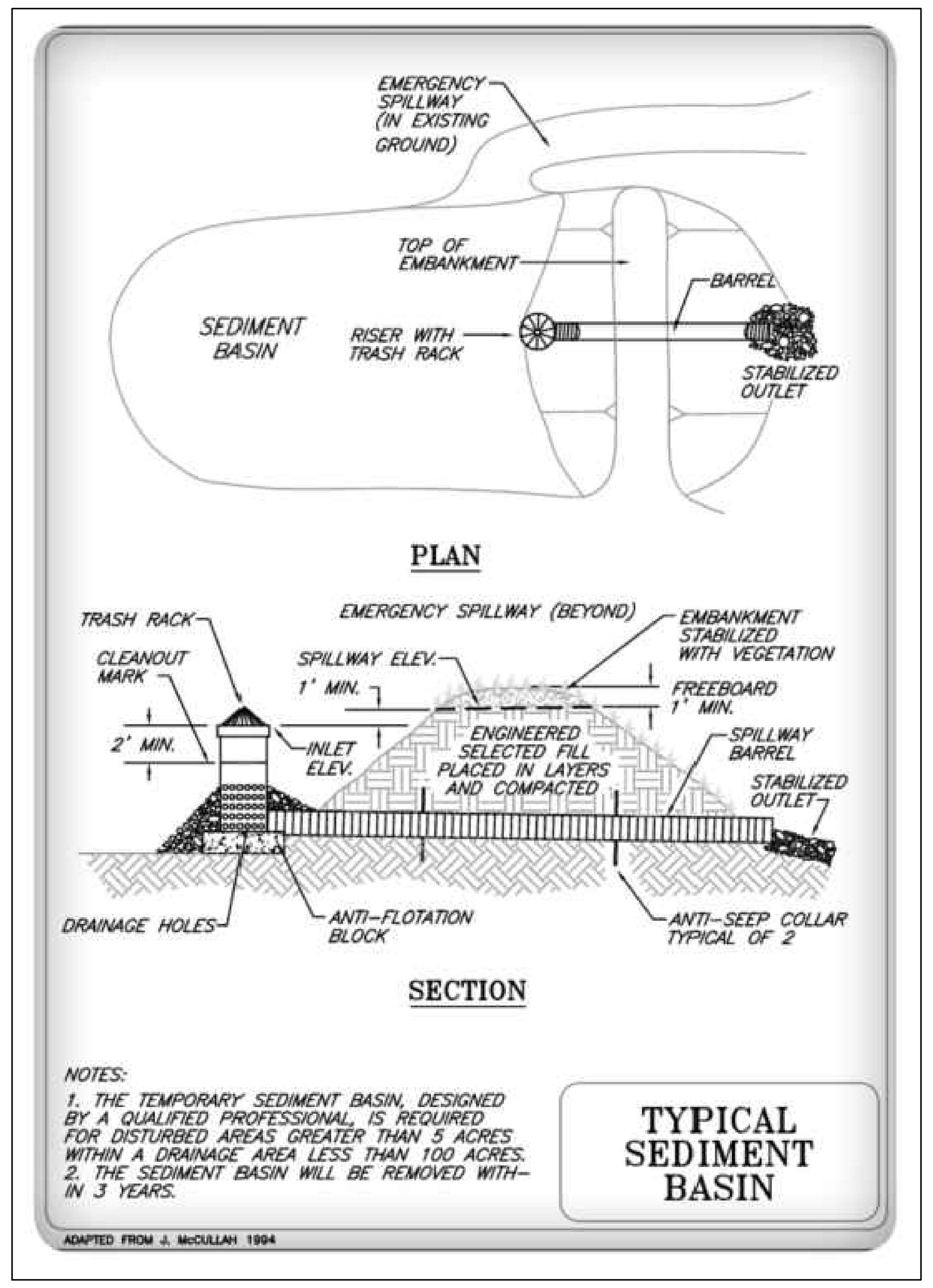
Project
MEDWAY BATTERY ENERGY STORAGE SYSTEM
MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title
SOIL EROSION & SEDIMENT CONTROL DETAILS I

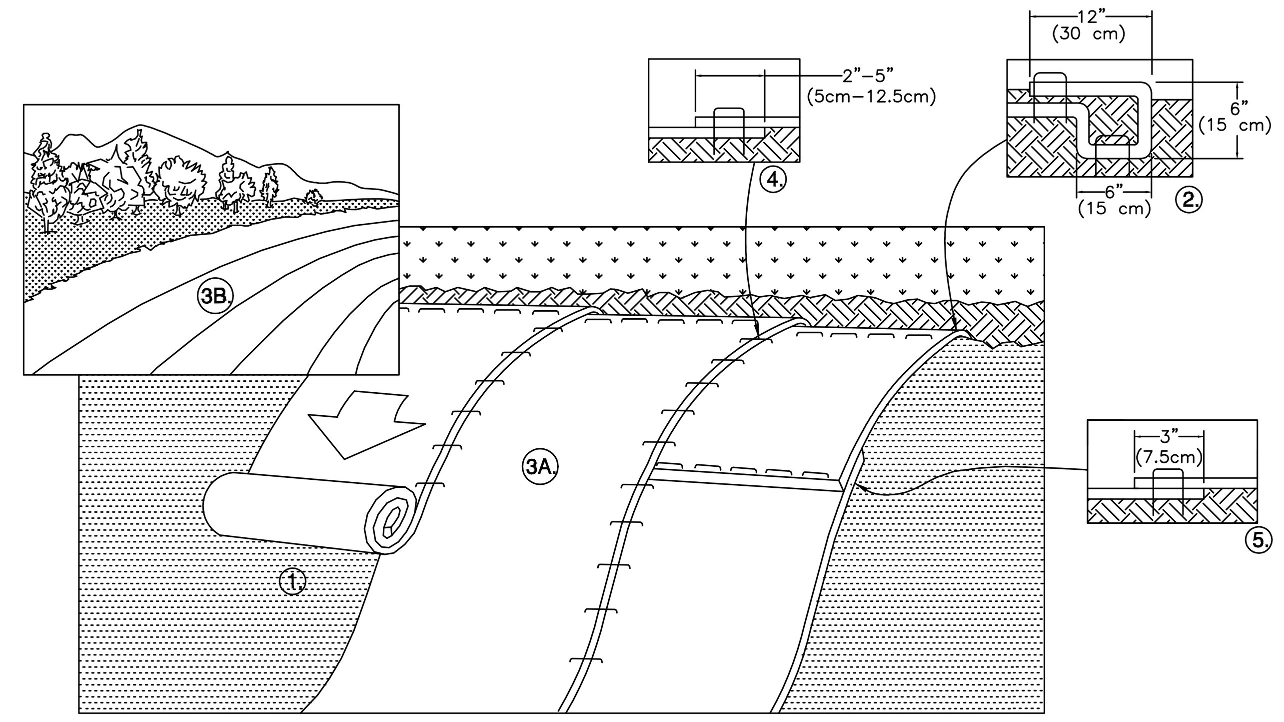
Project No. 151033401	Drawing No.
Date 06/08/2023	CE501
Drawn By JNW	
Checked By FH	

LANGAN
Project No. 151033401



1 SEDIMENT BASIN

N.T.S.



NOTES:

1. EROSION CONTROL BLANKETS SHALL BE BIONET SC150BN OR APPROVED EQUAL.
2. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE: WHEN USING CELL–O–SEED. DO NOT SEED PREPARED AREA. CELL–O–SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
3. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A 6" (15cm) WIDE TRENCH WITH APPROXIMATELY 12" (30cm) OF BLANKET EXTENDED BEYOND THE UP–SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIAMATELY 12" (30cm) APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" (30cm) PORTION OF THE BLANKET BACK OVER SEED AND COMPACTED SOIL. SECURE BLANKET OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" (30cm) APART ACROSS THE WIDTH OF THE BLANKET.
4. ROLL THE BLANKETS (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. BLANKETS WILL UNROLL WITH THE APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL BLANKETS MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING OPTIONAL DOT SYSTEM, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
5. THE EDGES OF PARALLEL BLANKETS MUST BE STAPLED WITH APPROXIMATELY 2"–5" (5cm–12.5cm) OVERLAP DEPENDING ON BLANKET TYPE. TO ENSURE PROPER SEAM ALIGNMENT, PLACE THE EDGE OF THE OVERLAPPING BLANKET (BLANKET BEING INSTALLED ON TOP) EVEN WITH THE COLORED SEAM STITCH ON THE PREVIOUSLY INSTALLED BLANKET.
6. CONSECUTIVE BLANKETS SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" (7.5cm) OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" (30cm) APART ACROSS ENTIRE BLANKET WIDTH.
7. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15cm) MAT BE NECESSARY TO PROPERLY ANCHOR THE BLANKETS.
8. PROVIDE EROSION CONTROL BLANKET ON ALL SLOPES 4H:1V TO 3H:1V.
9. PREPARE SOIL BEFORE INSTALLING ROLLED EROSION CONTROL PRODUCTS (RECP'S), INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
10. FOLLOW MANUFACTURER'S INSTALLATION INSTRUCTIONS.
11. SEE EROSION AND SEDIMENT CONTROL NOTE 5 ON DRAWING CS002 FOR SLOPE STABILIZATION ON SLOPES STEEPER THAN 3H:1V.

2 EROSION CONTROL BLANKETS (SLOPE STABILIZATION SLOPES 4H:1V TO 3H:1V)

N.T.S.

Date	Description	No.

Revisions

COMMONWEALTH OF MASSACHUSETTS
FRANK HOLMES
CIVIL
No. 40203
REGISTERED PROFESSIONAL ENGINEER

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Project

MEDWAY BATTERY ENERGY STORAGE SYSTEM

MEDWAY

NORFOLK COUNTY MASSACHUSETTS

Drawing Title

SOIL EROSION & SEDIMENT CONTROL DETAILS II

Project No. 151033401

Date 06/08/2023

Drawn By JNW

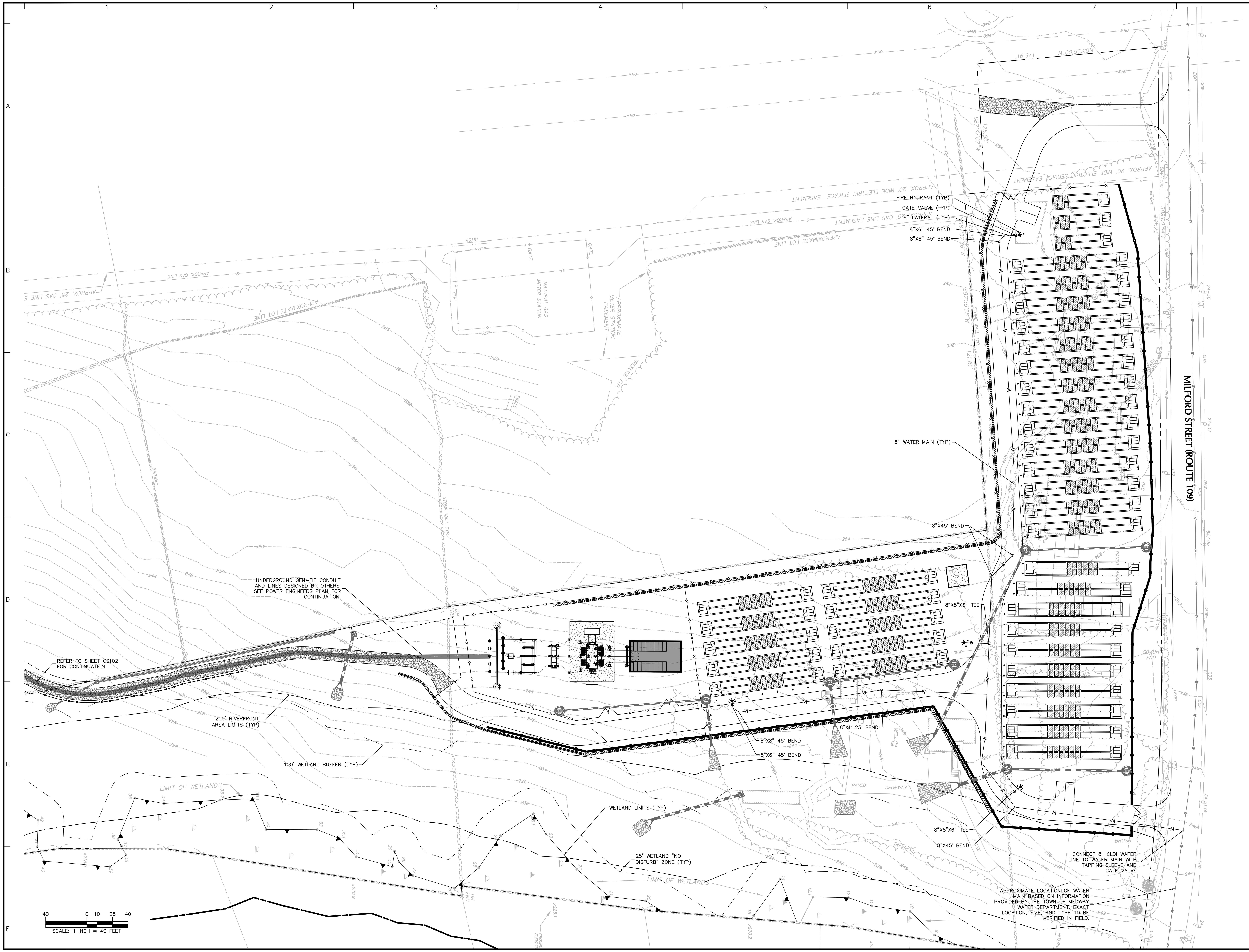
Checked By FH

Drawing No. CE502

LANGAN

Project No. 151033401

Date: 6/6/2023 Time: 13:54 User: jpark Style Table: Langan.stb Layout: CE502 Document Code: 151033401-0501-CE501-0102



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Project

MEDWAY BATTERY ENERGY STORAGE SYSTEM

MEDWAY

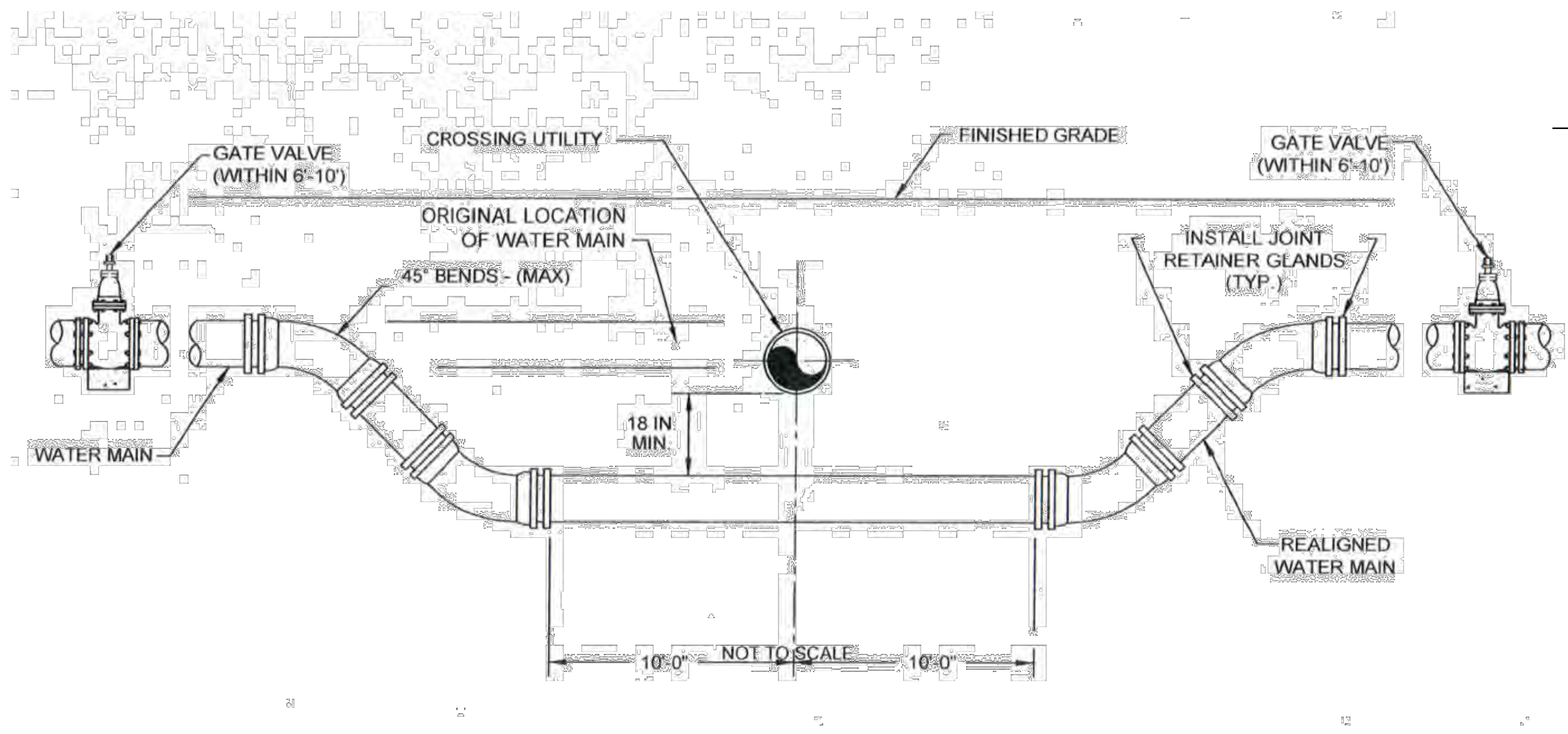
NORFOLK COUNTY MASSACHUSETTS

Drawing Title

UTILITY PLAN

Project No.	151033401
Date	06/08/2023
Drawn By	JNW
Checked By	FH
Drawing No.	CU101

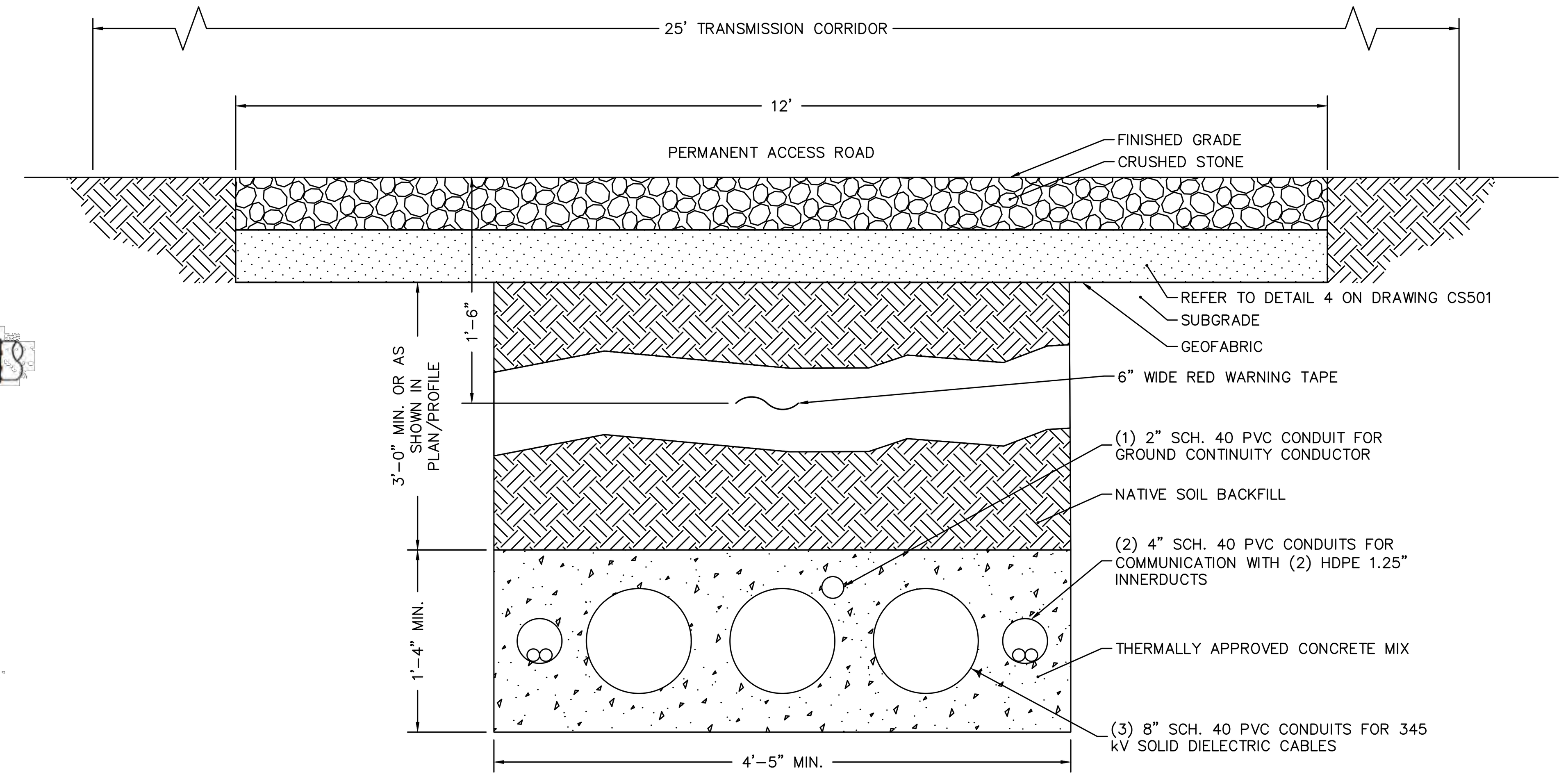
Project No. 151033401



NOTES:
1. ALL FITTINGS AND JOINTS IN LOWERING AREA TO BE RESTRAINED. TOWN MAY REQUIRE THREADED ROD RESTRAINS IN CERTAIN SITUATIONS.
2. WHEN IT IS IMPOSSIBLE TO OBTAIN HORIZONTAL OR VERTICAL SEPARATION AS INDICATED IN THE DETAIL ABOVE, BOTH THE WATER AND THE SEWER SHOULD BE ENCASED IN CONTROL DENSITY FILL FOR A DISTANCE OF 10 FEET ON EITHER SIDE OF THE CROSSING.
3. ALL DUCTILE IRON PIPE AND FITTINGS SHALL BE WRAPPED WITH POLYETHYLENE ENCASEMENT WHEN CONTACTING CONTROL DENSITY FILL.

1 WATER MAIN LOWERING DETAIL

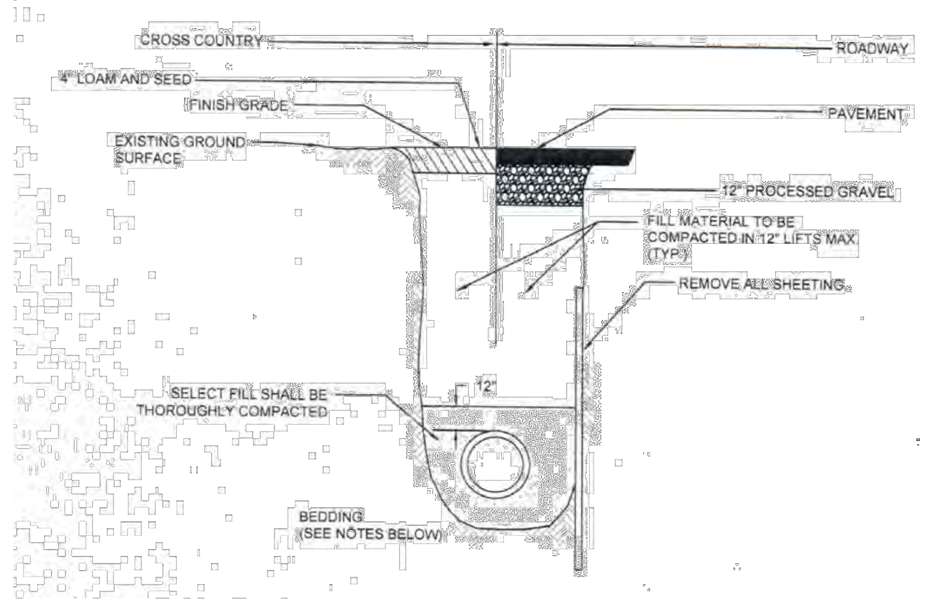
N.T.S. – SOURCE: TOWN OF MEDWAY DEPARTMENT OF PUBLIC SERVICES



NOTES:
1. DETAIL FOR REFERENCE ONLY. REFER TO PLANS PREPARED BY POWER ENGINEERS FOR TRENCH SECTION AND CONDUIT LAYOUT SPECIFICATIONS.

2 TYPICAL CONDUIT TRENCH SECTION

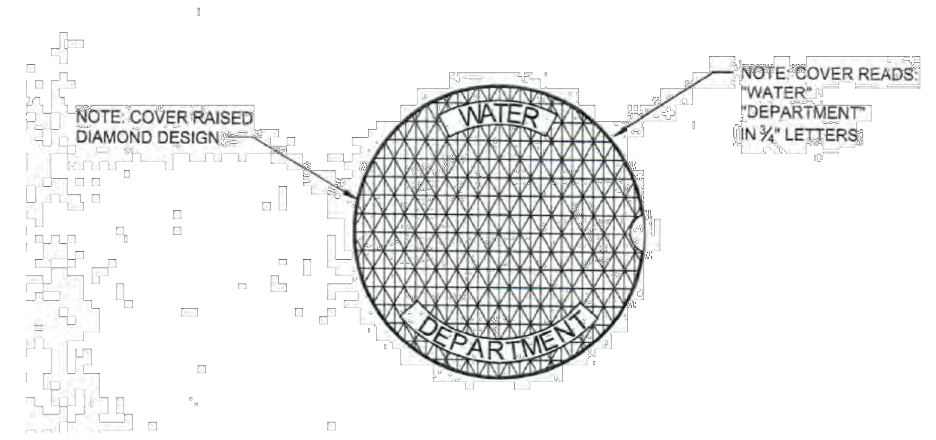
N.T.S. SOURCE: POWER ENGINEERS



NOTES:
1. TOWN OF MEDWAY MAY REQUIRE FLOWABLE FILL AT ITS DISCRETION.
2. FOR LOCATIONS WHERE LEDGE IS NOT ENCOUNTERED IN TRENCH, PIPE CAN LAY ON UNDISTURBED EARTH, OR ON SAND BEDDING CONSISTENT WITH AWWA GUIDELINES.
3. FOR LOCATIONS WHERE LEDGE IS ENCOUNTERED, SAND BEDDING SHALL BE MINIMUM 12" THICK UNDER PIPE.
4. FILL MATERIAL SHALL BE COMPACTED TO 95% PROCTOR DENSITY.
5. WATER MAIN SHALL HAVE 5'–0" MINIMUM COVER. LESS THAN 5'–0" OF COVER SHALL BE INSULATED.
6. LEDGE SHALL BE REMOVED 12 INCHES AROUND PIPE.

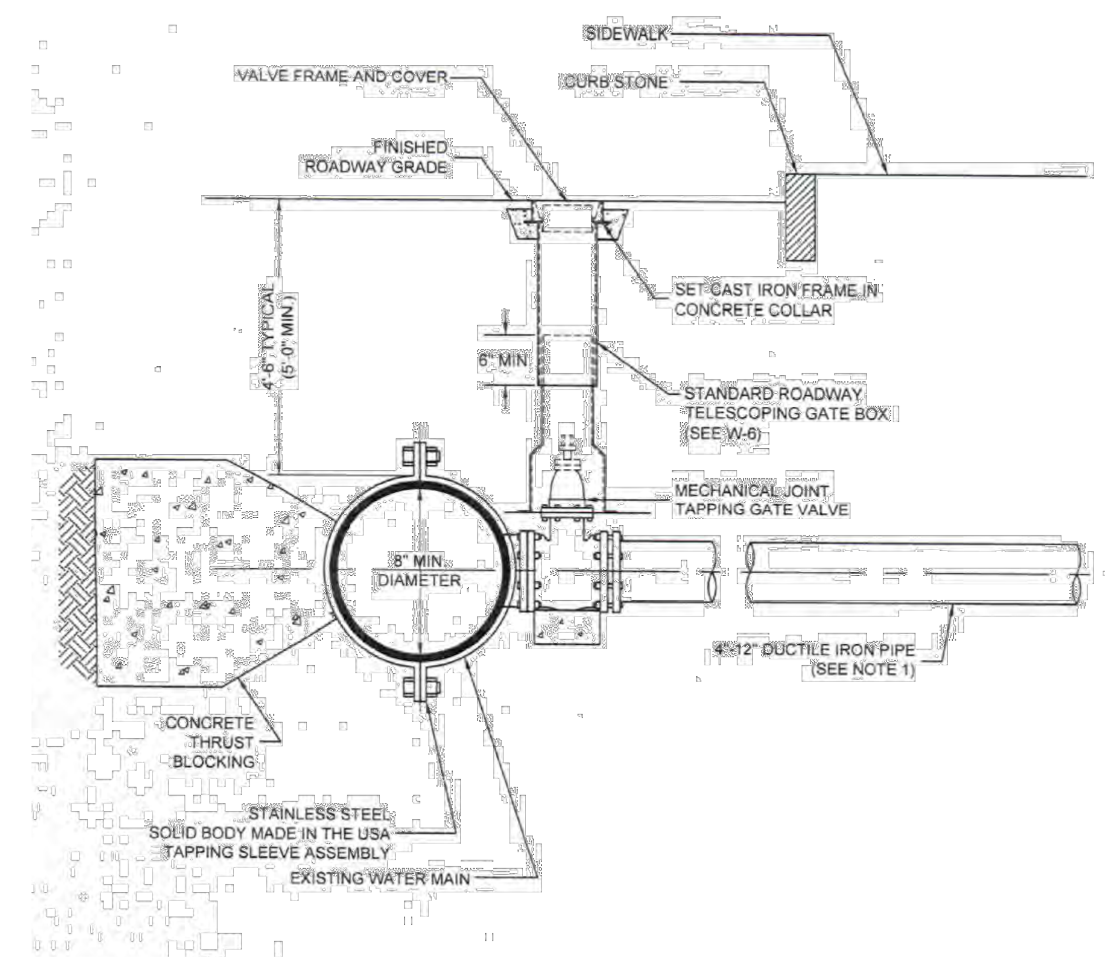
3 WATER MAIN TRENCH

N.T.S. – SOURCE: TOWN OF MEDWAY DEPARTMENT OF PUBLIC SERVICES



4 WATER GATE COVER

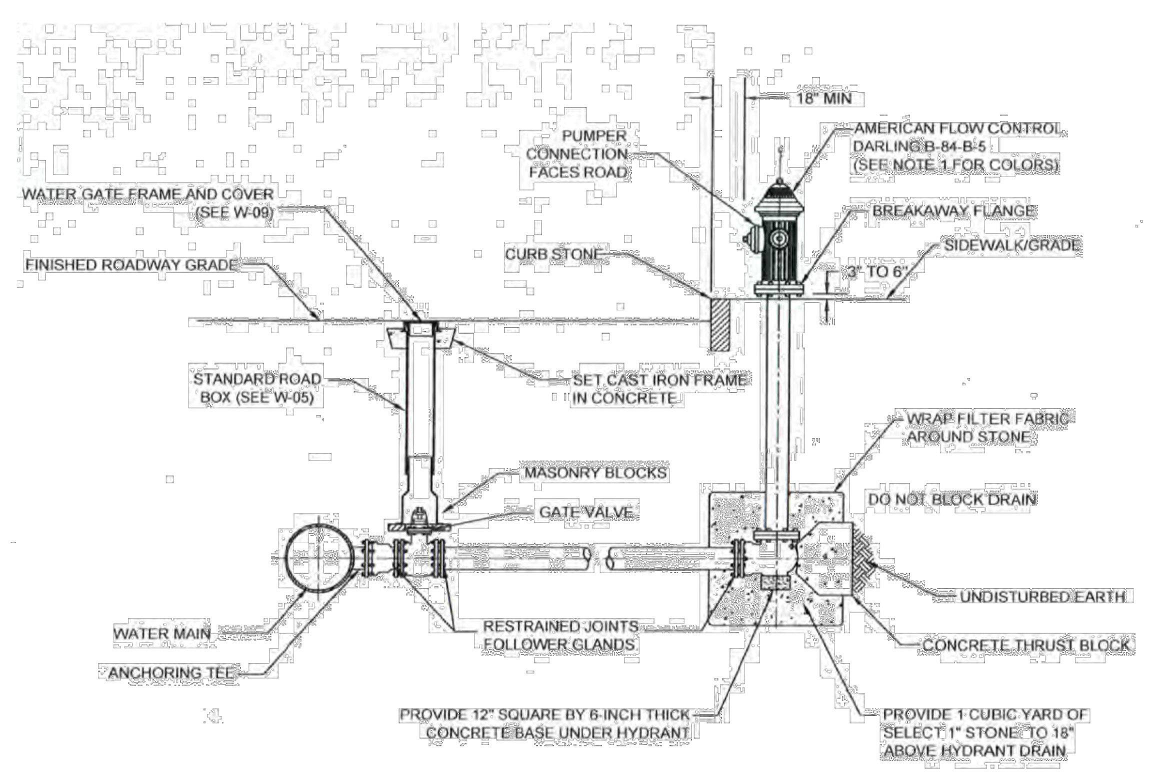
N.T.S.



NOTES:
1. MAXIMUM TAPPING SLEEVE SHALL NOT BE GREATER THAN ½ DIAMETER OF CONNECTING MAIN.
2. MECHANICAL JOINT RESTRAINTS AND GASKETS ON ALL MECHANICAL JOINTS.
3. TOWN MAY REQUIRE THREADED ROD AS RESTRAINT.

5 TYPICAL CONNECTION (TAPPING SLEEVE)

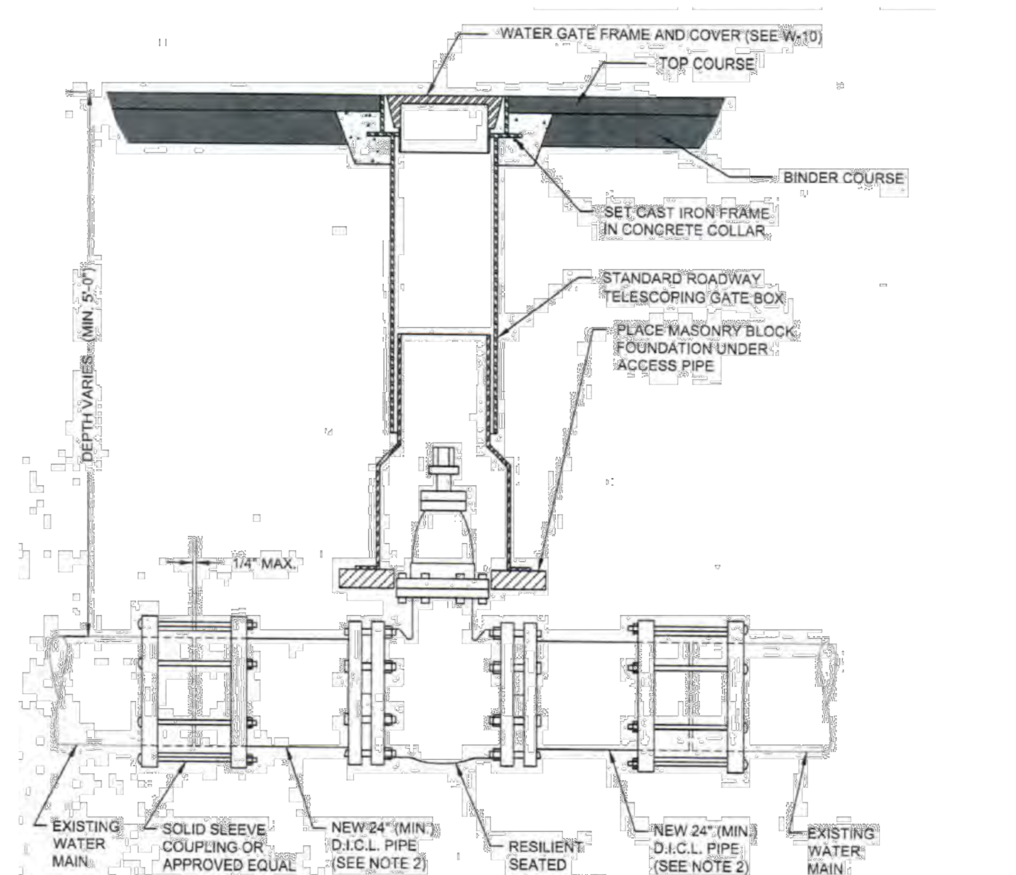
N.T.S. – SOURCE: TOWN OF MEDWAY DEPARTMENT OF PUBLIC SERVICES



NOTES:
1. HYDRANT SHALL BE PAINTED THE FOLLOWING COLORS:
   BARREL: BLUE SAFETY (COLOR CODE: 822913)
   COVER & CAPS: SILVER (COLOR CODE: 822903)
2. HYDRANT SHALL OPEN LEFT PER TOWN STANDARDS.
3. HYDRANT LATERAL SHALL BE FULLY RESTRAINED.
4. 3'–0" CLEAR AND FLAT ALL AROUND HYDRANT PER NFPA STANDARD.

6 FIRE HYDRANT INSTALLATION

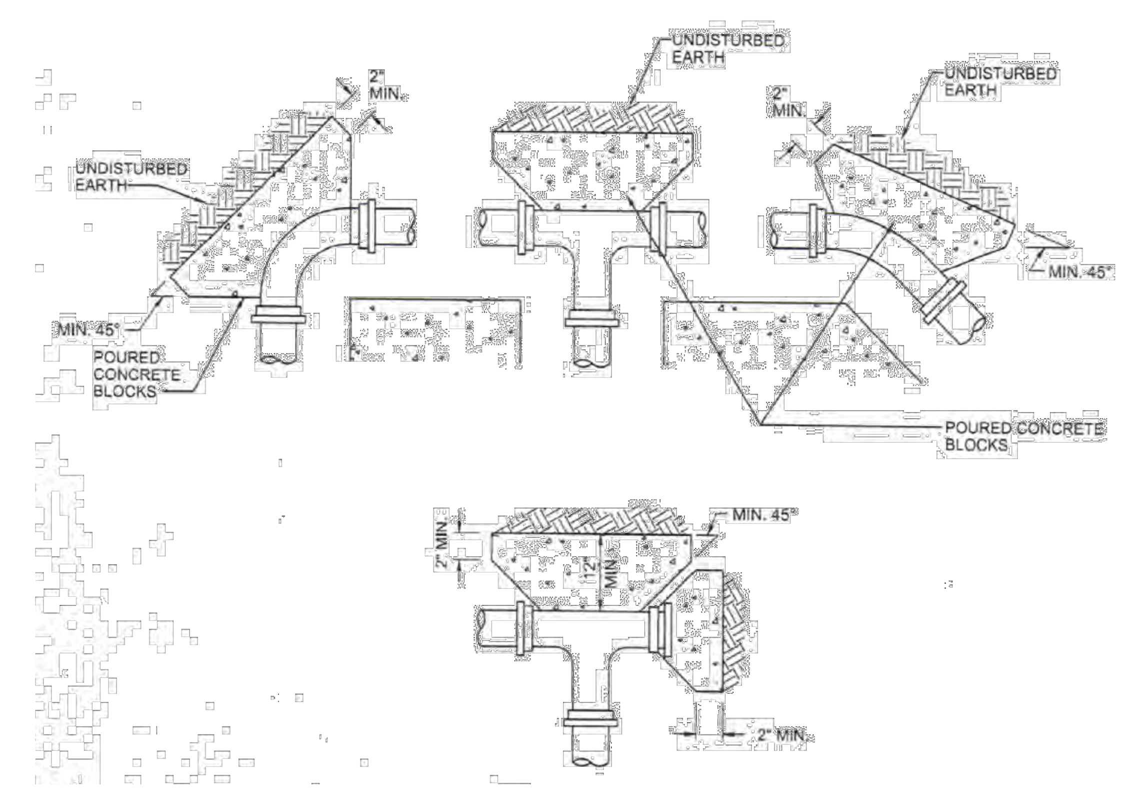
N.T.S. – SOURCE: TOWN OF MEDWAY DEPARTMENT OF PUBLIC SERVICES



NOTES:
1. ALL EXCAVATION, BACKFILLING AND PAVING SHALL BE IN ACCORDANCE WITH THE TOWN OF MEDWAY REQUIREMENTS.
2. TO THE EXTENT PRACTICAL, VALVE TO BE INSTALLED DIRECTLY TO EXISTING MAIN TO MINIMIZE NUMBER OF MECHANICAL JOINTS.

7 GATE VALVE

N.T.S. – SOURCE: TOWN OF MEDWAY DEPARTMENT OF PUBLIC SERVICES



NOTES:
1. SPECIFIC THRUST BLOCK DESIGN SHALL CONFORM TO AWWA GUIDELINES.
2. PLACE 4 MIL. POLYETHYLENE BETWEEN CONCRETE AND FITTING (CONCRETE SHALL NOT INTERFERE WITH JOINT).
3. MINIMUM CONCRETE THICKNESS SHALL BE 12 INCHES.
4. THRUST BLOCK ORIENTATION SHALL BE SUCH THAT THE CENTER OF THE FITTING CORRESPONDS WITH THE CENTER OF THE THRUST BLOCK.
5. THE MINIMUM ALLOWABLE ANGLE (EITHER VERTICAL OR HORIZONTAL) SHALL BE 45 DEGREES.

8 TYPICAL THRUST BLOCK

N.T.S. – SOURCE: TOWN OF MEDWAY DEPARTMENT OF PUBLIC SERVICES

Date	Description	No.

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MEDWAY BATTERY ENERGY STORAGE SYSTEM
MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title
UTILITY DETAILS I

Project No. 151033401
Date 06/08/2023
Drawn By JNW
Checked By FH
Drawing No. CU501

Project No. 151033401

Date: 6/6/2023 Time: 13:55 User: jpark Style Table: Langan.stb Layout: CU501 Document Code: 151033401-0501-CU501-0101

SITE LIGHTING SCHEDULE

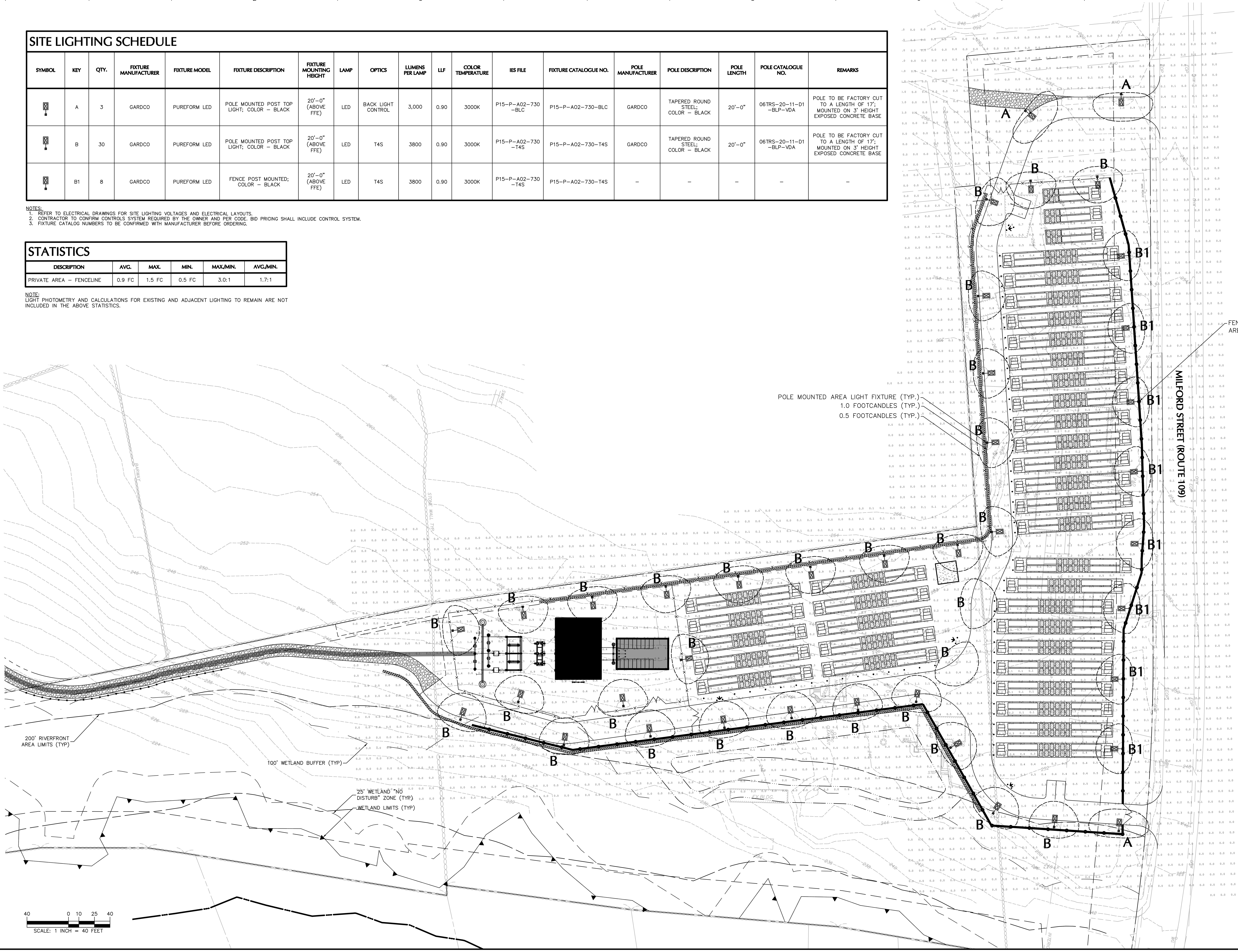
SYMBOL	KEY	QTY.	FIXTURE MANUFACTURER	FIXTURE MODEL	FIXTURE DESCRIPTION	FIXTURE MOUNTING HEIGHT	LAMP	OPTICS	LUMENS PER LAMP	LLF	COLOR TEMPERATURE	IES FILE	FIXTURE CATALOGUE NO.	POLE MANUFACTURER	POLE DESCRIPTION	POLE LENGTH	POLE CATALOGUE NO.	REMARKS
	A	3	GARDCO	PUREFORM LED	POLE MOUNTED POST TOP LIGHT; COLOR – BLACK	20'–0" (ABOVE FFE)	LED	BACK LIGHT CONTROL	3,000	0.90	3000K	P15–P–A02–730 –BLC	P15–P–A02–730–BLC	GARDCO	TAPERED ROUND STEEL; COLOR – BLACK	20'–0"	06TRS–20–11–D1 –BLP–VDA	POLE TO BE FACTORY CUT TO A LENGTH OF 17'; MOUNTED ON 3' HEIGHT EXPOSED CONCRETE BASE
	B	30	GARDCO	PUREFORM LED	POLE MOUNTED POST TOP LIGHT; COLOR – BLACK	20'–0" (ABOVE FFE)	LED	T4S	3800	0.90	3000K	P15–P–A02–730 –T4S	P15–P–A02–730–T4S	GARDCO	TAPERED ROUND STEEL; COLOR – BLACK	20'–0"	06TRS–20–11–D1 –BLP–VDA	POLE TO BE FACTORY CUT TO A LENGTH OF 17'; MOUNTED ON 3' HEIGHT EXPOSED CONCRETE BASE
	B1	8	GARDCO	PUREFORM LED	FENCE POST MOUNTED; COLOR – BLACK	20'–0" (ABOVE FFE)	LED	T4S	3800	0.90	3000K	P15–P–A02–730 –T4S	P15–P–A02–730–T4S	–	–	–	–	–

NOTES:
1. REFER TO ELECTRICAL DRAWINGS FOR SITE LIGHTING VOLTAGES AND ELECTRICAL LAYOUTS.
2. CONTRACTOR TO CONFIRM CONTROLS SYSTEM REQUIRED BY THE OWNER AND PER CODE. BID PRICING SHALL INCLUDE CONTROL SYSTEM.
3. FIXTURE CATALOG NUMBERS TO BE CONFIRMED WITH MANUFACTURER BEFORE ORDERING.

STATISTICS

DESCRIPTION	AVG.	MAX.	MIN.	MAX./MIN.	AVG./MIN.
PRIVATE AREA – FENCELINE	0.9 FC	1.5 FC	0.5 FC	3.0:1	1.7:1

NOTE:
LIGHT PHOTOMETRY AND CALCULATIONS FOR EXISTING AND ADJACENT LIGHTING TO REMAIN ARE NOT INCLUDED IN THE ABOVE STATISTICS.



Date	Description	No.

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Project
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MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title
LIGHTING PLAN

Project No. 151033401
Date 06/08/2023
Drawn By LL/SH
Checked By MH
Drawing No. LL101

LANGAN
Project No. 151033401

LIGHTING NOTES:

GENERAL

1. POINT–BY–POINT CALCULATIONS PROVIDED WITHIN HAVE BEEN PREPARED IN ACCORDANCE TO IESNA STANDARDS AND IN CONSIDERATION OF THE VARIABLES WITHIN THESE NOTES AND SITE LIGHTING SCHEDULE. THE VALUES SHOWN ON THE PLANS ARE NOT AN INDICATION OF THE INITIAL LIGHT INTENSITIES OF THE LAMPS. THESE VALUES ARE AN APPROXIMATION OF THE MAINTAINED INTENSITIES DELIVERED TO THE GROUND PLANE USING INDUSTRY STANDARD LIGHT LOSS FACTORS (LLF) WHICH COVER LAMP DEGRADATION AND NATURAL BUILDUP/ DIRT DEGRADATION ON THE FIXTURE LENS. THE LIGHTING PLAN IS DESIGNED WITH AN INDUSTRY STANDARD LLF IN ACCORDANCE WITH GUIDANCE AS PROVIDED BY IESNA. MINOR VARIATIONS IN TOPOGRAPHY, PHYSICAL OBSTRUCTIONS, AMBIENT OR ADJACENT LIGHT SOURCES AND/OR OTHER POTENTIAL IMPACTS HAVE NOT BEEN INCLUDED IN THESE CALCULATIONS. THEREFORE, AS–BUILT LIGHT INTENSITIES MAY VARY, IN EITHER DIRECTION, FROM WHAT IS EXPLICITLY PORTRAYED WITHIN THESE DRAWINGS.NO GUARANTEE OF LIGHT LEVELS IS EXPRESSED OR IMPLIED BY THE POINT BY POINT CALCULATIONS SHOWN ON THESE PLANS.
2. LIGHT LEVEL POINT SPACING IS 10 FT. LEFT TO RIGHT AND 10 FT. TOP TO BOTTOM. POINT BY POINT CALCULATIONS ARE BASED ON THE LIGHT LOSS FACTOR AS STATED IN THE LIGHTING SCHEDULE.
3. ALL LIGHTING IS TO BE FULL CUT–OFF.

COMPLIANCE

3. ALL SITE LIGHTING RELATED WORK AND MATERIALS SHALL COMPLY WITH CITY, COUNTY, AND OTHER APPLICABLE GOVERNING AUTHORITY REQUIREMENTS.
4. LIGHTING LAYOUT COMPLIES WITH THE ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA) SAFETY STANDARDS FOR LIGHT LEVELS.

COORDINATION

5. CONTRACTOR TO COORDINATE POWER SOURCE WITH LIGHT FIXTURES TO ENSURE ALL SITE LIGHTING IS OPERATING EFFECTIVELY, EFFICIENTLY AND SAFELY.
6. REFER TO ELECTRIFICATION PLAN FOR PROVIDING ADEQUATE POWER FOR SITE LIGHTING.
7. CONTRACTOR TO COORDINATE LOCATION OF EASEMENTS, UNDERGROUND UTILITIES AND DRAINAGE BEFORE DRILLING POLE BASES.
8. INSTALLATION OF ALL LIGHTING FIXTURES, POLES, FOOTINGS, AND FEEDER CABLE TO BE COORDINATED WITH ALL SITE WORK TRADES TO AVOID CONFLICT WITH FINISHED AND PROPOSED WORK.
9. CONTRACTOR TO COORDINATE INSTALLATION OF UNDERGROUND FEEDER CABLE FOR EXTERIOR LIGHTING WITH EXISTING AND PROPOSED UTILITIES, SITE DRAINAGE SYSTEMS, AND PAVING. CONTRACTOR SHALL PROMPTLY NOTIFY THE OWNER'S REPRESENTATIVE SHOULD ANY UTILITIES, NOT SHOWN ON THE PLANS, BE FOUND DURING EXCAVATIONS.

POLES AND FOOTINGS

10. PROVIDE A CONCRETE BASE FOR EACH LIGHT POLE AT THE LOCATIONS INDICATED ON THE CONSTRUCTION DRAWINGS AND/OR IN ACCORDANCE WITH PROJECT PLANS AND SPECIFICATIONS RELATING DIRECTLY TO CAST–IN–PLACE CONCRETE. THE USE OF ALTERNATE LIGHTING FOUNDATIONS, SUCH AS PRECAST, MAY CHANGE THE SIZING AND REINFORCEMENT REQUIREMENTS FROM THOSE SHOWN ON THESE PLANS. CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR REVIEW PRIOR TO ORDERING ANY SUBSTITUTED PRODUCTS.
11. CONTRACTOR SHALL EXAMINE AND VERIFY THAT SOIL CONDITIONS ARE SUITABLE TO SUPPORT LOADS EXERTED UPON THE FOUNDATIONS DURING EXCAVATION. CONTRACTOR SHALL NOTIFY ENGINEER OF ANY UNSATISFACTORY CONDITIONS.
12. POLE FOUNDATIONS SHALL NOT BE POURED IF FREE STANDING WATER IS PRESENT IN EXCAVATED AREA.
13. ALL POLES HIGHER THAN 25 FT. SHALL BE EQUIPPED WITH FACTORY INSTALLED VIBRATION DAMPENERS.

WALL MOUNTED FIXTURES

14. CONTRACTOR TO COORDINATE INSTALLATION OF ALL THE WALL MOUNTED FIXTURES AND ELECTRICAL CONNECTIONS TO SITE STRUCTURE(S) WITH BUILDING MEP, ARCHITECT, AND/OR OWNER.
15. INSTALLATION AND ELECTRICAL CONNECTIONS FOR WALL MOUNTED FIXTURES TO BE COORDINATED WITH ARCHITECTURAL, STRUCTURAL, UTILITY AND SITE PLANS AND TO BE IN ACCORDANCE WITH ALL APPLICABLE CODES.

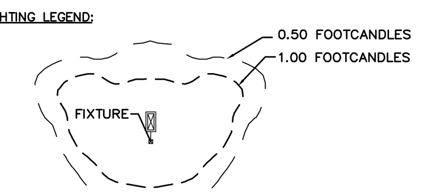
ADJUSTMENT AND INSPECTION

16. CONTRACTOR TO OPERATE EACH LUMINAIRE AFTER INSTALLATION AND CONNECTION. INSPECT FOR IMPROPER CONNECTIONS AND OPERATION.
17. CONTRACTOR TO AIM AND ADJUST ALL LUMINAIRES TO PROVIDE ILLUMINATION LEVELS AND DISTRIBUTION AS INDICATED ON THE CONSTRUCTION DRAWINGS OR AS DIRECTED BY THE LANDSCAPE ARCHITECT AND/OR OWNER.
18. CONTRACTOR TO CONFIRM THAT LIGHT FIXTURES, TILT ANGLE AND AIMING MATCH SPECIFICATIONS ON THE PLANS.

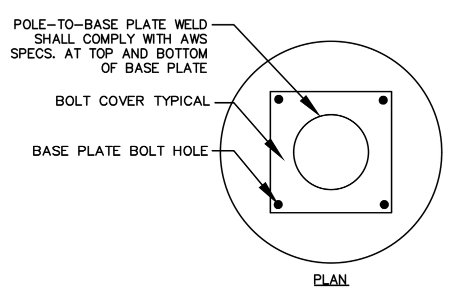
REQUIREMENTS FOR ALTERNATES

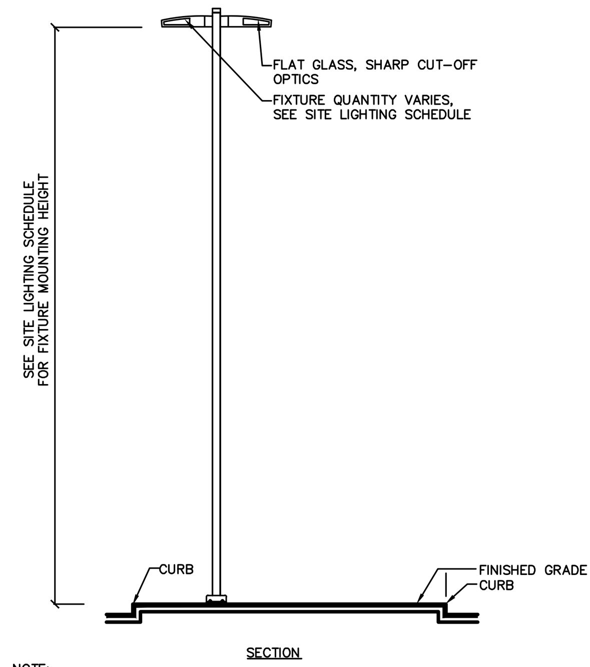
19. ALL LIGHTING SUBSTITUTIONS MUST BE MADE WITHIN 14 DAYS PRIOR TO THE BID DATE TO PROVIDE AMPLE TIME FOR REVIEW AND TO ISSUE AN ADDENDUM INCORPORATING THE SUBSTITUTION WITH THE FOLLOWING REQUIREMENTS:
   A. ANY SUBSTITUTION TO LIGHTING FIXTURES, POLES, ETC. MUST BE APPROVED BY THE OWNER, ENGINEER AND TENANTS. ANY COST ASSOCIATED WITH REVIEW AND/OR APPROVAL OF THE SUBSTITUTIONS SHALL BE ENTIRELY BORNE BY THE CONTRACTOR
   B. COMPUTER PREPARED PHOTOMETRIC LAYOUT OF THE PROPOSED LIGHTED AREA WHICH INDICATES, BY ISOFOOTCANDLE, THE SYSTEM'S PERFORMANCE.
   C. A PHOTOMETRIC REPORT FROM A NATIONAL INDEPENDENT TESTING LABORATORY WITH REPORT NUMBER, DATE, FIXTURE CATALOG NUMBER, LUMINAIRE AND LAMP SPECIFICATIONS; IES CALCULATIONS, POINT BY POINT FOOT CANDLE PLAN, STATISTIC ZONES SHOWING AVERAGE, MAXIMUM, MINIMUM AND UNIFORMITY RATIOS, SUMMARY, ISOLUX PLOT, AND CATALOGUE CUTS. CATALOGUE CUTS MUST IDENTIFY OPTICS, LAMP TYPE, DISTRIBUTION TYPE, REFLECTOR, LENS, BALLASTS, WATTAGE, VOLTAGE, FINISH HOUSING DESCRIPTION AND ALL OTHER PERTINENT INFORMATION.
   D. POLE MANUFACTURER AASHTO CALCULATIONS INDICATING THE POLE AND ANCHOR BOLTS BEING SUBMITTED ARE CAPABLE OF SUPPORTING THE POLE AND FIXTURE SYSTEMS BEING UTILIZED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
   E. THE UNDERWRITERS LABORATORY LISTING AND FILE NUMBER FOR THE SPECIFIC FIXTURE(S) TO BE UTILIZED.
   F. A COLOR PHOTOGRAPH THAT CLEARLY SHOWS THE REPLACEMENT FIXTURE POLE MOUNTED, THE FIXTURE'S COLOR, FINISH, AND PHYSICAL CHARACTERISTICS.

PHOTOMETRIC LIGHTING LEGEND:



NOTE: THE PHOTOMETRIC TEMPLATE REPRESENTS LIGHT THROW FOR EACH INDIVIDUAL FIXTURE AND DOES NOT REPRESENT LIGHT COMING FROM OTHER SOURCES.

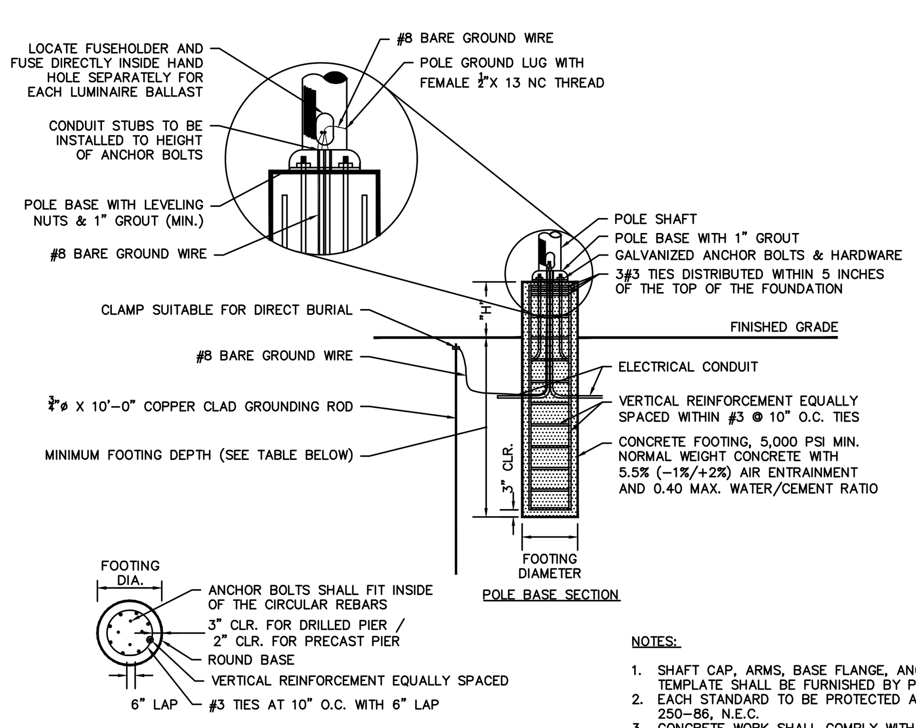




NOTE:

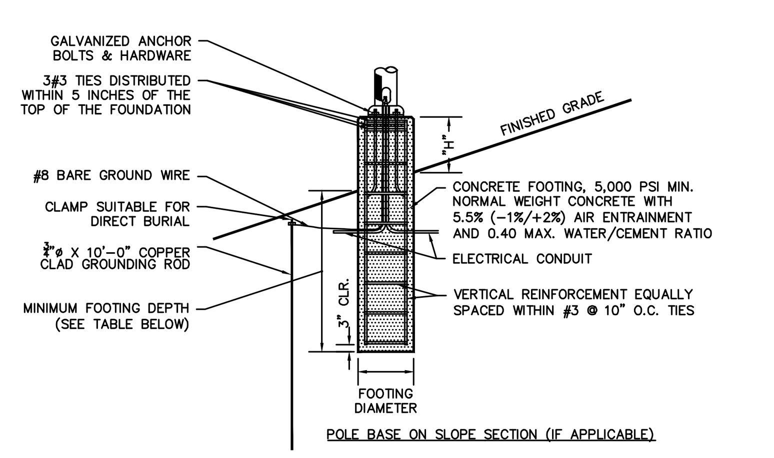
1. ALL LIGHTS WITH 25' MOUNTING HEIGHT OR GREATER TO RECEIVE FACTORY INSTALLED VIBRATION DAMPENERS.

LIGHT FIXTURE AND POLE



NOTES:

EXPOSED HEIGHT OF POLE BASE (H) SHALL BE MEASURED ON THE UPHILL SIDE OF A SLOPE. FOOTING DEPTH (D) SHALL BE MEASURED ON THE DOWNHILL SIDE OF A SLOPE. AN ADDITIONAL VARIABLE HEIGHT (V) WILL BE BASED ON THE SLOPE ON WHICH THE POLE BASE IS LOCATED. CONTRACTOR TO CALCULATE FULL LENGTH OF EACH POLE BASE REQUIRED ON SLOPES (H+D+V = TOTAL BASE LENGTH)



NOTES:

1. SHAFT CAP, ARMS, BASE FLANGE, ANCHOR BOLTS, LEVELING NUTS, CONNECTION HARDWARE, BOLT COVERS, HANDHOLE COVER, AND BOLT CIRCLE TEMPLATE SHALL BE FURNISHED BY POLE MANUFACTURER.
2. EACH STANDARD TO BE PROTECTED AGAINST LIGHTNING WITH AN INTERCONNECTED GROUND ROD. THIS ROD SHALL BE BONDED PER SECTION NUMBER 250–86, N.E.C.
3. CONCRETE WORK SHALL COMPLY WITH THE REQUIREMENT OF ACI 318. CAST–IN–PLACE SHALL HAVE UNCONFINED COMPRESSIVE STRENGTH OF AT LEAST 5,000 PSI AT 28–DAYS. DEFORMED REINFORCEMENT BARS SHALL CONFORM TO ASTM A615, GRADE 60.
4. CONTRACTOR TO ENSURE CONCRETE POLE BASES ARE POURED / PLACED ABSOLUTELY VERTICAL & LEVEL.
5. IF POLE BASE IS CAST–IN–PLACE, POLE BASE SHALL BE ONE CONTINUOUS POUR. EXPOSED PORTION OF BASE SHALL BE HAND–RUBBED SMOOTH.
6. CONTRACTOR TO COMPACT SUBGRADE AROUND POLE BASE PER EARTHWORK SPECIFICATIONS / GEOTECH REPORT.
7. THE INFORMATION ILLUSTRATED IN THE LIGHT POLE FOUNDATION DETAIL HAS BEEN PROVIDED FOR GENERAL REFERENCE AND PRELIMINARY COST ESTIMATE PURPOSES. LIGHT POLE FOUNDATIONS SHOULD BE DESIGNED AND DETAILED BY A LICENSED STRUCTURAL ENGINEER BASED ON EXISTING SOIL CONDITIONS, LOCAL DESIGN STANDARDS AND MANUFACTURERS RECOMMENDATIONS.
8. CONTRACTOR TO CONFIRM GROUNDING DESIGN WITH MEP.

MOUNTING HEIGHT	FOOTING DEPTH	FOOTING DIAMETER	VERTICAL REINFORCEMENT	'H'
20'–0"	7'–0"	2'–0"	6 #5 BARS	3'–0"

1 POLE FOOTING

NTS

GARDCO by Signify

Site & Area

PureForm

P15 small square area light

Gardco PureForm LED area small square precision P15 features a sleek, low profile design. Precision optics are optimized for maximum efficiency and uniformity. Multiple optical distributions and color temperatures are available to allow you to customize your selection.

Project:
Location:
Cat.No:
Type:
Lumens: Qty:
Notes:

Ordering guide

example: P15-P-A06-740-T5S-AR1-UNV-BL50-L3-BZ

Prefix	Optic Technology	Configuration (nominal lumens)	Color Temperature	Distribution	Mounting	Voltage
P15	P					
P15 PureForm area small, 15" square	**P** Precision	**A01** 2,000 lumens **A02** 4,000 lumens **A03** 6,000 lumens **A04** 8,000 lumens **A05** 10,000 lumens **A06** 12,000 lumens **A07** 14,000 lumens **A08** 16,000 lumens	**730** 70CRI 3000K **740** 70CRI 4000K **750** 70CRI 5000K **835**[2] 80CRI 3500K **827**[2] 80CRI 2700K	**T2M** Type 2 Medium **T3M** Type 3 Medium **T4S** Type 4 Short **T5S** Type 5 Short **BLC** Back Light Control	**AR1**[3] Arm mount (Standard) The following mounting kits must be ordered separately (See accessories) **RAM**[3] Retrofit arm mount kit **WAL** Wall mount	**120** 120V **208** 208V **240** 240V **277** 277V **347** 347V **480** 480V **UNV** 120-277V (50/60Hz) **HVU** 347-480V (50/60Hz)

Options

Dimming controls	Motion sensor lens	Electrical/Shielding	Finish
(0-10V dimming driver standard) **DLEA**[4] Dimming Leads Externally Accessible (controls by others) **FAWS**[4,5] Field Adjustable Wattage Selector **BL50**[4,6] Bi-level set at 50% dimming **SIWI**[4,7,9,10] SiteWise integral module **SRDR**[4,7,8,14] SR driver connected to Zhaga socket DynaDimmer: Automatic Profile Dimming **CS50**[4,8] Security 50% Dimming, 7 hours **CM50**[4,8] Median 50% Dimming, 8 hours **CS30**[4,8] Security 30% Dimming, 7 hours **CM30**[4,8] Median 30% Dimming, 8 hours	**L2**[6,13,14] PIR Sensor #2 lens **L3**[6,13,14] PIR Sensor #3 lens	**PCB**[8,10] Photocontrol Button **TR7**[8,11] 7-pin Twist Lock Receptacle **TLP**[10,12] 7-pin Twist Lock Receptacle w/ 3-pinPhotocell **SP2**[1] Increased 20kA **FS1**[10] Single Fuse (120, 277, 347VAC) **FS2**[10] Double Fuse (208, 240, 480VAC) **HIS** Internal house side shield	Textured **BK** Black **WH** White **BZ** Bronze **DG** Dark Gray **MG** Medium Gray Customer specified **RAL** Specify optional color or RAL (ex: RAL7024) **CC** Custom color (Must supply color chip for required factory quote)

1. Product ships standard with 10kA.
2. Extended lead times apply. Contact factory for details.
3. Mounts to a 4-5" OD round pole with adapter included for square poles.
4. Not available with other dimming control options (mutually exclusive).
5. Not available with motion sensor.
6. BL50 must be specified with a motion sensor lens (L2 or L3).
7. Not available with photocontrols.
8. Not available in 347 or 480V.
9. Available only in 120 or 277V.
10. Must specify input voltage.
11. All 7 pins in NEMA receptacle are connected to SR driver.
12. Not available in 480V. Order photocell separately with TR7.
13. Not available with DLEA and FAWS dimming control options.
14. When ordering SRDR with L2 or L3, controller to be used on socket must be SR compatible (See specifications for more details).

P15_PureForm_area_small_square_precision 04/21 page 1 of 6

2 FIXTURE TYPE A & B

NTS

GARDCO by Signify

Pole/Bracket

Site and Area Poles

Tapered Round Steel

The Gardco TRS Tapered Round Steel pole consists of a one-piece design fabricated steel tubing circumferentially welded to a structural quality hot rolled carbon steel plate. The poles are finished with an electrostatically applied, thermally cured TGIC polyester powdercoat.

Project:
Location:
Cat.No:
Type:
Lamps: Qty:
Notes:

Ordering Guide

example: 05TRS-20-11-D1-BRP

Prefix	Height	Gauge	Drilling[1]	Finish	Options
05TRS **06TRS** **07TRS** **08TRS** **09TRS**	20 20 25[2] 25 30[2] 35[2] 30 35 39[2] 39	11	**D1** 1 Way **D2** 2 Way at 180° **D2@90** 2 Way at 90° **D3** 3 Way at 90° **D3@120** 3 Way at 120° **D4** 4 Way **T2** 2.4" OD Tenon X 4" long **T3** 3" OD Tenon X 5" long **T4** 4" OD Tenon X 6" long **P** Plain Top (No Drilling/No Tenon)	**BRP** Bronze Paint **BLP** Black Paint **WP** White Paint **MGY** Medium Grey **DGY** Dark Grey **GV** Galvanized (No Paint) **FPGV** Finished Paint over Galvanized (specify color) **OC** Optional Color Paint (Specify RAL designation ex: RAL7024) **SC** Special Color Paint (Specify. Must supply color chip.)	**FES** Festoon Outlet **VDA** Vibration Dampener **AHH** Additional Hand Hole For Festoon Outlets and Additional Hand Holes, indicate height above base and orientation to original hand hole. See Pole Orientation Information on Page 4. **Nipples and Couplings** **CL1/2** Coupling - Internal Thread 1/2" **CL3/4** Coupling - Internal Thread 3/4" **CL1** Coupling - Internal Thread 1" **CL1-1/4** Coupling - Internal Thread 1-1/4" **CL1-1/2** Coupling - Internal Thread 1-1/2" **NL1/2** Nipple - External Thread 1/2" **NL3/4** Nipple - External Thread 3/4" **NL1** Nipple - External Thread 1" **NL1-1/4** Nipple - External Thread 1-1/4" **NL1-1/2** Nipple - External Thread 1-1/2" Indicate height above base and orientation to hand hole. See Pole Orientation Information on Page 4. **Single Side Mount Bullhorn Brackets** **GM-080-19** Single - 1.9" OD (For Gardco DFL7/DFC7 only) **GM-080-24** Single - 2.4" OD Indicate height above base and orientation to hand hole. See Pole Orientation Information on Page 4 Additional and alternative brackets and accessories available. Refer to the Signify product catalog (eCat) website for more information.

Enter the order code into the appropriate box above. **Note:** Gardco reserves the right to refuse a configuration. Not all combinations and configurations are valid. Refer to notes below for exclusions and limitations. For questions or concerns, please consult the factory.

1. Standard poles are drilled in factory for compatibility with Signify luminaires only (D* options). For non-Signify-brand luminaires, select the P drilling option.
2. Poles with a 2.4" top OD cannot be side drilled. The 2.4" top has the same OD as the T2 tenon.

Anchor Bolts for Gardco 0xTRS Poles, ordered separately:

	12NC for ordering	Description (in inches)
For Pre-ship service (Order 4 per pole)	912400215784	1 x 36 x 4.5
For shipment with the pole (Order 1 per pole)	912400200208	1 x 36 x 4.5

TRS_Spec_Sheet 02/21 page 1 of 4

3 POLE TYPE A & B

NTS

Date	Description	No.

Revisions

LANGAN

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Project

MEDWAY BATTERY ENERGY STORAGE SYSTEM

MEDWAY

NORFOLK COUNTY MASSACHUSETTS

Drawing Title

LIGHTING DETAILS

Project No. 151033401

Date 06/08/2023

Drawn By LL/AS

Checked By MH

Drawing No. LL501

Project No. 151033401

PLANT SCHEDULE

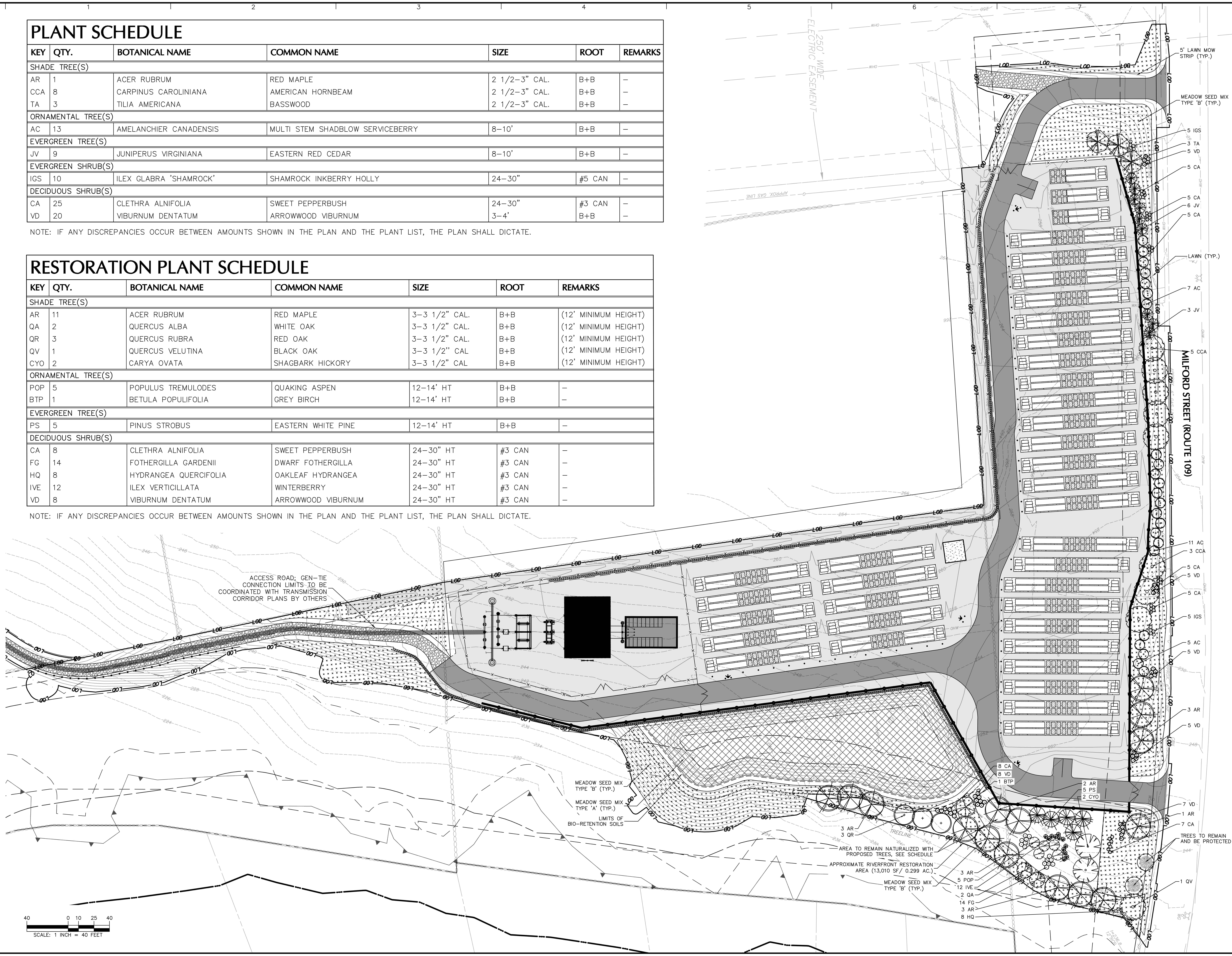
KEY	QTY.	BOTANICAL NAME	COMMON NAME	SIZE	ROOT	REMARKS
SHADE TREE(S)						
AR	1	ACER RUBRUM	RED MAPLE	2 1/2-3" CAL.	B+B	–
CCA	8	CARPINUS CAROLINIANA	AMERICAN HORNBEAM	2 1/2-3" CAL.	B+B	–
TA	3	TILIA AMERICANA	BASSWOOD	2 1/2-3" CAL.	B+B	–
ORNAMENTAL TREE(S)						
AC	13	AMELANCHIER CANADENSIS	MULTI STEM SHADBLOW SERVICEBERRY	8-10'	B+B	–
EVERGREEN TREE(S)						
JV	9	JUNIPERUS VIRGINIANA	EASTERN RED CEDAR	8-10'	B+B	–
EVERGREEN SHRUB(S)						
IGS	10	ILEX GLABRA 'SHAMROCK'	SHAMROCK INKBERRY HOLLY	24-30"	#5 CAN	–
DECIDUOUS SHRUB(S)						
CA	25	CLETHRA ALNIFOLIA	SWEET PEPPERBUSH	24-30"	#3 CAN	–
VD	20	VIBURNUM DENTATUM	ARROWWOOD VIBURNUM	3-4'	B+B	–

NOTE: IF ANY DISCREPANCIES OCCUR BETWEEN AMOUNTS SHOWN IN THE PLAN AND THE PLANT LIST, THE PLAN SHALL DICTATE.

RESTORATION PLANT SCHEDULE

KEY	QTY.	BOTANICAL NAME	COMMON NAME	SIZE	ROOT	REMARKS
SHADE TREE(S)						
AR	11	ACER RUBRUM	RED MAPLE	3-3 1/2" CAL.	B+B	(12' MINIMUM HEIGHT)
QA	2	QUERCUS ALBA	WHITE OAK	3-3 1/2" CAL.	B+B	(12' MINIMUM HEIGHT)
QR	3	QUERCUS RUBRA	RED OAK	3-3 1/2" CAL.	B+B	(12' MINIMUM HEIGHT)
QV	1	QUERCUS VELUTINA	BLACK OAK	3-3 1/2" CAL	B+B	(12' MINIMUM HEIGHT)
CYO	2	CARYA OVATA	SHAGBARK HICKORY	3-3 1/2" CAL	B+B	(12' MINIMUM HEIGHT)
ORNAMENTAL TREE(S)						
POP	5	POPULUS TREMULODES	QUAKING ASPEN	12-14' HT	B+B	–
BTP	1	BETULA POPULIFOLIA	GREY BIRCH	12-14' HT	B+B	–
EVERGREEN TREE(S)						
PS	5	PINUS STROBUS	EASTERN WHITE PINE	12-14' HT	B+B	–
DECIDUOUS SHRUB(S)						
CA	8	CLETHRA ALNIFOLIA	SWEET PEPPERBUSH	24-30" HT	#3 CAN	–
FG	14	FOTHERGILLA GARDENII	DWARF FOTHERGILLA	24-30" HT	#3 CAN	–
HQ	8	HYDRANGEA QUERCIFOLIA	OAKLEAF HYDRANGEA	24-30" HT	#3 CAN	–
IVE	12	ILEX VERTICILLATA	WINTERBERRY	24-30" HT	#3 CAN	–
VD	8	VIBURNUM DENTATUM	ARROWWOOD VIBURNUM	24-30" HT	#3 CAN	–

NOTE: IF ANY DISCREPANCIES OCCUR BETWEEN AMOUNTS SHOWN IN THE PLAN AND THE PLANT LIST, THE PLAN SHALL DICTATE.



Date	Description	No.

Revisions

LANGAN
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Project
MEDWAY BATTERY ENERGY STORAGE SYSTEM
MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title
PLANTING PLAN

Project No. 151033401
Date 06/08/2023
Drawn By AS/SH
Checked By MH
Drawing No. LP101

Project No. 151033401

Date: 6/7/2023 Time: 11:15 User: asookying Style Table: Langan.stb Layout: LP101 Document Code: 151033401-0501-LP101-0101

GENERAL LANDSCAPE PLANTING NOTES

1. NAMES OF PLANTS AS DESCRIBED ON THIS PLAN CONFORM TO THOSE GIVEN IN "STANDARDIZED PLANT NAMES", 1942 EDITION, PREPARED BY THE AMERICAN JOINT COMMITTEE ON HORTICULTURAL NOMENCLATURE. NAMES OF PLANT VARIETIES NOT INCLUDED THEREIN CONFORM TO NAMES GENERALLY ACCEPTED IN NURSERY TRADE.
2. ALL EXPOSED GROUND SURFACES THAT ARE NOT PAVED WITHIN THE CONTRACT LIMIT LINE, AND THAT ARE NOT COVERED BY LANDSCAPE PLANTING OR SEEDING AS SPECIFIED, SHALL BE COVERED BY A NATURAL MULCH THAT WILL PREVENT SOIL EROSION AND THE EMANATION OF DUST.
3. NO PLANT SHALL BE PUT INTO THE GROUND BEFORE ROUGH GRADING HAS BEEN COMPLETED AND APPROVED BY THE PROJECT LANDSCAPE ARCHITECT OR PROJECT ENGINEER.
4. STANDARDS FOR TYPE, SPREAD, HEIGHT, ROOT BALL AND QUALITY OF NEW PLANT MATERIAL SHALL BE IN ACCORDANCE WITH GUIDELINES AS SET FORTH IN THE "AMERICAN STANDARD FOR NURSERY STOCK", PUBLISHED BY THE AMERICAN ASSOCIATION OF NURSERYMEN. PLANT MATERIAL SHALL HAVE NORMAL HABIT OF GROWTH AND BE HEALTHY, VIGOROUS, AND FREE FROM DISEASES AND INSECT INFESTATION.
5. NEW PLANT MATERIAL SHALL BE NURSERY GROWN UNLESS SPECIFIED OTHERWISE. ALL PLANTS SHALL BE SET PLUMB AND SHALL BEAR THE SAME RELATIONSHIP TO FINISHED GRADE AS THE PLANT'S ORIGINAL GRADE BEFORE DIGGING. PLANT MATERIAL OF THE SAME SPECIES AND SPECIFIED AS THE SAME SIZE SHOULD BE SIMILAR IN SHAPE, COLOR AND HABIT. THE LANDSCAPE ARCHITECT HAS THE RIGHT TO REJECT PLANT MATERIAL THAT DOES NOT CONFORM TO THE TYPICAL OR SPECIFIED HABIT OF THAT SPECIES.
6. THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL EXISTING UNDERGROUND UTILITY AND SEWER LINES PRIOR TO THE START OF EXCAVATION ACTIVITIES. NOTIFY THE PROJECT ENGINEER AND OWNER IMMEDIATELY OF ANY CONFLICTS WITH PROPOSED PLANTING LOCATIONS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE.
7. THE CONTRACTOR SHALL NOT MAKE SUBSTITUTIONS. IF THE SPECIFIED LANDSCAPE MATERIAL IS NOT OBTAINABLE, THE CONTRACTOR SHALL SUBMIT PROOF OF NON-AVAILABILITY TO THE LANDSCAPE ARCHITECT AND OWNER, TOGETHER WITH A WRITTEN PROPOSAL FOR USE OF AN EQUIVALENT MATERIAL.
8. LANDSCAPE CONTRACTOR TO STAKE OUT PLANTING LOCATIONS, FOR REVIEW AND APPROVAL BY THE LANDSCAPE ARCHITECT AND/OR OWNER BEFORE PLANTING WORK BEGINS. THE LANDSCAPE ARCHITECT AND/OR OWNER SHALL DIRECT THE CONTRACTOR IN THE FINAL PLACEMENT OF ALL PLANT MATERIAL AND LOCATION OF PLANTING BEDS TO ENSURE COMPLIANCE WITH DESIGN INTENT UNLESS OTHERWISE INSTRUCTED.
9. THE LANDSCAPE ARCHITECT MAY REVIEW PLANT MATERIALS AT THE SITE, BEFORE PLANTING, FOR COMPLIANCE WITH REQUIREMENTS FOR GENUS, SPECIES, VARIETY, SIZE, AND QUALITY. THE LANDSCAPE ARCHITECT RETAINS THE RIGHT TO FURTHER REVIEW PLANT MATERIALS FOR SIZE AND CONDITION OF BALLS AND ROOT SYSTEM, INSECTS, INJURIES, AND LATENT DEFECTS, AND TO REJECT UNSATISFACTORY OR DEFECTIVE MATERIAL AT ANY TIME DURING PROGRESS OF WORK. THE CONTRACTOR SHALL REMOVE REJECTED PLANT MATERIALS IMMEDIATELY FROM PROJECT SITE AS DIRECTED BY THE LANDSCAPE ARCHITECT OR OWNER.
10. DELIVERY, STORAGE, AND HANDLING
    A. PACKAGED MATERIALS: PACKAGED MATERIALS SHALL BE DELIVERED IN CONTAINERS SHOWING WEIGHT, ANALYSIS, AND NAME OF MANUFACTURER. MATERIALS SHALL BE PROTECTED FROM DETERIORATION DURING DELIVERY, AND WHILE STORED AT SITE.
    B. TREES AND SHRUBS: THE CONTRACTOR SHALL PROVIDE TREES AND SHRUBS DUG FOR THE GROWING SEASON FOR WHICH THEY WILL BE PLANTED. DO NOT PRUNE PRIOR TO DELIVERY UNLESS OTHERWISE DIRECTED BY THE LANDSCAPE ARCHITECT. DO NOT BEND OR BIND-TIE TREES OR SHRUBS IN SUCH A MANNER AS TO DAMAGE BARK, BREAK BRANCHES, OR DESTROY NATURAL SHAPE. PROVIDE PROTECTIVE COVERING DURING TRANSIT. DO NOT DROP BALLED AND BURLAPPED STOCK DURING DELIVERY OR HANDLING.
    C. ALL PLANTS SHALL BE BALLED AND BURLAPPED OR CONTAINER GROWN AS SPECIFIED. NO CONTAINER GROWN STOCK WILL BE ACCEPTED IF IT IS ROOT BOUND. ALL ROOTBALL WRAPPING AND BINDING MATERIAL MADE OF SYNTHETICS OR PLASTICS SHALL BE REMOVED FROM THE TOP OF THE BALL AT THE TIME OF PLANTING. IF THE PLANT IS SHIPPED WITH A WIRE BASKET AROUND THE ROOT BALL, THE WIRE BASKET SHALL BE CUT AND FOLDED DOWN 8 INCHES INTO THE PLANTING HOLE. WITH CONTAINER GROWN STOCK, THE CONTAINER SHALL BE REMOVED AND THE ROOT BALL SHALL BE CUT THROUGH THE SURFACE IN TWO LOCATIONS.
    D. THE CONTRACTOR SHALL HAVE TREES AND SHRUBS DELIVERED TO SITE AFTER PREPARATIONS FOR PLANTING HAVE BEEN COMPLETED AND PLANT IMMEDIATELY. IF PLANTING IS DELAYED MORE THAN 6 HOURS AFTER DELIVERY, THE CONTRACTOR SHALL SET TREES AND SHRUBS IN SHADE, PROTECT FROM WEATHER AND MECHANICAL DAMAGE AND KEEP ROOTS MOIST BY COVERING WITH MULCH, BURLAP OR OTHER ACCEPTABLE MEANS OF RETAINING MOISTURE.
11. ALL LANDSCAPED AREAS TO BE CLEARED OF ROCKS, STUMPS, TRASH AND OTHER UNSIGHTLY DEBRIS. ALL FINE GRADED AREAS SHOULD BE HAND RAKED SMOOTH ELIMINATING ANY CLUMPS AND AND UNEVEN SURFACES PRIOR TO PLANTING OR MULCHING.
12. ALL PLANT MATERIAL SHALL BE INSTALLED AS PER DETAILS, NOTES AND CONTRACT SPECIFICATIONS. THE LANDSCAPE ARCHITECT MAY REVIEW INSTALLATION AND MAINTENANCE PROCEDURES.
13. NEW PLANT MATERIAL SHALL BE GUARANTEED TO BE ALIVE AND IN VIGOROUS GROWING CONDITION FOR A PERIOD OF ONE YEAR FOLLOWING ACCEPTANCE BY THE OWNER. PLANT MATERIAL FOUND TO BE UNHEALTHY, DYING OR DEAD DURING THIS PERIOD, SHALL BE REMOVED AND REPLACED IN KIND BY THE CONTRACTOR AT NO EXPENSE TO THE OWNER.
14. THE CONTRACTOR SHALL KEEP AREA CLEAN DURING DELIVERY AND INSTALLATION OF PLANT MATERIALS. REMOVE AND DISPOSE OF OFF-SITE ANY ACCUMULATED DEBRIS OR UNUSED MATERIALS. REPAIR DAMAGE TO ADJACENT AREAS CAUSED BY LANDSCAPE INSTALLATION OPERATIONS.
15. ALL PLANTS SHALL BE WATERED THOROUGHLY TWICE DURING THE FIRST 24-HOUR PERIOD AFTER PLANTING. ALL PLANTS SHALL THEN BE WATERED WEEKLY OR AS REQUIRED BY SITE AND WEATHER CONDITIONS TO MAINTAIN VIGOROUS AND HEALTHY PLANT GROWTH.
16. THE BACKFILL MIXTURE AND SOIL MIXES TO BE INSTALLED PER THE SPECIFICATIONS.
17. AFTER PLANT IS PLACED IN TREE PIT LOCATION, ALL TWINE HOLDING ROOT BALL TOGETHER SHOULD BE COMPLETELY REMOVED AND THE BURLAP SHOULD BE PULLED DOWN SO 1/3 OF THE ROOT BALL IS EXPOSED. SYNTHETIC BURLAP SHOULD BE COMPLETELY REMOVED AFTER INSTALLATION.
18. MULCH SHOULD NOT BE PILED UP AROUND THE TRUNK OF ANY PLANT MATERIAL. NO MULCH OR TOPSOIL SHOULD BE TOUCHING THE BASE OF THE TRUNK ABOVE THE ROOT COLLAR.
19. ALL FENCE INSTALLATION SHALL BE COMPLETED PRIOR TO COMMENCEMENT OF ANY LANDSCAPE PLANTING, LAWN AND GRASSES, OR IRRIGATION WORK.
20. FOR ANY DISCREPANCIES BETWEEN THE PLANT SCHEDULE AND PLANTING PLAN THE GRAPHIC QUANTITY SHOWN SHALL GOVERN.
21. PLANT MATERIALS SHALL NOT BE PLANTED UNTIL THE FINISHED GRADING HAS BEEN COMPLETED.
22. ALL PLANT INSTALLATIONS SHALL BE COMPLETED EITHER BETWEEN APRIL 1 – JUNE 15 OR AUGUST 15 – NOVEMBER 1, UNLESS OTHERWISE DIRECTED BY THE PROJECT LANDSCAPE ARCHITECT. SEE LAWN SEEDING DATES IN SEEDING NOTES.

LAWN WATERING SCHEDULE

THE FOLLOWING WATERING SCHEDULE COVERS ROUGHLY 8 WEEKS TO ESTABLISH A HEALTHY STAND OF GRASS FROM SEED. THE CONTRACTOR SHALL BE OBLIGATED TO ENSURE A HEALTHY STAND OF GRASS AT THE END OF THE MAINTENANCE/BOND PERIOD. ANY BARE OR DEAD AREAS IN THE LAWN SHALL BE PREPARED, RESEEDED AND REESTABLISHED PRIOR TO THE END OF THE MAINTENANCE/BOND PERIOD AND TO THE SATISFACTION OF THE PROJECT LANDSCAPE ARCHITECT AND THE OWNER.

IMPORTANT ASPECTS TO ATTAINING AND SUSTAINING A HEALTHY STAND OF GRASS ARE THE INSTALLATION OF TOPSOIL, SEED BED PREPARATION, ATTAINING OPTIMAL pH FOR THE INTENDED PLANT SPECIES, FERTILIZING, MULCH COVERING, AND SUFFICIENT WATERING PER THESE NOTES AND/OR PROJECT SPECIFICATIONS.

1. SEEDING SHALL BE DONE DURING THE SEASONS SPECIFIED IN THE LAWN SEED MIX NOTES AND/OR PROJECT SPECIFICATIONS.
2. AFTER THE SEEDBED IS PREPARED, SEED IS INSTALLED, AND MULCH IS APPLIED, WATER LIGHTLY TO KEEP THE TOP 2 INCHES OF SOIL CONSISTENTLY MOIST, NOT SATURATED. AT NO TIME SHOULD WATER BE APPLIED TO THE POINT OF RUNOFF OR THE DISPLACEMENT OF SEED.
3. DEPENDING ON SOIL TEMPERATURES, IT MAY TAKE SEVERAL WEEKS FOR GERMINATION TO OCCUR. DIFFERENT SPECIES WITHIN THE MIX GERMINATE AT DIFFERENT TIMES AND THEREFORE CONTRACTOR SHOULD CONTINUE THE LIGHT WATERING, AS DESCRIBED ABOVE, UNTIL THERE IS AT LEAST 2 INCHES OF GROWTH THROUGHOUT.
4. AT THIS POINT, WATERING FREQUENCY MAY BE REDUCED TO EVERY 3 TO 5 DAYS. WATER SHALL BE APPLIED TO WET A 6 INCH MINIMUM SOIL DEPTH TO PROMOTE HEALTHY DEEP ROOTS.
5. BEGIN MOWING ONCE PER WEEK AFTER THE GRASS HAS REACHED 3 INCHES HEIGHT. MOW TO A HEIGHT OF NO LESS THAN 2-½ INCHES. AFTER 2 TO 3 WEEKS OF MOWING, CONTINUE TO WATER TO A 6 INCH MINIMUM SOIL DEPTH AS NECESSARY PER WEATHER CONDITIONS, AND SOIL MOISTURE SENSORS IF APPLICABLE.

LAWN SEED MIX

1. LAWN SEED MIX: LESCO GRASS SEED – ALL PRO TRANSITION MIX (3 TURF-TYPE TALL-FESCUE GRASSES)

   NOTES:
   A) SEED RATE:
      1) NEW ESTABLISHMENT: SEED AT A RATE OF 6-8 LBS/1000 SQ FT
      2) RENOVATION: 20-50% EXISTING COVER: 5-7 LBS/1000 SQ FT
         50-75% EXISTING COVER: 4-6 LBS/1000 SQ FT

GENERAL SEEDING NOTES:

1. SEEDING SHALL TAKE PLACE IN THE SPRING (APRIL 1 TO JUNE 15) OR THE FALL (SEPTEMBER 1 TO OCTOBER 15).
2. PROTECT ALL EXISTING TREES AND SHRUBS TO REMAIN PER TREE PROTECTION DETAILS. NO DRILL SEEDING OR HERBICIDE USE WITHIN DRIPLINE OF EXISTING TREES TO REMAIN.
3. ELIMINATE UNWANTED SHRUB AND BRUSH AND MOW ALL LAWN TO GRADE IN AREAS TO BE SEEDED PRIOR TO INSTALLATION.
4. ELIMINATE REMAINING VEGETATION PRIOR TO SEEDING USING A NON-SELECTIVE HERBICIDE PER MANUFACTURER'S SPECIFICATIONS.
5. ALL AREAS NOT DISTURBED DUE TO SITE GRADING SHALL NOT BE TILLED. A TRUAX-TYPE DRILL SEEDER SHALL BE USED IN THOSE LOCATIONS. IN ALL REMAINING AREAS TO BE SEEDED, CONTRACTOR IS TO SUBMIT SEEDING METHODOLOGY TO PROJECT LANDSCAPE ARCHITECT FOR REVIEW AND APPROVAL BY CONSERVATION COMMISSION PRIOR TO SEEDING.
6. THERE MUST BE CONTINUOUS SOIL MOISTURE FOR 4-6 WEEKS TO ALLOW PROPER GERMINATION.

WEED CONTROL / MAINTENANCE

1. DURING THE ESTABLISHMENT YEAR, CONTRACTOR SHALL MOW SEEDING IF WEED HEIGHT EXCEEDS MEADOW MIX HEIGHT. MOW AT A HEIGHT OF 8"-10". DO NOT MOW CLOSE, AS SOME OF THE MEADOW MIX MAY BE DAMAGED.
2. AFTER THE FIRST GROWING SEASON, AND IF MEADOW MIX IS WELL ESTABLISHED, THE MEADOW MIX SHALL BE MOWED ONLY ONCE ANNUALLY. ANNUAL MAINTENANCE MOWING SHALL BE DONE IN LATE WINTER DURING THE MONTH OF MARCH.
3. MOW IN DETENTION BASIN AND WETLAND TRANSITION AREAS DURING DRIER SITE CONDITIONS WHEN SOIL DISTURBANCE WILL NOT OCCUR. MAINTENANCE FOR DETENTION BASIN AND WETLAND TRANSITION AREAS SHALL OCCUR DURING LATE SUMMER (JULY 15 – AUGUST 15) WHEN THE WATER TABLE IS USUALLY AT ITS LOWEST POINT OF THE YEAR. DO NOT MOW IN DETENTION BASIN, WETLAND OR WETLAND TRANSITION AREAS AFTER ESTABLISHMENT OF MEADOW MIX.
4. IN THE EVENT THAT INVASIVE SPECIES ARE PRESENT AFTER THE ESTABLISHMENT PERIOD, MEADOW AREAS ARE TO BE TRIMMED TO A HEIGHT OF 8". ANY TRIMMING SHOULD CEASE BY MID-SEPTEMBER.

PLANTING SOIL SPECIFICATIONS

1. PLANTING SOIL, ALTERNATELY MAY BE REFERRED TO AS TOPSOIL, SHOULD BE FRIABLE, FERTILE, WELL DRAINED, FREE OF DEBRIS, TOXINS, TRASH AND STONES OVER 1/2" DIA., IT SHOULD HAVE A HIGH ORGANIC CONTENT SUITABLE TO SUSTAIN HEALTHY PLANT GROWTH AND SHOULD LOOK AESTHETICALLY PLEASING HAVING NO NOXIOUS ODORS.
2. PLANTING SOIL:

   REUSE SURFACE SOILS STOCKPILED ON SITE, VERIFYING COMPLIANCE WITH PLANTING SOIL AND TOPSOIL CRITERIA IN THIS SPECIFICATION THROUGH TESTING. CLEAN SURFACE SOIL OF ALL ROOTS, PLANTS, SOD, AND GRAVEL OVER 1" IN DIAMETER AND DELETERIOUS MATERIALS. IF ON-SITE SOILS ARE TO BE USED FOR PROPOSED PLANTING, THE CONTRACTOR SHALL DEMONSTRATE, THROUGH SOIL TESTING, THAT ON-SITE SOILS MEET THE SAME CRITERIA AS INDICATED IN NOTES PLANS AND SPECIFICATIONS.

   SUPPLEMENT WITH IMPORTED OR MANUFACTURED TOPSOIL FROM OFF SITE SOURCES WHEN TOPSOIL AND PLANTING SOIL QUANTITIES ARE INSUFFICIENT. OBTAIN SOIL DISPLACED FROM NATURALLY WELL-DRAINED SITES WHERE TOPSOIL OCCURS AT LEAST 4" DEEP. DO NOT OBTAIN FROM AGRICULTURAL LAND, BOGS, MARSHES OR CONTAMINATED SITES.

   CONTRACTOR SHALL TEST SOILS AND FURNISH SAMPLES UPON REQUEST. PACKAGED MATERIALS SHALL BE UNOPENED BAGS OR CONTAINERS, EACH BEARING A NAME, GUARANTEE, AND TRADEMARK OF THE PRODUCER, MATERIAL COMPOSITION, MANUFACTURER'S CERTIFIED ANALYSIS, AND THE WEIGHT OF THE MATERIALS. SOIL OR AMENDMENT MATERIALS SHALL BE STORED ON SITE TEMPORARILY IN STOCKPILES PRIOR TO PLACEMENT AND SHALL BE PROTECTED FROM INTRUSION OF CONTAMINANTS AND EROSION. AFTER MIXING, SOIL MATERIALS SHALL BE COVERED WITH A TARPAULIN UNTIL TIME OF ACTUAL USE.

   ALL PLANTING SOILS SHALL BE SUBMITTED FOR TESTING TO THE STATE COOPERATIVE EXTENSION SERVICE, OR APPROVED EQUAL, PRIOR TO DELIVERY TO THE SITE. CONTRACTOR SHALL FURNISH SOIL SAMPLES AND SOIL TEST RESULTS TO LANDSCAPE ARCHITECT OR OWNER AT A RATE OF ONE SAMPLE PER 500 CUBIC YARDS TO ENSURE CONSISTENCY ACROSS THE TOTAL VOLUME OF PLANTING SOIL REQUIRED. TEST RESULTS SHALL EVALUATE FOR ALL CRITERIA LISTED IN THIS SPECIFICATION. IF TESTING AGENCY DETERMINES THAT THE SOILS ARE DEFICIENT IN ANY MANNER AND MAY BE CORRECTED BY ADDING AMENDMENTS, THE CONTRACTOR SHALL FOLLOW STATED RECOMMENDATIONS FOR SOIL IMPROVEMENT AND FURNISH SUBMITTALS FOR ALL AMENDMENTS PRIOR TO DELIVERY OF SOIL TO THE PROJECT SITE.

   A. THE FOLLOWING TESTING SHOULD BE PERFORMED AND RESULTS GIVEN TO THE LANDSCAPE ARCHITECT FOR APPROVAL BEFORE INSTALLATION:
      a. PARTICLE SIZE ANALYSIS – LOAMY SAND: 60-75% SAND, 25-40% SILT, AND 5-15% CLAY.
      b. FERTILITY ANALYSIS: pH (5.5-6.5), SOLUBLE SALTS (LESS THAN 2 MMHO/CM), NITRATE, PHOSPHATE, POTASSIUM, CALCIUM AND MAGNESIUM
      c. ORGANIC MATTER CONTENT: 2.5-5% IN NATIVE SOILS; UP TO 10% IN AMENDED SOILS
      d. TOXIC SUBSTANCE ANALYSIS
      e. MATERIAL DRAINAGE RATE: 60% PASSING IN 2 MINUTES, 40% RETAINED
      f. NOT MORE THAN 1% OF MATERIAL SHALL BE RETAINED BY A #4 SIEVE
4. SOIL AMENDMENT FOR PLANT MATERIAL:
   IF SOIL ORGANIC CONTENT IS INADEQUATE, SOIL SHALL BE AMENDED WITH COMPOST OR ACCEPTABLE, WEED FREE, ORGANIC MATTER. ORGANIC AMENDMENT SHALL BE WELL COMPOSTED, PH RANGE OF 6-8; MOISTURE CONTENT 35-55% BY WEIGHT 100% PASSING THROUGH 1" SIEVE; SOLUBLE SALT CONTENT LESS THAN 0.5 MM HOS/CM; MEETING ALL APPLICABLE ENVIRONMENTAL CRITERIA FOR CLEAN FILL.

   A. ORGANIC MATTER AS A SOIL AMENDMENT: LEAF MOLD WITH 60-90% ORGANIC CONTENT BY WEIGHT. SHREDDED LEAF LITTER, COMPOSTED FOR A MINIMUM OF 1 YR. SHOULD BE FREE OF DEBRIS, STONES OVER 1/2", WOOD CHIPS OVER 1".
   B. SOIL IN BEDS AND PLANTING ISLANDS OTHER THAN BACKFILL MATERIAL AND TOPSOIL, SHOULD BE FRIABLE, WELL DRAINED, AND FREE OF DEBRIS, INCLUDING STONES AND TRASH.
   C. AMENDMENTS FOR BACK FILL IN TREE AND SHRUB PITS:
      a. GROUND LIMESTONE (WITH A MIN. OF 88% OF CALCIUM AND MAGNESIUM CARBONATES) USED PENDING RESULTS OF SOIL ANALYSIS.
         – BRING pH LEVELS TO 5.5 MIN. TO 6.5 FOR NON-ERICACEOUS PLANTS
         – BRING pH LEVELS TO 4.5 MIN. TO 5.5 FOR ERICACEOUS PLANTS
      b. TERRA-SORB BY 'PLANT HEALTH CARE' 800-421-9051 (SEE MANUFACTURER RECOMMENDATIONS) USED IN PLANTER BACKFILL MIXTURE WITH TREES AND SHRUBS.
      c. MYCOR-ROOT SAVER BY 'PLANT HEALTH CARE' 800-421-9051 (SEE MANUFACTURER RECOMMENDATIONS) USED IN BACKFILL MIXTURE WITH TREES.
5. WHERE PLANTING AREAS ARE PROPOSED FOR FORMER PAVED OR GRAVEL AREAS, BEDS SHALL BE EXCAVATED TO A MINIMUM 30" DEPTH AND, AT A MINIMUM, BE BACKFILLED WITH BOTTOM LAYER OF SANDY LOAM (ORGANIC CONTENT LESS THAN 2%) OVER WHICH TOPSOIL AND PLANTING SOILS WILL BE PLACED AT DEPTHS INDICATED IN PLANS, DETAILS AND NOTES.
6. CLEAN SOIL FILL IN LANDSCAPE AREAS:
   LANDSCAPE FILL MATERIAL, BELOW PLANTING SOILS, SHALL HAVE THE PHYSICAL PROPERTIES OF A SANDY LOAM WITH AN ORGANIC CONTENT OF LESS THAN 2% AND A PH BETWEEN 5 – 7.
7. SOIL PLACEMENT:
   A. CONTRACTOR TO PROVIDE SIX INCHES (6") MINIMUM DEPTH PLANTING SOIL LAYER IN LAWN AREAS, TWELVE INCHES (12") MINIMUM DEPTH PLANTING SOIL LAYER IN GROUNDCOVER AND PERENNIAL AREAS, EIGHTEEN INCHES (18") MINIMUM DEPTH PLANTING SOIL LAYER IN SHRUB AREAS, AND THIRTY-SIX INCHES (36") MINIMUM DEPTH PLANTING SOIL LAYER IN TREE PLANTING AREAS.
   B. SCARIFY AND/OR TILL COMPACTED SUBSOILS TO A MINIMUM DEPTH OF 6 INCHES. THOROUGHLY MIX A 6 INCH DEPTH LAYER OF PLANTING SOIL INTO THE SUBSOIL PRIOR TO PLACING PLANTING SOIL AT THE DEPTHS INDICATED ABOVE. PLANTING SOIL SHALL BE PLACED IN 12-18" LIFTS AND WATER THOROUGHLY BEFORE INSTALLING NEXT LIFT. REPEAT UNTIL DEPTHS AND FINISH GRADES HAVE BEEN ACHIEVED. NO SOILS SHALL BE PLACED IN A FROZEN OR MUDDY CONDITION.
   C. PLANTING SOIL PRESENT AT THE SITE, IF ANY, MAY BE USED TO SUPPLEMENT TOTAL AMOUNT REQUIRED. CONTRACTOR TO FURNISH AN ANALYSIS OF ON-SITE PLANTING SOIL UTILIZED IN ALL PLANTING AREAS.
8. SOIL CONDITIONING:
   A. ADJUST pH AND NUTRIENT LEVELS AS REQUIRED TO ENSURE AN ACCEPTABLE GROWING MEDIUM. LOWER pH USING ELEMENTAL SULFUR ONLY. PEAT MOSS OR COPPER SULFATE MAY NOT BE USED. GROUND LIMESTONE AS A SOIL AMENDMENT MATERIAL WILL ONLY BE USED PENDING RESULTS OF SOIL ANALYSIS. PROVIDE WITH MINIMUM 88% CALCIUM AND MAGNESIUM CARBONATES AND SHALL HAVE TOTAL 100% PASSING THE 10 MESH SIEVE, MINIMUM 90% PASSING 20 MESH SIEVE, AND MINIMUM 60% PASSING 100 MESH SIEVE.
   B. ALL DEBRIS EXPOSED FROM EXCAVATION AND CULTIVATION SHALL BE DISPOSED OF AT THE CONTRACTOR'S EXPENSE.
   C. SOIL MODIFICATIONS (PENDING RESULTS OF SOIL ANALYSIS):
      a. THOROUGHLY TILL ORGANIC MATTER (LEAF COMPOST) INTO THE TOP 6 TO 12 IN. OF MOST PLANTING SOILS TO IMPROVE THE SOIL'S ABILITY TO RETAIN WATER AND NUTRIENTS. ALL PRODUCTS SHOULD BE COMPOSTED TO A DARK COLOR AND BE FREE OF PIECES WITH IDENTIFIABLE LEAF OR WOOD STRUCTURE. AVOID MATERIAL WITH A pH HIGHER THAN 7.0. PEAT MOSS MAY NOT BE USED AS ORGANIC MATTER AMENDMENT.
      b. MODIFY HEAVY CLAY OR SILT (MORE THAN 40% CLAY OR SILT) BY ADDING COMPOSTED PINE BARK (UP TO 30% BY VOLUME) AND/OR GYPSUM. COARSE SAND MAY BE USED IF ENOUGH IS ADDED TO BRING THE SAND CONTENT TO MORE THAN 60% OF THE TOTAL MIX. IMPROVE DRAINAGE IN HEAVY SOILS BY PLANTING ON RAISED MOUNDS OR BEDS AND INCLUDING SUBSURFACE DRAINAGE LINES.
      c. MODIFY EXTREMELY SANDY SOILS (MORE THAN 85% SAND) BY ADDING ORGANIC MATTER AND/OR DRY, SHREDDED CLAY LOAM UP TO 30% OF THE TOTAL MIX.

MEADOW SEED NOTES

MEADOW SEED MIX A – ERNST SEED MIX ERNMX-183 (NATIVE DETENTION AREA MIX)

32% PANICUM CLANDESTINUM, 'TIOGA'	DEERTONGUE, 'TIOGA'
20% CAREX VULPINOIDEA	FOX SEDGE
20% ELYMUS VIRGINICUS	VIRGINIA WILDRYE
20% PANICUM VIRGATUM, 'SHAWNEE'	SWITCHGRASS, 'SHAWNEE'
4% AGROSTIS PERENNANS, ALBANY PINE BUSH	AUTUMN BENTGRASS, ALBANY PINE BUSH
2% JUNCUS TENUIS	PATH RUSH
1% JUNCUS EFFUSUS	SOFT RUSH
1% PANICUM RIGIDULUM	REDTOP PANICGRASS

NOTES:
SEED AT A RATE OF 20 LBS/ACRE OF 100% PURE LIVE SEED.

MEADOW SEED MIX B – NEW ENGLAND WETLAND PLANTS – NEW ENGLAND ROADSIDE MATRIX UPLAND SEED MIX

ELYMUS VIGINICUS	VIRGINIA WILD RYE
DESMODIUM PANICULATUM	PANICLEDLEAF TICK TREFOIL
SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM
ANDROPOGON GERARDII	BIG BLUESTEM
RESTUCA RUBRA	RED FESCUE
SORGHASTRUM NUTANS	INDIAN GRASS
PANICUM VIRGATUM	SWITCH GRASS
RHUS TYPHINA	STAGHORN SUMAC
CORNUS RACEMOSA	GREY DOGWOOD
CORNUS AMOMUM	SILKY DOGWOOD
OENOTHERA BIENNIS	EVENING PRIMROSE
ASCLEPIAS TUBEROSA	BUTTERFLY MILKWEED
RUDBECKIA HIRTA	BLACK EYED SUSAN
CHAMAECRISTA FASCICULATA	PARTRIDGE PEA
EUPATORIUM FISTULOSUM	HOLLOW-STEM JOE PYE WEED

NOTES:
SEED AT A RATE OF 35 LB/ACRE OF 100% PURE LIVE SEED

GENERAL SEEDING NOTES:

1. FINAL SEED MIXTURES, RATES & SPECIES TO BE DETERMINED BASED ON CONSERVATION COMMISSION REVIEW IN MASSACHUSETTS.
2. SEEDING SHALL TAKE PLACE IN THE SPRING (APRIL 1 TO JUNE 15) OR THE FALL (SEPTEMBER 1 TO OCTOBER 15).
3. ELIMINATE UNWANTED VEGETATION PRIOR TO SEEDING USING A NON-SELECTIVE HERBICIDE PER MANUFACTURER'S SPECIFICATIONS. CONTRACTOR TO ENSURE HERBICIDE IS INDICATED FOR USE AROUND WATER BODIES.
4. IT IS RECOMMENDED THAT CONTRACTOR INSTALL SEED MIXTURE USING A NO-TILL TRUAX-TYPE DRILL WHERE APPLICABLE.
5. THERE MUST BE CONTINUOUS SOIL MOISTURE FOR 4-6 WEEKS TO ALLOW PROPER GERMINATION.

WEED CONTROL / MAINTENANCE

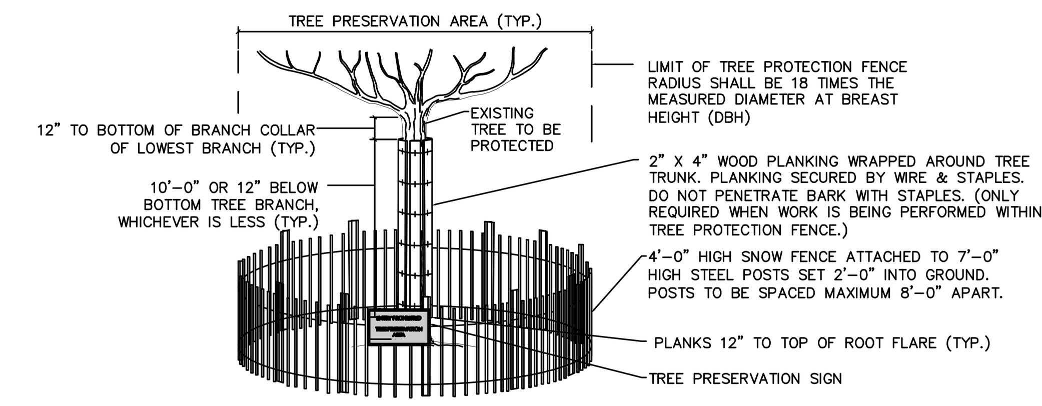
1. DURING THE ESTABLISHMENT YEAR, CONTRACTOR SHALL MOW SEEDING IF WEED HEIGHT EXCEEDS MEADOW MIX HEIGHT. MOW AT A HEIGHT OF 8"-10". DO NOT MOW CLOSE, AS SOME OF THE MEADOW MIX MAY BE DAMAGED.
2. AFTER THE FIRST GROWING SEASON, AND IF MEADOW MIX IS WELL ESTABLISHED, THE MEADOW MIX SHALL BE MOWED ONLY ONCE ANNUALLY. ANNUAL MAINTENANCE MOWING SHALL BE DONE IN LATE WINTER DURING THE MONTH OF MARCH.
3. MOW IN DETENTION BASIN AND WETLAND TRANSITION AREAS DURING DRIER SITE CONDITIONS WHEN SOIL DISTURBANCE WILL NOT OCCUR. MAINTENANCE FOR DETENTION BASIN AND WETLAND TRANSITION AREAS SHALL OCCUR DURING LATE SUMMER (JULY 15 – AUGUST 15) WHEN THE WATER TABLE IS USUALLY AT ITS LOWEST POINT OF THE YEAR. DO NOT MOW IN DETENTION BASIN, WETLAND OR WETLAND TRANSITION AREAS AFTER ESTABLISHMENT OF MEADOW MIX.

LANDSCAPE MAINTENANCE NOTES

1. MAINTENANCE OPERATIONS BEFORE APPROVAL:
   A. PLANT CARE SHALL BEGIN IMMEDIATELY AFTER EACH PLANT IS SATISFACTORILY INSTALLED AND SHALL CONTINUE THROUGHOUT THE LIFE OF THE CONTRACT UNTIL FINAL ACCEPTANCE OF THE PROJECT.
   B. CARE SHALL INCLUDE, BUT NOT BE LIMITED TO, REPLACING MULCH THAT HAS BEEN DISPLACED BY EROSION OR OTHER MEANS, REPAIRING AND RESHAPING WATER RINGS OR SAUCERS, MAINTAINING STAKES AND GUYS AS ORIGINALLY INSTALLED, WATERING WHEN NEEDED OR DIRECTED, AND PERFORMING ANY OTHER WORK REQUIRED TO KEEP THE PLANTS IN A HEALTHY CONDITION.
   C. CONTRACTOR SHALL REMOVE AND REPLACE ALL DEAD, DEFECTIVE AND/OR REJECTED PLANTS AS REQUIRED BEFORE FINAL ACCEPTANCE.
2. MAINTENANCE DURING CONSTRUCTION:
   A. MAINTENANCE SHALL BEGIN IMMEDIATELY AFTER PLANTING. PLANTS SHALL BE WATERED, MULCHED, WEEDED, PRUNED, SPRAYED, FERTILIZED, CULTIVATED, AND OTHERWISE MAINTAINED AND PROTECTED UNTIL PROVISIONAL ACCEPTANCE. SETTLED PLANTS SHALL BE RESET TO PROPER GRADE AND POSITION, PLANTING SAUCER RESTORED AND DEAD MATERIAL REMOVED. STAKES AND WIRES SHALL BE TIGHTENED AND REPAIRED. DEFECTIVE WORK SHALL BE CORRECTED AS SOON AS POSSIBLE AFTER IT BECOMES APPARENT AND WEATHER AND SEASON PERMIT.
   B. IF A SUBSTANTIAL NUMBER OF PLANTS ARE SICKLY OR DEAD AT THE TIME OF INSPECTION, ACCEPTANCE SHALL NOT BE GRANTED AND THE CONTRACTOR'S RESPONSIBILITY FOR MAINTENANCE OF ALL PLANTS SHALL BE EXTENDED FROM THE TIME REPLACEMENTS ARE MADE OR EXISTING PLANTS ARE DEEMED ACCEPTABLE BY THE LANDSCAPE ARCHITECT.
   C. ALL REPLACEMENTS SHALL BE PLANTS OF THE SAME KIND AND SIZE SPECIFIED ON THE PLANT LIST OR THAT WHICH WAS TO REMAIN OR BE RELOCATED. THEY SHALL BE FURNISHED AND PLANTED AS SPECIFIED. THE COST SHALL BE BORNE BY THE CONTRACTOR. REPLACEMENTS RESULTING FROM REMOVAL, LOSS, OR DAMAGE DUE TO OCCUPANCY OF THE PROJECT IN ANY PART, VANDALISM, PHYSICAL DAMAGE BY ANIMALS, VEHICLES, ETC., AND LOSSES DUE TO CURTAILMENT OF WATER BY LOCAL AUTHORITIES SHALL BE APPROVED AND PAID FOR BY THE OWNER.
   D. PLANTS SHALL BE GUARANTEED FOR A PERIOD OF TWO YEARS AFTER INSPECTION AND PROVISIONAL ACCEPTANCE.
   E. AT THE END OF THE ESTABLISHMENT PERIOD, INSPECTION SHALL BE MADE AGAIN. ANY PLANT REQUIRED UNDER THIS CONTRACT THAT IS DEAD OR UNSATISFACTORY TO THE LANDSCAPE ARCHITECT OR OWNER SHALL BE REMOVED FROM THE SITE AND REPLACED DURING THE NORMAL PLANTING SEASON.
3. LAWN MAINTENANCE:
   A. BEGIN MAINTENANCE IMMEDIATELY AFTER EACH PORTION OF LAWN IS PLANTED AND CONTINUE FOR 8 WEEKS AFTER ALL LAWN PLANTING IS COMPLETED.
   B. WATER TO KEEP SURFACE SOIL MOIST, REPAIR WASHED OUT AREAS BY FILLING WITH TOPSOIL, LIMING, FERTILIZING AND RE-SEEDING; MOW TO 2 1/2 – 3 INCHES AFTER GRASS REACHES 3 1/2 INCHES IN HEIGHT, AND MOW FREQUENTLY ENOUGH TO KEEP GRASS FROM EXCEEDING 3 1/2 INCHES. WEED BY LOCAL SPOT APPLICATION OF SELECTIVE HERBICIDE ONLY AFTER GRASS IS WELL-ESTABLISHED.

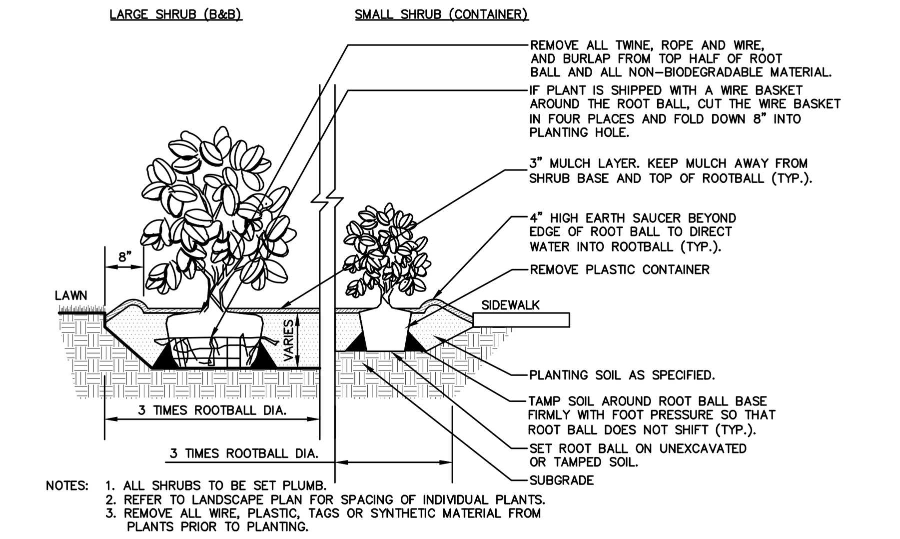
TREE PROTECTION NOTES:

1. ALL EXISTING TREES WITHIN THE LIMITS OF TREE PROTECTION FENCING. SHALL BE PROTECTED THOUGHOUT THE DURATION OF WORK. TREE PROTECTION FENCING SHALL BE INSTALLED AT THE DRIP-LINE OF THE PROTECTED TREE UNLESS CONDITIONS WARRANT THE FENCE TO BE LOCATED WITHIN THE LIMIT OF BRANCHING. THE PROJECT LANDSCAPE ARCHITECT TO APPROVE THE LOCATION OF ALL FENCING PRIOR TO EXCAVATION.
2. TREE PROTECTION PLANKING SHALL BE INSTALLED AROUND ALL EXISTING TREES AS NOTED ON THIS DRAWING. REFER TO DETAIL ON THIS SHEET.
3. TREE PROTECTION FENCING SHALL BE MAINTAINED TO PROTECT TREES AT ALL TIMES. ANY DAMAGED FENCING SHALL BE IMMEDIATELY REPLACED WHEN DAMAGED.
4. IF TREE PROTECTION FENCING NEEDS TO BE MOVED OR BREACHED DUE TO TEMPORARY CONSTRUCTION ACTIVITY WITHIN THE TREE PROTECTION ZONE, THE FENCING WILL BE RESET TO ITS ORIGINAL LOCATION IMMEDIATELY AFTER CONSTRUCTION WITHIN THE TREE PROTECTION ZONE IS COMPLETE.
5. DEMOLITION WORK ADJACENT TO PROTECTED TREES SHALL BE PERFORMED BY NON-MECHANICAL METHODS. CONTRACTOR TO PROTECT ROOT MASS AGAINST DAMAGE DURING EXCAVATION. ANY TREE ROOTS THAT ARE DISTURBED, BROKEN, OR CUT SHALL BE PRUNED BACK WITH CLEAN SHARP TOOLS.
6. ALL EXPOSED TREE ROOTS SHALL BE THOROUGHLY IRRIGATED ON A DAILY BASIS AS DIRECTED BY THE PROJECT LANDSCAPE ARCHITECT.
7. ALL WORK TO BE PERFORMED UNDER THE DIRECT SUPERVISION OF EITHER THE OWNER'S REPRESENTATIVE OR THE PROJECT LANDSCAPE ARCHITECT.



1 TREE PROTECTION FENCE AND PLANKING

NTS



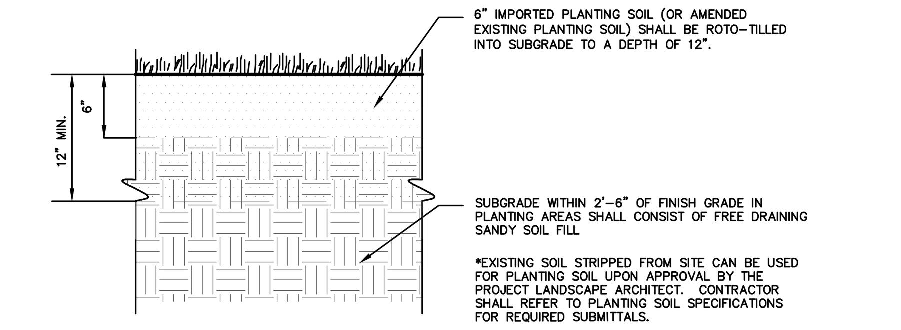
NOTES:
1. ALL SHRUBS TO BE SET PLUMB.
2. REFER TO LANDSCAPE PLAN FOR SPACING OF INDIVIDUAL PLANTS.
3. REMOVE ALL WIRE, PLASTIC, TAGS OR SYNTHETIC MATERIAL FROM PLANTS PRIOR TO PLANTING.

4 SHRUB AND ORNAMENTAL GRASS PLANTING

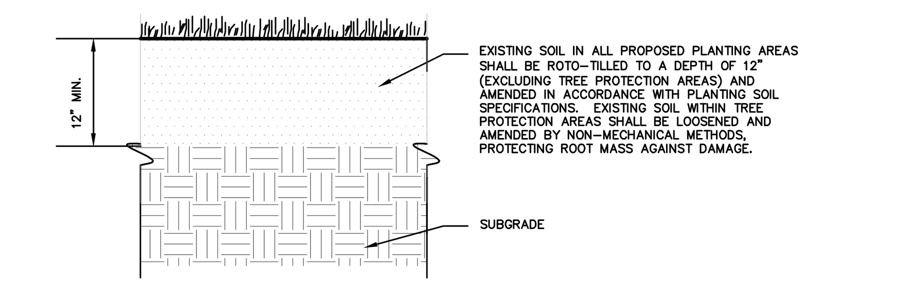
NTS

GENERAL NOTE:

DUE TO GENERAL CONSTRUCTION ACTIVITIES AND ADJACENT SITE COMPACTION REQUIREMENTS, SUBGRADE SOILS WITHIN PROPOSED PLANTING AREAS TEND TO BECOME HIGHLY COMPACTED. IN ORDER TO CREATE A HEALTHY GROWTH MEDIUM TO ALLOW PROPOSED PLANTINGS TO ESTABLISH A VIGOROUS ROOT MASS, THIS SUBGRADE SOIL MUST UNDERGO A RESTORATION PROCESS. IN ADDITION, IMPORTED OR AMENDED EXISTING SOILS SHALL BE MIXED WITH SUBGRADE SOILS WHERE THEY MEET IN ORDER TO CREATE A TRANSITIONAL GRADIENT TO ALLOW FOR PROPER DRAINAGE.



PLANTING SOIL WITHIN AREAS OF CUT OR RAISED GRADE



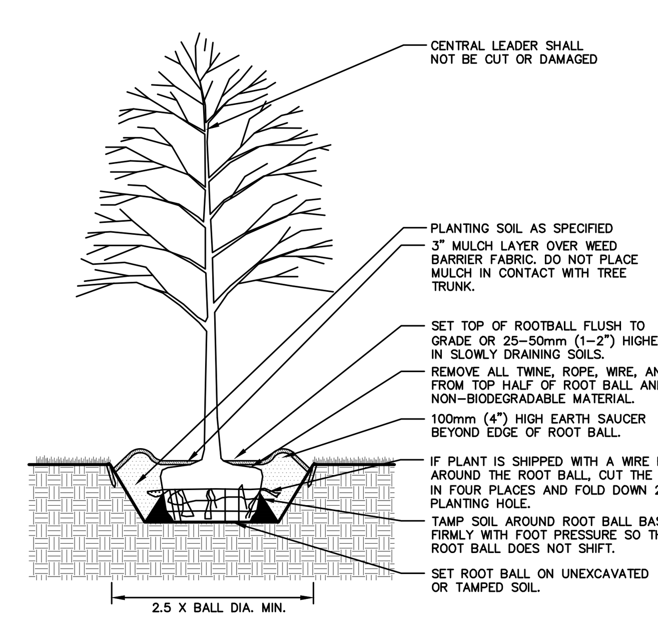
PLANTING SOIL WITHIN AREAS OF UNCHANGED GRADE

NOTES:

1. CONTRACTOR IS RESPONSIBLE TO SEND SAMPLES OF EXISTING SOILS INTENDED FOR USE IN PLANTING AREAS (1 PER 500 CY.) TO TESTING LABORATORY OR UNIVERSITY COOPERATIVE EXTENSION FOR TESTING. ALL TESTING COSTS ARE AT THE CONTRACTOR'S EXPENSE.
2. RECYCLED CRUSHED CONCRETE AND ASPHALT MILLINGS SHALL NOT BE PLACED WITHIN 2'-6" OF FINISH GRADE IN PROPOSED LANDSCAPE AREAS.
3. IMPORTED FILL SHALL CONTAIN NO CONTAMINATION IN EXCEEDENCE OF THE APPLICABLE STATE ENVIRONMENTAL STANDARDS AND MEET THE ENVIRONMENTAL REQUIREMENTS FOR THE PROJECT. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION OF COMPLIANCE PRIOR TO DELIVERY OF ANY FILL TO THE SITE.
4. CONTRACTOR TO LIGHTLY COMPACT ALL PLACED PLANTING SOILS AND RAISE GRADES ACCORDINGLY TO ALLOW FOR FUTURE SETTLEMENT OF PLANTING SOILS (TYP.)
5. NO STONES, WOOD CHIPS, OR DEBRIS LARGER THAN 1/2" SHALL BE ACCEPTABLE WITHIN PLANTING AREAS.

2 PLANTING SOIL

NTS



3 TREE PLANTING

NTS

TOWN OF MEDWAY - WETLAND BYLAW COMPLIANCE CHART

SECTION	REQUIRED/ PERMITTED	PROVIDED/ PROPOSED	COMPLIANCE
23. F. 1	THE REPLACEMENT OF VEGETATION SHALL BE ACCORDING TO THE FOLLOWING TABLE: FOR EVERY EXISTING TRUNK (DBH) — REPLACEMENT QUANTITY 3 TO 8 INCHES — 1 8 TO 20 INCHES — 2 > 20 INCHES — 3	TOTAL TREES REQUIRED: 25 TREES TOTAL TREES PLANTED: 25 TREES	COMPLIES

Date	Description	No.

Revisions

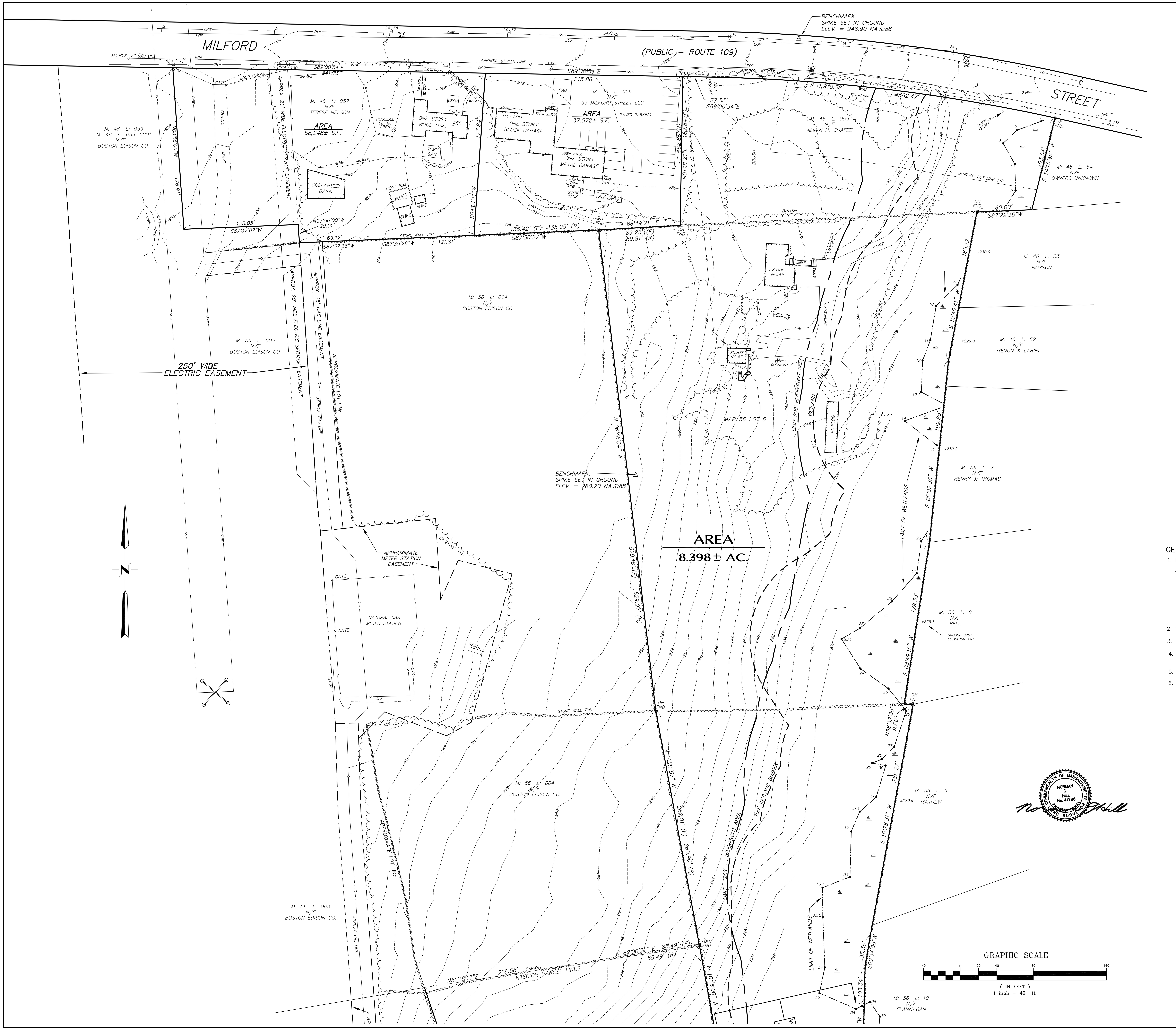
LANGAN
Langan Engineering and Environmental Services, Inc.
100 Cambridge Street, Suite 1310
Boston, MA 02114
T: 617.824.9100 F: 617.824.9101 www.langan.com

Project
MEDWAY BATTERY ENERGY STORAGE SYSTEM
MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title
PLANTING DETAILS

Project No. 151033401
Date 06/08/2023
Drawn By LL/AS
Checked By MH
Drawing No. LP501

LANGAN
Project No. 151033401



LEGEND

CLF	CHAIN LINK FENCE
CB/DH	CONCRETE BOUND W/ DRILL HOLE
FND	FOUND
IR/IP	IRON ROD/PIPE
	LIGHT POLE
UP	UTILITY POLE
CMP	CORRUGATED METAL PIPE
CBN	CATCH BASIN
RCP	REINFORCED CONCRETE PIPE
EOP	EDGE OF PAVEMENT
GP	GATE POST
	SIGN
UE	UNDERGROUND ELECTRIC
OHW	OVERHEAD WIRES
2-3	WETLAND FLAGS
	LIMIT OF WETLANDS
	100' WETLAND BUFFER
	LIMIT 200' RIVERFONT AREA

UTILITY NOTE:

THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION AND COMPILED FROM PROPOSED PLAN INFORMATION THE SURVEYOR MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED ALTHOUGH HE DOES CERTIFY THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM INFORMATION AVAILABLE. THE SURVEYOR HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES.

BEFORE DESIGN AND CONSTRUCTION PLEASE CALL "DIG SAFE" AT 1-888-344-7233.

GENERAL NOTES:

1. LOT SUMMARY

MAP	LOT	OWNERS	DEED REFERENCES
46	055	ALLAN H. CHAFFEE	BK. 10210 PG. 268
46	057	TERESE NELSON	BK. 32451 PG. 470
56	006	ALLAN H. CHAFFEE	BK. 10210 PG. 268
46	056	53 MILFORD STREET LLC	BK. 34947 PG. 237
56	004	BOSTON EDISON CO.	BK. 4355 PG. 587
66	012	EXELON WEST MEDWAY LLC	BK. 12521 PG. 109

2. WORCESTER COUNTY SOUTH REGISTRY OF DEEDS DISTRICT
3. LAND IS ZONED: RESIDENCE A
4. PROPERTY LINES SHOWN AREA COMPILED FROM EITHER FIELD SURVEY INFORMATION OR AVAILABLE PLANS AND DEEDS OF RECORD.
5. ELEVATIONS BASED ON NAVD88
6. PLAN REFERENCES: BK. 636 PG. 3
   BK. 632 PG. 72
   BK. 476 PG. 68

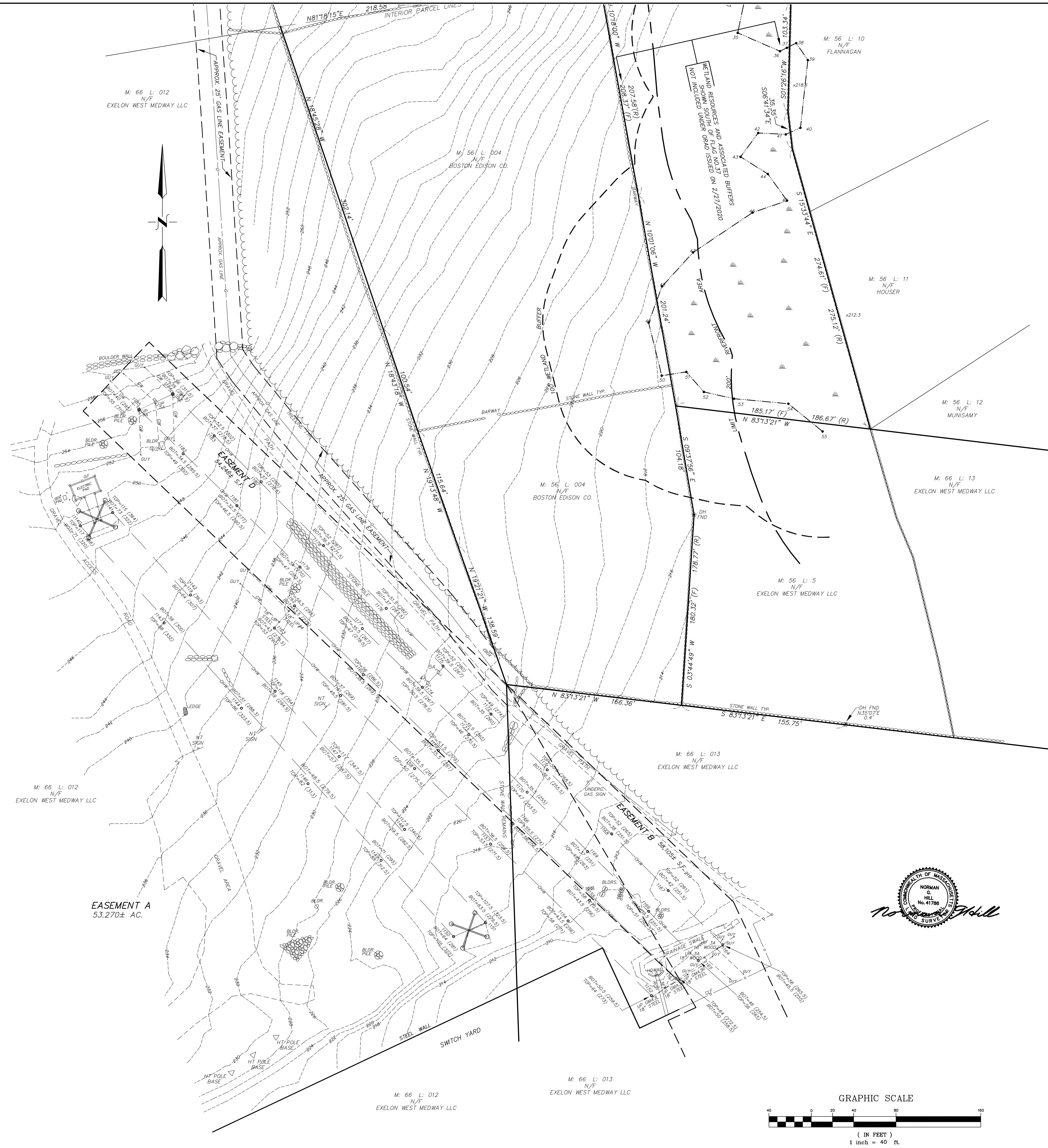
EXISTING CONDTIONS PLAN
MILFORD STREET
MEDWAY, MA

PREPARED FOR:
TRC
650 SUFFOLK STREET
LOWELL, MA 01854

LAND PLANNING, INC.

HANSON: 1115 MAIN STREET 02341 (781) 294-4144
BELLINGHAM: 167 HARTFORD AVE. 02019 (508) 966-4130
N. GRAFTON: 214 WORCESTER ST. 01536 (508) 839-9526

CALCS.	JOB NO.	DWG NAME.	DATE	SHEET NO.
G.R.R.	P-3506	P3506-EX5	11/10/2021	1 OF 2



OVERHEAD
WIRE LOCATIONS

PT NO.	NORTH.	EAST.
1140	2876513	669899
1141	2876525	669929
1142	2876448	670003
1143	2876421	669978
1144	2876341	670051
1145	2876359	670085
1146	2876269	670114
1147	2876295	670143
1148	2876226	670205
1149	2876197	670183
1150	2876125	670251
1151	2876138	670282
1152	2876069	670438
1153	2876086	670461
1154	2876140	670359
1155	2876159	670380
1156	2876231	670307
1157	2876212	670286
1158	2876284	670214
1159	2876301	670237
1160	2876372	670166
1161	2876353	670145
1162	2876437	670101
1163	2876416	670082
1164	2876117	670505
1165	2876102	670482
1166	2876149	670435
1167	2876168	670454
1168	2876222	670400
1169	2876205	670378
1170	2876261	670321
1171	2876282	670340
1172	2876335	670287
1173	2876316	670266
1174	2876360	670222
1175	2876380	670241
1176	2876435	670188
1177	2876416	670165
1178	2876494	670128
1179	2876474	670106
1180	2876554	670070
1181	2876532	670047
1182	2876581	669996
1183	2876598	670025
1184	2876637	669986
1185	2876623	669954

WIRES LOCATED ON 6/25/21
TEMPERATURE = 68°
WIND 5–10 MPH

LEGEND

CLF	CHAIN LINK FENCE
CB/DH	CONCRETE BOUND W/ DRILL HOLE
FND	FOUND
IR/IP	IRON ROD/PIPE
	LIGHT POLE
UP	UTILITY POLE
CMP	CORRUGATED METAL PIPE
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COMMONWEALTH OF MASSACHUSETTS
NORMAN G. HILL
No. 41786
PROFESSIONAL LAND SURVEYOR

EXISTING CONDTIONS PLAN
MILFORD STREET
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CALCS.	JOB NO.	DWG NAME.	DATE	SHEET NO.
G.R.R.	P–3506	P3506–EX5	11/10/2021	2 OF 2

Attachment F

Stormwater Management Report

STORMWATER MANAGEMENT REPORT

for

Medway Grid Energy Storage Project
Milford Street, Medway, MA 02053

Prepared For:

Medway Grid, LLC
988 Howard Avenue, Suite 200
Burlingame, CA 94010

Prepared By:

Langan Engineering and Environmental Services, Inc.
100 Cambridge Street, Suite 1310
Boston, MA 02114

COMMONWEALTH OF MASSACHUSETTS
FRANK HOLMES
CIVIL
No. 40203
REGISTERED
PROFESSIONAL ENGINEER

Frank Holmes

Frank Holmes, P.E.
Massachusetts Licensed Professional Engineer No. 40203
fholmes@langan.com

June 2023
Langan Project No. 151033401

LANGAN

TABLE OF CONTENTS

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(Continued)

FIGURES

DRAWINGS

Appendices

EXECUTIVE SUMMARY

This stormwater management report has been prepared in support of the proposed battery energy storage system (BESS) known as the Medway Grid Energy Storage Project in Medway, Massachusetts.

Project Description

The project consists of the installation of a new battery storage system on an existing 10.6-acre site consisting of 4 parcels located at 47, 49, 53 and 55 Milford Street in Medway, Massachusetts. As part of this development, battery energy storage system modules consisting of lithium-ion batteries housed in above-ground storage cabinets and transformers on pier-supported concrete slabs will be installed on the site with an ancillary electric substation located on the southern side of the parcel. A proposed transmission interconnection will allow the power stored at the facility to be transported to Eversource Energy's existing West Medway Substation, located to the south of the property.

Regulatory Authority

Methodologies for stormwater management proposed for the site are in compliance with the Medway General Bylaws Article XXVI for Stormwater Management and Land Disturbance (5/10/21). The Conservation Commission shall be the permitting authority as land within the 100-foot buffer zone will be disturbed and is subject to the town of Medway's Wetland Protection Bylaw.

The project proposes to disturb more than 20,000 square feet and the addition of 10,000 square feet or more of impervious surface and is therefore regulated under the Stormwater Management and Land Disturbance Bylaw. A completed Land Disturbance Permit Application will be required for the project.

This submittal includes the following:

- Completed Land Disturbance Application form
- Erosion and Sediment Control Plans (Section 9.0 and Drawings attached herein)
- Drainage calculations in compliance with Massachusetts Stormwater Standards (Section 2.2)
- Stormwater Operations and Maintenance Plan (Section 9.0, Appendix I, and Drawings attached herein)

- Post-construction Stormwater Management Plan (Sections 1.0 – 10.0, Appendix A - L, and Drawings attached herein)
- Long-Term Stormwater Operations and Maintenance Plan (Appendix I)
- Permits received for the project to date

The stormwater management system has been designed in accordance with the town of Medway's Stormwater Management and Land Disturbance Bylaw, the Massachusetts Department of Environmental Protection (MasssDEP) Stormwater Handbook, the Resilient Massachusetts Action Team (RMAT) *Climate Resilience Design Standards & Guidelines* (4/1/2021), and the U.S. Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination System (NPDES).

Stormwater Management

The project proposes to disturb ± 6.66-acres of land, resulting in approximately 2.2-acres of impervious surfaces for battery cabinets, equipment pads, and paved internal access roads.

Stormwater runoff generated on site and from adjacent properties will be captured through a system of dry wells connected to a perforated and closed pipe network system and routed to an infiltration basin prior to discharging to riprap outlet protection upstream of the existing wetlands on site. Swales are implemented to direct off-site stormwater runoff around the perimeter of the site from neighboring properties.

Summary

It is the opinion of this office and the findings of this report that the proposed stormwater system, as designed, will effectively manage quality and quantity of stormwater runoff for the proposed development in accordance with the town of Medway's and the MassDEP's regulations.

1.0 INTRODUCTION

1.1 General

This stormwater management report has been prepared in support of the proposed battery energy storage system (BESS) development located along Milford Street (Route 109) in Medway, Massachusetts. The project includes the development of the site to install battery energy storage system modules consisting of lithium ion batteries housed in above-ground storage cabinets and transformers on pier-supported concrete slabs . The site will include two paved internal circulation drives, four parking spaces and an electric substation in the southern portion of the lot, encompassed by security fences on all sides and sound attenuation walls along the east and west sides of the property. This report outlines the engineering design and methodologies of stormwater conveyance and management system for the project.

The project will result in an increase of approximately 1.2 acres of impervious surfaces on site. 2.2 total acres of impervious surfaces are proposed, with 1.4 acres derived from the battery storage structures and foundation systems, and 0.8 acres derived from paved access drives internal to the site.

Table 1.1.1: Impervious Area

	Existing Condition	Proposed Condition
Impervious Area	1.0 acres	2.2 acres (see note)
Pervious Area	9.6 acres	8.4 acres (see note)

Note: 2.2 acres of paved area, 2.3 acres is crushed stone, and 6.1 acres is pervious vegetated area.

1.2 Site Location

The project site consists of four existing parcels, 49, 53, 55 and 61 Milford Street, combined to encompass a total of 10.6 acres and referred to collectively as the site. The 49 Milford Street parcel contains two residences and one additional building. The 53 Milford Street parcel contains an automotive repair shop and associated parking lot. The 55 Milford Street parcel contains an existing residence with various garages, barns and sheds. The 61 Milford Street site contains a portion of an existing gravel drive and is largely undeveloped. The site is bound by Milford Street (Route 109) to the north, residential properties along Little Tree Road to the east, undeveloped wooded areas buffering Eversource Energy's existing West Medway Substation and Exelon Power's

West Medway Generating Station to the south, and an existing Eversource electric transmission corridor to the west.

1.3 Existing Conditions

The site contains approximately 0.9 acres of developed area consisting of three residences and an automotive repair shop, with the remaining 9.7 acres undeveloped as forested and wetland areas.

A bordering vegetated wetland area surrounding Center Brook is located along the eastern property boundary and extends offsite to the neighboring residential properties. Center Brook is a perennial water body flowing from north to south to the east of the site property line and is a tributary to the Charles River. The site is in the Charles River Watershed. The Charles River Watershed has a phosphorous and pathogen TMDL (Total Maximum Daily Load). The site is not located within the 100-year floodplain. State and local resource areas on site include a 200-ft riverfront area, bordering vegetated wetlands and the 100-ft buffer zone to the wetlands. The site generally slopes from west (el. ± 266) to east (el. ± 224) toward the wetland areas. An additional 5.2 acres of area located on the parcel west of the site is included in the existing conditions analysis as stormwater runoff is directed on site from this area. Stormwater runoff from site is directed to four points of analysis in the existing conditions: Milford Street to the west, an existing catch basin located along Milford Street to the east, the wetlands to the east, and a wooded area west of the project site. The site is divided into four watersheds.

1.4 Project Description

The proposed development consists of a 250-megawatt (MW) / 500 megawatt-hour (MWh) battery energy storage system (BESS), 345 kilovolt (kV) electric substation and 345 kV underground transmission interconnection between the proposed substation and adjacent Eversource substation. The project will include the demolition of all existing structures on site for the development of the battery storage systems and electric substation. The battery storage containers will be Tesla Megapacks, consisting of stand-alone cabinets supported by concrete slabs and pier foundations and surrounded by crushed stone. Each module consists of 1 medium voltage transformer, 2 Megapack battery cabinets and room allotted between units for future augmentation. This future augmentation area will house additional battery cabinets as needed throughout the life of the project. The modules will be placed in a back-to-back orientation, totaling 142 Megapacks and 71 transformers on site.

Two points of access along Milford Street will be in the eastern and western corners of the site, respectively. The proposed paved access drives continue into the facility and connect to provide means of emergency access to and egress from the site. Four parking spaces, two located near each entrance, will be constructed to support maintenance personnel accessing the storage systems. The development will also include a substation that will be an ancillary structure to the battery storage systems. The substation will include the electrical equipment, substation building, security fencing, and crushed stone yard area. Areas on site not containing paved access drives or equipment will be covered in crushed stone.

1.5 FEMA

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panel No. 25021C0139E (July 7, 2021), the project is not located within any flood zone areas.

1.6 Soil Conditions

According to the USDA Natural Resources Conservation Service (NRCS) Web Soil Survey, the site soil type is comprised of Whitman fine sandy loam, Charlton-Hollis-Rock outcrop, and Canton fine sandy loam.

Soils are classified into hydrologic soil groups (HSG) to indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting. The HSGs, which are A, B, C and D, are one element used to determine runoff curve numbers and analyzing stormwater characteristics of a site.

> *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.

The Web Soil Survey has classified the soils on site to be mostly hydrologic soil group B, with areas of A and D.

Table 1.6.1: Site Soils

Map Unit Symbol	Map Unit Name	HSG Rating
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D
103B	Charlton-Holis-Rock outcrop complex, 3 to 8 percent slopes	A
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	B
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	B

2.0 STORMWATER MANAGEMENT CRITERIA

2.1 Stormwater Management Regulations

The purpose of the Stormwater Management Plan is to provide long-term protection of natural resources in and around the site. This is achieved by implementing stormwater quality and quantity control measures designed to reduce pollutant discharge from the site, maintain a level of stormwater recharge, and control discharge rates.

The following regulations and guidelines where referenced for this project:

- Massachusetts Stormwater Handbook (2008)
- U.S. Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Stormwater Permit for Construction Activities (EPA, Federal Register, December 8, 1999 as amended).

- Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas, Department of Environmental Protection, Bureau of Resource Protection (May 2003)
- U.S. EPA's NPDES Small Municipal Separate Storm Sewer Systems (MS4) General Permit (EPA, 2016).
- Massachusetts Department of Transportation Project Development and Design Guide, Chapter 8 Drainage and Erosion Control (2006)
- Town of Medway General Bylaws – Article XXVI Stormwater Management and Land Disturbance (2021)

2.2 MassDEP Stormwater Performance Standards

A summary of MassDEP Stormwater Performance Standards as well as a method of ensuring compliance with each standard are summarized below:

1. No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

   Response: New stormwater conveyances are routed through treatment practices to prevent discharge of untreated stormwater directly to wetlands and waters of the Commonwealth. Treatment features include crushed stone surfacing throughout the site, dry wells, and an infiltration. Permanent erosion control measures include rip rap outlet protection. These measures are intended to treat discharge and prevent erosion in wetlands or waters of the Commonwealth and are included in further detail in Section 4 and 7 and Appendices D-G of this report.

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

   Response: The development of this site will result in an overall decrease of peak discharge rates from the existing condition, as shown in Section 3.4 of this report.

3. Loss of annual recharge to groundwater shall be eliminated or minimized using 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.

Response: The required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook is met and exceeded with the proposed recharge volumes for the development as shown in Section 5 of this report. Best management practice selection of an infiltration basin and dry wells support the recharge of groundwater on site.

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

   - Suitable practices for source control and pollution prevention are identified in a long- term pollution prevention plan, and thereafter are implemented and maintained;

   - Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and

   - Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

Response: Runoff from the project site will meet the water quality requirements by using on-site treatment practices such as dry wells and an infiltration basin. Water Quality Calculations and TSS Removal Worksheets can be found in Appendix D and E of this report.

Stormwater Operations & Maintenance Procedures are included in Appendix I of this report.

5. For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for

such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

Response: The proposed development does not include a Land Use with a Higher Potential Pollutant Load (LUHPPL) and is therefore not eligible to comply with this standard.

6. Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area, if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

Response: The project is not located within a Zone II or IWPA and does not discharge near to a critical area and is therefore not eligible to comply with this standard.

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

Response: This project does not meet the definition of a redevelopment per the Massachusetts Stormwater Standards. While portions of the site are developed in the existing condition, the project proposes a net

increase in impervious area. The project is therefore not eligible to comply with this standard.

8. A plan to control construction related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

   All redevelopment projects shall fully comply with Standard 8.

   Response: Soil erosion and sediment control plans are included in the drawings of this report. These plans have been designed in accordance with the Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas.

9. A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

   Response: Stormwater Operations & Maintenance Plan is included in Appendix I to ensure the proposed stormwater management system functions as designed throughout the life of the project.

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

    Response: The stormwater management system designed for this site does not include any illicit discharges to the system. An illicit discharge compliance statement is included in Appendix J of this report.

2.3 Town of Medway Stormwater Management and Land Disturbance Regulations

The Stormwater Management and Land Disturbance Bylaw includes regulations for connections to the Municipal Separate Storm Sewer System (MS4) and Land Disturbance and Construction Activities. The town of Medway's Stormwater Standards largely coincide with state standards as outlined in Section 2.2 above. Regulations imposed by the Town as well as a method of ensuring compliance with each standard are summarized below:

<u>MS4 Storm Drain Connections</u>

The project does not propose a connection to the MS4.

Land Disturbance and Construction Activity

The total land disturbance from the project's limit of work is greater than 20,000 square feet and is therefore subject to comply with the following standards and submittal requirements for a Land Disturbance Permit:

a. Completed Land Disturbance Application Form

   Response: A completed Land Disturbance application form will be filed with the town of Medway Conservation Commission. A copy of the completed form for the project is included in Appendix L.

b. Erosion and Sediment Control Plans

   Response: The Soil Erosion and Sediment Control plans containing the required information per Section 26.5.6 of the town of Medway Stormwater Bylaw can be found in Section 9.0 of this report and the CE Drawings included within this report.

c. Drainage Calculations in Compliance with the most current Massachusetts Stormwater Management Standards and the National Oceanic and Atmospheric (NOAA) Atlas 14 precipitation rates

   Response: Compliance with the most current Massachusetts Stormwater Management Standards is outlined in Section 2.2 of this report, with supporting calculations in Appendices A-G. NOAAA precipitation rates and methodology used can be found in Section 3.1 of this report.

d. Narrative on how the project meets the most current Massachusetts Stormwater Management Standards
   Response: Compliance with Massachusetts Stormwater Standards 1-10 is outlined above in Section 2.2 of this report.

e. Construction Sequencing or Phasing Plan

   Response: Outlined information regarding the sequencing of construction and phasing is included in Section 9.2 of this report.

f. Stormwater Operations and Maintenance Plan During Construction

   Response: A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is outlined in Section 9.0 of this report.

g. Post-Construction Stormwater Management Plan

   Response: A Post-Construction Stormwater Management Plan is outlined in this report containing information to evaluate the effectiveness of controlling the quality and quantity of stormwater runoff. The proposed design also includes the required information per Section 26.5.8 of the town of Medway Stormwater Bylaw as outlined herein.

h. Long-Term Operations and Maintenance Plan

Response: A Long-Term Operations and Maintenance Plan containing the required information per Section 26.5.9 of the town of Medway Stormwater Bylaw is included in Appendix I of this report.

3.0 STORMWATER QUANTITY

3.1 Design Criteria

Peak flow rates and flow volumes at all points of discharge from the site were analyzed to compare proposed discharge rates with the existing condition.

The Resilient Massachusetts Action Team (RMAT) Standards and Guidelines were used to produce a climate resilient design. The RMAT Tool provides a preliminary climate change exposure and risk rating, and recommended design standards for projects. The output of the RMAT tool for this project recommended a Target Planning Horizon of 2050 and a 50-year (2%) return period. The projected 24-hr Total Precipitation Depth for the given return period is 9 inches. Rainfall depths for Medway, Massachusetts were obtained from the National Oceanographic and Atmospheric Administration (NOAA). The NOAA values were then increased by ±23% to correspond to the 50-year (2%) storm as recommended by the MA Resilience Design Tool. The remaining projected depths were extrapolated from that depth, summarized in Table 3.1.1 below:

Table 3.1.1: Design Storm Frequency Depths

Recurrence Interval (Years)	NOAA Atlas 14 Present Baseline 24-hour (Inches)	Projected 2050 Planning Horizon Depth (Inches)
2	3.38	4.16
5	4.41	5.43
10	5.27	6.49
25	6.44	7.93
50	7.31	9.00
100	8.26	10.17

The storms analyzed include the 2-, 10-, 25-, and 100-year, 24-hour storm events for the NOAA Atlas 14 and Projected 2050 Planning Horizon.

These storm events align with the Tier III methodology, associated with a longer useful life for critical infrastructure. The stormwater system is designed to accommodate peak flows associated with the 2050 100-year storm (10.17”) which is a higher rainfall volume than the NOAA Present Baseline storm scenario (8.26") and appears to accommodate future climate conditions.

3.2 Design Methodology

The peak runoff discharges for the existing and proposed conditions were analyzed in HydroCAD, a modeling program, using Soil Conservation Service (SCS) TR-20 methodology, which outlines procedures for calculating peak rates of runoff resulting from precipitation events, and procedures for developing runoff hydrographs. Values for area, curve number, and time of concentration were calculated for the existing and proposed conditions.

The curve number "CN" is a land-sensitive coefficient that dictates the relationship between total rainfall depth and direct storm runoff. The soils within the watershed are divided into hydrologic soil groups (A, B, and D) as previously described.

The time of concentration, Tc, is defined as the time for runoff to travel from the hydraulically most distant point in the watershed to a point of interest. Values of time of concentration were determined for existing and proposed conditions based on land cover and slope of the flow path, using methods outlined in the SCS methodology.

For this study, a 24-hour SCS Type III standard rainfall distribution was used to determine the peak flow rate to all points of discharge from the site. Both the NOAAA Present Baseline storm scenarios and projected 2050 RMAT storm scenarios have been analyzed.

3.3 Existing Runoff Discharges

The site has been divided into four watersheds with corresponding design points as depicted in the Existing Watershed Map (EX-WS) included in the drawing section of this report. The existing watersheds analyzed were delineated into Watersheds A, B, C, and D with design points as described:

Watershed A consists of ±1.0 acres with an existing residence, gravel areas, and wooded areas in the western most portion of the site. Runoff from this watershed is directed from a southwest high point offsite toward a gravel drive to the west and to the western gutter of Milford Street (Design Point A).

Watershed B is ±1.3 acres consisting of an auto repair shop and parking lot and wooded areas surrounding it. Runoff form this watershed is directed from a southwestern high point in the neighboring parcel offsite through the site and to a catch basin that is part of the existing drainage system within Milford Street (Design Point B).

Watershed C is the largest drainage area made up of ±8.9 acres in the center and southern portions of the site and drains to the wetland area to the east. Approximately 3.0 acres of additional area west of the property line is included in this watershed as runoff is directed from a western high point offsite, through the property and to the eastern wetlands (Design Point C).

Watershed D is ± 0.6 acres in the southwestern corner of the site and largely consists of wooded areas and portion of a gravel drive. A portion of this watershed includes area south of the property as water is directed from an offsite high point through the site and discharges to the wooded area west of the project site (Design Point D).

See Appendix B for calculations of each of the drainage areas.

3.4 Proposed Runoff Discharges

The proposed watershed analysis remains within the existing watershed analysis area. The drainage areas delineated in the proposed conditions discharge to the same design points established in the existing conditions. In some cases, the watersheds have been broken into sub-drainage areas to model the proposed stormwater management best practices. The proposed conditions are depicted on the Proposed Watershed Map (PR-WS) included in the drawings section of this report. The proposed watershed analyzed were delineated into Watersheds A, B, C1, C2 and D as described below:

Watershed A consists of ± 0.4 acres in the western area of the site. This drainage area includes a paved access drive and landscaped areas outside of the main battery storage area on site, bordering Milford Street. Runoff from this drainage area runs to the western part of Milford Street (Design Point A).

Watershed B consists of ± 0.5 acres in the eastern area of the site. This drainage area includes the eastern access drive and landscaped buffer area outside of the main battery storage area on site, along the eastern portion of Milford Street. Runoff from this area drains to a catch basin that is part of the existing drainage system within Milford Street (Design Point B).

Watershed C is broken into 2 sub-drainage areas. Watershed C1 consists of ± 3.8 acres of the majority of the battery storage area on site. This area consists of equipment associated with the battery units, concrete pads, and paved access drives. Runoff from this area runs through crushed stone coverage to swales, directed to dry wells. From here runoff is conveyed through a series of perforated and closed pipes to an infiltration basin on site, and eventually discharged towards the wetlands (Design Point C). Watershed C2 is ± 6.4 acres largely consisting of wooded area offsite that is directed around the proposed development via a swale along the western property line. Runoff from this area is captured via a catch basin and discharged towards the wetlands (Design Point C).

Watershed D consists of ± 0.6 acres in the southwestern portion of the site. This drainage area includes a portion of wooded area offsite directed via a swale around the proposed development to a wooded area west of the project site (Design Point D).

The project has been designed so that post-construction peak flow rates do not exceed pre-construction peak flow rates, as required by MassDEP Stormwater Standard 2. See Table 3.4.1 below for the peak flow runoff rate comparison.

See Appendix C for calculations of each of the drainage areas, and for the routing of hydrographs from the drainage area through stormwater best management practices. See Appendix H for swale calculations.

Table 3.4.1: Peak Flow Runoff Rate Comparison, Existing (NOAA Atlas 14) vs. Proposed (2050 Planning Horizon) Conditions (cfs)

Design Point	Condition	2-year	10-year	25-year	100-year
A	Pre (cfs)	0.89	2.49	3.62	5.49
	Post (cfs)	0.73	1.66	2.27	3.26
	Delta	-18%	-33%	-37%	-41%
B	Pre (cfs)	1.33	3.15	4.39	6.40
	Post (cfs)	0.70	1.73	2.44	3.59
	Delta	-47%	-45%	-44%	-44%
C	Pre (cfs)	3.79	15.20	23.86	38.75
	Post (cfs)	2.81	9.67	14.43	25.45
	Delta	-26%	-36%	-40%	-34%
D	Pre (cfs)	0.52	1.46	2.13	3.24
	Post (cfs)	0.45	1.27	1.84	2.80
	Delta	-13%	-13%	-14%	-14%

Table 3.4.2: Peak Flow Runoff Rate Comparison, Existing (NOAA Atlas 14) vs. Proposed (NOAA Atlas 14) Conditions (cfs)

Design Point	Condition	2-year	10-year	25-year	100-year
A	Pre (cfs)	0.46	1.60	2.45	3.89
	Post (cfs)	0.46	1.16	1.64	2.42
	Delta	0%	-28%	-33%	-38%
B	Pre (cfs)	0.81	2.16	3.11	4.69
	Post (cfs)	0.41	1.17	1.71	2.61
	Delta	-49%	-46%	-45%	-44%
C	Pre (cfs)	1.40	8.61	14.91	25.96
	Post (cfs)	1.40	5.81	9.50	15.51
	Delta	0%	-33%	-36%	-40%
D	Pre (cfs)	0.27	0.94	1.44	2.29
	Post (cfs)	0.23	0.81	1.25	1.98
	Delta	-15%	-14%	-13%	-14%

4.0 STORMWATER QUALITY

4.1 Stormwater Quality Improvements

The stormwater management system has been designed in accordance with the MassDEP Stormwater Handbook, the Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas and the town of Medway Stormwater Management and Land Disturbance By-Law.

The WQV has been calculated using 1/2 inch multiplied by the total post-construction impervious surface area on the site.

The site utilizes several stormwater best management practices to provide stormwater quality and attenuation. Below are the BMPs used in the proposed design:

- Dry Well: Dry wells on site are used to provide groundwater recharge and reduce size and cost of downstream BMPs.
- Infiltration Basin: The infiltration basin on site provides peak flow attenuation, groundwater recharge and removal of TSS prior to infiltration.

All stormwater BMPs have been designed to treat a water quality volume equal to 1/2" across impervious surface. The provided recharge volumes for the project exceed the required water quality volumes. Therefore, the provided water quality volume treatment exceeds the required water quality volumes.

The measures described above have been sized to meet the 80% removal rate as required by the Standard 4: Water Quality of the MassDEP Checklist for Stormwater Report. TSS removal treatment train calculations are provided in Appendix E.

4.2 Additional Stormwater Quality Features

In addition to the water quality improvements described above, the following water-quality control measures will be provided:

- <u>Operations & Maintenance Plan:</u> Comprehensive Operations and Maintenance programs have been developed for the proposed site. These programs include regular catch basin cleaning, stormwater basin maintenance and best practices for the stormwater features. Refer to Appendix I of this report.

5.0 GROUNDWATER RECHARGE

5.1 Design Criteria

Groundwater recharge volumes have also been addressed for the site. Required volumes were calculated for each watershed based on the Medway General Bylaws, Article XXVI Stormwater Management and Land Disturbance requirements which are more stringent than the MA Stormwater Handbook guidelines. Medway requires that all stormwater management systems be designed to retain the volume of runoff equivalent to, or greater than one inch multiplied by the total post-construction impervious surface area on the site.

5.2 Retention and Infiltration Sizing

All calculations assume infiltration rates based on soil texture and hydrologic soil type from the soil classification in the Geotechnical Report. The Rawls Rates were then referenced from the Massachusetts Stormwater Handbook Table 2.3.3 based on the Geotechnical Report. The Sandy Loam classification and NRCS Hydrologic Soil Group B classification produces a design infiltration rate of 1.02 inches per hour.

See table 5.3.4 for assumed infiltration rates utilized. See Appendix K for the geotechnical report.

Total Required Recharge Volume (Rv)

Rv = Required Recharge Volume

F = Target Depth Factor associated with Hydrologic Soil Group (HSG)

$A_{Imp,}$= Total Impervious cover associated with HSG

Rv = ∑(F) x (A_{Imp})

Capture Area Adjustment

Not all impervious area is able to be routed to the proposed stormwater infiltration practices. The proposed infiltration practices are oversized by a Capture Area Adjustment Factor in order to provide sufficient infiltration for impervious areas not routed to them. See below for adjustment factor calculation. Crushed stone was considered impervious to be conservative for the recharge and capture area adjustment calculations.

Capture Area Adjustment Factor = Total Impervious Area / Impervious Area Draining to Infiltration BMPs

Table 5.3.1: Capture Area Adjustment

BMP	Impervious Area Draining to Infiltration BMPs	Total Impervious Area	Catchment Area Adjustment Factor
Infiltration Basin	3.27 ac	4.49 ac	1.37

Table 5.3.2: Required Recharge Volumes

BMP	A_{Imp} F = 1.0"	Required Recharge Volume (unadjusted)	Required Recharge Volume (adjusted)
Infiltration Basin	195, 441 sf	16,287 cf	22,340 cf

Table 5.3.3: Provided Recharge Volumes

BMP	Bottom Area	Depth of storage below outlet	Provided Recharge Volume	Required Recharge Volume (adjusted)
Infiltration Basin	11,283 sf	1.8 ft	23,242 cf	22,340 cf

Total Required Recharge Volume (Rv) for the Project

Rv = 22,340 cubic feet

Total Provided Recharge Volume (Rv) for the Project
Rv = 23,242 cubic feet

Table 5.3.4: Drawdown Rates

BMP	Provided Recharge Volume	Bottom Area (See Table 4.3.1)	K - Saturated Hydraulic Conductivity	Drawdown Time
Infiltration Basin	23,242 cf	11,283 sf	1.02 in / hr	24.2 hr

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

Additional infiltration will occur using dry wells on site, although the resulting recharge volumes were not accounted for in meeting requirements shown above.

6.0 STORM DRAINAGE COLLECTION SYSTEM DESIGN

6.1 Design Criteria

The proposed subsurface storm drainage collection system is designed to convey the 2050 projected 25-year design storm event to the discharge locations while maintaining an HGL below the proposed grade.

6.2 Design Methodology

The storm drainage system was analyzed using the Rational Method for estimating runoff for the 2050 projected 25-year design storm event. The site was divided into subareas, each contributing runoff to an individual catch basin or inlet. A value for area, time of concentration, and runoff coefficient was calculated for each contributing subarea. See Appendix F.

Values of time of concentration were chosen based on land cover and flow path slope from the hydraulically most distant point in the subarea to the appropriate inlet. A minimum 6-minute inlet time was assumed for each subarea.

The average runoff coefficient is the weighted average of the land uses within the drainage area. The runoff coefficient is an empirical coefficient representing the ratio of runoff to the rate of rainfall. The following runoff coefficients were used when calculating the average runoff coefficient for each drainage area.

CONDITION	C
Grass/Landscaping	0.30
Paved/Impervious	0.90

Rainfall intensities were taken from the intensity-duration-frequency curve for Massachusetts as presented in National Weather Service (NOAA) Precipitation Frequency Data Server (PFDS) and increased by ± 23% for the projected 2050 storms. Storm drainage pipes were then sized based on calculated flows using Manning's Equation and were verified by solving for the hydraulic grade line. Starting hydraulic grade lines for the pipe networks were set to the calculated maximum water elevations in the respective subsurface infiltration systems for the 25-year-design storm event creating a conservative tail water condition.

6.3 Storm Drainage Collection Summary

The runoff from the development will be collected using a system of dry wells with inlets, conveyed via a closed pipe network to an infiltration basin. Crushed stone cover and drainage swales throughout the site will direct runoff to these inlets.

See Appendix F for full conveyance calculations.

7.0 OUTLET PROTECTION

7.1 Design Criteria and Methodology

The outlet protection for pipe outlets are designed based on the pipe diameter, tailwater condition, and projected 2050 25-year design storm peak flow and velocity.

The pipe flows and velocity were obtained from the storm drainage collection system design described in Section 6 of this report.

See Appendix G for full calculation.

8.0 SWALE DESIGN

8.1 Design Criteria and Methodology

The proposed storm drainage swales on site are designed to convey the NOAA and 2050 25-year design storm event to the discharge locations while maintaining a velocity of 5 feet per second or less. Crushed stone with a D_{50} diameter of 4 inches will be installed along the bottom and sides of the swale. The roughness coefficient used for the swale analysis was based on the stone size and depth of flow.

The runoff to the swales was analyzed using the Soil Conservation Service (SCS) methodology, which outlines procedures for calculating peak rates of runoff resulting from precipitation events, and procedures for developing runoff hydrographs. Values for area, curve number, and time of concentration were calculated for the proposed conditions. For this study, a 24-hour SCS Type III standard rainfall distribution was used to determine the peak flow rate to the swale. The swales were then sized based on calculated flows using Manning's Equation.

See Appendix H for full swale calculations.

9.0 CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN

9.1 Introduction

The following sections describe the potential pollutant sources, controls to reduce the pollutants, construction sequence, and construction and earth movement schedules related to the project's soil disturbance. The site is anticipated to import approximately 10,000 cubic yards of material and disturb ± 6.5 acres. The Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan was developed to comply with standards set in the Environmental Protection Agency's (EPA) 2022 Construction General Permit (CGP). The Erosion and Sedimentation Control Plans (CE series) can be found in the construction drawings, submitted separately.

9.2 Construction Sequencing Schedule

The limit of disturbance of the proposed project site development is approximately 6.66 acres. The limit of disturbance off-site on Eversource property for the interconnect transmission line is 0.69 acres. The total area of disturbance on-site and off-site is 7.35 acres. The project will be completed in two phases. Overall construction sequencing with approximate durations is as follows:

Phase 1: Installation of erosion and sediment controls, demolition, and site clearing. Duration ±4 months.

1. A pre-construction meeting with the applicant, the applicant's technical representative, the general contractor or any other person with authority to make changes to the project, and the appropriate town staff and/or designated agents to review the permitted plans and their implementation.
2. Install erosion and sediment control practices. *(2 months)*
3. Complete demolition of existing structures, abandonment of utilities, clearing of trees and grubbing. *(2 months)*

Phase 2: Earthwork, site utilities, retaining walls, and stormwater management facilities, construction of building, final site paving, striping, site stabilization, and plantings. Duration: ±17 months.

1. Earthwork and grading. *(2 months)*
2. Excavation for drainage, foundation, electrical infrastructure. *(2 months)*
3. Concrete foundations. *(2 months)*
4. Retaining walls and sound attenuation wall. *(2 months)*
5. Equipment installation. *(2 months)*
6. Utility cabling, wiring and termination. *(2 months)*
7. Final stabilization, tree and restoration planting and removal of temporary erosion and sediment controls. *(2 months)*
8. Testing and commissioning of equipment. *(3 months)*

The construction sequence of the project is intended to provide a general description of the anticipated ground disturbing activities. Ground disturbances such as trenching for conduit and other electrical equipment installation needs may also be occurring during any of the stages above.

9.3 Construction Period Pollution Prevention Controls

Best Management Practices (BMPs) will be utilized as Construction Period Pollution Prevention Controls to reduce potential pollutants and prevent any off-site discharge. The objectives of the BMPs for construction activity are to minimize the disturbed areas, stabilize any disturbed areas, control the site perimeter, and retain sediment. The contractor will minimize the area disturbed by construction activities to reduce the potential for soil erosion and stormwater pollution problems. In addition, good housekeeping measures will be followed for the day-to-day operation of the construction site under the control of the contractor to minimize the impact of construction. This section describes the control practices that will be in place during construction activities.

9.3.1 Natural Buffers

All work is outside the 25- foot "No Disturb" wetland buffer zone. Work is proposed within the 100-foot wetland buffer zone. To minimize disturbed areas, work will be completed within well-defined work limits. These work limits are shown on the construction plans. The Contractor will be responsible to make sure that all their workers and any subcontractors know the proper work limits and do not extend their work into the undisturbed areas. The protective controls are described in more detail in the following sections.

9.3.2 Perimeter Controls

Perimeter controls for this project will consist of the installation of a perimeter silt fence and compost filter tube. The silt fence and compost filter tube will prevent sediment laden storm runoff from leaving the construction site or disturbed area. Perimeter controls will be installed before earth disturbing activities, pavement, and concrete slab removal.

9.3.3 Sediment Track-out Control

Stabilized construction entrances and stabilized construction pads shall be established on site within the drive aisles and throughout the construction area. The construction entrances are constructed in accordance with local regulatory criteria. The entrances are located within the perimeter silt fence.

9.3.4 Stockpiled Soil or Sediment

Soils to be removed will be loaded directly into dump trucks and removed from the site, or soil stockpile areas will be established on-site. The stockpile areas will be surrounded by poly wrapped haybale berms and compost filter tube and silt fencing, as identified on the referenced drawings and stabilized if unused for more than 14-days (e.g., hydroseed with an appropriate annual or winter rye seed mix and tackifier). The initial stockpile area will be established at the outset of the construction activities on site. As construction progresses, stockpile areas may be relocated as needed but must maintain the erosion and sediment control protection described above.

9.3.5 Sediment Basin

Sediment basins are excavated depressions surrounded by an earthen embankment that capture sediment from stormwater before it leaves the construction site. The sediment basin both slows the release of stormwater and reduces the amount of sediment it carries by allowing sediment to settle in the excavated depression. The sediment basin utilizes a perforated dewatering pipe and riser that discharges stormwater through the earthen embankment from the basin to the point of discharge. Outlet protection at the point of discharge has been sized to accommodate the projected 2050 25-year design storm peak flow and velocity and is based on pipe diameter and tailwater condition.

9.3.6 Dust Control

Dust control will be accomplished by use of vegetative cover, mulch, spray-on adhesives, tillage, water sprinkling, dust barriers, or stone. Dust control will be applied on an as-needed basis, specifically when dry or windy weather increases site-wide dust kick-up.

9.3.7 Minimize Disturbance of Steep Slopes

There are existing or proposed steep slopes at the site. In these areas the contractor will install soil erosion control blankets and provide soil roughening. soil erosion control blankets will be installed upon completion of grading.

9.3.8 Soil Compaction

Areas of sensitive vegetation will be accessible only to lightly loaded landscape equipment or hand-operated equipment and tools. Upon completion of grading, construction equipment and activities are to be avoided within areas designed for infiltration.

9.3.9 Storm Drain Inlet Protection

At-grade inlets and curb inlets will be provided with inlet protection throughout the construction activities until final stabilization is achieved. This inlet protection will be installed at the onset of the construction activities. The inlet protection shall consist of a silt filter bag which is placed under the grate. Straw bales or filter tubes may be placed around catch basins after the initial grading to filter and divert sediment until final paving is complete.

9.3.10 Dewatering

Based on the proposed construction activities, the depths of proposed excavations, and the known ground water table elevation, temporary construction dewatering practices is anticipated. Per the Geotechnical Report by GZA dated August 31, 2022 temporary groundwater control is anticipated to be necessary and should be performed in accordance with all federal, state, local and regulations.

9.3.11 Site Stabilization

During construction, any area of exposed soils that will be left idle for more than 30 days shall be stabilized with a layer of mulch hay or other means. For areas that are not meant to remain actively utilized, stabilization procedures will occur on the following schedule in compliance with Section 2.2.14 of the CGP:

- Initiate the installation of stabilization measures immediately in any areas of exposed soil where construction activities have permanently ceased or will be temporarily inactive for 14 or more calendar days.

- Complete the installation of stabilization measures as soon as practicable, but no later than 14 calendar days after stabilization has been initiated.

All exposed soil finish grade surfaces shall be immediately landscaped and stabilized, loamed, seeded, and mulched with a layer of mulch hay. All disturbed areas must be graded, loamed, and seeded prior to November 1st of each year. Outside of the growing season, beyond November 15th of any construction year, exposed soil finish grade surfaces shall be stabilized with a layer of mulch hay, straw, tackifier or biodegradable erosion control blanket until climate conditions allow for seeding.

All temporary erosion and sedimentation controls will be removed after final site stabilization.

9.4 Pollution Prevention Standards

Potential sources of pollution during construction are:

- sediment from exposed soils and dewatering
- construction material debris
- human waste
- concrete washout
- diesel, gasoline, and hydraulic and engine oil

All sources of soil erosion pollution or construction pollution to stormwater bodies will be mitigated with the use of silt fence, compost filter tubes, and construction fencing around the construction area. To prevent prohibited non-stormwater discharge the good housekeeping practices must be followed.

9.4.1 Spill Prevention and Response

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

Each employee will be instructed that all spills are to be reported to the spill prevention and cleanup coordinator. The supervisor will assess the incident and initiate proper containment and response procedures immediately upon notification. Workers should avoid direct contact with spilled materials during the containment procedures.

In the event of a release of oil or hazardous materials, the reporting person should notify the Fire Department and the Department of Public Works. Secondary notification will be to the certified cleanup contractor if deemed necessary by fire and police personnel. The third level of notification (within 1 hour) is to the DEP or municipality's Licensed Site Professional (LSP). The specific cleanup contractor to be used will be identified by the Contractor prior to commencement of construction activities.

In the event of a release of non-hazardous material, the reporting person shall notify the Department of Public Works no later than the next business day. The reporting person shall provide to the Department of Public Works written confirmation of all telephone, electronic or in-person notifications within three business days thereafter.

If the discharge of prohibited materials is from a commercial or industrial facility, the facility owner or operator of the facility shall retain on-site a written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

9.4.2 Designated Washout Areas

Concrete waste will be placed in designated dumpster (or comparable structure) and concrete washout will occur in designated containment areas outside of riverfront and wetland resource areas and buffer zones.

9.4.3 Proper Equipment, Vehicle Fueling, and Maintenance Practices

On-site vehicles will be monitored for leaks and receive regular preventative maintenance off-site to reduce the risk of leakage. To ensure that leaks on stored equipment do not contaminate the site, oil-absorbing mats will be placed under oil-containing equipment during storage. Refueling will occur outside riverfront and wetland resource areas and buffers. Any petroleum products will be stored in tightly sealed containers that are clearly labeled with spill control pads/socks placed under/around their perimeters.

9.4.4 Equipment and Vehicle Washing

No equipment, vehicles, or machines will be washed on-site.

9.4.5 Spill Control Equipment

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

9.4.6 Spill Containment and Clean-Up Measures

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

9.4.7 Hazardous Materials Spill Report

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

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

9.5 Operation and Maintenance of Erosion Control

The erosion control measures will be installed as detailed on the drawings (CE series). If there is a failure to the controls the contractor, under the supervision of the engineer, will be required to stop work until the failure is repaired. Periodically throughout the work, whenever the engineer deems it necessary, the sediment that has been deposited against the controls will be removed to ensure that the controls are working properly.

9.6 Inspection Schedule

During construction, the erosion and sedimentation controls will be inspected as detailed on the drawings and in the project SWPPP. Once the Contractor is selected, an on-site inspector will be selected to work closely to make sure that erosion and sedimentation controls are in place and working properly.

Prior to the start of clearing, excavation, construction or land disturbing activity the applicant, the applicant's technical representative, the general contractor or any other person with authority to make changes to the project, shall meet with the appropriate town staff and/or designated agents to review the permitted plans and their implementation.

The applicable Conservation Commission staff or its designated agent shall make inspections as required and will approve the portion of completed work or notify the permittee wherein the work fails to comply with the Land Disturbance Permit as approved.

The Permitee shall notify the Conservation Commission at least two working days before each of the following and must schedule the following site inspections with the appropriate Conservation Commission staff:

1. Erosion and sediment control measures are in place and stabilized
2. Site clearing has been substantially completed
3. Rough grading has been substantially completed
4. Installation of physical control measures
5. Final grading has been substantially completed
6. Close of the construction season
7. Final landscaping (permanent stabilization) and project final completion

A written report of these inspections is to be provided to both the permittee and the Conservation Commission and may be combined with other inspections required under any other permits issued to authorize the project.

10.0 CONCLUSION

The proposed stormwater management system has been designed in accordance with the Massachusetts Stormwater Management Handbook, the Massachusetts Erosion and

Sediment Control Guidelines for Urban and Suburban Areas, and the town of Medway's Stormwater Management and Land Disturbance Bylaw. The system incorporates stormwater quality measures and maintains or decreases the existing rate of runoff for all storm events analyzed.

We believe based on the findings of this report that the proposed stormwater system, as designed, will effectively manage quality and quantity of stormwater runoff for the proposed redevelopment.

11.0 REFERENCES

1. Stormwater Management Handbook, Massachusetts Department of Environmental Protection, 2008.

2. Hydrology Handbook for Conservation Commissioners, Massachusetts Department of Environmental Protection, 2002.

3. Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas, Department of Environmental Protection, Bureau of Resource Protection, May 2003.

4. Precipitation Frequency Data Server (PFDS) National Weather Service (NOAA), April 21, 2017.

5. USGS Web Soil Survey, United States National Resources Conservation Service, 2016.

6. Urban Hydrology for Small Watersheds, Technical Release 55, United States Department of Agriculture, Soil Conservation Service, June 1986.

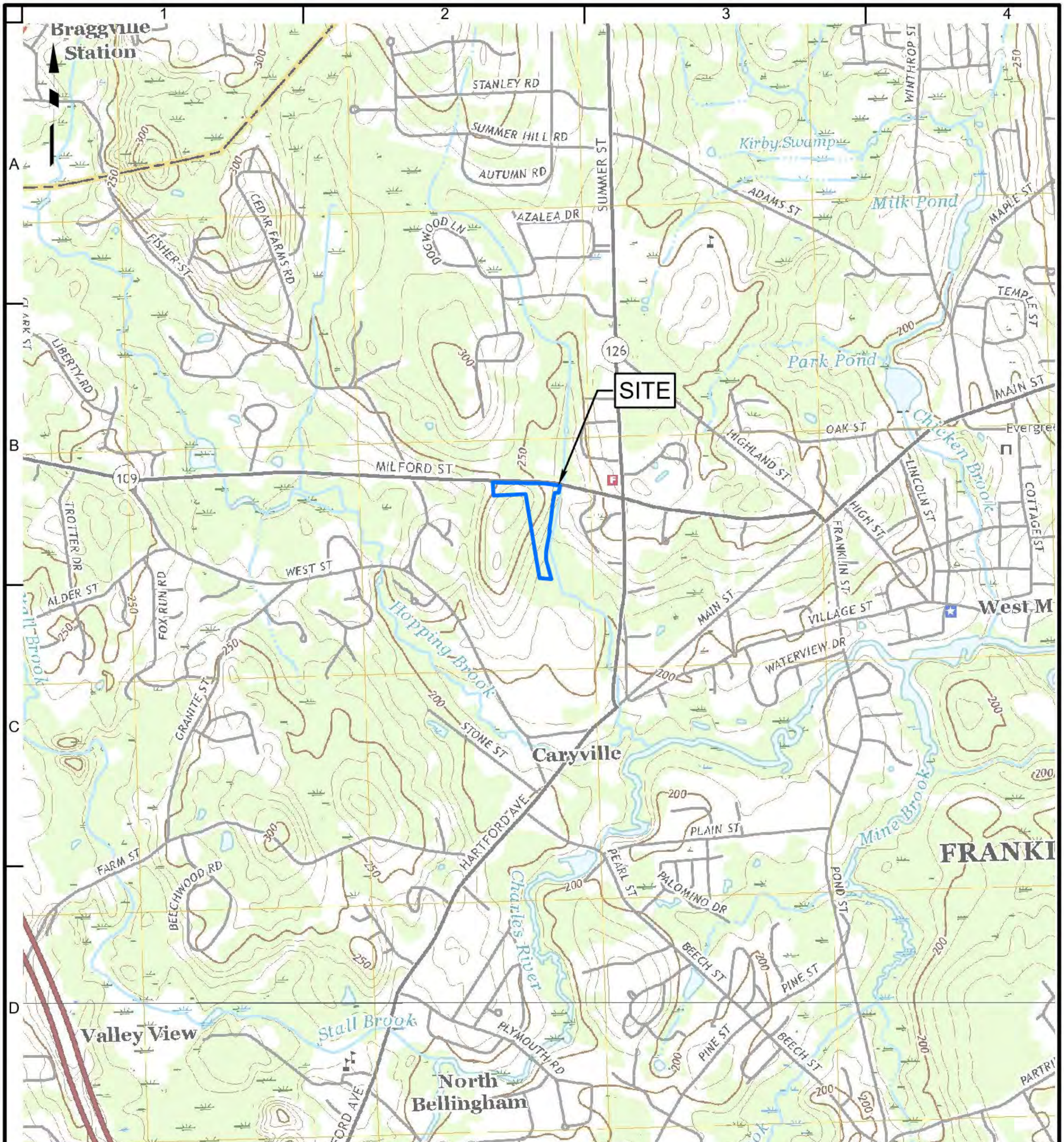
7. Massachusetts Small MS4 General Permit 2016 Final Permit, effective January 6, 2021.

8. Project Development and Design Guide, Chapter 8 Drainage and Erosion Control, Massachusetts Department of Transportation, 2006.

9. Stormwater Management and Land Disturbance Bylaws – Article XXVI, Town of Medway, May 2021

\\langan.com\data\BOS\data4\151033401\Project Data_Discipline\Site Civil\Reports\Stormwater\Battery Storage - Medway Stormwater Management Report Narrative.docx

Figures



Legend

Approximate Site Boundary

2,000 0 2,000

SCALE IN FEET

Notes:
1. Basemap adapted from United States Geological Survey (USGS) 7.5-Minute Series Topographical Maps, Holliston, Massachusetts, Quadrangle.

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Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
Langan International LLC
Collectively known as Langan

Project	Figure Title	Project No.	Figure No.
MEDWAY BATTERY ENERGY STORAGE SYSTEM MEDWAY NORFOLK COUNTY MASSACHUSETTS	SITE LOCATION MAP	151033401 Date: 3/3/2023 Scale: 1"=2,000' Drawn By: MG Submission Date	1

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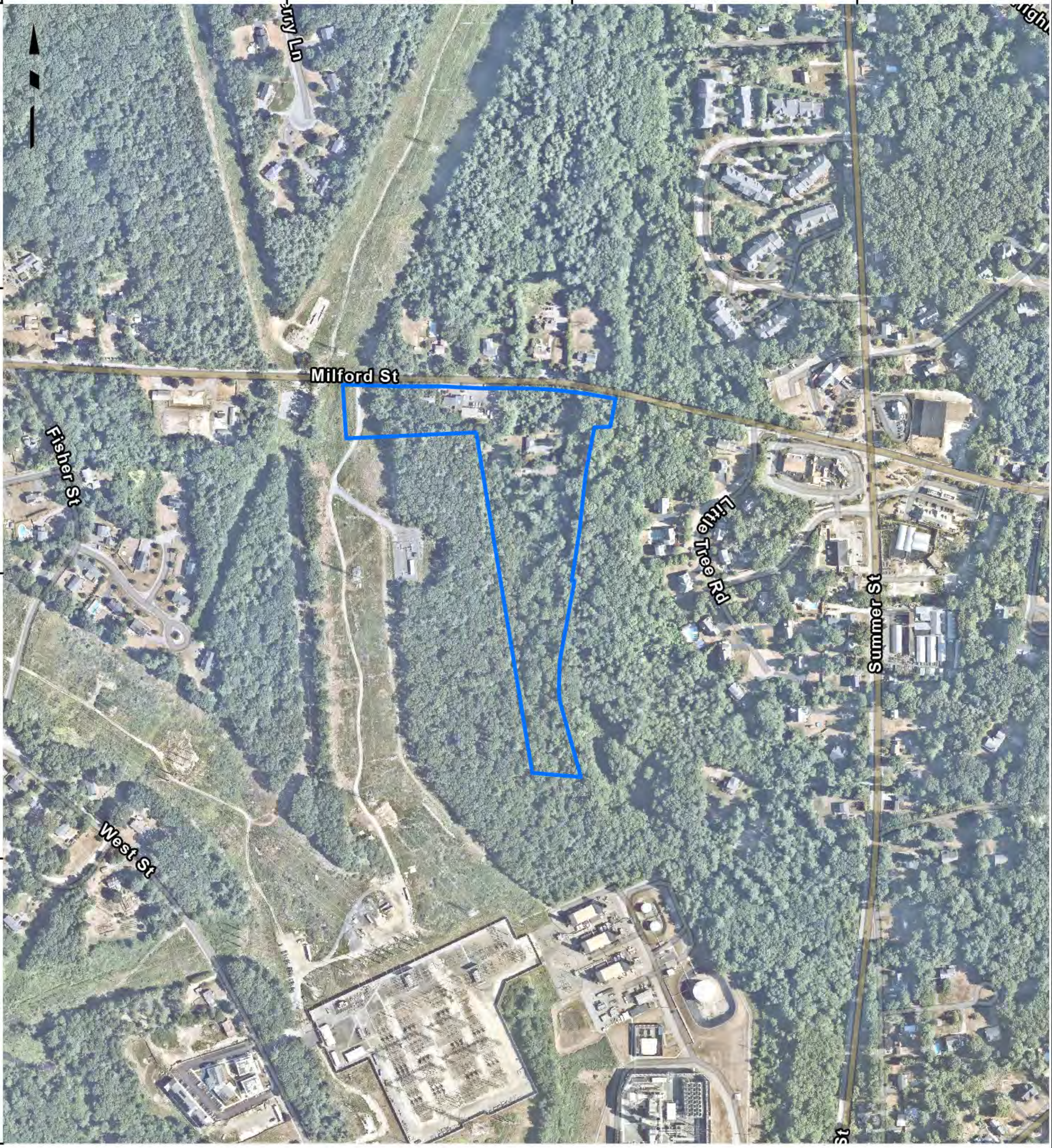

Legend

Approximate Site Boundary

500 0 500
SCALE IN FEET

Notes:
1. Aerial imagery provided through Langan's subscription to Near Map, dated 08/03/2022.

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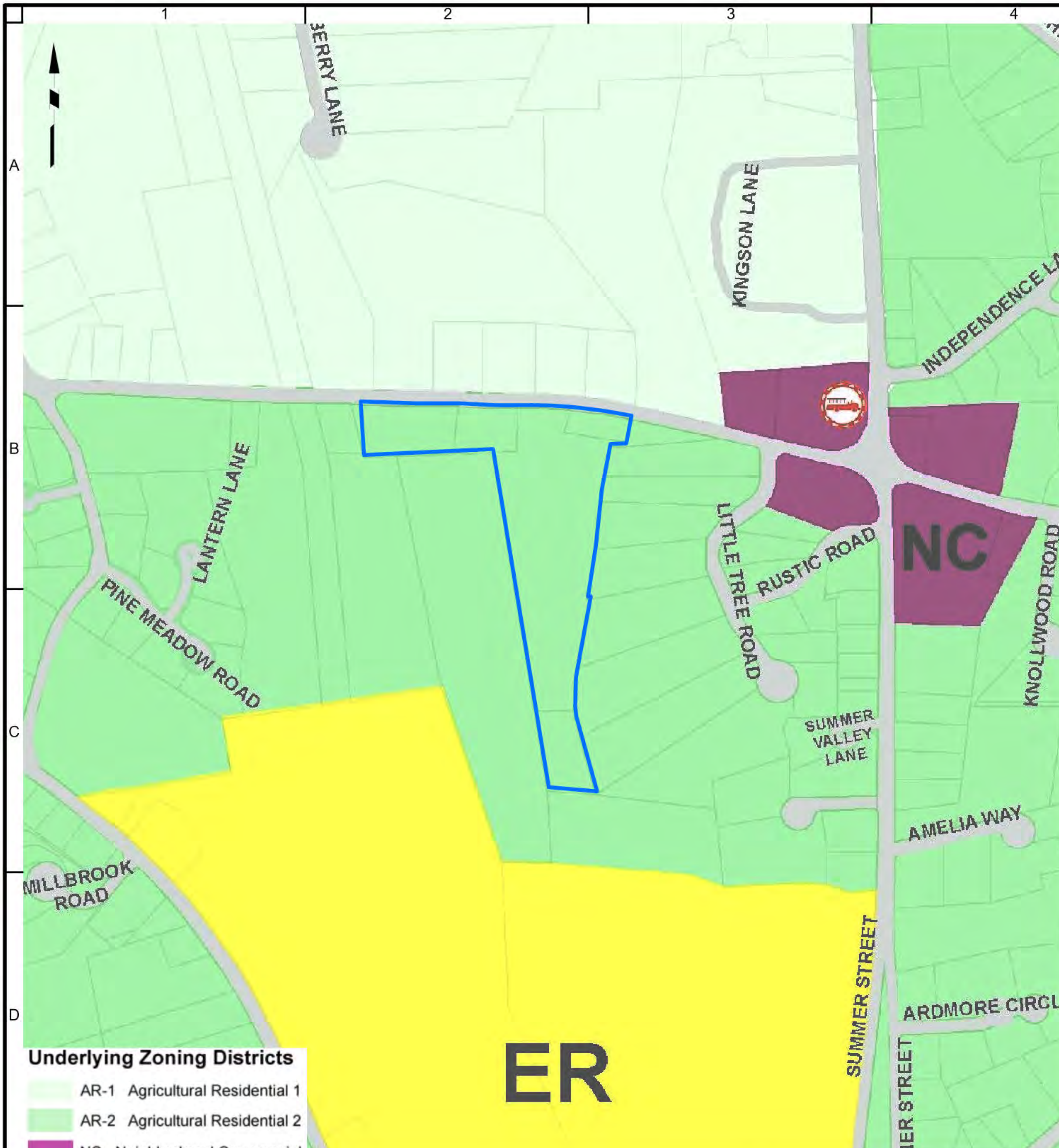
Path: \\langan.com\data\BOS\data4\151033401\Project Data\ArcGIS\APRX\151033401\151033401.aprx Date: 3/3/2023 User: mgeorgalas Time: 11:04 AM



Underlying Zoning Districts

- AR-1 Agricultural Residential 1
- AR-2 Agricultural Residential 2
- NC Neighborhood Commercial
- ER Energy Resources
- Approximate Site Boundary

500 0 500
SCALE IN FEET

Notes:
1. Zoning map provided by the Town of Medway, dated December 27, 2019.

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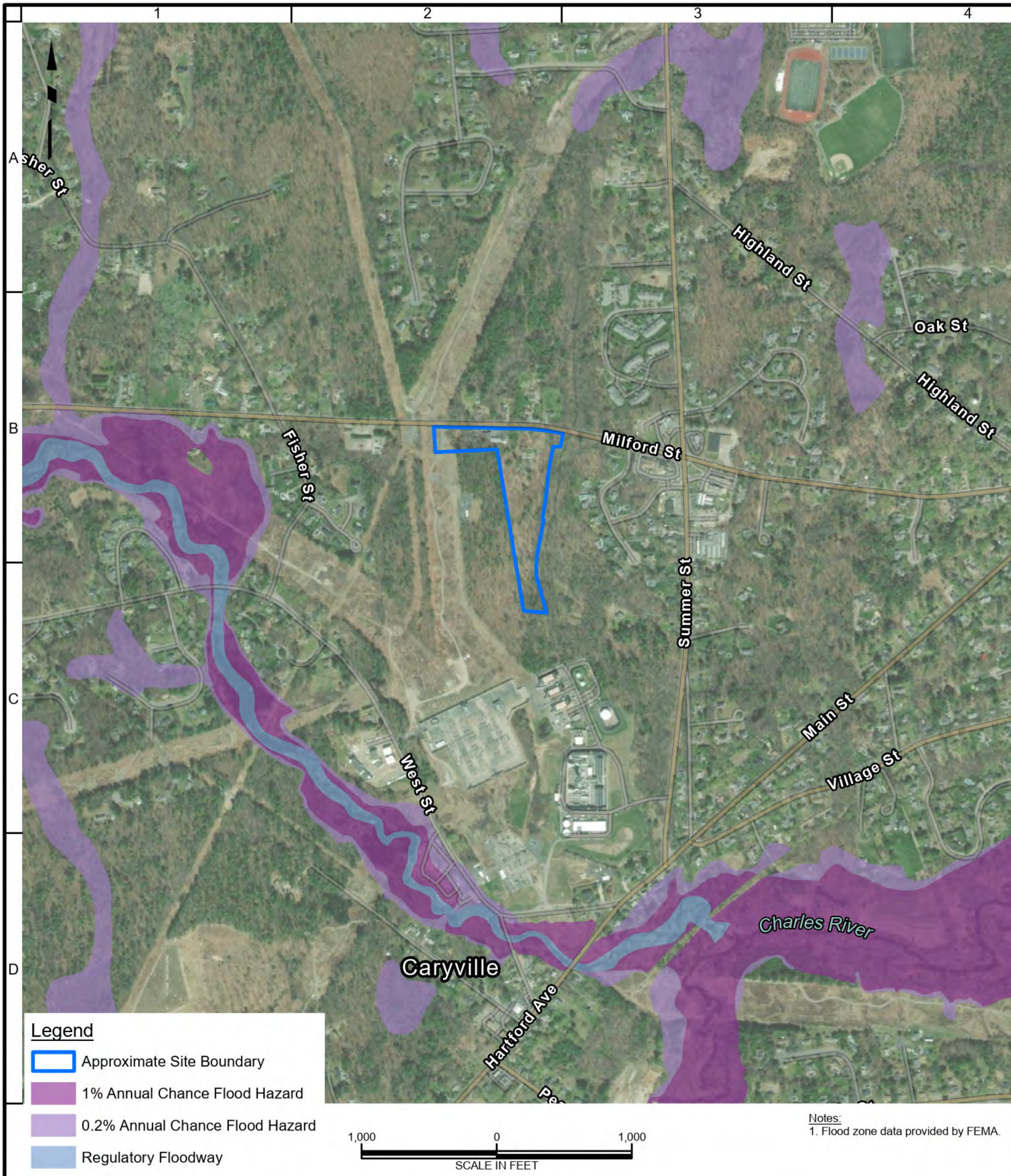

Notes:
1. Flood zone data provided by FEMA.

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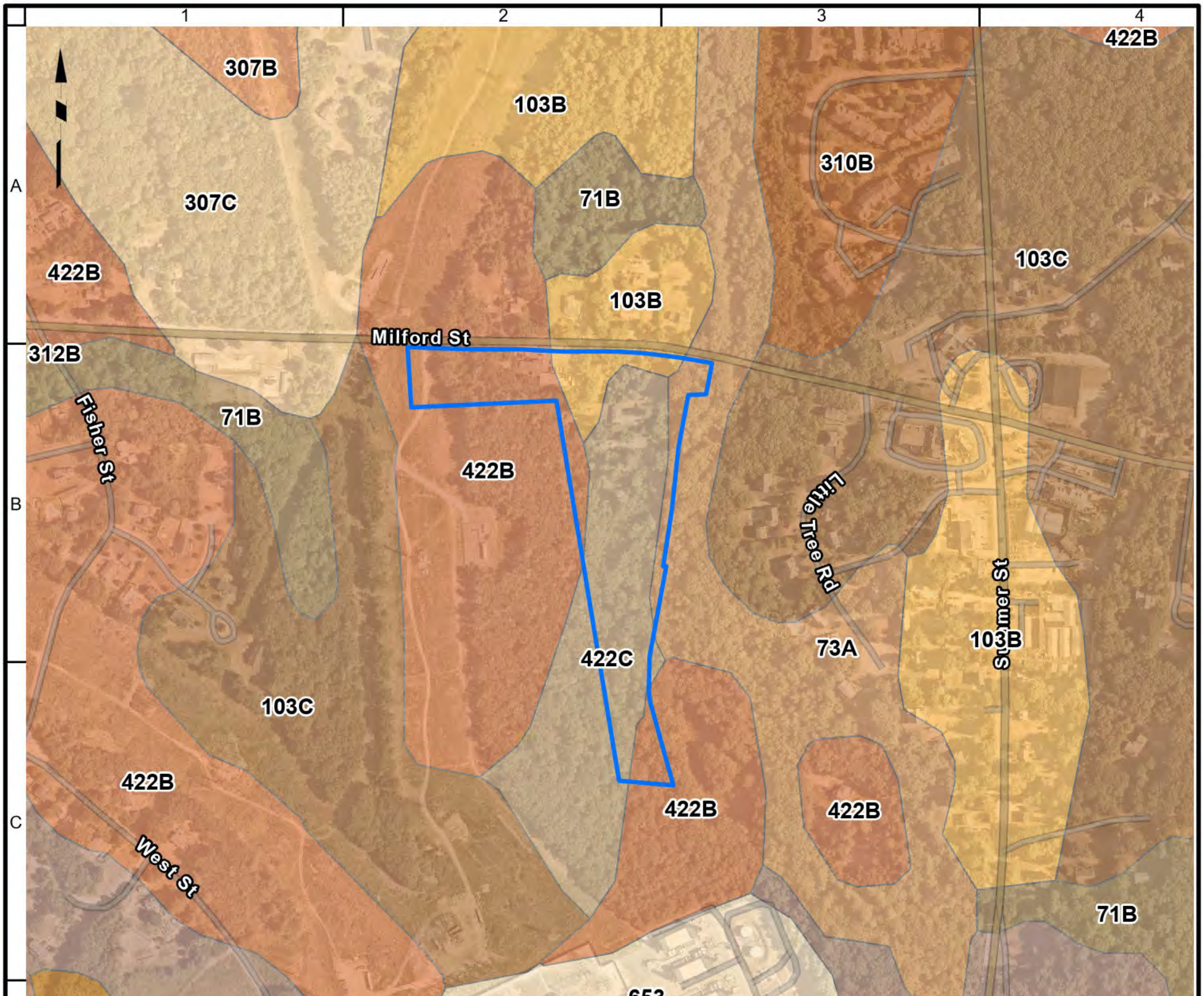

Legend

- Approximate Site Boundary
- 10,Scarboro and Birdsall soils, 0 to 3 percent slopes
- 103B,Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes
- 103C,Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes
- 254B,Merrimac fine sandy loam, 3 to 8 percent slopes
- 260B,Sudbury fine sandy loam, 2 to 8 percent slopes
- 307B,Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony
- 307C,Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony
- 310B,Woodbridge fine sandy loam, 3 to 8 percent slopes
- 312B,Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony
- 422B,Canton fine sandy loam, 0 to 8 percent slopes, extremely stony
- 422C,Canton fine sandy loam, 8 to 15 percent slopes, extremely stony
- 5,Saco silt loam, frequently ponded, 0 to 1 percent slopes, frequently flooded
- 653,Udorthents, sandy
- 71B,Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony
- 73A,Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony

500 0 500

SCALE IN FEET

Notes:
1. Aerial imagery provided through Langan's subscription to Near Map, dated 08/03/2022.
2. Soils data provided by the USDA Natural Resources Conservation Service.

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Project	Figure Title	Project No.	Figure No.
MEDWAY BATTERY ENERGY STORAGE SYSTEM MEDWAY NORFOLK COUNTY MASSACHUSETTS	NRCS SOILS MAP	151033401	5
		Date: 3/3/2023	
		Scale: 1"=500'	
		Drawn By: MG	
		Submission Date	

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Drawings

Existing Watershed Map

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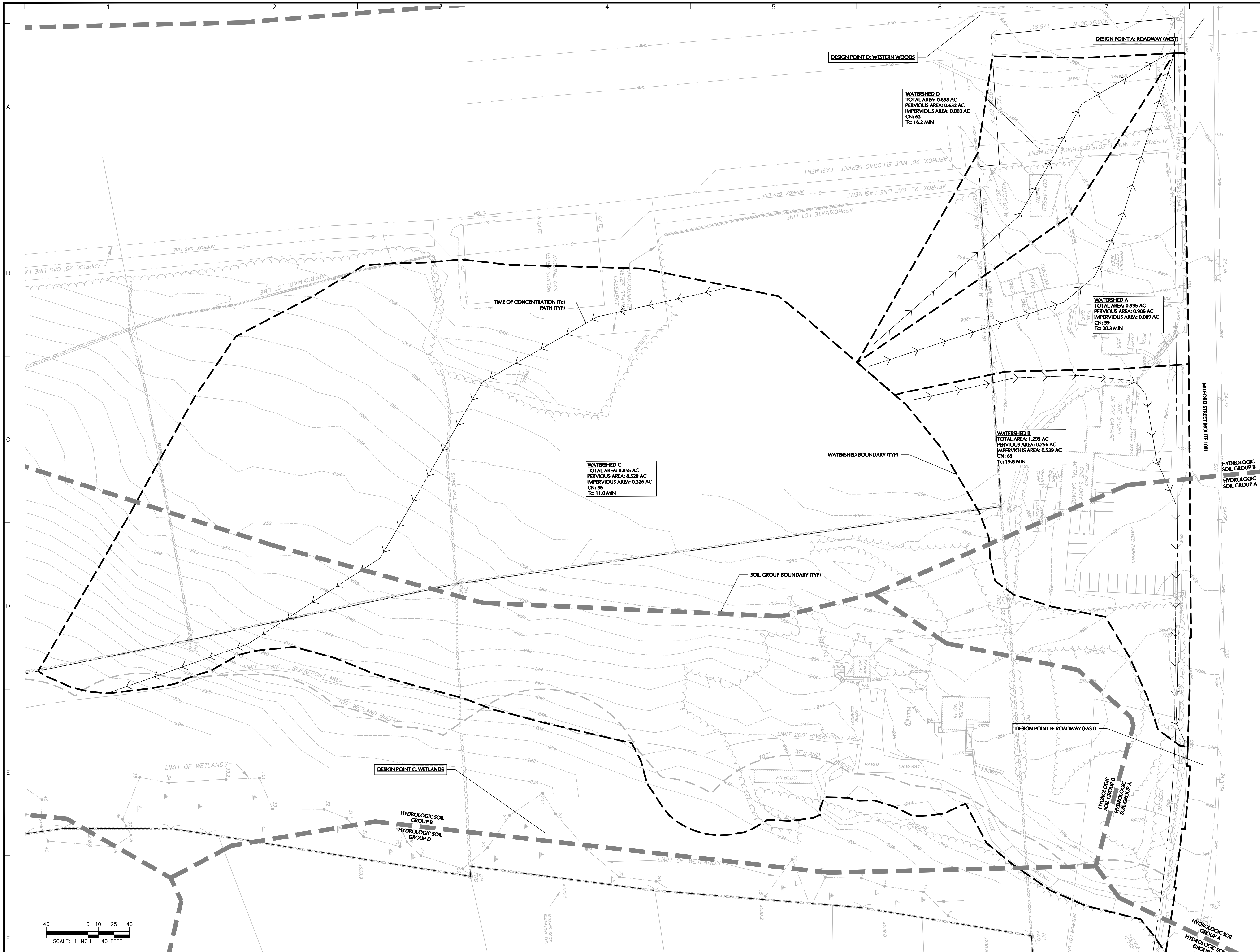

Date	Description	No.

Revisions

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Project

MEDWAY BATTERY ENERGY STORAGE SYSTEM

MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title

EXISTING WATERSHED MAP

Project No. 151033401	Drawing No. EX-WS
Date 05/25/2023	
Drawn By JNW	
Checked By FH	

Project No. 151033401

Proposed Watershed Map

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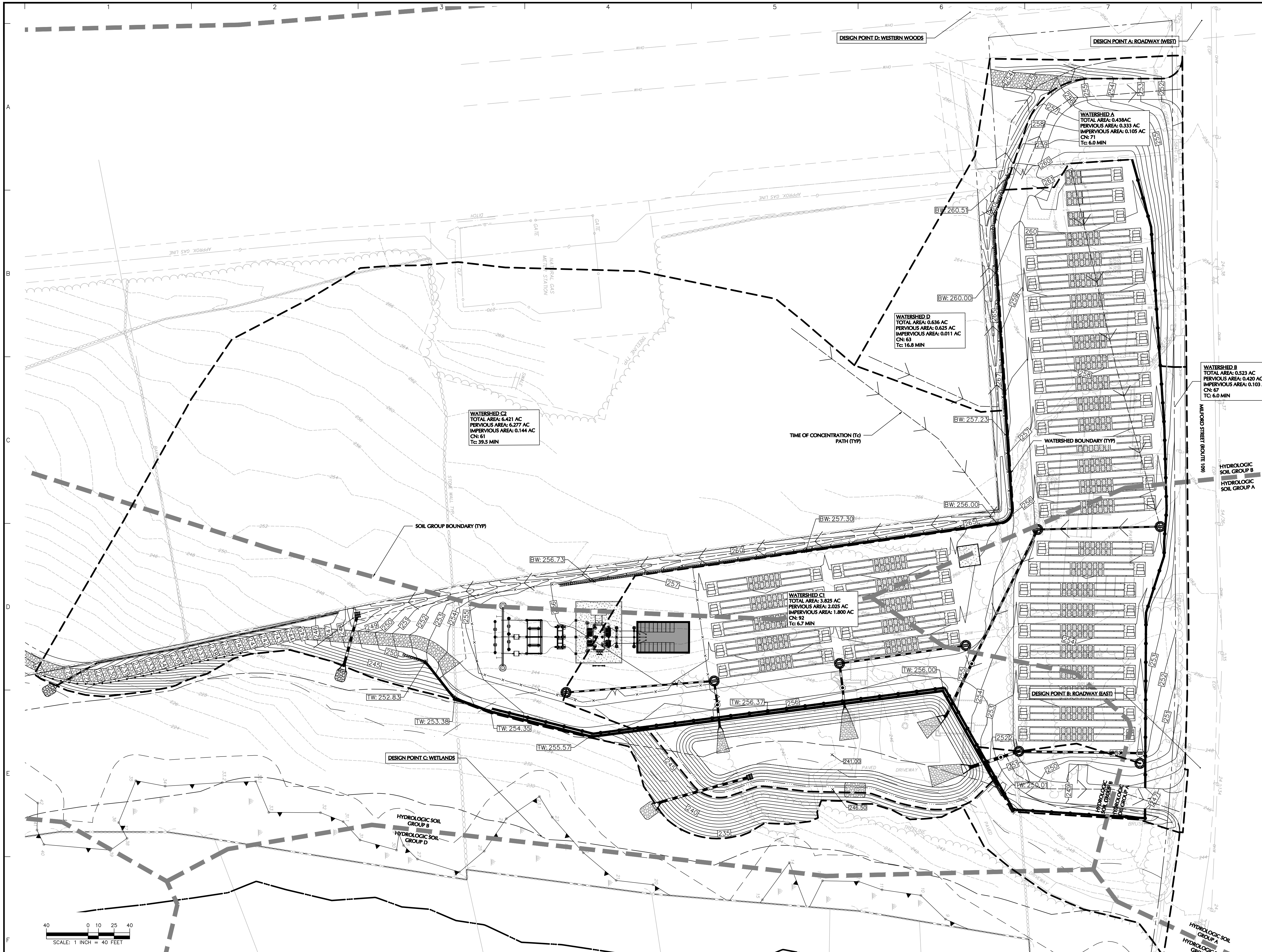

Date	Description	No.

Revisions

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MEDWAY BATTERY ENERGY STORAGE SYSTEM

MEDWAY
NORFOLK COUNTY MASSACHUSETTS

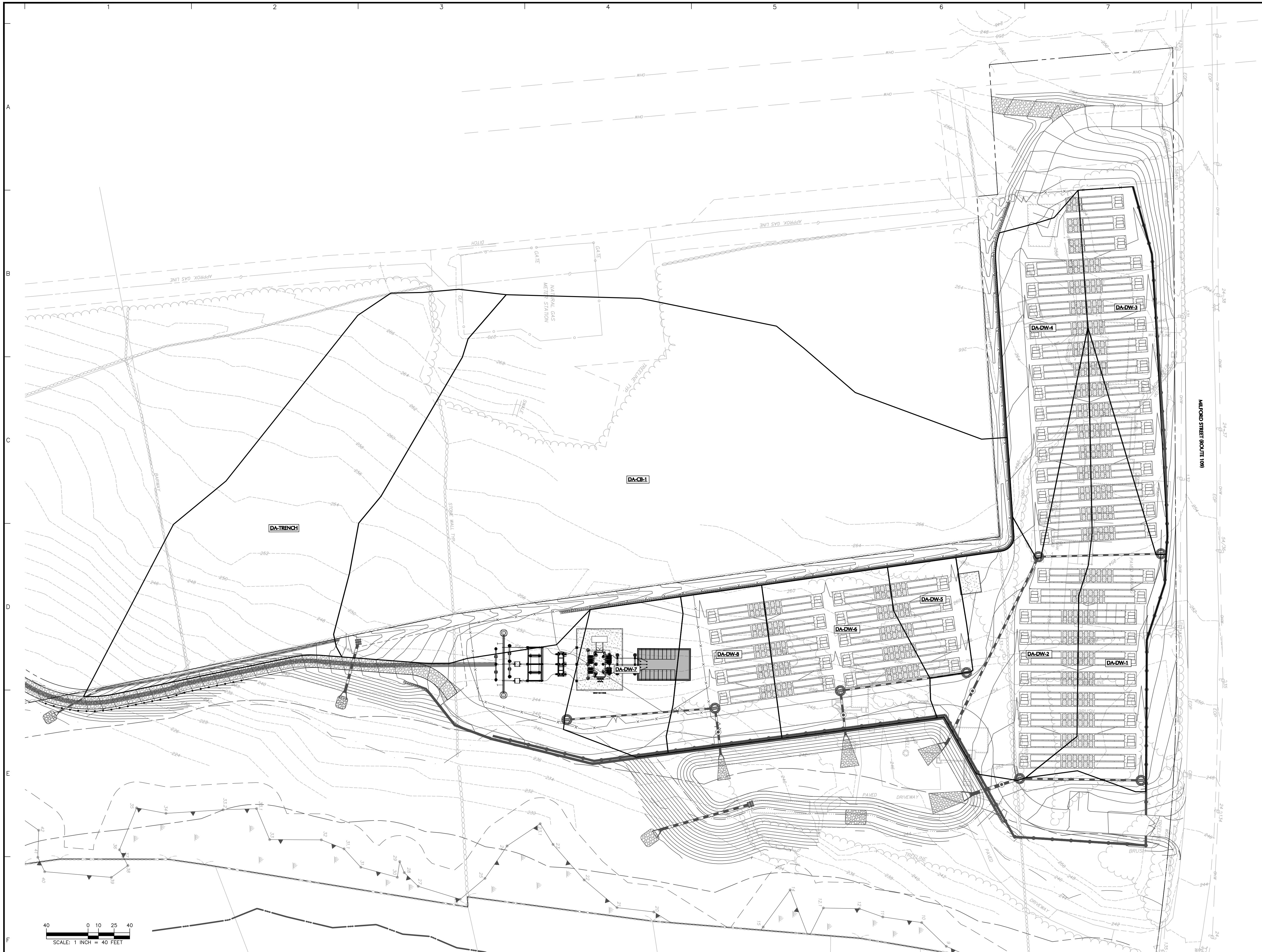
Drawing Title

PROPOSED WATERSHED MAP

Project No. 151033401
Date 05/25/2023
Drawn By JNW
Checked By FH
Drawing No. PR-WS

Project No. 151033401

Drainage Area Map



Date	Description	No.

Revisions

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Project

MEDWAY BATTERY ENERGY STORAGE SYSTEM

MEDWAY
NORFOLK COUNTY MASSACHUSETTS

Drawing Title

DRAINAGE AREA MAP

Project No. 151033401
Date 05/25/2023
Drawn By JNW
Checked By FH
Drawing No. DA-CB

APPENDICES

APPENDIX A

MassDEP Checklists

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

Checklist for Stormwater Report

A. Introduction

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

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

The Stormwater Report must include:

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

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

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

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

---

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

COMMONWEALTH OF MASSACHUSETTS
FRANK
HOLMES
CIVIL
No. 40203
REGISTERED
PROFESSIONAL ENGINEER

Frank Holmes

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:

- [x] No disturbance to any Wetland Resource Areas
- [ ] Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- [ ] Reduced Impervious Area (Redevelopment Only)
- [x] 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
- [x] Other (describe): infiltration basin, dry wells

Standard 1: No New Untreated Discharges

- [x] No new untreated discharges
- [x] Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- [x] 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 for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist (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

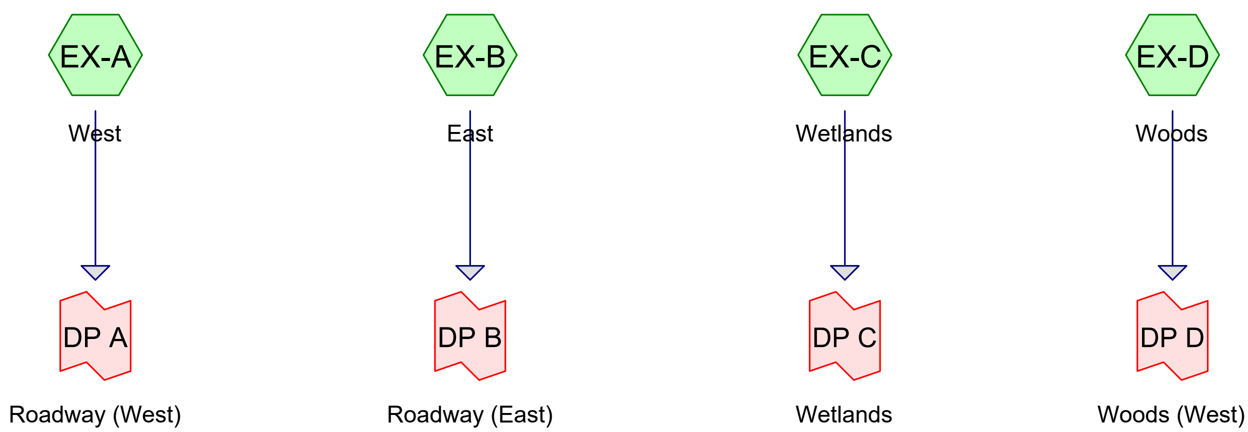
☑ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

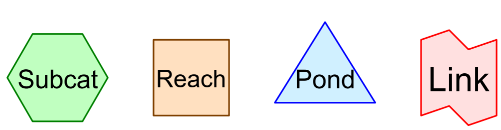
☑ An Illicit Discharge Compliance Statement is attached;

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

APPENDIX B

Existing Stormwater Discharge Calculations





Routing Diagram for LAN Existing Conditions
Prepared by Langan Engineering, Printed 5/19/2023
HydroCAD® 10.20-2f s/n 08223 © 2022 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year (2050)	Type III 24-hr		Default	24.00	1	4.16	2
2	2-year (NOAA)	Type III 24-hr		Default	24.00	1	3.38	2
3	10-year (2050)	Type III 24-hr		Default	24.00	1	6.49	2
4	10-year (NOAA)	Type III 24-hr		Default	24.00	1	5.27	2
5	25-year (2050)	Type III 24-hr		Default	24.00	1	7.93	2
6	25-year (NOAA)	Type III 24-hr		Default	24.00	1	6.44	2
7	100-year (2050)	Type III 24-hr		Default	24.00	1	10.17	2
8	100-year (NOAA)	Type III 24-hr		Default	24.00	1	8.26	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.391	39	>75% Grass cover, Good, HSG A (EX-B, EX-C)
2.166	61	>75% Grass cover, Good, HSG B (EX-A, EX-B, EX-C, EX-D)
0.029	80	>75% Grass cover, Good, HSG D (EX-C)
0.130	30	Brush, Good, HSG A (EX-C)
0.149	48	Brush, Good, HSG B (EX-C)
0.213	98	Buildings (EX-A, EX-B, EX-C)
0.082	96	Gravel surface, HSG B (EX-A, EX-D)
0.004	98	Parking Lot / Drive (EX-D)
0.714	98	Parking Lot/Drive (EX-B, EX-C)
0.027	98	Parking Lot/Drives (EX-A)
0.391	30	Woods, Good, HSG A (EX-B, EX-C)
6.363	55	Woods, Good, HSG B (EX-B, EX-C)
1.184	58	Woods/grass comb., Good, HSG B (EX-A, EX-D)
11.843	**59**	**TOTAL AREA**

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX-A: West	Runoff Area=0.995 ac 8.94% Impervious Runoff Depth>0.90" Flow Length=450' Tc=9.9 min CN=63 Runoff=0.89 cfs 0.075 af
SubcatchmentEX-B: East	Runoff Area=1.295 ac 41.62% Impervious Runoff Depth>1.24" Flow Length=550' Tc=19.8 min CN=69 Runoff=1.33 cfs 0.134 af
SubcatchmentEX-C: Wetlands	Runoff Area=8.855 ac 3.68% Impervious Runoff Depth>0.56" Flow Length=746' Tc=11.0 min CN=56 Runoff=3.79 cfs 0.415 af
SubcatchmentEX-D: Woods	Runoff Area=0.698 ac 0.57% Impervious Runoff Depth>0.90" Flow Length=400' Tc=16.2 min CN=63 Runoff=0.52 cfs 0.052 af
Link DP A: Roadway (West)	Inflow=0.89 cfs 0.075 af Primary=0.89 cfs 0.075 af
Link DP B: Roadway (East)	Inflow=1.33 cfs 0.134 af Primary=1.33 cfs 0.134 af
Link DP C: Wetlands	Inflow=3.79 cfs 0.415 af Primary=3.79 cfs 0.415 af
Link DP D: Woods (West)	Inflow=0.52 cfs 0.052 af Primary=0.52 cfs 0.052 af

Total Runoff Area = 11.843 ac Runoff Volume = 0.677 af Average Runoff Depth = 0.69"
91.91% Pervious = 10.885 ac 8.09% Impervious = 0.958 ac

Summary for Subcatchment EX-A: West

Runoff = 0.89 cfs @ 12.16 hrs, Volume= 0.075 af, Depth> 0.90"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (2050) Rainfall=4.16"

	Area (ac)	CN	Description
	0.034	61	>75% Grass cover, Good, HSG B
	0.847	58	Woods/grass comb., Good, HSG B
	0.025	96	Gravel surface, HSG B
*	0.062	98	Buildings
*	0.027	98	Parking Lot/Drives
	0.995	63	Weighted Average
	0.906		91.06% Pervious Area
	0.089		8.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	50	0.0450	0.26		**Sheet Flow, 1** Range n= 0.130 P2= 4.16"
1.9	147	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.5	38	0.0540	1.16		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.4	49	0.0940	2.15		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
3.9	166	0.0205	0.72		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
9.9	450	Total			

Summary for Subcatchment EX-B: East

Runoff = 1.33 cfs @ 12.30 hrs, Volume= 0.134 af, Depth> 1.24"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (2050) Rainfall=4.16"

	Area (ac)	CN	Description
	0.151	39	>75% Grass cover, Good, HSG A
	0.114	61	>75% Grass cover, Good, HSG B
	0.156	30	Woods, Good, HSG A
	0.335	55	Woods, Good, HSG B
*	0.097	98	Buildings
*	0.442	98	Parking Lot/Drive
	1.295	69	Weighted Average
	0.756		58.38% Pervious Area
	0.539		41.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0560	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
0.7	52	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.8	64	0.0670	1.29		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.8	46	0.0400	1.00		**Shallow Concentrated Flow, 4** Woodland Kv= 5.0 fps
0.0	8	0.1820	2.99		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0430	4.21		**Shallow Concentrated Flow, 6** Paved Kv= 20.3 fps
0.3	64	0.0250	3.21		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
0.2	46	0.0450	4.31		**Shallow Concentrated Flow, 8** Paved Kv= 20.3 fps
0.5	84	0.0210	2.94		**Shallow Concentrated Flow, 9** Paved Kv= 20.3 fps
1.2	16	0.0010	0.22		**Shallow Concentrated Flow, 10** Short Grass Pasture Kv= 7.0 fps
2.7	107	0.0180	0.67		**Shallow Concentrated Flow, 11** Woodland Kv= 5.0 fps
19.8	550	Total			

Summary for Subcatchment EX-C: Wetlands

Runoff = 3.79 cfs @ 12.21 hrs, Volume= 0.415 af, Depth> 0.56"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (2050) Rainfall=4.16"

	Area (ac)	CN	Description
	0.240	39	>75% Grass cover, Good, HSG A
	1.718	61	>75% Grass cover, Good, HSG B
	0.029	80	>75% Grass cover, Good, HSG D
	0.130	30	Brush, Good, HSG A
	0.149	48	Brush, Good, HSG B
	0.235	30	Woods, Good, HSG A
	6.028	55	Woods, Good, HSG B
*	0.054	98	Buildings
*	0.272	98	Parking Lot/Drive
	8.855	56	Weighted Average
	8.529		96.32% Pervious Area
	0.326		3.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.0280	0.22		**Sheet Flow, Sheet** Range n= 0.130 P2= 4.16"
0.3	11	0.0187	0.68		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.4	67	0.0246	2.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.6	127	0.0452	3.42		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
2.5	196	0.0665	1.29		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.0	152	0.0646	1.27		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
1.4	143	0.1200	1.73		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
11.0	746	Total			

Summary for Subcatchment EX-D: Woods

Runoff = 0.52 cfs @ 12.26 hrs, Volume= 0.052 af, Depth> 0.90"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (2050) Rainfall=4.16"

	Area (ac)	CN	Description
	0.300	61	>75% Grass cover, Good, HSG B
	0.337	58	Woods/grass comb., Good, HSG B
	0.057	96	Gravel surface, HSG B
*	0.004	98	Parking Lot / Drive
	0.698	63	Weighted Average
	0.694		99.43% Pervious Area
	0.004		0.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	50	0.0600	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.7	136	0.0730	1.35		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.7	57	0.0650	1.27		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.1	17	0.0784	1.96		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
0.8	49	0.0220	1.04		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.4	29	0.0348	1.31		**Shallow Concentrated Flow, 6** Short Grass Pasture Kv= 7.0 fps
0.4	62	0.0146	2.45		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
16.2	400	Total			

Summary for Link DP A: Roadway (West)

Inflow Area = 0.995 ac, 8.94% Impervious, Inflow Depth > 0.90" for 2-year (2050) event
Inflow = 0.89 cfs @ 12.16 hrs, Volume= 0.075 af
Primary = 0.89 cfs @ 12.16 hrs, Volume= 0.075 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area = 1.295 ac, 41.62% Impervious, Inflow Depth > 1.24" for 2-year (2050) event
Inflow = 1.33 cfs @ 12.30 hrs, Volume= 0.134 af
Primary = 1.33 cfs @ 12.30 hrs, Volume= 0.134 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area = 8.855 ac, 3.68% Impervious, Inflow Depth > 0.56" for 2-year (2050) event
Inflow = 3.79 cfs @ 12.21 hrs, Volume= 0.415 af
Primary = 3.79 cfs @ 12.21 hrs, Volume= 0.415 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area =	0.698 ac,	0.57% Impervious,	Inflow Depth > 0.90"	for 2-year (2050) event
Inflow =	0.52 cfs @	12.26 hrs, Volume=	0.052 af	
Primary =	0.52 cfs @	12.26 hrs, Volume=	0.052 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX-A: West Runoff Area=0.995 ac 8.94% Impervious Runoff Depth>0.53"
Flow Length=450' Tc=9.9 min CN=63 Runoff=0.46 cfs 0.044 af

SubcatchmentEX-B: East Runoff Area=1.295 ac 41.62% Impervious Runoff Depth>0.79"
Flow Length=550' Tc=19.8 min CN=69 Runoff=0.81 cfs 0.085 af

SubcatchmentEX-C: Wetlands Runoff Area=8.855 ac 3.68% Impervious Runoff Depth>0.29"
Flow Length=746' Tc=11.0 min CN=56 Runoff=1.40 cfs 0.213 af

SubcatchmentEX-D: Woods Runoff Area=0.698 ac 0.57% Impervious Runoff Depth>0.53"
Flow Length=400' Tc=16.2 min CN=63 Runoff=0.27 cfs 0.031 af

Link DP A: Roadway (West) Inflow=0.46 cfs 0.044 af
Primary=0.46 cfs 0.044 af

Link DP B: Roadway (East) Inflow=0.81 cfs 0.085 af
Primary=0.81 cfs 0.085 af

Link DP C: Wetlands Inflow=1.40 cfs 0.213 af
Primary=1.40 cfs 0.213 af

Link DP D: Woods (West) Inflow=0.27 cfs 0.031 af
Primary=0.27 cfs 0.031 af

Total Runoff Area = 11.843 ac Runoff Volume = 0.373 af Average Runoff Depth = 0.38"
91.91% Pervious = 10.885 ac 8.09% Impervious = 0.958 ac

Summary for Subcatchment EX-A: West

Runoff = 0.46 cfs @ 12.17 hrs, Volume= 0.044 af, Depth> 0.53"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (NOAA) Rainfall=3.38"

	Area (ac)	CN	Description
	0.034	61	>75% Grass cover, Good, HSG B
	0.847	58	Woods/grass comb., Good, HSG B
	0.025	96	Gravel surface, HSG B
*	0.062	98	Buildings
*	0.027	98	Parking Lot/Drives
	0.995	63	Weighted Average
	0.906		91.06% Pervious Area
	0.089		8.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	50	0.0450	0.26		**Sheet Flow, 1** Range n= 0.130 P2= 4.16"
1.9	147	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.5	38	0.0540	1.16		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.4	49	0.0940	2.15		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
3.9	166	0.0205	0.72		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
9.9	450	Total			

Summary for Subcatchment EX-B: East

Runoff = 0.81 cfs @ 12.31 hrs, Volume= 0.085 af, Depth> 0.79"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (NOAA) Rainfall=3.38"

	Area (ac)	CN	Description
	0.151	39	>75% Grass cover, Good, HSG A
	0.114	61	>75% Grass cover, Good, HSG B
	0.156	30	Woods, Good, HSG A
	0.335	55	Woods, Good, HSG B
*	0.097	98	Buildings
*	0.442	98	Parking Lot/Drive
	1.295	69	Weighted Average
	0.756		58.38% Pervious Area
	0.539		41.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0560	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
0.7	52	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.8	64	0.0670	1.29		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.8	46	0.0400	1.00		**Shallow Concentrated Flow, 4** Woodland Kv= 5.0 fps
0.0	8	0.1820	2.99		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0430	4.21		**Shallow Concentrated Flow, 6** Paved Kv= 20.3 fps
0.3	64	0.0250	3.21		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
0.2	46	0.0450	4.31		**Shallow Concentrated Flow, 8** Paved Kv= 20.3 fps
0.5	84	0.0210	2.94		**Shallow Concentrated Flow, 9** Paved Kv= 20.3 fps
1.2	16	0.0010	0.22		**Shallow Concentrated Flow, 10** Short Grass Pasture Kv= 7.0 fps
2.7	107	0.0180	0.67		**Shallow Concentrated Flow, 11** Woodland Kv= 5.0 fps
19.8	550	Total			

Summary for Subcatchment EX-C: Wetlands

Runoff = 1.40 cfs @ 12.35 hrs, Volume= 0.213 af, Depth> 0.29"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (NOAA) Rainfall=3.38"

	Area (ac)	CN	Description
	0.240	39	>75% Grass cover, Good, HSG A
	1.718	61	>75% Grass cover, Good, HSG B
	0.029	80	>75% Grass cover, Good, HSG D
	0.130	30	Brush, Good, HSG A
	0.149	48	Brush, Good, HSG B
	0.235	30	Woods, Good, HSG A
	6.028	55	Woods, Good, HSG B
*	0.054	98	Buildings
*	0.272	98	Parking Lot/Drive
	8.855	56	Weighted Average
	8.529		96.32% Pervious Area
	0.326		3.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.0280	0.22		**Sheet Flow, Sheet** Range n= 0.130 P2= 4.16"
0.3	11	0.0187	0.68		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.4	67	0.0246	2.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.6	127	0.0452	3.42		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
2.5	196	0.0665	1.29		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.0	152	0.0646	1.27		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
1.4	143	0.1200	1.73		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
11.0	746	Total			

Summary for Subcatchment EX-D: Woods

Runoff = 0.27 cfs @ 12.29 hrs, Volume= 0.031 af, Depth> 0.53"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (NOAA) Rainfall=3.38"

	Area (ac)	CN	Description
	0.300	61	>75% Grass cover, Good, HSG B
	0.337	58	Woods/grass comb., Good, HSG B
	0.057	96	Gravel surface, HSG B
*	0.004	98	Parking Lot / Drive
	0.698	63	Weighted Average
	0.694		99.43% Pervious Area
	0.004		0.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	50	0.0600	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.7	136	0.0730	1.35		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.7	57	0.0650	1.27		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.1	17	0.0784	1.96		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
0.8	49	0.0220	1.04		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.4	29	0.0348	1.31		**Shallow Concentrated Flow, 6** Short Grass Pasture Kv= 7.0 fps
0.4	62	0.0146	2.45		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
16.2	400	Total			

Summary for Link DP A: Roadway (West)

Inflow Area = 0.995 ac, 8.94% Impervious, Inflow Depth > 0.53" for 2-year (NOAA) event
Inflow = 0.46 cfs @ 12.17 hrs, Volume= 0.044 af
Primary = 0.46 cfs @ 12.17 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area = 1.295 ac, 41.62% Impervious, Inflow Depth > 0.79" for 2-year (NOAA) event
Inflow = 0.81 cfs @ 12.31 hrs, Volume= 0.085 af
Primary = 0.81 cfs @ 12.31 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area =	8.855 ac,	3.68% Impervious,	Inflow Depth > 0.29"	for 2-year (NOAA) event	
Inflow =	1.40 cfs @	12.35 hrs,	Volume=	0.213 af	
Primary =	1.40 cfs @	12.35 hrs,	Volume=	0.213 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area = 0.698 ac, 0.57% Impervious, Inflow Depth > 0.53" for 2-year (NOAA) event
Inflow = 0.27 cfs @ 12.29 hrs, Volume= 0.031 af
Primary = 0.27 cfs @ 12.29 hrs, Volume= 0.031 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX-A: West Runoff Area=0.995 ac 8.94% Impervious Runoff Depth>2.32"
Flow Length=450' Tc=9.9 min CN=63 Runoff=2.49 cfs 0.192 af

SubcatchmentEX-B: East Runoff Area=1.295 ac 41.62% Impervious Runoff Depth>2.86"
Flow Length=550' Tc=19.8 min CN=69 Runoff=3.15 cfs 0.309 af

SubcatchmentEX-C: Wetlands Runoff Area=8.855 ac 3.68% Impervious Runoff Depth>1.71"
Flow Length=746' Tc=11.0 min CN=56 Runoff=15.20 cfs 1.266 af

SubcatchmentEX-D: Woods Runoff Area=0.698 ac 0.57% Impervious Runoff Depth>2.31"
Flow Length=400' Tc=16.2 min CN=63 Runoff=1.46 cfs 0.134 af

Link DP A: Roadway (West) Inflow=2.49 cfs 0.192 af
Primary=2.49 cfs 0.192 af

Link DP B: Roadway (East) Inflow=3.15 cfs 0.309 af
Primary=3.15 cfs 0.309 af

Link DP C: Wetlands Inflow=15.20 cfs 1.266 af
Primary=15.20 cfs 1.266 af

Link DP D: Woods (West) Inflow=1.46 cfs 0.134 af
Primary=1.46 cfs 0.134 af

Total Runoff Area = 11.843 ac Runoff Volume = 1.901 af Average Runoff Depth = 1.93"
91.91% Pervious = 10.885 ac 8.09% Impervious = 0.958 ac

Summary for Subcatchment EX-A: West

Runoff = 2.49 cfs @ 12.15 hrs, Volume= 0.192 af, Depth> 2.32"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (2050) Rainfall=6.49"

	Area (ac)	CN	Description
	0.034	61	>75% Grass cover, Good, HSG B
	0.847	58	Woods/grass comb., Good, HSG B
	0.025	96	Gravel surface, HSG B
*	0.062	98	Buildings
*	0.027	98	Parking Lot/Drives
	0.995	63	Weighted Average
	0.906		91.06% Pervious Area
	0.089		8.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	50	0.0450	0.26		**Sheet Flow, 1** Range n= 0.130 P2= 4.16"
1.9	147	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.5	38	0.0540	1.16		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.4	49	0.0940	2.15		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
3.9	166	0.0205	0.72		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
9.9	450	Total			

Summary for Subcatchment EX-B: East

Runoff = 3.15 cfs @ 12.28 hrs, Volume= 0.309 af, Depth> 2.86"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (2050) Rainfall=6.49"

	Area (ac)	CN	Description
	0.151	39	>75% Grass cover, Good, HSG A
	0.114	61	>75% Grass cover, Good, HSG B
	0.156	30	Woods, Good, HSG A
	0.335	55	Woods, Good, HSG B
*	0.097	98	Buildings
*	0.442	98	Parking Lot/Drive
	1.295	69	Weighted Average
	0.756		58.38% Pervious Area
	0.539		41.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0560	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
0.7	52	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.8	64	0.0670	1.29		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.8	46	0.0400	1.00		**Shallow Concentrated Flow, 4** Woodland Kv= 5.0 fps
0.0	8	0.1820	2.99		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0430	4.21		**Shallow Concentrated Flow, 6** Paved Kv= 20.3 fps
0.3	64	0.0250	3.21		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
0.2	46	0.0450	4.31		**Shallow Concentrated Flow, 8** Paved Kv= 20.3 fps
0.5	84	0.0210	2.94		**Shallow Concentrated Flow, 9** Paved Kv= 20.3 fps
1.2	16	0.0010	0.22		**Shallow Concentrated Flow, 10** Short Grass Pasture Kv= 7.0 fps
2.7	107	0.0180	0.67		**Shallow Concentrated Flow, 11** Woodland Kv= 5.0 fps
19.8	550	Total			

Summary for Subcatchment EX-C: Wetlands

Runoff = 15.20 cfs @ 12.17 hrs, Volume= 1.266 af, Depth> 1.71"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (2050) Rainfall=6.49"

	Area (ac)	CN	Description
	0.240	39	>75% Grass cover, Good, HSG A
	1.718	61	>75% Grass cover, Good, HSG B
	0.029	80	>75% Grass cover, Good, HSG D
	0.130	30	Brush, Good, HSG A
	0.149	48	Brush, Good, HSG B
	0.235	30	Woods, Good, HSG A
	6.028	55	Woods, Good, HSG B
*	0.054	98	Buildings
*	0.272	98	Parking Lot/Drive
	8.855	56	Weighted Average
	8.529		96.32% Pervious Area
	0.326		3.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.0280	0.22		**Sheet Flow, Sheet** Range n= 0.130 P2= 4.16"
0.3	11	0.0187	0.68		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.4	67	0.0246	2.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.6	127	0.0452	3.42		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
2.5	196	0.0665	1.29		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.0	152	0.0646	1.27		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
1.4	143	0.1200	1.73		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
11.0	746	Total			

Summary for Subcatchment EX-D: Woods

Runoff = 1.46 cfs @ 12.24 hrs, Volume= 0.134 af, Depth> 2.31"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (2050) Rainfall=6.49"

	Area (ac)	CN	Description
	0.300	61	>75% Grass cover, Good, HSG B
	0.337	58	Woods/grass comb., Good, HSG B
	0.057	96	Gravel surface, HSG B
*	0.004	98	Parking Lot / Drive
	0.698	63	Weighted Average
	0.694		99.43% Pervious Area
	0.004		0.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	50	0.0600	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.7	136	0.0730	1.35		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.7	57	0.0650	1.27		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.1	17	0.0784	1.96		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
0.8	49	0.0220	1.04		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.4	29	0.0348	1.31		**Shallow Concentrated Flow, 6** Short Grass Pasture Kv= 7.0 fps
0.4	62	0.0146	2.45		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
16.2	400	Total			

Summary for Link DP A: Roadway (West)

Inflow Area =	0.995 ac,	8.94% Impervious, Inflow Depth > 2.32"		for 10-year (2050) event
Inflow =	2.49 cfs @	12.15 hrs, Volume=	0.192 af	
Primary =	2.49 cfs @	12.15 hrs, Volume=	0.192 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area =	1.295 ac,	41.62% Impervious,	Inflow Depth > 2.86"	for 10-year (2050) event
Inflow =	3.15 cfs @	12.28 hrs, Volume=	0.309 af	
Primary =	3.15 cfs @	12.28 hrs, Volume=	0.309 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area = 8.855 ac, 3.68% Impervious, Inflow Depth > 1.71" for 10-year (2050) event
Inflow = 15.20 cfs @ 12.17 hrs, Volume= 1.266 af
Primary = 15.20 cfs @ 12.17 hrs, Volume= 1.266 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area = 0.698 ac, 0.57% Impervious, Inflow Depth > 2.31" for 10-year (2050) event
Inflow = 1.46 cfs @ 12.24 hrs, Volume= 0.134 af
Primary = 1.46 cfs @ 12.24 hrs, Volume= 0.134 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX-A: West Runoff Area=0.995 ac 8.94% Impervious Runoff Depth>1.53"
Flow Length=450' Tc=9.9 min CN=63 Runoff=1.60 cfs 0.127 af

SubcatchmentEX-B: East Runoff Area=1.295 ac 41.62% Impervious Runoff Depth>1.97"
Flow Length=550' Tc=19.8 min CN=69 Runoff=2.16 cfs 0.213 af

SubcatchmentEX-C: Wetlands Runoff Area=8.855 ac 3.68% Impervious Runoff Depth>1.06"
Flow Length=746' Tc=11.0 min CN=56 Runoff=8.61 cfs 0.781 af

SubcatchmentEX-D: Woods Runoff Area=0.698 ac 0.57% Impervious Runoff Depth>1.53"
Flow Length=400' Tc=16.2 min CN=63 Runoff=0.94 cfs 0.089 af

Link DP A: Roadway (West) Inflow=1.60 cfs 0.127 af
Primary=1.60 cfs 0.127 af

Link DP B: Roadway (East) Inflow=2.16 cfs 0.213 af
Primary=2.16 cfs 0.213 af

Link DP C: Wetlands Inflow=8.61 cfs 0.781 af
Primary=8.61 cfs 0.781 af

Link DP D: Woods (West) Inflow=0.94 cfs 0.089 af
Primary=0.94 cfs 0.089 af

Total Runoff Area = 11.843 ac Runoff Volume = 1.210 af Average Runoff Depth = 1.23"
91.91% Pervious = 10.885 ac 8.09% Impervious = 0.958 ac

Summary for Subcatchment EX-A: West

Runoff = 1.60 cfs @ 12.15 hrs, Volume= 0.127 af, Depth> 1.53"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (NOAA) Rainfall=5.27"

	Area (ac)	CN	Description
	0.034	61	>75% Grass cover, Good, HSG B
	0.847	58	Woods/grass comb., Good, HSG B
	0.025	96	Gravel surface, HSG B
*	0.062	98	Buildings
*	0.027	98	Parking Lot/Drives
	0.995	63	Weighted Average
	0.906		91.06% Pervious Area
	0.089		8.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	50	0.0450	0.26		**Sheet Flow, 1** Range n= 0.130 P2= 4.16"
1.9	147	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.5	38	0.0540	1.16		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.4	49	0.0940	2.15		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
3.9	166	0.0205	0.72		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
9.9	450	Total			

Summary for Subcatchment EX-B: East

Runoff = 2.16 cfs @ 12.29 hrs, Volume= 0.213 af, Depth> 1.97"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (NOAA) Rainfall=5.27"

	Area (ac)	CN	Description
	0.151	39	>75% Grass cover, Good, HSG A
	0.114	61	>75% Grass cover, Good, HSG B
	0.156	30	Woods, Good, HSG A
	0.335	55	Woods, Good, HSG B
*	0.097	98	Buildings
*	0.442	98	Parking Lot/Drive
	1.295	69	Weighted Average
	0.756		58.38% Pervious Area
	0.539		41.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0560	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
0.7	52	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.8	64	0.0670	1.29		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.8	46	0.0400	1.00		**Shallow Concentrated Flow, 4** Woodland Kv= 5.0 fps
0.0	8	0.1820	2.99		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0430	4.21		**Shallow Concentrated Flow, 6** Paved Kv= 20.3 fps
0.3	64	0.0250	3.21		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
0.2	46	0.0450	4.31		**Shallow Concentrated Flow, 8** Paved Kv= 20.3 fps
0.5	84	0.0210	2.94		**Shallow Concentrated Flow, 9** Paved Kv= 20.3 fps
1.2	16	0.0010	0.22		**Shallow Concentrated Flow, 10** Short Grass Pasture Kv= 7.0 fps
2.7	107	0.0180	0.67		**Shallow Concentrated Flow, 11** Woodland Kv= 5.0 fps
19.8	550	Total			

Summary for Subcatchment EX-C: Wetlands

Runoff = 8.61 cfs @ 12.18 hrs, Volume= 0.781 af, Depth> 1.06"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (NOAA) Rainfall=5.27"

	Area (ac)	CN	Description
	0.240	39	>75% Grass cover, Good, HSG A
	1.718	61	>75% Grass cover, Good, HSG B
	0.029	80	>75% Grass cover, Good, HSG D
	0.130	30	Brush, Good, HSG A
	0.149	48	Brush, Good, HSG B
	0.235	30	Woods, Good, HSG A
	6.028	55	Woods, Good, HSG B
*	0.054	98	Buildings
*	0.272	98	Parking Lot/Drive
	8.855	56	Weighted Average
	8.529		96.32% Pervious Area
	0.326		3.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.0280	0.22		**Sheet Flow, Sheet** Range n= 0.130 P2= 4.16"
0.3	11	0.0187	0.68		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.4	67	0.0246	2.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.6	127	0.0452	3.42		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
2.5	196	0.0665	1.29		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.0	152	0.0646	1.27		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
1.4	143	0.1200	1.73		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
11.0	746	Total			

Summary for Subcatchment EX-D: Woods

Runoff = 0.94 cfs @ 12.24 hrs, Volume= 0.089 af, Depth> 1.53"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (NOAA) Rainfall=5.27"

	Area (ac)	CN	Description
	0.300	61	>75% Grass cover, Good, HSG B
	0.337	58	Woods/grass comb., Good, HSG B
	0.057	96	Gravel surface, HSG B
*	0.004	98	Parking Lot / Drive
	0.698	63	Weighted Average
	0.694		99.43% Pervious Area
	0.004		0.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	50	0.0600	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.7	136	0.0730	1.35		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.7	57	0.0650	1.27		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.1	17	0.0784	1.96		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
0.8	49	0.0220	1.04		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.4	29	0.0348	1.31		**Shallow Concentrated Flow, 6** Short Grass Pasture Kv= 7.0 fps
0.4	62	0.0146	2.45		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
16.2	400	Total			

Summary for Link DP A: Roadway (West)

Inflow Area =	0.995 ac,	8.94% Impervious,	Inflow Depth > 1.53"	for 10-year (NOAA) event	
Inflow =	1.60 cfs @	12.15 hrs,	Volume=	0.127 af	
Primary =	1.60 cfs @	12.15 hrs,	Volume=	0.127 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area = 1.295 ac, 41.62% Impervious, Inflow Depth > 1.97" for 10-year (NOAA) event
Inflow = 2.16 cfs @ 12.29 hrs, Volume= 0.213 af
Primary = 2.16 cfs @ 12.29 hrs, Volume= 0.213 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area =	8.855 ac,	3.68% Impervious,	Inflow Depth > 1.06"	for 10-year (NOAA) event	
Inflow =	8.61 cfs @	12.18 hrs,	Volume=	0.781 af	
Primary =	8.61 cfs @	12.18 hrs,	Volume=	0.781 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area = 0.698 ac, 0.57% Impervious, Inflow Depth > 1.53" for 10-year (NOAA) event
Inflow = 0.94 cfs @ 12.24 hrs, Volume= 0.089 af
Primary = 0.94 cfs @ 12.24 hrs, Volume= 0.089 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX-A: West Runoff Area=0.995 ac 8.94% Impervious Runoff Depth>3.34"
Flow Length=450' Tc=9.9 min CN=63 Runoff=3.62 cfs 0.277 af

SubcatchmentEX-B: East Runoff Area=1.295 ac 41.62% Impervious Runoff Depth>3.98"
Flow Length=550' Tc=19.8 min CN=69 Runoff=4.39 cfs 0.429 af

SubcatchmentEX-C: Wetlands Runoff Area=8.855 ac 3.68% Impervious Runoff Depth>2.60"
Flow Length=746' Tc=11.0 min CN=56 Runoff=23.86 cfs 1.918 af

SubcatchmentEX-D: Woods Runoff Area=0.698 ac 0.57% Impervious Runoff Depth>3.33"
Flow Length=400' Tc=16.2 min CN=63 Runoff=2.13 cfs 0.194 af

Link DP A: Roadway (West) Inflow=3.62 cfs 0.277 af
Primary=3.62 cfs 0.277 af

Link DP B: Roadway (East) Inflow=4.39 cfs 0.429 af
Primary=4.39 cfs 0.429 af

Link DP C: Wetlands Inflow=23.86 cfs 1.918 af
Primary=23.86 cfs 1.918 af

Link DP D: Woods (West) Inflow=2.13 cfs 0.194 af
Primary=2.13 cfs 0.194 af

Total Runoff Area = 11.843 ac Runoff Volume = 2.818 af Average Runoff Depth = 2.86"
91.91% Pervious = 10.885 ac 8.09% Impervious = 0.958 ac

Summary for Subcatchment EX-A: West

Runoff = 3.62 cfs @ 12.15 hrs, Volume= 0.277 af, Depth> 3.34"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (2050) Rainfall=7.93"

	Area (ac)	CN	Description
	0.034	61	>75% Grass cover, Good, HSG B
	0.847	58	Woods/grass comb., Good, HSG B
	0.025	96	Gravel surface, HSG B
*	0.062	98	Buildings
*	0.027	98	Parking Lot/Drives
	0.995	63	Weighted Average
	0.906		91.06% Pervious Area
	0.089		8.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	50	0.0450	0.26		**Sheet Flow, 1** Range n= 0.130 P2= 4.16"
1.9	147	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.5	38	0.0540	1.16		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.4	49	0.0940	2.15		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
3.9	166	0.0205	0.72		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
9.9	450	Total			

Summary for Subcatchment EX-B: East

Runoff = 4.39 cfs @ 12.28 hrs, Volume= 0.429 af, Depth> 3.98"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (2050) Rainfall=7.93"

	Area (ac)	CN	Description
	0.151	39	>75% Grass cover, Good, HSG A
	0.114	61	>75% Grass cover, Good, HSG B
	0.156	30	Woods, Good, HSG A
	0.335	55	Woods, Good, HSG B
*	0.097	98	Buildings
*	0.442	98	Parking Lot/Drive
	1.295	69	Weighted Average
	0.756		58.38% Pervious Area
	0.539		41.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0560	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
0.7	52	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.8	64	0.0670	1.29		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.8	46	0.0400	1.00		**Shallow Concentrated Flow, 4** Woodland Kv= 5.0 fps
0.0	8	0.1820	2.99		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0430	4.21		**Shallow Concentrated Flow, 6** Paved Kv= 20.3 fps
0.3	64	0.0250	3.21		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
0.2	46	0.0450	4.31		**Shallow Concentrated Flow, 8** Paved Kv= 20.3 fps
0.5	84	0.0210	2.94		**Shallow Concentrated Flow, 9** Paved Kv= 20.3 fps
1.2	16	0.0010	0.22		**Shallow Concentrated Flow, 10** Short Grass Pasture Kv= 7.0 fps
2.7	107	0.0180	0.67		**Shallow Concentrated Flow, 11** Woodland Kv= 5.0 fps
19.8	550	Total			

Summary for Subcatchment EX-C: Wetlands

Runoff = 23.86 cfs @ 12.16 hrs, Volume= 1.918 af, Depth> 2.60"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (2050) Rainfall=7.93"

	Area (ac)	CN	Description
	0.240	39	>75% Grass cover, Good, HSG A
	1.718	61	>75% Grass cover, Good, HSG B
	0.029	80	>75% Grass cover, Good, HSG D
	0.130	30	Brush, Good, HSG A
	0.149	48	Brush, Good, HSG B
	0.235	30	Woods, Good, HSG A
	6.028	55	Woods, Good, HSG B
*	0.054	98	Buildings
*	0.272	98	Parking Lot/Drive
	8.855	56	Weighted Average
	8.529		96.32% Pervious Area
	0.326		3.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.0280	0.22		**Sheet Flow, Sheet** Range n= 0.130 P2= 4.16"
0.3	11	0.0187	0.68		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.4	67	0.0246	2.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.6	127	0.0452	3.42		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
2.5	196	0.0665	1.29		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.0	152	0.0646	1.27		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
1.4	143	0.1200	1.73		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
11.0	746	Total			

Summary for Subcatchment EX-D: Woods

Runoff = 2.13 cfs @ 12.23 hrs, Volume= 0.194 af, Depth> 3.33"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (2050) Rainfall=7.93"

	Area (ac)	CN	Description
	0.300	61	>75% Grass cover, Good, HSG B
	0.337	58	Woods/grass comb., Good, HSG B
	0.057	96	Gravel surface, HSG B
*	0.004	98	Parking Lot / Drive
	0.698	63	Weighted Average
	0.694		99.43% Pervious Area
	0.004		0.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	50	0.0600	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.7	136	0.0730	1.35		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.7	57	0.0650	1.27		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.1	17	0.0784	1.96		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
0.8	49	0.0220	1.04		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.4	29	0.0348	1.31		**Shallow Concentrated Flow, 6** Short Grass Pasture Kv= 7.0 fps
0.4	62	0.0146	2.45		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
16.2	400	Total			

Summary for Link DP A: Roadway (West)

Inflow Area =	0.995 ac,	8.94% Impervious, Inflow Depth > 3.34"	for 25-year (2050) event	
Inflow =	3.62 cfs @	12.15 hrs, Volume=	0.277 af	
Primary =	3.62 cfs @	12.15 hrs, Volume=	0.277 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area = 1.295 ac, 41.62% Impervious, Inflow Depth > 3.98" for 25-year (2050) event
Inflow = 4.39 cfs @ 12.28 hrs, Volume= 0.429 af
Primary = 4.39 cfs @ 12.28 hrs, Volume= 0.429 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area = 8.855 ac, 3.68% Impervious, Inflow Depth > 2.60" for 25-year (2050) event
Inflow = 23.86 cfs @ 12.16 hrs, Volume= 1.918 af
Primary = 23.86 cfs @ 12.16 hrs, Volume= 1.918 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area = 0.698 ac, 0.57% Impervious, Inflow Depth > 3.33" for 25-year (2050) event
Inflow = 2.13 cfs @ 12.23 hrs, Volume= 0.194 af
Primary = 2.13 cfs @ 12.23 hrs, Volume= 0.194 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX-A: West Runoff Area=0.995 ac 8.94% Impervious Runoff Depth>2.28"
Flow Length=450' Tc=9.9 min CN=63 Runoff=2.45 cfs 0.189 af

SubcatchmentEX-B: East Runoff Area=1.295 ac 41.62% Impervious Runoff Depth>2.82"
Flow Length=550' Tc=19.8 min CN=69 Runoff=3.11 cfs 0.304 af

SubcatchmentEX-C: Wetlands Runoff Area=8.855 ac 3.68% Impervious Runoff Depth>1.69"
Flow Length=746' Tc=11.0 min CN=56 Runoff=14.91 cfs 1.244 af

SubcatchmentEX-D: Woods Runoff Area=0.698 ac 0.57% Impervious Runoff Depth>2.28"
Flow Length=400' Tc=16.2 min CN=63 Runoff=1.44 cfs 0.132 af

Link DP A: Roadway (West) Inflow=2.45 cfs 0.189 af
Primary=2.45 cfs 0.189 af

Link DP B: Roadway (East) Inflow=3.11 cfs 0.304 af
Primary=3.11 cfs 0.304 af

Link DP C: Wetlands Inflow=14.91 cfs 1.244 af
Primary=14.91 cfs 1.244 af

Link DP D: Woods (West) Inflow=1.44 cfs 0.132 af
Primary=1.44 cfs 0.132 af

Total Runoff Area = 11.843 ac Runoff Volume = 1.871 af Average Runoff Depth = 1.90"
91.91% Pervious = 10.885 ac 8.09% Impervious = 0.958 ac

Summary for Subcatchment EX-A: West

Runoff = 2.45 cfs @ 12.15 hrs, Volume= 0.189 af, Depth> 2.28"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (NOAA) Rainfall=6.44"

	Area (ac)	CN	Description
	0.034	61	>75% Grass cover, Good, HSG B
	0.847	58	Woods/grass comb., Good, HSG B
	0.025	96	Gravel surface, HSG B
*	0.062	98	Buildings
*	0.027	98	Parking Lot/Drives
	0.995	63	Weighted Average
	0.906		91.06% Pervious Area
	0.089		8.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	50	0.0450	0.26		**Sheet Flow, 1** Range n= 0.130 P2= 4.16"
1.9	147	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.5	38	0.0540	1.16		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.4	49	0.0940	2.15		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
3.9	166	0.0205	0.72		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
9.9	450	Total			

Summary for Subcatchment EX-B: East

Runoff = 3.11 cfs @ 12.28 hrs, Volume= 0.304 af, Depth> 2.82"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (NOAA) Rainfall=6.44"

	Area (ac)	CN	Description
	0.151	39	>75% Grass cover, Good, HSG A
	0.114	61	>75% Grass cover, Good, HSG B
	0.156	30	Woods, Good, HSG A
	0.335	55	Woods, Good, HSG B
*	0.097	98	Buildings
*	0.442	98	Parking Lot/Drive
	1.295	69	Weighted Average
	0.756		58.38% Pervious Area
	0.539		41.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0560	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
0.7	52	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.8	64	0.0670	1.29		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.8	46	0.0400	1.00		**Shallow Concentrated Flow, 4** Woodland Kv= 5.0 fps
0.0	8	0.1820	2.99		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0430	4.21		**Shallow Concentrated Flow, 6** Paved Kv= 20.3 fps
0.3	64	0.0250	3.21		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
0.2	46	0.0450	4.31		**Shallow Concentrated Flow, 8** Paved Kv= 20.3 fps
0.5	84	0.0210	2.94		**Shallow Concentrated Flow, 9** Paved Kv= 20.3 fps
1.2	16	0.0010	0.22		**Shallow Concentrated Flow, 10** Short Grass Pasture Kv= 7.0 fps
2.7	107	0.0180	0.67		**Shallow Concentrated Flow, 11** Woodland Kv= 5.0 fps
19.8	550	Total			

Summary for Subcatchment EX-C: Wetlands

Runoff = 14.91 cfs @ 12.17 hrs, Volume= 1.244 af, Depth> 1.69"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (NOAA) Rainfall=6.44"

	Area (ac)	CN	Description
	0.240	39	>75% Grass cover, Good, HSG A
	1.718	61	>75% Grass cover, Good, HSG B
	0.029	80	>75% Grass cover, Good, HSG D
	0.130	30	Brush, Good, HSG A
	0.149	48	Brush, Good, HSG B
	0.235	30	Woods, Good, HSG A
	6.028	55	Woods, Good, HSG B
*	0.054	98	Buildings
*	0.272	98	Parking Lot/Drive
	8.855	56	Weighted Average
	8.529		96.32% Pervious Area
	0.326		3.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.0280	0.22		**Sheet Flow, Sheet** Range n= 0.130 P2= 4.16"
0.3	11	0.0187	0.68		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.4	67	0.0246	2.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.6	127	0.0452	3.42		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
2.5	196	0.0665	1.29		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.0	152	0.0646	1.27		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
1.4	143	0.1200	1.73		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
11.0	746	Total			

Summary for Subcatchment EX-D: Woods

Runoff = 1.44 cfs @ 12.24 hrs, Volume= 0.132 af, Depth> 2.28"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (NOAA) Rainfall=6.44"

	Area (ac)	CN	Description
	0.300	61	>75% Grass cover, Good, HSG B
	0.337	58	Woods/grass comb., Good, HSG B
	0.057	96	Gravel surface, HSG B
*	0.004	98	Parking Lot / Drive
	0.698	63	Weighted Average
	0.694		99.43% Pervious Area
	0.004		0.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	50	0.0600	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.7	136	0.0730	1.35		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.7	57	0.0650	1.27		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.1	17	0.0784	1.96		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
0.8	49	0.0220	1.04		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.4	29	0.0348	1.31		**Shallow Concentrated Flow, 6** Short Grass Pasture Kv= 7.0 fps
0.4	62	0.0146	2.45		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
16.2	400	Total			

Summary for Link DP A: Roadway (West)

Inflow Area =	0.995 ac,	8.94% Impervious, Inflow Depth > 2.28"		for 25-year (NOAA) event
Inflow =	2.45 cfs @	12.15 hrs, Volume=	0.189 af	
Primary =	2.45 cfs @	12.15 hrs, Volume=	0.189 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area =	1.295 ac, 41.62% Impervious, Inflow Depth > 2.82"	for 25-year (NOAA) event	
Inflow =	3.11 cfs @ 12.28 hrs, Volume=	0.304 af	
Primary =	3.11 cfs @ 12.28 hrs, Volume=	0.304 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area = 8.855 ac, 3.68% Impervious, Inflow Depth > 1.69" for 25-year (NOAA) event
Inflow = 14.91 cfs @ 12.17 hrs, Volume= 1.244 af
Primary = 14.91 cfs @ 12.17 hrs, Volume= 1.244 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area =	0.698 ac,	0.57% Impervious,	Inflow Depth > 2.28"	for 25-year (NOAA) event
Inflow =	1.44 cfs @	12.24 hrs, Volume=	0.132 af	
Primary =	1.44 cfs @	12.24 hrs, Volume=	0.132 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX-A: West	Runoff Area=0.995 ac 8.94% Impervious Runoff Depth>5.06" Flow Length=450' Tc=9.9 min CN=63 Runoff=5.49 cfs 0.420 af
SubcatchmentEX-B: East	Runoff Area=1.295 ac 41.62% Impervious Runoff Depth>5.82" Flow Length=550' Tc=19.8 min CN=69 Runoff=6.40 cfs 0.628 af
SubcatchmentEX-C: Wetlands	Runoff Area=8.855 ac 3.68% Impervious Runoff Depth>4.14" Flow Length=746' Tc=11.0 min CN=56 Runoff=38.75 cfs 3.057 af
SubcatchmentEX-D: Woods	Runoff Area=0.698 ac 0.57% Impervious Runoff Depth>5.05" Flow Length=400' Tc=16.2 min CN=63 Runoff=3.24 cfs 0.294 af
Link DP A: Roadway (West)	Inflow=5.49 cfs 0.420 af Primary=5.49 cfs 0.420 af
Link DP B: Roadway (East)	Inflow=6.40 cfs 0.628 af Primary=6.40 cfs 0.628 af
Link DP C: Wetlands	Inflow=38.75 cfs 3.057 af Primary=38.75 cfs 3.057 af
Link DP D: Woods (West)	Inflow=3.24 cfs 0.294 af Primary=3.24 cfs 0.294 af

Total Runoff Area = 11.843 ac Runoff Volume = 4.399 af Average Runoff Depth = 4.46"
91.91% Pervious = 10.885 ac 8.09% Impervious = 0.958 ac

Summary for Subcatchment EX-A: West

Runoff = 5.49 cfs @ 12.14 hrs, Volume= 0.420 af, Depth> 5.06"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (2050) Rainfall=10.17"

	Area (ac)	CN	Description
	0.034	61	>75% Grass cover, Good, HSG B
	0.847	58	Woods/grass comb., Good, HSG B
	0.025	96	Gravel surface, HSG B
*	0.062	98	Buildings
*	0.027	98	Parking Lot/Drives
	0.995	63	Weighted Average
	0.906		91.06% Pervious Area
	0.089		8.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	50	0.0450	0.26		**Sheet Flow, 1** Range n= 0.130 P2= 4.16"
1.9	147	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.5	38	0.0540	1.16		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.4	49	0.0940	2.15		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
3.9	166	0.0205	0.72		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
9.9	450	Total			

Summary for Subcatchment EX-B: East

Runoff = 6.40 cfs @ 12.27 hrs, Volume= 0.628 af, Depth> 5.82"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (2050) Rainfall=10.17"

	Area (ac)	CN	Description
	0.151	39	>75% Grass cover, Good, HSG A
	0.114	61	>75% Grass cover, Good, HSG B
	0.156	30	Woods, Good, HSG A
	0.335	55	Woods, Good, HSG B
*	0.097	98	Buildings
*	0.442	98	Parking Lot/Drive
	1.295	69	Weighted Average
	0.756		58.38% Pervious Area
	0.539		41.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0560	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
0.7	52	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.8	64	0.0670	1.29		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.8	46	0.0400	1.00		**Shallow Concentrated Flow, 4** Woodland Kv= 5.0 fps
0.0	8	0.1820	2.99		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0430	4.21		**Shallow Concentrated Flow, 6** Paved Kv= 20.3 fps
0.3	64	0.0250	3.21		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
0.2	46	0.0450	4.31		**Shallow Concentrated Flow, 8** Paved Kv= 20.3 fps
0.5	84	0.0210	2.94		**Shallow Concentrated Flow, 9** Paved Kv= 20.3 fps
1.2	16	0.0010	0.22		**Shallow Concentrated Flow, 10** Short Grass Pasture Kv= 7.0 fps
2.7	107	0.0180	0.67		**Shallow Concentrated Flow, 11** Woodland Kv= 5.0 fps
19.8	550	Total			

Summary for Subcatchment EX-C: Wetlands

Runoff = 38.75 cfs @ 12.16 hrs, Volume= 3.057 af, Depth> 4.14"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (2050) Rainfall=10.17"

	Area (ac)	CN	Description
	0.240	39	>75% Grass cover, Good, HSG A
	1.718	61	>75% Grass cover, Good, HSG B
	0.029	80	>75% Grass cover, Good, HSG D
	0.130	30	Brush, Good, HSG A
	0.149	48	Brush, Good, HSG B
	0.235	30	Woods, Good, HSG A
	6.028	55	Woods, Good, HSG B
*	0.054	98	Buildings
*	0.272	98	Parking Lot/Drive
	8.855	56	Weighted Average
	8.529		96.32% Pervious Area
	0.326		3.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.0280	0.22		**Sheet Flow, Sheet** Range n= 0.130 P2= 4.16"
0.3	11	0.0187	0.68		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.4	67	0.0246	2.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.6	127	0.0452	3.42		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
2.5	196	0.0665	1.29		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.0	152	0.0646	1.27		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
1.4	143	0.1200	1.73		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
11.0	746	Total			

Summary for Subcatchment EX-D: Woods

Runoff = 3.24 cfs @ 12.23 hrs, Volume= 0.294 af, Depth> 5.05"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (2050) Rainfall=10.17"

	Area (ac)	CN	Description
	0.300	61	>75% Grass cover, Good, HSG B
	0.337	58	Woods/grass comb., Good, HSG B
	0.057	96	Gravel surface, HSG B
*	0.004	98	Parking Lot / Drive
	0.698	63	Weighted Average
	0.694		99.43% Pervious Area
	0.004		0.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	50	0.0600	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.7	136	0.0730	1.35		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.7	57	0.0650	1.27		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.1	17	0.0784	1.96		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
0.8	49	0.0220	1.04		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.4	29	0.0348	1.31		**Shallow Concentrated Flow, 6** Short Grass Pasture Kv= 7.0 fps
0.4	62	0.0146	2.45		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
16.2	400	Total			

Summary for Link DP A: Roadway (West)

Inflow Area = 0.995 ac, 8.94% Impervious, Inflow Depth > 5.06" for 100-year (2050) event
Inflow = 5.49 cfs @ 12.14 hrs, Volume= 0.420 af
Primary = 5.49 cfs @ 12.14 hrs, Volume= 0.420 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area = 1.295 ac, 41.62% Impervious, Inflow Depth > 5.82" for 100-year (2050) event
Inflow = 6.40 cfs @ 12.27 hrs, Volume= 0.628 af
Primary = 6.40 cfs @ 12.27 hrs, Volume= 0.628 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area = 8.855 ac, 3.68% Impervious, Inflow Depth > 4.14" for 100-year (2050) event
Inflow = 38.75 cfs @ 12.16 hrs, Volume= 3.057 af
Primary = 38.75 cfs @ 12.16 hrs, Volume= 3.057 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area =	0.698 ac,	0.57% Impervious, Inflow Depth > 5.05"	for 100-year (2050) event	
Inflow =	3.24 cfs @	12.23 hrs, Volume=	0.294 af	
Primary =	3.24 cfs @	12.23 hrs, Volume=	0.294 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX-A: West Runoff Area=0.995 ac 8.94% Impervious Runoff Depth>3.58"
Flow Length=450' Tc=9.9 min CN=63 Runoff=3.89 cfs 0.297 af

SubcatchmentEX-B: East Runoff Area=1.295 ac 41.62% Impervious Runoff Depth>4.24"
Flow Length=550' Tc=19.8 min CN=69 Runoff=4.69 cfs 0.458 af

SubcatchmentEX-C: Wetlands Runoff Area=8.855 ac 3.68% Impervious Runoff Depth>2.82"
Flow Length=746' Tc=11.0 min CN=56 Runoff=25.96 cfs 2.078 af

SubcatchmentEX-D: Woods Runoff Area=0.698 ac 0.57% Impervious Runoff Depth>3.57"
Flow Length=400' Tc=16.2 min CN=63 Runoff=2.29 cfs 0.208 af

Link DP A: Roadway (West) Inflow=3.89 cfs 0.297 af
Primary=3.89 cfs 0.297 af

Link DP B: Roadway (East) Inflow=4.69 cfs 0.458 af
Primary=4.69 cfs 0.458 af

Link DP C: Wetlands Inflow=25.96 cfs 2.078 af
Primary=25.96 cfs 2.078 af

Link DP D: Woods (West) Inflow=2.29 cfs 0.208 af
Primary=2.29 cfs 0.208 af

Total Runoff Area = 11.843 ac Runoff Volume = 3.041 af Average Runoff Depth = 3.08"
91.91% Pervious = 10.885 ac 8.09% Impervious = 0.958 ac

Summary for Subcatchment EX-A: West

Runoff = 3.89 cfs @ 12.15 hrs, Volume= 0.297 af, Depth> 3.58"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (NOAA) Rainfall=8.26"

	Area (ac)	CN	Description
	0.034	61	>75% Grass cover, Good, HSG B
	0.847	58	Woods/grass comb., Good, HSG B
	0.025	96	Gravel surface, HSG B
*	0.062	98	Buildings
*	0.027	98	Parking Lot/Drives
	0.995	63	Weighted Average
	0.906		91.06% Pervious Area
	0.089		8.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	50	0.0450	0.26		**Sheet Flow, 1** Range n= 0.130 P2= 4.16"
1.9	147	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.5	38	0.0540	1.16		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.4	49	0.0940	2.15		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
3.9	166	0.0205	0.72		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
9.9	450	Total			

Summary for Subcatchment EX-B: East

Runoff = 4.69 cfs @ 12.27 hrs, Volume= 0.458 af, Depth> 4.24"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (NOAA) Rainfall=8.26"

	Area (ac)	CN	Description
	0.151	39	>75% Grass cover, Good, HSG A
	0.114	61	>75% Grass cover, Good, HSG B
	0.156	30	Woods, Good, HSG A
	0.335	55	Woods, Good, HSG B
*	0.097	98	Buildings
*	0.442	98	Parking Lot/Drive
	1.295	69	Weighted Average
	0.756		58.38% Pervious Area
	0.539		41.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0560	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
0.7	52	0.0640	1.26		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.8	64	0.0670	1.29		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.8	46	0.0400	1.00		**Shallow Concentrated Flow, 4** Woodland Kv= 5.0 fps
0.0	8	0.1820	2.99		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.1	13	0.0430	4.21		**Shallow Concentrated Flow, 6** Paved Kv= 20.3 fps
0.3	64	0.0250	3.21		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
0.2	46	0.0450	4.31		**Shallow Concentrated Flow, 8** Paved Kv= 20.3 fps
0.5	84	0.0210	2.94		**Shallow Concentrated Flow, 9** Paved Kv= 20.3 fps
1.2	16	0.0010	0.22		**Shallow Concentrated Flow, 10** Short Grass Pasture Kv= 7.0 fps
2.7	107	0.0180	0.67		**Shallow Concentrated Flow, 11** Woodland Kv= 5.0 fps
19.8	550	Total			

Summary for Subcatchment EX-C: Wetlands

Runoff = 25.96 cfs @ 12.16 hrs, Volume= 2.078 af, Depth> 2.82"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (NOAA) Rainfall=8.26"

	Area (ac)	CN	Description
	0.240	39	>75% Grass cover, Good, HSG A
	1.718	61	>75% Grass cover, Good, HSG B
	0.029	80	>75% Grass cover, Good, HSG D
	0.130	30	Brush, Good, HSG A
	0.149	48	Brush, Good, HSG B
	0.235	30	Woods, Good, HSG A
	6.028	55	Woods, Good, HSG B
*	0.054	98	Buildings
*	0.272	98	Parking Lot/Drive
	8.855	56	Weighted Average
	8.529		96.32% Pervious Area
	0.326		3.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.0280	0.22		**Sheet Flow, Sheet** Range n= 0.130 P2= 4.16"
0.3	11	0.0187	0.68		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.4	67	0.0246	2.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.6	127	0.0452	3.42		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
2.5	196	0.0665	1.29		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.0	152	0.0646	1.27		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
1.4	143	0.1200	1.73		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
11.0	746	Total			

Summary for Subcatchment EX-D: Woods

Runoff = 2.29 cfs @ 12.23 hrs, Volume= 0.208 af, Depth> 3.57"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (NOAA) Rainfall=8.26"

	Area (ac)	CN	Description
	0.300	61	>75% Grass cover, Good, HSG B
	0.337	58	Woods/grass comb., Good, HSG B
	0.057	96	Gravel surface, HSG B
*	0.004	98	Parking Lot / Drive
	0.698	63	Weighted Average
	0.694		99.43% Pervious Area
	0.004		0.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	50	0.0600	0.07		**Sheet Flow, 1** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.7	136	0.0730	1.35		**Shallow Concentrated Flow, 2** Woodland Kv= 5.0 fps
0.7	57	0.0650	1.27		**Shallow Concentrated Flow, 3** Woodland Kv= 5.0 fps
0.1	17	0.0784	1.96		**Shallow Concentrated Flow, 4** Short Grass Pasture Kv= 7.0 fps
0.8	49	0.0220	1.04		**Shallow Concentrated Flow, 5** Short Grass Pasture Kv= 7.0 fps
0.4	29	0.0348	1.31		**Shallow Concentrated Flow, 6** Short Grass Pasture Kv= 7.0 fps
0.4	62	0.0146	2.45		**Shallow Concentrated Flow, 7** Paved Kv= 20.3 fps
16.2	400	Total			

Summary for Link DP A: Roadway (West)

Inflow Area =	0.995 ac,	8.94% Impervious,	Inflow Depth > 3.58"	for 100-year (NOAA) event	
Inflow =	3.89 cfs @	12.15 hrs,	Volume=	0.297 af	
Primary =	3.89 cfs @	12.15 hrs,	Volume=	0.297 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area =	1.295 ac, 41.62% Impervious, Inflow Depth > 4.24"	for 100-year (NOAA) event	
Inflow =	4.69 cfs @ 12.27 hrs, Volume=	0.458 af	
Primary =	4.69 cfs @ 12.27 hrs, Volume=	0.458 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area =	8.855 ac,	3.68% Impervious,	Inflow Depth > 2.82"	for 100-year (NOAA) event	
Inflow =	25.96 cfs @	12.16 hrs,	Volume=	2.078 af	
Primary =	25.96 cfs @	12.16 hrs,	Volume=	2.078 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

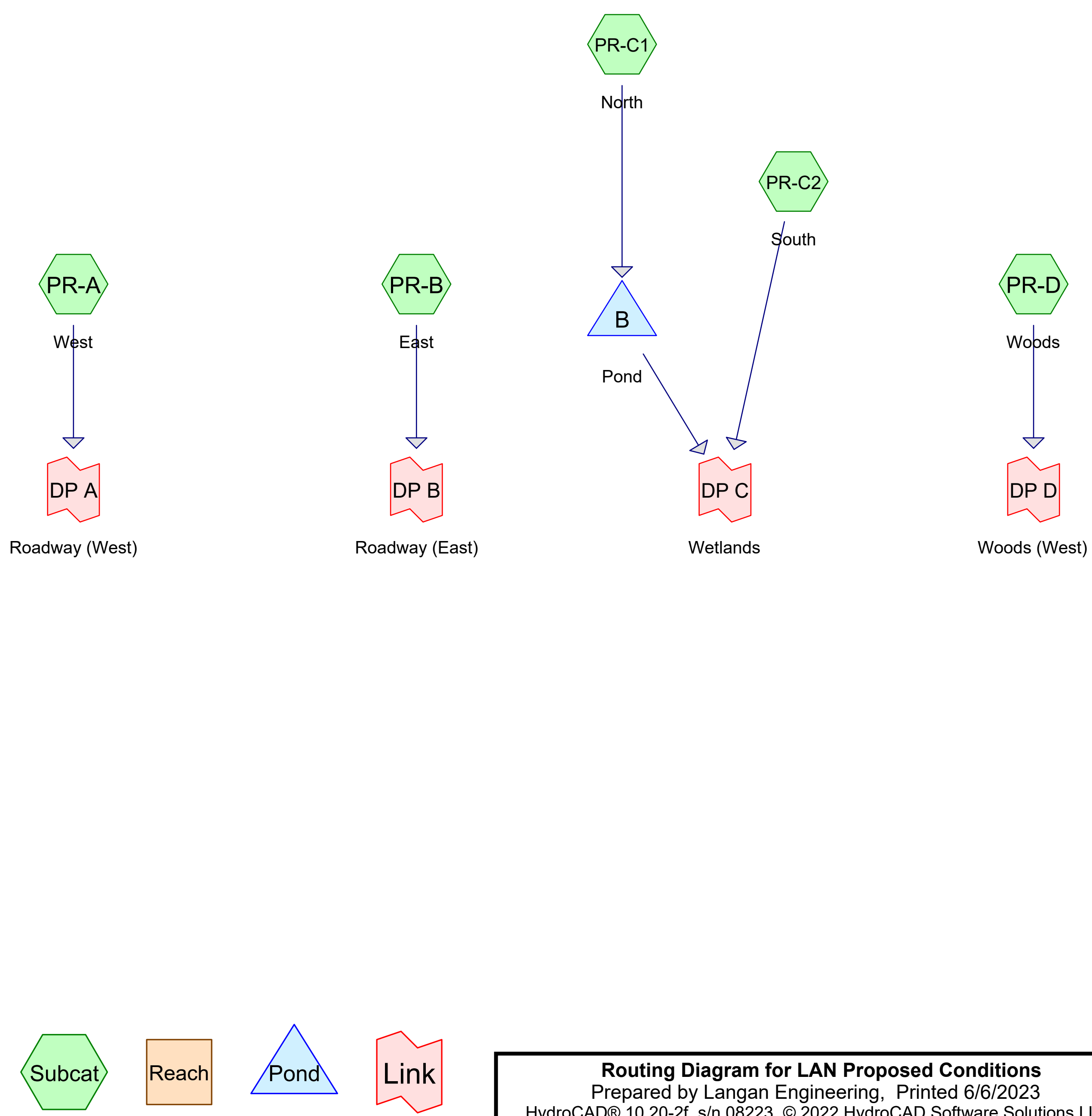
Inflow Area =	0.698 ac,	0.57% Impervious,	Inflow Depth > 3.57"	for 100-year (NOAA) event	
Inflow =	2.29 cfs @	12.23 hrs,	Volume=	0.208 af	
Primary =	2.29 cfs @	12.23 hrs,	Volume=	0.208 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

APPENDIX C

Proposed Stormwater Discharge Calculations

LANGAN



Routing Diagram for LAN Proposed Conditions
Prepared by Langan Engineering, Printed 6/6/2023
HydroCAD® 10.20-2f s/n 08223 © 2022 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.362	39	>75% Grass cover, Good, HSG A (PR-B, PR-C2)
2.339	61	>75% Grass cover, Good, HSG B (PR-A, PR-B, PR-C1, PR-C2, PR-D)
0.074	80	>75% Grass cover, Good, HSG D (PR-C2)
0.340	98	Concrete Pads, HSG A (PR-C1)
0.986	98	Concrete Pads, HSG B (PR-C1, PR-C2)
0.034	76	Gravel roads, HSG A (PR-B)
0.030	85	Gravel roads, HSG B (PR-A, PR-D)
0.363	96	Gravel surface, HSG A (PR-C1)
1.897	96	Gravel surface, HSG B (PR-A, PR-B, PR-C1, PR-C2, PR-D)
0.016	58	Meadow, non-grazed, HSG B (PR-C2)
0.105	98	Paved parking, HSG A (PR-B, PR-C1)
0.591	98	Paved parking, HSG B (PR-B, PR-C1, PR-C2, PR-D)
0.105	98	Paved roads w/curbs & sewers, HSG B (PR-A)
0.036	98	Unconnected roofs, HSG B (Substation Bldg Roof) (PR-C1)
4.565	55	Woods, Good, HSG B (PR-C2, PR-D)
11.843	**72**	**TOTAL AREA**

Time span=0.00-100.00 hrs, dt=0.05 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-A: West Runoff Area=0.438 ac 23.97% Impervious Runoff Depth=1.50"
Flow Length=199' Tc=6.0 min CN=71 Runoff=0.73 cfs 0.055 af

SubcatchmentPR-B: East Runoff Area=0.523 ac 19.69% Impervious Runoff Depth=1.24"
Flow Length=188' Tc=6.0 min CN=67 Runoff=0.70 cfs 0.054 af

SubcatchmentPR-C1: North Runoff Area=3.825 ac 47.06% Impervious Runoff Depth=3.27"
Flow Length=669' Tc=9.0 min CN=92 Runoff=12.57 cfs 1.043 af

SubcatchmentPR-C2: South Runoff Area=6.421 ac 2.24% Impervious Runoff Depth=0.90"
Flow Length=968' Tc=39.5 min CN=61 Runoff=2.81 cfs 0.479 af

SubcatchmentPR-D: Woods Runoff Area=0.636 ac 1.73% Impervious Runoff Depth=1.01"
Flow Length=537' Tc=18.7 min CN=63 Runoff=0.45 cfs 0.053 af

Pond B: Pond Peak Elev=243.03' Storage=26,574 cf Inflow=12.57 cfs 1.043 af
Discarded=0.51 cfs 1.002 af Primary=0.14 cfs 0.041 af Outflow=0.65 cfs 1.043 af

Link DP A: Roadway (West) Inflow=0.73 cfs 0.055 af
Primary=0.73 cfs 0.055 af

Link DP B: Roadway (East) Inflow=0.70 cfs 0.054 af
Primary=0.70 cfs 0.054 af

Link DP C: Wetlands Inflow=2.81 cfs 0.520 af
Primary=2.81 cfs 0.520 af

Link DP D: Woods (West) Inflow=0.45 cfs 0.053 af
Primary=0.45 cfs 0.053 af

Total Runoff Area = 11.843 ac Runoff Volume = 1.684 af Average Runoff Depth = 1.71"
81.74% Pervious = 9.680 ac 18.26% Impervious = 2.163 ac

Summary for Subcatchment PR-A: West

Runoff = 0.73 cfs @ 12.10 hrs, Volume= 0.055 af, Depth= 1.50"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (2050) Rainfall=4.16"

Area (ac)	CN	Description
0.320	61	>75% Grass cover, Good, HSG B
0.002	85	Gravel roads, HSG B
0.011	96	Gravel surface, HSG B
0.105	98	Paved roads w/curbs & sewers, HSG B
0.438	71	Weighted Average
0.333		76.03% Pervious Area
0.105		23.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0423	1.84		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	18	0.0535	4.70		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.1	26	0.0560	4.80		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	105	0.0419	4.16		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
1.1	199	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-B: East

Runoff = 0.70 cfs @ 12.10 hrs, Volume= 0.054 af, Depth= 1.24"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (2050) Rainfall=4.16"

Area (ac)	CN	Description
0.225	39	>75% Grass cover, Good, HSG A
0.057	61	>75% Grass cover, Good, HSG B
0.034	76	Gravel roads, HSG A
0.104	96	Gravel surface, HSG B
0.039	98	Paved parking, HSG A
0.064	98	Paved parking, HSG B
0.523	67	Weighted Average
0.420		80.31% Pervious Area
0.103		19.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	24	0.3500	3.70		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	28	0.0323	3.65		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	69	0.0234	3.11		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.3	67	0.0302	3.53		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.9	188	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-C1: North

Runoff = 12.57 cfs @ 12.12 hrs, Volume= 1.043 af, Depth= 3.27"
Routed to Pond B : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (2050) Rainfall=4.16"

	Area (ac)	CN	Description
	0.554	61	>75% Grass cover, Good, HSG B
	0.363	96	Gravel surface, HSG A
	1.108	96	Gravel surface, HSG B
*	0.036	98	Unconnected roofs, HSG B (Substation Bldg Roof)
	0.066	98	Paved parking, HSG A
	0.403	98	Paved parking, HSG B
*	0.340	98	Concrete Pads, HSG A
*	0.955	98	Concrete Pads, HSG B
	3.825	92	Weighted Average
	2.025		52.94% Pervious Area
	1.800		47.06% Impervious Area
	0.036		2.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0158	1.24		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.7	85	0.0158	2.02		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
1.3	200	0.0158	2.55		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.2	17	0.0090	1.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
3.0	118	0.0100	0.66	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
2.0	144	0.0343	1.22	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
1.1	55	0.0163	0.84	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
9.0	669	Total			

Summary for Subcatchment PR-C2: South

Runoff = 2.81 cfs @ 12.64 hrs, Volume= 0.479 af, Depth= 0.90"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (2050) Rainfall=4.16"

	Area (ac)	CN	Description
	0.137	39	>75% Grass cover, Good, HSG A
	1.238	61	>75% Grass cover, Good, HSG B
	0.074	80	>75% Grass cover, Good, HSG D
	3.928	55	Woods, Good, HSG B
	0.279	55	Woods, Good, HSG B
	0.605	96	Gravel surface, HSG B
	0.113	98	Paved parking, HSG B
*	0.031	98	Concrete Pads, HSG B
	0.016	58	Meadow, non-grazed, HSG B
	6.421	61	Weighted Average
	6.277		97.76% Pervious Area
	0.144		2.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	50	0.0060	0.03		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
3.8	157	0.0191	0.69		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.8	58	0.0600	1.22		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.2	28	0.3570	2.99		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.8	514	0.0260	3.11	15.54	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.3	77	0.0439	4.04	20.19	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.1	32	0.0414	3.92	19.61	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
1.0	52	0.0191	0.91	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
39.5	968	Total			

Summary for Subcatchment PR-D: Woods

Runoff = 0.45 cfs @ 12.30 hrs, Volume= 0.053 af, Depth= 1.01"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (2050) Rainfall=4.16"

Area (ac)	CN	Description
0.170	61	>75% Grass cover, Good, HSG B
0.358	55	Woods, Good, HSG B
0.069	96	Gravel surface, HSG B
0.028	85	Gravel roads, HSG B
0.011	98	Paved parking, HSG B
0.636	63	Weighted Average
0.625		98.27% Pervious Area
0.011		1.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	50	0.0400	0.06		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.3	66	0.0300	0.87		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.1	12	0.1630	2.83		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.1	6	0.0064	1.29		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.5	175	0.0308	5.64	28.18	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.1	60	0.0502	7.20	35.98	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.4	45	0.0775	1.95		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
1.3	84	0.0237	1.08		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.6	39	0.0259	1.13		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
18.7	537	Total			

Summary for Pond B: Pond

Inflow Area = 3.825 ac, 47.06% Impervious, Inflow Depth = 3.27" for 2-year (2050) event
Inflow = 12.57 cfs @ 12.12 hrs, Volume= 1.043 af
Outflow = 0.65 cfs @ 14.74 hrs, Volume= 1.043 af, Atten= 95%, Lag= 156.9 min
Discarded = 0.51 cfs @ 14.74 hrs, Volume= 1.002 af
Primary = 0.14 cfs @ 14.74 hrs, Volume= 0.041 af
Routed to Link DP C : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Peak Elev= 243.03' @ 14.74 hrs Surf.Area= 14,988 sf Storage= 26,574 cf

Plug-Flow detention time= 546.6 min calculated for 1.043 af (100% of inflow)
Center-of-Mass det. time= 546.8 min (1,338.3 - 791.4)

Volume	Invert	Avail.Storage	Storage Description
#1	241.00'	90,440 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
241.00	11,283	0	0
242.00	13,082	12,183	12,183
243.00	14,939	14,011	26,193
244.00	16,851	15,895	42,088
245.00	18,821	17,836	59,924
246.00	20,847	19,834	79,758
246.50	21,881	10,682	90,440

Device	Routing	Invert	Outlet Devices
#1	Primary	237.50'	**24.0" Round Culvert** L= 89.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 237.50' / 234.50' S= 0.0337 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	242.80'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	243.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	244.90'	**4.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Discarded	241.00'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 237.00' Phase-In= 0.01'

Discarded OutFlow Max=0.51 cfs @ 14.74 hrs HW=243.03' (Free Discharge)
└─**5=Exfiltration** (Controls 0.51 cfs)

Primary OutFlow Max=0.14 cfs @ 14.74 hrs HW=243.03' (Free Discharge)
└─**1=Culvert** (Passes 0.14 cfs of 40.22 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.14 cfs @ 1.62 fps)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP A: Roadway (West)

Inflow Area = 0.438 ac, 23.97% Impervious, Inflow Depth = 1.50" for 2-year (2050) event
Inflow = 0.73 cfs @ 12.10 hrs, Volume= 0.055 af
Primary = 0.73 cfs @ 12.10 hrs, Volume= 0.055 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area =	0.523 ac,	19.69% Impervious,	Inflow Depth = 1.24"	for 2-year (2050) event
Inflow =	0.70 cfs @	12.10 hrs, Volume=	0.054 af	
Primary =	0.70 cfs @	12.10 hrs, Volume=	0.054 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area =	10.246 ac,	18.97% Impervious,	Inflow Depth = 0.61"	for 2-year (2050) event	
Inflow =	2.81 cfs @	12.64 hrs,	Volume=	0.520 af	
Primary =	2.81 cfs @	12.64 hrs,	Volume=	0.520 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area = 0.636 ac, 1.73% Impervious, Inflow Depth = 1.01" for 2-year (2050) event
Inflow = 0.45 cfs @ 12.30 hrs, Volume= 0.053 af
Primary = 0.45 cfs @ 12.30 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Time span=0.00-100.00 hrs, dt=0.05 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-A: West Runoff Area=0.438 ac 23.97% Impervious Runoff Depth=0.99"
Flow Length=199' Tc=6.0 min CN=71 Runoff=0.46 cfs 0.036 af

SubcatchmentPR-B: East Runoff Area=0.523 ac 19.69% Impervious Runoff Depth=0.78"
Flow Length=188' Tc=6.0 min CN=67 Runoff=0.41 cfs 0.034 af

SubcatchmentPR-C1: North Runoff Area=3.825 ac 47.06% Impervious Runoff Depth=2.52"
Flow Length=669' Tc=9.0 min CN=92 Runoff=9.81 cfs 0.804 af

SubcatchmentPR-C2: South Runoff Area=6.421 ac 2.24% Impervious Runoff Depth=0.52"
Flow Length=968' Tc=39.5 min CN=61 Runoff=1.40 cfs 0.278 af

SubcatchmentPR-D: Woods Runoff Area=0.636 ac 1.73% Impervious Runoff Depth=0.60"
Flow Length=537' Tc=18.7 min CN=63 Runoff=0.23 cfs 0.032 af

Pond B: Pond Peak Elev=242.58' Storage=20,126 cf Inflow=9.81 cfs 0.804 af
Discarded=0.45 cfs 0.804 af Primary=0.00 cfs 0.000 af Outflow=0.45 cfs 0.804 af

Link DP A: Roadway (West) Inflow=0.46 cfs 0.036 af
Primary=0.46 cfs 0.036 af

Link DP B: Roadway (East) Inflow=0.41 cfs 0.034 af
Primary=0.41 cfs 0.034 af

Link DP C: Wetlands Inflow=1.40 cfs 0.278 af
Primary=1.40 cfs 0.278 af

Link DP D: Woods (West) Inflow=0.23 cfs 0.032 af
Primary=0.23 cfs 0.032 af

Total Runoff Area = 11.843 ac Runoff Volume = 1.184 af Average Runoff Depth = 1.20"
81.74% Pervious = 9.680 ac 18.26% Impervious = 2.163 ac

Summary for Subcatchment PR-A: West

Runoff = 0.46 cfs @ 12.10 hrs, Volume= 0.036 af, Depth= 0.99"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (NOAA) Rainfall=3.38"

Area (ac)	CN	Description
0.320	61	>75% Grass cover, Good, HSG B
0.002	85	Gravel roads, HSG B
0.011	96	Gravel surface, HSG B
0.105	98	Paved roads w/curbs & sewers, HSG B
0.438	71	Weighted Average
0.333		76.03% Pervious Area
0.105		23.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0423	1.84		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	18	0.0535	4.70		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.1	26	0.0560	4.80		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	105	0.0419	4.16		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
1.1	199	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-B: East

Runoff = 0.41 cfs @ 12.11 hrs, Volume= 0.034 af, Depth= 0.78"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (NOAA) Rainfall=3.38"

Area (ac)	CN	Description
0.225	39	>75% Grass cover, Good, HSG A
0.057	61	>75% Grass cover, Good, HSG B
0.034	76	Gravel roads, HSG A
0.104	96	Gravel surface, HSG B
0.039	98	Paved parking, HSG A
0.064	98	Paved parking, HSG B
0.523	67	Weighted Average
0.420		80.31% Pervious Area
0.103		19.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	24	0.3500	3.70		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	28	0.0323	3.65		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	69	0.0234	3.11		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.3	67	0.0302	3.53		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.9	188	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-C1: North

Runoff = 9.81 cfs @ 12.12 hrs, Volume= 0.804 af, Depth= 2.52"
Routed to Pond B : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (NOAA) Rainfall=3.38"

	Area (ac)	CN	Description
	0.554	61	>75% Grass cover, Good, HSG B
	0.363	96	Gravel surface, HSG A
	1.108	96	Gravel surface, HSG B
*	0.036	98	Unconnected roofs, HSG B (Substation Bldg Roof)
	0.066	98	Paved parking, HSG A
	0.403	98	Paved parking, HSG B
*	0.340	98	Concrete Pads, HSG A
*	0.955	98	Concrete Pads, HSG B
	3.825	92	Weighted Average
	2.025		52.94% Pervious Area
	1.800		47.06% Impervious Area
	0.036		2.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0158	1.24		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.7	85	0.0158	2.02		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
1.3	200	0.0158	2.55		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.2	17	0.0090	1.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
3.0	118	0.0100	0.66	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
2.0	144	0.0343	1.22	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
1.1	55	0.0163	0.84	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
9.0	669	Total			

Summary for Subcatchment PR-C2: South

Runoff = 1.40 cfs @ 12.69 hrs, Volume= 0.278 af, Depth= 0.52"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (NOAA) Rainfall=3.38"

	Area (ac)	CN	Description
	0.137	39	>75% Grass cover, Good, HSG A
	1.238	61	>75% Grass cover, Good, HSG B
	0.074	80	>75% Grass cover, Good, HSG D
	3.928	55	Woods, Good, HSG B
	0.279	55	Woods, Good, HSG B
	0.605	96	Gravel surface, HSG B
	0.113	98	Paved parking, HSG B
*	0.031	98	Concrete Pads, HSG B
	0.016	58	Meadow, non-grazed, HSG B
	6.421	61	Weighted Average
	6.277		97.76% Pervious Area
	0.144		2.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	50	0.0060	0.03		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
3.8	157	0.0191	0.69		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.8	58	0.0600	1.22		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.2	28	0.3570	2.99		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.8	514	0.0260	3.11	15.54	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.3	77	0.0439	4.04	20.19	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.1	32	0.0414	3.92	19.61	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
1.0	52	0.0191	0.91	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
39.5	968	Total			

Summary for Subcatchment PR-D: Woods

Runoff = 0.23 cfs @ 12.33 hrs, Volume= 0.032 af, Depth= 0.60"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year (NOAA) Rainfall=3.38"

Area (ac)	CN	Description
0.170	61	>75% Grass cover, Good, HSG B
0.358	55	Woods, Good, HSG B
0.069	96	Gravel surface, HSG B
0.028	85	Gravel roads, HSG B
0.011	98	Paved parking, HSG B
0.636	63	Weighted Average
0.625		98.27% Pervious Area
0.011		1.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	50	0.0400	0.06		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.3	66	0.0300	0.87		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.1	12	0.1630	2.83		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.1	6	0.0064	1.29		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.5	175	0.0308	5.64	28.18	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.1	60	0.0502	7.20	35.98	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.4	45	0.0775	1.95		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
1.3	84	0.0237	1.08		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.6	39	0.0259	1.13		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
18.7	537	Total			

Summary for Pond B: Pond

Inflow Area = 3.825 ac, 47.06% Impervious, Inflow Depth = 2.52" for 2-year (NOAA) event
Inflow = 9.81 cfs @ 12.12 hrs, Volume= 0.804 af
Outflow = 0.45 cfs @ 15.20 hrs, Volume= 0.804 af, Atten= 95%, Lag= 184.7 min
Discarded = 0.45 cfs @ 15.20 hrs, Volume= 0.804 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP C : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Peak Elev= 242.58' @ 15.20 hrs Surf.Area= 14,165 sf Storage= 20,126 cf

Plug-Flow detention time= 482.7 min calculated for 0.804 af (100% of inflow)
Center-of-Mass det. time= 482.9 min (1,281.5 - 798.6)

Volume	Invert	Avail.Storage	Storage Description
#1	241.00'	90,440 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
241.00	11,283	0	0
242.00	13,082	12,183	12,183
243.00	14,939	14,011	26,193
244.00	16,851	15,895	42,088
245.00	18,821	17,836	59,924
246.00	20,847	19,834	79,758
246.50	21,881	10,682	90,440

Device	Routing	Invert	Outlet Devices
#1	Primary	237.50'	**24.0" Round Culvert** L= 89.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 237.50' / 234.50' S= 0.0337 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	242.80'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	243.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	244.90'	**4.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Discarded	241.00'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 237.00' Phase-In= 0.01'

Discarded OutFlow Max=0.45 cfs @ 15.20 hrs HW=242.58' (Free Discharge)
└─**5=Exfiltration** (Controls 0.45 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=241.00' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 29.90 cfs potential flow)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP A: Roadway (West)

Inflow Area =	0.438 ac,	23.97% Impervious, Inflow Depth = 0.99"	for 2-year (NOAA) event	
Inflow =	0.46 cfs @	12.10 hrs, Volume=	0.036 af	
Primary =	0.46 cfs @	12.10 hrs, Volume=	0.036 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area =	0.523 ac, 19.69% Impervious, Inflow Depth = 0.78"	for 2-year (NOAA) event	
Inflow =	0.41 cfs @ 12.11 hrs, Volume=	0.034 af	
Primary =	0.41 cfs @ 12.11 hrs, Volume=	0.034 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area =	10.246 ac, 18.97% Impervious, Inflow Depth = 0.33"	for 2-year (NOAA) event
Inflow =	1.40 cfs @ 12.69 hrs, Volume=	0.278 af
Primary =	1.40 cfs @ 12.69 hrs, Volume=	0.278 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area = 0.636 ac, 1.73% Impervious, Inflow Depth = 0.60" for 2-year (NOAA) event
Inflow = 0.23 cfs @ 12.33 hrs, Volume= 0.032 af
Primary = 0.23 cfs @ 12.33 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Time span=0.00-100.00 hrs, dt=0.05 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-A: West Runoff Area=0.438 ac 23.97% Impervious Runoff Depth=3.30"
Flow Length=199' Tc=6.0 min CN=71 Runoff=1.66 cfs 0.120 af

SubcatchmentPR-B: East Runoff Area=0.523 ac 19.69% Impervious Runoff Depth=2.91"
Flow Length=188' Tc=6.0 min CN=67 Runoff=1.73 cfs 0.127 af

SubcatchmentPR-C1: North Runoff Area=3.825 ac 47.06% Impervious Runoff Depth=5.55"
Flow Length=669' Tc=9.0 min CN=92 Runoff=20.72 cfs 1.770 af

SubcatchmentPR-C2: South Runoff Area=6.421 ac 2.24% Impervious Runoff Depth=2.34"
Flow Length=968' Tc=39.5 min CN=61 Runoff=8.39 cfs 1.252 af

SubcatchmentPR-D: Woods Runoff Area=0.636 ac 1.73% Impervious Runoff Depth=2.53"
Flow Length=537' Tc=18.7 min CN=63 Runoff=1.27 cfs 0.134 af

Pond B: Pond Peak Elev=243.99' Storage=41,911 cf Inflow=20.72 cfs 1.770 af
Discarded=0.63 cfs 1.233 af Primary=1.38 cfs 0.537 af Outflow=2.01 cfs 1.770 af

Link DP A: Roadway (West) Inflow=1.66 cfs 0.120 af
Primary=1.66 cfs 0.120 af

Link DP B: Roadway (East) Inflow=1.73 cfs 0.127 af
Primary=1.73 cfs 0.127 af

Link DP C: Wetlands Inflow=9.67 cfs 1.789 af
Primary=9.67 cfs 1.789 af

Link DP D: Woods (West) Inflow=1.27 cfs 0.134 af
Primary=1.27 cfs 0.134 af

Total Runoff Area = 11.843 ac Runoff Volume = 3.403 af Average Runoff Depth = 3.45"
81.74% Pervious = 9.680 ac 18.26% Impervious = 2.163 ac

Summary for Subcatchment PR-A: West

Runoff = 1.66 cfs @ 12.09 hrs, Volume= 0.120 af, Depth= 3.30"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (2050) Rainfall=6.49"

Area (ac)	CN	Description
0.320	61	>75% Grass cover, Good, HSG B
0.002	85	Gravel roads, HSG B
0.011	96	Gravel surface, HSG B
0.105	98	Paved roads w/curbs & sewers, HSG B
0.438	71	Weighted Average
0.333		76.03% Pervious Area
0.105		23.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0423	1.84		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	18	0.0535	4.70		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.1	26	0.0560	4.80		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	105	0.0419	4.16		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
1.1	199	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-B: East

Runoff = 1.73 cfs @ 12.10 hrs, Volume= 0.127 af, Depth= 2.91"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (2050) Rainfall=6.49"

Area (ac)	CN	Description
0.225	39	>75% Grass cover, Good, HSG A
0.057	61	>75% Grass cover, Good, HSG B
0.034	76	Gravel roads, HSG A
0.104	96	Gravel surface, HSG B
0.039	98	Paved parking, HSG A
0.064	98	Paved parking, HSG B
0.523	67	Weighted Average
0.420		80.31% Pervious Area
0.103		19.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	24	0.3500	3.70		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	28	0.0323	3.65		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	69	0.0234	3.11		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.3	67	0.0302	3.53		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.9	188	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-C1: North

Runoff = 20.72 cfs @ 12.12 hrs, Volume= 1.770 af, Depth= 5.55"
Routed to Pond B : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (2050) Rainfall=6.49"

	Area (ac)	CN	Description
	0.554	61	>75% Grass cover, Good, HSG B
	0.363	96	Gravel surface, HSG A
	1.108	96	Gravel surface, HSG B
*	0.036	98	Unconnected roofs, HSG B (Substation Bldg Roof)
	0.066	98	Paved parking, HSG A
	0.403	98	Paved parking, HSG B
*	0.340	98	Concrete Pads, HSG A
*	0.955	98	Concrete Pads, HSG B
	3.825	92	Weighted Average
	2.025		52.94% Pervious Area
	1.800		47.06% Impervious Area
	0.036		2.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0158	1.24		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.7	85	0.0158	2.02		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
1.3	200	0.0158	2.55		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.2	17	0.0090	1.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
3.0	118	0.0100	0.66	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
2.0	144	0.0343	1.22	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
1.1	55	0.0163	0.84	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
9.0	669	Total			

Summary for Subcatchment PR-C2: South

Runoff = 8.39 cfs @ 12.58 hrs, Volume= 1.252 af, Depth= 2.34"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (2050) Rainfall=6.49"

	Area (ac)	CN	Description
	0.137	39	>75% Grass cover, Good, HSG A
	1.238	61	>75% Grass cover, Good, HSG B
	0.074	80	>75% Grass cover, Good, HSG D
	3.928	55	Woods, Good, HSG B
	0.279	55	Woods, Good, HSG B
	0.605	96	Gravel surface, HSG B
	0.113	98	Paved parking, HSG B
*	0.031	98	Concrete Pads, HSG B
	0.016	58	Meadow, non-grazed, HSG B
	6.421	61	Weighted Average
	6.277		97.76% Pervious Area
	0.144		2.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	50	0.0060	0.03		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
3.8	157	0.0191	0.69		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.8	58	0.0600	1.22		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.2	28	0.3570	2.99		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.8	514	0.0260	3.11	15.54	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.3	77	0.0439	4.04	20.19	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.1	32	0.0414	3.92	19.61	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
1.0	52	0.0191	0.91	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
39.5	968	Total			

Summary for Subcatchment PR-D: Woods

Runoff = 1.27 cfs @ 12.27 hrs, Volume= 0.134 af, Depth= 2.53"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (2050) Rainfall=6.49"

Area (ac)	CN	Description
0.170	61	>75% Grass cover, Good, HSG B
0.358	55	Woods, Good, HSG B
0.069	96	Gravel surface, HSG B
0.028	85	Gravel roads, HSG B
0.011	98	Paved parking, HSG B
0.636	63	Weighted Average
0.625		98.27% Pervious Area
0.011		1.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	50	0.0400	0.06		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.3	66	0.0300	0.87		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.1	12	0.1630	2.83		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.1	6	0.0064	1.29		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.5	175	0.0308	5.64	28.18	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.1	60	0.0502	7.20	35.98	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.4	45	0.0775	1.95		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
1.3	84	0.0237	1.08		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.6	39	0.0259	1.13		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
18.7	537	Total			

Summary for Pond B: Pond

Inflow Area = 3.825 ac, 47.06% Impervious, Inflow Depth = 5.55" for 10-year (2050) event
Inflow = 20.72 cfs @ 12.12 hrs, Volume= 1.770 af
Outflow = 2.01 cfs @ 13.04 hrs, Volume= 1.770 af, Atten= 90%, Lag= 54.8 min
Discarded = 0.63 cfs @ 13.04 hrs, Volume= 1.233 af
Primary = 1.38 cfs @ 13.04 hrs, Volume= 0.537 af
Routed to Link DP C : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Peak Elev= 243.99' @ 13.04 hrs Surf.Area= 16,831 sf Storage= 41,911 cf

Plug-Flow detention time= 457.3 min calculated for 1.769 af (100% of inflow)
Center-of-Mass det. time= 457.6 min (1,235.3 - 777.6)

Volume	Invert	Avail.Storage	Storage Description
#1	241.00'	90,440 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
241.00	11,283	0	0
242.00	13,082	12,183	12,183
243.00	14,939	14,011	26,193
244.00	16,851	15,895	42,088
245.00	18,821	17,836	59,924
246.00	20,847	19,834	79,758
246.50	21,881	10,682	90,440

Device	Routing	Invert	Outlet Devices
#1	Primary	237.50'	**24.0" Round Culvert** L= 89.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 237.50' / 234.50' S= 0.0337 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	242.80'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	243.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	244.90'	**4.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Discarded	241.00'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 237.00' Phase-In= 0.01'

Discarded OutFlow Max=0.63 cfs @ 13.04 hrs HW=243.99' (Free Discharge)
└─**5=Exfiltration** (Controls 0.63 cfs)

Primary OutFlow Max=1.38 cfs @ 13.04 hrs HW=243.99' (Free Discharge)
└─**1=Culvert** (Passes 1.38 cfs of 44.30 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.92 cfs @ 4.67 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.47 cfs @ 2.38 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP A: Roadway (West)

Inflow Area = 0.438 ac, 23.97% Impervious, Inflow Depth = 3.30" for 10-year (2050) event
Inflow = 1.66 cfs @ 12.09 hrs, Volume= 0.120 af
Primary = 1.66 cfs @ 12.09 hrs, Volume= 0.120 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area = 0.523 ac, 19.69% Impervious, Inflow Depth = 2.91" for 10-year (2050) event
Inflow = 1.73 cfs @ 12.10 hrs, Volume= 0.127 af
Primary = 1.73 cfs @ 12.10 hrs, Volume= 0.127 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area =	10.246 ac,	18.97% Impervious,	Inflow Depth = 2.09"	for 10-year (2050) event	
Inflow =	9.67 cfs @	12.59 hrs,	Volume=	1.789 af	
Primary =	9.67 cfs @	12.59 hrs,	Volume=	1.789 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area =	0.636 ac,	1.73% Impervious,	Inflow Depth = 2.53"	for 10-year (2050) event	
Inflow =	1.27 cfs @	12.27 hrs,	Volume=	0.134 af	
Primary =	1.27 cfs @	12.27 hrs,	Volume=	0.134 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Time span=0.00-100.00 hrs, dt=0.05 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-A: West Runoff Area=0.438 ac 23.97% Impervious Runoff Depth=2.32"
Flow Length=199' Tc=6.0 min CN=71 Runoff=1.16 cfs 0.085 af

SubcatchmentPR-B: East Runoff Area=0.523 ac 19.69% Impervious Runoff Depth=1.99"
Flow Length=188' Tc=6.0 min CN=67 Runoff=1.17 cfs 0.087 af

SubcatchmentPR-C1: North Runoff Area=3.825 ac 47.06% Impervious Runoff Depth=4.35"
Flow Length=669' Tc=9.0 min CN=92 Runoff=16.47 cfs 1.388 af

SubcatchmentPR-C2: South Runoff Area=6.421 ac 2.24% Impervious Runoff Depth=1.53"
Flow Length=968' Tc=39.5 min CN=61 Runoff=5.28 cfs 0.821 af

SubcatchmentPR-D: Woods Runoff Area=0.636 ac 1.73% Impervious Runoff Depth=1.68"
Flow Length=537' Tc=18.7 min CN=63 Runoff=0.81 cfs 0.089 af

Pond B: Pond Peak Elev=243.48' Storage=33,659 cf Inflow=16.47 cfs 1.388 af
Discarded=0.57 cfs 1.129 af Primary=0.62 cfs 0.259 af Outflow=1.19 cfs 1.388 af

Link DP A: Roadway (West) Inflow=1.16 cfs 0.085 af
Primary=1.16 cfs 0.085 af

Link DP B: Roadway (East) Inflow=1.17 cfs 0.087 af
Primary=1.17 cfs 0.087 af

Link DP C: Wetlands Inflow=5.81 cfs 1.080 af
Primary=5.81 cfs 1.080 af

Link DP D: Woods (West) Inflow=0.81 cfs 0.089 af
Primary=0.81 cfs 0.089 af

Total Runoff Area = 11.843 ac Runoff Volume = 2.469 af Average Runoff Depth = 2.50"
81.74% Pervious = 9.680 ac 18.26% Impervious = 2.163 ac

Summary for Subcatchment PR-A: West

Runoff = 1.16 cfs @ 12.10 hrs, Volume= 0.085 af, Depth= 2.32"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (NOAA) Rainfall=5.27"

Area (ac)	CN	Description
0.320	61	>75% Grass cover, Good, HSG B
0.002	85	Gravel roads, HSG B
0.011	96	Gravel surface, HSG B
0.105	98	Paved roads w/curbs & sewers, HSG B
0.438	71	Weighted Average
0.333		76.03% Pervious Area
0.105		23.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0423	1.84		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	18	0.0535	4.70		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.1	26	0.0560	4.80		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	105	0.0419	4.16		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
1.1	199	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-B: East

Runoff = 1.17 cfs @ 12.10 hrs, Volume= 0.087 af, Depth= 1.99"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (NOAA) Rainfall=5.27"

Area (ac)	CN	Description
0.225	39	>75% Grass cover, Good, HSG A
0.057	61	>75% Grass cover, Good, HSG B
0.034	76	Gravel roads, HSG A
0.104	96	Gravel surface, HSG B
0.039	98	Paved parking, HSG A
0.064	98	Paved parking, HSG B
0.523	67	Weighted Average
0.420		80.31% Pervious Area
0.103		19.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	24	0.3500	3.70		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	28	0.0323	3.65		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	69	0.0234	3.11		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.3	67	0.0302	3.53		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.9	188	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-C1: North

Runoff = 16.47 cfs @ 12.12 hrs, Volume= 1.388 af, Depth= 4.35"
Routed to Pond B : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (NOAA) Rainfall=5.27"

	Area (ac)	CN	Description
	0.554	61	>75% Grass cover, Good, HSG B
	0.363	96	Gravel surface, HSG A
	1.108	96	Gravel surface, HSG B
*	0.036	98	Unconnected roofs, HSG B (Substation Bldg Roof)
	0.066	98	Paved parking, HSG A
	0.403	98	Paved parking, HSG B
*	0.340	98	Concrete Pads, HSG A
*	0.955	98	Concrete Pads, HSG B
	3.825	92	Weighted Average
	2.025		52.94% Pervious Area
	1.800		47.06% Impervious Area
	0.036		2.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0158	1.24		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.7	85	0.0158	2.02		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
1.3	200	0.0158	2.55		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.2	17	0.0090	1.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
3.0	118	0.0100	0.66	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
2.0	144	0.0343	1.22	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
1.1	55	0.0163	0.84	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
9.0	669	Total			

Summary for Subcatchment PR-C2: South

Runoff = 5.28 cfs @ 12.60 hrs, Volume= 0.821 af, Depth= 1.53"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (NOAA) Rainfall=5.27"

	Area (ac)	CN	Description
	0.137	39	>75% Grass cover, Good, HSG A
	1.238	61	>75% Grass cover, Good, HSG B
	0.074	80	>75% Grass cover, Good, HSG D
	3.928	55	Woods, Good, HSG B
	0.279	55	Woods, Good, HSG B
	0.605	96	Gravel surface, HSG B
	0.113	98	Paved parking, HSG B
*	0.031	98	Concrete Pads, HSG B
	0.016	58	Meadow, non-grazed, HSG B
	6.421	61	Weighted Average
	6.277		97.76% Pervious Area
	0.144		2.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	50	0.0060	0.03		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
3.8	157	0.0191	0.69		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.8	58	0.0600	1.22		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.2	28	0.3570	2.99		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.8	514	0.0260	3.11	15.54	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.3	77	0.0439	4.04	20.19	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.1	32	0.0414	3.92	19.61	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
1.0	52	0.0191	0.91	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
39.5	968	Total			

Summary for Subcatchment PR-D: Woods

Runoff = 0.81 cfs @ 12.28 hrs, Volume= 0.089 af, Depth= 1.68"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year (NOAA) Rainfall=5.27"

Area (ac)	CN	Description
0.170	61	>75% Grass cover, Good, HSG B
0.358	55	Woods, Good, HSG B
0.069	96	Gravel surface, HSG B
0.028	85	Gravel roads, HSG B
0.011	98	Paved parking, HSG B
0.636	63	Weighted Average
0.625		98.27% Pervious Area
0.011		1.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	50	0.0400	0.06		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.3	66	0.0300	0.87		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.1	12	0.1630	2.83		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.1	6	0.0064	1.29		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.5	175	0.0308	5.64	28.18	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.1	60	0.0502	7.20	35.98	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.4	45	0.0775	1.95		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
1.3	84	0.0237	1.08		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.6	39	0.0259	1.13		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
18.7	537	Total			

Summary for Pond B: Pond

Inflow Area = 3.825 ac, 47.06% Impervious, Inflow Depth = 4.35" for 10-year (NOAA) event
Inflow = 16.47 cfs @ 12.12 hrs, Volume= 1.388 af
Outflow = 1.19 cfs @ 13.66 hrs, Volume= 1.388 af, Atten= 93%, Lag= 92.1 min
Discarded = 0.57 cfs @ 13.66 hrs, Volume= 1.129 af
Primary = 0.62 cfs @ 13.66 hrs, Volume= 0.259 af
Routed to Link DP C : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Peak Elev= 243.48' @ 13.66 hrs Surf.Area= 15,866 sf Storage= 33,659 cf

Plug-Flow detention time= 501.7 min calculated for 1.387 af (100% of inflow)
Center-of-Mass det. time= 502.0 min (1,285.9 - 783.9)

Volume	Invert	Avail.Storage	Storage Description
#1	241.00'	90,440 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
241.00	11,283	0	0
242.00	13,082	12,183	12,183
243.00	14,939	14,011	26,193
244.00	16,851	15,895	42,088
245.00	18,821	17,836	59,924
246.00	20,847	19,834	79,758
246.50	21,881	10,682	90,440

Device	Routing	Invert	Outlet Devices
#1	Primary	237.50'	**24.0" Round Culvert** L= 89.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 237.50' / 234.50' S= 0.0337 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	242.80'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	243.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	244.90'	**4.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Discarded	241.00'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 237.00' Phase-In= 0.01'

Discarded OutFlow Max=0.57 cfs @ 13.66 hrs HW=243.48' (Free Discharge)
└─**5=Exfiltration** (Controls 0.57 cfs)

Primary OutFlow Max=0.62 cfs @ 13.66 hrs HW=243.48' (Free Discharge)
└─**1=Culvert** (Passes 0.62 cfs of 42.22 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.62 cfs @ 3.17 fps)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP A: Roadway (West)

Inflow Area =	0.438 ac, 23.97% Impervious, Inflow Depth = 2.32"		for 10-year (NOAA) event
Inflow =	1.16 cfs @ 12.10 hrs, Volume=	0.085 af	
Primary =	1.16 cfs @ 12.10 hrs, Volume=	0.085 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area = 0.523 ac, 19.69% Impervious, Inflow Depth = 1.99" for 10-year (NOAA) event
Inflow = 1.17 cfs @ 12.10 hrs, Volume= 0.087 af
Primary = 1.17 cfs @ 12.10 hrs, Volume= 0.087 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area =	10.246 ac,	18.97% Impervious,	Inflow Depth = 1.26"	for 10-year (NOAA) event
Inflow =	5.81 cfs @	12.61 hrs,	Volume=	1.080 af
Primary =	5.81 cfs @	12.61 hrs,	Volume=	1.080 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area =	0.636 ac,	1.73% Impervious, Inflow Depth = 1.68"	for 10-year (NOAA) event
Inflow =	0.81 cfs @	12.28 hrs, Volume=	0.089 af
Primary =	0.81 cfs @	12.28 hrs, Volume=	0.089 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Time span=0.00-100.00 hrs, dt=0.05 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-A: West Runoff Area=0.438 ac 23.97% Impervious Runoff Depth=4.52"
Flow Length=199' Tc=6.0 min CN=71 Runoff=2.27 cfs 0.165 af

SubcatchmentPR-B: East Runoff Area=0.523 ac 19.69% Impervious Runoff Depth=4.06"
Flow Length=188' Tc=6.0 min CN=67 Runoff=2.44 cfs 0.177 af

SubcatchmentPR-C1: North Runoff Area=3.825 ac 47.06% Impervious Runoff Depth=6.97"
Flow Length=669' Tc=9.0 min CN=92 Runoff=25.70 cfs 2.223 af

SubcatchmentPR-C2: South Runoff Area=6.421 ac 2.24% Impervious Runoff Depth=3.39"
Flow Length=968' Tc=39.5 min CN=61 Runoff=12.43 cfs 1.815 af

SubcatchmentPR-D: Woods Runoff Area=0.636 ac 1.73% Impervious Runoff Depth=3.61"
Flow Length=537' Tc=18.7 min CN=63 Runoff=1.84 cfs 0.192 af

Pond B: Pond Peak Elev=244.60' Storage=52,465 cf Inflow=25.70 cfs 2.223 af
Discarded=0.72 cfs 1.334 af Primary=2.04 cfs 0.889 af Outflow=2.76 cfs 2.223 af

Link DP A: Roadway (West) Inflow=2.27 cfs 0.165 af
Primary=2.27 cfs 0.165 af

Link DP B: Roadway (East) Inflow=2.44 cfs 0.177 af
Primary=2.44 cfs 0.177 af

Link DP C: Wetlands Inflow=14.43 cfs 2.704 af
Primary=14.43 cfs 2.704 af

Link DP D: Woods (West) Inflow=1.84 cfs 0.192 af
Primary=1.84 cfs 0.192 af

Total Runoff Area = 11.843 ac Runoff Volume = 4.571 af Average Runoff Depth = 4.63"
81.74% Pervious = 9.680 ac 18.26% Impervious = 2.163 ac

Summary for Subcatchment PR-A: West

Runoff = 2.27 cfs @ 12.09 hrs, Volume= 0.165 af, Depth= 4.52"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (2050) Rainfall=7.93"

Area (ac)	CN	Description
0.320	61	>75% Grass cover, Good, HSG B
0.002	85	Gravel roads, HSG B
0.011	96	Gravel surface, HSG B
0.105	98	Paved roads w/curbs & sewers, HSG B
0.438	71	Weighted Average
0.333		76.03% Pervious Area
0.105		23.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0423	1.84		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	18	0.0535	4.70		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.1	26	0.0560	4.80		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	105	0.0419	4.16		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
1.1	199	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-B: East

Runoff = 2.44 cfs @ 12.09 hrs, Volume= 0.177 af, Depth= 4.06"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (2050) Rainfall=7.93"

Area (ac)	CN	Description
0.225	39	>75% Grass cover, Good, HSG A
0.057	61	>75% Grass cover, Good, HSG B
0.034	76	Gravel roads, HSG A
0.104	96	Gravel surface, HSG B
0.039	98	Paved parking, HSG A
0.064	98	Paved parking, HSG B
0.523	67	Weighted Average
0.420		80.31% Pervious Area
0.103		19.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	24	0.3500	3.70		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	28	0.0323	3.65		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	69	0.0234	3.11		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.3	67	0.0302	3.53		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.9	188	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-C1: North

Runoff = 25.70 cfs @ 12.12 hrs, Volume= 2.223 af, Depth= 6.97"
Routed to Pond B : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (2050) Rainfall=7.93"

	Area (ac)	CN	Description
	0.554	61	>75% Grass cover, Good, HSG B
	0.363	96	Gravel surface, HSG A
	1.108	96	Gravel surface, HSG B
*	0.036	98	Unconnected roofs, HSG B (Substation Bldg Roof)
	0.066	98	Paved parking, HSG A
	0.403	98	Paved parking, HSG B
*	0.340	98	Concrete Pads, HSG A
*	0.955	98	Concrete Pads, HSG B
	3.825	92	Weighted Average
	2.025		52.94% Pervious Area
	1.800		47.06% Impervious Area
	0.036		2.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0158	1.24		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.7	85	0.0158	2.02		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
1.3	200	0.0158	2.55		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.2	17	0.0090	1.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
3.0	118	0.0100	0.66	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
2.0	144	0.0343	1.22	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
1.1	55	0.0163	0.84	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
9.0	669	Total			

Summary for Subcatchment PR-C2: South

Runoff = 12.43 cfs @ 12.57 hrs, Volume= 1.815 af, Depth= 3.39"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (2050) Rainfall=7.93"

	Area (ac)	CN	Description
	0.137	39	>75% Grass cover, Good, HSG A
	1.238	61	>75% Grass cover, Good, HSG B
	0.074	80	>75% Grass cover, Good, HSG D
	3.928	55	Woods, Good, HSG B
	0.279	55	Woods, Good, HSG B
	0.605	96	Gravel surface, HSG B
	0.113	98	Paved parking, HSG B
*	0.031	98	Concrete Pads, HSG B
	0.016	58	Meadow, non-grazed, HSG B
	6.421	61	Weighted Average
	6.277		97.76% Pervious Area
	0.144		2.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	50	0.0060	0.03		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
3.8	157	0.0191	0.69		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.8	58	0.0600	1.22		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.2	28	0.3570	2.99		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.8	514	0.0260	3.11	15.54	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.3	77	0.0439	4.04	20.19	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.1	32	0.0414	3.92	19.61	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
1.0	52	0.0191	0.91	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
39.5	968	Total			

Summary for Subcatchment PR-D: Woods

Runoff = 1.84 cfs @ 12.27 hrs, Volume= 0.192 af, Depth= 3.61"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (2050) Rainfall=7.93"

Area (ac)	CN	Description
0.170	61	>75% Grass cover, Good, HSG B
0.358	55	Woods, Good, HSG B
0.069	96	Gravel surface, HSG B
0.028	85	Gravel roads, HSG B
0.011	98	Paved parking, HSG B
0.636	63	Weighted Average
0.625		98.27% Pervious Area
0.011		1.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	50	0.0400	0.06		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.3	66	0.0300	0.87		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.1	12	0.1630	2.83		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.1	6	0.0064	1.29		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.5	175	0.0308	5.64	28.18	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.1	60	0.0502	7.20	35.98	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.4	45	0.0775	1.95		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
1.3	84	0.0237	1.08		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.6	39	0.0259	1.13		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
18.7	537	Total			

Summary for Pond B: Pond

Inflow Area = 3.825 ac, 47.06% Impervious, Inflow Depth = 6.97" for 25-year (2050) event
Inflow = 25.70 cfs @ 12.12 hrs, Volume= 2.223 af
Outflow = 2.76 cfs @ 12.93 hrs, Volume= 2.223 af, Atten= 89%, Lag= 48.7 min
Discarded = 0.72 cfs @ 12.93 hrs, Volume= 1.334 af
Primary = 2.04 cfs @ 12.93 hrs, Volume= 0.889 af
Routed to Link DP C : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Peak Elev= 244.60' @ 12.93 hrs Surf.Area= 18,023 sf Storage= 52,465 cf

Plug-Flow detention time= 418.9 min calculated for 2.222 af (100% of inflow)
Center-of-Mass det. time= 419.3 min (1,191.4 - 772.1)

Volume	Invert	Avail.Storage	Storage Description
#1	241.00'	90,440 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
241.00	11,283	0	0
242.00	13,082	12,183	12,183
243.00	14,939	14,011	26,193
244.00	16,851	15,895	42,088
245.00	18,821	17,836	59,924
246.00	20,847	19,834	79,758
246.50	21,881	10,682	90,440

Device	Routing	Invert	Outlet Devices
#1	Primary	237.50'	**24.0" Round Culvert** L= 89.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 237.50' / 234.50' S= 0.0337 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	242.80'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	243.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	244.90'	**4.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Discarded	241.00'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 237.00' Phase-In= 0.01'

Discarded OutFlow Max=0.72 cfs @ 12.93 hrs HW=244.59' (Free Discharge)
└─**5=Exfiltration** (Controls 0.72 cfs)

Primary OutFlow Max=2.04 cfs @ 12.93 hrs HW=244.59' (Free Discharge)
└─**1=Culvert** (Passes 2.04 cfs of 46.68 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.18 cfs @ 5.98 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.87 cfs @ 4.43 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP A: Roadway (West)

Inflow Area =	0.438 ac,	23.97% Impervious, Inflow Depth = 4.52"	for 25-year (2050) event	
Inflow =	2.27 cfs @	12.09 hrs, Volume=	0.165 af	
Primary =	2.27 cfs @	12.09 hrs, Volume=	0.165 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area = 0.523 ac, 19.69% Impervious, Inflow Depth = 4.06" for 25-year (2050) event
Inflow = 2.44 cfs @ 12.09 hrs, Volume= 0.177 af
Primary = 2.44 cfs @ 12.09 hrs, Volume= 0.177 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area = 10.246 ac, 18.97% Impervious, Inflow Depth = 3.17" for 25-year (2050) event
Inflow = 14.43 cfs @ 12.58 hrs, Volume= 2.704 af
Primary = 14.43 cfs @ 12.58 hrs, Volume= 2.704 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area =	0.636 ac,	1.73% Impervious,	Inflow Depth = 3.61"	for 25-year (2050) event	
Inflow =	1.84 cfs @	12.27 hrs,	Volume=	0.192 af	
Primary =	1.84 cfs @	12.27 hrs,	Volume=	0.192 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Time span=0.00-100.00 hrs, dt=0.05 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-A: West Runoff Area=0.438 ac 23.97% Impervious Runoff Depth=3.26"
Flow Length=199' Tc=6.0 min CN=71 Runoff=1.64 cfs 0.119 af

SubcatchmentPR-B: East Runoff Area=0.523 ac 19.69% Impervious Runoff Depth=2.87"
Flow Length=188' Tc=6.0 min CN=67 Runoff=1.71 cfs 0.125 af

SubcatchmentPR-C1: North Runoff Area=3.825 ac 47.06% Impervious Runoff Depth=5.50"
Flow Length=669' Tc=9.0 min CN=92 Runoff=20.54 cfs 1.754 af

SubcatchmentPR-C2: South Runoff Area=6.421 ac 2.24% Impervious Runoff Depth=2.31"
Flow Length=968' Tc=39.5 min CN=61 Runoff=8.26 cfs 1.234 af

SubcatchmentPR-D: Woods Runoff Area=0.636 ac 1.73% Impervious Runoff Depth=2.49"
Flow Length=537' Tc=18.7 min CN=63 Runoff=1.25 cfs 0.132 af

Pond B: Pond Peak Elev=243.97' Storage=41,568 cf Inflow=20.54 cfs 1.754 af
Discarded=0.63 cfs 1.229 af Primary=1.35 cfs 0.524 af Outflow=1.98 cfs 1.754 af

Link DP A: Roadway (West) Inflow=1.64 cfs 0.119 af
Primary=1.64 cfs 0.119 af

Link DP B: Roadway (East) Inflow=1.71 cfs 0.125 af
Primary=1.71 cfs 0.125 af

Link DP C: Wetlands Inflow=9.50 cfs 1.758 af
Primary=9.50 cfs 1.758 af

Link DP D: Woods (West) Inflow=1.25 cfs 0.132 af
Primary=1.25 cfs 0.132 af

Total Runoff Area = 11.843 ac Runoff Volume = 3.363 af Average Runoff Depth = 3.41"
81.74% Pervious = 9.680 ac 18.26% Impervious = 2.163 ac

Summary for Subcatchment PR-A: West

Runoff = 1.64 cfs @ 12.09 hrs, Volume= 0.119 af, Depth= 3.26"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (NOAA) Rainfall=6.44"

Area (ac)	CN	Description
0.320	61	>75% Grass cover, Good, HSG B
0.002	85	Gravel roads, HSG B
0.011	96	Gravel surface, HSG B
0.105	98	Paved roads w/curbs & sewers, HSG B
0.438	71	Weighted Average
0.333		76.03% Pervious Area
0.105		23.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0423	1.84		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	18	0.0535	4.70		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.1	26	0.0560	4.80		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	105	0.0419	4.16		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
1.1	199	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-B: East

Runoff = 1.71 cfs @ 12.10 hrs, Volume= 0.125 af, Depth= 2.87"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (NOAA) Rainfall=6.44"

Area (ac)	CN	Description
0.225	39	>75% Grass cover, Good, HSG A
0.057	61	>75% Grass cover, Good, HSG B
0.034	76	Gravel roads, HSG A
0.104	96	Gravel surface, HSG B
0.039	98	Paved parking, HSG A
0.064	98	Paved parking, HSG B
0.523	67	Weighted Average
0.420		80.31% Pervious Area
0.103		19.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	24	0.3500	3.70		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	28	0.0323	3.65		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	69	0.0234	3.11		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.3	67	0.0302	3.53		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.9	188	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-C1: North

Runoff = 20.54 cfs @ 12.12 hrs, Volume= 1.754 af, Depth= 5.50"
Routed to Pond B : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (NOAA) Rainfall=6.44"

	Area (ac)	CN	Description
	0.554	61	>75% Grass cover, Good, HSG B
	0.363	96	Gravel surface, HSG A
	1.108	96	Gravel surface, HSG B
*	0.036	98	Unconnected roofs, HSG B (Substation Bldg Roof)
	0.066	98	Paved parking, HSG A
	0.403	98	Paved parking, HSG B
*	0.340	98	Concrete Pads, HSG A
*	0.955	98	Concrete Pads, HSG B
	3.825	92	Weighted Average
	2.025		52.94% Pervious Area
	1.800		47.06% Impervious Area
	0.036		2.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0158	1.24		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.7	85	0.0158	2.02		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
1.3	200	0.0158	2.55		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.2	17	0.0090	1.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
3.0	118	0.0100	0.66	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
2.0	144	0.0343	1.22	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
1.1	55	0.0163	0.84	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
9.0	669	Total			

Summary for Subcatchment PR-C2: South

Runoff = 8.26 cfs @ 12.59 hrs, Volume= 1.234 af, Depth= 2.31"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (NOAA) Rainfall=6.44"

	Area (ac)	CN	Description
	0.137	39	>75% Grass cover, Good, HSG A
	1.238	61	>75% Grass cover, Good, HSG B
	0.074	80	>75% Grass cover, Good, HSG D
	3.928	55	Woods, Good, HSG B
	0.279	55	Woods, Good, HSG B
	0.605	96	Gravel surface, HSG B
	0.113	98	Paved parking, HSG B
*	0.031	98	Concrete Pads, HSG B
	0.016	58	Meadow, non-grazed, HSG B
	6.421	61	Weighted Average
	6.277		97.76% Pervious Area
	0.144		2.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	50	0.0060	0.03		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
3.8	157	0.0191	0.69		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.8	58	0.0600	1.22		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.2	28	0.3570	2.99		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.8	514	0.0260	3.11	15.54	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.3	77	0.0439	4.04	20.19	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.1	32	0.0414	3.92	19.61	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
1.0	52	0.0191	0.91	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
39.5	968	Total			

Summary for Subcatchment PR-D: Woods

Runoff = 1.25 cfs @ 12.27 hrs, Volume= 0.132 af, Depth= 2.49"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year (NOAA) Rainfall=6.44"

Area (ac)	CN	Description
0.170	61	>75% Grass cover, Good, HSG B
0.358	55	Woods, Good, HSG B
0.069	96	Gravel surface, HSG B
0.028	85	Gravel roads, HSG B
0.011	98	Paved parking, HSG B
0.636	63	Weighted Average
0.625		98.27% Pervious Area
0.011		1.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	50	0.0400	0.06		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.3	66	0.0300	0.87		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.1	12	0.1630	2.83		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.1	6	0.0064	1.29		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.5	175	0.0308	5.64	28.18	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.1	60	0.0502	7.20	35.98	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.4	45	0.0775	1.95		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
1.3	84	0.0237	1.08		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.6	39	0.0259	1.13		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
18.7	537	Total			

Summary for Pond B: Pond

Inflow Area = 3.825 ac, 47.06% Impervious, Inflow Depth = 5.50" for 25-year (NOAA) event
Inflow = 20.54 cfs @ 12.12 hrs, Volume= 1.754 af
Outflow = 1.98 cfs @ 13.04 hrs, Volume= 1.754 af, Atten= 90%, Lag= 55.2 min
Discarded = 0.63 cfs @ 13.04 hrs, Volume= 1.229 af
Primary = 1.35 cfs @ 13.04 hrs, Volume= 0.524 af
Routed to Link DP C : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Peak Elev= 243.97' @ 13.04 hrs Surf.Area= 16,792 sf Storage= 41,568 cf

Plug-Flow detention time= 459.1 min calculated for 1.753 af (100% of inflow)
Center-of-Mass det. time= 459.4 min (1,237.3 - 777.9)

Volume	Invert	Avail.Storage	Storage Description
#1	241.00'	90,440 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
241.00	11,283	0	0
242.00	13,082	12,183	12,183
243.00	14,939	14,011	26,193
244.00	16,851	15,895	42,088
245.00	18,821	17,836	59,924
246.00	20,847	19,834	79,758
246.50	21,881	10,682	90,440

Device	Routing	Invert	Outlet Devices
#1	Primary	237.50'	**24.0" Round Culvert** L= 89.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 237.50' / 234.50' S= 0.0337 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	242.80'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	243.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	244.90'	**4.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Discarded	241.00'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 237.00' Phase-In= 0.01'

Discarded OutFlow Max=0.63 cfs @ 13.04 hrs HW=243.97' (Free Discharge)
└─**5=Exfiltration** (Controls 0.63 cfs)

Primary OutFlow Max=1.35 cfs @ 13.04 hrs HW=243.97' (Free Discharge)
└─**1=Culvert** (Passes 1.35 cfs of 44.22 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.91 cfs @ 4.62 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.45 cfs @ 2.33 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP A: Roadway (West)

Inflow Area =	0.438 ac,	23.97% Impervious,	Inflow Depth = 3.26"	for 25-year (NOAA) event
Inflow =	1.64 cfs @	12.09 hrs, Volume=	0.119 af	
Primary =	1.64 cfs @	12.09 hrs, Volume=	0.119 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area =	0.523 ac,	19.69% Impervious,	Inflow Depth = 2.87"	for 25-year (NOAA) event
Inflow =	1.71 cfs @	12.10 hrs, Volume=	0.125 af	
Primary =	1.71 cfs @	12.10 hrs, Volume=	0.125 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area =	10.246 ac, 18.97% Impervious, Inflow Depth = 2.06"	for 25-year (NOAA) event
Inflow =	9.50 cfs @ 12.60 hrs, Volume=	1.758 af
Primary =	9.50 cfs @ 12.60 hrs, Volume=	1.758 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area =	0.636 ac,	1.73% Impervious,	Inflow Depth = 2.49"	for 25-year (NOAA) event	
Inflow =	1.25 cfs @	12.27 hrs,	Volume=	0.132 af	
Primary =	1.25 cfs @	12.27 hrs,	Volume=	0.132 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Time span=0.00-100.00 hrs, dt=0.05 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-A: West Runoff Area=0.438 ac 23.97% Impervious Runoff Depth=6.51"
Flow Length=199' Tc=6.0 min CN=71 Runoff=3.26 cfs 0.238 af

SubcatchmentPR-B: East Runoff Area=0.523 ac 19.69% Impervious Runoff Depth=5.98"
Flow Length=188' Tc=6.0 min CN=67 Runoff=3.59 cfs 0.261 af

SubcatchmentPR-C1: North Runoff Area=3.825 ac 47.06% Impervious Runoff Depth=9.20"
Flow Length=669' Tc=9.0 min CN=92 Runoff=33.39 cfs 2.931 af

SubcatchmentPR-C2: South Runoff Area=6.421 ac 2.24% Impervious Runoff Depth=5.17"
Flow Length=968' Tc=39.5 min CN=61 Runoff=19.20 cfs 2.768 af

SubcatchmentPR-D: Woods Runoff Area=0.636 ac 1.73% Impervious Runoff Depth=5.44"
Flow Length=537' Tc=18.7 min CN=63 Runoff=2.80 cfs 0.288 af

Pond B: Pond Peak Elev=245.33' Storage=66,164 cf Inflow=33.39 cfs 2.931 af
Discarded=0.82 cfs 1.452 af Primary=6.25 cfs 1.479 af Outflow=7.08 cfs 2.931 af

Link DP A: Roadway (West) Inflow=3.26 cfs 0.238 af
Primary=3.26 cfs 0.238 af

Link DP B: Roadway (East) Inflow=3.59 cfs 0.261 af
Primary=3.59 cfs 0.261 af

Link DP C: Wetlands Inflow=25.45 cfs 4.247 af
Primary=25.45 cfs 4.247 af

Link DP D: Woods (West) Inflow=2.80 cfs 0.288 af
Primary=2.80 cfs 0.288 af

Total Runoff Area = 11.843 ac Runoff Volume = 6.485 af Average Runoff Depth = 6.57"
81.74% Pervious = 9.680 ac 18.26% Impervious = 2.163 ac

Summary for Subcatchment PR-A: West

Runoff = 3.26 cfs @ 12.09 hrs, Volume= 0.238 af, Depth= 6.51"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (2050) Rainfall=10.17"

Area (ac)	CN	Description
0.320	61	>75% Grass cover, Good, HSG B
0.002	85	Gravel roads, HSG B
0.011	96	Gravel surface, HSG B
0.105	98	Paved roads w/curbs & sewers, HSG B
0.438	71	Weighted Average
0.333		76.03% Pervious Area
0.105		23.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0423	1.84		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	18	0.0535	4.70		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.1	26	0.0560	4.80		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	105	0.0419	4.16		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
1.1	199	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-B: East

Runoff = 3.59 cfs @ 12.09 hrs, Volume= 0.261 af, Depth= 5.98"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (2050) Rainfall=10.17"

Area (ac)	CN	Description
0.225	39	>75% Grass cover, Good, HSG A
0.057	61	>75% Grass cover, Good, HSG B
0.034	76	Gravel roads, HSG A
0.104	96	Gravel surface, HSG B
0.039	98	Paved parking, HSG A
0.064	98	Paved parking, HSG B
0.523	67	Weighted Average
0.420		80.31% Pervious Area
0.103		19.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	24	0.3500	3.70		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	28	0.0323	3.65		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	69	0.0234	3.11		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.3	67	0.0302	3.53		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.9	188	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-C1: North

Runoff = 33.39 cfs @ 12.12 hrs, Volume= 2.931 af, Depth= 9.20"
Routed to Pond B : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (2050) Rainfall=10.17"

	Area (ac)	CN	Description
	0.554	61	>75% Grass cover, Good, HSG B
	0.363	96	Gravel surface, HSG A
	1.108	96	Gravel surface, HSG B
*	0.036	98	Unconnected roofs, HSG B (Substation Bldg Roof)
	0.066	98	Paved parking, HSG A
	0.403	98	Paved parking, HSG B
*	0.340	98	Concrete Pads, HSG A
*	0.955	98	Concrete Pads, HSG B
	3.825	92	Weighted Average
	2.025		52.94% Pervious Area
	1.800		47.06% Impervious Area
	0.036		2.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0158	1.24		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.7	85	0.0158	2.02		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
1.3	200	0.0158	2.55		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.2	17	0.0090	1.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
3.0	118	0.0100	0.66	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
2.0	144	0.0343	1.22	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
1.1	55	0.0163	0.84	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
9.0	669	Total			

Summary for Subcatchment PR-C2: South

Runoff = 19.20 cfs @ 12.56 hrs, Volume= 2.768 af, Depth= 5.17"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (2050) Rainfall=10.17"

	Area (ac)	CN	Description
	0.137	39	>75% Grass cover, Good, HSG A
	1.238	61	>75% Grass cover, Good, HSG B
	0.074	80	>75% Grass cover, Good, HSG D
	3.928	55	Woods, Good, HSG B
	0.279	55	Woods, Good, HSG B
	0.605	96	Gravel surface, HSG B
	0.113	98	Paved parking, HSG B
*	0.031	98	Concrete Pads, HSG B
	0.016	58	Meadow, non-grazed, HSG B
	6.421	61	Weighted Average
	6.277		97.76% Pervious Area
	0.144		2.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	50	0.0060	0.03		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
3.8	157	0.0191	0.69		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.8	58	0.0600	1.22		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.2	28	0.3570	2.99		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.8	514	0.0260	3.11	15.54	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.3	77	0.0439	4.04	20.19	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.1	32	0.0414	3.92	19.61	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
1.0	52	0.0191	0.91	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
39.5	968	Total			

Summary for Subcatchment PR-D: Woods

Runoff = 2.80 cfs @ 12.26 hrs, Volume= 0.288 af, Depth= 5.44"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (2050) Rainfall=10.17"

Area (ac)	CN	Description
0.170	61	>75% Grass cover, Good, HSG B
0.358	55	Woods, Good, HSG B
0.069	96	Gravel surface, HSG B
0.028	85	Gravel roads, HSG B
0.011	98	Paved parking, HSG B
0.636	63	Weighted Average
0.625		98.27% Pervious Area
0.011		1.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	50	0.0400	0.06		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.3	66	0.0300	0.87		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.1	12	0.1630	2.83		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.1	6	0.0064	1.29		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.5	175	0.0308	5.64	28.18	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.1	60	0.0502	7.20	35.98	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.4	45	0.0775	1.95		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
1.3	84	0.0237	1.08		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.6	39	0.0259	1.13		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
18.7	537	Total			

Summary for Pond B: Pond

Inflow Area = 3.825 ac, 47.06% Impervious, Inflow Depth = 9.20" for 100-year (2050) event
Inflow = 33.39 cfs @ 12.12 hrs, Volume= 2.931 af
Outflow = 7.08 cfs @ 12.57 hrs, Volume= 2.931 af, Atten= 79%, Lag= 27.0 min
Discarded = 0.82 cfs @ 12.57 hrs, Volume= 1.452 af
Primary = 6.25 cfs @ 12.57 hrs, Volume= 1.479 af
Routed to Link DP C : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Peak Elev= 245.33' @ 12.57 hrs Surf.Area= 19,481 sf Storage= 66,164 cf

Plug-Flow detention time= 368.9 min calculated for 2.930 af (100% of inflow)
Center-of-Mass det. time= 369.4 min (1,135.1 - 765.8)

Volume	Invert	Avail.Storage	Storage Description
#1	241.00'	90,440 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
241.00	11,283	0	0
242.00	13,082	12,183	12,183
243.00	14,939	14,011	26,193
244.00	16,851	15,895	42,088
245.00	18,821	17,836	59,924
246.00	20,847	19,834	79,758
246.50	21,881	10,682	90,440

Device	Routing	Invert	Outlet Devices
#1	Primary	237.50'	**24.0" Round Culvert** L= 89.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 237.50' / 234.50' S= 0.0337 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	242.80'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	243.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	244.90'	**4.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Discarded	241.00'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 237.00' Phase-In= 0.01'

Discarded OutFlow Max=0.82 cfs @ 12.57 hrs HW=245.32' (Free Discharge)
└─**5=Exfiltration** (Controls 0.82 cfs)

Primary OutFlow Max=6.22 cfs @ 12.57 hrs HW=245.32' (Free Discharge)
└─**1=Culvert** (Passes 6.22 cfs of 49.28 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.43 cfs @ 7.26 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 1.19 cfs @ 6.04 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 3.61 cfs @ 2.13 fps)

Summary for Link DP A: Roadway (West)

Inflow Area =	0.438 ac,	23.97% Impervious,	Inflow Depth = 6.51"	for 100-year (2050) event
Inflow =	3.26 cfs @	12.09 hrs, Volume=	0.238 af	
Primary =	3.26 cfs @	12.09 hrs, Volume=	0.238 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area =	0.523 ac,	19.69% Impervious,	Inflow Depth = 5.98"	for 100-year (2050) event
Inflow =	3.59 cfs @	12.09 hrs, Volume=	0.261 af	
Primary =	3.59 cfs @	12.09 hrs, Volume=	0.261 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area = 10.246 ac, 18.97% Impervious, Inflow Depth = 4.97" for 100-year (2050) event
Inflow = 25.45 cfs @ 12.56 hrs, Volume= 4.247 af
Primary = 25.45 cfs @ 12.56 hrs, Volume= 4.247 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area =	0.636 ac,	1.73% Impervious,	Inflow Depth = 5.44"	for 100-year (2050) event	
Inflow =	2.80 cfs @	12.26 hrs,	Volume=	0.288 af	
Primary =	2.80 cfs @	12.26 hrs,	Volume=	0.288 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Time span=0.00-100.00 hrs, dt=0.05 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-A: West	Runoff Area=0.438 ac 23.97% Impervious Runoff Depth=4.81" Flow Length=199' Tc=6.0 min CN=71 Runoff=2.42 cfs 0.175 af
SubcatchmentPR-B: East	Runoff Area=0.523 ac 19.69% Impervious Runoff Depth=4.34" Flow Length=188' Tc=6.0 min CN=67 Runoff=2.61 cfs 0.189 af
SubcatchmentPR-C1: North	Runoff Area=3.825 ac 47.06% Impervious Runoff Depth=7.30" Flow Length=669' Tc=9.0 min CN=92 Runoff=26.83 cfs 2.327 af
SubcatchmentPR-C2: South	Runoff Area=6.421 ac 2.24% Impervious Runoff Depth=3.64" Flow Length=968' Tc=39.5 min CN=61 Runoff=13.40 cfs 1.950 af
SubcatchmentPR-D: Woods	Runoff Area=0.636 ac 1.73% Impervious Runoff Depth=3.87" Flow Length=537' Tc=18.7 min CN=63 Runoff=1.98 cfs 0.205 af
Pond B: Pond	Peak Elev=244.73' Storage=54,993 cf Inflow=26.83 cfs 2.327 af Discarded=0.74 cfs 1.357 af Primary=2.16 cfs 0.970 af Outflow=2.90 cfs 2.327 af
Link DP A: Roadway (West)	Inflow=2.42 cfs 0.175 af Primary=2.42 cfs 0.175 af
Link DP B: Roadway (East)	Inflow=2.61 cfs 0.189 af Primary=2.61 cfs 0.189 af
Link DP C: Wetlands	Inflow=15.51 cfs 2.920 af Primary=15.51 cfs 2.920 af
Link DP D: Woods (West)	Inflow=1.98 cfs 0.205 af Primary=1.98 cfs 0.205 af

Total Runoff Area = 11.843 ac Runoff Volume = 4.847 af Average Runoff Depth = 4.91"
81.74% Pervious = 9.680 ac 18.26% Impervious = 2.163 ac

Summary for Subcatchment PR-A: West

Runoff = 2.42 cfs @ 12.09 hrs, Volume= 0.175 af, Depth= 4.81"
Routed to Link DP A : Roadway (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (NOAA) Rainfall=8.26"

Area (ac)	CN	Description
0.320	61	>75% Grass cover, Good, HSG B
0.002	85	Gravel roads, HSG B
0.011	96	Gravel surface, HSG B
0.105	98	Paved roads w/curbs & sewers, HSG B
0.438	71	Weighted Average
0.333		76.03% Pervious Area
0.105		23.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0423	1.84		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	18	0.0535	4.70		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.1	26	0.0560	4.80		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	105	0.0419	4.16		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
1.1	199	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-B: East

Runoff = 2.61 cfs @ 12.09 hrs, Volume= 0.189 af, Depth= 4.34"
Routed to Link DP B : Roadway (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (NOAA) Rainfall=8.26"

Area (ac)	CN	Description
0.225	39	>75% Grass cover, Good, HSG A
0.057	61	>75% Grass cover, Good, HSG B
0.034	76	Gravel roads, HSG A
0.104	96	Gravel surface, HSG B
0.039	98	Paved parking, HSG A
0.064	98	Paved parking, HSG B
0.523	67	Weighted Average
0.420		80.31% Pervious Area
0.103		19.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	24	0.3500	3.70		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.1	28	0.0323	3.65		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.4	69	0.0234	3.11		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.3	67	0.0302	3.53		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.9	188	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PR-C1: North

Runoff = 26.83 cfs @ 12.12 hrs, Volume= 2.327 af, Depth= 7.30"
Routed to Pond B : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (NOAA) Rainfall=8.26"

	Area (ac)	CN	Description
	0.554	61	>75% Grass cover, Good, HSG B
	0.363	96	Gravel surface, HSG A
	1.108	96	Gravel surface, HSG B
*	0.036	98	Unconnected roofs, HSG B (Substation Bldg Roof)
	0.066	98	Paved parking, HSG A
	0.403	98	Paved parking, HSG B
*	0.340	98	Concrete Pads, HSG A
*	0.955	98	Concrete Pads, HSG B
	3.825	92	Weighted Average
	2.025		52.94% Pervious Area
	1.800		47.06% Impervious Area
	0.036		2.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0158	1.24		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 4.16"
0.7	85	0.0158	2.02		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
1.3	200	0.0158	2.55		**Shallow Concentrated Flow, SCF** Paved Kv= 20.3 fps
0.2	17	0.0090	1.53		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
3.0	118	0.0100	0.66	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
2.0	144	0.0343	1.22	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
1.1	55	0.0163	0.84	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
9.0	669	Total			

Summary for Subcatchment PR-C2: South

Runoff = 13.40 cfs @ 12.57 hrs, Volume= 1.950 af, Depth= 3.64"
Routed to Link DP C : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (NOAA) Rainfall=8.26"

	Area (ac)	CN	Description
	0.137	39	>75% Grass cover, Good, HSG A
	1.238	61	>75% Grass cover, Good, HSG B
	0.074	80	>75% Grass cover, Good, HSG D
	3.928	55	Woods, Good, HSG B
	0.279	55	Woods, Good, HSG B
	0.605	96	Gravel surface, HSG B
	0.113	98	Paved parking, HSG B
*	0.031	98	Concrete Pads, HSG B
	0.016	58	Meadow, non-grazed, HSG B
	6.421	61	Weighted Average
	6.277		97.76% Pervious Area
	0.144		2.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	50	0.0060	0.03		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
3.8	157	0.0191	0.69		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.8	58	0.0600	1.22		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.2	28	0.3570	2.99		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
2.8	514	0.0260	3.11	15.54	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.3	77	0.0439	4.04	20.19	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
0.1	32	0.0414	3.92	19.61	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.055
1.0	52	0.0191	0.91	0.01	**Pipe Channel, Pipe** 12.0" Round w/ 11.5" inside fill Area= 0.0 sf Perim= 0.8' r= 0.01' n= 0.013 Corrugated PE, smooth interior
39.5	968	Total			

Summary for Subcatchment PR-D: Woods

Runoff = 1.98 cfs @ 12.27 hrs, Volume= 0.205 af, Depth= 3.87"
Routed to Link DP D : Woods (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year (NOAA) Rainfall=8.26"

Area (ac)	CN	Description
0.170	61	>75% Grass cover, Good, HSG B
0.358	55	Woods, Good, HSG B
0.069	96	Gravel surface, HSG B
0.028	85	Gravel roads, HSG B
0.011	98	Paved parking, HSG B
0.636	63	Weighted Average
0.625		98.27% Pervious Area
0.011		1.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	50	0.0400	0.06		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.16"
1.3	66	0.0300	0.87		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
0.1	12	0.1630	2.83		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.1	6	0.0064	1.29		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
0.5	175	0.0308	5.64	28.18	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.1	60	0.0502	7.20	35.98	**Channel Flow, Swale** Area= 5.0 sf Perim= 8.3' r= 0.60' n= 0.033
0.4	45	0.0775	1.95		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
1.3	84	0.0237	1.08		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
0.6	39	0.0259	1.13		**Shallow Concentrated Flow, SCF** Short Grass Pasture Kv= 7.0 fps
18.7	537	Total			

Summary for Pond B: Pond

Inflow Area = 3.825 ac, 47.06% Impervious, Inflow Depth = 7.30" for 100-year (NOAA) event
Inflow = 26.83 cfs @ 12.12 hrs, Volume= 2.327 af
Outflow = 2.90 cfs @ 12.93 hrs, Volume= 2.327 af, Atten= 89%, Lag= 48.2 min
Discarded = 0.74 cfs @ 12.93 hrs, Volume= 1.357 af
Primary = 2.16 cfs @ 12.93 hrs, Volume= 0.970 af
Routed to Link DP C : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Peak Elev= 244.73' @ 12.93 hrs Surf.Area= 18,298 sf Storage= 54,993 cf

Plug-Flow detention time= 412.9 min calculated for 2.326 af (100% of inflow)
Center-of-Mass det. time= 413.3 min (1,184.3 - 771.0)

Volume	Invert	Avail.Storage	Storage Description
#1	241.00'	90,440 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
241.00	11,283	0	0
242.00	13,082	12,183	12,183
243.00	14,939	14,011	26,193
244.00	16,851	15,895	42,088
245.00	18,821	17,836	59,924
246.00	20,847	19,834	79,758
246.50	21,881	10,682	90,440

Device	Routing	Invert	Outlet Devices
#1	Primary	237.50'	**24.0" Round Culvert** L= 89.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 237.50' / 234.50' S= 0.0337 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	242.80'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	243.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	244.90'	**4.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Discarded	241.00'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 237.00' Phase-In= 0.01'

Discarded OutFlow Max=0.74 cfs @ 12.93 hrs HW=244.73' (Free Discharge)
└─**5=Exfiltration** (Controls 0.74 cfs)

Primary OutFlow Max=2.16 cfs @ 12.93 hrs HW=244.73' (Free Discharge)
└─**1=Culvert** (Passes 2.16 cfs of 47.21 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.23 cfs @ 6.25 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.94 cfs @ 4.78 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP A: Roadway (West)

Inflow Area =	0.438 ac,	23.97% Impervious, Inflow Depth = 4.81"	for 100-year (NOAA) event	
Inflow =	2.42 cfs @	12.09 hrs, Volume=	0.175 af	
Primary =	2.42 cfs @	12.09 hrs, Volume=	0.175 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP B: Roadway (East)

Inflow Area =	0.523 ac,	19.69% Impervious, Inflow Depth = 4.34"	for 100-year (NOAA) event	
Inflow =	2.61 cfs @	12.09 hrs, Volume=	0.189 af	
Primary =	2.61 cfs @	12.09 hrs, Volume=	0.189 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP C: Wetlands

Inflow Area = 10.246 ac, 18.97% Impervious, Inflow Depth = 3.42" for 100-year (NOAA) event
Inflow = 15.51 cfs @ 12.57 hrs, Volume= 2.920 af
Primary = 15.51 cfs @ 12.57 hrs, Volume= 2.920 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Summary for Link DP D: Woods (West)

Inflow Area =	0.636 ac,	1.73% Impervious, Inflow Depth = 3.87"	for 100-year (NOAA) event	
Inflow =	1.98 cfs @	12.27 hrs, Volume=	0.205 af	
Primary =	1.98 cfs @	12.27 hrs, Volume=	0.205 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

APPENDIX D

Stormwater Quality and Recharge Calculations

Standard 3: Recharge

Total Impervious Coverage	195,441	sf	*4.487*	*ac*
Total Impervious Site Area Draining to Recharge Facilities			3.271	*ac*
% Site Impervious Area Draining to Recharge Facilities			73%	
Recharge Adjustment = Site Impervious / Imp Draining to Recharge Facilities =			1.37	

F (in)	A_{Imp} (sf)	Rv (cf)		
1.00	195,441	16,287		
Total Required Recharge Volume, Rv			**16,287**	cf
Adjusted Total Required Recharge			**22,340**	cf

Total Recharge Volume Provided	**23,242**	cf

Summary for Pond B: Pond

Inflow Area = 3.825 ac, 47.06% Impervious, Inflow Depth = 9.20" for 100-year (2050) event
Inflow = 33.39 cfs @ 12.12 hrs, Volume= 2.931 af
Outflow = 7.08 cfs @ 12.57 hrs, Volume= 2.931 af, Atten= 79%, Lag= 27.0 min
Discarded = 0.82 cfs @ 12.57 hrs, Volume= 1.452 af
Primary = 6.25 cfs @ 12.57 hrs, Volume= 1.479 af
Routed to Link DP C : Wetlands

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Peak Elev= 245.33' @ 12.57 hrs Surf.Area= 19,481 sf Storage= 66,164 cf

Plug-Flow detention time= 368.9 min calculated for 2.930 af (100% of inflow)
Center-of-Mass det. time= 369.4 min (1,135.1 - 765.8)

Volume	Invert	Avail.Storage	Storage Description
#1	241.00'	90,440 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
241.00	11,283	0	0
242.00	13,082	12,183	12,183
243.00	14,939	14,011	26,193
244.00	16,851	15,895	42,088
245.00	18,821	17,836	59,924
246.00	20,847	19,834	79,758
246.50	21,881	10,682	90,440

Device	Routing	Invert	Outlet Devices
#1	Primary	237.50'	**24.0" Round Culvert** L= 89.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 237.50' / 234.50' S= 0.0337 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	242.80'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	243.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	244.90'	**4.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Discarded	241.00'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 237.00' Phase-In= 0.01'

Discarded OutFlow Max=0.82 cfs @ 12.57 hrs HW=245.32' (Free Discharge)
└─**5=Exfiltration** (Controls 0.82 cfs)

Primary OutFlow Max=6.22 cfs @ 12.57 hrs HW=245.32' (Free Discharge)
└─**1=Culvert** (Passes 6.22 cfs of 49.28 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.43 cfs @ 7.26 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 1.19 cfs @ 6.04 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 3.61 cfs @ 2.13 fps)

Stage-Area-Storage for Pond B: Pond

Elevation (feet)	Surface (sq-ft)	Horizontal (sq-ft)	Storage (cubic-feet)
241.00	11,283	11,283	0
241.20	11,643	11,643	2,293
241.40	12,003	12,003	4,657
241.60	12,362	12,362	7,094
241.80	12,722	12,722	9,602
242.00	13,082	13,082	12,183
242.20	13,453	13,453	14,836
242.40	13,825	13,825	17,564
242.60	14,196	14,196	20,366
242.80	14,568	14,568	23,242
243.00	14,939	14,939	26,193
243.20	15,321	15,321	29,219
243.40	15,704	15,704	32,322
243.60	16,086	16,086	35,501
243.80	16,469	16,469	38,756
244.00	16,851	16,851	42,088
244.20	17,245	17,245	45,498
244.40	17,639	17,639	48,986
244.60	18,033	18,033	52,553
244.80	18,427	18,427	56,199
245.00	18,821	18,821	59,924
245.20	19,226	19,226	63,729
245.40	19,631	19,631	67,614
245.60	20,037	20,037	71,581
245.80	20,442	20,442	75,629
246.00	20,847	20,847	79,758
246.20	21,261	21,261	83,969
246.40	**21,674**	**21,674**	**88,262**

Standard 3: 72-hour Drawdown Analysis

Table 2.3.3. 1982 Rawls Rates[18]

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	0.27
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

$$\textbf{Drawdown Time} = \frac{\textbf{Rv}}{\textbf{(K) (Bottom Area)}}$$

where:

Rv = Storage Volume Below Outlet [Ac-ft]

K= Infiltration Rate [in/hr]

Bottom Area= Bottom Area of Recharge System [Ac]

Infiltration System

Rv =	0.534	Ac-ft	
K =	1.020	in/hr	
Bottom Area =	0.259	Acres	
Drawdown Time =	**24.2**	**Hours**	*< 72 Hours, Design is in compliance with the standard.*

Stormwater Quality Calculations

Calculation	Design Guideline
Stormwater Quality Volume (WQV)	Massachusetts Stormwater Handbook / MS4 Watershed
Stormwater Quality Flow (WQF)	MassDEP & Ubran Hydrology for Small Watersheds TR-55

Proposed Watershed **A**

Watershed Characteristics

Total Watershed Area	0.44	ac			
Impervious Area, A_{imp}	0.12	ac	>>>	**0.0002**	**mi^2**
Time of Concentration , T_c	6	min	>>>	**0.1**	**hr**

Water Quality Volume (WQV)

$WQV = (Q_{WQV})*(A_{Imp})$

Water Quality Depth, Q_{WQV}	0.5	in			
Impervious Area, A_{imp}	0.12	ac			
Water Quality Volume, WQV	**0.00**	**ac-ft**	>>>	**212**	**ft^3**

Water Quality Flow (WQF)

$WQF = (q_u)*(A_{Imp})*(Q_{WQV})$
q_u = Unit Peak Discharge (csm/in)
A = drainage area (mi^2)

Water Quality Depth, Q_{WQV}	0.5	in	
CN =	98		
Tc =	0.100	hr	
Ia =	0.041		
P =	1.2	in	
Ia / P =	0.034		
Unit Peak Discharge, q_u	752	csm/in	Determine qu, using *MassDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices* Figure 3 or 4 for Ia/P =0.034 for 1" Q_{WQV}
Water Quality Flow, WQF =	**0.08**	**cfs**	

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Stormwater Quality Calculations

Calculation	Design Guideline
Stormwater Quality Volume (WQV)	Massachusetts Stormwater Handbook / MS4 Watershed
Stormwater Quality Flow (WQF)	MassDEP & Ubran Hydrology for Small Watersheds TR-55

Proposed Watershed **B**

Watershed Characteristics

Total Watershed Area	0.52	ac			
Impervious Area, A_{imp}	0.24	ac	>>>	**0.0004**	**mi^2**
Time of Concentration , T_c	6	min	>>>	**0.1**	**hr**

Water Quality Volume (WQV)

$WQV = (Q_{WQV})*(A_{Imp})$

Water Quality Depth, Q_{WQV}	0.5	in			
Impervious Area, A_{imp}	0.24	ac			
Water Quality Volume, WQV	**0.01**	**ac-ft**	>>>	**437**	**ft^3**

Water Quality Flow (WQF)

$WQF = (q_u)* (A_{Imp})*(Q_{WQV})$
q_u = Unit Peak Discharge (csm/in)
A = drainage area (mi^2)

Water Quality Depth, Q_{WQV}	0.5	in
CN =	98	
Tc =	0.100	hr
Ia =	0.041	
P =	1.2	in
Ia / P =	0.034	
Unit Peak Discharge, q_u	752	csm/in
Water Quality Flow, WQF =	**0.15**	**cfs**

Determine qu, using *MassDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices* Figure 3 or 4 for Ia/P =0.034 for 1" Q_{WQV}

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Stormwater Quality Calculations

Calculation	Design Guideline
Stormwater Quality Volume (WQV)	Massachusetts Stormwater Handbook / MS4 Watershed
Stormwater Quality Flow (WQF)	MassDEP & Ubran Hydrology for Small Watersheds TR-55

Proposed Watershed **C1**

Watershed Characteristics

Total Watershed Area	3.83	ac			
Impervious Area, A_{imp}	3.27	ac	>>>	**0.0051**	**mi^2**
Time of Concentration , T_c	7	min	>>>	**0.112**	**hr**

Water Quality Volume (WQV)

$WQV = (Q_{WQV})*(A_{Imp})$

Water Quality Depth, Q_{WQV}	0.5	in			
Impervious Area, A_{imp}	3.27	ac			
Water Quality Volume, WQV	**0.14**	**ac-ft**	>>>	**5,937**	**ft^3**

Water Quality Flow (WQF)

$WQF = (q_u)* (A_{Imp})*(Q_{WQV})$
q_u = Unit Peak Discharge (csm/in)
A = drainage area (mi^2)

Water Quality Depth, Q_{WQV}	0.5	in	
CN =	98		
Tc =	0.112	hr	
Ia =	0.041		
P =	1.2	in	
Ia / P =	0.034		
Unit Peak Discharge, q_u	752	csm/in	Determine qu, using *MassDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices* Figure 3 or 4 for Ia/P =0.034 for 1" Q_{WQV}
Water Quality Flow, WQF =	**1.92**	**cfs**	

Stormwater Quality Calculations

Calculation	Design Guideline
Stormwater Quality Volume (WQV)	Massachusetts Stormwater Handbook / MS4 Watershed
Stormwater Quality Flow (WQF)	MassDEP & Ubran Hydrology for Small Watersheds TR-55

Proposed Watershed	**C2**

Watershed Characteristics

Total Watershed Area	4.63	ac			
Impervious Area, A_{imp}	0.68	ac	>>>	**0.0011**	**mi^2**
Time of Concentration , T_c	37	min	>>>	**0.62**	**hr**

Water Quality Volume (WQV)

WQV = $(Q_{WQV})*(A_{Imp})$

Water Quality Depth, Q_{WQV}	0.5	in			
Impervious Area, A_{imp}	0.68	ac			
Water Quality Volume, WQV	**0.03**	**ac-ft**	>>>	**1,225**	**ft^3**

Water Quality Flow (WQF)

WQF = $(q_u)*(A_{Imp})*(Q_{WQV})$

q_u = Unit Peak Discharge (csm/in)

A = drainage area (mi^2)

Water Quality Depth, Q_{WQV}	0.5	in
CN =	98	
Tc =	0.620	hr
Ia =	0.041	
P =	1.2	in
Ia / P =	0.034	
Unit Peak Discharge, q_u	752	csm/in
Water Quality Flow, WQF =	**0.41**	**cfs**

Determine qu, using *MassDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices* Figure 3 or 4 for Ia/P =0.034 for 1" Q_{WQV}

Stormwater Quality Calculations

Calculation	Design Guideline
Stormwater Quality Volume (WQV)	Massachusetts Stormwater Handbook / MS4 Watershed
Stormwater Quality Flow (WQF)	MassDEP & Ubran Hydrology for Small Watersheds TR-55

Proposed Watershed **D**

Watershed Characteristics

Total Watershed Area	0.57	ac			
Impervious Area, A_{imp}	0.08	ac	>>>	**0.0001**	**mi^2**
Time of Concentration , T_c	19	min	>>>	**0.312**	**hr**

Water Quality Volume (WQV)

WQV = $(Q_{WQV})*(A_{Imp})$

Water Quality Depth, Q_{WQV}	0.5	in			
Impervious Area, A_{imp}	0.08	ac			
Water Quality Volume, WQV	**0.00**	**ac-ft**	>>>	**145**	**ft^3**

Water Quality Flow (WQF)

WQF = $(q_u)* (A_{Imp})*(Q_{WQV})$
q_u = Unit Peak Discharge (csm/in)
A = drainage area (mi^2)

Water Quality Depth, Q_{WQV}	0.5	in
CN =	98	
Tc =	0.312	hr
Ia =	0.041	
P =	1.2	in
Ia / P =	0.034	
Unit Peak Discharge, q_u	752	csm/in
Water Quality Flow, WQF =	**0.04**	**cfs**

Determine qu, using *MassDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices*
Figure 3 or 4 for Ia/P =0.034 for 1" Q_{WQV}

Stormwater Quality Calculations

Calculation	Design Guideline
Stormwater Quality Volume (WQV)	Massachusetts Stormwater Handbook / MS4 Watershed
Stormwater Quality Flow (WQF)	MassDEP & Ubran Hydrology for Small Watersheds TR-55

Proposed Watershed **A**

Watershed Characteristics

Total Watershed Area	0.44	ac			
Impervious Area, A_{imp}	0.12	ac	>>>	**0.0002**	**mi^2**
Time of Concentration , T_c	6	min	>>>	**0.1**	**hr**

Water Quality Volume (WQV)

$WQV = (Q_{WQV})*(A_{Imp})$

Water Quality Depth, Q_{WQV}	0.5	in			
Impervious Area, A_{imp}	0.12	ac			
Water Quality Volume, WQV	**0.00**	**ac-ft**	>>>	**212**	**ft^3**

Water Quality Flow (WQF)

$WQF = (q_u)* (A_{Imp})*(Q_{WQV})$

q_u = Unit Peak Discharge (csm/in)

A = drainage area (mi^2)

Water Quality Depth, Q_{WQV}	0.5	in
CN =	98	
Tc =	0.100	hr
Ia =	0.041	
P =	1.2	in
Ia / P =	0.034	
Unit Peak Discharge, q_u	752	csm/in
Water Quality Flow, WQF =	**0.08**	**cfs**

Determine qu, using *MassDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices*
Figure 3 or 4 for Ia/P =0.034 for 1" Q_{WQV}

Stormwater Quality Calculations

Calculation	Design Guideline
Stormwater Quality Volume (WQV)	Massachusetts Stormwater Handbook / MS4 Watershed
Stormwater Quality Flow (WQF)	MassDEP & Ubran Hydrology for Small Watersheds TR-55

Proposed Watershed **B**

Watershed Characteristics

Total Watershed Area	0.52	ac			
Impervious Area, A_{imp}	0.24	ac	>>>	**0.0004**	**mi^2**
Time of Concentration , T_c	6	min	>>>	**0.1**	**hr**

Water Quality Volume (WQV)

$WQV = (Q_{WQV})*(A_{Imp})$

Water Quality Depth, Q_{WQV}	0.5	in			
Impervious Area, A_{imp}	0.24	ac			
Water Quality Volume, WQV	**0.01**	**ac-ft**	>>>	**437**	**ft^3**

Water Quality Flow (WQF)

$WQF = (q_u)* (A_{Imp})*(Q_{WQV})$

q_u = Unit Peak Discharge (csm/in)

A = drainage area (mi^2)

Water Quality Depth, Q_{WQV}	0.5	in
CN =	98	
Tc =	0.100	hr
Ia =	0.041	
P =	1.2	in
Ia / P =	0.034	
Unit Peak Discharge, q_u	752	csm/in
Water Quality Flow, WQF =	**0.15**	**cfs**

Determine qu, using *MassDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices* Figure 3 or 4 for Ia/P =0.034 for 1" Q_{WQV}

Stormwater Quality Calculations

Calculation	Design Guideline
Stormwater Quality Volume (WQV)	Massachusetts Stormwater Handbook / MS4 Watershed
Stormwater Quality Flow (WQF)	MassDEP & Ubran Hydrology for Small Watersheds TR-55

Proposed Watershed **C1**

Watershed Characteristics

Total Watershed Area	3.83	ac			
Impervious Area, A_{imp}	3.27	ac	>>>	**0.0051**	**mi^2**
Time of Concentration , T_c	7	min	>>>	**0.112**	**hr**

Water Quality Volume (WQV)

$WQV = (Q_{WQV})*(A_{Imp})$

Water Quality Depth, Q_{WQV}	0.5	in			
Impervious Area, A_{imp}	3.27	ac			
Water Quality Volume, WQV	**0.14**	**ac-ft**	>>>	**5,937**	**ft^3**

Water Quality Flow (WQF)

$WQF = (q_u)* (A_{Imp})*(Q_{WQV})$

q_u = Unit Peak Discharge (csm/in)

A = drainage area (mi^2)

Water Quality Depth, Q_{WQV}	0.5	in
CN =	98	
Tc =	0.112	hr
Ia =	0.041	
P =	1.2	in
Ia / P =	0.034	
Unit Peak Discharge, q_u	752	csm/in
Water Quality Flow, WQF =	**1.92**	**cfs**

Determine qu, using *MassDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices*
Figure 3 or 4 for Ia/P =0.034 for 1" Q_{WQV}

Stormwater Quality Calculations

Calculation	Design Guideline
Stormwater Quality Volume (WQV)	Massachusetts Stormwater Handbook / MS4 Watershed
Stormwater Quality Flow (WQF)	MassDEP & Ubran Hydrology for Small Watersheds TR-55

Proposed Watershed	C2

Watershed Characteristics

Total Watershed Area	4.63	ac			
Impervious Area, A_{imp}	0.68	ac	>>>	**0.0011**	**mi^2**
Time of Concentration , T_c	37	min	>>>	**0.62**	**hr**

Water Quality Volume (WQV)

$WQV = (Q_{WQV})*(A_{Imp})$

Water Quality Depth, Q_{WQV}	0.5	in			
Impervious Area, A_{imp}	0.68	ac			
Water Quality Volume, WQV	**0.03**	**ac-ft**	>>>	**1,225**	**ft^3**

Water Quality Flow (WQF)

$WQF = (q_u)* (A_{Imp})*(Q_{WQV})$
q_u = Unit Peak Discharge (csm/in)
A = drainage area (mi^2)

Water Quality Depth, Q_{WQV}	0.5	in	
CN =	98		
Tc =	0.620	hr	
Ia =	0.041		
P =	1.2	in	
Ia / P =	0.034		
Unit Peak Discharge, q_u	752	csm/in	Determine qu, using *MassDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices* Figure 3 or 4 for Ia/P =0.034 for 1" Q_{WQV}
Water Quality Flow, WQF =	**0.41**	**cfs**	

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Stormwater Quality Calculations

Calculation	Design Guideline
Stormwater Quality Volume (WQV)	Massachusetts Stormwater Handbook / MS4 Watershed
Stormwater Quality Flow (WQF)	MassDEP & Ubran Hydrology for Small Watersheds TR-55

Proposed Watershed	**D**

Watershed Characteristics

Total Watershed Area	0.57	ac			
Impervious Area, A_{imp}	0.08	ac	>>>	**0.0001**	**mi^2**
Time of Concentration , T_c	19	min	>>>	**0.312**	**hr**

Water Quality Volume (WQV)

$WQV = (Q_{WQV})*(A_{Imp})$

Water Quality Depth, Q_{WQV}	0.5	in			
Impervious Area, A_{imp}	0.08	ac			
Water Quality Volume, WQV	**0.00**	**ac-ft**	>>>	**145**	**ft^3**

Water Quality Flow (WQF)

$WQF = (q_u)* (A_{Imp})*(Q_{WQV})$

q_u = Unit Peak Discharge (csm/in)

A = drainage area (mi^2)

Water Quality Depth, Q_{WQV}	0.5	in
CN =	98	
Tc =	0.312	hr
Ia =	0.041	
P =	1.2	in
Ia / P =	0.034	
Unit Peak Discharge, q_u	752	csm/in
Water Quality Flow, WQF =	**0.04**	**cfs**

Determine qu, using *MassDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices* Figure 3 or 4 for Ia/P =0.034 for 1" Q_{WQV}

APPENDIX E

TSS Removal Worksheets

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TSS Removal Calculation Worksheet

100 Cambridge Street
Boston, MA 02114

Project Name:	Medway Battery Storage	Sheet:	1 of 2
Project Number:	151033401	Date:	12-Apr-2023
Location:	Medway, MA	Computed by:	JNW
Discharge Point:	Wetlands	Checked by:	HH
Drainage Area(s):			

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Dry Well	80%	1.00	0.80	0.20
	0%	0.20	0.00	0.20
	0%	0.20	0.00	0.20
	0%	0.20	0.00	0.20
	0%	0.20	0.00	0.20

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1
** Equals remaining load from previous BMP (E)

Treatment Train TSS Removal = **80%**

LANGAN

TSS Removal Calculation Worksheet

100 Cambridge Street
Boston, MA 02114

Project Name:	**Medway Battery Storage**	Sheet:	**2 of 2**
Project Number:	**151033401**	Date:	**12-Apr-2023**
Location:	**Medway, MA**	Computed by:	**JNW**
Discharge Point:	**Wetlands**	Checked by:	**HH**
Drainage Area(s):			

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Infiltration Basin	**80%**	**1.00**	**0.80**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**

Treatment Train TSS Removal = **80%**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1
** Equals remaining load from previous BMP (E)
***Proprietary Pretreatment Structures are sized to treat Water Quality Flow. See attached water quality flow calculations. Removal rates for propriety devices are from approved studies and/or manufacturer data. See attached data sheets.

APPENDIX F

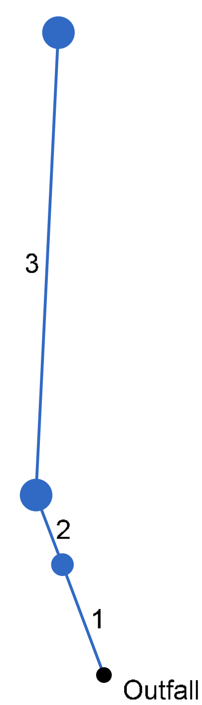
Stormwater Collection System Calculations

Project	MEDWAY BATTERY STORAGE FACILITY	By	SBF	Date	5/17/2023
Location	MEDWAY, MA	Revised	HH	Date	5/17/2023
Circle one:	Present Developed	Job No.	151033401		

1. Rational 'C' Runoff Coefficient & Area Calculations

Catchment Area	Total Area		Impervious (C=.9)		Pervious (C=0.3)		Percent Impervious	C
	SF	AC	SF	AC	SF	AC		
DW-1	22,665	0.520	22,665	0.520	0	0.000	100%	0.90
DW-2	29,727	0.682	29,727	0.682	0	0.000	100%	0.90
DW-3	16,828	0.386	16,828	0.386	0	0.000	100%	0.90
DW-4	20,280	0.466	20,280	0.466	0	0.000	100%	0.90
DW-5	6,576	0.151	6,576	0.151	0	0.000	100%	0.90
DW-6	20,061	0.461	20,061	0.461	0	0.000	100%	0.90
DW-7	13,310	0.306	13,310	0.306	0	0.000	100%	0.90
DW-8	18,634	0.428	18,634	0.428	0	0.000	100%	0.90
CB-1	144,619	3.320	9,830	0.226	134,789	3.094	7%	0.34
TRENCH	60,936	1.399	0	0.000	60,936	1.399	0%	0.30

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: B-1.stm	Number of lines: 3	Date: 5/17/2023

Storm Sewers v2022.00

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
3	2	116.440	19.089	Grate	4.89	0.52	0.90	6.0	246.25	1.50	248.00	18	Cir	0.012	1.00	252.50	PIPE-4
2	1	18.281	0.000	Grate	11.09	0.68	0.90	6.0	245.37	5.00	246.28	24	Cir	0.012	0.57	251.86	PIPE-5
1	End	28.812	-106.898	MH	11.07	0.00	0.00	0.0	243.00	3.58	244.03	30	Cir	0.012	0.15	251.36	PIPE-5 (1)

Project File: B-1.stm	Number of lines: 3	Date: 5/17/2023

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
3	PIPE-4	8.61	18	Cir	116.440	246.25	248.00	1.505	248.03	249.14	n/a	249.14 j	2	Grate
2	PIPE-5	24.46	24	Cir	18.281	245.37	246.28	5.000	246.30	248.03	n/a	248.03	1	Grate
1	PIPE-5 (1)	35.52	30	Cir	28.812	243.00	244.03	3.578	244.84	246.05	0.16	246.05	End	Manhole

Project File: B-1.stm | Number of lines: 3 | Run Date: 5/17/2023

NOTES: Return period = 25 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
3	2	116.440	0.52	0.52	0.90	0.47	0.47	6.0	6.0	7.9	8.61	13.95	5.44	18	1.50	246.25	248.00	248.03	249.14	251.86	252.50	PIPE-4
2	1	18.281	0.68	1.20	0.90	0.61	1.08	6.0	6.4	7.8	24.46	54.79	12.67	24	5.00	245.37	246.28	246.30	248.03	251.36	251.86	PIPE-5
1	End	28.812	0.00	1.20	0.00	0.00	1.08	0.0	6.4	7.8	35.52	84.05	8.76	30	3.58	243.00	244.03	244.84	246.05	245.83	251.36	PIPE-5 (1)

Project File: B-1.stm | Number of lines: 3 | Run Date: 5/17/2023

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

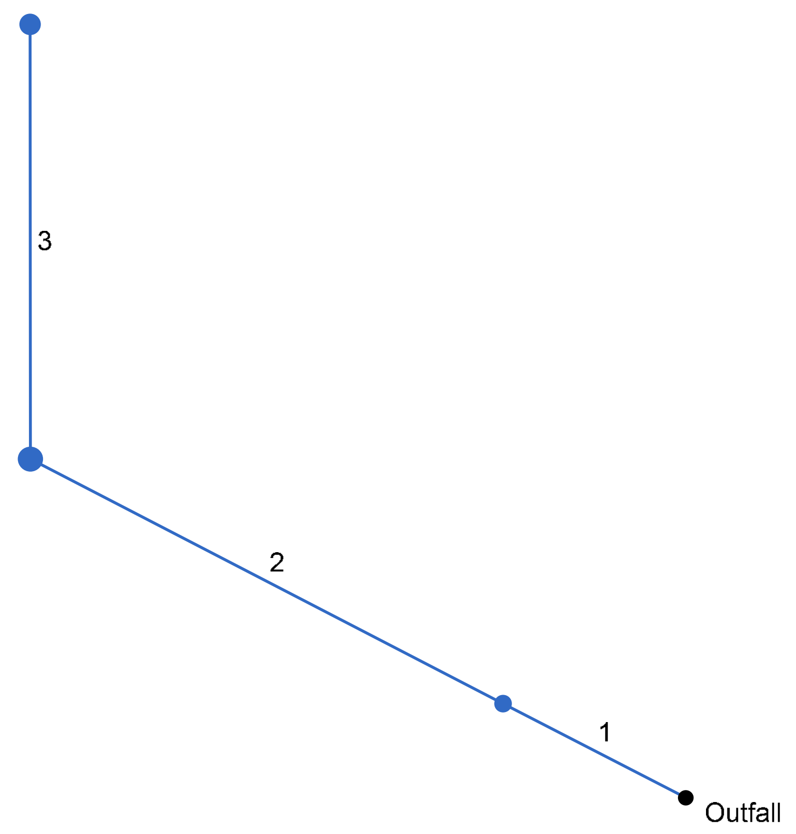
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
3	18	8.61	246.25	248.03	1.50	1.44	4.88	0.37	248.40	0.574	116.440	248.00	249.14 j	1.14**	1.44	6.00	0.56	249.70	0.675	0.624	n/a	1.00	0.56
2	24	24.46	245.37	246.30	0.94*	1.44	16.94	1.10	247.40	0.000	18.281	246.28	248.03	1.75**	2.91	8.41	1.10	249.12	0.000	0.000	n/a	0.57	n/a
1	30	35.52	243.00	244.84	1.84	3.87	9.17	1.09	245.93	0.000	28.812	244.03	246.05	2.02**	4.25	8.35	1.09	247.14	0.000	0.000	n/a	0.15	0.16

Project File: B-1.stm	Number of lines: 3	Run Date: 5/17/2023

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: B-2.stm	Number of lines: 3	Date: 5/17/2023

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
3	2	117.614	62.451	Grate	2.81	0.39	0.90	6.0	250.22	1.30	251.75	15	Cir	0.012	1.00	255.01	PIPE-1
2	1	143.574	0.000	Grate	6.15	0.47	0.90	6.0	245.92	3.00	250.23	18	Cir	0.012	1.36	255.35	PIPE-2
1	End	55.408	-152.505	MH	6.11	0.00	0.00	0.0	244.00	1.80	245.00	24	Cir	0.012	0.15	254.77	PIPE-2 (1)

Project File: B-2.stm	Number of lines: 3	Date: 5/17/2023

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
3	PIPE-1	5.58	15	Cir	117.614	250.22	251.75	1.299	251.63	252.71	n/a	252.71 j	2	Grate
2	PIPE-2	14.96	18	Cir	143.574	245.92	250.23	3.000	246.90	251.63	1.60	251.63	1	Grate
1	PIPE-2 (1)	21.01	24	Cir	55.408	244.00	245.00	1.805	245.16	246.64	0.14	246.64	End	Manhole

Project File: B-2.stm	Number of lines: 3	Run Date: 5/17/2023

NOTES: Return period = 25 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
3	2	117.614	0.39	0.39	0.90	0.35	0.35	6.0	6.0	7.9	5.58	7.97	5.04	15	1.30	250.22	251.75	251.63	252.71	255.35	255.01	PIPE-1
2	1	143.574	0.47	0.85	0.90	0.42	0.77	6.0	6.4	7.8	14.96	19.70	10.48	18	3.00	245.92	250.23	246.90	251.63	254.77	255.35	PIPE-2
1	End	55.408	0.00	0.85	0.00	0.00	0.77	0.0	6.7	7.7	21.01	32.92	9.36	24	1.80	244.00	245.00	245.16	246.64	246.25	254.77	PIPE-2 (1)

Project File: B-2.stm | Number of lines: 3 | Run Date: 5/17/2023

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

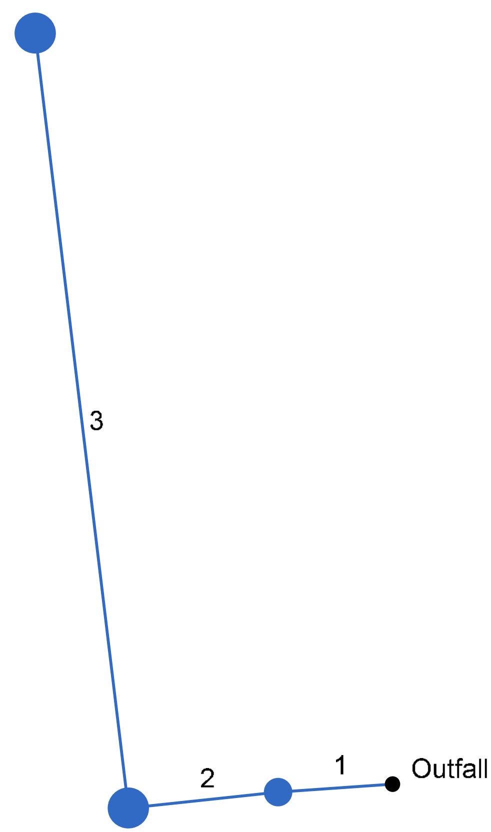
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
3	15	5.58	250.22	251.63	1.25	1.01	4.54	0.32	251.96	0.636	117.614	251.75	252.71 j	0.96**	1.01	5.54	0.48	253.18	0.731	0.683	n/a	1.00	n/a
2	18	14.96	245.92	246.90	0.98*	1.22	12.26	1.18	248.08	0.000	143.574	250.23	251.63	1.40**	1.72	8.70	1.18	252.81	0.000	0.000	n/a	1.36	1.60
1	24	21.01	244.00	245.16	1.16	1.89	11.11	0.90	246.06	0.000	55.408	245.00	246.64	1.64**	2.76	7.62	0.90	247.54	0.000	0.000	n/a	0.15	0.14

Project File: B-2.stm	Number of lines: 3	Run Date: 5/17/2023

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: B-3.stm	Number of lines: 3	Date: 5/17/2023

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
3	2	122.388	89.053	Grate	1.10	0.15	0.90	6.0	251.28	1.00	252.50	15	Cir	0.012	1.00	255.44	PIPE-6
2	1	23.516	-1.109	Grate	4.38	0.46	0.90	6.0	249.94	5.66	251.27	18	Cir	0.012	1.50	255.46	PIPE-7
1	End	17.920	175.241	MH	4.37	0.00	0.00	0.0	246.00	3.63	246.65	18	Cir	0.012	0.15	255.92	PIPE-12

Project File: B-3.stm | Number of lines: 3 | Date: 5/17/2023

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
3	PIPE-6	2.18	15	Cir	122.388	251.28	252.50	1.000	252.47	253.09	n/a	253.09 j	2	Grate
2	PIPE-7	9.68	18	Cir	23.516	249.94	251.27	5.658	250.56	252.47	0.95	252.47	1	Grate
1	PIPE-12	14.03	18	Cir	17.920	246.00	246.65	3.627	246.88	248.03	n/a	248.03	End	Manhole

Project File: B-3.stm | Number of lines: 3 | Run Date: 5/17/2023

NOTES: Return period = 25 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
3	2	122.388	0.15	0.15	0.90	0.14	0.14	6.0	6.0	7.9	2.18	7.00	2.82	15	1.00	251.28	252.50	252.47	253.09	255.46	255.44	PIPE-6
2	1	23.516	0.46	0.61	0.90	0.41	0.55	6.0	7.1	7.6	9.68	27.06	10.21	18	5.66	249.94	251.27	250.56	252.47	255.92	255.46	PIPE-7
1	End	17.920	0.00	0.61	0.00	0.00	0.55	0.0	7.2	7.6	14.03	21.67	10.64	18	3.63	246.00	246.65	246.88	248.03	247.75	255.92	PIPE-12

Project File: B-3.stm | Number of lines: 3 | Run Date: 5/17/2023

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

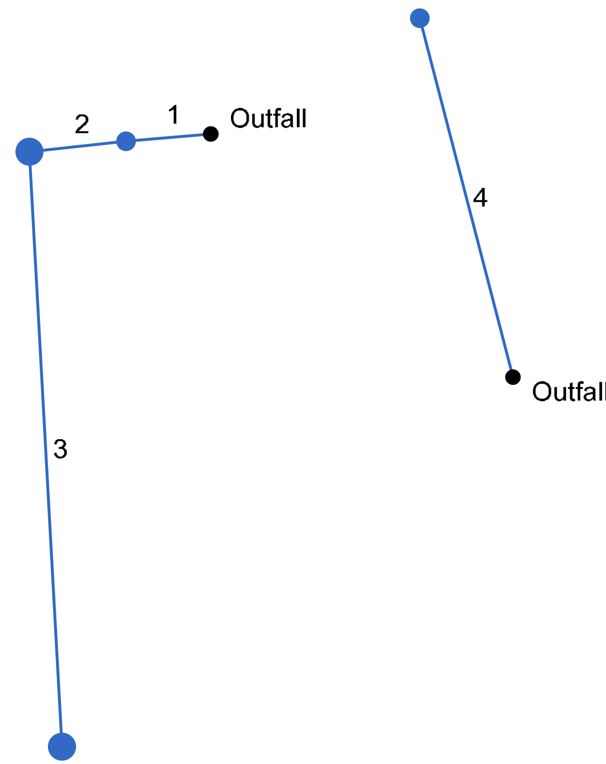
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
3	15	2.18	251.28	252.47	1.19	0.57	1.80	0.23	252.70	0.000	122.388	252.50	253.09 j	0.59**	0.57	3.83	0.23	253.32	0.000	0.000	n/a	1.00	0.23
2	18	9.68	249.94	250.56	0.62*	0.69	14.04	0.63	251.19	0.000	23.516	251.27	252.47	1.20**	1.52	6.39	0.63	253.10	0.000	0.000	n/a	1.50	0.95
1	18	14.03	246.00	246.88	0.88	1.08	13.04	1.06	247.94	0.000	17.920	246.65	248.03	1.38**	1.70	8.24	1.06	249.09	0.000	0.000	n/a	0.15	n/a

Project File: B-3.stm	Number of lines: 3	Run Date: 5/17/2023

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: B-4.stm	Number of lines: 4	Date: 6/6/2023

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
4	End	88.960	-104.431	MH	2.10	0.00	0.00	0.0	234.50	3.37	237.50	24	Cir	0.012	1.00	246.00	PIPE-10
3	2	142.664	-86.676	Grate	2.23	0.31	0.90	6.0	249.83	1.00	251.26	15	Cir	0.012	1.00	255.31	PIPE-8
2	1	23.153	-1.673	Grate	4.47	0.32	0.90	6.0	247.96	5.01	249.12	18	Cir	0.012	1.50	255.44	PIPE-9
1	End	20.233	175.228	MH	4.47	0.00	0.00	0.0	245.00	4.94	246.00	18	Cir	0.012	0.15	255.94	PIPE-9 (1)

Project File: B-4.stm	Number of lines: 4	Date: 6/6/2023

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
4	PIPE-10	2.10	24	Cir	88.960	234.50	237.50	3.372	242.07*	242.55*	n/a	242.55	End	Manhole
3	PIPE-8	4.45	15	Cir	142.664	249.83	251.26	1.002	250.55	252.11	n/a	252.11	2	Grate
2	PIPE-9	11.10	18	Cir	23.153	247.96	249.12	5.010	248.65	250.39	1.12	250.39	1	Grate
1	PIPE-9 (1)	15.56	18	Cir	20.233	245.00	246.00	4.942	245.85	247.42	n/a	247.42	End	Manhole

Project File: B-4.stm	Number of lines: 4	Run Date: 6/6/2023

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown).

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
4	End	88.960	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.10	0.00	5.27	24	3.37	234.50	237.50	242.07	242.55	236.75	246.00	PIPE-10
3	2	142.664	0.31	0.31	0.90	0.28	0.28	6.0	6.0	7.9	4.45	0.00	5.51	15	1.00	249.83	251.26	250.55	252.11	255.44	255.31	PIPE-8
2	1	23.153	0.32	0.63	0.90	0.29	0.57	6.0	6.7	7.8	11.10	25.46	10.42	18	5.01	247.96	249.12	248.65	250.39	255.94	255.44	PIPE-9
1	End	20.233	0.00	0.63	0.00	0.00	0.57	0.0	6.7	7.7	15.56	25.29	12.02	18	4.94	245.00	246.00	245.85	247.42	246.75	255.94	PIPE-9 (1)

Project File: B-4.stm	Number of lines: 4	Run Date: 6/6/2023

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
4	24	2.10	234.50	242.07	0.00	0.00	5.27	0.00	242.07	0.000	88.960	237.50	242.55	0.00**	0.00	5.27	0.00	242.55	0.000	0.000	0.000	1.00	n/a
3	15	4.45	249.83	250.55	0.00	0.00	6.04	0.00	250.55	0.000	142.664	251.26	252.11	0.00**	0.00	4.98	0.00	252.11	0.000	0.000	0.000	1.00	n/a
2	18	11.10	247.96	248.65	0.69*	0.80	13.91	0.75	249.40	0.000	23.153	249.12	250.39	1.27**	1.60	6.94	0.75	251.14	0.000	0.000	n/a	1.50	1.12
1	18	15.56	245.00	245.85	0.85	1.03	15.05	1.26	247.11	0.000	20.233	246.00	247.42	1.42**	1.73	9.00	1.26	248.68	0.000	0.000	n/a	0.15	n/a

Project File: B-4.stm	Number of lines: 4	Run Date: 6/6/2023

Notes: * depth assumed; ** Critical depth. ; c = cir e = ellip b = box

APPENDIX G

Outlet Protection Calculations

LANGAN

25YR Event - Riprap Outlet Protection Calculations[1]

Outfall Number	FES-1	FES-2	FES-3	FES-4	FES-5	FES-6	FES-7
Outfall Parameters							
Discharge Destination	Basin Inlet	Basin Inlet	Basin Inlet	Basin Inlet	Swale Collection Outfall	Basin Outfall	Trench Collection Outfall
Outfall Do (in)	30	24	18	18	18	24	12
Outfall Do (ft)	2.5	2	1.5	1.5	1.5	2	1
Q, Flow 25yr (cfs)	37.62	22.51	15.13	16.63	8.59	2.10	2.41
V, Velocity 25yr (ft/s)	10.07	9.61	11.02	12.41	5.11	6.33	5.18
Tailwater, TW (ft)	1.58	0.58	0	0	0.00	0	0
Type A (TW< D/2) or B (Is TW >= D/2)	B	A	A	A	PFSH	PFSH	PFSH

Type A/B Riprap Apron Dimensions							
Length (ft)	35	21	20	21			
Width Upstream (ft)	8	6	5	5			
Width Downstream (ft)	21	21	18	13			
Riprap Section	Std	Int	Std	Std			
Recommended Design D50 (in)	9	9	9	9			
Riprap Thickness (ft)	1.5	1.5	1.5	1.5			
Preformed Scour Hole (PFSH) Dimensions (Type 1)							
Outfall Do + 0.5 ft, E (ft)					2	2.5	1.5
Hole Depth 0.5Do, F (ft) (1 ft min.)					1	1.25	0.75
Hole Length, 3E (ft)					6	7.5	4.5
Hole Width, 2E (ft)					4	5	3
Overall Length, C (ft)					12	15	9
Overall Width, B (ft)					10	12.5	7.5
Recommended Design D50 (in)					6	6	6
Riprap Thickness (ft)					1	1	1

Note:

1. Calculations based on methodology found in Connecticut DOT Drainage Manual

APPENDIX H

Swale Calculations

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.   Thursday, Apr 13 2023

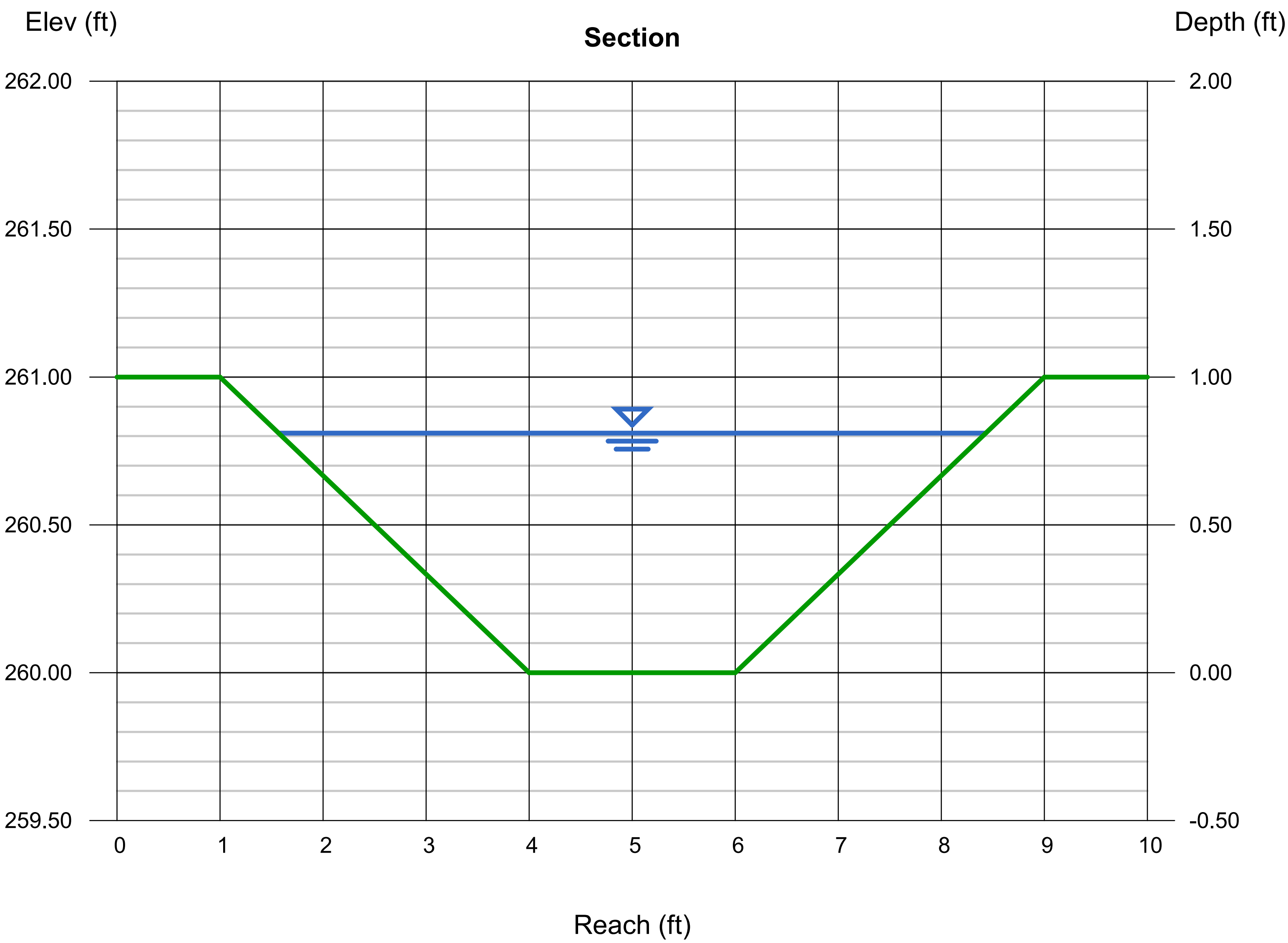
25-year, 24-hour NOAA Atlas 14 storm event

C-2 Swale

Trapezoidal	
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 260.00
Slope (%)	= 1.20
N-Value	= 0.055

Calculations	
Compute by:	Known Q
Known Q (cfs)	= 6.70

Highlighted	
Depth (ft)	= 0.81
Q (cfs)	= 6.700
Area (sqft)	= 3.59
Velocity (ft/s)	= 1.87
Wetted Perim (ft)	= 7.12
Crit Depth, Yc (ft)	= 0.54
Top Width (ft)	= 6.86
EGL (ft)	= 0.86

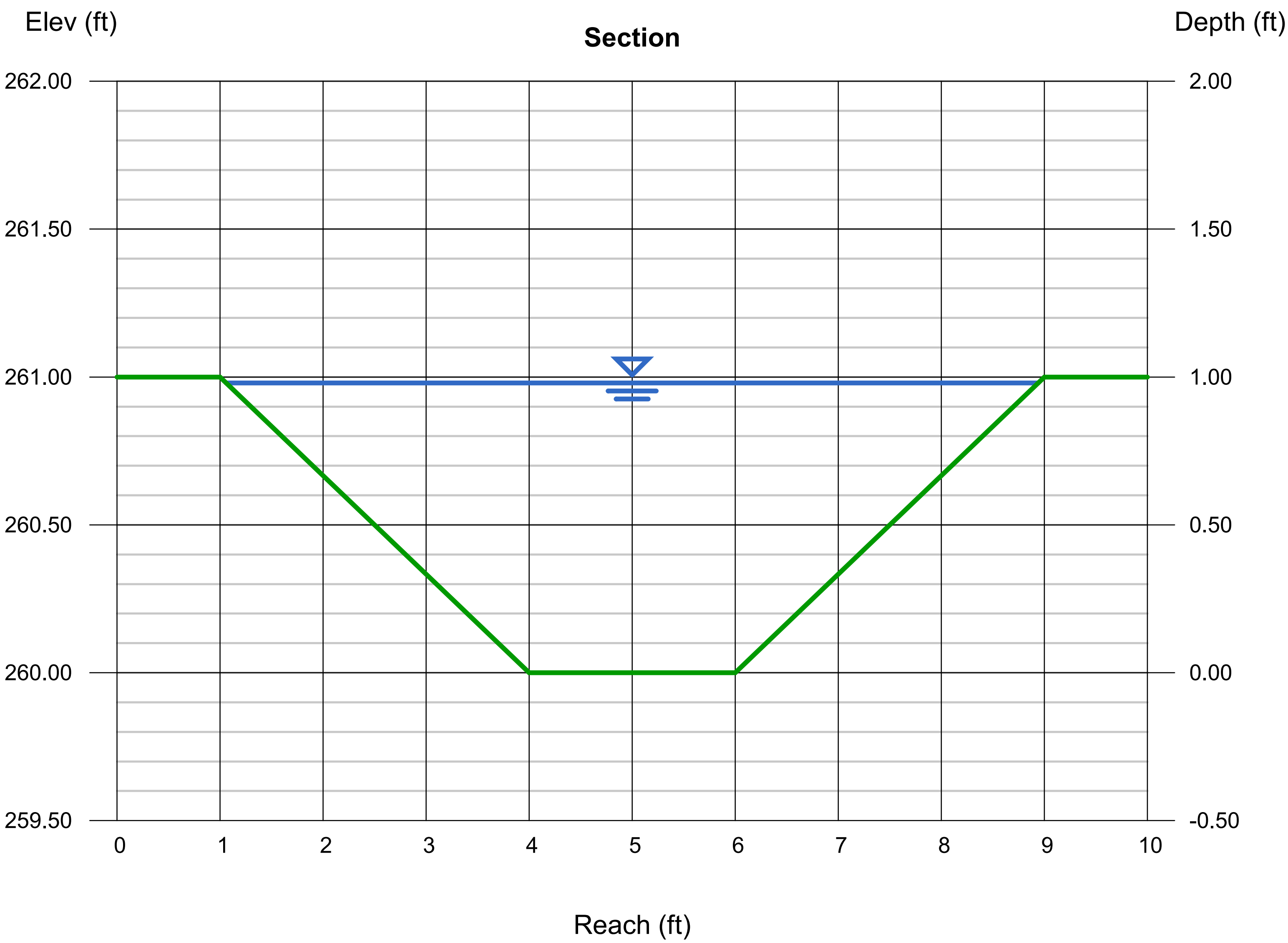


Channel Report

C-2 Swale

25-year, 24-hour Future 2050 storm event

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 2.00	Depth (ft)	= 0.98
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 9.900
Total Depth (ft)	= 1.00	Area (sqft)	= 4.84
Invert Elev (ft)	= 260.00	Velocity (ft/s)	= 2.04
Slope (%)	= 1.20	Wetted Perim (ft)	= 8.20
N-Value	= 0.055	Crit Depth, Yc (ft)	= 0.67
		Top Width (ft)	= 7.88
Calculations		EGL (ft)	= 1.05
Compute by:	Known Q		
Known Q (cfs)	= 9.90		

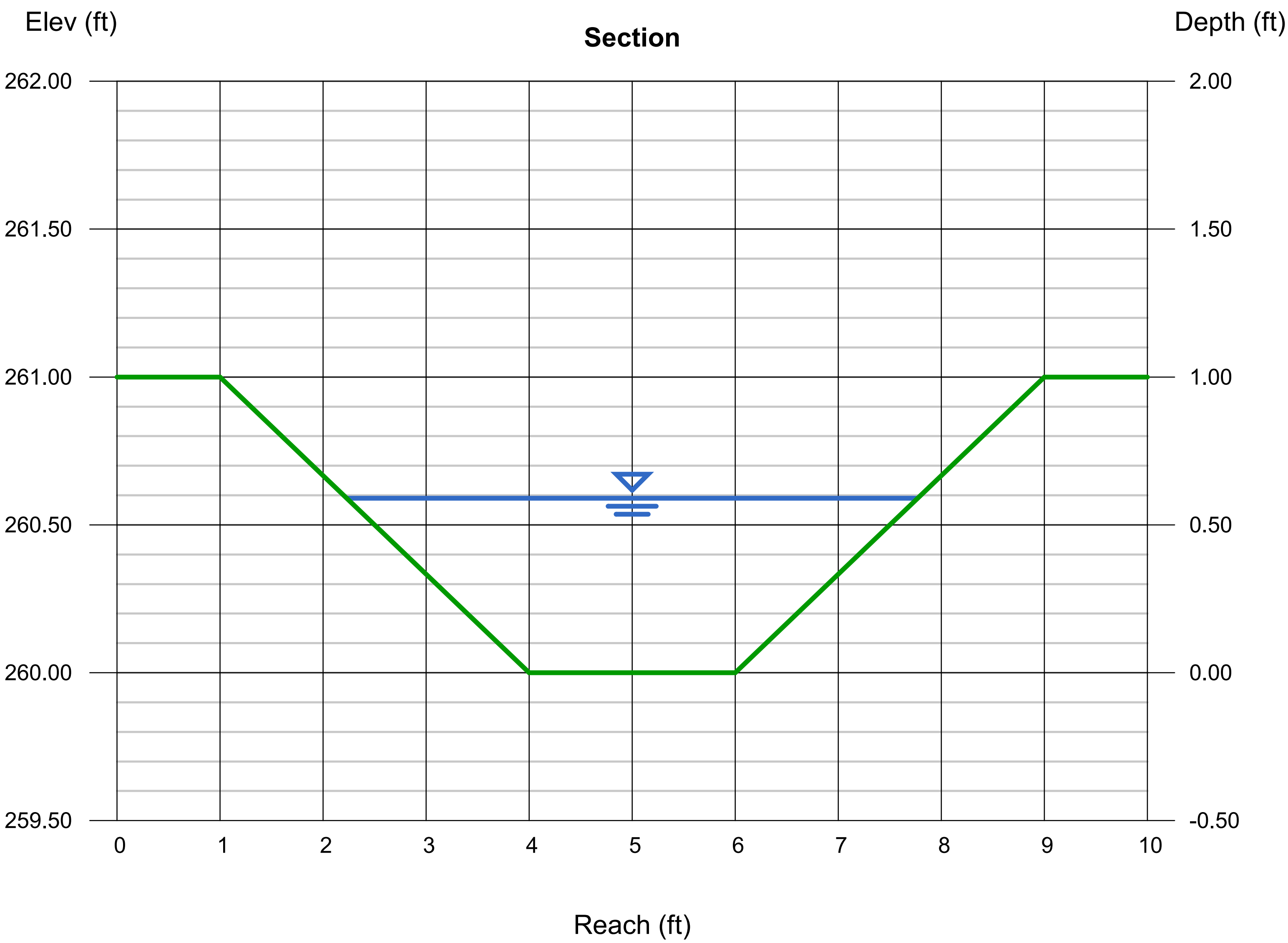


Channel Report

C-2 Swale

25-year, 24-hour NOAA Atlas 14 storm event

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 2.00	Depth (ft)	= 0.59
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 6.700
Total Depth (ft)	= 1.00	Area (sqft)	= 2.22
Invert Elev (ft)	= 260.00	Velocity (ft/s)	= 3.01
Slope (%)	= 4.40	Wetted Perim (ft)	= 5.73
N-Value	= 0.055	Crit Depth, Yc (ft)	= 0.54
		Top Width (ft)	= 5.54
Calculations		EGL (ft)	= 0.73
Compute by:	Known Q		
Known Q (cfs)	= 6.70		



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Apr 13 2023

C-2 Swale

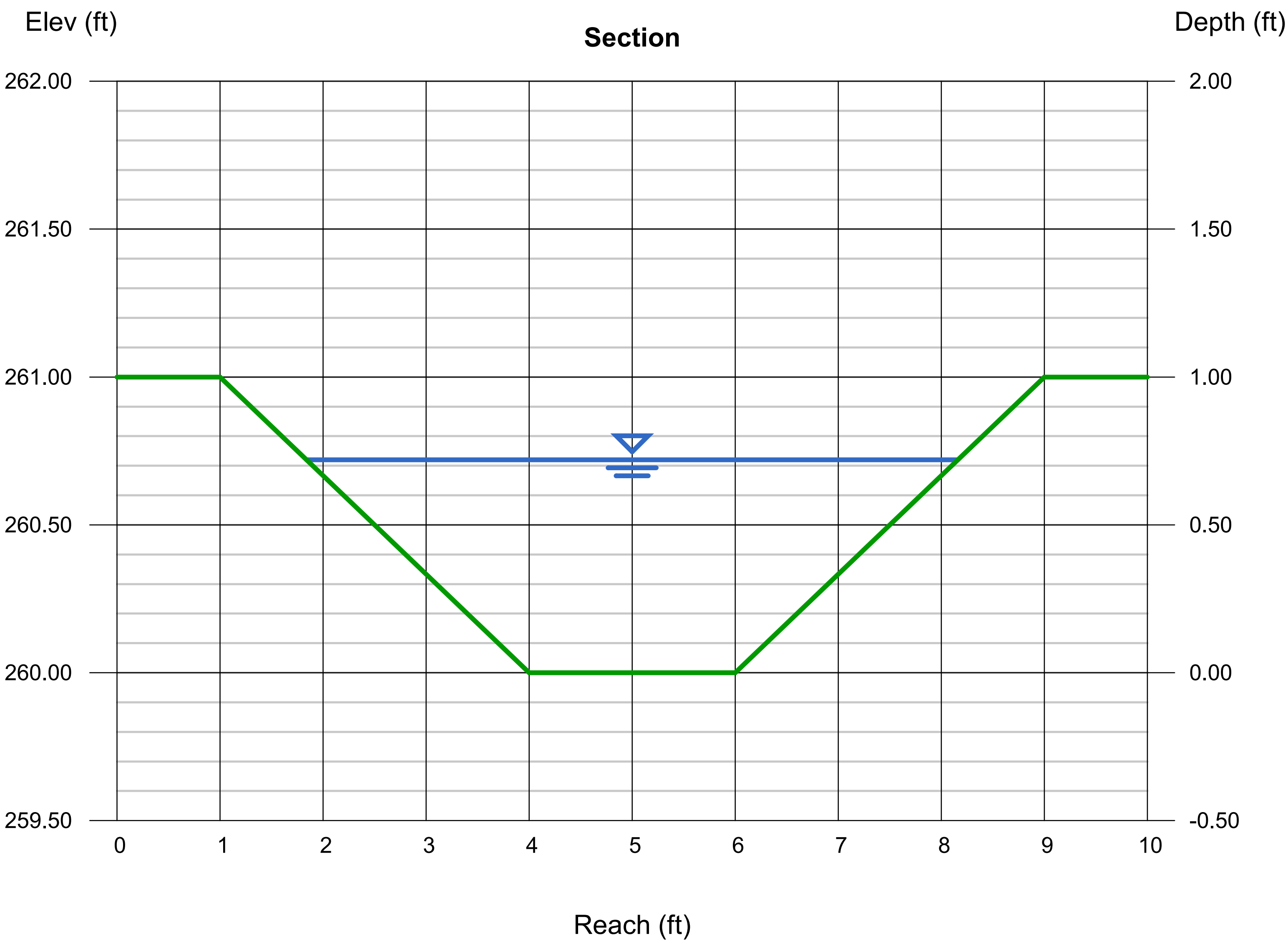
25-year, 24-hour Future 2050 storm event

Trapezoidal		Highlighted	
Bottom Width (ft)	= 2.00	Depth (ft)	= 0.72
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 9.900
Total Depth (ft)	= 1.00	Area (sqft)	= 3.00
Invert Elev (ft)	= 260.00	Velocity (ft/s)	= 3.31
Slope (%)	= 4.40	Wetted Perim (ft)	= 6.55
N-Value	= 0.055	Crit Depth, Yc (ft)	= 0.67
		Top Width (ft)	= 6.32
		EGL (ft)	= 0.89

Calculations

Compute by: Known Q

Known Q (cfs) = 9.90



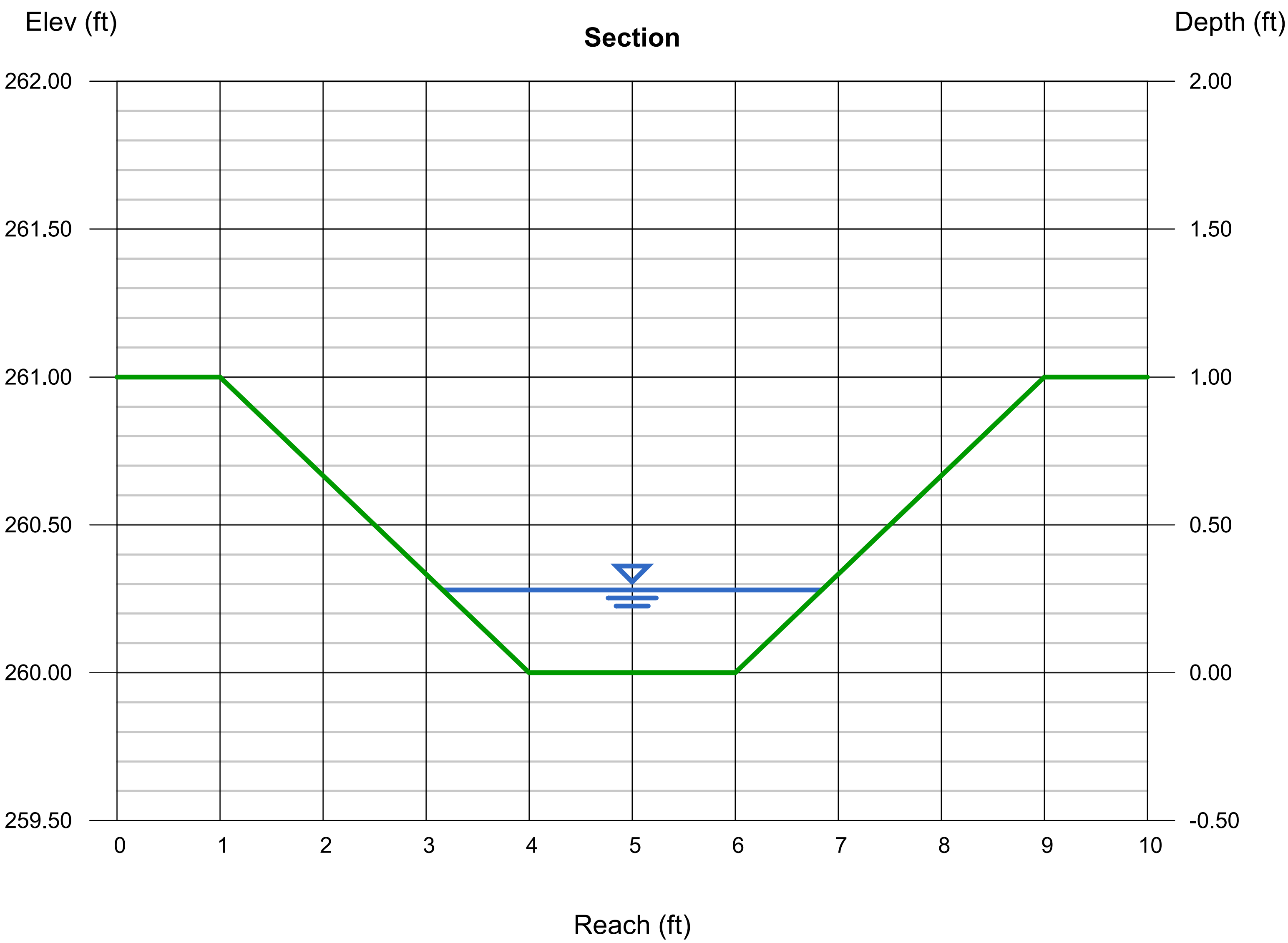
Channel Report

D Swale

25-year, 24-hour NOAA Atlas 14 storm event

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 2.00	Depth (ft)	= 0.28
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 1.120
Total Depth (ft)	= 1.00	Area (sqft)	= 0.80
Invert Elev (ft)	= 260.00	Velocity (ft/s)	= 1.41
Slope (%)	= 2.30	Wetted Perim (ft)	= 3.77
N-Value	= 0.055	Crit Depth, Yc (ft)	= 0.20
		Top Width (ft)	= 3.68
		EGL (ft)	= 0.31

Calculations
Compute by: Known Q
Known Q (cfs) = 1.12



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. — Thursday, Apr 13 2023

D Swale

25-year, 24-hour Future 2050 storm event

Trapezoidal

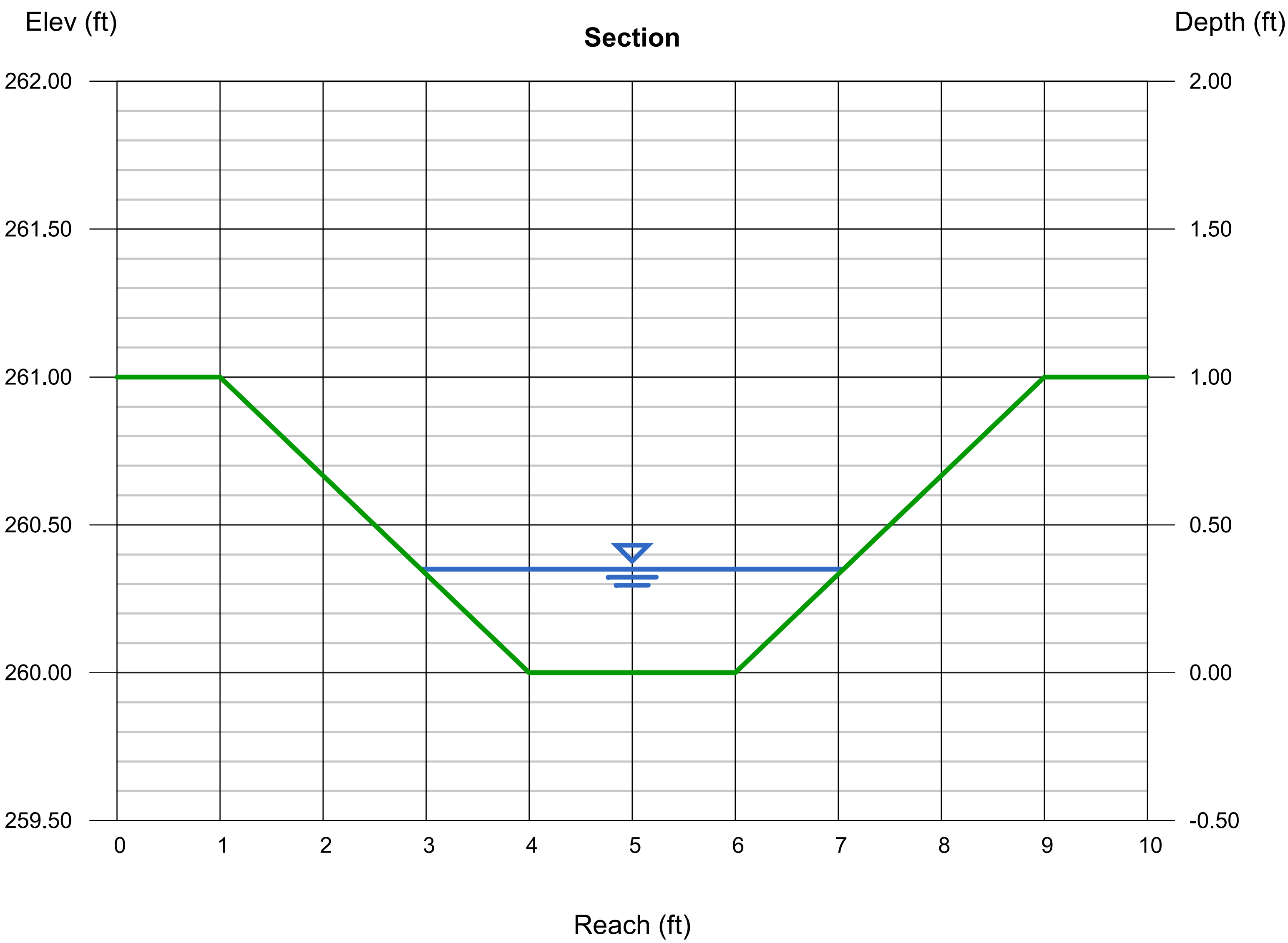
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 260.00
Slope (%)	= 2.30
N-Value	= 0.055

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.66

Highlighted

Depth (ft)	= 0.35
Q (cfs)	= 1.660
Area (sqft)	= 1.07
Velocity (ft/s)	= 1.56
Wetted Perim (ft)	= 4.21
Crit Depth, Yc (ft)	= 0.25
Top Width (ft)	= 4.10
EGL (ft)	= 0.39



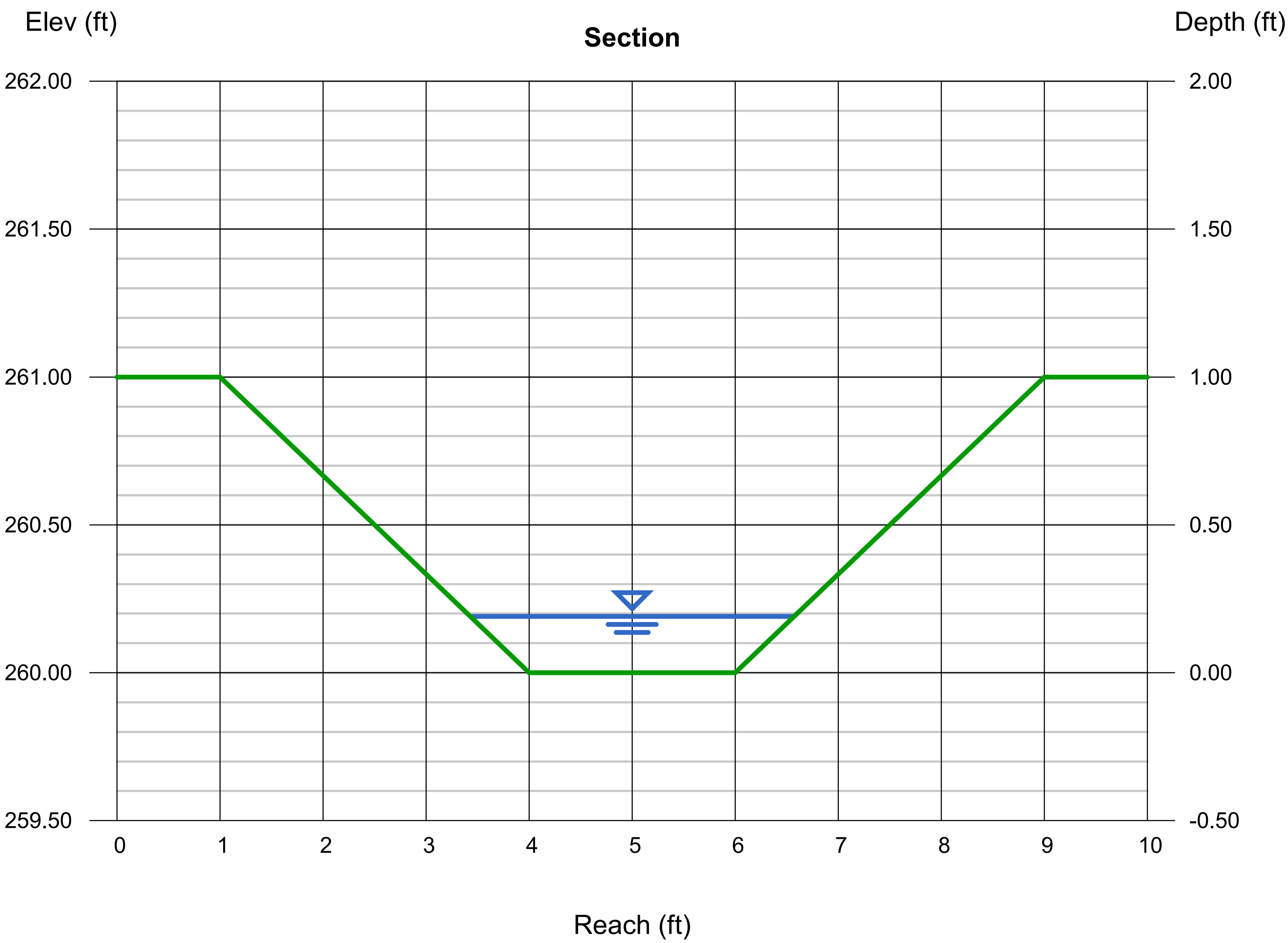
Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Apr 13 2023

D Swale

25-year, 24-hour NOAA Atlas 14 storm event

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 2.00	Depth (ft)	= 0.19
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 1.120
Total Depth (ft)	= 1.00	Area (sqft)	= 0.49
Invert Elev (ft)	= 260.00	Velocity (ft/s)	= 2.29
Slope (%)	= 10.00	Wetted Perim (ft)	= 3.20
N-Value	= 0.055	Crit Depth, Yc (ft)	= 0.20
		Top Width (ft)	= 3.14
Calculations		EGL (ft)	= 0.27
Compute by:	Known Q		
Known Q (cfs)	= 1.12		



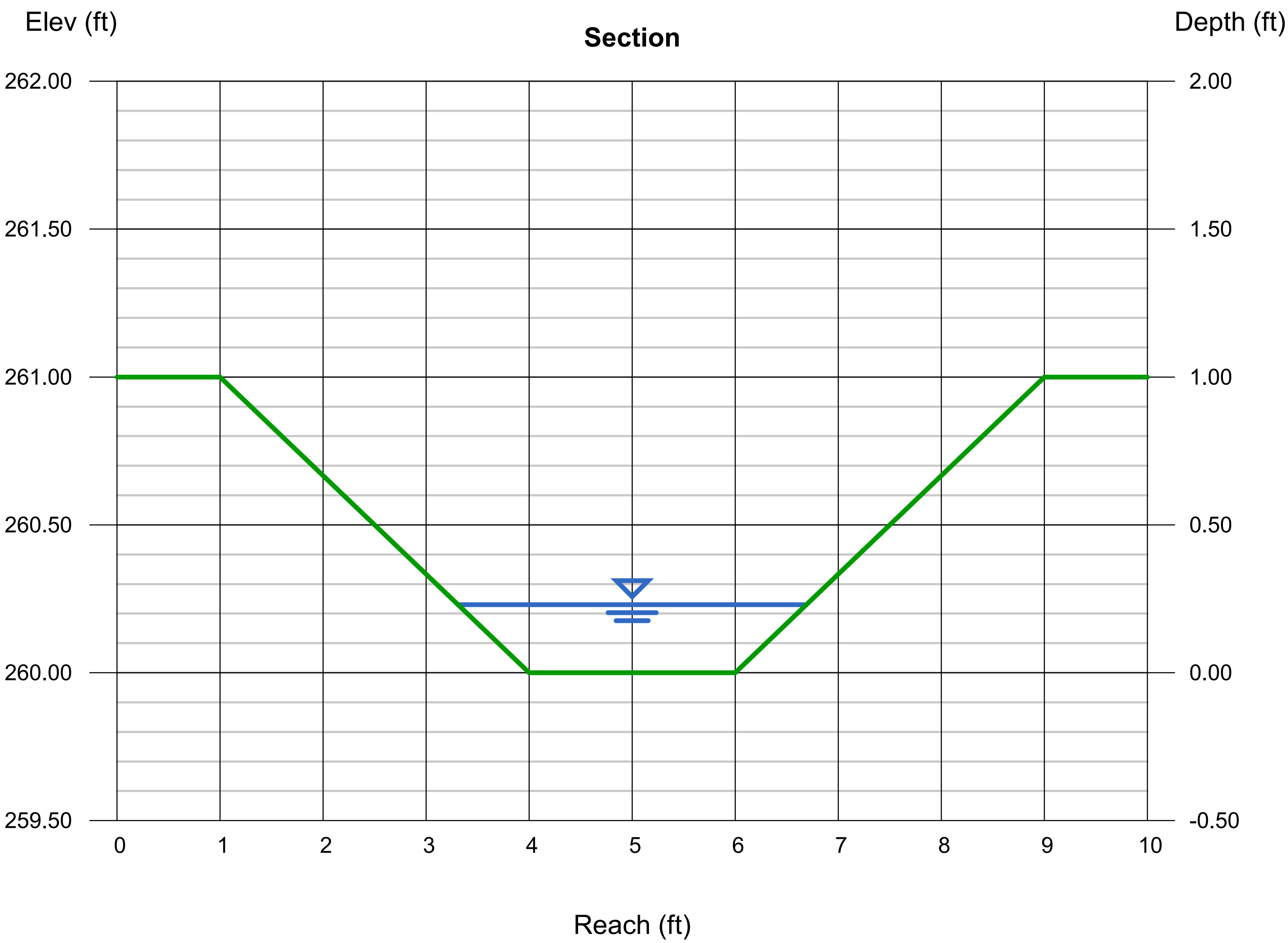
Channel Report

D Swale

25-year, 24-hour Future 2050 storm event

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 2.00	Depth (ft)	= 0.23
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 1.660
Total Depth (ft)	= 1.00	Area (sqft)	= 0.62
Invert Elev (ft)	= 260.00	Velocity (ft/s)	= 2.68
Slope (%)	= 10.00	Wetted Perim (ft)	= 3.45
N-Value	= 0.055	Crit Depth, Yc (ft)	= 0.25
		Top Width (ft)	= 3.38
		EGL (ft)	= 0.34

Calculations
Compute by: Known Q
Known Q (cfs) = 1.66



APPENDIX I

Long Term Pollution Prevention Operation and Maintenance Plan

LANGAN

SITE OPERATION AND MAINTENANCE PLAN

for

Medway Grid Energy Storage Project
Milford Street, Medway, MA 02053

55 Milford Street, 53 Milford Street, 49 Milford Street, 47 Milford Street

Prepared By:

Langan Engineering and Environmental Services, Inc.
100 Cambridge Street, Suite 1310
Boston, MA 02114

Prepared For:

Medway Grid, LLC
988 Howard Avenue, Suite 200
Burlingame, CA 94010
Justin Adams
justin.adams@eolianenergy.com
860.839.8373

LANGAN

May 2023
Langan Project No. 151033401

Stormwater Operation and Maintenance Plan
Medway Battery Energy Storage System, Medway, MA

Long Term Pollution Prevention Operation and Maintenance Plan

The purpose of this Long-Term Pollution Prevention Operation and Maintenance Plan ("O&M") is to provide project specific information related to the long term operation, maintenance, inspection, documentation, and performance of the structural and non-structural stormwater features. Regular inspection and maintenance of the stormwater management system is necessary to ensure proper operation of the system. The following O&M has been prepared to ensure the proposed system functions as intended. This O&M plan identifies maintenance procedures, schedules, and responsible parties.

The Long-Term Pollution Prevention Operation and Maintenance Plan has been compiled in general accordance with Federal, State, and Local requirement in addition to stormwater best management practices ("BMPs").

Responsible Parties

Medway Grid, LLC, or any successor of, shall be the party responsible for implementing this O&M plan.

Medway Grid, LLC
988 Howard Avenue, Suite 200
Burlingame, CA 94010
(860) 839-8373 (Contact: Justin Adams)

Name and Title: Justin Adams, Vice President

Signature: ____

Date: ____

Stormwater Operation and Maintenance Procedures

Procedures are obtained from the Massachusetts Stormwater Handbook. These procedures are for all structural and non-structural BMPs and are intended to eliminate or reduce the long-term soil erosion and degradation of stormwater features following construction completion. The inspection and successful implementation of all stormwater measures, shall be the Property Manager's responsibility. The Property Manager is responsible for training employees to perform O&M and to provide ongoing training as needed in response to staff changes. Implement employee training program and hold session at least once a year. The stormwater management system inspection and maintenance checklist, stormwater management system maintenance log form, and photographs shall be submitted to the Department of Public Works on the anniversary date of the permit or on an annual date as required by the town.

The maintenance schedule may be amended to by mutual agreement of the Department of

Public Works and the Responsible Parties. Proposed amendments must be in writing and signed by all Responsible Parties. Responsible Parties shall include owner(s), persons with financial responsibility, and persons with operational responsibility. Proposed amendments must be described in detail along with reasons why the town should consider them. Amendments will not be considered until at least three years after Project Completion as defined in Section 26.5.12 of the Medway General Bylaws, Article XXVI Stormwater Management and Land Disturbance.

Estimated Annual Costs

The estimated annual cost for the implementation of this plan is **$20,000.**

Notification to Future Property Owners and Department of Public Works

Medway Grid, or any successor of, agrees to notify in writing all future property owners of the presence of the storm water management system and the requirements for proper operation and maintenance. The owner(s) of the stormwater management system must notify the Department of Public Works of changes in ownership or assignment of financial responsibility.

Stormwater Management Plan Overview

Stormwater runoff is managed on site using an underground perforated and closed pipe network with dry wells, deep sump catch basin, swales, and an infiltration basin.

Infiltration BMPs

Dry Well

Activity	Frequency
Inspect dry wells.	After every major storm in the first few months after construction to ensure proper stabilization and function. Thereafter, inspect annually.
Measure the water depth in the observation well at 24- and 48-hour intervals after a storm. Calculate the clearance rates by dividing the drop in water level (inches) by the time elapsed (hours).	See activity.

Infiltration Basin

Activity	Frequency
Preventative maintenance.	Twice a year.
Inspect to ensure proper functioning.	After every major storm during the first 3 months of operation and twice a year thereafter and when there are discharges through the high outlet orifice.
Mow the buffer area, side slopes, and basin bottom if grassed floor; remove trash and debris; remove grass clippings and accumulated organic matter.	Once a year.

Structural BMPs

Outlet Control Structures and Manholes

Activity	Frequency
Inspect outlet control structure and manhole structures. Test shut-off valves to ensure proper functioning.	Two times per year.
Clean units. Remove sediment, trash, and other trapped pollutants.	As required.

Deep Sump Catch Basin

Activity	Frequency
Inspect units.	Four times per year.
Clean units.	Four times per year or whenever the depth of deposits is greater than or equal to one half of the depth from the bottom of the invert of the lowest pipe in the basin.

Conveyance BMPs

Swale

Activity	Frequency
Inspect channels to make sure crushed stone is adequate and for signs of rilling and gullying. Repair any rills or gullies. Replace misplaced stone.	The first few months after construction and twice a year thereafter.
Check for wear in filter fabric.	As necessary. Replace torn or worn filter fabric as needed.
Remove sediment and debris manually.	At least once a year.
Reapply stone.	As necessary.

Crushed Stone Trench

Activity	Frequency
Inspect trench to make sure crushed stone is adequate. Replace misplaced stone.	The first few months after construction and twice a year thereafter.
Check for wear in filter fabric.	As necessary. Replace torn or worn filter fabric as needed.
Remove sediment and debris manually.	At least once a year.
Reapply stone.	As necessary.

Meadow Vegetation

Several meadow mixes for vegetation are designated throughout the site on steep slopes, within the infiltration basin, and other areas. Refer to the LP100 series plans. After the first growing season, and if the meadow mix is well established, the meadow mix shall be mowed only once annually. The typical height of the meadow mix will be taller than 12 inches. Annual maintenance mowing shall be done in late winter during the month of March. Mow the detention basin and wetland transition areas during drier site conditions when soil disturbance will not occur. Do not mow in wetland areas.

Material and Equipment Storage

Material and equipment storage shall be done in a safe and orderly fashion. All debris and waste shall be collected and disposed of offsite in a legal manner in accordance with local and federal guidelines.

Snow Management

The temporary storage of snow may be permitted in accordance with the locally approved permit plans in the pre-determined locations. If the capacity of the delineated snow storage areas are exceeded, additional snow shall be hauled off site. Snow may not be disposed of in or around wetland area or riverfront area. The wetlands, riverfront area and wetlands buffer zones are shown in the attached permit drawings.

Deicing materials may be applied to areas such as access roads, and parking stalls before a storm event. Alternative materials to salt, such as calcium chloride and calcium magnesium acetate should be considered. Use of salt for deicing should be minimized on site. Deicing materials should be used with discretion in accordance with standard practices and over application must be avoided. Deicing materials shall be stored offsite. Sand shall not be used.

After the winter season, all access drives shall be cleaned of sediment and debris.

Spill Control & Containment

The following measures must be implemented to minimize, control, and contain spills:

- Store chemicals inside and offsite, when applicable
- Pick up litter
- The spill shall be contained as close to the source as possible with a dike of absorbent materials from the spill cleanup equipment (such as socks, pads, pillows, or "pigs"). Additional dikes must be constructed to protect swales or other stormwater conveyances or streams. A cover or dike will shall protect any other stormwater structures such as catch basins.
- Implement employee training program and hold session at least once a year.
- Identify spill control team. The name(s) of the responsible spill personnel will be posted on-site.
- Each employee will be instructed that all spills are to be reported to the spill prevention and cleanup coordinator. The supervisor will assess the incident and initiate proper containment and response procedures immediately upon notification. Workers should avoid direct contact with spilled materials during the containment procedures.
- In the event of a release of oil or hazardous waste to the storm drainage system or waters of the Commonwealth, the person shall immediately notify the Fire and Department of Public Works.
- The reporting person shall provide to Department of Public Works written confirmation of all telephone, electronic or in-person notifications within three business days thereafter.
- If the discharge of prohibited materials emanates from a commercial or industrial facility, the facility owner or operator of the facility shall retain on-site a written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

Pesticides and Fertilizers

- Pesticide/Herbicide Usage – No pesticides are to be used unless a single spot treatment is required for a specific control application.
- Fertilizer usage should be avoided. If deemed necessary, slow-release fertilizer should be used. Fertilizer may be used to begin the establishment of vegetation in bare or damaged areas, but should not be applied on a regular basis unless necessary

Stormwater Operation and Maintenance Plan
Medway Battery Energy Storage System, Medway, MA

STORMWATER MANAGEMENT SYSTEM INSPECTION AND MAINTENANCE CHECKLIST

Medway Battery Energy Storage System, Medway, MA Date:					Time:	Inspector: Site Conditions:
Structural Best Management Practice	**Schedule**	**Action**	**Date Completed**	**Completed By**	**Satisfactory? Yes (Y) or No (N)**	**Comments or Corrective Measures Taken**
Dry Well						
Inspect dry wells	After every major storm in the first few months after construction. Thereafter, 1x a year	Inspect			Y N	
Measure the water depth in the observation well at 24- and 48-hr intervals after a storm. Calculate the clearance rates by dividing the drop in water level (in) by the time elapsed (hrs)	See activity	Inspect			Y N	
Infiltration Basin						
Preventative maintenance	2x a year	Inspect			Y N	
Inspect to ensure proper functioning	After every major storm during the first 3 months of operation and 2x a year thereafter and when there are discharges through the high outlet orifice	Inspect			Y N	
Mow the side slopes, and basin bottom if grassed floor; remove trash and debris; remove grass clippings and accumulated organic matter	1x year	Mow & Clean			Y N	

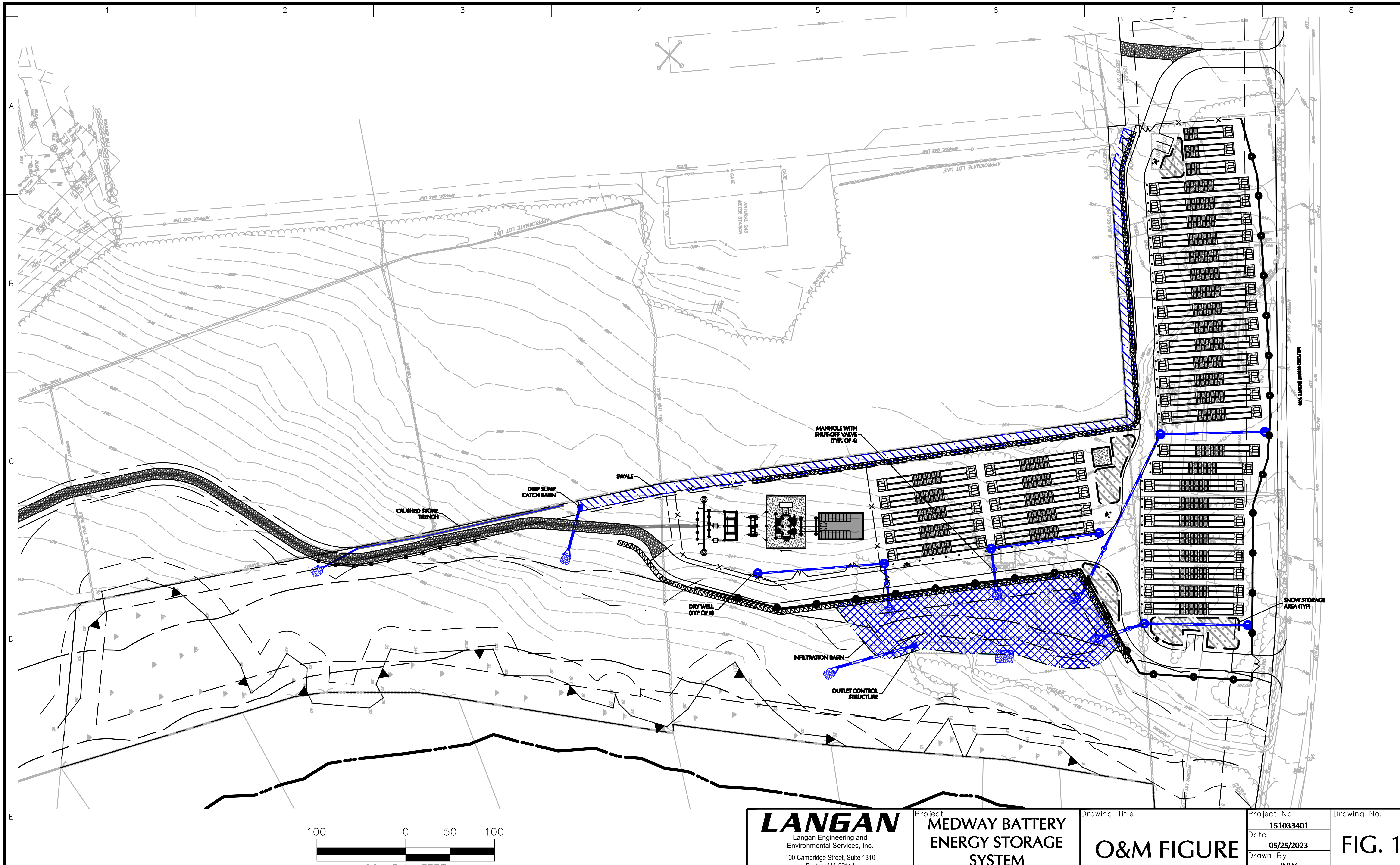
Stormwater Operation and Maintenance Plan
Medway Battery Energy Storage System, Medway, MA

Structural Best Management Practice	Schedule	Action	Date Completed	Completed By	Satisfactory? Yes (Y) or No (N)	Comments or Corrective Measures Taken
Deep Sump Catch Basin						
Inspect units	4x a year	Inspect			Y N	
Clean units	4x a year or whenever the depth of deposits is greater than or equal to one half of the depth from the bottom of the invert of the lowest pipe in the basin	Clean			Y N	
Outlet Control and Manhole Structure						
Inspect outlet control structure and manhole structures. Test shut-off valves to ensure proper functioning	2x a year	Inspect			Y N	
Clean units. Remove sediment, trash, and other trapped pollutants	As required	Clean			Y N	
Swale						
Inspect to ensure adequate stone cover and function	First few months after construction; 2x a year thereafter	Inspect			Y N	
Reapply and replace filter fabric	As necessary	Replace			Y N	
Crushed Stone Trench						
Inspect to ensure adequate stone cover and function		Inspect			Y N	
Remove sediment and debris		Clean			Y N	

Stormwater Operation and Maintenance Plan
Medway Battery Energy Storage System, Medway, MA

STORMWATER MANAGEMENT SYSTEM MAINTENANCE LOG FORM

Medway Battery Energy Storage System, Medway, MA				
No.	**Description of Maintenance Activity**	**Date**	**Staff or Contractor**	**Comments or Follow-up Items**



LANGAN

Langan Engineering and Environmental Services, Inc.
100 Cambridge Street, Suite 1310
Boston, MA 02114
T: 617.824.9100 F: 617.824.9101 www.langan.com

Project	Drawing Title	Project No.	Drawing No.
MEDWAY BATTERY ENERGY STORAGE SYSTEM	O&M FIGURE	151033401	FIG. 1
NORFOLK MEDWAY MASSACHUSETTS		Date 05/25/2023	
		Drawn By JNW	
		Checked By FH	Sheet of

LANGAN

Project No. 151033401

Date: 5/19/2023 Time: 08:48 User: jwatler Style Table: Langan.stb Layout: FIG. 1 Document Code: 151033401-0301-CG102-0101

APPENDIX J

Illicit Discharge Compliance Statement

ILLICIT DISCHARGE COMPLIANCE STATEMENT

RESPONSIBILITY:

The Owner is responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy and responsible for identifying and eliminating illicit discharges (as defined by USEPA).

OWNER NAME:	Medway Grid, LLC
ADDRESS:	988 Howard Avenue, Suite 200, Burlingame, CA 94010
TEL. NUMBER:	(860) 839-8373 (Contact Justin Adams)

OWNER'S COMPLIANCE STATEMENT:

To the best of my knowledge, the attached plans, computations and specifications meet the requirements of Standard 10 of the Massachusetts Stormwater Handbook regarding illicit discharges to the stormwater management system and that no detectable illicit discharges exist on the site. All documents and attachments were prepared under my direction and qualified personnel gathered and evaluated the information submitted, to the best of my knowledge.

Included with this statement are site plans, drawn to scale, that identify the location of systems for conveying stormwater on the site and show that these systems do not allow the entry of any illicit discharges into the stormwater management system. The plans also show any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater systems.

For a redevelopment project (if applicable), all actions taken to identify and remove illicit discharges, including without limitation, visual screening, dye or smoke testing, and the removal of any sources of illicit discharges to the stormwater management system are documented and included with this statement.

Name and Title: Justin Adams, Vice President

Signature:______________________________

Date:______________________________

APPENDIX K

Geotechnical Evaluations

LANGAN

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ENVIRONMENTAL
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WATER
CONSTRUCTION MANAGEMENT

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F: 781.278.5701
F: 781.278.5702
www.gza.com

VIA EMAIL

Updated August 31, 2022
File No. 01.0175331.20

Medway Grid, LLC
988 Howard Ave, Suite 200
Burlingame, CA 94010

Attn: Christina Wolf

Re: Updated Geotechnical Report
Proposed Energy Storage Installation
50-53 Milford Street
Medway, Massachusetts

Dear Ms. Wolf:

In accordance with our agreement executed on September 8, 2021 and revised on July 15, 2022, GZA GeoEnvironmental, Inc. (GZA) is pleased to present this updated geotechnical engineering report to Medway Grid, LLC (Client; Medway Grid) for the above-referenced battery energy storage system (BESS) project. The objectives of our services were to further evaluate subsurface conditions with additional test borings, conduct laboratory analysis of soils, and develop updated geotechnical recommendations for the proposed Battery Energy Storage System (BESS) foundations and associated site development. This report supersedes the GZA's geotechnical report issued October 18, 2021.

This report is subject to the *Limitations* outlined in **Appendix A** and the Terms and Conditions of our agreement.

BACKGROUND

This updated geotechnical report was prepared as part of our geotechnical engineering services for the site located at 50-53 Milford Street in Medway, Massachusetts (Site). Our understanding of the project was based on:

- Discussions with you and the project team;
- Online aerial photography;
- Our previous work at the site and our previous Geotechnical Report dated October 18, 2021;
- An Existing Conditions Plan, Sheets 1 and 2 prepared by Land Planning, Inc. and dated July 8, 2021;
- A Utility Findings Map prepared by GPRS Inc. and dated August 4, 2021;
- A plan entitled "Medway BESS Grading and Drainage Plan" prepared by Burns & McDonnell dated December 6, 2021;
- A plan entitled "Medway BESS General Arrangement Tesla" prepared by Burns & McDonnell, with a revision date of January 14, 2022;
- RFP documentation provided by Medway Grid to GZA and dated June 28, 2021; and

- GZA's recent Geotechnical Report for the Proposed Underground Transmission Line on the adjacent Eversource property, issued August 4, 2022.

Existing Conditions

The site is bounded by Milford Street to the north, tree cover to the south, overhead transmission lines to the west beyond a wooded area (owned by Eversource), and residential abutters and wetlands to the east. An existing electrical substation abuts the site further to the south. Access to the site is from Milford Street to the north.

The site Parcel IDs are Map 56, Lots 5 and 6 and Map 46, Lots 55, 56, and 57 which make up a combined site area of approximately 4.5 acres. The eastern portion of the site is currently occupied by a single-family home with several outbuildings. The western portion of the site along Milford Street is occupied by an autobody shop with a wooded area beyond to the west. Based on the provided plans, the site generally slopes down from west to east, with existing site grades consisting of:

- Grades along Milford Street range from approximately El. 254 in the west to El. 242 in the east.
- Grades in the central portion of the site range from approximately El. 264 in the west to El. 238 in the east (NAVD88 Datum).

Multiple bedrock outcrops are visible at the site around the existing single-family home and outbuildings. Conversations with the current homeowner indicated that shallow bedrock was encountered during construction of the outbuildings on the property.

Proposed Conditions

The proposed development consists of about 4.5 acres of energy storage/electrical equipment pad areas, including a separate substation equipment pad. Based on the January 2022 General Arrangement Plan, there will be four main energy storage areas. Three storage areas are shown along Milford Street. A fourth storage area will be located further south. An electrical substation is proposed at the southern portion of the development area. Each energy storage area will consist of five to thirteen rows of BESS structures. One transformer will be located at the end of each row of energy storage equipment. Based on the provided plans, we understand the energy storage containers consist of Tesla Megapacks and will be up to about 9 feet in height, approximately 5.5 feet in width, and approximately 30 feet in length. Energy storage containers will be placed in groups of two, back-to-back, such that two to four energy storage containers are constructed in each row. Based on available online information, Tesla Megapack energy storage containers are on the order of about 56,000 pounds, and will result in a load of approximately 350 pounds per square foot (psf).

A permanent unpaved access road is proposed to enter the site from Milford Street to the north. The access road will have two entrances along Milford Street, one to the east and one to the west of the three energy storage areas located along Milford Street. The access road will provide access to each of the energy storage areas and to the proposed substation in the southern portion of the site. The plans indicate that the unpaved access road will be 12 feet wide and will extend past the proposed substation to provide maintenance access to the proposed underground transmission line which extends into the adjacent Eversource property to the west. A 22-foot-tall sound barrier wall is proposed between the access road entrances along Milford Street and along the eastern perimeter of the BESS facility. We anticipate the foundation for the wall will consist of wall support elements cast into drilled shafts.

Proposed grades indicate that cuts up to 14 feet will be required in the west and fills up to 14 feet will be required in the east. A retaining wall/cut slope up to 14 feet in height is proposed along the western side of the central portion of the development area, with equipment shown less than ten feet from the western property line. A retaining wall/cut slope up to 12 feet high is proposed along the southern perimeter of the western parcel along Milford Street. A fill area of up to

14 feet is proposed along the eastern side of the site. Additionally, a stormwater retention pond is proposed along the eastern side of the eastern fill area with up to 12 feet of filling to create a stormwater retention pond. The retaining wall will taper to about 6 feet in height along most of the stormwater retention pond.

SCOPE OF SERVICES

To meet the stated objectives, GZA performed the following Scope of Services:

- Coordinated, performed, and documented an exploration program consisting of two days of test borings at the site in 2021, and an additional two days of supplemental test borings at the site in 2022.
- Performed laboratory gradation analyses on six soil samples; corrosivity testing was performed on one composite soil sample; and one composite soil sample was submitted for thermal resistivity laboratory testing, which included gradation analysis and modified Proctor compaction testing;
- Evaluated subsurface conditions based on the previous and supplemental explorations and laboratory results to develop updated geotechnical design and construction recommendations; and
- Prepared this updated geotechnical report summarizing our analyses and recommendations.

SUBSURFACE EXPLORATIONS

Test Borings

<u>2021 GZA BESS Test Borings</u>

GZA performed a subsurface exploration program consisting of 10 test borings (designated GZ-1 through GZ-10) in the area of the proposed BESS development. The test borings were performed by Drilex Environmental of Auburn, Massachusetts, on September 22 and 23, 2021 using a track-mounted, all-terrain drill rig. Borings were advanced to depths ranging between 3 and 11 feet below ground surface using hollow stem auger drilling techniques. All 10 borings, GZ-1 through GZ-10, were terminated due to auger refusal on probable bedrock. Split-spoon samples were collected, and Standard Penetration Tests (SPTs) were generally performed continuously to a depth of about 6 feet and at 5-foot intervals thereafter. The SPT method consists of driving a 1⅜-inch ID split-spoon sampler 24 inches with a 140-pound auto hammer falling 30 inches. The number of blows required to drive the sampler from 6 to 18 inches is the SPT blow count (N-value), which is a commonly used indicator of soil density and consistency. Where auger refusal was encountered above a depth of 10 feet, the boring was generally offset approximately 5 to 10 feet and reattempted in order to better assess the potential presence of bedrock. Upon completion, the borings were backfilled with drill cuttings to the approximate ground surface.

<u>Previous GZA Underground Transmission Line Test Borings</u>

GZA performed a subsurface exploration program consisting of 10 test borings (designated GZ-11UG through GZ-20OH) along the proposed underground transmission line alignment and in the vicinity of the proposed BESS substation at the locations requested by the project team. Test boring data and geotechnical recommendation related to the underground transmission line have been prepared under a separate cover. Refer to the Proposed Underground Transmission Line Geotechnical Report issued August 4, 2022 for additional details.

The two borings, designated GZ-18 and GZ-19, performed in the vicinity of the proposed BESS substation during this previous phase of work have also been included in this report. The remaining borings performed on the adjacent Eversource property are not included in this report. Refer to the Proposed Underground Transmission Line Geotechnical Report dated August 4, 2022 for further discussion of borings performed on the Eversource property.

2022 GZA BESS Explorations

GZA performed a supplemental subsurface exploration program consisting of five test borings (designated as GZ-21 through GZ-25) and, due to time limitations, 3 test probes (designated GZ-26 through GZ-28) along the western and southern property lines where cut slopes are proposed and along the alignment of the proposed sound wall. The borings were performed by New England Boring Contractors of Derry, New Hampshire, on August 4 and 5, 2022 using a track-mounted, all-terrain drill rig. Borings proposed at the western extent of the BESS along Milford Street were not able to be performed due to access issues for the drill rig in this wooded area.

The test borings and test probes were advanced to depths ranging between about 2 and 23 feet below ground surface using hollow stem auger or cased wash-rotary drilling techniques. Test boring GZ-23 and test probes GZ-26 through GZ-28 were terminated due to auger refusal on probable bedrock. Bedrock coring was performed at borings GZ-22 and GZ-24. Split-spoon samples were collected in the borings (GZ-21 through GZ-25), and Standard Penetration Tests (SPTs) were generally performed continuously to a depth of about 6 feet and at 5-foot intervals thereafter. SPTs and sampling was not performed in the probes (GZ-26 through GZ-28). Upon completion, the borings were backfilled with drill cuttings to the approximate ground surface.

A GZA representative observed the test borings and test probes, classified the soil samples based on the Modified Burmister Soil Classification System and ISRM rock classification system, and prepared the test boring logs attached as **Appendix B**. A handheld GPS unit was used to locate the borings in the field following completion. Refer to **Figure 1** for an exploration location plan depicting approximate exploration locations and a table of exploration coordinates obtained using a handheld GPS unit. The approximate locations of the underground transmission line test borings have been included in this exploration location plan for completeness and clarity. As previously discussed, test boring data and geotechnical recommendation related to the underground transmission line have been prepared under a separate cover. Refer to the Proposed Underground Transmission Line Geotechnical Report dated August 4, 2022 for additional details related to those explorations.

LABORATORY ANALYSES

GZA performed gradation analyses on six soil samples collected from the site. Laboratory test results for gradation are included in **Appendix C**.

Corrosivity Testing

One composite soil sample from test borings GZ-1 through GZ-10 was evaluated for corrosivity using a suite of tests. The results from the corrosivity test is summarized in the Summary of Laboratory Corrosivity Testing table below. Based on the parameters presented in the Comparison of Corrosivity Testing Results table below, below grade exposed steel components on this site are considered to be susceptible to corrosion due to low pH, according to the cited references. Laboratory test results for corrosivity analyses are included in **Appendix D**.

Summary of Laboratory Corrosion Testing	
Resistivity	0.032 Mohm-cm (32,000 ohm-cm)
Sulfate	ND
Sulfide	ND
Chloride	ND
Redox Potential	249 mv
pH	5.39

Comparison of Corrosion Testing Results				
Parameter	Corrosive Based on Corrosivity Criteria[1]			Corrosive Based on Laboratory Results Compared to Corrosivity Criteria?
	CalTrans	AASHTO	FHWA	
Electrical Resistivity (ohm-cm)	Below 1,000 ohm-cm	Below 2,000 ohm-cm	Below 3,000 ohm-cm	No
pH	Below 5.5	Below 5.5; or Between 5.5 and 8.5 for organic soils	Below 5 and above 10	Yes
Sulfate (ppm)	Above 2,000 ppm	Above 1,000 ppm	Above 200 ppm	No
Chloride (ppm)	Above 500 ppm	No Criteria	Above 100 ppm	No

Based on American Concrete Institute (ACI) 318-14 Building Code and Commentary Table 19.3.1.1 and Table 19.3.2.1, it is our interpretation that the exposure class is “S0” and “no restriction” on cement type is applicable.

Thermal Resistivity Testing

Thermal resistivity laboratory testing of a composite sample from the upper 4 feet of on-site soils from borings GZ-1 through GZ-10, excluding organics, was performed and the results are included in **Appendix C**.

SUBSURFACE CONDITIONS

Soil

Based on GZA’s test borings, subsurface conditions generally consist of Forest Mat/Topsoil underlain by Subsoil and Glacial Till. A thin layer of Fill was encountered below the pavement at the two borings performed in the area of the existing auto repair shop (GZ-21 and GZ-22). Refer to the exploration logs attached in **Appendix B** for detailed subsurface conditions at specific exploration locations. The depths, thicknesses, and elevations referenced herein should be considered approximate.

The subsurface soil strata are presented below in order of increasing depth:

> _Forest Mat/Topsoil_ – About 0.25 feet to 1 foot of Forest Mat/Topsoil was encountered at the ground surface at each of the test boring locations located in the unpaved areas (GZ-1 through GZ-10, GZ-18, GZ-19, and GZ-23 through GZ-25). The Forest Mat/Topsoil generally consisted of brown to dark brown, clayey Silt/Silt, with a visual estimate (based on weight) of up to 50 percent fine to medium Sand and Roots, and up to 20 percent Gravel.
>
> _Subsoil_ – A Subsoil layer was encountered below the Forest Mat/Topsoil at each of the test borings located in the unpaved areas (GZ-1 through GZ-10, GZ-18, GZ-19, and GZ-23 through GZ-25) at approximately 0.25 feet to 1 foot below ground surface (bgs). The Subsoil generally consisted of brown to light brown or tan, fine to coarse Sand,

[1] Three references used to evaluate corrosion test criteria herein included:
-CalTrans Publication entitled "Memo to Designers 3-1 July 2008.” CalTrans considers a site to be corrosive if one or more of the parameters listed in the table are exceeded.
-AASHTO LRFD Bridge Design Specifications (Fifth Edition 2010). AASHTO considers site conditions to be indicative of a potential pile deterioration or corrosion situation if one or more of the parameters listed on the table are exceeded.
-FHWA Publication No.FHWA NHI-05-039 entitled "Micropile Design and Construction" December2005. FHWA uses the criteria listed in the table to determine whether the ground is classified to have strong corrosion potential or is aggressive if any one of the conditions listed is exceeded.

with a visual estimate (based on weight) of up to 50 percent Gravel and Silt, and less than 10 percent Roots. The Subsoil ranged from about 1 to 2.7 feet in thickness. SPT N-values in this layer ranged from 2 to 9 blows per foot (bpf), indicating very loose to loose consistency.

Fill – A Fill stratum was encountered below approximately 0.2 and 0.5 feet of asphalt in test borings GZ-21 and GZ-22, respectively. The Fill was observed to extend to approximately 2 feet below ground surface. The Fill generally consisted of gray, fine to coarse Sand with a visual estimate (based on weight) of up to 20 percent Silt, and less than 10 percent Gravel. SPT N-values in the Fill were 7 and 38 bpf, respectively, indicating a loose to dense consistency.

Glacial Till – A Glacial Till stratum was observed below the Subsoil at test borings GZ-1 through GZ-10, GZ-18, GZ-19 and GZ-23 and GZ-25, and below the Fill below the pavement area test borings, GZ-21 and GZ-22. Glacial Till was not encountered in test boring GZ-24, where the subsoil was encountered directly overlying bedrock. The top of the Glacial Till stratum was encountered at approximately 2 to 3 feet below ground surface at the test boring locations, corresponding with about elevations 237 to 258 feet. The Glacial Till generally consisted of dark brown to light brown or gray, fine to coarse Sand with a visual estimate (based on weight) of up to 50 percent Gravel and Silt. Test borings GZ-1, and GZ-3 through GZ-9, GZ-21, and GZ-23 were terminated within the Glacial Till stratum. Where fully penetrated in test borings GZ-2, GZ-10, GZ-18, GZ-19, GZ-22, and GZ-25, the glacial till was about 4 to 13.5 feet in thickness. SPT N-values in this layer ranged from 20 to greater than 100 bpf, indicating medium dense to very dense consistency.

Bedrock

Weathered Bedrock was encountered below the glacial till stratum within borings GZ-2, GZ-10, GZ-22, and GZ-25 between approximately 6 and 15.5 feet below ground surface. The *Weathered Bedrock* was identified by being penetrable by the hollow stem auger drilling equipment. The *Weathered Bedrock* generally consisted of very dense, dark brown or gray Gravel with a visual estimate (based on weight) of up to 50 percent fine to medium Sand and Silt.

Probable sound bedrock was encountered directly below the glacial till in borings GZ-1, GZ-3 through GZ-9, and below the weathered bedrock in borings GZ-2 and GZ-10, based on auger refusal. Bedrock probes performed at GZ-26 through GZ-28 encountered auger refusal at depths between approximately 2 and 15 feet below ground surface. The refusals were attributed to encountering probable bedrock. To confirm the presence and quality of the bedrock, the bedrock was cored at borings GZ-18, GZ-19, GZ-22, and GZ-24. Based on the cores recovered, the rock generally consisted of highly to slightly weathered, fine to coarse grained granite with very close to close joints/fractures. An approximately 14-inch-long seam of light gray quartzite was observed within the recovered granite core C-1 from boring GZ-18. The rock quality designations (RQDs) for the rock core samples from boring GZ-18, GZ-22 and GZ-24 were 35%, 0%, and 33%, respectively. Photographs of the rock cores are included as **Appendix E**. The depths to the top of probable bedrock are summarized in the Geotechnical Implications section below.

Groundwater

Groundwater was encountered in two of the test borings, GZ-1 and GZ-10, at approximately 5 feet and 10 feet below ground surface, respectively. Soil mottling/rust staining was observed in test boring GZ-1 between about ground surface and 4 feet below ground surface. Soil mottling/rust staining may be indicative of seasonal high ground water levels.

Note that groundwater observations may not represent stabilized groundwater conditions, given the limited stabilization time and relatively low permeability soils. Fluctuations in groundwater levels may occur due to variations in season, rainfall, site features and other factors different from those existing at the time of the explorations and measurements.

GEOTECHNICAL IMPLICATIONS OF SUBSURFACE CONDITIONS

Based on our experience with similar BESS facilities, we understand that slab-on-grade mat foundations are typically the preferred foundation option for at-grade support. Such equipment pads are designed with drained non-frost susceptible soil within the frost zone, estimated by GZA to be approximately 4 feet for this site. Alternatively, the BESS and electrical equipment can be supported on traditional concrete spread footing foundations supported at least 4 feet below proposed grade to avoid frost impacts.

As shown in the table below and based on our explorations, up to about 14 feet of bedrock will need to be removed. Based on the borings, most locations will not require bedrock removal, with rock excavation up to about 6 feet required at some locations to provide 4 feet of non-frost susceptible soil below the pad foundations or support spread footings below the 4-foot-deep frost zone. Alternately, footings may bear directly on sound, intact rock at a depth of least 2½ feet below final exterior grades, provided water is unable to pool between the bottom of the footing and the bedrock surface, as described in more detail later in this report.

Exploration ID	Elevations in Feet (NAVD88 Vertical Datum)				Depth to Sound Bedrock	Depth of Sound Rock Removal
	Existing Ground Surface	Estimated Proposed Grade	4 ft Below Proposed Grade	Top of Sound Rock		
GZ-1	251	251	247	244.5	6.5	None
GZ-2	260	251	247	253	7	6
GZ-3	260	252	248	252.5	7.5	4.5
GZ-4	254	251	247	244.5	9.5	None
GZ-5	249	250	246	242	7	None
GZ-6	242	242	238	239	3	1
GZ-7	258	252	248	253.5	4.5	5.5
GZ-8	255	251	247	249.5	5.5	2.5
GZ-9	239	244	240	231	8	None
GZ-10	247	236	232	236	11	4
GZ-18	244	244	240	237.5	6.5	None
GZ-19	242	250	246	233	9	None
GZ-21	256	255	251	<240	N/A	None
GZ-22	253	253	249	234	19	None
GZ-23	252	253	249	238.9	13.1	None
GZ-24	250	250	246	247.2	2.8	N/A
GZ-25	246	247	243	234.8	11.2	N/A
GZ-26	266	256	252	261.5	4.5	9.5
GZ-27	264	252	248	262.2	1.8	14.2
GZ-28	262	251	247	247.2	14.8	0.2

1. Borings GZ-21 through GZ-25 were performed along the approximate alignment of the proposed sound barrier wall.
2. Probes GZ-26 through GZ-28 were performed along the approximate alignment of the proposed western retaining wall/cut slope.

3. Depth of Sound Rock Removal includes assumed 4 feet below proposed grade for anticipated backfill with non-frost susceptible soils.

Based on the shallow bedrock observed in the borings, Medway Grid may consider revising the preliminary Grading and Drainage Plan and BESS layout to limit the extent of rock removal and provide adequate space for the retaining walls and cut bedrock slopes, with rockfall catchment areas. Currently, bedrock cuts up to 14 feet may be required along the western side of the site where drilling refusal was encountered within the borings in this area as shallow as 1.8 feet below ground surface. Note that, at the location of probe boring GZ-27 where the bedrock is estimated at a depth of 1.8 feet, bedrock was not cored to confirm bedrock; this shallow auger refusal could also be a large boulder. In some locations between the borings, an even greater depth of bedrock removal may be required. Removing sound bedrock over large areas during construction will likely require the use of controlled blasting.

For either at-grade mat foundations or buried spread footing foundations, bedrock removal will be necessary in some areas to reach design excavation depths. Where site filling is required, existing Forest Mat/Topsoil and Subsoil containing organics will need to be removed before backfilling to required surface grades with compacted Structural Fill.

BESS Graded Pad Area Proximity Next to the Western Property Line

Based on our experience, cut retaining walls in soil next to a property line are typically proprietary gravity block walls, as they can be installed without geogrid retained soil reinforcement. To accommodate grading at the property line, block width and a face angle of between one-horizontal to four vertical (1H:4V) and 1H:6V, the base of a 14-foot-high wall in soil would be on the order of 10 to 15 feet from the property line, assuming a construction easement allowing temporary excavation onto the adjacent property. If no excavation is allowed on the adjacent property, such required setback could be on the order of 25 feet or more from the property line. An alternative to a gravity block wall could be a permanent soil nail wall. The advantage of a soil nail wall would be that the required setback could be less than a gravity block wall, although easements may be required from the adjacent property owner if the soil nails need to extend beyond the property line to achieve wall stability.

If a bedrock cut is required along the property line of at least 14 feet to finished grade, a practical setback from the property line is required to the BESS pad area grading. Typically, a rockfall catchment zone is provided at the base of a bedrock cut slope for pieces of rock to fall due to freeze-thaw action over time. Assuming bedrock at the current ground surface, a bedrock cut slope of 1H:6V and a 10-foot-wide, 3-foot deep rockfall catchment zone, the required setback would need to be on the order of at least 15 feet.

If the required cut near the property line is both soil and bedrock, assuming a combined cut soil slope of 2.5H:1V or a retaining wall over a bedrock cut of 1H:6V, setback would need to be on the order of at least 20 feet.

Actual soil versus bedrock depth along the entire western property line will not be known until construction. During planning, the grading designer should consider planning the edge of the BESS area no closer than about 20 feet set back from the property line to allow flexibility in the actual slope design, considering the factors discussed above. A soil nail wall could be closer (more like greater than 10 feet) but design and construction of a transition from the soil nail wall to cut bedrock may be difficult and costly. Current equipment is shown less than 10 feet from the western property line; the pad area would be even closer.

GEOTECHNICAL RECOMMENDATIONS

The recommendations presented below are based on our evaluation of the available data and information provided by Medway Grid at the time of this report. Our findings and recommendations are subject to the *Limitations* contained in **Appendix A**. References to the IBC refer to the International Building Code 2015 with Massachusetts State Building Code 9th Edition (MSBC) amendments.

DESIGN RECOMMENDATIONS

Foundations

Spread Footing Foundations supported Below the Frost Zone

Energy storage containers or electrical equipment can be supported on conventional spread footing foundations bearing below the frost zone (4 feet below grade) on an undisturbed, natural Glacial Till subgrade, or on compacted Granular Fill placed over the undisturbed, natural Glacial Till or bedrock after removal of Forest Mat/Topsoil, organic-containing Subsoil, and Fill.

Provided that footing subgrade preparation is performed in accordance with the recommendations of this report, the recommended maximum net allowable bearing pressure for design of spread footings or mat foundations bearing on undisturbed, natural Glacial Till, Weathered Bedrock, Bedrock, or Structural Fill placed over these materials is 6,000 pounds per square foot (psf).

Potential settlement of footings bearing on new compacted fill over Glacial Till or bedrock is expected to be less than about 1 inch. Differential settlement between footings is expected to be less than ½ inch.

GZA recommends that lateral loads, if any, be resisted by sliding friction between the base of the spread footings or mat foundations and subgrade soils. Foundations should be designed using a friction factor against base shear of 0.4. The factor of safety against sliding should be at least 1.5.

Strip footings and isolated footings should be at least 18 inches and 24 inches wide in the least lateral dimension, respectively. For frost protection, the footings should bear at least 4 feet below final exterior grades. If sound bedrock is encountered at or above footing subgrade, and the bedrock can be prepared such that the bedrock is approximately level, competent and intact, footings may bear directly on the rock at a depth of least 2½ feet below final exterior grades, provided water is unable to pool between the bottom of the footing and the bedrock surface. Potential differential settlement between footings supported directly on sound bedrock and footings supported on soil is expected to be up to ¾ inch.

A transition zone should be provided for continuous footings where the foundation subgrade changes from soil to bedrock. The transition zone should be constructed by excavating bedrock to 12 inches below the bottom of footing at the change in bearing material. Taper this bedrock excavation to 6 inches below the footing at 10 feet laterally from the subgrade change and backfill with compacted Structural Fill. Alternatively, provide a vertical construction joint in the foundation wall at the location of the subgrade change and/or provide additional reinforcement in the footing at the change in bearing material to limit uncontrolled cracking. Where footings will bear directly on rock, the bearing surface should be excavated essentially level or to within approximately 15 degrees of horizontal (1H:4V). Continuous wall footings on rock should be at least 12 inches wide and isolated footings at least 18 inches wide. Individual column footings should bear entirely on soil or entirely on rock.

Footings should not be placed such that their zone of influence, defined by a line extending from the bottom footing edge at a 1-horizontal to 1-vertical angle, intersects proposed below-grade foundation retaining walls or adjacent footings. Stepped wall footings should step up the slope at an overall slope no steeper than 1.5H:1V, with each step no greater than 2 feet in height.

Mat Foundations supported above the Frost Zone

Alternatively, pads and mat foundations that are not designed to tolerate movement from frost and that do not extend to below the frost depth, may be supported on non-frost-susceptible soil extending to the frost depth and laterally within the bearing zone, provided such soil is adequately drained. The bearing zone is defined as a minimum of 1 foot laterally from the outer edge of the concrete pad and extending an additional 1 foot laterally for every 1 foot of excavation depth. Non-frost-susceptible soil includes Free Draining Structural Fill (Granular Fill), Dense-Graded Crushed Stone, Sand-Gravel, or Crushed Stone, as described below. Surface water runoff should not be able to pond within the non-frost-susceptible soil. GZA recommends a subgrade reaction modulus of 150 pounds per cubic inch (pci) referenced to a 1-foot by 1-foot area for use in design of pads and mat foundations with subgrade prepared as described herein.

Therefore, excavation for the equipment pad area should extend to at least 5 feet outside the edge of the equipment pads and be performed with a smooth-edged bucket to minimize disturbance to the excavated subgrade. Based on our experience with similar projects, GZA understands the equipment pads are typically poured 8- to 12-inch-thick reinforced concrete. A base course is recommended below the equipment pads consisting of at least 18 inches of ¾-inch crushed stone underlain by non-woven filter fabric (Mirafi 140N or similar). The filter fabric should envelop the crushed stone so that the crushed stone does not contact adjacent soil. The base course should extend to at least 2 feet beyond the edge of the equipment pad.

Equipment pads on this site may be supported within the frost zone, underlain by a free-draining base course. Due to the fines content, the natural soils are considered highly frost-susceptible, and may cause frost heave/settlement of foundations which bear above the design frost depth over silty soil. To mitigate this frost heave/settlement risk, free-draining base course should be graded such that water is unable to pond within the frost zone of 4 feet as referenced to the frost depth map in **Appendix G**. Additionally, Medway Grid should consider installing underdrains beneath the pad areas consisting of a 4-inch-diameter perforated PVC pipe at 40-foot-spacing on center with perforations at the bottom and surrounded on all sides with approximately 6 inches of ¾-inch crushed stone wrapped in filter fabric (Mirafi 140N or similar). The invert of the drain should be located approximately 4 feet below the top of the concrete pad. The perforated PVC piping laid flat should be connected to solid PVC piping headers inclined to drain by gravity and daylight outside the pad area, with discharge per the design of the project civil engineer.

Conduits in Pad Areas

Based on our experience with similar projects, GZA understands equipment pad areas typically require excavation up to about 3 feet below finished grade for placing conduits. Backfill over the conduits should be compacted Free Draining Granular Fill, provided that the material in contact with the utility is screened to remove particles exceeding 1 inch in diameter and the material does not damage the conduit or inhibit the intended use; or backfilled as otherwise recommended by the conduit manufacturer. The Granular Fill should also extend at least 1 foot outside the conduit on all sides. The Granular Fill should be compacted to at least 95 percent of the maximum dry density at optimum moisture content as determined by ASTM Test D1557, Method C.

Site Retaining Walls

A retaining wall/cut slope up to 14 feet in height is proposed along the western side of the central portion of the development area. A second retaining wall/cut slope up to 12 feet high is proposed along the southern perimeter of the western parcel. The western/southern side retaining walls will be require cuts next to the property line and therefore a proprietary precast gravity block wall is likely, where geogrid-reinforced retained soil is impractical due to close proximity of the property line. Precast gravity block walls predominately rely on the mass of the blocks to retain site soils.

Retaining walls along the eastern side of the site will retain new fill up to 14 feet in height. On the eastern side of the site where filling is required to achieve proposed grades, we anticipate proprietary, mechanically-stabilized earth (MSE) modular block retaining walls with geogrid will be designed. MSE walls consist of a system of mortarless modular blocks connected to soil reinforcing grids embedded between compacted lifts of granular backfill behind the wall.

Where site retaining walls are retaining horizontal backfill, an equivalent fluid pressure of 45 pcf may be used for site retaining wall design. These equivalent fluid pressures assume fully drained active conditions. Where the pressure is less than 250 pounds per square foot (psf), it should be increased to 250 psf to account for compaction-induced stresses. Walls should be designed for appropriate surcharge (for example, construction, ground snow load and/or traffic loads), and seismic loads per IBC. See seismic section below for details.

A soil nail wall may also be a viable option for constructing the cut required for the western retaining wall where bedrock is deeper. Soil nail walls are constructed from top to bottom in cut situations provided the soil is stable enough to remain vertical in small depth increments, on the order of 4 to 5 feet, during construction. The nails are drilled into an exposed cut at an approximate spacing of 5 feet on center. Steel reinforcing bars are installed into the drilled holes before the holes are grouted. The cut is covered with a wire-mesh-reinforced, “shotcrete” concrete facing before the next 4- to 5-foot stage is excavated. The shotcrete concrete finish can be covered with a permanent cast-in-place concrete facing or a retaining wall could be constructed in front of the soil nail wall. A drainage board should be provided behind the wall to relieve hydrostatic pressure. If the soil nails are designed to extend beyond the property line, a permanent easement from the adjacent property owner would be required. Alternatively, the soil nails could be designed to be entirely outside of the adjacent property, but the required setback to the BESS equipment area would be greater to accommodate the soil nail lengths required to achieve soil nail wall stability.

Proprietary modular block site retaining walls are typically designed by the by the wall supplier’s design engineer. The walls should be designed by a Professional Engineer registered in the Commonwealth of Massachusetts in accordance with the requirements of the MSBC (including bearing capacity, sliding, overturning and global stability evaluations) and the manufacturer’s design requirements. The design should be reviewed by GZA before construction.

Regardless of the type of retaining wall selected (for example, gravity block or MSE), we recommend free-draining Structural Fill, with a fines content (passing the No. 200 sieve) of less than 8 percent (required gradation provided in Construction Recommendations section of this report), be placed within horizontal distance of 5 feet from the back of all site retaining walls. A 4-inch-diameter perforated pipe surrounded by at least 6 inches of crushed stone and wrapped in non-woven filter fabric should be installed behind and at the base of the wall to drain the wall backfill with weepholes discharging at the bottom of the exposed wall.

Slope Stability

<u>Loam and Seeded Slopes</u>

Based on the grading plan the new embankment slopes for the proposed stormwater retention basin will be constructed with a maximum slope of approximately 3 horizontal to 1 vertical (3H:1V). Slopes steeper than 4H:1V should be protected from erosion. Erosion control measures may consist of loam and seed with proper irrigation and temporary erosion control netting or erosion resistance granular materials consisting of a minimum 12-inch-thick layer of modified rock fill (MassDOT M2.02.4) placed on a 6-inch-thick bedding layer of 3/4-inch crushed stone over Mirafi FW700 woven-geotextile. We anticipate the embankment will be designed by others to include an impervious core..

Rock Stabilized Slopes

At this time rock stabilized slopes are not planned at the site, based on the proposed site grading plan. However, should rock stabilized slopes be included in the final design, we recommend rock stabilized slopes consist of at least a 6-inch thick bedding layer of 3/4-inch crushed stone over Mirafi FW700 woven-geotextile with boulders placed to form a near-planar surface at a slope of 1H:1V or flatter. Recommended rock stabilized slope geometry is shown in **Figure 2**.

Bedrock Face Slopes

At this time exposed rock slopes are also not planned at the site, based on the proposed site grading plan. However, based on the likely proposed bedrock cuts at the site, bedrock faced slopes may be included in the final design. We recommend presplitting the final bedrock face. Presplitting is where the bedrock is drilled in a line at the cut angle approximately every 2 feet before blasting. This produces a near-planar face and results in less slope maintenance scaling and removing rock that is loosened due to freeze-thaw cycles. Although initially more expensive than blasting to an uncontrolled finished face, presplitting can save on the cost of ongoing maintenance of the rock face. Final means and methods for bedrock face slope work should be coordinated with the geotechnical engineer.

Exposed bedrock faces should be no steeper than 1H:6V and no higher than 15 feet without benching. Based on our borings and the proposed grades, we do not anticipate bedrock faces will extend beyond 15 feet in height.

A potential rock face geometry section is depicted in **Figure 3**. Recommended overburden soil slope geometry (above the rock face) is depicted in **Figure 4**.

Figure 3 shows a 15-foot-high rock face at a 1H:6V slope or flatter with a 10-foot-wide buffer rockfall catchment swale. The buffer swale geometry shown in **Figure 3** can be reduced if a rock fall barrier (such as a jersey barrier or chain link fence on top of a jersey barrier) is constructed or upon field conditions acceptable to the geotechnical engineer, as certain rock faces may be free of loose, fractured zones requiring the more extensive safety precautions depicted in **Figure 3**.

Subsequent to blasting, final bedrock slopes should be observed by a qualified geotechnical engineer for conditions that may require additional support, such as rock bolts, to stabilize the face for long term exposure to the elements.

Sound Barrier Wall Foundations

A 22-foot-tall sound wall is proposed between the access road entrances along Milford Street and along the eastern perimeter of the BESS facility. Based on test borings GZ-21 through GZ-25, the subsurface conditions along the proposed wall generally consist of glacial till overlying bedrock. Along the proposed alignment bedrock depth was observed to generally rise from approximately 19 feet in the north to 2.8 feet below existing grades in the east. Based on test borings GZ-8, GZ-10, and GZ-25, it appears that bedrock generally slopes down from north to south, falling from approximately 2.8 feet bgs at test boring GZ-24 to about 11 feet at test boring GZ-10. The drilled shaft foundations may conservatively be designed assuming “medium dense sand” and “Wind Exposure C” criteria in accordance with MassDOT Standard Drawing Nos. 996.1 through 996.3 that are contained in **Appendix F.**

Based on the borings, shallow bedrock is expected to be encountered within the design depth for the sound barrier wall foundations at some locations. The foundations should be designed for a condition of shallow bedrock with a minimum rock socket length criterion to terminate the shaft and to provide fixity (2 times the diameter of the rock socket or a minimum of 5 feet, whichever is greater). This criterion should be developed for each sound barrier wall section such that foundations are installed either to the design depth or to the minimum rock socket depth in competent bedrock.

Construction of the sound barrier along the eastern side of the BESS facility, where a retaining wall and fills up to 14 feet are proposed, may be difficult and costly; A setback of at least 5 to 10 feet may be required.

Seismic

In accordance with Section 1613.3 of the IBC, we recommend that Site Class C be used for seismic design assuming that the foundations are designed and constructed as recommended herein.

Based on the test boring SPT data from the test borings (GZ-1 through GZ-10, GZ-18, GZ-19, and GZ-21 through GZ-25) performed at the site, we do not anticipate that the soils encountered at the site are susceptible to liquefaction.

Unpaved Site Access Roads

Based on our experience with similar projects, we understand that post-construction temporary site access roads fall into two categories:

1. Fire truck access, anticipated maximum use 2 times per year; and
2. Pickup truck access, anticipated maximum use 4 times per year.

The following pavement cross-section is recommended for new proposed fire truck access roads, in compliance with Appendix D of the International Fire Code (IFC), and assuming H-20 loading with a subgrade consisting of the Glacial Till:

	Minimum Thicknesses
Finish Course (Dense-Graded Crushed Stone)	5 inches
Sand-Gravel Base Course	10 inches

GZA recommends the Sand-Gravel Base Course is underlain by a bi-axial geotextile fabric (Mirafi HP-370 or similar).

The following pavement cross-section is recommended for new proposed pickup-truck-only access roads:

	Minimum Thicknesses
Finish Course (Dense-Graded Crushed Stone)	4 inches
Sand-Gravel Base Course	8 inches

GZA recommends the Sand-Gravel Base Course is underlain by a bi-axial geotextile fabric (Mirafi HP-370 or similar).

Note that these cross-sections are not intended for construction traffic.

CONSTRUCTION RECOMMENDATIONS

Demolition

Based on the proposed construction, we anticipate that existing pavements, existing structures, trees, Topsoil/Forest Mat, Subsoil with organics, existing Fill, and/or utilities will be removed from the footing and/or pad bearing area to facilitate construction of the new BESS development. Any utilities designated to remain should be protected during demolition and construction activities. Over-excavated areas should be backfilled with Structural Fill meeting the gradation and compaction requirements herein.

Controlled Blasting

Controlled blasting will be necessary to achieve proposed grades for portions of the proposed development. Perform all blasting in compliance with all Commonwealth of Massachusetts and local regulations. These regulations include blast size restrictions, vibration limits, and conducting vibration monitoring.

GZA recommends pre-construction surveys of existing structures within 250 horizontal feet of the blast areas. If existing structures should fall within 250 feet of proposed blasting areas, the blasting contractor should provide a vibration analysis and monitoring program to ensure that vibrations at adjacent structures do not exceed the limitations of the applicable code.

Where bedrock excavation is required to accommodate proposed footings (not poured directly on bedrock), slabs, pavement, or within utility trenches, over-excavate bedrock to at least 12 inches below the bottoms of slabs/footings or at least 6 inches below invert of utilities. Backfill to bottom of slab with compacted Sand and Gravel. Place and compact appropriate bedding material for utility pipes as recommended by the manufacturer.

Following blasting, final bedrock slope faces should be observed by a qualified geotechnical engineer to identify potential areas of instability in rock faces. This inspection should identify any rock block or wedges which are potentially unstable. Bedrock subgrade should be observed by a qualified geotechnical engineer to identify potential areas of overbreak and fracturing (with nested boulders) that may require the placement of fabric or a choke layer of stone to limit the potential migration of fines and resulting settlement.

Fill Material and Subgrade Preparation

- Excavate Forest Mat/Topsoil, Subsoil with organics, and Fill within the zone of influence of spread/strip footings or mat foundations, as defined by a 1-horizontal to 1-vertical (1H:1V) line, sloping downward and outward from 1-foot outside the bottom edge of footings/pads.
- Where practical, final excavation should be undertaken using a smooth-edged bucket to limit disturbance of the subgrade.
- Proof-compact the exposed soil subgrade with at least ten passes of a 10,000-pound (minimum static weight) roller or a heavy plate compactor in confined areas.
- Fine-grained soils are sensitive to moisture and should be suitably protected if exposed. If fine-grained soils degrade due to exposure, the wet/disturbed soil should be undercut to suitable, stable soil and either the foundation extended to a suitable bearing grade, or the exposed suitable soil subgrade raised with Structural Fill or ¾-inch crushed stone. If ¾-inch crushed stone is used, non-woven filter fabric should envelop the crushed stone when the overall thickness exceeds 6 inches. Construction should be sequenced and planned to limit the time that the subgrades are exposed to potential precipitation and/or frost.
- If an isolated footing subgrade is bedrock, surface should slope no more than 1V:6H and remove all soil and rock debris to provide a clean, near-level bearing surface.
- Protect the exposed subgrade from frost at all times during construction. Fill should not be placed over frozen soil.

Subgrade preparations for backfilling, equipment support slabs, and access roads must be conducted in such a way as to limit disturbance, work "in the dry," and use a smooth-edged excavator bucket, particularly if silty soils are encountered at subgrade level.

Medway Grid should monitor site clearing operations to help address the potential for excavating below proposed subgrade elevations and random uncontrolled backfilling. Backfilling (if required) should be performed in controlled lifts with adequate compaction in a similar manner to the methods outlined above.

Blast rock may be used to raise grades provided it is well graded and meets the following gradation:

Grain Size	Percent finer by weight
12-inch	100
4-inch	25
¾-inch	10

Blast rock fill should be placed in loose lift thicknesses of less than 18 inches and be compacted to an unyielding surface with heavy compaction equipment. Provide a minimum of 12 inches of compacted “choke-stone” over the blast rock fill. Choke stone should be a well-graded mixture of blast rock fragments less than 6 inches in size and Sand and Gravel, such that it could be readily compacted to fill voids in the rockfill below. Blast rock fill should not be placed within 5 feet below footing, pavement, or pad subgrades.

Sound Barrier Wall Pre-Drilled Holes

Structural steel sections for sound barrier walls should be installed in pre-drilled holes to limit impacts of vibrations on the existing utilities and roadway adjacent to the site, as well as to provide higher passive resistance on the embedded portion of the pile below the bottom of excavation. Also, due to the relatively dense nature of the glacial till, impact driving will be difficult, and pile alignment will likely be an issue. In GZA’s opinion, pre-drilling will better mitigate potential obstructions and shallow bedrock. Cobbles and shallow refusal were noted during drilling and the use of pre-drilled holes will also mitigate tolerance issues for the installation of posts to support the precast noise barrier panels.

The pre-drilled holes should be advanced using temporary casing or other methods of support to prevent caving of the holes and loss of ground. Drilling equipment for pre-drilling must be able to extend below groundwater level (if encountered) and through very dense soils, as well as obstructions, cobbles, boulders, and bedrock.

Drill spoils should be contained adjacent to the drill rig. Spoils that cannot be reused on site should be removed and disposed of off-site in accordance with applicable local, state, and federal regulations.

Temporary Groundwater Control

Based on the observed groundwater levels and soil mottling in the subsurface explorations, excavations for foundation construction are likely to encountered perched water or groundwater at some locations, particularly cut areas. Therefore, temporary construction dewatering is anticipated. Seepage out of cut slopes may cause localized sloughing and instability. The Contractor should be prepared to remove accumulated rainwater and runoff from excavations during construction through the use of submersible pumps.

Any discharge of pumped groundwater off-site should be performed in accordance with all federal, state, and/or local regulations, which may require a discharge permit and possible filtration and chemical testing of the water prior to discharge.

In addition, care must be taken to slope all working surfaces to facilitate drainage and control surface water. Appropriate dewatering/surface water control procedures should be implemented prior to performing final excavation to subgrade and proof-compaction. Temporary measures to reduce the amount of surface water (from rainfall runoff) into construction areas may include, but not be limited to:

- Construct small berms to divert and/or reduce the amount of surface water flowing over exposed subgrades during construction;
- Maintain general site grading to promote surface run-off and limit ponding; and
- Use a smooth drum compactor in static mode or back drag areas with a smooth bucket to help seal exposed soil surfaces prior to inclement weather.

Material Gradations

Sand-Gravel (Gravel) should consist of inert material comprised of hard, durable stone (not crushed concrete) and coarse sand, free from trash, ice, snow, tree stumps, roots, organic materials, and other deleterious matter, and conform to the following gradation:

Sieve Size (ASTM D422)	Percent Passing By Weight
2-inch	100
½-inch	50-85
No. 4	40-75
No. 40	10-35
No. 200	0-8

Dense-Graded Crushed Stone should consist of angular fragments of hard, durable crushed rock (not crushed concrete), free from a detrimental quantity of thin, flat, elongated pieces or be durable crushed gravel stone obtained by artificial crushing of gravel, cobbles, boulders, or fieldstone. The crushed stone should be free from trash, ice, snow, tree stumps, roots, organic materials, lumps or balls of clay, and other deleterious matter. Dense-Graded Crushed Stone should conform to the following gradation:

Sieve Size (ASTM D422)	Percent Passing By Weight
2-inch	100
1-1/2-inch	70-100
¾-inch	50-85
No. 4	30-55
No. 50	8-24
No. 200	3-8

Free Draining Structural Fill (Granular Fill) should be free from crushed concrete, trash, ice, snow, tree stumps, roots, organic materials, and other deleterious matter. Structural Fill should conform to the following gradation requirements:

Sieve Size (ASTM D422)	Percent Passing By Weight
3-inch	100
No. 10	30-95
No. 40	10-70
No. 200	0-10

3/4-inch Crushed Stone should consist of angular fragments of hard, durable crushed rock (not crushed concrete), free from a detrimental quantity of thin, flat, elongated pieces or should be durable crushed gravel stone obtained by artificial crushing of gravel boulders or fieldstone. The crushed stone should be free from trash, ice, snow, tree stumps, roots, organic materials, and other deleterious matter. Crushed Stone should conform to the following gradation:

Sieve Size (ASTM D422)	Percent Passing By Weight
1-inch	100
3/4-inch	90-100
1/2-inch	10-50
3/8-inch	0-20
No. 4	0-5

Based on our observations in the test borings performed at the site, the on-site materials do not appear to meet the recommended gradations above. However, it may be possible to process crushed bedrock removed by controlled blasting to produce some of these materials on-site.

Temporary Excavation Support

The Owner and the Contractor should become familiar with and follow all applicable local, state, and federal safety regulations, including the current Occupational Safety and Health Administration (OSHA) Excavation and Trench Safety Standards. Construction site safety generally is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. We are providing this information solely as a service to our client. Under no circumstances should the information provided herein be interpreted to mean that GZA is assuming responsibility for construction site safety or the Contractor’s activities, such responsibility is not being implied and shall not be inferred.

The Contractor should be aware that slope height, slope inclination, or excavation depth should in no case exceed those specified in local, state, or federal safety regulations, such as OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations. Such regulations are strictly enforced and, if they are not followed, the Owner, Contractor, and/or earthwork and utility subcontractors could be liable for substantial penalties.

A simple sloped excavation is likely to be practical for temporary case, provided excavation is performed above the groundwater level. The resulting area of the slope will need to be backfilled after completion of construction. It is recommended that all vehicles and soil piles be kept a minimum lateral distance from the crest of slopes equal to no less than the slope height. Exposed slope faces should also be protected against the elements.

As an alternative to temporary slopes, vertical excavations can be temporarily supported. Where excavation is proposed near the property boundary, such as along the western side of the site where cuts up to 14 feet are proposed, temporary excavation support may be necessary to reach proposed grades without impacting the abutting property. The Contractor or the Contractor's specialty subcontractor would be responsible for the design of the temporary excavation support in accordance with applicable regulatory requirements, but the recommendations of this report will serve as a minimum requirement. Selection of the temporary excavation support system should consider the groundwater level, potential obstructions, and anticipated construction loads. The design of the excavation support systems should be performed in conjunction with the design of the dewatering systems and should be performed by a qualified Professional Engineer registered in the Commonwealth of Massachusetts, with the design reviewed by GZA before construction.

FINAL DESIGN AND CONSTRUCTION SERVICES

We recommend that GZA be retained to prepare specifications for earthwork, temporary excavation support, blasting, contractor-designed site retaining walls and/or soil nail walls and review/comment on near-final foundation and grading plans to assist with implementation of our geotechnical recommendations. During construction, we recommend GZA be engaged to observe foundation and site earthwork construction (including observation of foundation and slab subgrade preparation, blasting, rock face and subgrade condition, vibration monitoring, and site earthwork, including site retaining wall construction) for compliance with our recommendations, the contract foundation plans, and specifications. In addition, backfilling below the equipment pad areas should be monitored for compaction and gradation control.

CLOSING

We trust the information presented herein is sufficient for your use. We have enjoyed working with you on this project and look forward to our assisting you on future projects. Please call us with any questions.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Luke W. Prohaske, P.E.
Assistant Project Manager

David G. Lamothe, P.E.
Consultant/Reviewer

Bruce W. Fairless, P.E.
Principal

Attachments:

Figure 1 – Exploration Location Plan
Figure 2 – Rock Stabilized Slope
Figure 3 – Rock Slope Treatment
Figure 4 – Soil Slope Treatment at Rock Slope
Appendix A – Limitations
Appendix B – Test Boring Logs
Appendix C – Geotechnical Laboratory Test Results
Appendix D – Environmental Laboratory Test Results
Appendix E – Rock Core Photographs
Appendix F – MassDOT Standard Drawing for Noise Barrier Structure Foundations
Appendix G – U.S. Navy Frost Depth Map

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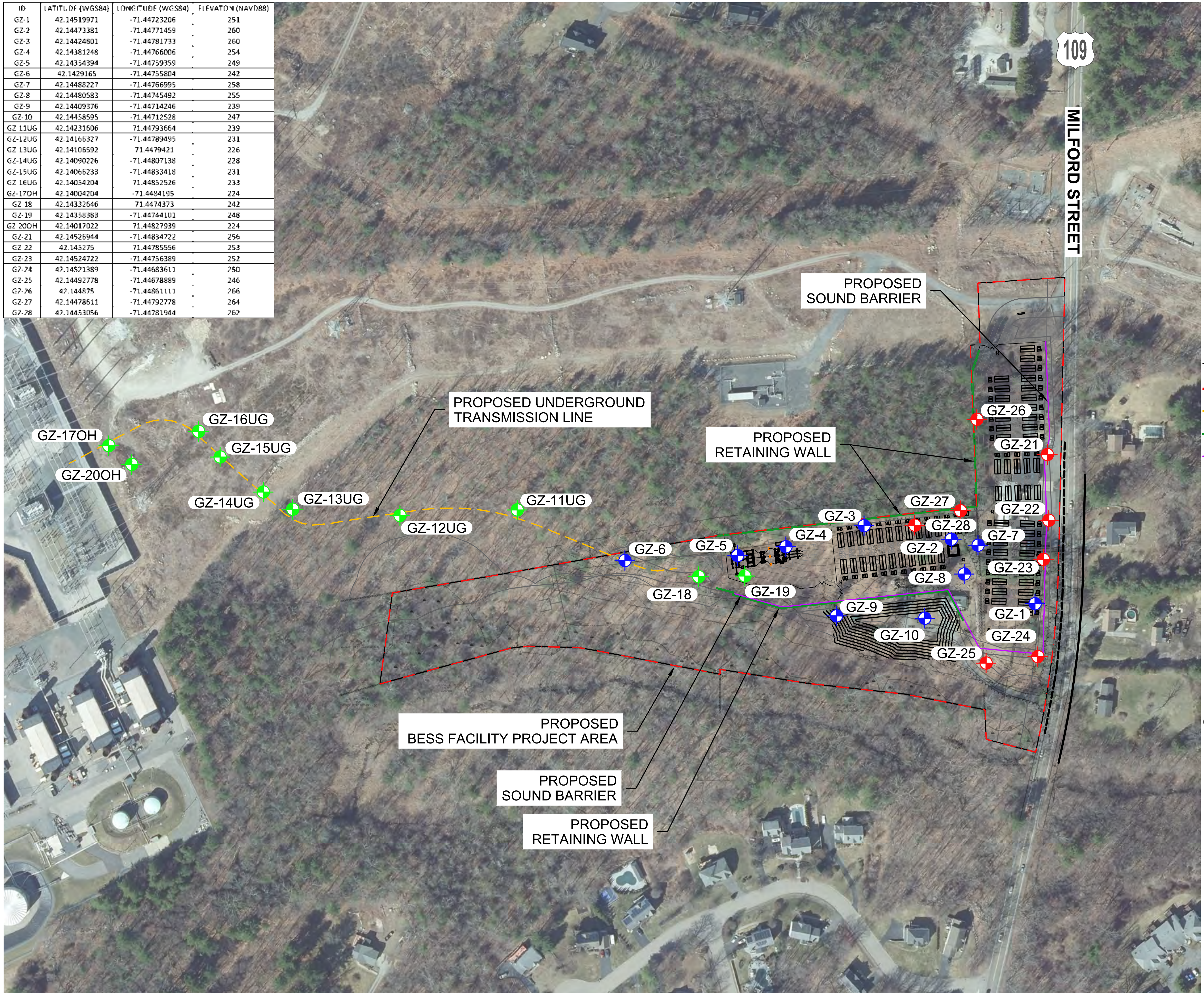
Figures

ID	LATITUDE (WGS84)	LONGITUDE (WGS84)	ELEVATON (NAVD88)
GZ-1	42.14519971	-71.44723206	251
GZ-2	42.14473381	-71.44771459	260
GZ-3	42.14424801	-71.44781733	260
GZ-4	42.14381248	-71.44766006	254
GZ-5	42.14354394	-71.44759359	249
GZ-6	42.1429165	-71.44755804	242
GZ-7	42.14488227	-71.44766995	258
GZ-8	42.14480583	-71.44745492	255
GZ-9	42.14409376	-71.44714246	239
GZ-10	42.14458595	-71.44712528	247
GZ 11UG	42.14231606	71.44793664	239
GZ-12UG	42.14166327	-71.44789495	231
GZ 13UG	42.14106592	71.4479421	226
GZ-14UG	42.14090226	-71.44807138	228
GZ-15UG	42.14066233	-71.44833418	231
GZ 16UG	42.14054204	71.44852526	233
GZ-17OH	42.14004204	-71.4484195	224
GZ 18	42.14332646	71.4474373	242
GZ-19	42.14358383	-71.44744101	248
GZ 20OH	42.14017022	71.44827939	224
GZ-21	42.14526944	-71.44834722	256
GZ 22	42.145275	71.44785556	253
GZ-23	42.14524722	-71.44756389	252
GZ-24	42.14521389	-71.44683611	250
GZ-25	42.14492778	-71.44678889	246
GZ-26	42.144875	-71.44861111	266
GZ-27	42.14478611	-71.44792778	264
GZ-28	42.14453056	-71.44781944	262



SOURCE:

1. THIS MAP CONTAINS THE 2021 AERIAL IMAGERY MAP SERVICE DISTRIBUTED BY MASSGIS ON JANUARY 26, 2022. THE PLANNING, ACQUISITION, PROCESSING, AND CREATION OF DERIVATIVE PRODUCTS BY MASSGIS AND NV5 GEOSPATIAL OF LEXINGTON, KY. THE IMAGERY WAS ACQUIRED BETWEEN MARCH 17 AND APRIL 24, 2021.
2. THE USE OF AERIAL PHOTOGRAPHY CAN OFTEN MAKE BUILDINGS AND OTHER SITE FEATURES APPEAR TO BE OVERLAPPING AND DISTORTED WHEN OVERLAID WITH ACTUAL SITE FEATURES.
3. THE BASE PLAN WAS OBTAIN FROM ELECTRONIC FILES PREPARED BY BURNS & MCDONNELL ENGINEERING CO, INC., ENTITLED "MEDWAY BESS GENERAL ARRAGEMENT TESLA", DATED: 1/14/22, ORIGINAL SCALE: 1"=60', DRAWING NO.: LAYOUT-F, CAD FILE: MEDWAY TESLA MPXL - 250 MW 2 HR - REV K.DWG, TRANSMITTED TO GZA ON 7/27/2022, AND AN ELECTRONIC FILE PROVIDED BY THE CLIENT ENTITLED: ABLE GRID MEDWAY 345kV UNDERGROUND TRANSMISSION ROUTE, PREPARED BY POWER ENGINEERS, DATED NOVEMBER 5, 2021.
4. ALL BORINGS WERE OBSERVED AND LOGGED BY GZA PERSONNEL. THE TEST BORINGS WERE LOCATED BY GZA PERSONNEL USING A TRIMBLE R1 HAND-HELD GPS. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USE.

LEGEND:

PROPOSED PROJECT AREA

PROPOSED UNDERGROUND TRANSMISSION LINE

PROPOSED RETAINING WALL

PROPOSED SOUND BARRIER

TEST BORINGS PERFORMED BY NEW ENGLAND BORING CONTRACTORS INC., ON AUGUST 4-5, 2022. OBSERVED AND LOGGED BY GZA PERSONNEL.

TEST BORINGS WERE PERFORMED BY DRILEX ENVIRONMENTAL INC., ON JUNE 20-22, 2022. OBSERVED AND LOGGED BY GZA PERSONNEL.

TEST BORINGS WERE PERFORMED BY DRILEX ENVIRONMENTAL INC., ON SEPTEMBER 22-23, 2021. OBSERVED AND LOGGED BY GZA PERSONNEL.

0 100 200 400

SCALE IN FEET

W S N E

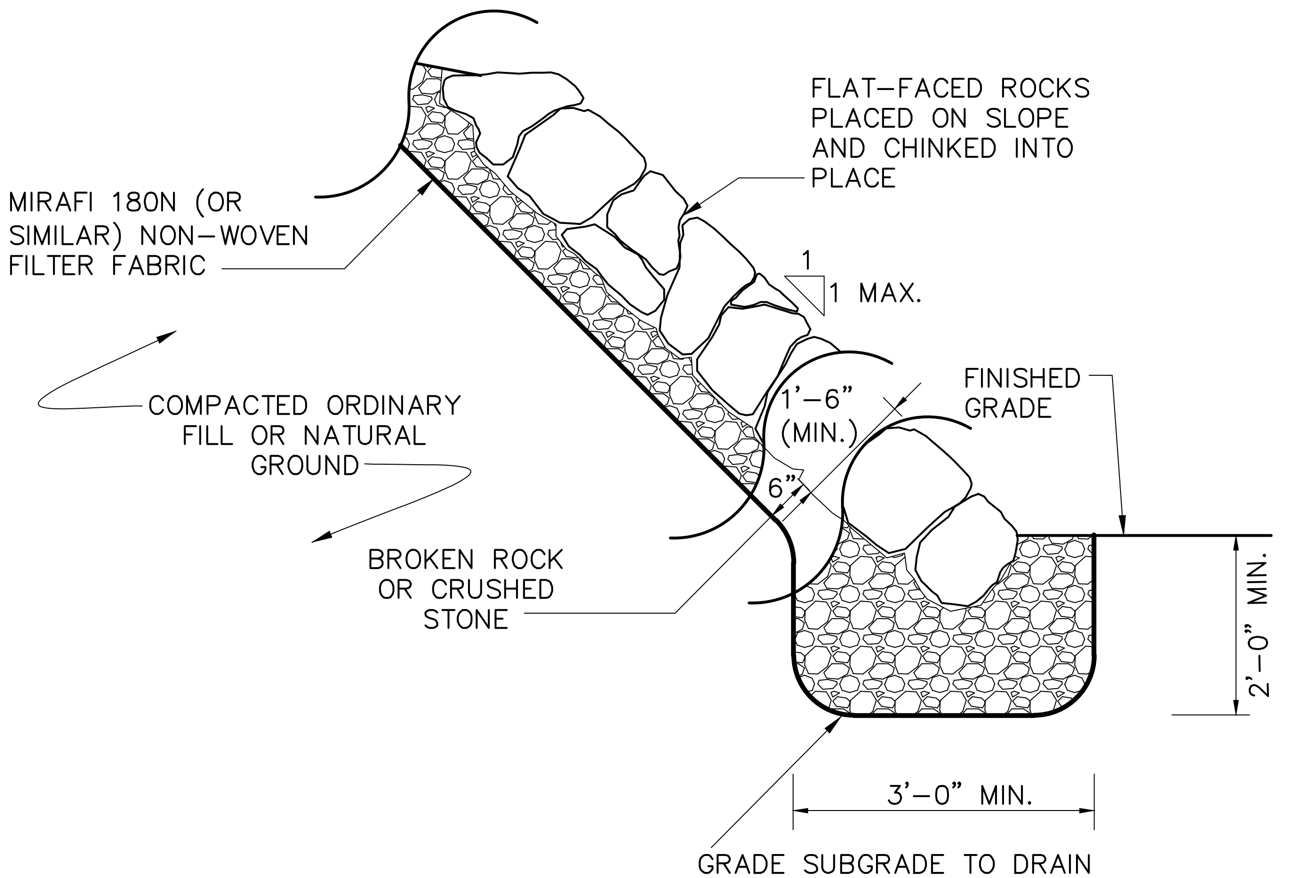
MEDWAY BESS
50-53 MILFORD STREET
MEDWAY, MASSACHUSETTS

EXPLORATION LOCATION PLAN

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
MEDWAY GRID, LLC.

PROJ MGR: LWP	REVIEWED BY: BWF	CHECKED BY: DGL	FIGURE
DESIGNED BY: LWP	DRAWN BY: AJP	SCALE: AS SHOWN	1
DATE: AUGUST 2022	PROJECT NO. 01.0175331.20	REVISION NO. -	



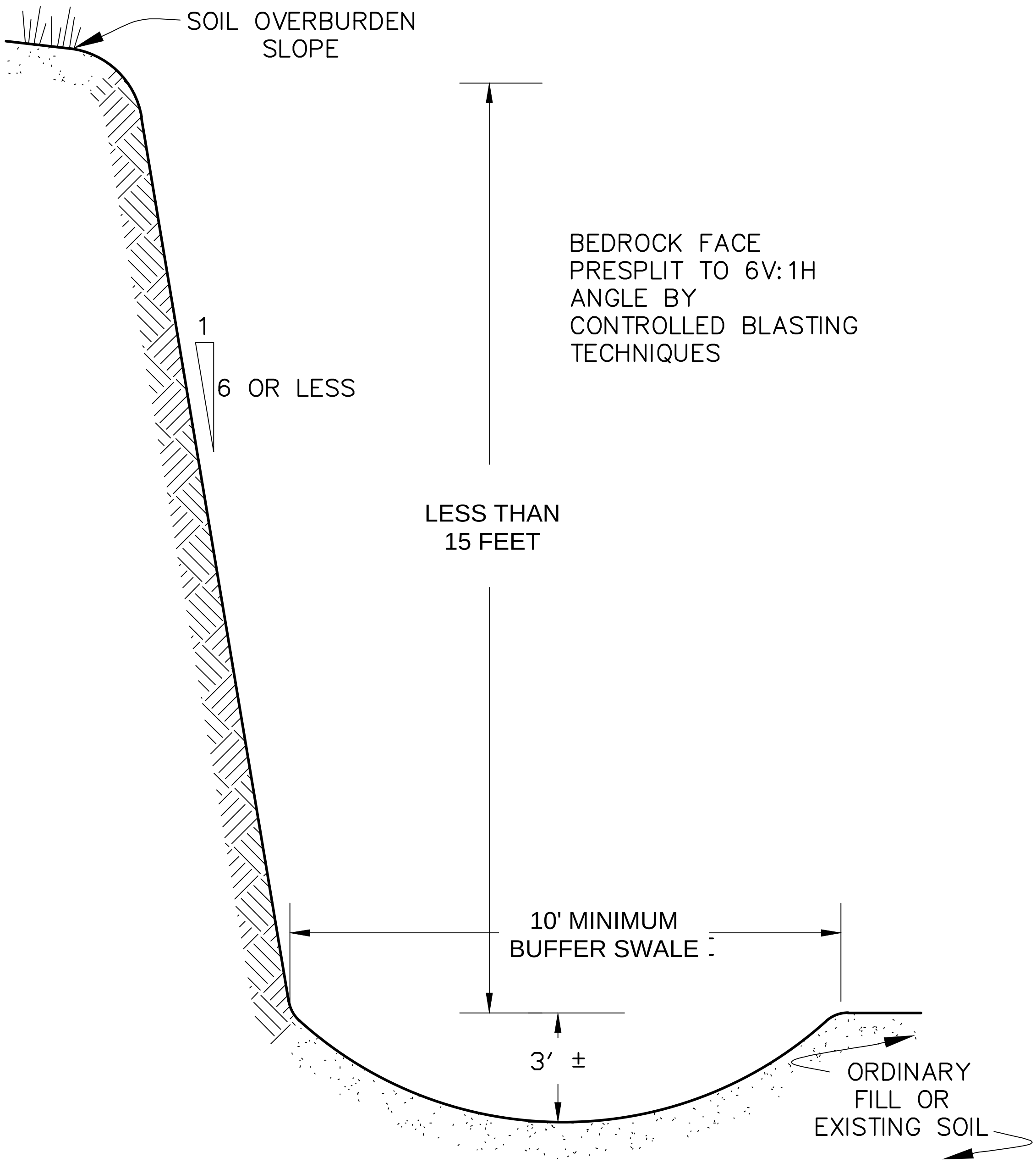
Note:

Rock Stabilized Slope

AUGUST, 2022

N.T.S.

FIGURE 2



Notes:

1. BUFFER SWALE MAY BE 6± FEET WIDE IF ADDITIONAL PROTECTION IS PROVIDED AT EDGE OF SWALE; SUCH AS ROCK WALL (MIN. 3' HIGH) OR JERSEY BARRIERS. FURTHER PROTECTION MAY BE PROVIDED BY A CHAIN LINK FENCE ON TOP OF JERSEY BARRIERS

2. SWALE MAY BE VEGETATED

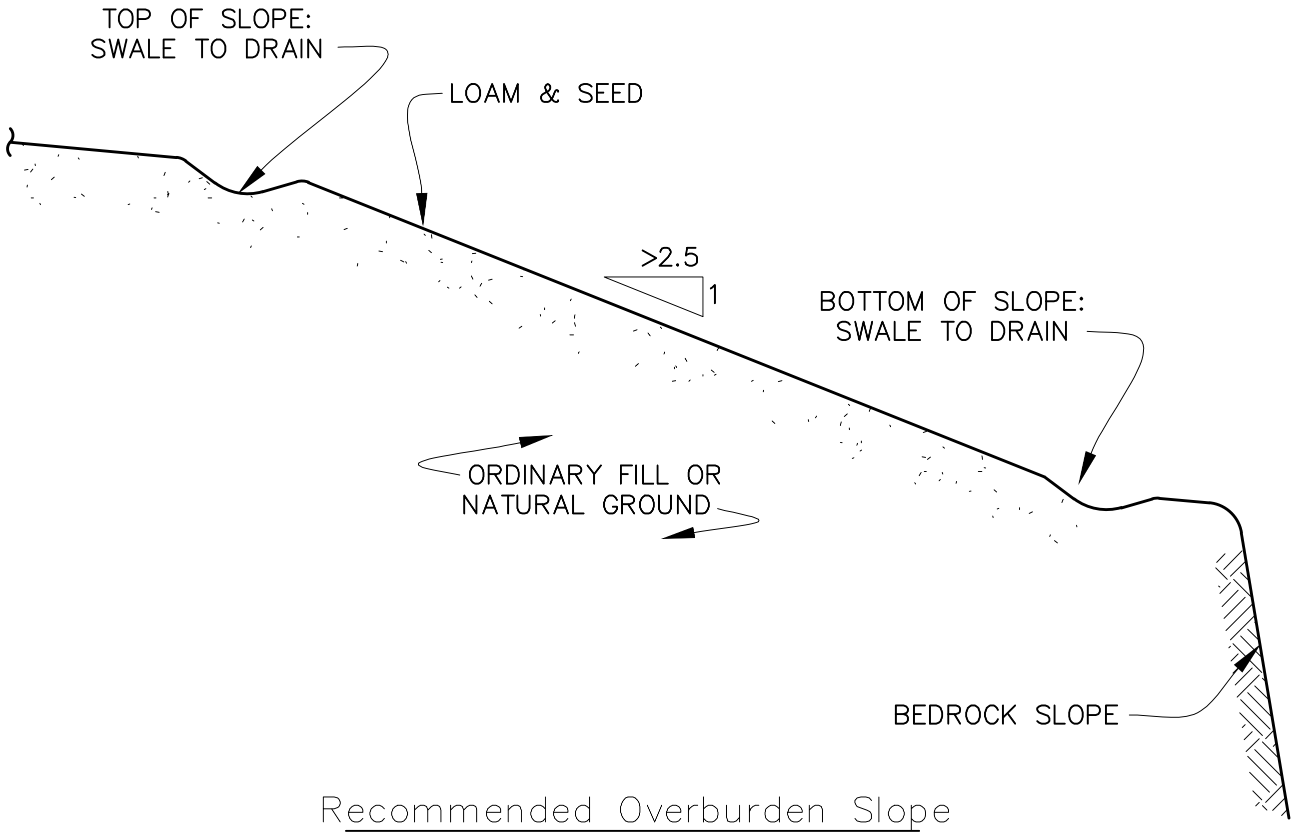
Rock Slope Treatment

AUGUST, 2022

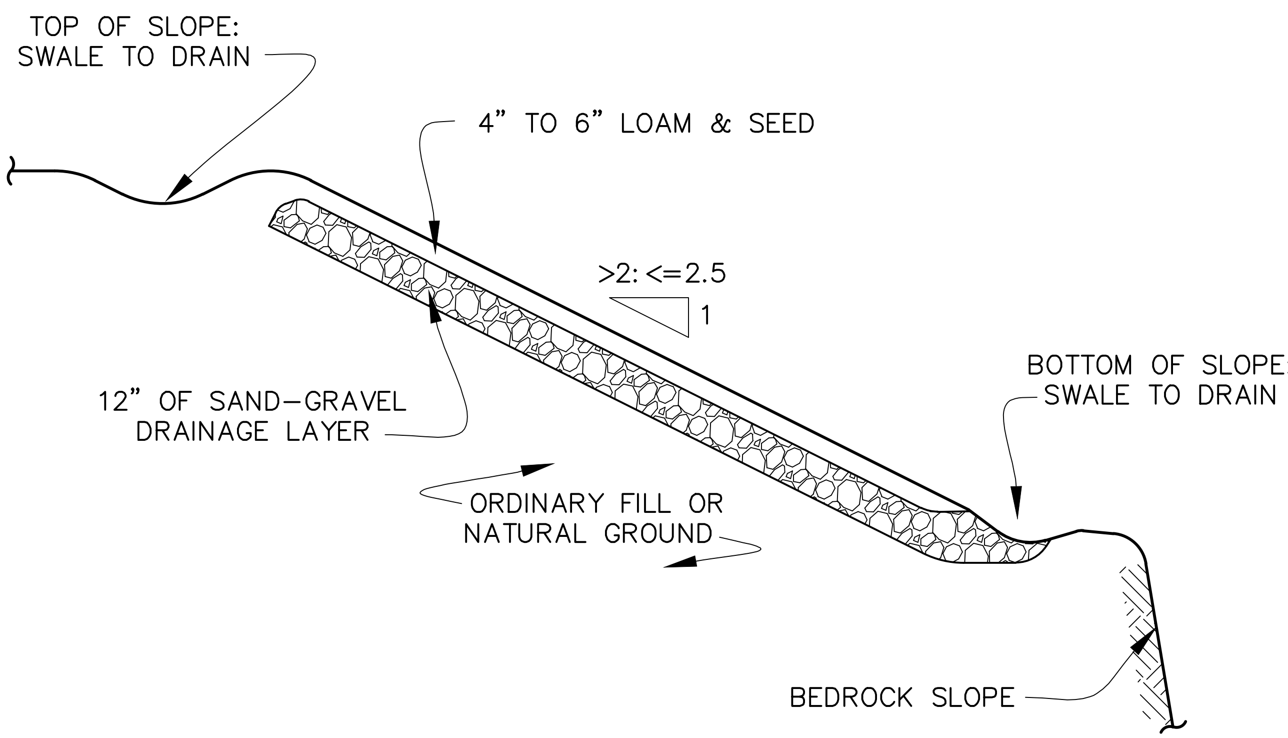
N.T.S.

FIGURE 3

Proposed Energy Storage Installation
Medway Grid, LLC
01.0175331.20



Recommended Overburden Slope



Soil Slope Treatment @ Rock Slope

AUGUST, 2022

N.T.S.

FIGURE 4

Appendix A – Limitations

USE OF REPORT

1. GZA GeoEnvironmental (GZA) prepared this report on behalf of, and for the exclusive use of Medway Grid, LLC (Client) for the stated purpose(s) and location(s) identified in the Agreement and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. GZA's findings and conclusions are based on the current available information as part of the Scope of Services set forth in Agreement and/or Report, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. If conditions other than those described in this report are found at the subject location(s), or the design has been altered in any way, GZA shall be so notified and afforded the opportunity to revise the report, as appropriate, to reflect the unanticipated changed conditions. The findings in this report will be revised based on additional subsurface explorations performed as part of final design.

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

4. In conducting our work, GZA relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of that information. Inconsistencies in this information which we have noted, if any, are discussed in the report.

SUBSURFACE CONDITIONS

5. The generalized soil profile(s) provided in our report are based on widely-spaced subsurface explorations performed by others and are intended only to convey trends in subsurface conditions. GZA cannot be responsible for the accuracy of the data. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs.

6. In preparing this report, GZA relied on certain information provided by Client, state and local officials, and other parties referenced therein which were made available to GZA at the time of our evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

7. Water level readings have been made in test holes at the specified times and under the stated conditions. GZA cannot be responsible for the accuracy of the data. These data have been reviewed and interpretations have been made in this report. Fluctuations in the level of the groundwater however occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The water table encountered in the course of the work may differ from that indicated in the report.

8. GZA's services did not include an assessment of the presence of oil or hazardous materials at the property. The project's Licesnsed Site Professional shall be responsible for considering the potential impacts (if any) that contaminants in soil or groundwater may have on construction activities, or the use of structures on the property.

9. Recommendations for foundation drainage, waterproofing, and moisture control address the conventional geotechnical engineering aspects of seepage control. These recommendations may not preclude an environment that allows the infestation of mold or other biological pollutants.

COMPLIANCE WITH CODES AND REGULATIONS

10. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.

ADDITIONAL SERVICES

11. GZA recommends that we be retained to provide services during any future: site observations, design, implementation activities, construction and/or property development/redevelopment. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

Appendix B – Boring Logs

Modified Burmister Soil Classification

Soil samples are visually classified by the Modified Burmister System using the following format and order:

1. Density or Consistency
2. Color
3. MAJOR SOIL TYPE
4. Minor Components
5. Special Components

Density or Consistency – Density or consistency estimates are based on the measured N-Values obtained from the Standard Penetration Test (SPT). For granular soils (sand, gravel, silt), density is reported. For plastic soils, consistency is reported. Broken gravel, if encountered at the tip of the spoon, is indicated on the log and will affect the measured SPT N-Value.

Table A-1: Density and Consistency of Soils

Granular Soils		Plastic Soils	
SPT N-Value	Relative Density	SPT N-Value	Consistency
0-4	Very Loose	<2	Very Soft
4-10	Loose	2-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
>50	Very Dense	15-30	Very Stiff
		>30	Hard

Color - The color of the soil matrix is estimated in the field by the engineer or geologist observing the borehole.

Major Soil Type - The soil type is determined by the major component of the soil that comprises 50% or more of the sample by weight. The major component in the description is capitalized (e.g. SAND, GRAVEL, SILT).

Table A-2: Soil Types/Components

Sieve Size	Description	Visual Description
Passing No. 200	SILT	No grains, cannot roll into thread
	Clayey SILT	Can roll into 1/4" thread*
	SILT & CLAY	Can roll into 1/8" thread*
	CLAY & SILT	Can roll into 1/16" thread*
	Silty CLAY	Can roll into 1/32" thread*
	CLAY	Can roll into 1/64" thread*
No. 200 – No. 40	Fine SAND	Finest Visible Particles
No. 40 – No. 10	Medium SAND	1/64 to 1/16"
No. 10 – No. 4	Coarse SAND	1/16 to 1/4"
No. 4 – 3/4 Inch	Fine GRAVEL	1/4 to 3/4"
3/4 Inch – 3 Inch	Coarse GRAVEL	
3 Inch – 6 Inch	Cobbles	
>6 Inch	Boulders	

* May need to moisten sample to determine thread diameter

Table A-3: Expanded Sand/Gravel Soil Descriptions

Granular Description	Proportions of Component
Fine	Less than 10% coarse and medium
Medium	Less than 10% coarse and fine
Fine to Medium	Less than 10% coarse
Medium to Coarse	Less than 10% fine
Fine to Coarse	All greater than 10%

Minor Components – Minor components are described after the major component in order of decreasing percentages. Only the first letter of the minor component is capitalized, except if "and" is used (e.g. trace Silt).

Table A-4: Definition of Proportional Terms

Proportional Term	Percent by Weight of Total Sample
and	35-50
some	20-35
little	10-20
trace	<10

Special Components – anthropogenic materials encountered in the fill such as Glass, Brick fragments, etc. Proportional terms used are occasional (<15% by weight) and frequent (15% or more by weight).

Modified ISRM Rock Classification

Rock cores are visually classified by the Modified ISRM System using the following format and order: Field hardness, weathering, grain size, color, ROCK TYPE, foliation thickness, foliation dip angle, foliation joint/fracture shape and roughness, foliation joint/fracture spacing, dip angle of other joints and fractures, condition of joint surfaces, other features such as minerals.

FIELD HARDNESS:
Very Hard – Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologists pick.
Hard – Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Medium – Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1 in. maximum size by hard blows from the point of a geologist's pick.
Soft – Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very Soft – Can be carved with knife. Can be excavated readily with point of pick. Pieces 1 in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

WEATHERING:
Fresh – Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Slight – Rock generally fresh, joints stained, and discoloration and weathering effects. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate – Significant portions of rock show discoloration and weathering effects. In granitoid rock, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Severe – All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Complete – Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small scattered locations. Quartz may be present as dikes or Stringers.

GRAIN SIZE:
Fine Grained – Barely seen with naked eye.
Coarse Grained: 1/8 in. to 1/4 in.
Amorphous: Too small to be seen with naked eye.
Medium Grained: Barely seen with naked eye to 1/8 in.
Very Coarse Grained: >1/4 in.

DISCONTINUITIES:
Healed Joint – A partial or incomplete fracture.
Joint/Fracture – A simple fracture along which no shear displacement has occurred. May form sets.
Shear – A zone of fractures along which differential movement has taken place parallel to the surface sufficient to produce slickensides, striations, or polishing. May be accompanied by a zone of fractured rock up to a few inches wide.
Fault – A fracture along which there has been displacement and accompanying slickensides, striations, or polishing by gouge and/or severely fractured adjacent zone.
Shear or Fault Zone – A band or zone of parallel, closely spaced shears or faults accompanied by gouge, maylonite, and breccia.

Table A-5: Fractures and Foliation Spacing and Attitude

Fractures	Foliation	Spacing	Attitude	Angle
Very close	Very thin	Less than 2 in.	Horizontal	0° - 5°
Close	Thin	2 in. - 1 ft.	Subhorizontal	5° - 35°
Moderately close	Medium	1 ft. - 3 ft.	Moderately dipping	35° - 55°
Wide	Thick	3 ft. - 10 ft.	Subvertical	55° - 85°
Very Wide	Very thick	More than 10 ft.	Vertical	85° - 90°

Table A-6: Condition of Joint/Fracture Surfaces

Descriptive Term	Conditions
Planar	A flat surface
Curved	A curved surface
Irregular	Multi-curved surface
Slick	A polished and striated surface indicating sliding along a plane; also referred to as slickensided.
Smooth	Few irregularities, but no obvious indication of sliding; adjacent pieces of core can be slid past on another with relative ease.
Rough	Many irregularities; difficult to slide adjacent pieces of core by each other.

GZA reports the total core recovery and rock quality designation for each core run* on the boring logs. The definitions of these terms are as follows:

TOTAL CORE RECOVERY (REC)

$$\textbf{REC (\%)} = \frac{\text{Sum of Recovered Core}}{\text{Length of Core Run}} \times 100$$

ROCK QUALITY DESIGNATION (RQD)

$$\textbf{RQD (\%)} = \frac{\text{Sum of Lengths of intact Core with Full Diameter in Pieces 4 in. and Longer}}{\text{Length of Core Run}} \times 100$$

The RQD is in general accordance with methodology described by Deere and Deere (1988). In addition, significant vertical to sub-vertical foliation/cross-foliation joints/fractures occur within the rock mass and influence ground behavior. The length of core exhibiting the vertical to sub-vertical joints/fractures has been deducted from the RQD, which is consistent with the "pieces of intact rock core" criteria. The vertical to sub-vertical joints/fractures have been identified on the rock core or the upside divider in the core box with permanent "dots" spaced every 0.1 feet apart. These dots have been counted and entered in the fractures per foot column on the boring log.

* - RQD not reported for severely and/or completely weathered rock or core runs with length of 2.0 feet or less.

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Able Grid Energy Solutions
Proposed Battery Energy Storage System
50-53 Milford Sreet
Medway, Massachusetts

BORING NO.: GZ-1
SHEET: 1 of 1
PROJECT NO: 01.0175331.00
REVIEWED BY: BJG/LWP

Drilling Co.: Drilex Environmental, Inc.	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** See Plan
Foreman: Chris Hogan	**Rig Model:** CMB-55	**Ground Surface Elev. (ft.):** 251	
Logged By: Anthony Lupo	**Drilling Method:** HSA	**Final Boring Depth (ft.):** 6.5	
		Date Start - Finish: 9/22/2021 - 9/22/2021	**V. Datum:** See Plan

Auger/Casing Type: HSA	**Sampler Type:** Split Spoon
I.D/O.D.(in): 4.25"/9"	**I.D./O.D. (in.):** 1.375"/2"
Hammer Weight (lb.): -	**Sampler Hmr Wt (lb):** 140
Hammer Fall (in.): -	**Sampler Hmr Fall (in):** 30
Other: -	**Other:** Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
9/22/21	0850	5.0	5.5	2 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0-2	24	13	2 3 5 13	8	S-1: (Top 6") Brown/dark brown, Clayey SILT, little fine to medium Sand, little Roots. S-1: (Bottom 7") Loose, tan/brown, fine to medium SAND and GRAVEL, some Silt.	1			FOREST MAT	
1											1'		250.0'
												SUBSOIL	
2											2'		249.0'
		S-2	2-3.5	18	18	31 43 75/6"	R	S-2: Very dense, brown/light brown, fine to medium SAND, some Silt.	2				
3													
4									3 4			GLACIAL TILL	
5									5				
6		S-3	5.5-6	6	3	55/6"	R	S-3: Very dense, brown/light brown/gray, fine to medium SAND, some Gravel, some Silt.			6.5'		244.5'
7								Bottom of boring at 6.5 feet. Refusal on probable bedrock at 6.5 feet.	6 7				
8													
9													
10													
11													
12													
13													
14													
15													

REMARKS

1. Ground surface elevation estimated from the USGS 3DEP 1M Digital Elevation Model and are cited in the North American Vertical Datum of 1988 in units of feet (NAVD88).
2. Slight orange-stained soil mottling throughout samples S-1 and S-2.
3. Grinding observed at approximately 3.5 to 5.5 fet below ground surface (bgs).
4. Utilizing up to 400 lbs. down pressure while advancing between 4 and 6.5 feet bgs.
5. HSA used to sample depths from approximately 3.5 to 6.5 feet bgs.
6. Auger refusal observed at approximately 6.5 feet bgs. Up to 400 lbs. of down pressure used with no advancement.
7. Upon completion, boreholes backfilled with cuttings up to ground surface.

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

Boring No.: GZ-1

175331.00 50-53 MILFORD ST. MEDWAY.GPJ; STRATUM ONLY NORWOOD; 10/11/2021

TEST BORING LOG

GZA GeoEnvironmental, Inc. *Engineers and Scientists*	Able Grid Energy Solutions Proposed Battery Energy Storage System 50-53 Milford Sreet Medway, Massachusetts	BORING NO.: GZ-2 SHEET: 1 of 1 PROJECT NO: 01.0175331.00 REVIEWED BY: BJG/LWP

Drilling Co.:	Drilex Environmental, Inc.	**Type of Rig:**	ATV	**Boring Location:**	See Plan	**H. Datum:**	See Plan
Foreman:	Chris Hogan	**Rig Model:**	CMB-55	**Ground Surface Elev. (ft.):**	260		
Logged By:	Anthony Lupo	**Drilling Method:**	HSA	**Final Boring Depth (ft.):**	7		
				Date Start - Finish:	9/22/2021 - 9/22/2021	**V. Datum:**	See Plan

Auger/Casing Type:	HSA	**Sampler Type:**	Split Spoon
I.D/O.D.(in):	4.25"/9"	**I.D./O.D. (in.):**	1.375"/2"
Hammer Weight (lb.):	-	**Sampler Hmr Wt (lb):**	140
Hammer Fall (in.):	-	**Sampler Hmr Fall (in):**	30
Other:	-	**Other:**	Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
0		S-1	0-2	24	20	2 1 2 3	3	S-1: (Top 6") Brown/dark brown, Clayey SILT, little fine to medium Sand, trace Roots. S-1: (Bottom 14") Very loose, brown/light brown, fine to medium SAND, some Silt.	1, 2		0.5'	TOPSOIL	259.5'
											2'	SUBSOIL	258.0'
2		S-2	2-4	24	14	9 19 34 20	53	S-2: Very dense, tan/gray, fine to coarse SAND and GRAVEL, little (-) Silt.					
4		S-3	4-6	24	18	13 22 25 59	47	S-3: Dense, tan/gray, fine to coarse SAND, some Gravel, little Silt.			6'	GLACIAL TILL	254.0'
6									3, 4		7'	WEATHERED BEDROCK	253.0'
7								Bottom of boring at 7 feet. Refusal on probable bedrock at 7 feet.	5, 6, 7				

REMARKS

1. Ground surface elevation estimated from the USGS 3DEP 1M Digital Elevation Model and are cited in the North American Vertical Datum of 1988 in units of feet (NAVD88).
2. HSA used to sample depths from approximately 4 to 7 feet below ground surface (bgs).
3. Utilizing up to 500 lbs. down pressure while advancing between 6 and 7 feet bgs.
4. Grinding observed at approximately 6.5 to 7 feet bgs.
5. Driller noted auger refusal at 7 feet bgs based on no advancement while using up to 500 lbs. of down pressure.
6. Driller offset approximately 10 feet west and advanced HSA to auger refusal at 8.5 feet bgs to confirm top of bedrock.
7. Upon completion, boreholes backfilled with cuttings up to ground surface.

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

Boring No.: GZ-2

175331.00 50-53 MILFORD ST. MEDWAY.GPJ; STRATUM ONLY NORWOOD; 10/11/2021

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists	Able Grid Energy Solutions Proposed Battery Energy Storage System 50-53 Milford Sreet Medway, Massachusetts	BORING NO.: GZ-3 SHEET: 1 of 1 PROJECT NO: 01.0175331.00 REVIEWED BY: BJG/LWP

Drilling Co.: Drilex Environmental, Inc. **Foreman:** Chris Hogan **Logged By:** Anthony Lupo	**Type of Rig:** ATV **Rig Model:** CMB-55 **Drilling Method:** HSA	**Boring Location:** See Plan **Ground Surface Elev. (ft.):** 260 **Final Boring Depth (ft.):** 7.5 **Date Start - Finish:** 9/22/2021 - 9/22/2021 **H. Datum:** See Plan **V. Datum:** See Plan

Auger/Casing Type: HSA **I.D/O.D.(in):** 4.25"/9" **Hammer Weight (lb.):** - **Hammer Fall (in.):** - **Other:** -	**Sampler Type:** Split Spoon **I.D./O.D. (in.):** 1.375"/2" **Sampler Hmr Wt (lb):** 140 **Sampler Hmr Fall (in):** 30 **Other:** Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
0		S-1	0-2	24	5	2 1 1 2	2	S-1: Very loose, brown/dark brown, fine to medium SAND, some Silt, little Gravel, trace Roots.	1, 2			FOREST MAT	
1											1'		259.0'
												SUBSOIL	
2		S-2	2-4	24	12	14 15 23 30	38	S-2: Dense, brown/tan/gray, fine to coarse SAND and GRAVEL, little (-) Silt.	3		2'		258.0'
4		S-3	4-4.8	9	9	57 50/3"	R	S-3: Very dense, light brown/tan/gray/light gray, fine to coarse SAND and GRAVEL, trace (+) Silt.	4			GLACIAL TILL	
7.5											7.5'		252.5'
								Bottom of boring at 7.5 feet. Refusal on probable bedrock at 7.5 feet.	5, 6, 7				

REMARKS

1. Ground surface elevation estimated from the USGS 3DEP 1M Digital Elevation Model and are cited in the North American Vertical Datum of 1988 in units of feet (NAVD88).
2. HSA used to sample depths from 4 to 7.5 feet below ground surface (bgs).
3. Grinding observed at approximately 3 to 7.5 feet bgs.
4. Utilizing up to 500 lbs. down pressure while advancing between 3 and 7.5 feet bgs.
5. Driller noted auger refusal at 7.5 feet bgs based on no advancement while using up to 500 lbs of down pressure.
6. Driller offset approximately 4 feet northeast and advanced HSA to auger refusal at 8 feet bgs to confirm bedrock depth.
7. Upon completion, boreholes backfilled with cuttings up to ground surface.

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

Boring No.: GZ-3

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Able Grid Energy Solutions
Proposed Battery Energy Storage System
50-53 Milford Sreet
Medway, Massachusetts

BORING NO.: GZ-4
SHEET: 1 of 1
PROJECT NO: 01.0175331.00
REVIEWED BY: BJG/LWP

Drilling Co.: Drilex Environmental, Inc.	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** See Plan		
Foreman: Chris Hogan	**Rig Model:** CMB-55	**Ground Surface Elev. (ft.):** 254			
Logged By: Anthony Lupo	**Drilling Method:** HSA	**Final Boring Depth (ft.):** 9.5			
		Date Start - Finish: 9/22/2021 - 9/22/2021	**V. Datum:** See Plan		

Auger/Casing Type: HSA	**Sampler Type:** Split Spoon
I.D/O.D.(in): 4.25"/9"	**I.D./O.D. (in.):** 1.375"/2"
Hammer Weight (lb.): -	**Sampler Hmr Wt (lb):** 140
Hammer Fall (in.): -	**Sampler Hmr Fall (in):** 30
Other: -	**Other:** Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
0		S-1	0-2	24	12	2 2 2 5	4	S-1: (Top 6") Very loose, brown/dark brown, fine to medium SAND, some Silt, trace (+) Roots. S-1: (Bottom 6") Brown/light brown, fine SAND, some Silt.	1, 2		0.5'	TOPSOIL	253.5'
											2'	SUBSOIL	252.0'
2		S-2	2-4	24	6	7 13 20 20	33	S-2: Dense, brown, SILT, some (+) fine to coarse Sand, some Gravel.					
4		S-3	4-6	24	24	18 37 45 39	82	S-3: Very dense, light brown/tan/light gray, fine to coarse SAND and GRAVEL, little (+) Silt.	3, 4		9.5'	GLACIAL TILL	244.5'
9.5								Bottom of boring at 9.5 feet. Refusal on probable bedrock at 9.5 feet.	5, 6, 7				

REMARKS

1. Ground surface elevation estimated from the USGS 3DEP 1M Digital Elevation Model and are cited in the North American Vertical Datum of 1988 in units of feet (NAVD88).
2. HSA used to sample depths from 4 to 9.5 feet below ground surface (bgs).
3. Grinding observed at approximately 3.5 to 9.5 feet bgs.
4. Utilizing up to 450 lbs. down pressure while advancing between 3.5 and 9.5 feet bgs.
5. Driller noted auger refusal at 9.5 feet bgs based on no advancement while using up to 450 lbs of down pressure.
6. Driller offset approximately 6 feet north and advanced HSA to auger refusal at 7 feet bgs to confirm bedrock depth.
7. Upon completion, boreholes backfilled with cuttings up to ground surface.

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

Boring No.: GZ-4

175331.00 50-53 MILFORD ST. MEDWAY.GPJ; STRATUM ONLY NORWOOD; 10/11/2021

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Able Grid Energy Solutions
Proposed Battery Energy Storage System
50-53 Milford Sreet
Medway, Massachusetts

BORING NO.: GZ-5
SHEET: 1 of 1
PROJECT NO: 01.0175331.00
REVIEWED BY: BJG/LWP

Drilling Co.:	Drilex Environmental, Inc.	**Type of Rig:**	ATV	**Boring Location:** See Plan	**H. Datum:** See Plan
Foreman:	Chris Hogan	**Rig Model:**	CMB-55	**Ground Surface Elev. (ft.):** 249	
Logged By:	Anthony Lupo	**Drilling Method:**	HSA	**Final Boring Depth (ft.):** 7	
				Date Start - Finish: 9/22/2021 - 9/22/2021	**V. Datum:** See Plan

Auger/Casing Type:	HSA	**Sampler Type:**	Split Spoon
I.D/O.D.(in):	4.25"/9"	**I.D./O.D. (in.):**	1.375"/2"
Hammer Weight (lb.):	-	**Sampler Hmr Wt (lb):**	140
Hammer Fall (in.):	-	**Sampler Hmr Fall (in):**	30
Other:	-	**Other:**	Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
0		S-1	0-2	24	14	2 6 2 3	8	S-1: (Top 6") Brown/dark brown, fine to medium SAND, some Silt, trace (+) Roots. S-1: (Bottom 8") Loose, brown/light brown/tan, fine SAND, some Silt.	1, 2		0.5'	FOREST MAT	248.5'
												SUBSOIL	
2		S-2	2-4	24	24	3 8 15 13	23	S-2: Medium dense, light brown/tan/light gray, fine to coarse SAND and GRAVEL, some Silt.	3		2'		247.0'
4		S-3	4-5.5	18	17	15 50 50/6"	R	S-3: Very dense, light brown/tan/light gray, fine to coarse SAND and GRAVEL, some (-) Silt.	4			GLACIAL TILL	
7								Bottom of boring at 7 feet. Refusal on probable bedrock at 7 feet.	5, 6, 7		7'		242.0'

REMARKS

1. Ground surface elevation estimated from the USGS 3DEP 1M Digital Elevation Model and are cited in the North American Vertical Datum of 1988 in units of feet (NAVD88).
2. HSA used to sample depths from 4 to 7 feet below ground surface (bgs).
3. Grinding observed at approximately 2 to 7 feet bgs.
4. Utilizing up to 400 lbs. down pressure while advancing between 4 and 7 feet bgs.
5. Driller noted auger refusal at 7 feet bgs based on no advancement while using up to 450 lbs of down pressure.
6. Driller offset approximately 5 feet north and advanced HSA to auger refusal at 6.5 feet bgs to confirm bedrock depth.
7. Upon completion, boreholes backfilled with cuttings up to ground surface.

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

Boring No.: GZ-5

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Able Grid Energy Solutions
Proposed Battery Energy Storage System
50-53 Milford Sreet
Medway, Massachusetts

BORING NO.: GZ-6
SHEET: 1 of 1
PROJECT NO: 01.0175331.00
REVIEWED BY: BJG/LWP

Drilling Co.: Drilex Environmental, Inc.
Foreman: Chris Hogan
Logged By: Anthony Lupo

Type of Rig: ATV
Rig Model: CMB-55
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 242
Final Boring Depth (ft.): 3
Date Start - Finish: 9/23/2021 - 9/23/2021

H. Datum: See Plan
V. Datum: See Plan

Auger/Casing Type: HSA
I.D/O.D.(in): 4.25"/9"
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other: -

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

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
0-1		S-1	0-2	24	14	2 2 7 10	9	S-1: Loose, brown, fine to medium SAND, little Silt, trace (+) Roots.	1		1'	FOREST MAT	241.0'
1-2											2'	SUBSOIL	240.0'
2-3		S-2	2-3	12	3	13 50/6"	R	S-2: Very dense, brown/light brown/light gray, fine to coarse SAND and GRAVEL, some Silt.	2, 3		3'	GLACIAL TILL	239.0'
								Bottom of boring at 3 feet.	4				
								Refusal on probable bedrock at 3 feet.	5				
									6				

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

REMARKS

1. Ground surface elevation estimated from the USGS 3DEP 1M Digital Elevation Model and are cited in the North American Vertical Datum of 1988 in units of feet (NAVD88).
2. Grinding observed at approximately 2 to 3 feet below ground surface (bgs).
3. Utilizing up to 450 lbs. of down pressure while advancing between 2 and 3 feet bgs.
4. Driller noted auger refusal at 3 feet bgs based on no advancement while using up to 450 lbs. of down pressure.
5. Driller offset approximately 5 feet north and advanced HSA to auger refusal at 3 feet bgs to confirm bedrock depth.
6. Upon completion, boreholes backfilled with cuttings up to ground surface.

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

Boring No.: GZ-6

TEST BORING LOG

GZA GeoEnvironmental, Inc. *Engineers and Scientists*	Able Grid Energy Solutions Proposed Battery Energy Storage System 50-53 Milford Sreet Medway, Massachusetts	BORING NO.: GZ-7 SHEET: 1 of 1 PROJECT NO: 01.0175331.00 REVIEWED BY: BJG/LWP

Drilling Co.: Drilex Environmental, Inc. **Foreman:** Chris Hogan **Logged By:** Anthony Lupo	**Type of Rig:** ATV **Rig Model:** CMB-55 **Drilling Method:** HSA	**Boring Location:** See Plan **Ground Surface Elev. (ft.):** 258 **Final Boring Depth (ft.):** 4.5 **Date Start - Finish:** 9/23/2021 - 9/23/2021	**H. Datum:** See Plan **V. Datum:** See Plan

Auger/Casing Type: HSA **I.D/O.D.(in):** 4.25"/9" **Hammer Weight (lb.):** - **Hammer Fall (in.):** - **Other:** -	**Sampler Type:** Split Spoon **I.D./O.D. (in.):** 1.375"/2" **Sampler Hmr Wt (lb):** 140 **Sampler Hmr Fall (in):** 30 **Other:** Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0-2	24	10	2 2 2 2	4	S-1: (Top 7") Very loose, brown/dark brown, fine to coarse SAND, some Silt, little Gravel, trace (+) Roots. S-1: (Bottom 3") Brown, fine SAND, some Silt.	1 2		1'	TOPSOIL	257.0'
											2'	SUBSOIL	256.0'
		S-2	2-4	24	8	9 31 36 47	67	S-2: Very dense, light brown/light gray, fine to coarse SAND and GRAVEL, some (-) Silt.	3 4		4.5'	GLACIAL TILL	253.5'
								Bottom of boring at 4.5 feet. Refusal on probable bedrock at 4.5 feet.	5 6 7				

Depth scale: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

REMARKS

1. Ground surface elevation estimated from the USGS 3DEP 1M Digital Elevation Model and are cited in the North American Vertical Datum of 1988 in units of feet (NAVD88).
2. HSA used to sample depths from 4 to 4.5 feet below ground surface (bgs).
3. Grinding observed at approximately 2 to 4.5 feet bgs.
4. Utilizing up to 450 lbs. down pressure while advancing between 4 and 4.5 feet bgs.
5. Driller noted auger refusal at 4.5 feet bgs based on no advancement while using up to 450 lbs of down pressure.
6. Driller offset approximately 5 feet south and advanced HSA to auger refusal at 4 feet bgs to confirm bedrock depth.
7. Upon completion, boreholes backfilled with cuttings up to ground surface.

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

Boring No.: GZ-7

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Able Grid Energy Solutions
Proposed Battery Energy Storage System
50-53 Milford Sreet
Medway, Massachusetts

BORING NO.: GZ-8
SHEET: 1 of 1
PROJECT NO: 01.0175331.00
REVIEWED BY: BJG/LWP

Drilling Co.:	Drilex Environmental, Inc.	**Type of Rig:**	ATV	**Boring Location:** See Plan	**H. Datum:** See Plan
Foreman:	Chris Hogan	**Rig Model:**	CMB-55	**Ground Surface Elev. (ft.):** 255	
Logged By:	Anthony Lupo	**Drilling Method:**	HSA	**Final Boring Depth (ft.):** 5.5	
				Date Start - Finish: 9/23/2021 - 9/23/2021	**V. Datum:** See Plan

Auger/Casing Type:	HSA	**Sampler Type:**	Split Spoon
I.D/O.D.(in):	4.25"/9"	**I.D./O.D. (in.):**	1.375"/2"
Hammer Weight (lb.):	-	**Sampler Hmr Wt (lb):**	140
Hammer Fall (in.):	-	**Sampler Hmr Fall (in):**	30
Other:	-	**Other:**	Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0-2	24	21	2 2 2 14	4	S-1: Very loose, brown/dark brown, fine to coarse SAND, some Silt, little Gravel, trace (+) Roots.	1			TOPSOIL	
1									2		1'		254.0'
												SUBSOIL	
2											2'		253.0'
		S-2	2-2.5	6	6	17 50/0"	R	S-2: Very dense, light brown/light gray, fine to coarse SAND and GRAVEL, some Silt.	3				
3									4				
4									5			GLACIAL TILL	
		S-3	4-5	12	8	30 40 50/0"	R	S-3: Very dense, light brown/light gray, fine to coarse SAND and GRAVEL, some (-) Silt.	6				
5											5.5'		249.5'
6								Bottom of boring at 5.5 feet.	7				
								Refusal on probable bedrock at 5.5 feet.	8				
7													
8													
9													
10													
11													
12													
13													
14													
15													

REMARKS

1. Ground surface elevation estimated from the USGS 3DEP 1M Digital Elevation Model and are cited in the North American Vertical Datum of 1988 in units of feet (NAVD88).
2. HSA used to sample depths from 3 to 3.5 feet below ground surface (bgs).
3. Grinding observed at approximately 2 to 3.5 feet bgs.
4. Utilizing up to 450 lbs. down pressure while advancing between 2 and 3.5 feet bgs.
5. Driller noted auger refusal at 3.5 feet bgs based on no advancement while using up to 450 lbs of down pressure.
6. Driller offset approximately 7 feet south and advanced augers to 4 feet bgs and resumed sampling.
7. Driller noted auger refusal at offset location at 5.5 feet bgs based on no advancement while using up to 450 lbs of down pressure.
8. Upon completion, boreholes backfilled with cuttings up to ground surface.

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

Boring No.: GZ-8

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Able Grid Energy Solutions
Proposed Battery Energy Storage System
50-53 Milford Sreet
Medway, Massachusetts

BORING NO.: GZ-9
SHEET: 1 of 1
PROJECT NO: 01.0175331.00
REVIEWED BY: BJG/LWP

Drilling Co.: Drilex Environmental, Inc.
Foreman: Chris Hogan
Logged By: Anthony Lupo

Type of Rig: ATV
Rig Model: CMB-55
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 239
Final Boring Depth (ft.): 8
Date Start - Finish: 9/23/2021 - 9/23/2021

H. Datum: See Plan
V. Datum: See Plan

Auger/Casing Type: HSA
I.D/O.D.(in): 4.25"/9"
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other: -

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

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0-2	24	15	3 4 3 7	7	S-1: (Top 3") Brown/dark brown, fine to coarse SAND, some Silt, little Gravel, trace (+) Roots. S-1: (Bottom 12") Very loose, brown, fine to coarse SAND, some Gravel, some Silt.	1, 2		0.5'	TOPSOIL	238.5'
											2'	SUBSOIL	237.0'
		S-2	2-4	24	10	9 18 26 18	44	S-2: Dense, light brown/light gray, fine to coarse SAND and GRAVEL, some Silt.	3				
		S-3	4.5-6.5	24	18	29 32 26 50	58	S-3: Very dense, brown, GRAVEL, some fine to coarse Sand, little Silt.	4		8'	GLACIAL TILL	231.0'
								Bottom of boring at 8 feet. Refusal on probable bedrock at 8 feet.	5, 6, 7				

REMARKS

1. Ground surface elevation estimated from the USGS 3DEP 1M Digital Elevation Model and are cited in the North American Vertical Datum of 1988 in units of feet (NAVD88).
2. HSA used to sample depths from 4 to 8 feet below ground surface (bgs).
3. Grinding observed at approximately 4 to 8 feet bgs.
4. Utilizing up to 450 lbs. down pressure while advancing between 4 and 8 feet bgs.
5. Driller noted auger refusal at 8 feet bgs based on no advancement while using up to 450 lbs of down pressure.
6. Driller offset approximately 5 feet south and advanced HSA to auger refusal at 6 feet bgs to confirm bedrock depth.
7. Upon completion, boreholes backfilled with cuttings up to ground surface.

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

Boring No.: GZ-9

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Able Grid Energy Solutions
Proposed Battery Energy Storage System
50-53 Milford Sreet
Medway, Massachusetts

BORING NO.: GZ-10
SHEET: 1 of 1
PROJECT NO: 01.0175331.00
REVIEWED BY: BJG/LWP

Drilling Co.: Drilex Environmental, Inc.
Foreman: Chris Hogan
Logged By: Anthony Lupo

Type of Rig: ATV
Rig Model: CMB-55
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 247
Final Boring Depth (ft.): 11
Date Start - Finish: 9/23/2021 - 9/23/2021

H. Datum: See Plan
V. Datum: See Plan

Auger/Casing Type: HSA
I.D/O.D.(in): 4.25"/9"
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other: -

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

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
9/23/21	1300	10.0	11	0 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
0		S-1	0-2	24	12	2 2 2 3	4	S-1: Very loose, brown/dark brown, fine to coarse SAND, some Gravel, some Silt, trace (+) Roots.	1, 2		1'	TOPSOIL	246.0'
1–2											2'	SUBSOIL	245.0'
2		S-2	2-3	12	12	8 17 50/0"	R	S-2: Very dense, brown/light brown/light gray, fine to coarse SAND and GRAVEL, some Silt.	3				
4		S-3	4-6	24	18	13 21 20 50	41	S-3: (Top 8") Gray, fine to coarse SAND and GRAVEL, some Silt. S-3: (Bottom 10") Dense, light brown, fine to medium SAND, some Silt, little Gravel.	4		9'	GLACIAL TILL	238.0'
10		S-4	10-11	12	12	34 100/6"	R	S-4: Very dense, dark brown, GRAVEL, some Clayey Silt, some fine to coarse Sand.			11'	WEATHERED BEDROCK	236.0'
11								Bottom of boring at 11 feet. Refusal on bedrock at 11 feet.	5, 6				

REMARKS

1. Ground surface elevation estimated from the USGS 3DEP 1M Digital Elevation Model and are cited in the North American Vertical Datum of 1988 in units of feet (NAVD88).
2. HSA used to sample depths from 3 to 11 feet below ground surface (bgs).
3. Grinding observed at approximately 6 to 11 feet bgs.
4. Utilizing up to 450 lbs. down pressure while advancing between 6 and 11 feet bgs.
5. Driller noted auger refusal at 11 feet bgs based on no advancement while using up to 450 lbs of down pressure.
6. Upon completion, boreholes backfilled with cuttings up to ground surface.

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

Boring No.: GZ-10

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Medway Grid, LLC
Proposed BESS Underground Transmission Line
50-53 Milford Street
Medway, Massachusetts

BORING NO.: GZ-18
SHEET: 1 of 1
PROJECT NO: 01.0175331.10
REVIEWED BY: LWP/BPG

Drilling Co.:	Drilex Environmental, Inc.	**Type of Rig:**	ATV	**Boring Location:** See Plan	**H. Datum:**
Foreman:	Jamie Hastings	**Rig Model:**	CME 55	**Ground Surface Elev. (ft.):** 244	
Logged By:	Ernesto Pena	**Drilling Method:**	HSA	**Final Boring Depth (ft.):** 11.5	**V. Datum:** See Plan
				Date Start - Finish: 6/22/2022 - 6/22/2022	

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

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
0-2		S-1	0-2	24	5	1 2 2 2	4	S-1: Very loose, dark brown/brown, fine to medium SAND, little Silt, trace Grass/Roots. (SM)	1, 2		0.25'	TOPSOIL	243.8'
											2.5'	SUBSOIL	241.5'
2-4		S-2	2-4	24	13	8 8 12 49	20	S-2: (Top 3") Brown, fine to medium SAND, little Silt, trace Gravel, trace Roots. (SM) S-2: (Bottom 10") Light brown/light gray, fine to medium SAND, little (-) Gravel, trace Silt. (SP)					
4-6		S-3	4-6	24	11	42 52 72 60/3"	R	S-3: Very dense, light brown/light gray, fine to coarse SAND and GRAVEL, trace Silt. (SW)	3, 4		6.5'	GLACIAL TILL	237.5'
6.5-11.5		C-1	6.5-11.5	60	56			C-1A: (0-26") Very hard, slightly weathered, medium grained, gray, GRANITE, very thin foliation, horizontal bedding, rough, irregular, very close to close, sub-horizontal to moderately dipping joints/fractures. C-1B: (26-40") Very hard, slightly weathered, medium grained, light gray to white, QUARTZITE, very thin foliation, horizontal to moderately dipping bedding, rough, irregular, close, horizontal to sub-horizontal joints/fractures. C-1C: (40-56") Very hard, slightly weathered, medium grained, gray, GRANITE, very thin foliation, horizontal bedding, rough, irregular, close, sub-horizontal to vertical joints/fractures RQD = 35%	5, 6		11.5'	BEDROCK	232.5'
								Bottom of boring at 11.5 feet.					

REMARKS

1. Ground surface elevations estimated from plan entitled "Proposed 345kV Underground Transmission Line", prepared by Power Engineers, with a revision date of November 5, 2021. Borehole located with a handheld GPS device upon completion.
2. HSA used to sample depths from approximately 4 to 6.5 feet below ground surface (bgs).
3. Rig chatter observed at approximately 5-6.5 feet bgs.
4. Cobble fragments observed in sample S-2 and S-3.
5. Auger refusal observed at approximately 6.5 feet bgs. Up to 450 lbs of down pressure used with no advancement.
6. Upon completion, borehole backfilled with cuttings to approximate ground surface.

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

Boring No.: GZ-18

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Medway Grid, LLC
Proposed BESS Underground Transmission Line
50-53 Milford Street
Medway, Massachusetts

BORING NO.: GZ-19
SHEET: 1 of 1
PROJECT NO: 01.0175331.10
REVIEWED BY: LWP/BPG

Drilling Co.:	Drilex Environmental, Inc.	**Type of Rig:**	ATV	**Boring Location:** See Plan	**H. Datum:**
Foreman:	Jamie Hastings	**Rig Model:**	CME 55	**Ground Surface Elev. (ft.):** 242	
Logged By:	Ernesto Pena	**Drilling Method:**	HSA	**Final Boring Depth (ft.):** 9.5	**V. Datum:** See Plan
				Date Start - Finish: 6/22/2022 - 6/22/2022	

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

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
0		S-1	0-2	24	15	3 4 3 5	7	S-1: (Top 6") Dark brown, fine to medium SAND, trace Gravel, trace Silt, trace Grass/Roots. (SP) S-1: (Bottom 9") Loose, brown, fine to medium SAND, little Silt, trace Gravel, trace Roots. (SM)	1, 2		0.5'	TOPSOIL	241.5'
											2'	SUBSOIL	240.0'
2		S-2	2-4	24	11	15 23 55/3"	R	S-2: Very dense, light brown/light gray, fine to medium SAND, little Gravel, trace (+) Silt. (SP-SM)					
4		S-3	4-4.7	7	0	16 50/1"	R	S-3: No recovery.	3				
5		S-4	5-5.9	11	6	22 70/5"	R	S-4: Very dense, light gray, GRAVEL and fine to coarse SAND, trace Silt. (GW)	4, 5		9'	GLACIAL TILL	233.0'
9		C-1	9-9.5	6	5			C-1: Very hard, slightly weathered, coarse grained, light gray, GRANITE, very thin bedding, horizontal attitude, rough, irregular, very close, fractures. RQD=0%	6, 7, 8		9.5'	BEDROCK	232.5'
								Bottom of boring at 9.5 feet.					

REMARKS

1. Ground surface elevations estimated from plan entitled "Proposed 345kV Underground Transmission Line", prepared by Power Engineers, with a revision date of November 5, 2021. Borehole located with a handheld GPS device upon completion.
2. HSA used to sample depths from approximately 4 to 9 feet below ground surface (bgs).
3. Gravel observed lodged in tip of sample S-3.
4. Rig chatter observed at approximately 4.5-9 feet bgs.
5. Cobble fragments observed in sample S-4.
6. Auger refusal observed at approximately 9 feet bgs. Up to 450 lbs of down pressure used with no advancement.
7. While attempting to core sample C-1, core barrel became jammed at approximately 9.5 feet bgs and inner barrel was damaged. Core C-1 was terminated at 9.5 feet bgs.
8. Upon completion, borehole backfilled with cuttings to approximate ground surface.

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

Boring No.: GZ-19

175331.10 MEDWAY GRID, LLC.GPJ; STRATUM ONLY NORWOOD; 7/18/2022

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Medway Grid LLC
Proposed Battery Energy Storage System
50-53 Milford Street
Medway, Massachusetts

BORING NO.: GZ-21
SHEET: 1 of 1
PROJECT NO: 01.0175331.20
REVIEWED BY: BPG/LWP

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:**
Foreman: Walter Hoeckele	**Rig Model:** Mobile B53	**Ground Surface Elev. (ft.):** 256	**V. Datum:** NAVD88
Logged By: Leonard Kilmartin	**Drilling Method:** Drive & Wash	**Final Boring Depth (ft.):** 16	
		Date Start - Finish: 8/4/2022 - 8/4/2022	

Auger/Casing Type: HW	**Sampler Type:** Split Spoon
I.D/O.D.(in): 4/4.5	**I.D./O.D. (in.):** 1.375/2
Hammer Weight (lb.): 140	**Sampler Hmr Wt (lb):** 140
Hammer Fall (in.): 30	**Sampler Hmr Fall (in):** 30
Other: Auto Hammer	**Other:** Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
											0.2'	ASPHALT	255.8'
		S-1	0.5-2	18	15	3 3 4	7	S-1: Loose, gray, fine to coarse SAND, little Silt, trace Gravel.	1		2'	FILL	254.0'
		S-2	2-4	24	16	11 14 23 22	37	S-2: Dense, gray, fine to coarse SAND, some Silt, little Gravel.					
5		S-3	4-6	24	19	24 30 48 38	78	S-3: Very dense, gray, fine to coarse SAND, some Silt, little Gravel.	2				
10		S-4	9-11	24	15	18 23 31 28	54	S-4: Very dense, gray, fine to coarse SAND, some (-) Gravel, little Silt.				GLACIAL TILL	
15		S-5	14-16	24	20	21 28 40 40	68	S-5: Very dense, dark gray/brown, fine to coarse SAND, little (+) Silt, little Gravel, damp.	3		16'		240.0'
								Bottom of boring at 16 feet.	4				
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from plan entitled "Grading and Drainage Plan" prepared by Burns & McDonnell and dated December 6, 2021.
2. Drillers advanced 4-inch diameter casing to sample depths from approximately 4 to 16 feet below ground surface (bgs).
3. Strong hydrocarbon-like odor in wash water noted at approximately 14 feet bgs.
4. Upon completion, borehole backfilled with cuttings to ground surface.

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

Boring No.: GZ-21

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Medway Grid LLC
Proposed Battery Energy Storage System
50-53 Milford Street
Medway, Massachusetts

BORING NO.: GZ-22
SHEET: 1 of 1
PROJECT NO: 01.0175331.20
REVIEWED BY: BPG/LWP

Drilling Co.:	New England Boring Contractors	**Type of Rig:**	ATV	**Boring Location:** See Plan	**H. Datum:**
Foreman:	Walter Hoeckele	**Rig Model:**	Mobile B53	**Ground Surface Elev. (ft.):** 253	**V. Datum:** NAVD88
Logged By:	Leonard Kilmartin	**Drilling Method:**	Drive & Wash	**Final Boring Depth (ft.):** 22.3	
				Date Start - Finish: 8/4/2022 - 8/4/2022	

Auger/Casing Type:	HW	**Sampler Type:**	Split Spoon
I.D/O.D.(in):	4/4.5	**I.D./O.D. (in.):**	1.375/2
Hammer Weight (lb.):	140	**Sampler Hmr Wt (lb):**	140
Hammer Fall (in.):	30	**Sampler Hmr Fall (in):**	30
Other:	Auto Hammer	**Other:**	Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0.5-2	18	13	12 16 22	38	S-1: Medium dense, gray, fine to medium SAND, little Silt, trace Gravel.	1		0.5'	ASPHALT	252.5'
											2'	FILL	251.0'
		S-2	2-4	24	18	22 21 22 22	43	S-2: Dense, gray, fine to medium SAND, little Silt, trace Gravel.					
5		S-3	4-6	24	20	21 20 19 18	39	S-3: Dense, gray, fine to coarse SAND, some Silt, little Gravel.	2				
									3				
10		S-4	9-11	24	15	11 12 14 19	26	S-4: Medium dense, gray, fine to coarse SAND, some Silt, little Gravel.				GLACIAL TILL	
15											15.5'		237.5'
		S-5	15.9-17.9	3	3	50/3"	R	S-5: Very dense, gray to brown, fine SAND, some Silt, little Gravel.	4 5			WEATHERED BEDROCK	
											19'		234.0'
20	2:52 2:15	C-1	19-22.3	39	17			C-1: Medium, highly weathered, brown, GRANITE, fine to medium grained, very close, sub-horizontal to vertical, iron-oxide stained joints/fractures. RQD=0%				BEDROCK	
									6		22.3'		230.7'
								Bottom of boring at 22.3 feet.	7				
25													
30													

REMARKS

1. Ground surface elevation estimated from plan entitled "Grading and Drainage Plan" prepared by Burns & McDonnell and dated December 6, 2021.
2. Drillers advanced 4-inch diameter casing to sample depths from approximately 4 to 19 feet below ground surface (bgs).
3. Increase in effort observed while advancing casing at approximately 7.5 feet bgs.
4. Increase in drill effort observed while advancing rollerbit at approximately 15.5 and again at 19 feet bgs.
5. Rollerbit advancement rate through likely weathered bedrock was approximately 2.5 min/ft.
6. Core barrel jammed after a penetration of approximately 39 inches.
7. Upon completion, borehole backfilled with cuttings to ground surface.

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

Boring No.: GZ-22

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Medway Grid LLC
Proposed Battery Energy Storage System
50-53 Milford Street
Medway, Massachusetts

BORING NO.: GZ-23
SHEET: 1 of 1
PROJECT NO: 01.0175331.20
REVIEWED BY: BPG/LWP

Drilling Co.:	New England Boring Contractors	**Type of Rig:**	ATV	**Boring Location:** See Plan	**H. Datum:**
Foreman:	Walter Hoeckele	**Rig Model:**	Mobile B53	**Ground Surface Elev. (ft.):** 252	
Logged By:	Leonard Kilmartin	**Drilling Method:**	HSA	**Final Boring Depth (ft.):** 13.1	**V. Datum:** NAVD88
				Date Start - Finish: 8/4/2022 - 8/4/2022	

Auger/Casing Type:	HSA	**Sampler Type:**	Split Spoon
I.D/O.D.(in):	3.25/6.5	**I.D./O.D. (in.):**	1.375/2
Hammer Weight (lb.):		**Sampler Hmr Wt (lb):**	140
Hammer Fall (in.):		**Sampler Hmr Fall (in):**	30
Other:		**Other:**	Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0-2	24	11	1 WOH 3 4	3	S-1: (Top 4") Dark brown, SILT and ROOTS, little fine Sand. S-1: (Bottom 7") Tan, fine SAND, some Silt.	1		0.3'	FOREST MAT	251.7'
												SUBSOIL	
		S-2	2-4	24	24	10 17 28 40	45	S-2: (Top 12") Tan, fine SAND, some Silt. S-2: (Bottom 12") Light gray, fine to medium SAND, little Silt, trace Gravel.			3'		249.0'
5		S-3	4-6	24	20	19 25 26 27	51	S-3: Very dense, gray, fine to coarse SAND, some Silt, some Gravel.	2			GLACIAL TILL	
10		S-4	9-11	24	17	10 12 18 14	30	S-4: Medium dense, gray, fine to coarse SAND, some Silt, little Gravel.					
								Bottom of boring at 13.1 feet.	3 4		13.1'		238.9'
15													
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from plan entitled "Grading and Drainage Plan" prepared by Burns & McDonnell and dated December 6, 2021.
2. Drillers advanced HSA to sample depths from approximately 4 to 13.1 feet below ground surface (bgs).
3. Auger refusal observed at approximately 13.1 feet bgs.
4. Upon completion, borehole backfilled with cuttings to ground surface.

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

Boring No.: GZ-23

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Medway Grid LLC
Proposed Battery Energy Storage System
50-53 Milford Street
Medway, Massachusetts

BORING NO.: GZ-24
SHEET: 1 of 1
PROJECT NO: 01.0175331.20
REVIEWED BY: BPG/LWP

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan		**H. Datum:**	
Foreman: Walter Hoeckele	**Rig Model:** Mobile B53	**Ground Surface Elev. (ft.):** 250			
Logged By: Leonard Kilmartin	**Drilling Method:** Drive & Wash	**Final Boring Depth (ft.):** 8.3		**V. Datum:** NAVD88	
		Date Start - Finish: 8/5/2022 - 8/5/2022			

Auger/Casing Type: HW	**Sampler Type:** Split Spoon	**Groundwater Depth (ft.)**			
I.D/O.D.(in): 4/4.5	**I.D./O.D. (in.):** 1.375/2	**Date**	**Time**	**Water Depth**	**Casing**	**Stab. Time**
Hammer Weight (lb.): 140	**Sampler Hmr Wt (lb):** 140	Not	encountered			
Hammer Fall (in.): 30	**Sampler Hmr Fall (in):** 30					
Other: Auto Hammer	**Other:** Auto Hammer					

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0-2	24	1	9 4 4 4	8	S-1: Loose, brown, fine SAND and SILT, some Roots.	1		0.3'	TOPSOIL	249.7'
												SUBSOIL	
	min/ft	S-2	2-2.8	10	5	12 50/4"	R	S-2: Very dense, fine SAND and SILT.			2.8'		247.2'
	5	C-1	3.3-8.3	60	60			C-1: Medium to hard, moderately weathered, fine grained, gray, GRANITE, very thin, moderately dipping foliation, very close to close, iron-oxide stained, horizontal to moderately dipping joints/fractures. RQD=33%				BEDROCK	
5	7												
	7.1												
	9.9												
	2.9								2		8.3'		241.7'
								Bottom of boring at 8.3 feet.	3				
10													
15													
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from plan entitled "Grading and Drainage Plan" prepared by Burns & McDonnell and dated December 6, 2021.
2. Core barrel jammed after a penetration of approximately 42 inches.
3. Upon completion, borehole backfilled with cuttings to ground surface.

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

Boring No.: GZ-24

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Medway Grid LLC
Proposed Battery Energy Storage System
50-53 Milford Street
Medway, Massachusetts

BORING NO.: GZ-25

PROJECT NO: 01.0175331.20
REVIEWED BY: BPG/LWP

Drilling Co.:	New England Boring Contractors	**Type of Rig:**	ATV	**Boring Location:**	See Plan
Foreman:	Walter Hoeckele	**Rig Model:**	Mobile B53	**Ground Surface Elev. (ft.):**	246
Logged By:	Leonard Kilmartin	**Drilling Method:**	Drive & Wash	**Final Boring Depth (ft.):**	11.2
				Date Start - Finish:	8/5/2022 - 8/5/2022
				H. Datum:	
				V. Datum:	NAVD88

Auger/Casing Type:	HW	**Sampler Type:**	Split Spoon
I.D/O.D.(in):	4/4.5	**I.D./O.D. (in.):**	1.375/2
Hammer Weight (lb.):	140	**Sampler Hmr Wt (lb):**	140
Hammer Fall (in.):	30	**Sampler Hmr Fall (in):**	30
Other:	Auto Hammer	**Other:**	Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0-2	24	8	2 4 1 1	5	S-1: (Top 4") Brown, fine SAND and SILT, some Roots. S-1: (Bottom 4") Tan, fine SAND and SILT.	1		0.3'	TOPSOIL	245.7'
		S-2	2-4	24	14	5 8 15 56	23	S-2: (Top 6") Tan, fine SAND and SILT. S-2: (Bottom 8") Light gray/light brown, fine to coarse SAND, some Silt, some Gravel.			2.5'	SUBSOIL	243.5'
5		S-3	4.5-6.5	24	16	24 30 27 25	57	S-3: Very dense, dark gray/dark brown, fine to coarse SAND, some Silt, some Gravel.	2				
10		S-4	9-9.2	2	1	50/2"	R	S-4: Very dense, dark gray, fine to medium SAND and SILT, trace Gravel.	3		10'	GLACIAL TILL	236.0'
											11.2'	WEATHERED BEDROCK	234.8'
								Bottom of boring at 11.2 feet.	4 5				
15													
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from plan entitled "Grading and Drainage Plan" prepared by Burns & McDonnell and dated December 6, 2021.
2. Drillers advanced 4-inch diameter casing to sample depths from approximately 4.5 to 9.2 feet below ground surface (bgs).
3. Increase in effort observed while advancing rollerbit at approximately 10 feet bgs. Rock fragments observed in wash water between 10 and 11 feet bgs.
4. Auger refusal observed at approximately 11.2 feet bgs.
5. Upon completion, borehole backfilled with cuttings to ground surface.

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

Boring No.: GZ-25

TEST BORING LOG

GZA GeoEnvironmental, Inc. *Engineers and Scientists*	**Medway Grid LLC** **Proposed Battery Energy Storage System** **50-53 Milford Street** **Medway, Massachusetts**	**BORING NO.:** GZ-26 **SHEET:** 1 of 1 **PROJECT NO:** 01.0175331.20 **REVIEWED BY:** LWP

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:**
Foreman: Walter Hoeckele	**Rig Model:** Mobile B53	**Ground Surface Elev. (ft.):** 266	
Logged By: Leonard Kilmartin	**Drilling Method:** HSA	**Final Boring Depth (ft.):** 4.5	**V. Datum:** NAVD88
		Date Start - Finish: 8/5/2022 - 8/5/2022	

Auger/Casing Type: HSA	**Sampler Type:**
I.D/O.D.(in): 3.25/6.5	**I.D./O.D. (in.):**
Hammer Weight (lb.):	**Sampler Hmr Wt (lb):**
Hammer Fall (in.):	**Sampler Hmr Fall (in):**
Other:	**Other:**

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		GZ-26	0-4.5					GZ-26: No samples collected in probe boring.	1		4.5'		261.5'
5								Bottom of boring at 4.5 feet.	2 3				
10													
15													
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from plan entitled "Grading and Drainage Plan" prepared by Burns & McDonnell and dated December 6, 2021.
2. Hollow stem auger refusal observed at approximately 4.5 feet bgs using up to 500 lbs of down pressure.
3. Upon completion borehole backfilled with cuttings to ground surface.

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

Boring No.: GZ-26

TEST BORING LOG

GZA GeoEnvironmental, Inc. *Engineers and Scientists*	Medway Grid LLC Proposed Battery Energy Storage System 50-53 Milford Street Medway, Massachusetts	BORING NO.: GZ-27 SHEET: 1 of 1 PROJECT NO: 01.0175331.20 REVIEWED BY: LWP

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:**
Foreman: Walter Hoeckele	**Rig Model:** Mobile B53	**Ground Surface Elev. (ft.):** 264	**V. Datum:** NAVD88
Logged By: Leonard Kilmartin	**Drilling Method:** HSA	**Final Boring Depth (ft.):** 1.8	
		Date Start - Finish: 8/5/2022 - 8/5/2022	

Auger/Casing Type: HSA
I.D/O.D.(in): 3.25/6.5
Hammer Weight (lb.):
Hammer Fall (in.):
Other:

Sampler Type:
I.D./O.D. (in.):
Sampler Hmr Wt (lb):
Sampler Hmr Fall (in):
Other:

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		GZ-27	0-1.8					GZ-27: No samples collected in probe boring.	1		1.8'		262.2'
								Bottom of boring at 1.8 feet.	2 3				
5													
10													
15													
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from plan entitled "Grading and Drainage Plan" prepared by Burns & McDonnell and dated December 6, 2021.
2. Hollow stem auger refusal observed at approximately 1.8 feet bgs using up to 500 lbs of down pressure.
3. Upon completion borehole backfilled with cuttings to ground surface.

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

Boring No.: GZ-27

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Medway Grid LLC
Proposed Battery Energy Storage System
50-53 Milford Street
Medway, Massachusetts

BORING NO.: GZ-28
SHEET: 1 of 1
PROJECT NO: 01.0175331.20
REVIEWED BY: LWP

Drilling Co.: New England Boring Contractors
Foreman: Walter Hoeckele
Logged By: Leonard Kilmartin

Type of Rig: ATV
Rig Model: Mobile B53
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 262
Final Boring Depth (ft.): 14.8
Date Start - Finish: 8/5/2022 - 8/5/2022

H. Datum:
V. Datum: NAVD88

Auger/Casing Type: HSA
I.D/O.D.(in): 3.25/6.5
Hammer Weight (lb.):
Hammer Fall (in.):
Other:

Sampler Type:
I.D./O.D. (in.):
Sampler Hmr Wt (lb):
Sampler Hmr Fall (in):
Other:

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
0–14.8		GZ-28	0-14.8					GZ-28: No samples collected in probe boring.	1		14.8'		247.2'
14.8								Bottom of boring at 14.8 feet.	2 3				

Depth scale: 5, 10, 15, 20, 25, 30

REMARKS

1. Ground surface elevation estimated from plan entitled "Grading and Drainage Plan" prepared by Burns & McDonnell and dated December 6, 2021.
2. Hollow stem auger refusal observed at approximately 14.8 feet bgs using up to 500 lbs of down pressure.
3. Upon completion borehole backfilled with cuttings to ground surface.

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

Boring No.: GZ-28

Appendix C – Geotechnical Laboratory Test Results

THIELSCH ENGINEERING

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Luke Prohaske
Assigned By: Luke Prohaske
Collected By: Leonard Kilmartin

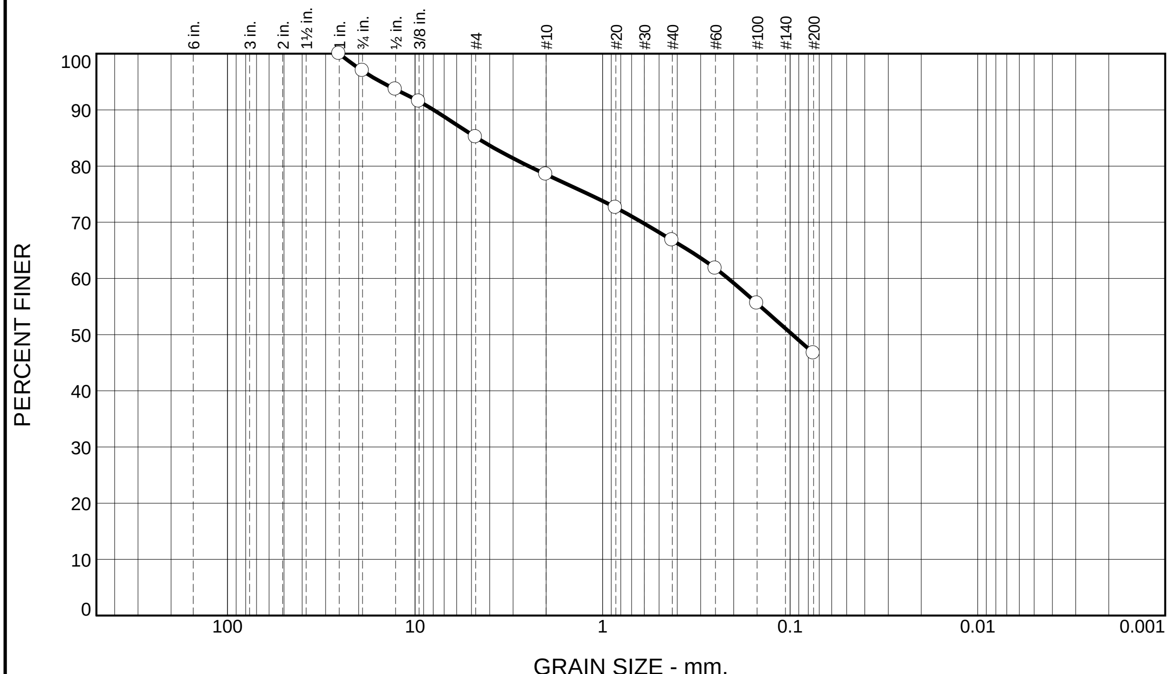
Project Information:
Medway BESS
Medway, MA
GZA Project Number: 01.0175331
Summary Page: 1 of 1
Report Date: 10.14.21

LABORATORY TESTING DATA SHEET, Report No.: 7421-J-B011, Rev.1

Source	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / Thermal Resistivity								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	Thermal Resistivity Optimum (°C*cm/W)	Thermal Resistivity Mid Point (°C*cm/W)	Thermal Resistivity Oven Dried (°C*cm/W)	
				D2216	D4318		D6913			D2974	D854			D1557			D5334			
Composite	Compsite	1-4	21-S-B255				14.8	38.5	46.7			101.0	11.1	119.1 / 11.4	121.9 / 10.5	85	66.46	91.42	285.47	Tan SILT and f-c SAND, little f-c Gravel
GZ-4	S-2	2-4	21-S-B256				29.4	33.7	36.9											Brown SILT, some f-c Sand, some f-c Gravel
GZ-9	S-3	4.5-6.5	21-S-B257				58.0	29.5	12.5											Brown f-c GRAVEL, some f-c Sand, little Silt

Date Received: *09.28.21*　　Reviewed By: 　　Date Reviewed: *10.14.21*

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.0	11.8	6.7	11.7	20.1	46.7	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	97.0		
0.5"	93.6		
0.375"	91.5		
#4	85.2		
#10	78.5		
#20	72.6		
#40	66.8		
#60	61.8		
#100	55.6		
#200	46.7		

* (no specification provided)

Material Description

Tan SILT and f-c SAND, little f-c Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 7.9632 D_{85}= 4.6633 D_{60}= 0.2139
D_{50}= 0.0972 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as non-plastic.

Date Received: 09.28.21 **Date Tested:** 10.05.21
Tested By: RL / DN / CC
Checked By: Steven Accetta
Title: Laboratory Coordinator

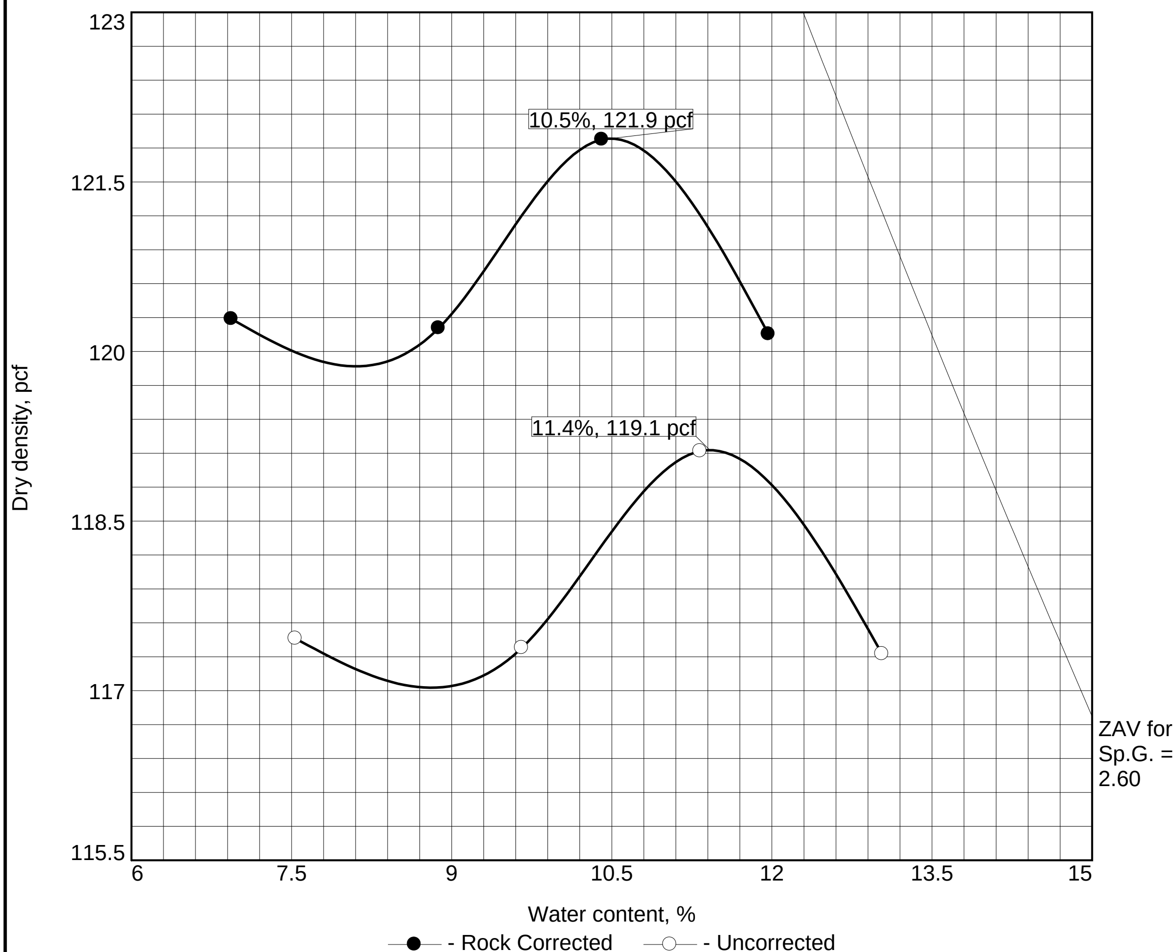
Source of Sample: Composite **Depth:** 1-4' **Date Sampled:**
Sample Number: Composite

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Medway BESS
Medway, MA
Project No: 01.0175331.00 **Figure** 21-S-B255

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method B Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
1-4'	SM	A-4(0)		2.6	NV	NP	8.5	46.7

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 121.9 pcf	119.1 pcf	Tan SILT and f-c SAND, little f-c Gravel
Optimum moisture = 10.5 %	11.4 %	

Project No. 01.0175331.00 **Client:** GZA GeoEnvironmental
Project: Medway BESS
Medway, MA
○ **Source of Sample:** Composite **Sample Number:** Composite

Remarks:

Thielsch Engineering Inc.

Cranston, RI

Figure 21-MC-

Tested By: DN **Checked By:** Steven Accetta

THIELSCH ENGINEERING	195 Frances Avenue Cranston RI, 02910 Phone: (401)-467-6454 Fax: (401)-467-2398 http://www.thielsch.com	**Client Information** GZA GeoEnviormental Norwood, MA Luke Prohaske Luke.Prohaske@gza.com

Determination of Thermal Conductivity of Soil by Thermal Needle Probe Procedure

ASTM D5334-14

Project Name:	Medway BESS	**Thermal Meter:**		TEMPOS	
Project Number:	01.0175331.00	**Calibration:**		08.09.18	
Lab Number:	21-B-255	**Thermal Probe:**		TR-3 000143	
Sample Number:	Composite	**Calibration:**		08.09.18	
Material Source:	Medway, MA	**Specimen Prep:**		Reconstituted Specimen	
Depth:	1 to 4'	**Mold Type:**		"B" Proctor	
Date:	10.14.21	**Tested by:**	AV	**Reviewed by:**	SA

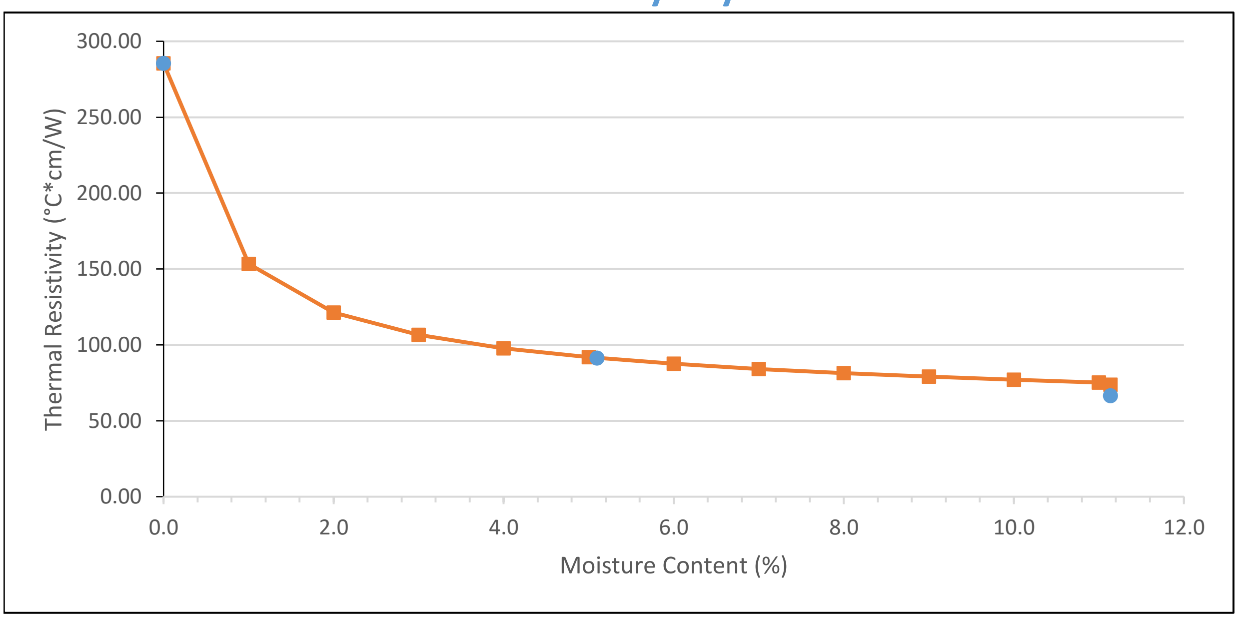
Compaction & Moisture Content Information

Soil Description:	Tan SILT and f-c SAND, little f-c Gravel		
Oversized Material (%):	8.5	Passing #200 Sieve (%):	46.7
Proctor Method:	ASTM D1557 B	Requested % Compaction:	85.0
Maximum Dry Density (pcf):	121.9	Opt. Moisture Content (%):	10.5
Remolded Dry Density (pcf):	101.0	In-situ Moisture Cont. (%):	

Thermal Resistivity Test Results

Moisture Content (%)	Thermal Conductivity (W/m*K)	Thermal Resistivity (°C*cm/W)
5.1	1.0939	91.42
11.1	1.5047	66.46
0.0	0.3503	285.47

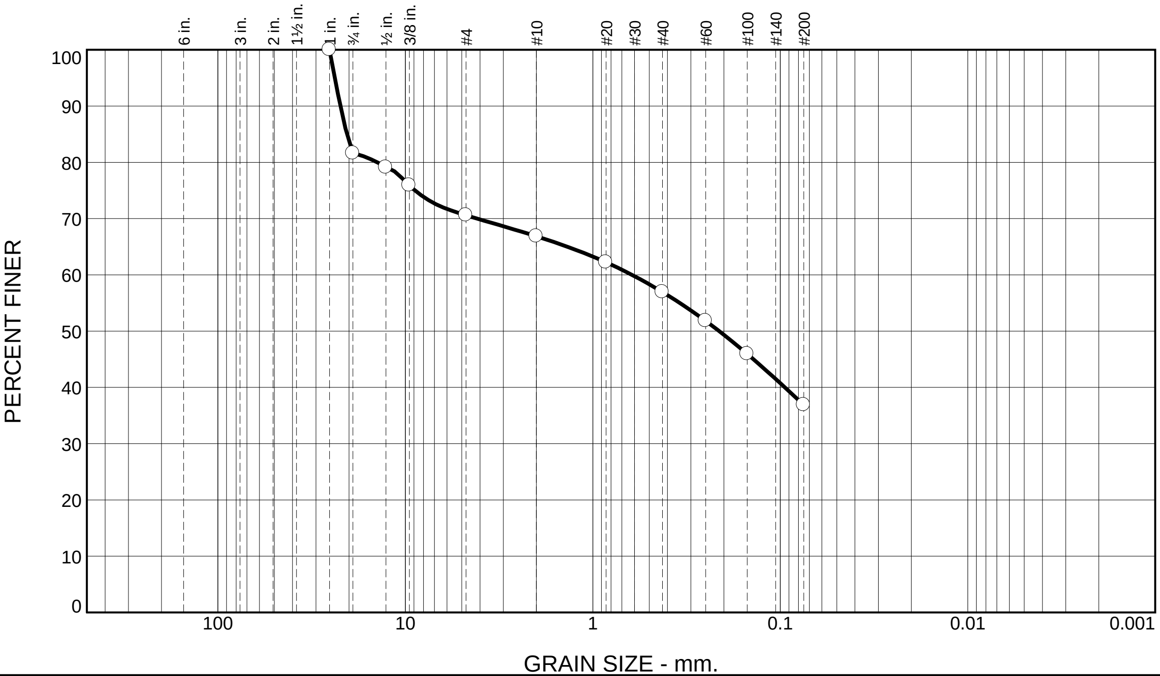
Thermal Resistivity Dryout Curve



Test Notes:

Optimum, Mid-Point, and Oven-Dried Test Conditions provided for Dryout Curve.
Maximum particle size used for reconstituted sample was 3/8".

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	18.4	11.0	3.7	10.0	20.0	36.9	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	81.6		
0.5"	79.1		
0.375"	75.9		
#4	70.6		
#10	66.9		
#20	62.2		
#40	56.9		
#60	51.8		
#100	45.9		
#200	36.9		

* (no specification provided)

Material Description

Brown SILT, some f-c Sand, some f-c Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 22.2078 D_{85}= 20.4933 D_{60}= 0.6183
D_{50}= 0.2118 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as non-plastic.

Date Received: 09.28.21 **Date Tested:** 10.05.21

Tested By: CC / DN

Checked By: Steven Accetta

Title: Laboratory Coordinator

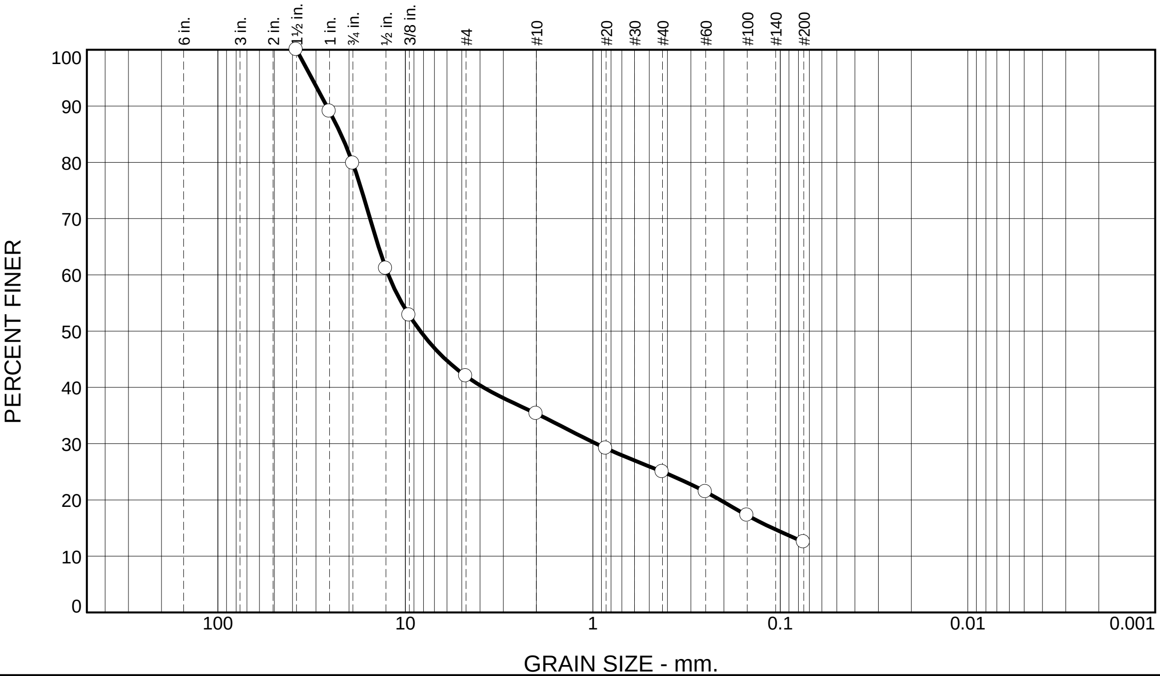
Source of Sample: Borings **Depth:** 2-4' **Date Sampled:**
Sample Number: GZ-4 / S-2

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Medway BESS
Medway, MA
Project No: 01.0175331.00 **Figure** 21-S-B256

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.2	37.8	6.7	10.3	12.5	12.5	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0		
1"	89.1		
3/4"	79.8		
1/2"	61.1		
3/8"	52.8		
#4	42.0		
#10	35.3		
#20	29.2		
#40	25.0		
#60	21.4		
#100	17.2		
#200	12.5		

* (no specification provided)

Material Description

Brown f-c GRAVEL, some f-c Sand, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= GM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 26.2847 D_{85}= 22.0726 D_{60}= 12.3281
D_{50}= 8.3143 D_{30}= 0.9615 D_{15}= 0.1101
D_{10}= C_u= C_c=

Remarks

Date Received: 09.28.21 **Date Tested:** 10.04.21

Tested By: CC / DN

Checked By: Steven Accetta

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 4.5-6.5' **Date Sampled:**
Sample Number: GZ-9 / S-3

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Medway BESS
Medway, MA
Project No: 01.0175331.00 **Figure** 21-S-B257

THIELSCH ENGINEERING

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Luke Prohaske
Assigned By: Benjamin Gerardi
Collected By: L. Kilmartin

Project Information:
Medway BESS - Phase II
Medway, MA
GZA Project Number: 01.0175331.20
Summary Page: 1 of 1
Report Date: 08.22.2022

LABORATORY TESTING DATA SHEET, Report No.: 7422-H-B010

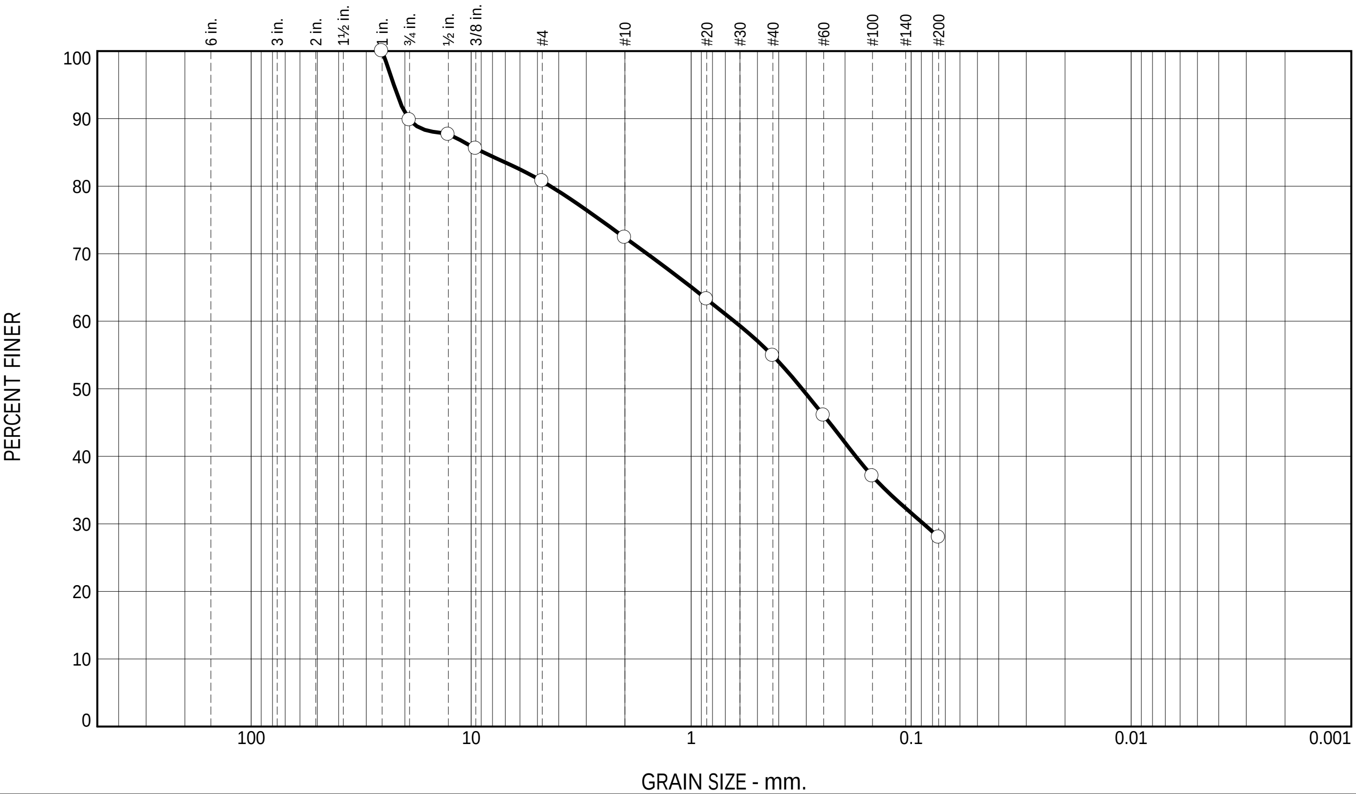
				Identification Tests								Proctor / Thermal Resistivity							
Boring ID	Sample ID	Depth (Ft)	Laboratory No.	As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	Thermal Resistivity Optimum (°C*cm/W)	Thermal Resistivity Oven Dried (°C*cm/W)	Laboratory Log and Soil Description
				D2216	D4318		D6913			D2974	D854			D1557			D5334		
GZ-21	S-2	2-4	22-S-B659				19.3	52.7	28.0										Light Grey f-c SAND, some Silt, little f-c Gravel
GZ-22	S-4	9-11	22-S-B660				15.8	52.5	31.7										Light Grey f-c SAND, some Silt, little f-c Gravel
GZ-23	S-3	4-6	22-S-B661				27.3	43.7	29.0										Light Grey f-c SAND, some Silt, some f-c Gravel
GZ-25	S-3	4.5-6.5	22-S-B662				20.9	45.4	33.7										Brown f-c SAND, some Silt, some fine Gravel

Date Received: *08.12.2022*   Reviewed By: ____________________   Date Reviewed: *08.22.2022*

This report only relates to items inspect and/or tested. No warranty, expressed or implied, is made.
This report shall not be reporduced, except in full, without prior written approval from the Agency, as defined in ASTM E329.

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.2	9.1	8.3	17.5	26.9	28.0	

Test Results (ASTM D6913)				
Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1"	100.0			
3/4"	89.8			
1/2"	87.6			
3/8"	85.6			
#4	80.7			
#10	72.4			
#20	63.2			
#40	54.9			
#60	46.1			
#100	37.1			
#200	28.0			

* (no specification provided)

Material Description

Light Grey f-c SAND, some Silt, little f-c Gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 19.2943 D_{85}= 8.7800 D_{60}= 0.6371
D_{50}= 0.3136 D_{30}= 0.0879 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Source of Sample: GZ-21 Depth: 2-4'
Sample Number: S-2 Sample Date:

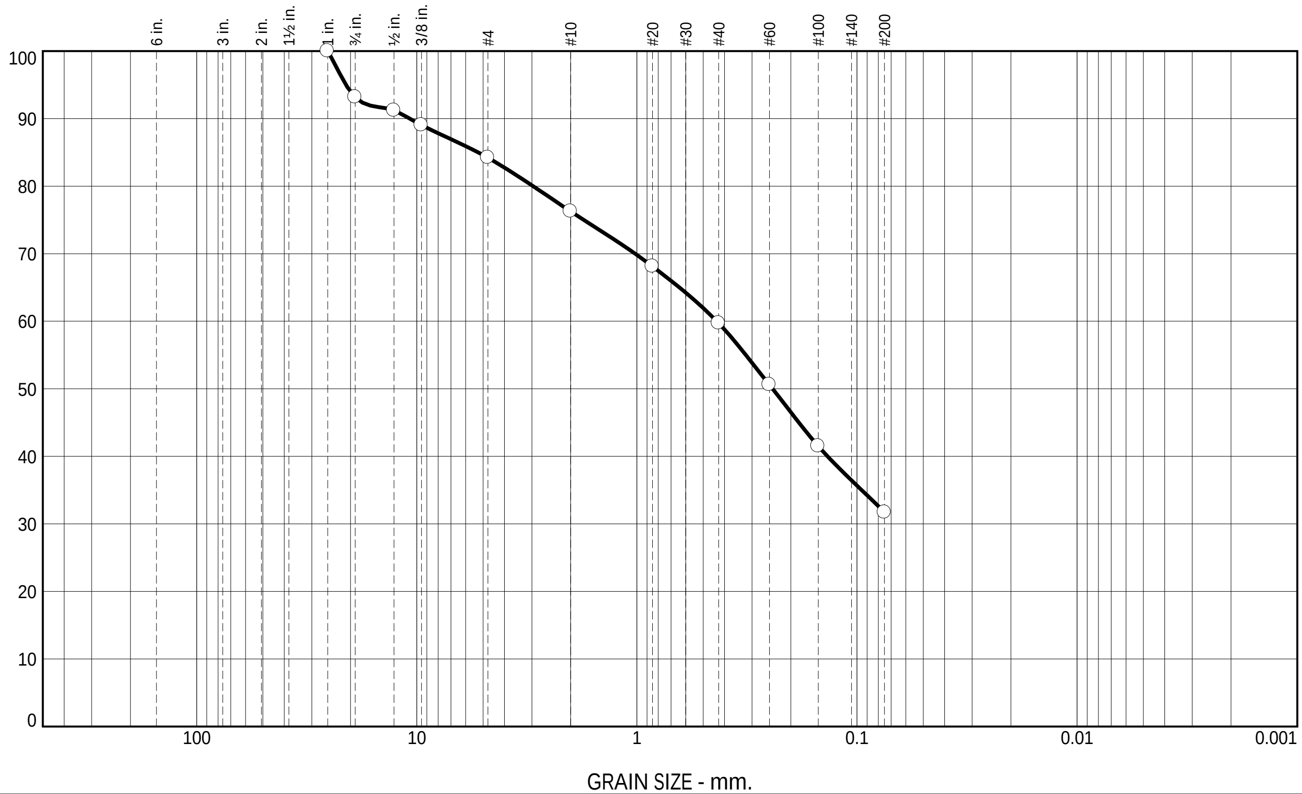
Thielsch Engineering Inc. Cranston, RI	Client: GZA GeoEnvironmental Project: Medway BESS - Phase II Medway, MA Project No: 01.0175331.20 Figure 22-S-B659

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

Tested By: DN / CDC Checked By: Ronelle LeBlanc

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.8	9.0	7.9	16.6	28.0	31.7	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1"	100.0			
3/4"	93.2			
1/2"	91.2			
3/8"	89.0			
#4	84.2			
#10	76.3			
#20	68.1			
#40	59.7			
#60	50.6			
#100	41.5			
#200	31.7			

* (no specification provided)

Material Description

Light Grey f-c SAND, some Silt, little f-c Gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 10.7677 D_{85}= 5.2658 D_{60}= 0.4337
D_{50}= 0.2418 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Source of Sample: GZ-22 Depth: 9-11
Sample Number: S-4

Sample Date:

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Medway BESS - Phase II
Medway, MA
Project No: 01.0175331.20

Figure 22-S-B660

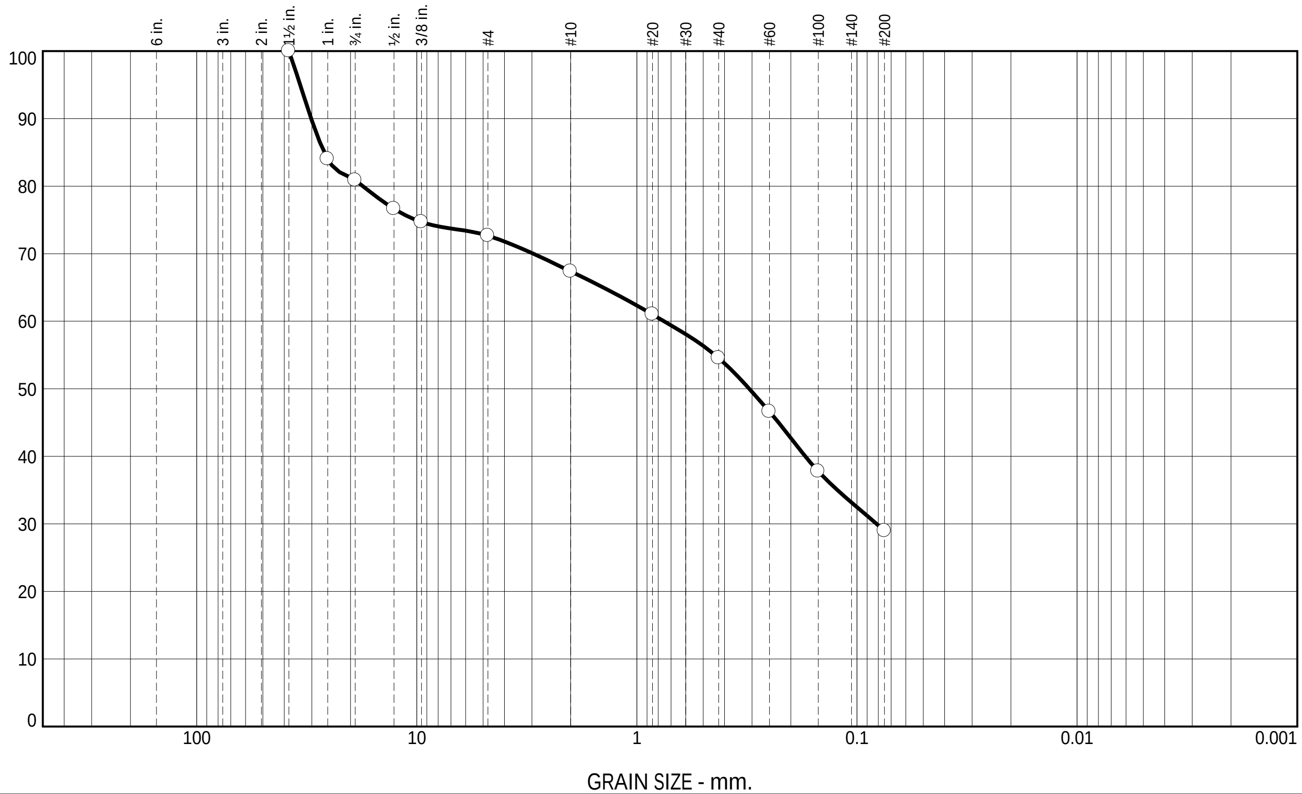
These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

Tested By: DN / CDC

Checked By: Ronelle LeBlanc

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	19.1	8.2	5.3	12.9	25.5	29.0	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1-1/2"	100.0			
1"	84.0			
3/4"	80.9			
1/2"	76.6			
3/8"	74.7			
#4	72.7			
#10	67.4			
#20	61.0			
#40	54.5			
#60	46.6			
#100	37.8			
#200	29.0			

* (no specification provided)

Material Description

Light Grey f-c SAND, some Silt, some f-c Gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 30.1815 D_{85}= 26.3276 D_{60}= 0.7533
D_{50}= 0.3087 D_{30}= 0.0815 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Source of Sample: GZ-23 Depth: 4-6
Sample Number: S-3 Sample Date:

Thielsch Engineering Inc.

Cranston, RI

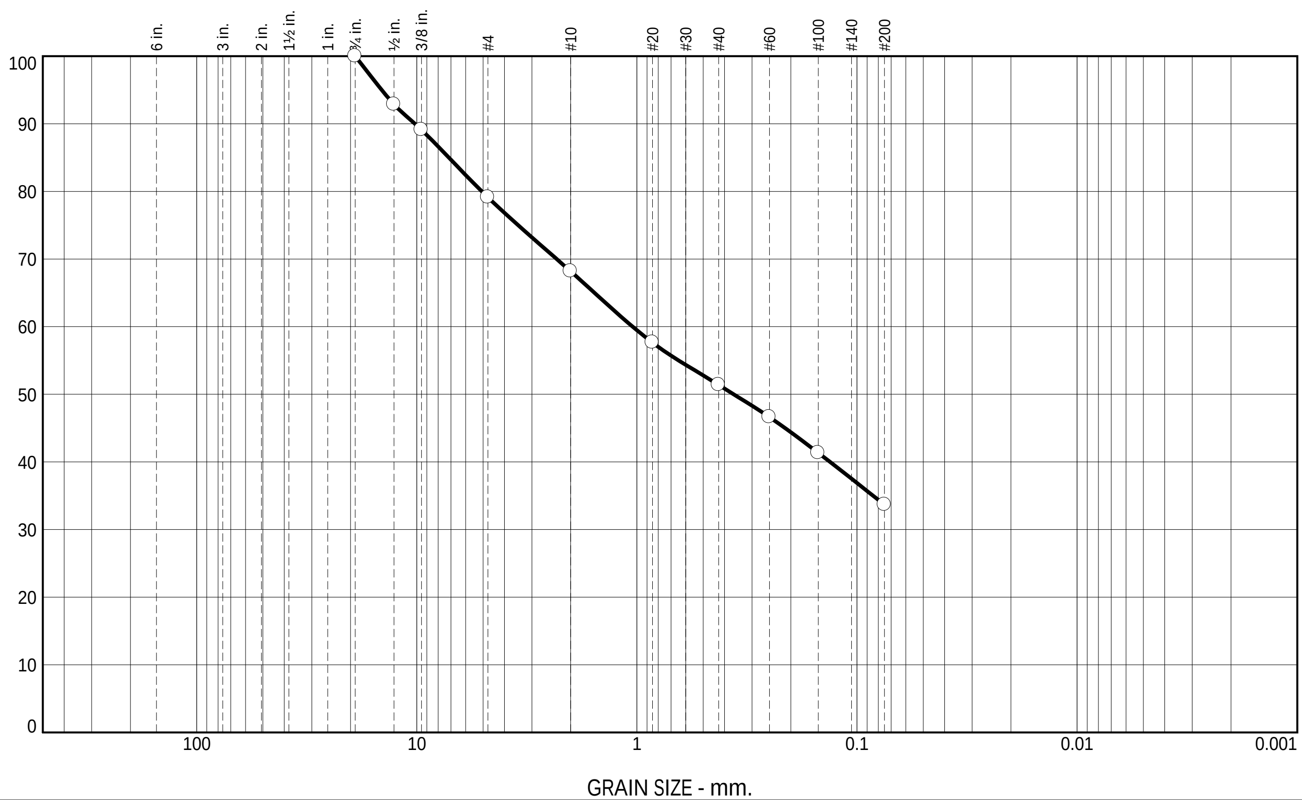
Client: GZA GeoEnvironmental
Project: Medway BESS - Phase II
Medway, MA
Project No: 01.0175331.20 Figure 22-S-B661

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

Tested By: DN / CDC Checked By: Ronelle LeBlanc

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	20.9	10.9	16.8	17.7	33.7	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/4"	100.0			
1/2"	92.9			
3/8"	89.1			
#4	79.1			
#10	68.2			
#20	57.6			
#40	51.4			
#60	46.6			
#100	41.3			
#200	33.7			

* (no specification provided)

Material Description

Brown f-c SAND, some Silt, some fine Gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 10.1947 D_{85}= 7.1516 D_{60}= 1.0460
D_{50}= 0.3635 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Source of Sample: GZ-25 Depth: 4.5-6.5
Sample Number: S-3

Sample Date:

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Medway BESS - Phase II
Medway, MA
Project No: 01.0175331.20

Figure 22-S-B662

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

Tested By: DN / CDC

Checked By: Ronelle LeBlanc

Appendix D – Environmental Laboratory Test Results

CERTIFICATE OF ANALYSIS

Luke Prohaske
GZA GeoEnvironmental, Inc.
249 Vanderbilt Avenue
Norwood, MA 02062

RE: Medway BESS - Medway MA (01.0175311.00)
ESS Laboratory Work Order Number: 21I1004

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 1:23 pm, Oct 05, 2021

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Medway BESS - Medway MA

ESS Laboratory Work Order: 21I1004

SAMPLE RECEIPT

The following samples were received on September 28, 2021 for the analyses specified on the enclosed Chain of Custody Record.

Lab Number	Sample Name	Matrix	Analysis
21I1004-01	Medway BESS Composite Sample	Soil	2580, 9030B, 9038, 9045, 9050A, 9250

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Medway BESS - Medway MA
ESS Laboratory Work Order: 21I1004

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Medway BESS - Medway MA

ESS Laboratory Work Order: 21I1004

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 18-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Medway BESS - Medway MA
Client Sample ID: Medway BESS Composite Sample
Date Sampled: 09/23/21 15:00
Percent Solids: 92

ESS Laboratory Work Order: 21I1004
ESS Laboratory Sample ID: 21I1004-01
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Chloride	**WL** ND (32)		9250		1	EEM	09/30/21 14:52	mg/kg dry	DI13027
Corrosivity (pH)	**5.39** (N/A)		9045		1	EAM	09/28/21 20:26	S.U.	DI12846
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 22.2 °C.**								
Redox Potential	**WL 249** (N/A)		2580		1	EAM	09/28/21 20:26	mv	DI12845
Resistivity	**0.032** (N/A)		9050A		1	LAB	09/30/21 11:56	Mohms-cm	DI13019
Sulfate	**WL** ND (54)		9038		1	JLK	09/29/21 20:05	mg/kg dry	DI12938
Sulfide	**WL** ND (0.5)		9030B		1	JLK	09/29/21 20:05	mg/kg dry	DI12939

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Medway BESS - Medway MA

ESS Laboratory Work Order: 21I1004

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
				Classical Chemistry						
Batch DI12938 - General Preparation										
Blank										
Sulfate	ND	5	mg/kg wet							
LCS										
Sulfate	10		mg/L	9.988		96	80-120			
Batch DI12939 - General Preparation										
Blank										
Sulfide	ND	0.05	mg/kg wet							
LCS										
Sulfide	0.5		mg/L	0.5000		99	85-115			
Batch DI13027 - General Preparation										
Blank										
Chloride	ND	3	mg/kg wet							
LCS										
Chloride	31		mg/L	30.00		103	90-110			

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Medway BESS - Medway MA
ESS Laboratory Work Order: 21I1004

Notes and Definitions

Z-10	Soil pH measured in water at 22.2 ºC.
WL	Results obtained from a deionized water leach of the sample.
U	Analyte included in the analysis, but not detected
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Medway BESS - Medway MA
ESS Laboratory Work Order: 21I1004

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: GZA - Norwood, MA - GZA/TB

Shipped/Delivered Via: ESS Courier

ESS Project ID: 21I1004
Date Received: 9/28/2021
Project Due Date: 10/5/2021
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 3.8 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
10. Were any analyses received outside of hold time? Yes / No
    PH, ORP

11. Any Subcontracting needed? Yes / No
    ESS Sample IDs:
    Analysis:
    TAT:
12. Were VOAs received? Yes / No
    a. Air bubbles in aqueous VOAs? Yes / No
    b. Does methanol cover soil completely? Yes / No / NA

13. Are the samples properly preserved? Yes / No
    a. If metals preserved upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. Was there a need to contact the client? Yes / No
    Who was contacted? Date: Time: By:
    TD 9/28/21

Sample Number	Container ID	Proper Container	Air Bubbles Present	Sufficient Volume	Container Type	Preservative	Record pH (Cyanide and 608 Pesticides)
1	212001	Yes	N/A	Yes	Plastic Baggie	NP	

2nd Review

Were all containers scanned into storage/lab? Initials TD
Are barcode labels on correct containers? Yes / No
Are all Flashpoint stickers attached/container ID # circled? Yes / No / NA
Are all Hex Chrome stickers attached? Yes / No / NA
Are all QC stickers attached? Yes / No / NA
Are VOA stickers attached if bubbles noted? Yes / No / ~~NA~~

Completed By: [signature] Date & Time: 9/28/21 1904
Reviewed By: [signature] Date & Time: 9/28/21 1925

ESS Laboratory

Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston, RI 02910-2211 Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS LAB PROJECT ID: Z1I1004

Turn Time __X__ Standard Rush______ Approved By: ________

Reporting Limits -

State where samples were collected: MA RI CT NH NJ NY ME Other______

Is this project for any of the following: (please circle)
MA-MCP CT-RCP RGP DOD Other________

Electonic Deliverable Yes_x_ No____
Format: Excel_x_ Access___ PDF_x_ Other_____

GZA Project Manager: ____Luke Prohaske_____
GZA GeoEnvironmental, Inc.
249 Vanderbilt Ave.
Norwood, Massachusetts 02062
(781)-278-5799
PRESUMPTIVE CERTAINTY REQUIRED

Project #: 01.0175331.00
Project Name: Medway BESS, Medway, MA
Contract Pricing ____
Special Pricing WO#: ________

ESS Lab Sample ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample Identification	# of Containers	Electrical Resistivity	pH	Sulfate	Sulfide	Soluble Chloride	Oxidation/Reduction Potential					Comment #
1	09/23/2021	1500	C	SOIL	Medway BESS Composite Sample	1	x	x	x	x	x	x					

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-______

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present __✓__ Yes _____No
Seals Intact _____ Yes __–__ No NA: _____
Cooler Temperature: 3.8 Ice

Sampled by : A. Lupo

Comments: Contact Email - Luke.Prohaske@GZA.com

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	1030 09/27	[signature] 9/27/21 15:00	[signature]	9/27/21 16:39	[signature]
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)

Please E-mail all changes to Chain of Custody in writing.

Page ____ of ____

Appendix E – Rock Core Photographs

Boring No.	Run	Approximate Depths of Run		Recovery		Rock Quality (%)
		Top (ft)	Bottom(ft)	(in)	(%)	
GZ-18	C-1	6.5	11.5	56	93	35
GZ-19	C-1	9	9.5	5	83	-

Dry Condition

Wet Condition

Medway Grid, LLC
50-53 Milford Street
Medway, Massachusetts
ROCK CORE PHOTOGRAPHS

Appendix E

Boring No.	Run	Approximate Depths of Run		Recovery		Rock Quality (%)
		Top (ft)	Bottom(ft)	(in)	(%)	
GZ-22	C-1	19	22.3	17	44	0
GZ-24	C-1	3.3	8.3	58	97	33

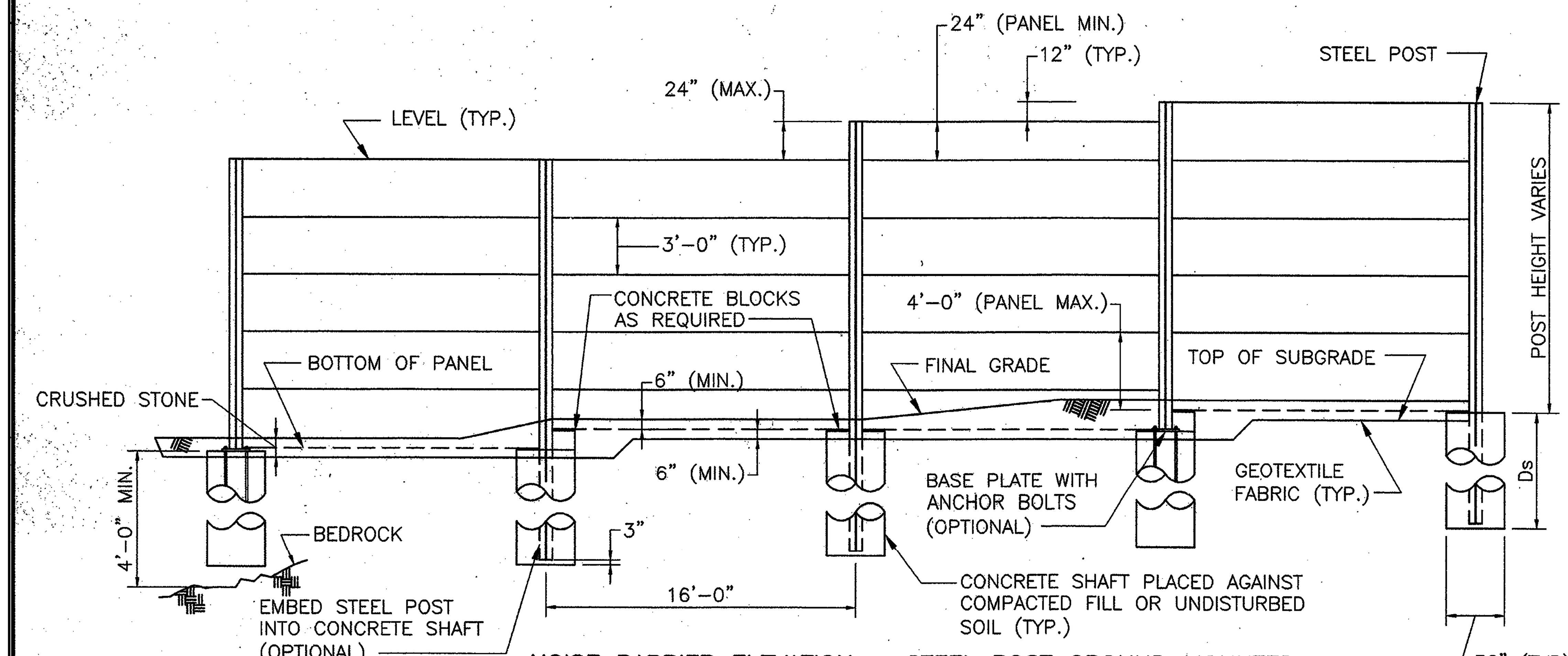
Dry Condition

Wet Condition

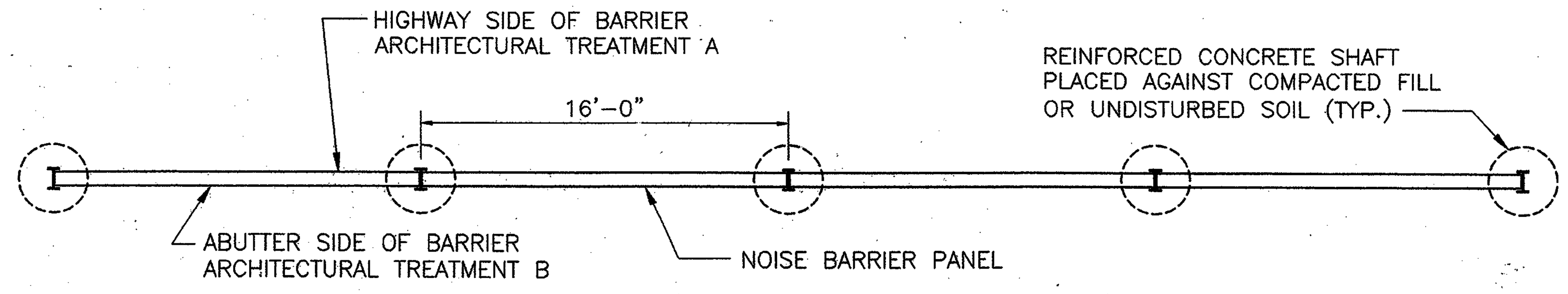
Medway Grid, LLC
50-53 Milford Street
Medway, Massachusetts
ROCK CORE PHOTOGRAPHS

Appendix E

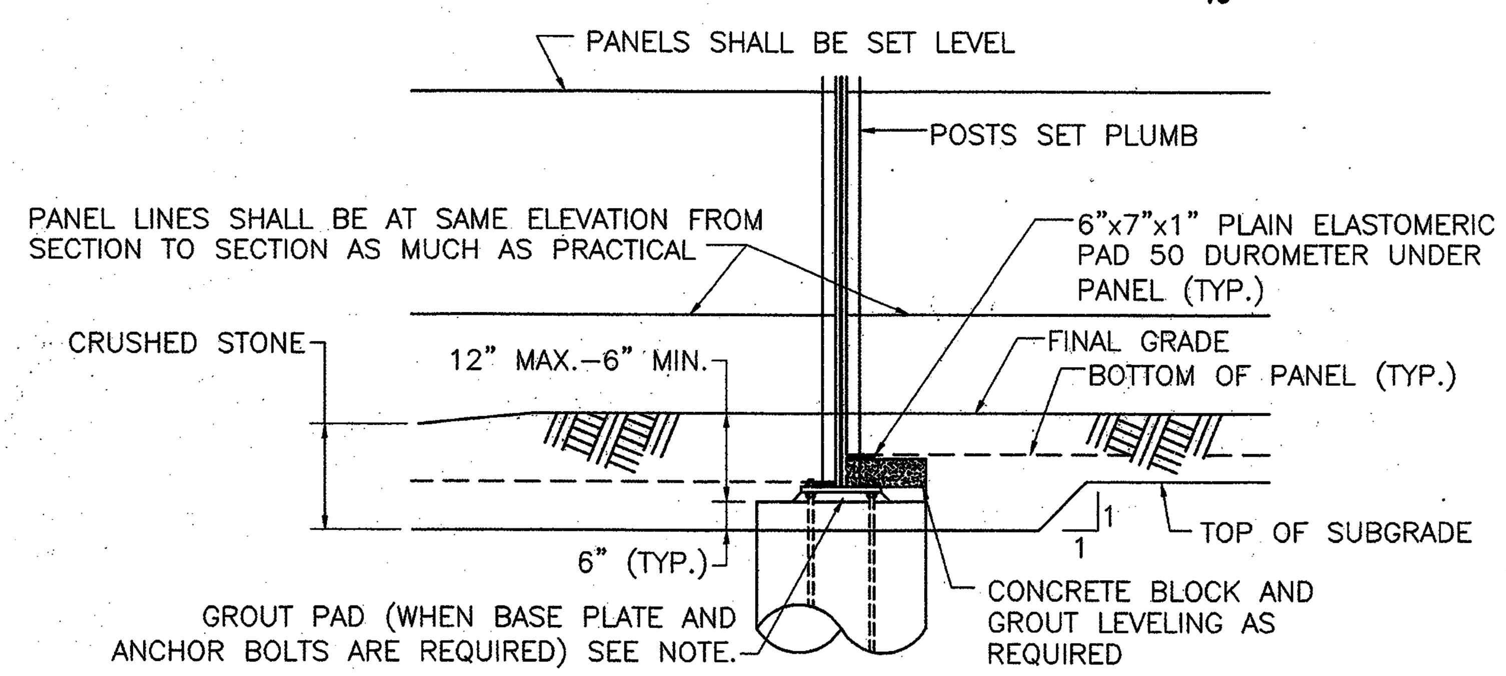
Appendix F – MassDOT Standard Drawing for Noise Barrier Structure Foundations



NOISE BARRIER ELEVATION – STEEL POST GROUND MOUNTED
SCALE 3/16"=1'-0"

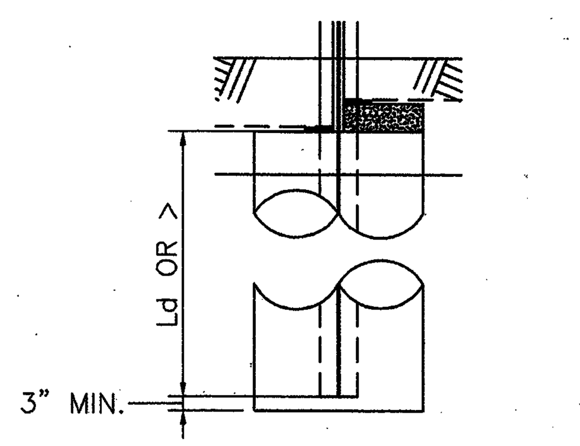


NOISE BARRIER TYPICAL PLAN – STEEL POST GROUND MOUNTED
SCALE 3/16"=1'-0"

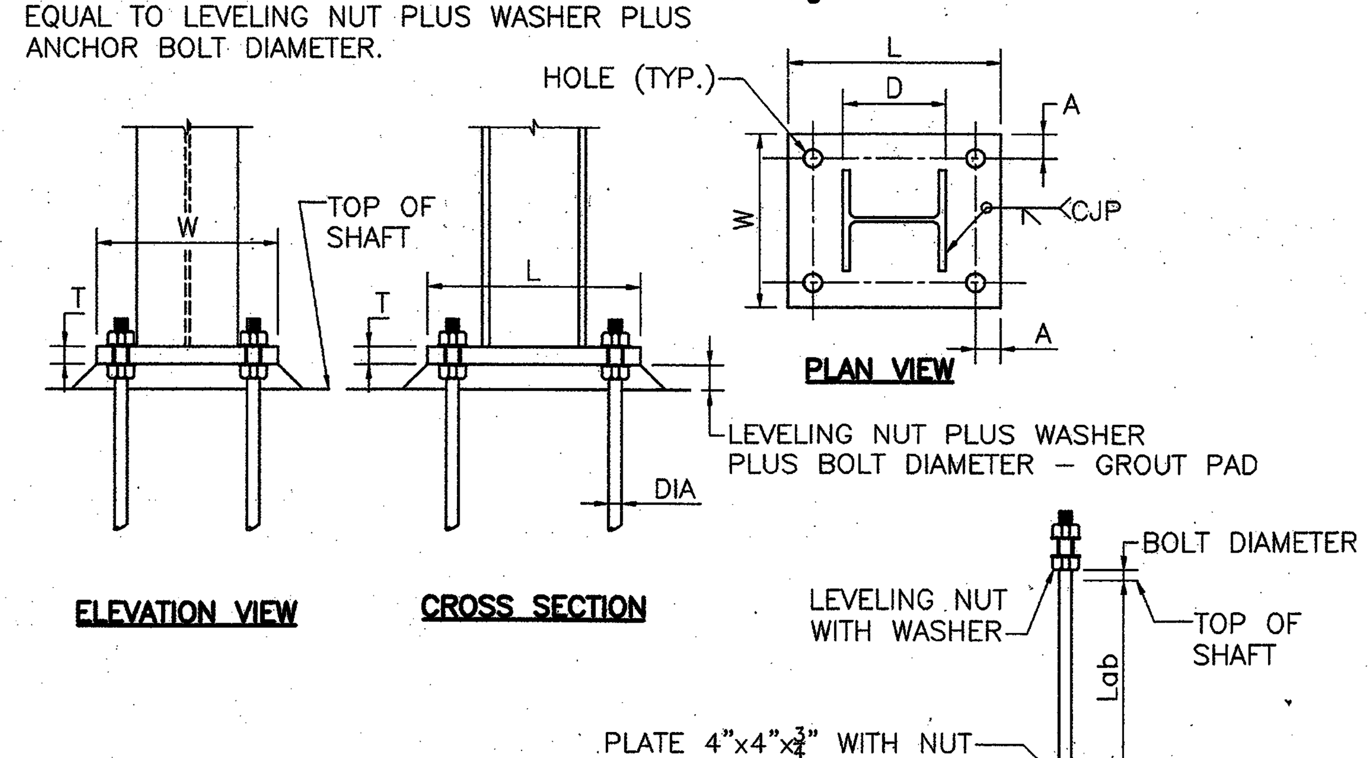


SECTION AT POST
(SHOWN AS POST WITH BASE PLATE)
SCALE 3/8"=1'-0"

NOTE: MAXIMUM GROUT PAD THICKNESS IS EQUAL TO LEVELING NUT PLUS WASHER PLUS ANCHOR BOLT DIAMETER.



SECTION AT POST
(SHOWN WITH EMBEDDED POST)
SCALE 3/8"=1'-0"

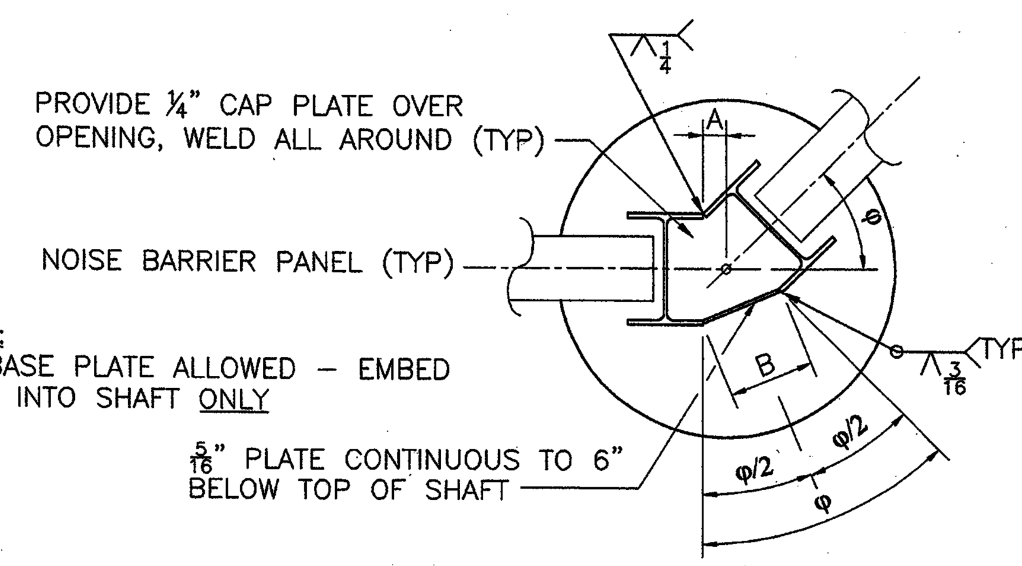


BASE PLATE AND ANCHOR BOLT DETAILS
SCALE 1"=1'-0"

INTERMEDIATE POST										
	Exposure Category C		BASE PLATE							
			DIMENSION					ANCHOR BOLT		
Height	Post	Ld	W	L	T	A	D	DIA	HOLE	Lab
8 ft	W8x24	36 in	12 in	14 in	0.750 in	1.6250 in	7.930 in	0.750 in	1.000 in	23 in
10 ft	W8x24	36 in	14 in	16 in	1.000 in	2.1250 in	7.930 in	1.000 in	1.250 in	30 in
12 ft	W8x24	36 in	14 in	17 in	1.125 in	2.3750 in	7.930 in	1.125 in	1.375 in	34 in
14 ft	W8x28	36 in	15 in	18 in	1.250 in	2.6250 in	8.060 in	1.250 in	1.500 in	38 in
16 ft	W10x33	38 in	17 in	20 in	1.375 in	2.8750 in	9.730 in	1.375 in	1.625 in	41 in
18 ft	W12x40	42 in	17 in	23 in	1.500 in	3.1250 in	11.940 in	1.500 in	1.750 in	45 in
20 ft	W12x50	47 in	18 in	25 in	1.750 in	3.6250 in	12.190 in	1.750 in	2.000 in	53 in
22 ft	W12x53	47 in	21 in	28 in	2.000 in	4.1250 in	12.060 in	2.000 in	2.250 in	60 in
24 ft	W14x61	50 in	21 in	29 in	2.000 in	4.1250 in	13.890 in	2.000 in	2.250 in	60 in
26 ft	W14x68	54 in	22 in	30 in	2.000 in	4.1250 in	14.040 in	2.000 in	2.250 in	60 in
	Exposure Category D		BASE PLATE							
			DIMENSION					ANCHOR BOLT		
Height	Post	Ld	W	L	T	A	D	DIA	HOLE	Lab
8 ft	W8x24	36 in	14 in	16 in	1.000 in	2.1250 in	7.930 in	1.000 in	1.250 in	30 in
10 ft	W8x24	36 in	14 in	17 in	1.125 in	2.3750 in	7.930 in	1.125 in	1.375 in	34 in
12 ft	W8x31	36 in	17 in	19 in	1.375 in	2.8750 in	8.000 in	1.375 in	1.625 in	41 in
14 ft	W10x39	40 in	17 in	21 in	1.500 in	3.1250 in	9.920 in	1.500 in	1.750 in	45 in
16 ft	W12x40	45 in	18 in	25 in	1.750 in	3.6250 in	11.940 in	1.750 in	2.000 in	53 in
18 ft	W12x50	50 in	18 in	25 in	1.750 in	3.6250 in	12.190 in	1.750 in	2.000 in	53 in
20 ft	W12x58	50 in	22 in	28 in	2.000 in	4.1250 in	12.190 in	2.000 in	2.250 in	60 in
22 ft	W14x68	54 in	22 in	30 in	2.000 in	4.1250 in	14.040 in	2.000 in	2.250 in	60 in
24 ft	W14x74	60 in	22 in	31 in	2.250 in	4.6250 in	14.170 in	2.250 in	2.500 in	68 in
26 ft	W14x90	60 in	28 in	33 in	2.250 in	5.1250 in	14.020 in	2.500 in	2.750 in	75 in

END OR BEND POST				
	Exposure Category C		Exposure Category D	
Height	Post	Ld	Post	Ld
8 ft	W8x24	36 in	W8x24	36 in
10 ft	W8x24	36 in	W8x24	36 in
12 ft	W8x24	36 in	W8x24	36 in
14 ft	W8x24	36 in	W8x24	36 in
16 ft	W8x24	36 in	W8x31	36 in
18 ft	W8x31	36 in	W10x33	37 in
20 ft	W10x33	36 in	W12x40	40 in
22 ft	W12x40	38 in	W12x45	44 in
24 ft	W12x45	40 in	W12X53	44 in
26 ft	W12x50	43 in	W14x61	46 in

NOTE: IF A AND B DIMENSIONS ARE NOT PROVIDED THEN BEND ANGLE CAN BE ACHIEVED WITH ONLY ONE INTERMEDIATE POST AND ROTATING PANEL TO PROPER ALIGNMENT.



BARRIER BEND DETAIL
SCALE 3/4"=1'-0"

W8x24		
ANGLE	A	B
5 deg	-	-
7.5 deg	-	-
10 deg	3 1/2	1 3/8
15 deg	3 5/8	2 1/16
20 deg	3 13/16	2 3/4
25 deg	4	3 7/16
30 deg	4 3/16	4 1/8
35 deg	4 3/8	4 3/4
40 deg	4 9/16	5 7/16
45 deg	4 3/4	6 1/16

W14x61		
ANGLE	A	B
5 deg	-	-
7.5 deg	-	-
10 deg	-	-
15 deg	-	-
20 deg	-	-
25 deg	-	-
30 deg	6 11/16	7 3/16
35 deg	7	8 3/8
40 deg	7 5/16	9 1/2
45 deg	7 11/16	10 5/8

W8x31		
ANGLE	A	B
5 deg	-	-
7.5 deg	-	-
10 deg	-	-
15 deg	4 3/8	2 1/16
20 deg	4 9/16	2 3/4
25 deg	4 3/4	3 7/16
30 deg	4 15/16	4 1/8
35 deg	5 1/8	4 13/16
40 deg	5 5/16	5 1/2
45 deg	5 1/2	6 1/8

W10x33		
ANGLE	A	B
5 deg	-	-
7.5 deg	-	-
10 deg	-	-
15 deg	-	-
20 deg	4 11/16	3 3/8
25 deg	4 15/16	4 3/16
30 deg	5 1/8	5 1/16
35 deg	5 3/8	5 7/8
40 deg	5 5/8	6 5/8
45 deg	5 7/8	7 7/16

W12x40		
ANGLE	A	B
5 deg	-	-
7.5 deg	-	-
10 deg	-	-
15 deg	-	-
20 deg	4 15/16	4 1/8
25 deg	5 3/16	5 3/16
30 deg	5 7/16	6 3/16
35 deg	5 3/4	7 3/16
40 deg	6	8 3/16
45 deg	6 5/16	9 1/8

W12x45		
ANGLE	A	B
5 deg	-	-
7.5 deg	-	-
10 deg	-	-
15 deg	-	-
20 deg	4 15/16	4 3/16
25 deg	5 3/16	5 1/4
30 deg	5 1/2	6 1/4
35 deg	5 3/4	7 1/4
40 deg	6 1/16	8 1/4
45 deg	6 1/4	9 1/4

W12x50		
ANGLE	A	B
5 deg	-	-
7.5 deg	-	-
10 deg	-	-
15 deg	-	-
20 deg	4 15/16	4 1/4
25 deg	5 3/16	5 1/4
30 deg	5 1/2	6 5/16
35 deg	5 3/4	7 5/16
40 deg	6 1/16	8 5/16
45 deg	6 3/8	9 5/16

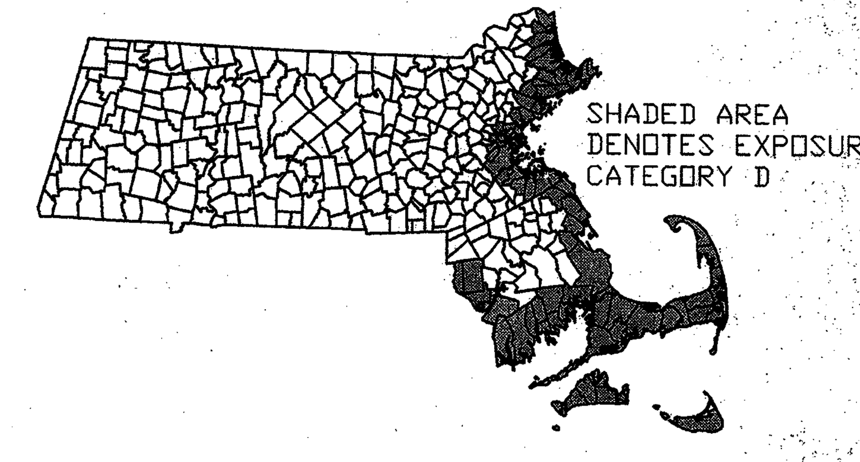
W12x53		
ANGLE	A	B
5 deg	-	-
7.5 deg	-	-
10 deg	-	-
15 deg	-	-
20 deg	-	-
25 deg	-	-
30 deg	6 7/16	6 1/4
35 deg	6 3/4	7 1/4
40 deg	7	8 1/4
45 deg	7 5/16	9 1/4

NOISE BARRIER DETAILS – STEEL POSTS

1. THE DESIGN AND CONSTRUCTION SHALL BE IN ACCORDANCE WITH RELEVANT SECTIONS OF:
   * GUIDE SPECIFICATIONS FOR STRUCTURAL DESIGN OF SOUND BARRIERS - 1989 WITH INTERIMS THROUGH 2002;
   * STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES - 17TH EDITION - 2002; AND
   * STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS - 4TH EDITION WITH INTERIMS THROUGH 2003;
   * MASSHIGHWAY STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES
2. REFER TO STANDARD DRAWING 996.2 FOR FOUNDATIONS AND 996.3 FOR CONCRETE PANELS.
3. DESIGN AND DETAILS ARE APPLICABLE TO GROUND MOUNTED STRUCTURES ONLY AND DO NOT APPLY TO BRIDGE OR WALL MOUNTED BARRIERS.
4. FOR EXPOSURE CATEGORIES SEE MAP AND TABLE BELOW. NOTE THAT THE TABLE ONLY CONTAINS THOSE CITIES AND TOWNS WHICH REQUIRE A CATEGORY D DESIGN, . ALL OTHERS ARE CATEGORY C.
5. EXPOSURE C CONFORMS TO AN AVERAGE WIND PRESSURE OF 33 PSF, FOR DESIGN HEIGHTS LESS THAN 14'–0" AND 42 PSF FOR DESIGN HEIGHTS GREATER THAN 14'–0" AT A DESIGN WIND SPEED OF 90 MPH.
6. EXPOSURE D CONFORMS TO AN AVERAGE WIND PRESSURE OF 50 PSF, FOR DESIGN HEIGHTS LESS THAN 14'–0", AND 57 PSF FOR DESIGN HEIGHTS GREATER THAN 14'–0" ALSO AT A DESIGN WIND SPEED OF 90 MPH.
7. THE FOUNDATIONS, POSTS AND PANELS HAVE BEEN DESIGNED FOR WIND LOADS ONLY, WITH NO PROVISIONS FOR VEHICLE IMPACT LOADS. IF THE DESIGNER IS CALLING FOR PLACEMENT OF A NOISE BARRIER IN A LOCATION LIKELY TO SUBJECT IT TO VEHICLE IMPACT A REDESIGN CONSIDERING THESE FORCES MUST BE COMPLETED.
8. POST AND CAISSON DESIGNS MAKE NO PROVISIONS FOR UNBALANCED SOIL LOADS BEHIND THE PANEL. THEREFORE THE USE OF THIS NOISE BARRIER SYSTEM FOR EARTH RETENTION IS NOT ALLOWED.
9. FOR POST HEIGHTS EXCEEDING 26 FEET AND/OR POST SPACING EXCEEDING 16 FEET A DESIGN MUST BE PERFORMED IN ACCORDANCE WITH THE SPECIFICATIONS CITED IN THESE STANDARDS.
10. MAXIMUM POST DEFLECTION EQUALS H/100 (EXCLUDING FOUNDATION MOVEMENT).
11. ALL STRUCTURAL STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO DESIGNATION M270 (ASTM A709) GRADE 36, EXCEPT FOR THE BASE PLATES WHICH SHALL BE GRADE 50.
12. ALL STRUCTURAL STEEL SHALL BE HOT DIPPED GALVANIZED AND PAINTED. SEE SPECIAL PROVISIONS FOR COLOR REQUIREMENTS.
13. ALL ANCHOR BOLTS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F1554 GRADE 55 AND SHALL USE HEAVY DUTY NUTS AND WASHERS. ALL ANCHOR BOLTS AND HARDWARE SHALL BE HOT DIPPED GALVANIZED.
14. THE NOISE BARRIER SHALL BE CONSTRUCTED PLUMB.

EXPOSURE D CRITERIA - CITIES AND TOWNS			
ACUSHNET	ESSEX	MATTAPOISETT	SALEM
AQUINNAH	EVERETT	MEDFORD	SALISBURY
BARNSTABLE	FAIRHAVEN	MILTON	SANDISFIELD
BEVERLY	FALL RIVER	NAHANT	SANDWICH
BOSTON	FALMOUTH	NANTUCKET	SAUGUS
BOURNE	GLOUCESTER	NEW BEDFORD	SCITUATE
BRAINTREE	GOSNOLD	NEWBURY	SEEKONK
BREWSTER	HAMILTON	NEWBURYPORT	SOMERSET
BROOKLINE	HARWICH	NORWELL	SOMERVILLE
CAMBRIDGE	HINGHAM	OAK BLUFFS	SWAMPSCOTT
CHATHAM	HULL	ORLEANS	SWANSEA
CHELSEA	IPSWICH	PEABODY	TISBURY
CHILMARK	KINGSTON	PLYMOUTH	TRURO
COHASSET	LYNN	PROVINCETOWN	WAREHAM
DANVERS	MALDEN	QUINCY	WELLFLEET
DARTMOUTH	MANCHESTER BY THE SEA	REHOBOTH	WENHAM
DENNIS	MARBLEHEAD	REVERE	WEST TISBURY
DUXBURY	MARION	ROCHESTER	WESTPORT
EASTHAM	MARSHFIELD	ROCKPORT	WEYMOUTH
EDGARTOWN	MASHPEE	ROWLEY	YARMOUTH

ALL OTHER CITIES AND TOWNS NOT LISTED ABOVE ARE EXPOSURE CATEGORY C



THE COMMONWEALTH OF MASSACHUSETTS
HIGHWAY DEPARTMENT

STANDARD DRAWING 996.1
NOISE BARRIER STRUCTURES
STEEL POSTS

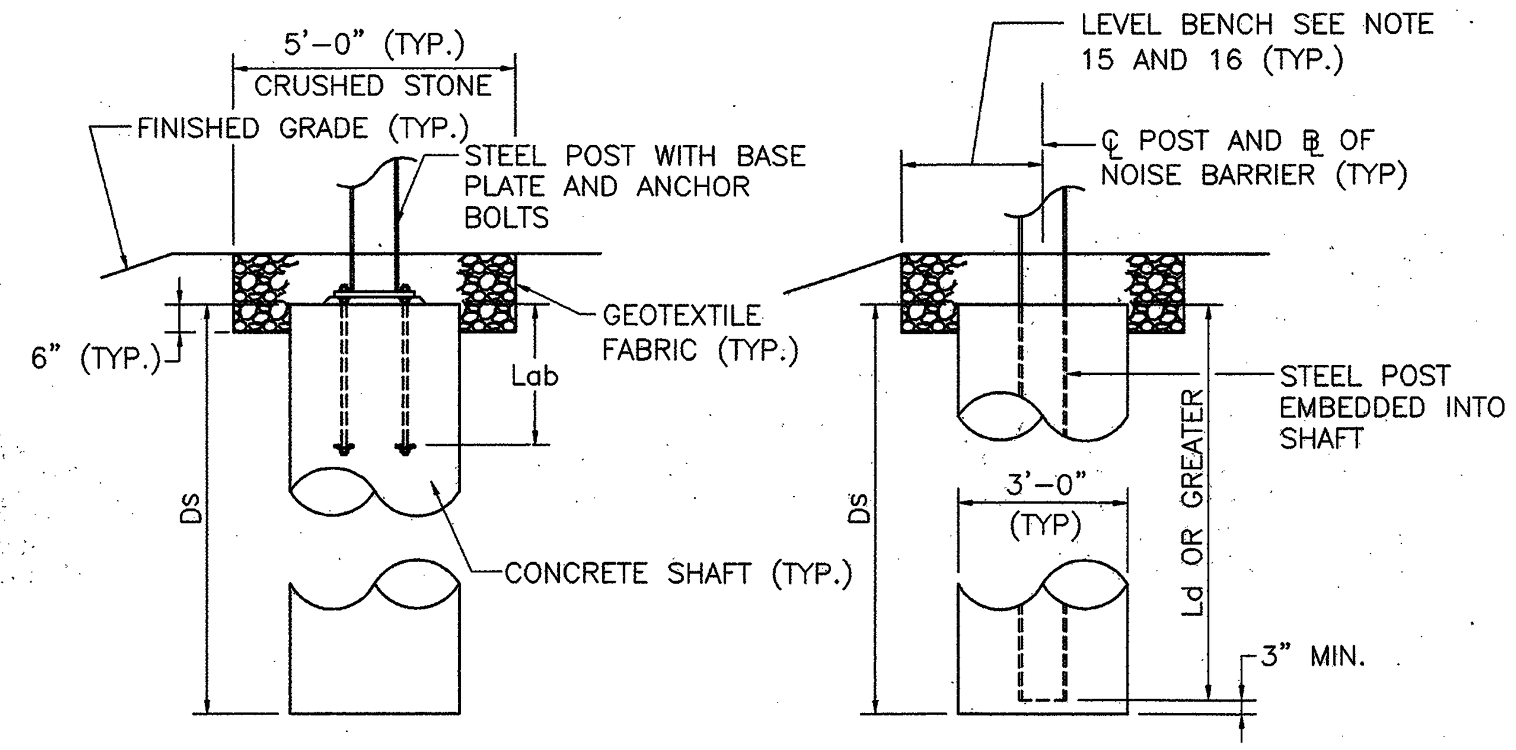
ISSUED DATE JANUARY 4, 2007

CHIEF ENGINEER
DIRECTOR OF BRIDGES AND STRUCTURES

NOTE:
1. STANDARD DRAWING IS NOT SHOWN TO SCALE. DRAWING IS SCALED DOWN TO 85%.

		WALL HEIGHT	DRILLED SHAFT DEPTH (Ds) (ft)		DRILLED SHAFT ROCK SOCKET REQUIREMENTS BEDROCK SOCKET LENGTH, Dr (ft) BEDROCK DEPTH BELOW GROUND SURFACE, Z					DRILLED SHAFT BAR A, B & C REINFORCING SCHEDULE									
		H (ft)	CATEGORY C	CATEGORY D	CATEGORY C		CATEGORY D			CATEGORY C					CATEGORY D				
					Z= 4-8 ft	Z=8-Ds ft	Z= 4-8 ft	Z= 8-12 ft	Z=12-Ds ft	BAR A	BAR B	X	BAR C	BAR D	BAR A	BAR B	X	BAR C	BAR D
Alluvial/Silty	Medium Stiff Clay	8	6.00	7.00	1.00	0.00	1.00	0.00	0.00	8 - #5	#4 @ 12"	6	#6	8 - #4	8 - #5	#4 @ 12"	7	#6	8 - #4
		10	7.00	8.00	"	"	"	"	"	"	"	7	"	"	"	"	7	"	"
		12	8.00	9.00	"	"	1.50	1.00	"	"	"	7	"	"	"	"	9	"	"
		14	9.00	10.00	"	1.00	"	"	"	"	"	8	"	"	"	"	10	"	"
		16	9.50	11.50	"	"	"	"	"	"	"	10	"	"	8 - #6	"	12	"	"
		18	10.25	12.25	1.50	"	2.00	1.50	1.00	8 - #6	"	11	"	"	8 - #8	"	13	"	"
		20	11.00	13.00	"	"	"	"	"	"	"	12	"	"	"	"	15	"	"
		22	11.75	13.75	2.00	1.50	"	2.00	"	8 - #8	"	14	"	"	8 - #9	"	17	"	"
		24	12.50	14.50	"	"	"	"	"	"	"	15	"	"	"	"	18	"	"
		26	13.50	15.50	"	"	2.50	"	"	8 - #9	"	17	"	"	8 - #10	"	23	#7	"
	Loose Sand	8	8.00	9.50	1.00	0.00	1.00	1.00	0.00	8 - #5	#4 @ 12"	6	#6	8 - #4	8 - #5	#4 @ 12"	7	#6	8 - #4
		10	9.00	11.00	"	1.00	"	"	"	"	"	7	"	"	"	"	7	"	"
		12	10.00	12.25	"	"	1.50	"	1.00	"	"	7	"	"	"	"	9	"	"
		14	11.00	13.50	"	"	"	"	"	"	"	8	"	"	8 - #6	"	10	"	"
		16	12.50	15.00	"	"	"	1.50	"	"	"	10	"	"	8 - #7	"	12	"	"
		18	13.50	15.75	1.50	"	2.00	"	"	8 - #7	"	11	"	"	8 - #8	"	13	"	"
		20	14.50	16.50	"	"	"	"	"	"	"	12	"	"	"	"	15	"	"
		22	15.25	17.75	2.00	1.50	2.50	2.00	1.50	8 - #8	"	14	"	"	8 - #10	"	17	"	8 - #5
		24	16.00	19.00	"	"	"	"	"	"	"	15	"	"	"	"	18	"	"
		26	17.00	20.00	"	2.00	"	"	2.00	8 - #9	"	17	"	"	8 - #11	"	23	#7	"
	MeD Dense Sand	8	6.50	8.00	1.00	0.00	1.00	0.00	0.00	8 - #5	#4 @ 12"	6	#6	8 - #4	8 - #5	#4 @ 12"	7	#6	8 - #4
		10	7.50	9.00	"	"	"	1.00	"	"	"	7	"	"	"	"	7	"	"
		12	8.25	10.00	"	1.00	1.50	"	"	"	"	7	"	"	"	"	9	"	"
		14	9.00	11.00	"	"	"	"	"	"	"	8	"	"	8 - #6	"	10	"	"
		16	10.00	12.00	"	"	"	"	"	"	"	10	"	"	"	"	12	"	"
		18	11.00	13.00	"	"	"	1.50	1.00	8 - #7	"	11	"	"	8 - #8	"	13	"	"
		20	12.00	14.00	"	"	"	"	"	"	"	12	"	"	"	"	15	"	"
		22	12.75	14.75	1.50	1.50	2.00	2.00	"	8 - #8	"	14	"	"	8 - #9	"	17	"	"
		24	13.50	15.50	"	"	"	"	"	"	"	15	"	"	"	"	18	"	"
		26	14.00	16.00	2.00	"	2.50	"	1.50	8 - #9	"	17	"	"	8 - #10	"	23	#7	8 - #5
	Dense Sand	8	5.50	6.50	1.00	0.00	1.00	0.00	0.00	8 - #5	#4 @ 12"	6	#6	8 - #4	8 - #5	#4 @ 12"	7	#6	8 - #4
		10	6.50	7.50	"	"	"	"	"	"	"	7	"	"	"	"	7	"	"
		12	7.00	8.25	"	"	"	1.00	"	"	"	7	"	"	8 - #6	"	9	"	"
		14	7.50	9.00	"	"	"	"	"	"	"	8	"	"	"	"	10	"	"
		16	8.50	10.00	"	"	1.50	"	"	"	"	10	"	"	"	"	12	"	"
		18	9.25	10.75	"	1.00	"	"	"	8 - #7	"	11	"	"	8 - #8	"	13	"	"
		20	10.00	11.50	"	"	"	"	"	"	"	12	"	"	"	"	15	"	"
		22	10.50	12.25	1.50	1.00	2.00	1.50	1.00	8 - #8	"	14	"	"	8 - #9	"	17	"	"
		24	11.00	13.00	"	"	"	"	"	"	"	15	"	"	"	"	18	"	"
		26	11.50	13.50	2.00	"	2.50	2.00	"	8 - #9	"	17	"	"	8 - #10	"	23	#7	"

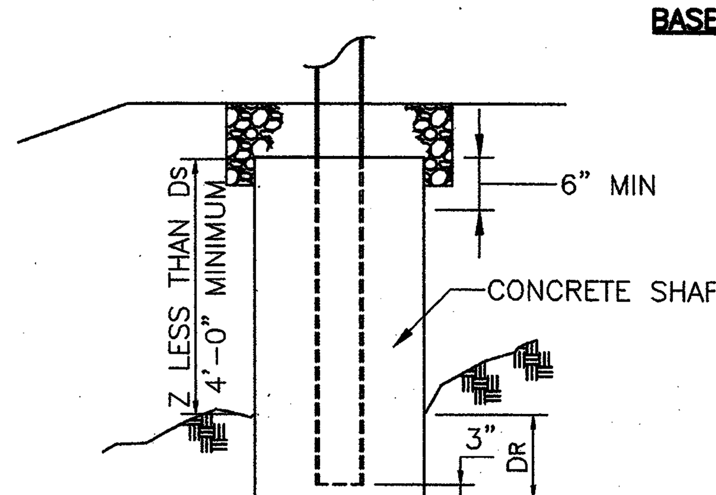
TYPICAL SOIL PARAMETERS			
UNIT WIEGHT γ (pcf)	FRICTION ANGLE ϕ (°)	SHEAR STRENGTH C (undrained) (psf)	BLOW COUNT Nspt60 (bpf)
ALLUVIAL/SILTY			
115	30	575	4-8
MEDIUM STIFF CLAY			
123	NA	1000	4-8
Loose Sand			
120	30	NA	5-10
MEDIUM DENSE SAND			
125	35	NA	10-30
DENSE SAND			
132	40	NA	30-60



BASE PLATE WITH ANCHOR BOLTS
(CONTRACTOR OPTION)

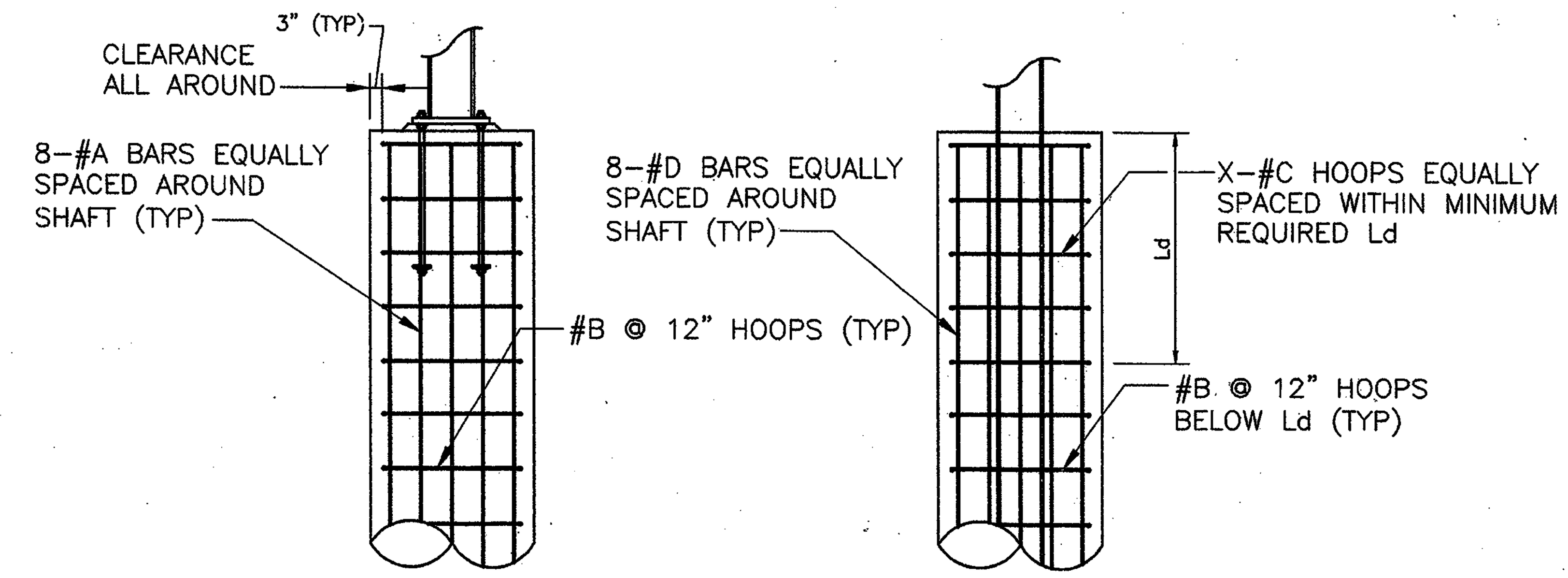
EMBEDDED POST
(CONTRACTOR OPTION)

SHAFT IN SOIL
SCALE $\frac{3}{8}$"=1'-0"



NOTE:
DETAIL SHOWN WITH EMBEDDED POST. THE USE OF ANCHOR BOLTS WITH A BASE PLATE IS ACCEPTABLE.

SHAFT SOCKET INTO ROCK
SCALE $\frac{3}{8}$"=1'-0"



BASE PLATE WITH ANCHOR BOLTS
(CONTRACTOR OPTION)

EMBEDDED POST
(CONTRACTOR OPTION)

SHAFT REINFORCING
SCALE $\frac{3}{8}$"=1'-0"

NOISE BARRIER DETAILS – FOUNDATION NOTES:

MATERIALS
1. ALL REINFORCED CONCRETE SHALL BE 4000 PSI –$\frac{3}{4}$" – 565 LB CEMENT CONCRETE MASONRY. FOUNDATIONS ARE 3'-0" DIAMETER CONCRETE SHAFTS.
2. ALL REINFORCING STEEL, FOR THE SHAFTS, SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31/M31M GRADE 60 (ASTM A615 GRADE 60) UNCOATED. ALL CONTACT LAP SPLICES SHALL BE AASHTO CLASS C, UNLESS OTHERWISE NOTED.
3. ALL ANCHOR BOLTS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F1554 GRADE 55 AND SHALL USE HEAVY DUTY NUTS AND WASHERS. ALL ANCHOR BOLTS AND HARDWARE SHALL BE HOT DIPPED GALVANIZED.

FOUNDATION SELECTION AND POST ATTACHMENT OPTIONS:
4. DEPENDING UPON THE DEPTH TO LEDGE ONE OF TWO SPECIFIC FOUNDATIONS MAY BE UTILIZED.
   (A) IF ROCK IS BELOW THE REQUIRED BOTTOM OF SHAFT FOR A PARTICULAR SOIL, THEN A REINFORCED CONCRETE SHAFT IS REQUIRED. THE STEEL POST IS CONNECTED TO THE CAISSON AT THE CONTRACTOR'S OPTION BY EITHER EMBEDDING THE POST OR THROUGH THE USE OF A BASE PLATE WITH ANCHOR BOLTS.
   (B) IF ROCK IS AT A DEPTH GREATER THAN 4'-0" AND LESS THAN (A) ABOVE THE CONTRACTOR SHALL USE A DRILLED SHAFT WITH THE MINIMUM REQUIRED ROCK SOCKET (Dr). THE STEEL POST MAY BE CONNECTED TO THE SHAFT EITHER BY EMBEDDING THE POST OR THROUGH THE USE OF A BASE PLATE WITH ANCHOR BOLTS, AT THE CONTRACTOR'S OPTION.

5. IF A POOR SOIL IS ENCOUNTERED (ONE WHICH DOES NOT APPLY TO THE DESIGN CHARTS SHOWN ON THIS SHEET) OR BEDROCK IS LOCATED WITHIN 4'-0" OF THE TOP OF FOUNDATION AN ALTERNATIVE DESIGN SHALL DEVELOPED BY THE DESIGN ENGINEER, BASED UPON THE PARAMETERS OF THESE STANDARDS AND SUBMITTED TO THE ENGINEER FOR APPROVAL.

CONSTRUCTION REQUIREMENTS
6. THE EXCAVATION FOR THE SHAFTS SHALL BE MADE THROUGH EITHER THE USE OF A ROTARY DRILLING MACHINE OR BY A GENERAL OPEN EXCAVATION. WHEN DRILLING THE USE OF A CASING MAY BE REQUIRED TO MAINTAIN THE GEOMETRY OF THE HOLE. WHEN USING AN OPEN EXCAVATION THE CONTRACTOR SHALL FOLLOW ALL DEPARTMENT AND OSHA SAFETY PROCEDURES.
7. WHERE AN OPEN EXCAVATION HAS BEEN USED THE CONTRACTOR SHALL PLACE AND COMPACT THE BACKFILL AROUND THE SHAFT AFTER IT HAS BEEN POURED AND PROPERLY CURED. THE BACKFILL AND ITS PLACEMENT SHALL MEET THE REQUIREMENTS OF THE MASS HIGHWAY STANDARD SPECIFICATIONS SECTION 150
FOR
BACKFILLING STRUCTURES.
8. FOR THE EMBEDDED POST OPTION THE POST SHALL BE HELD PLUMB IN THE SHAFT, PRIOR TO CONCRETE PLACEMENT, WITH THE USE OF AN INSTALLATION TEMPLATE. THE TEMPLATE SHALL BE ADJUSTABLE FOR HORIZONTAL PLACEMENT, VERTICAL PLACEMENT AND PLUMB OF POSTS.
9. FOR THE BASE PLATE AND ANCHOR BOLT OPTION THE CONTRACTOR SHALL USE A TEMPLATE TO LOCATE THE BOLTS IN THE SHAFT PRIOR TO CONCRETE PLACEMENT.

DESIGN PARAMETERS
10. DETERMINATION OF EXISTING SOIL CONDITIONS SHALL BE MADE BY THE DESIGN ENGINEER AND IDENTIFIED ON THE PLANS.
11. FOUNDATION DEPTHS ARE BASED UPON AASHTO GROUP IV LOADING AND A MAXIMUM HORIZONTAL DEFLECTION OF 1" AT THE TOP OF THE SHAFT.
12. BEDROCK SOCKET LENGTHS ARE BASED UPON A CORE COMPRESSIVE STRENGTH OF 2000 PSI AND AN RQD > 50% TO A DEPTH OF 3'-0" BELOW THE SOCKET TIP.
13. SOIL CONDITIONS ARE ASSUMED TO BE SATURATED.
14. CONCRETE SHAFT EMBEDMENT DEPTHS MAY BE INTERPOLATED FOR INTERMEDIATE WALL HEIGHTS.
15. DRILLED SHAFT DEPTHS, PRESENTED IN ABOVE TABLE, ARE BASED UPON A LEVEL 4'-0" BENCH FROM CENTERLINE OF CONCRETE SHAFT TO DOWNWARD SLOPE BREAKPOINT.
16. IF A DRILLED SHAFT IS LOCATED WITHIN SLOPING GROUND, PROVIDE A MINIMUM 2'-6" LEVEL BENCH FROM CENTERLINE OF CONCRETE SHAFT TO DOWNWARD SLOPE BREAKPOINT AND INCREASE DRILLED SHAFT DEPTH AS FOLLOWS:

    2'-0" FOR 3H:1V
    3'-0" FOR 2H:1V

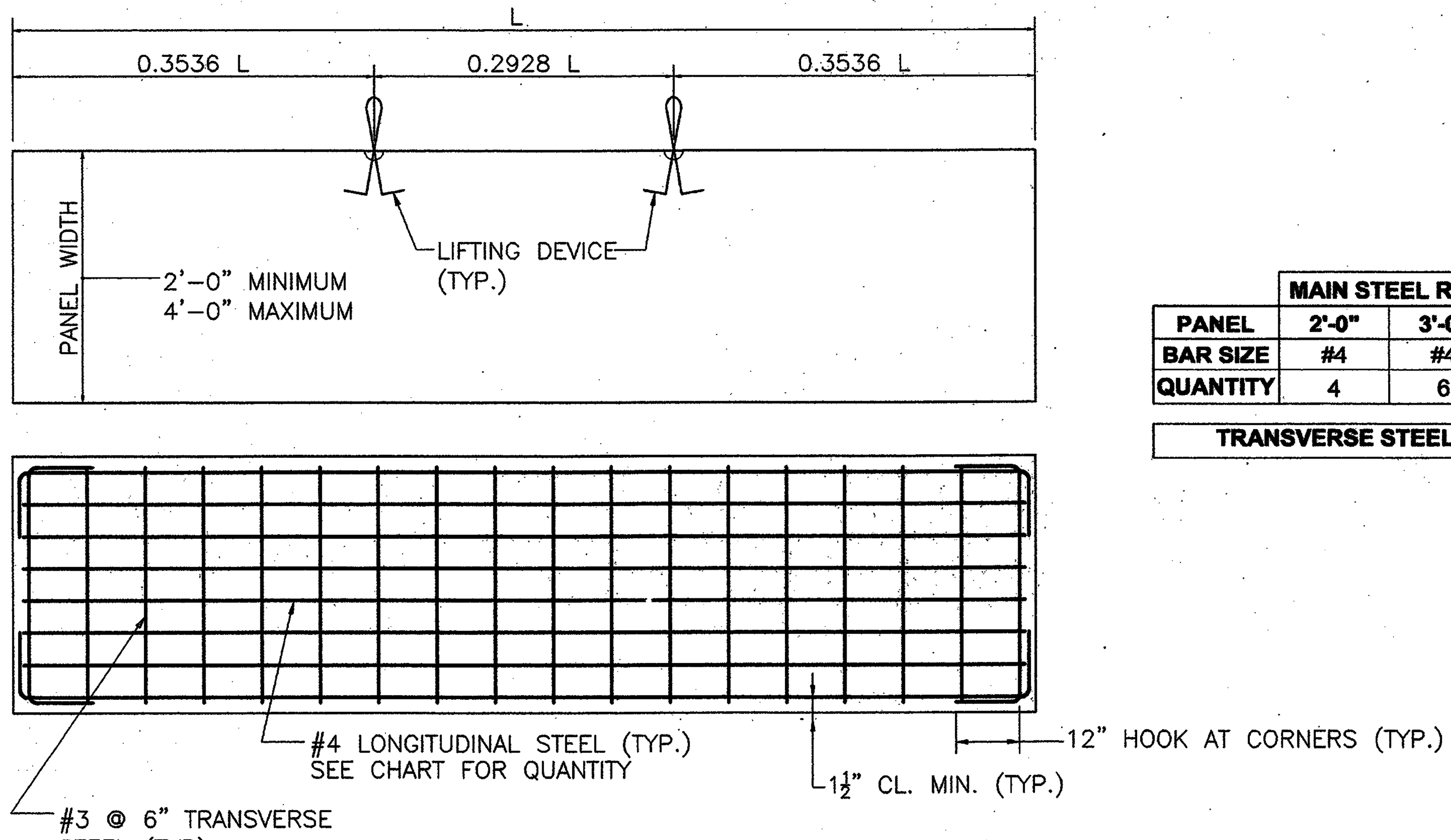
THE COMMONWEALTH OF MASSACHUSETTS
HIGHWAY DEPARTMENT

STANDARD DRAWING 996.2
NOISE BARRIER STRUCTURES
FOUNDATIONS

ISSUED DATE JANUARY 4, 2007

CHIEF ENGINEER | DIRECTOR OF BRIDGES AND STRUCTURES

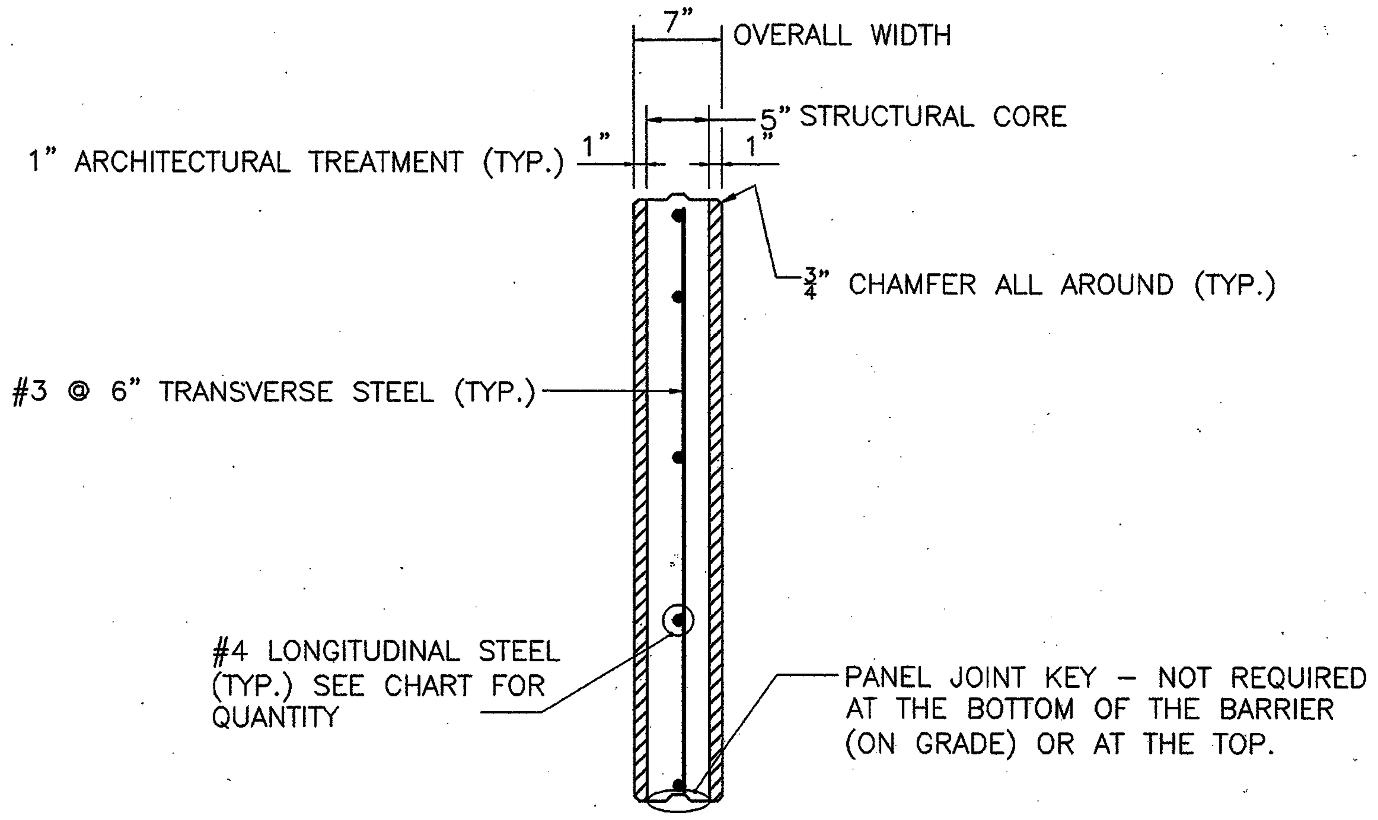
NOTE:
1. STANDARD DRAWING IS NOT SHOWN TO SCALE. DRAWING IS SCALED DOWN TO 85%.



REINFORCED CONCRETE PANELS
SCALE ½"=1'-0"

	MAIN STEEL REINFORCING		
PANEL	2'-0"	3'-0"	4'-0"
BAR SIZE	#4	#4	#4
QUANTITY	4	6	8

TRANSVERSE STEEL #3 @ 6"

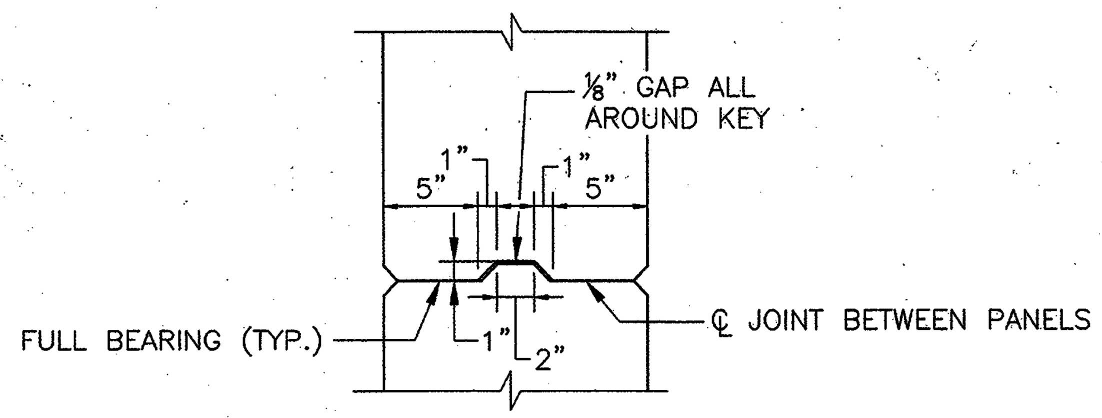


NOTE: CENTER LONGITUDINAL STEEL ON MID-DEPTH OF SLAB

PANEL CROSS SECTION
SCALE ¾"=1'-0"

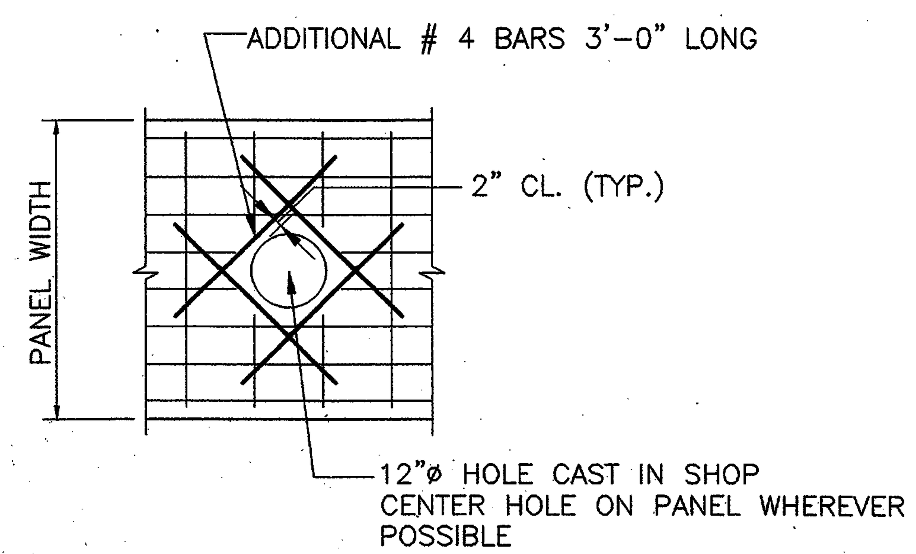
NOISE BARRIER DETAILS – CONCRETE PANELS

1. ALL REINFORCED CONCRETE SHALL BE 4000 PSI -¾" - 565 LB CEMENT CONCRETE MASONRY.
2. ALL REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31/M31M GRADE 60 (ASTM A615 GRADE 60). ALL CONTACT LAP SPLICES SHALL BE AASHTO CLASS C, UNLESS OTHERWISE NOTED.
3. ALL REINFORCING STEEL IN THE CONCRETE PANELS SHALL EITHER BE ALL EPOXY COATED IN ACCORDANCE WITH AASHTO M284 (ASTM A775) OR ALL HOT DIPPED GALVANIZED IN ACCORDANCE WITH ASTM A767. ALL SUPPORT OR SPACING DEVICES SHALL BE COATED CONSISTENT WITH THE REINFORCING STEEL.
4. ARCHITECTURAL FINISHES FOR THE CONCRETE PANELS SHALL BE AS SPECIFIED IN THE SPECIAL PROVISIONS.
5. DESIGN OF ALL PANEL LIFTING DEVICES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE INCLUDED ON SHOP DRAWINGS. ALL HARDWARE SHALL BE GALVANIZED AND ALL VOIDS OR POCKETS SHALL BE FILLED WITH NON-SHRINK GROUT.
6. THE PANELS FOR W8 POSTS REQUIRE A REDUCED TONGUE (6½"). SEE SECTION OF PANEL AT POST THIS SHEET.
7. WELDED WIRE FABRIC OF EQUIVALENT STEEL AREA MAY BE SUBSTITUTED FOR THE REINFORCING STEEL AS SHOWN ON THIS SHEET.

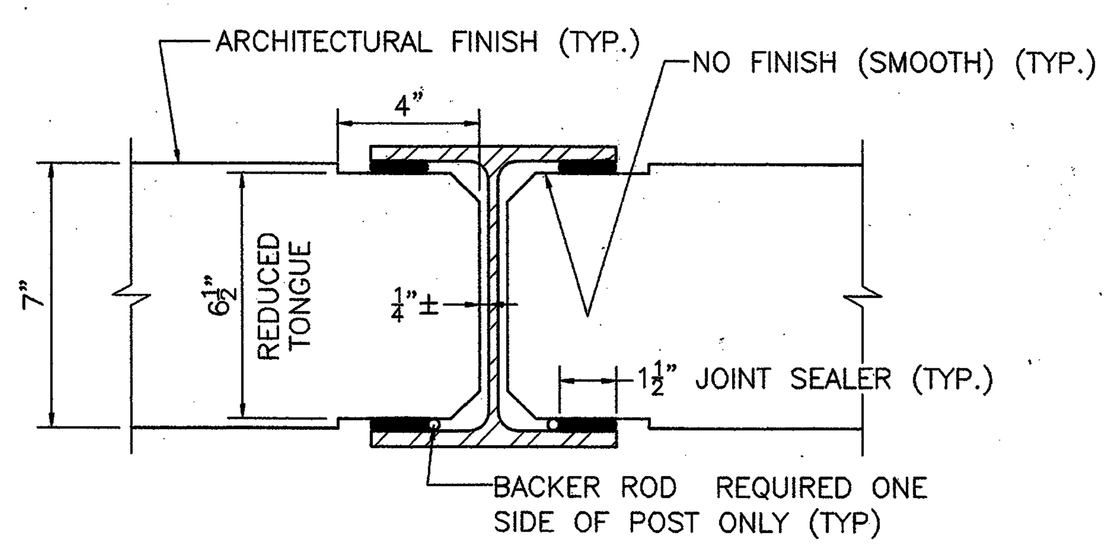


NOTE: KEYS NOT REQUIRED TOP AND BOTTOM OF BARRIER

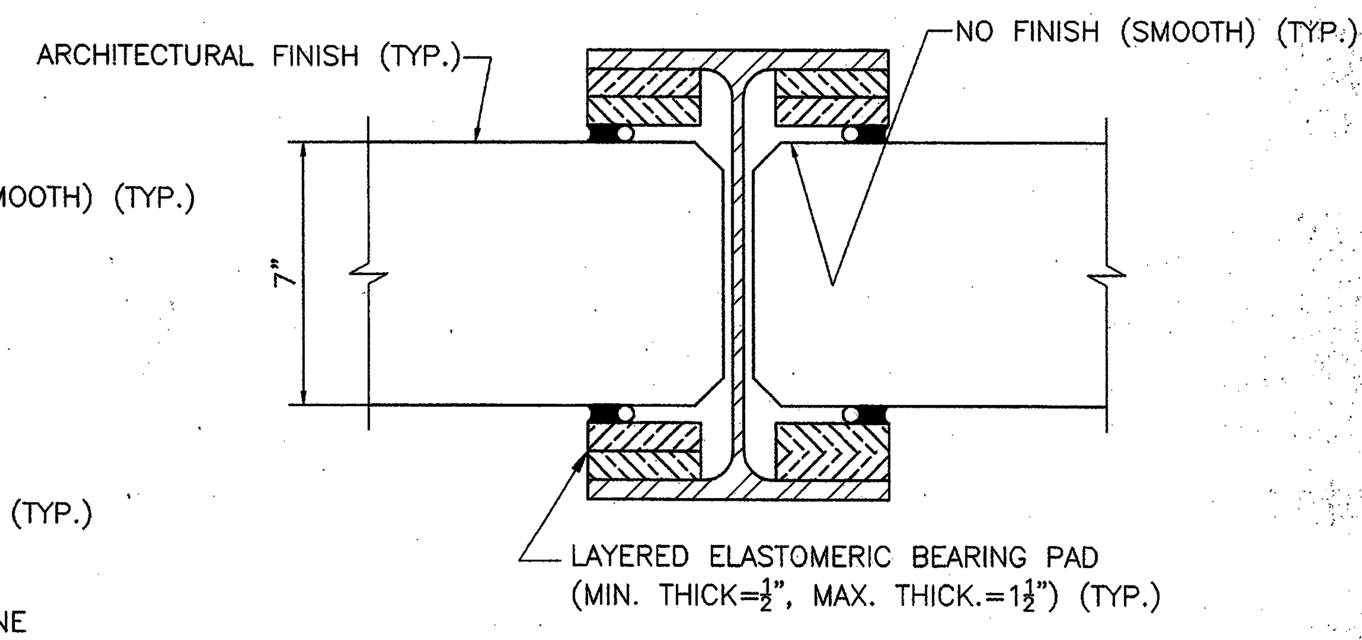
JOINT BETWEEN PANELS
SCALE 1½"=1'-0"



ADDITIONAL REINFORCING AROUND HYDRANT PANEL HOLE
NOT TO SCALE



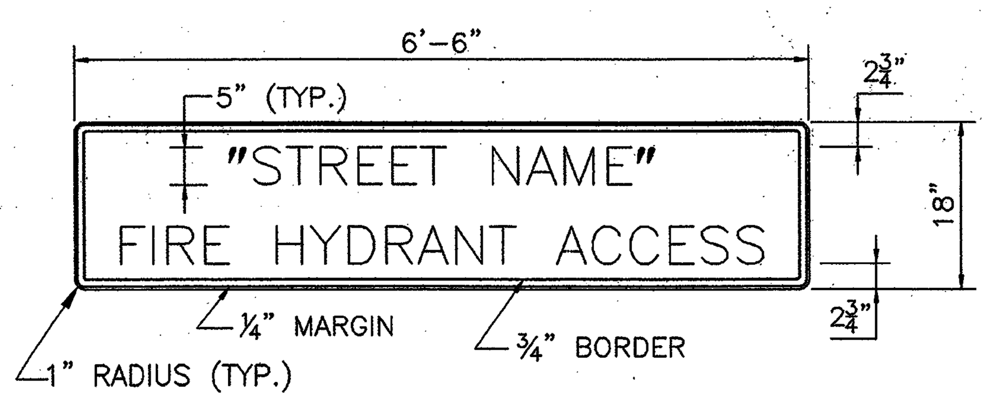
SECTION OF PANEL AT POST
W8x24; W8x31; W8x28



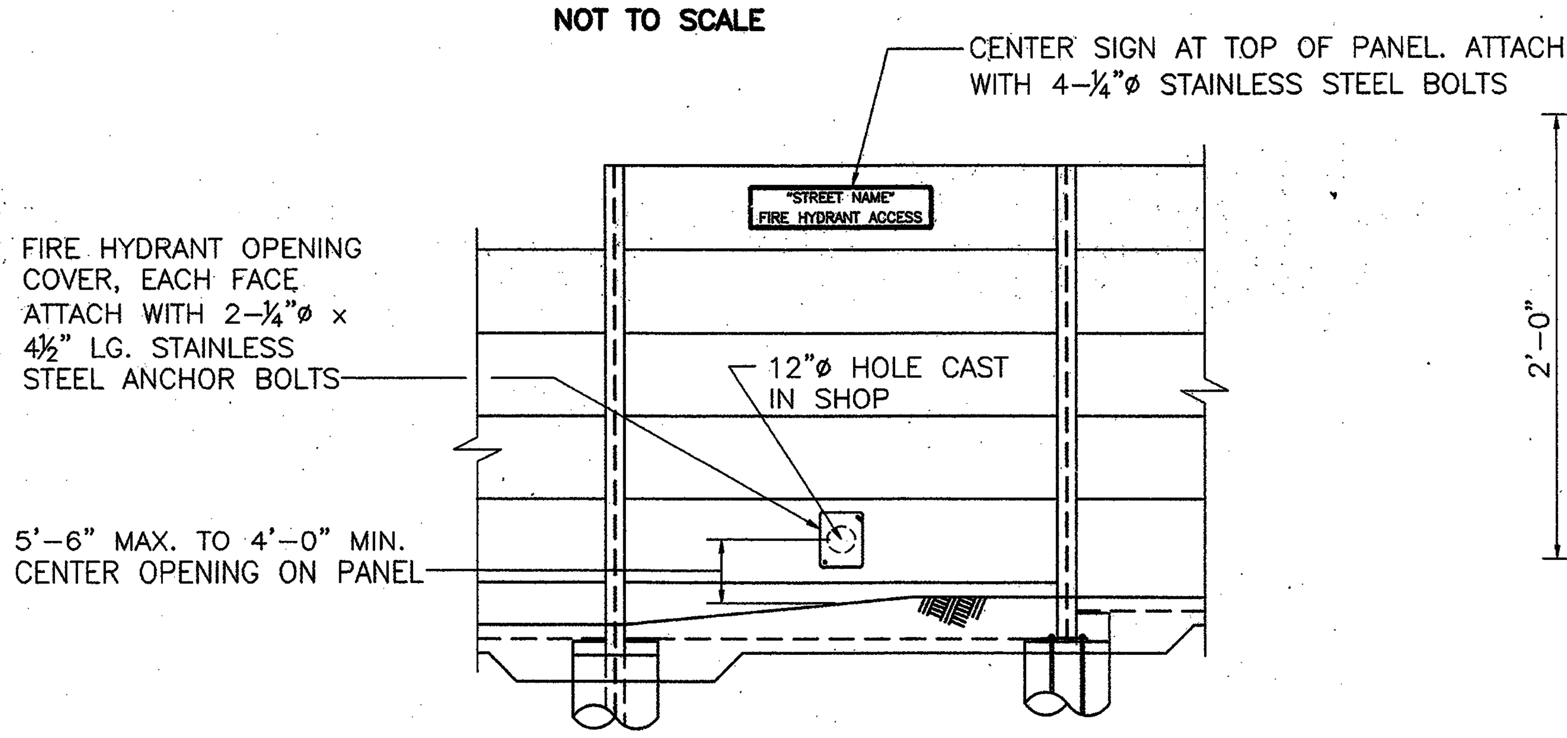
SECTION OF PANEL AT POST
ALL OTHER POSTS

NOISE BARRIER PANEL INSTALLATION NOTES

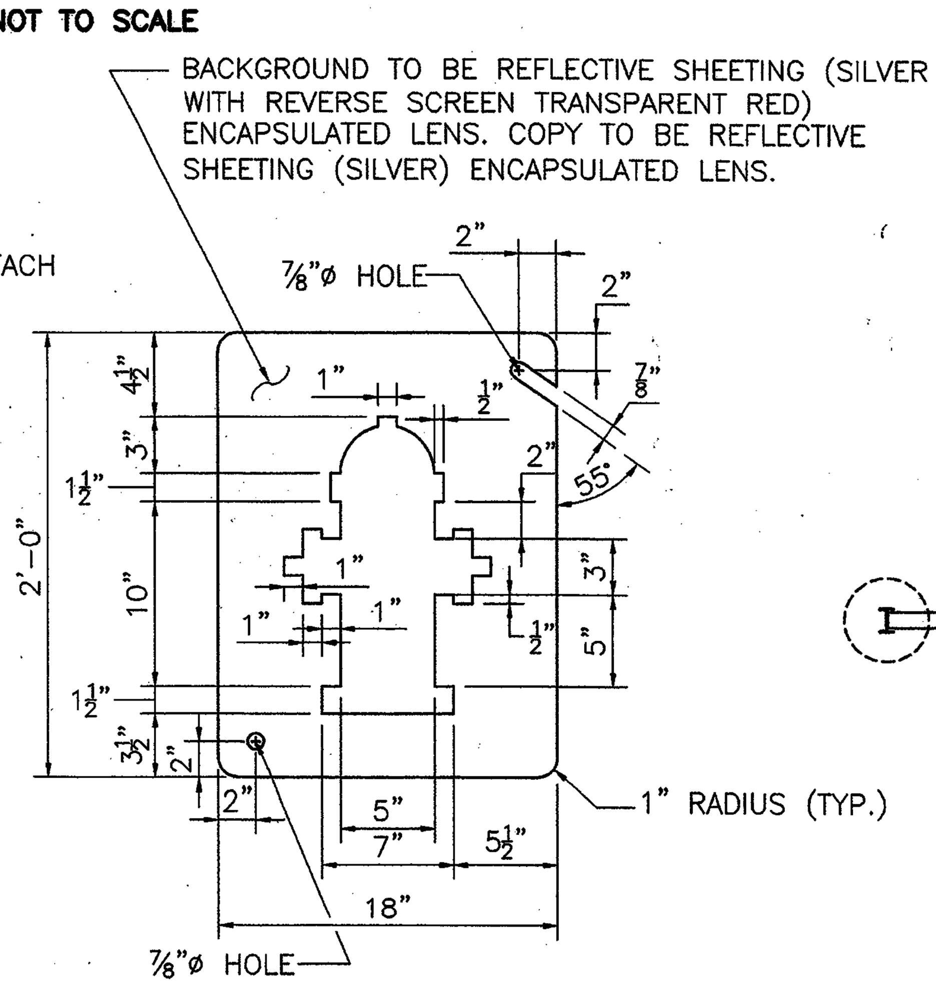
1. ELASTOMERIC BEARING PADS NOT REQUIRED IF JOINT BETWEEN PANEL AND FLANGE OF POST IS LESS THAN ¾". ZERO, ONE OR TWO PADS MAY BE REQUIRED AT EACH PANEL AND FLANGE LOCATION, DEPENDING UPON THE SIZE OF THE STEEL POST.
2. IF REQUIRED, GLUE ELASTOMERIC BEARING PAD TO INSIDE FLANGE OF POST USING AN APPROVED ADHESIVE. ADHESIVE MUST BE SUITABLE FOR EXTERIOR EXPOSURES WITH OPERATING TEMPERATURES OF BETWEEN -20° F AND 100° F. APPLY (¼" MINIMUM THICKNESS) OF JOINT SEALER TO FACE OF BEARING PAD.
3. ERECT PRECAST PANEL. WEDGE TIGHT AGAINST POST WITH BEARING PAD.
4. IF REQUIRED, GLUE BEARING PAD TO INSIDE FLANGE OF POST ON OTHER SIDE.
5. APPLY JOINT SEALER USING BACKER ROD IF OPENING IS GREATER THAN ¼".
6. WHERE NO PAD IS REQUIRED SEAL PANEL TO POSTS WITH JOINT SEALER USING BACKER ROD IF REQUIRED.
7. LEAVE 4" UNSEALED GAP AT BOTTOM PANEL FOR DRAINAGE.



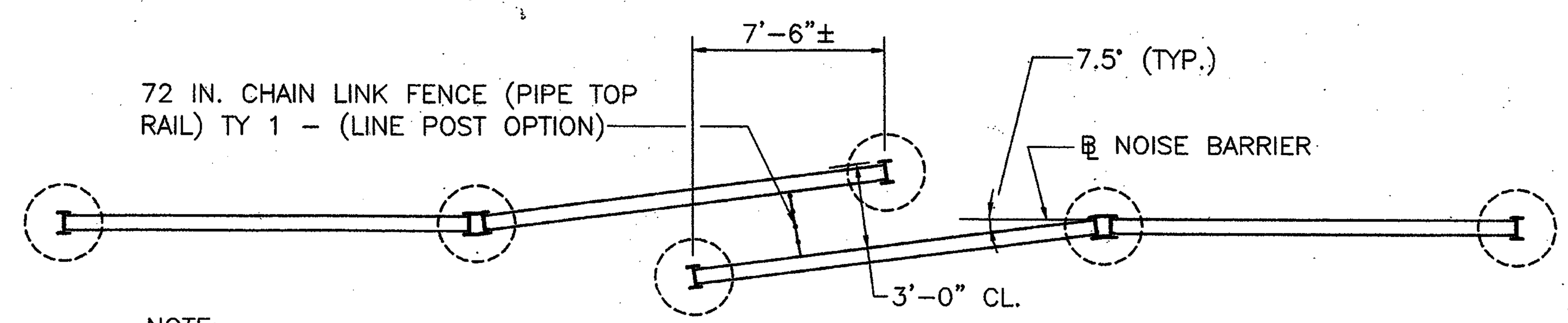
HYDRANT LOCATION SIGN
NOT TO SCALE



FIRE HYDRANT SIGN LOCATION
SCALE 3/16"=1'-0"



OPENING COVER DETAIL
NOT TO SCALE



NOTE:
1. ACCESS LOCATIONS TO BE DETERMINED BY THE DESIGN ENGINEER WITH CONSIDERATION TO LOCAL CONDITIONS AND ROADWAY USAGE. APPROXIMATE LOCATIONS SHALL BE SHOWN ON THE PLANS.
2. RECOMMENDED SPACING OF 1,250 FEET BETWEEN ACCESS POINTS. THEREFORE THE MAXIMUM LENGTH OF BARRIER WITHOUT ACCESS OPENING SHALL BE 1,250 FEET.

NOISE BARRIER TYPICAL ACCESS PLAN
SCALE 3/16"=1'-0"

THE COMMONWEALTH OF MASSACHUSETTS
HIGHWAY DEPARTMENT

STANDARD DRAWING 996.3
NOISE BARRIER STRUCTURES
CONCRETE PANELS

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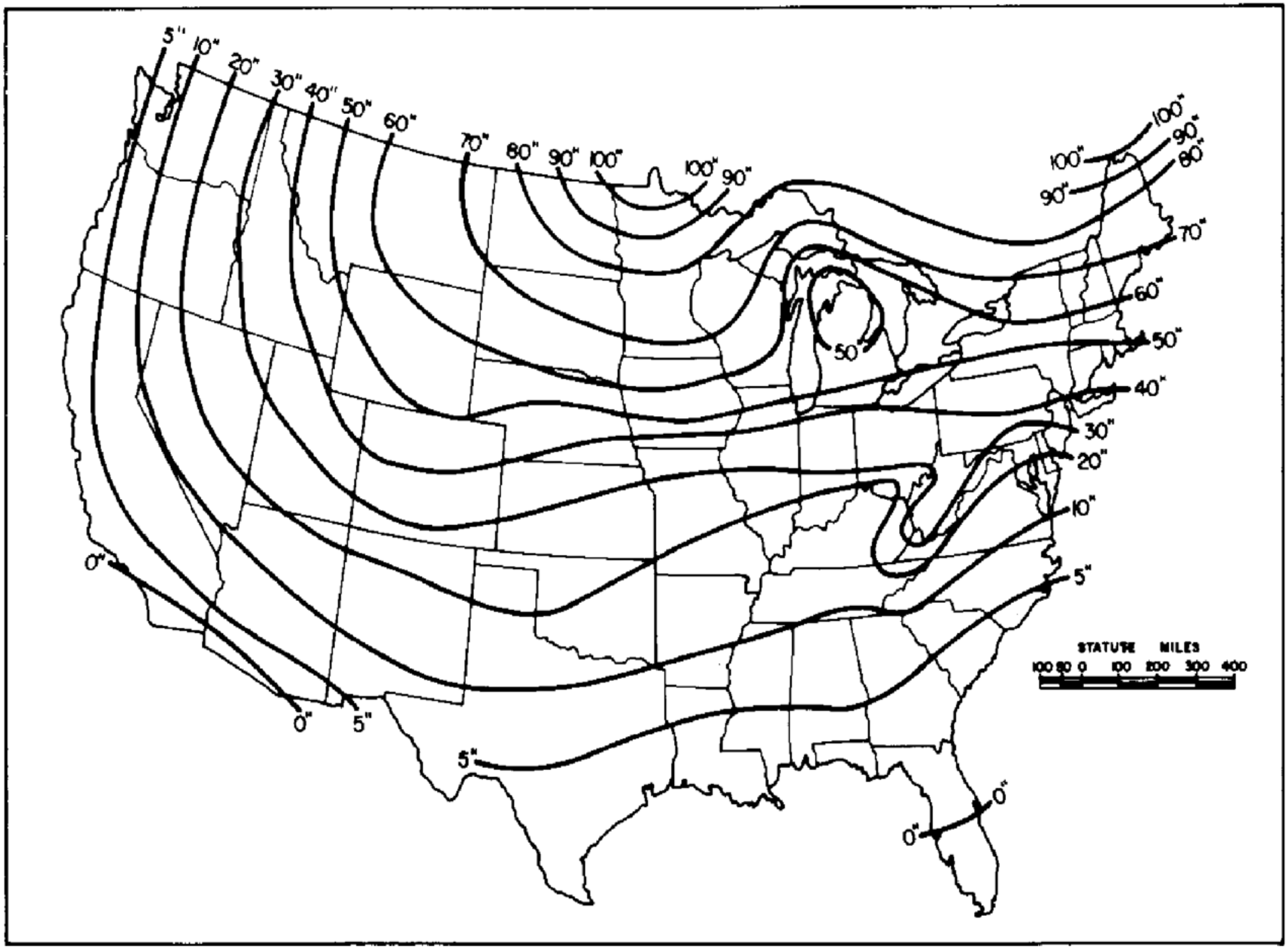
Appendix G – U.S. Navy Frost Depth Map



Approximate Depth of Frost Penetration in the United States (NAVFAC Design Manual 7.01 U.S. Navy, 1986