GREENWICH SUBSTATION & LINE PROJECT
SUBSTATION DEVELOPMENT & MANAGEMENT PLAN

The Connecticut Light and Power Company doing business as Eversource Energy

Volume I – Part 1

Cos Cob Substation Modifications

February 2018

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A. Introduction

A.1 Project Overview and Purpose of the Plan

The Connecticut Light and Power Company doing business as Eversource Energy ("Eversource" or "the Company") has prepared this Development and Management Plan ("D&M Plan" or "Plan") as part of the Greenwich Substation & Line Project (the "Project") needed to enhance the electric system in Greenwich, Connecticut. The Project includes the construction, operation, and maintenance of one (1) new substation, two (2) new all-underground 115-kilovolt (kV) XPLE[1] transmission lines, as well as providing improvements and modifications to the existing Cos Cob Substation ("Substation"). These Project improvements will consist of the following:

- Improvements and modifications to the existing Cos Cob Substation off Sound Shore Drive.
- One (1) new open-air insulated substation ("AIS") located at 290 Railroad Avenue.
- Two (2) new 2.3-mile underground 115-kV XPLE transmission lines (to be designated the 1020 and 1703 lines) with splice vaults to be located within road rights-of-way ("ROWs") to the extent that space is available given the locations of other existing underground utilities or on property adjacent to road ROWs. Installation of the new 115-kV transmission lines will require a pipe jacking crossing beneath Interstate 95 and a crossing of Indian Harbor pond within Bruce Park utilizing a cofferdam and standard trenching methods to span the pond.

In addition to the above, the Project will also require installation of underground distribution feeders to connect the new substation to the distribution system and some modifications to Prospect Street Substation.

Please refer to Figure A-1, Project Facilities Location Map.

On May 5, 2017, Eversource submitted to the Connecticut Siting Council ("Council" or "CSC") a Petition for Reconsideration ("Motion to Reopen") (Council Docket No. 461A). After public meetings, evidentiary hearings, and technical reviews, the Council approved the Project on November 9, 2017. Condition 3 of the Council's Decision and Order approving the Project requires that Eversource prepare two D&M Plans (one specific to the new Greenwich Substation and other substation improvements and one specific to the construction of the transmission lines), in compliance with Sections 16-50j-60 through 16-50j-62 of the Regulations of Connecticut State Agencies (RCSA: Requirements for a D&M Plan, Elements of a D&M Plan, Reporting Requirements). Accordingly, the D&M Plans will address all construction activities for the Project. A copy of the Council's Decision and Order is provided as Appendix A.

[1] Cross-linked polyethylene (XLPE).

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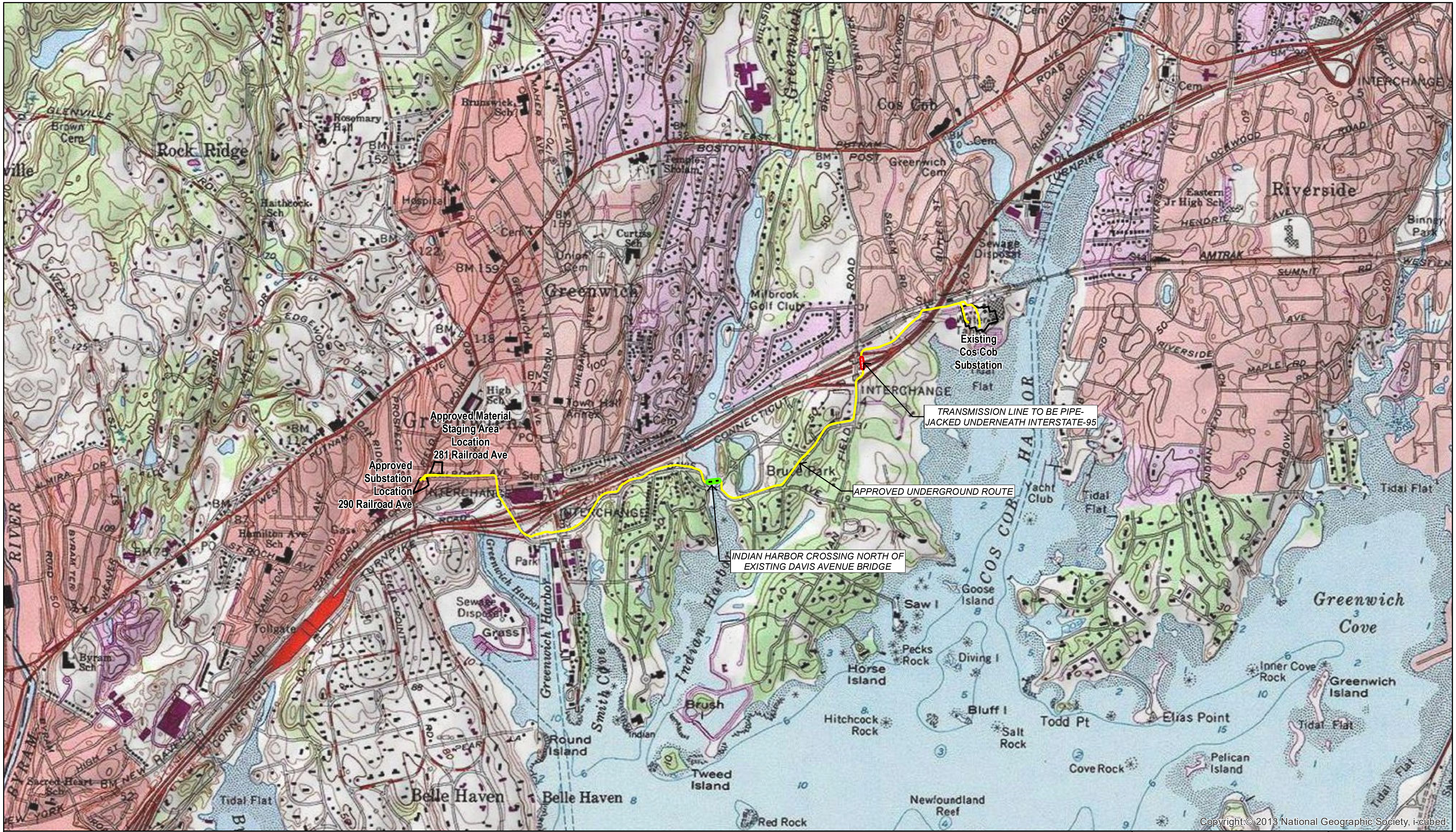
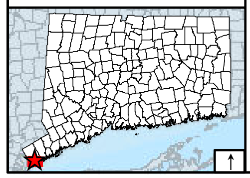


INDEX MAP



Legend

- Trenchless Crossing Underneath Interstate I-95
- Indian Harbor Crossing North of Existing Davis Avenue Bridge
- Approved Underground Route
- Approved Greenwich Substation Location
- Approved Material Staging Area Location
- Existing Cos Cob Substation Location

Base Map: ESRI USA Topographic Map

1:18,000

2,000 1,000 0 2,000 Feet

Figure A-1
Project Facilities Location Map

Greenwich Substation and Line Project
Greenwich, Connecticut

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A.1.1 Changes to the Approved Project Section

Volume I, Exhibit A of the Motion to Reopen Docket 461A discussed the utilization of PassM0[2] technology (Section A.2) for both the proposed 1020 and 1703 terminals. However, the final design has now been modified to exclude this technology per the following:

- 1703 Terminal: Two conventional air breakers, one installed on each side of the new 1703 terminal will be utilized instead of a double PassM0 circuit breaker system. The original need for the PassM0 system has been eliminated as a result of more detailed design review and the application of traditional breakers would not result in a cost increase to the Project.
- 1020 Terminal: Conventional termination methods (i.e. use of a stand-alone disconnect switch and potential transformer) on the 1020 Line instead of an in-line PassM0 termination. The 1020 termination equipment is located at the western edge of the Substation in a densely packed area of electrical equipment. Additional analysis has demonstrated that construction of an in-line PassM0 termination would be significantly more difficult than a conventional termination arrangement due to the configuration and larger size of the PassM0 equipment. As is the case with the proposed 1703 breaker(s) modification, Eversource, estimated that there would not be an increase in cost to modify the design to a conventional termination. Also, Eversource's familiarity with conventional termination equipment allows for a more seamless navigation of engineering and vendor coordination.

[2] Volume I, Exhibit A of the Motion to Reopen Docket 461A proposed to reconfigure the existing 1020 line-terminal position to accommodate an in-line PASS M0.

A.2 Organization of the D&M Plan

This D&M Plan consists of two volumes with Volume I being submitted in two separate parts with their own appendices:

- **Volume I – Part 1 – Cos Cob Substation:** Addresses all construction activities for the modifications to the Cos Cob Substation; and,
- **Volume I – Part 2 – Greenwich Substation (*Under Separate Cover*):** Addresses all construction activities for the new substation located at 290 Railroad Avenue.
- **Volume II – 115-kV Underground Transmission Line (*Under Separate Cover*):** Addresses all construction activities for the 2.3-mile-long, 115-kV underground transmission line connecting Cos Cob Substation to the new Greenwich Substation at 290 Railroad Avenue.

A.2.1 Volume I – Part 1 – Cos Cob Substation Modifications D&M Plan

Volume I – Part 1 (Sections A through G) provides information and procedures that are pertinent to the final design and construction activities for the proposed modifications to the Cos Cob Substation, including regulatory requirements, general construction procedures and special plans, construction schedule, public outreach activities, and processes for reporting Project progress to the Council and notifying and requesting approval from the Council in the event changes to the D&M Plan are required.

Table A-1 herein summarizes each of the Council's D&M Plan requirements, pursuant to RCSA Sections 16-50j-60 through 16-50j-62, while Table A-2 identifies the requirements pertaining to the Project as contained in the Council's Decision and Order and Opinion. For each D&M Plan requirement, Tables A-1 and A-2 either identify the location in this D&M Plan where the requirement is addressed or state why the requirement is not relevant.

Specific to Cos Cob Substation, all the proposed modifications will be implemented either within presently developed portions of the existing substation or in adjacent areas that have been previously disturbed. Please refer to Figure A-2, Cos Cob Substation Modifications.

C:\Users\NicoleCastro\Dropbox (APT GIS)\APT GIS Team Folder\Projects\Eversource\Greenwich_SS_Route_2017\mxd\Petition_Figures\Approved_Route\Figure A-2 Cos Cob Substation SS Modifications.mxd

Legend

- Substation Termination
- Proposed Substation Modifications
- Proposed Cos Cob Temporary Easement (Staging Area)
- Approximate Substation Property Boundary

Figure A-2
Cos Cob Substation Modifications

Cos Cob Substation
Sound Shore Drive
Greenwich, Connecticut

N W E S

125 62.5 0 125 Feet

Map Notes:
Base Map: 2016 Orthophotography (CTECO Map Service)
Map Scale: 1 inch = 125 feet
Map Date: February 2018

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Appendices regarding the modifications to Cos Cob Substation include:

- Appendix A: The Council's Decision and Order and Opinion for the Project (Docket No. 461A)
- Appendix B: Substation Drawings
- Appendix C: Eversource's Best Management Practices Manual for Massachusetts and Connecticut (Construction and Maintenance Environmental Requirements), September 2016;
- Appendix D: Post-Construction Electric and Magnetic Field Monitoring Plan for the Project;

A.2.2 Volume I – Part 2 – Greenwich Substation D&M Plan

Volume I – Part 2 addresses Project-related activities associated with the final design and construction of the new open-air insulated substation to be located at 290 Railroad Avenue and also provides information and procedures that are pertinent to demolition of the existing building and construction activities. The D&M Plan will also identify regulatory requirements, describe general construction procedures and special plans, provide an overall construction schedule and public outreach activities, and include processes for reporting Project activities to the Council, and notifying and requesting approval from the Council in the event changes to the D&M Plan are required.

A.2.3 Volume II – 115-kV Underground Transmission Line

Volume II addresses information relevant to the final design and construction of the two new 115-kV underground transmission lines. The main text of Volume II will include information and procedures that are pertinent to construction activities for these transmission facilities, including regulatory requirements, general Project construction procedures and special plans, overall construction schedule, public outreach, and processes for reporting Project activities to the Council, and notifying and requesting approval from the Council in the event changes to the D&M Plan are required.

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A.3 Development and Management Plan Directory

Table A-1 presents the requirements for a D&M Plan pursuant to RCSA Section 16-50j-60 through 62, as amended, and indicates where within the D&M Plan the relevant information is located.

Table A-1, D&M Plan Directory
Volume I – Part 1 – Cos Cob Substation Modifications
(Compliance with RCSA Sections 16-50j-60, -61 and -62, as amended through September 7, 2012)

R.C.S.A Section	Description	D&M Plan (Section Reference, as Applicable)
16-50j-60	**Requirements for a D&M Plan**	
(a)	**Purpose.** The Council may require the preparation of full or partial D&M Plans for proposed energy facilities, modifications to existing energy facilities, or where the preparation of such a Plan would help significantly in balancing the need for adequate and reliable utility services at the lowest reasonable cost to consumers with the need to protect the environment and the ecology of the state.	This D&M Plan (Volume I – Part 1) applies to modifications to the Cos Cob Substation.
(b)	**When required.** A partial or full D&M Plan shall be prepared in accordance with this regulation and shall include the information described in RCSA Sections 16-50j-61 to 16-50j-62, inclusive, for any proposed energy facility for which the Council issues a certificate of environmental compatibility and public need, except where the Council provides otherwise at the time it issues the certificate. Relevant information in the Council's record may be referenced.	D&M Plan (Volume I – Part 1) applies to modifications to the Cos Cob Substation.
(c)	**Procedure for preparation**. The D&M Plan shall be prepared by the certificate holder or the owner or operator of the proposed facility or modification to an existing facility. The preparer may consult with the staff of the Council to prepare the D&M Plan.	This D&M Plan was prepared by Eversource.
(d)	**Timing of plan.** The D&M Plan shall be submitted to the Council in one or more sections, and the Council shall approve, modify, or disapprove each section of the Plan not later than 60 days after receipt of it. If the Council does not act to approve, modify or disapprove the Plan or a section thereof within 60 days after receipt of it, the Plan shall be deemed approved. Except as otherwise authorized by the Council, no clearing or construction shall begin prior to approval of applicable sections of the D&M Plan by the Council.	This Volume includes relevant information for the Cos Cob Substation modifications except for the list of contractor personnel as specified in Section 16-50j-61(c)(8). Contact information for the prime contractor(s) for the Substation modification work will be provided to the Council in a supplemental submission, after contract award, prior to the commencement of construction.

R.C.S.A Section	Description	D&M Plan (Section Reference, as Applicable)
16-50j-61	**Elements of D&M Plan**	
(a)	**Key Map**, 1 inch=2,000 feet USGS topographic map	Volume I – Part 1, Figure A-1
(b)	**Plan Drawings**, 1 inch=100 feet or larger, and supporting documents, which shall contain the following information:	Construction Drawings are included in Volume I – Part 1 Appendix B.
1.	Edges of the proposed site and any existing site contiguous to or crossing the site, portions of the site owned by the company in fee, and the identity of property owners of record of the portions of the site not owned by the company in fee	Volume I – Part 1 Appendix B.
2.	Public roads and public land crossings or adjoining the site	Volume I – Part 1 Appendix B.
3.	Approximate location of 50-foot contours along the site	Volume I – Part 1 Appendix B.
4.	The probable location, type, and height of each new transmission structure, position of guys, generalized description of foundations, trench grading plans, depth and width of trenches, trench back-filling plans, and the location of any utility or other structures to remain on the right-of-way or to be removed	Volume I – Part 1 Appendix B.
5.	Probable points of access to the site, and the route and likely nature of accessways, including alternatives	Volume I – Part 1 Appendix B.
6.	Edges of existing and proposed clearing areas, the type of proposed clearing along each part of the site, and the location and species identification of vegetation that would remain for aesthetic and wildlife value	Volume I – Part 1 Appendix B.
7.	Identification of sensitive areas and conditions within and adjoining the site, including but not limited to:	
	A. Wetland and watercourse areas regulated under CGS Chapter 440 and any locations where construction may create drainage problems	Not Applicable to Volume I – Part 1
	B. Areas of high erosion potential	Not Applicable to Volume I – Part 1
	C. Known critical habitats or areas identified as having rare, endangered, or threatened, or special concern plant or animal species listed by the state or federal government	Not Applicable to Volume I – Part 1
	D. Location of known underground utilities or resources agencies to be crossed (electric lines, fuel lines, drainage systems and natural or artificial public or private water resources)	Volume I – Part 1, Appendix B

R.C.S.A Section	Description	D&M Plan (Section Reference, as Applicable)
	E. Residences or businesses within or adjoining the site that may be disrupted during the construction process	Volume I – Part 1, Section G, Figure G-1 & Table G-1
	F. Significant environmental, historic and ecological features (significantly large or old trees, buildings, monuments, stone walls or features of local interest)	Not Applicable to Volume I – Part 1
(c)	**Supplemental Information**	
1.	Plans (if any) to salvage marketable timber, restore habitat and maintain snag trees within or adjoining the site	Not Applicable to Volume I – Part 1
2.	All construction and rehabilitation procedures with reasonable mitigation measures that shall be taken to protect areas and conditions identified in 7 above, including but not limited to:	
	A. Construction techniques at wetland and watercourse crossings	Not Applicable to Volume I – Part 1
	B. E & S control and rehabilitation procedures, consistent with the CT Guidelines for Soil Erosion and Sediment Control, as updated and amended, for areas of high erosion potential.	Volume I – Part 1 Section C.2.5; E.2; and Appendix C, Eversource BMPs
	C. Precautions and all reasonable mitigation measures to be taken in areas within or adjoining the site to minimize any adverse impacts of such actions or modifications endangered, threatened, or special concern plant or animal species listed by federal or state agencies and critical habitats that are in compliance with federal and state recommended standards and guidelines, as amended	Not Applicable to Volume I – Part 1
	D. Plans for modification and rehabilitation of surface, drainage, and other hydrologic features	Volume I – Part 1 Section E.2
	E. Plans for watercourse bank restoration in accordance with Chapter 440 of the C.G.S.	Not Applicable to Volume I – Part 1
	F. Plans for the protection of historic and archaeological resources with review and comment from a state historic preservation officer of the CT Department of Economic and Community Development (DECD) or its successor agency	Not Applicable to Volume I – Part 1
3.	Plans for the method and type of vegetation clearing and maintenance to be used within or adjacent to the site	Tree Trimming and Management referenced in Volume I – Part 1, Appendix B, Volume I - Part 2, Section C.2.3 and Section F.1, Appendix B and Volume II
4.	Location of public recreation areas or activities known to exist or being proposed in or adjacent to the site, together with copies of agreements between the company and public agencies authorizing	Volume I - Part 1, Figure A-2

R.C.S.A Section	Description	D&M Plan (Section Reference, as Applicable)
	the public recreation use of the site to the extent of the company's rights thereto.	
5.	Plans for ultimate disposal of excess excavated material, stump removal, and periodic maintenance of the site	Volume I – Part 1, Section E.4
6.	Locations of areas where blasting is anticipated	Not Applicable to Volume I – Part 1
7.	Rehabilitation plans, including but not limited to reseeding and topsoil restoration	Volume I – Part 1, Section E.2.
8.	Contact information for the personnel of the contractor assigned to the project	Contact information for the Substation modification work will be provided to the Council in a supplemental submission, after contract award, prior to the commencement of construction.
9.	Such site-specific information as the CSC may require	Refer to Table A-2: List of requirements per Docket 461A Decision and Order and Opinion
(d)	**Notice** A copy, or notice of the filing, of the D&M Plan, or a copy, or notice of the filing of any changes to the D&M Plan, or any section thereof, shall be provided to the service list and the property owner of record, if applicable, at the same time the plan, or any section thereof, is submitted to the CSC	Volume I – Part 1, Section F.2
(e)	**Changes to the Plan** The CSC may order changes to the D&M plan, including but not limited to vegetative screening, paint color, or fence design at any time during the preparation of the plan	As applicable; refer to Volume I – Part 1, Section F.2 Eversource's Change Notice process
16-50j-62	**Supplemental Reporting Requirements**	
(a)	**Site Testing and Staging Areas** The certificate holder, or facility owner or operator, shall provide the CSC with written notice of the location and size of all areas to be accessed or used for site testing or staging areas. If such an area is to be used prior to approval of the D&M plan, the CSC may approve such use on terms as it deems appropriate.	Volume I – Part 1, Sections C.2.1, and F.1. The locations of contractor yards and material staging areas will be identified by the contractor and submitted to the Council for review and approval prior to use, pursuant to the Change Notice process described in Section F.2

R.C.S.A Section	Description	D&M Plan (Section Reference, as Applicable)
(b)	**Notice**	
1.	The certificate holder, or facility owner or operator, shall provide the CSC, in writing with a minimum of two weeks advance notice of the beginning of modifications to the Cos Cob Substation	Volume I – Part 1, Section F.1
2.	The certificate holder, or facility owner or operator, shall provide the CSC with advance written notice whenever a significant change of the approved D&M plan is necessary. If advance written notice is impractical, verbal notice shall be provided to the CSC immediately and shall be followed by written notice not later than 48 hours after the verbal notice. Significant changes to the approved D&M Plan shall include, but not be limited to, the following:	Volume I – Part 1, Sections F.1 and F.2
	A. The location of wetland or watercourse crossing	
	B. The location of an accessway or structure in a regulated wetland or watercourse area.	
	C. The construction or placement of any temporary structures or equipment	
	D. A change in structure type or location including, but not limited to, towers, guy wires, associated equipment or other facility structures	
	E. Utilization of additional mitigation measure, or elimination of mitigation measures. The CSC or its designee shall promptly review the changes and shall approve, modify, or disapprove the changes in accordance with subsection (d) of Section 16-50j-60 of the RCSA	
3.	The certificate holder, or facility owner or operator, shall provide the CSC with a monthly construction progress report or a construction progress report at intervals determined by the CSC or its designee, indicating changes and deviations from the approved D&M Plan. The CSC may approve changes and deviations, request corrections, or require mitigation measures.	Volume I – Part 1, Table F-1
4.	The certificate holder, or facility owner or operator, shall provide the CSC with written notice of completion of construction and site rehabilitation.	Volume I – Part 1, Section F.1; Table F-1
(c)	**Final Report** The certificate holder, or facility owner or operator, shall provide the CSC with a final report for the facility not later than 180 days after completion of all site construction and site rehabilitation. The report shall identify:	Volume I – Part 1, Section F.1

R.C.S.A Section	Description	D&M Plan (Section Reference, as Applicable)
1.	All agreements with abutters or other property owners regarding special maintenance precautions	Volume I – Part 1, Section F.1
2.	Significant changes of the D&M Plan that were required because of property rights of underlying and adjoining owners for other reasons	
3.	The location of construction materials which have been left in place including, but not limited to, culverts, erosion control structures along watercourses and steep slopes, and corduroy roads in regulated wetlands	
4.	The location of areas where special planting and reseeding have been done	
5.	The actual construction cost of the facility, including but not limited to the following costs:	
	A. Clearing and access	
	B. Construction of the facility and associated equipment	
	C. Rehabilitation; and	
	D. Property acquisition for the site or access to the site	
(d)	**Protective Order** The certificate holder, or facility owner or operator, may file a motion for protective order pertaining to commercial or financial information related to the site or access to the site.	Not Applicable

A.4 CSC Decision and Order Checklist

Table A-2 presents the Council's requirements for the Project as provided in the Docket No. 461A Decision and Order and indicates where within the D&M Plan the relevant information is located.

Table A-2, D&M Plan Directory of Docket No. 461A
Decision and Order Requirements Greenwich Substation and Transmission Line Project

Condition Number	**Description**	**D&M Plan (Section Reference, as Applicable)**
Condition Number	**Decision and Order**	
(1)	The Certificate Holder shall construct the proposed substation at 290 Railroad Avenue, enclosed by a perimeter brick wall. The brick wall shall be relocated south by approximately 10 feet to increase the setback distance between the brick wall and Railroad Avenue.	Not Applicable to this Volume. *See Volume I – Part 2 Greenwich Substation D&M Plan (under separate cover).*
(2)	The Certificate Holder shall construct the proposed underground electric transmission line along the proposed route using a pipe jack crossing of Interstate 95 and a trench/cofferdam crossing of Indian Harbor, and perform related Project improvements, as proposed, subject to modifications during final site design and approval of the Development and Management (D&M) Plan for the project.	Not Applicable to this Volume. *See Volume II - 115-kV Underground Transmission Line D&M Plan (under separate cover).*
(3)	The Certificate Holder shall prepare two D&M Plans for this Project; one specific to the proposed substation and other substation improvements, and one specific to the proposed construction of the new transmission line. Both D&M Plans shall be in compliance with Sections 16-50j-60 through 16-50j-62 of the Regulations of Connecticut State Agencies. The D&M Plans shall be served on the Town of Greenwich for comment, and all parties and intervenors as listed in the service list, and submitted to and approved by the Council prior to the commencement of facility construction. The D&M Plans shall include:	Eversource is preparing separate D&M Plans for the project: Volume I – Part 1 for the Cos Cob Substation Modifications; Volume I – Part 2 for the new Greenwich Substation; and Volume II for construction of the new underground transmission lines.
	a. A detailed site plan showing the placement of all substation equipment, structures, and buildings within the substation perimeter, access, provisions for storm water management and transformer oil containment and fencing;	D&M Plan, Volume I - Parts 1 and 2; – D&M Plan Volume II
	b. A detailed site plan showing the underground transmission line route, splice vaults, traffic management plan, identification of pipe jacking sites, provisions for underground cable protection, substation improvements, and equipment and material staging areas;	D&M Plan, Volume I - Parts 1 and 2; D&M Plan Volume II
	c. An erosion and sediment control plan that includes provisions for any areas for the temporary storage of fill materials and is	D&M Plan, Volume I - Parts 1 and 2, and Volume II.

Condition Number	Description	D&M Plan (Section Reference, as Applicable)
	consistent with the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control,* as amended;	
	d. A spill prevention control and countermeasures plan; e. Identification of areas for staging and equipment lay down, field office trailers, sanitary facilities and parking; f. Details for the Indian Harbor crossing including related temporary and permanent construction impacts and methods to reduce such impacts; g. A vegetative clearing/trimming plan;	Volume I - Part 1, Section E.1. Volume I - Part 1, Appendix B. Not Applicable to this Volume. *See Volume II* Tree Trimming and Management referenced in Volume I - Part 1 Appendix B, Volume I - Part 2, Section C.2.3 and Section F.1, Appendix B and Volume II
	h. Restoration plan for disturbed areas and roads; i. A construction schedule, including construction hours j. A blasting plan, if necessary; k. EMF Monitoring Plan; and l. Submission of monthly construction progress reports.	Not Applicable to this Volume. *See Volume II* Volume I – Part 1, Section D. Not Applicable to this Project Appendix D Volume I – Part 1, Section F.3; Table F-1.
(4)	The Certificate Holder shall obtain necessary permits from the Connecticut Department of Energy and Environmental Protection, Department of Transportation and other entities, as necessary, prior to the commencement of construction.	Volume I – Part 1, Table B-1.
(5)	The Certificate Holder shall comply with all future electric and magnetic field standards promulgated by State or federal regulatory agencies. Upon the establishment of any new standards, the facilities	Volume I – Part 1, Appendix D.

Condition Number	Description	D&M Plan (Section Reference, as Applicable)
	granted in this Decision and Order shall be brought into compliance with such standards.	
(6)	The Certificate Holder shall provide to the Council an operating report within three months after the conclusion of the first year of operation of all facilities herein, and annually thereafter for a period of three years, with information relevant to the overall condition, safety, reliability, and operation of the new transmission line.	Volume I – Part 1, Section F.
(7)	Unless otherwise approved by the Council, this Decision and Order shall be void if all construction authorized herein is not completed within five years of the effective date of the Decision and Order, or within five years after all appeals to this Decision and Order have been resolved Authority to monitor and modify this schedule, as necessary, is delegated to the Executive Director. The Certificate Holder shall provide written notice to the Executive Director of any schedule changes as soon as is practicable.	Not Applicable at this time.
(8)	Any request for extension of the time period referred to in Condition 7 shall be filed with the Council not later than 60 days prior to the expiration date of this Certificate and shall be served on all parties and intervenors, as listed in the service list, and the Town of Greenwich.	Not Applicable at this time.
(9)	This Certificate may be surrendered by the Certificate Holder upon written notification to the Council.	
(10)	In accordance with Section 16-50j-62 of the Regulations of Connecticut State Agencies, the Certificate Holder shall provide the Council with written notice two weeks prior to the commencement of site construction activities. In addition, the Certificate Holder shall provide the Council with written notice of the completion of site construction, and the commencement of site operation.	Volume I – Part 1, Section F.
(11)	The Certificate Holder shall remit timely payments associated with annual assessments and invoices submitted by the Council for expenses attributable to the facility under Conn. Gen. Stat. §16-50v.	
(12)	This Certificate may be transferred in accordance with Conn. Gen. Stat. §16-50k(b), provided both the Certificate Holder/transferor and the transferee are current with payments to the Council for their respective annual assessments and invoices under Conn. Gen. Stat. §16-50v. In addition, both the Certificate Holder/transferor and the transferee shall provide the Council a written agreement as to the entity responsible for any quarterly assessment charges under Conn. Gen. Stat. §16-50v(b)(2) that may be associated with this facility.	

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B. Regulatory Approvals and Consultations for the Project

B.1 Regulatory Approvals and Requirements

This D&M Plan conforms to the specifications of Sections 16-50j-60 through 16-50j-62 of the RCSA (Requirements for a D&M Plan, Elements of a D&M Plan, Reporting Requirements); incorporates Eversource's commitments as contained in the record of the Council's Docket 461A regulatory process; and reflects adherence to the conditions of the Council's approval for the Project and other relevant, previously received or anticipated regulatory approvals. The federal and state permits and approvals needed for the Project are listed in Table B-1.

B.2 Consultations – Including Town Interactions

During the planning of the Project, Eversource consulted with representatives of the Town of Greenwich, as well as with representatives of various state and federal agencies, including the U.S. Army Corps of Engineers ("USACE"), New England District; U.S. Fish and Wildlife Service ("USFWS"); Connecticut Department of Energy and Environmental Protection ("CT DEEP"); CT DEEP Land and Water Resource Division ("LWRD"); State Historic Preservation Office ("SHPO"), and Connecticut Department of Transportation ("ConnDOT"). In addition, Eversource coordinated with property owners along the transmission line route.

Discussions with the Town of Greenwich ("Town") regarding the Project commenced in June 2011 and have continued throughout the siting process. Subsequent to the Council's decision, Eversource is continuing to meet with the Town to discuss elements of the D&M Plan. In accordance with Condition 3 of the Council's Decision and Order, Eversource served this D&M Plan on the Town of Greenwich for comment and on all parties and intervenors on the service list for this Docket. Additional information regarding Eversource's public outreach activities is included in Section G.

Table B-1, Permits, Reviews, and Approvals Required for the Project

Agency	Certificate, Permit, Review, Approval or Confirmation	Activity Regulated
FEDERAL		
USACE, New England Division	Section 401 Clean Waters Act (CWA) Section 10 Rivers and Harbors Act Section 404 CWA (Permits requires conformance with Section 106 of the National Historic Preservation Act (NHPA), see Tribal and SHPO consultations below)	Required consultation under CT DEEP LWRD Permit application Excavation/Dredging in navigable water Discharge of fill
U.S. Fish and Wildlife Service	Coordinates with USACE regarding endangered or threatened species	Activities that may affect federally-listed endangered or threatened species (Note: Consultations with this agency revealed that no federally-listed species will be affected by the Project)
Federally-recognized Tribal Nations in CT	Coordinates with USACE regarding native American cultural resources	Activities that may affect Native American sites
CONNECTICUT		
Connecticut Siting Council[3]	Certificate of Environmental Compatibility and Public Need (Docket 461A, November 9, 2017; refer to Appendix A D&M Plan approvals	General transmission line need, siting, construction, environmental compatibility, safety, and operation / maintenance and management procedures
CT DEEP Land and Water Resources Division (LWRD)	Structures, Dredging and Fill & 401 Water Quality Certification	Activities in in tidal, coastal or navigable waters of the state; Conformance to Section 401 of the CWA
CT DEEP	Threatened, Endangered, and Special Concern Species	Construction and operation activities that may affect state-listed threatened, endangered, and/or special concern species (Note: Consultations with CT DEEP confirmed that no state-listed species will be affected by the Project)
CT DEEP	General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities; Stormwater Pollution Control Plan Activities	Construction activities affecting greater than one acre of disturbance
CT DEEP Public Utilities Regulatory Authority	Approval pursuant to CGS Section 16-243	Method & Manner of Construction Approval to Energize Lines

[3] Shaded sections specific to modification to the Cos Cob Substation.

Agency	Certificate, Permit, Review, Approval or Confirmation	Activity Regulated
SHPO	Approval of proposed Project consistency with the NHPA; comments during Council and USACE processes	Construction and operation activities that may affect archaeological or historic resources (Note: investigations revealed that no cultural sites will be affected by the Project)
ConnDOT Highway	Encroachment permits	Arch Street crossing beneath I-95 overpass; pipejacking beneath I-95 parallel to Indian Field Road; construction on ConnDOT property off Sound Shore Drive; and, crossing beneath I-95 overpass in MNR commuter Lot (Cos Cob Train Station).
ConnDOT Highway	Encroachment Agreement	Occupation of ConnDOT Highway property off of Sound Shore Drive.
ConnDOT Rails	License Agreement	Permanent occupation of underground line in MNR Commuter lot (Cos Cob Train Station) and Arch Street crossing underneath MNR overpass.
ConnDOT Rails	Right of Entry Permit	Construction of underground line in MNR Commuter Lot (Cos Cob Train Station).
ConnDOT Rails[4]	Right of Entry Permit	Staging area in Cos Cob Substation yard
Department of Health	Asbestos Abatement Permit	Asbestos Abatement
TOWN OF GREENWICH		
Town of Greenwich	Highway permit	All work to be performed in the Town right-of-way. Required to perform installation of the underground transmission line duct bank
Town of Greenwich	Demolition Permit	Demolition of the existing Pet Pantry building located at 290 Railroad Avenue
Town of Greenwich	Sewer Permit	Capping and removal of the existing sewer line on 290 Railroad Avenue site and the installation of a temporary cap from Field Point Road until new lead to new Control House is installed.
Town of Greenwich	Building Permit	Control House

[4] Shaded sections specific to modification to the Cos Cob Substation.

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C. General Construction Procedures for Substation Modifications

The Project modifications to Cos Cob Substation (or the "Substation") will involve a sequential and phased construction approach based on four separate outage seasons, which are anticipated to take place during spring 2018, fall 2018, spring 2019, and fall 2019. The following sub-sections summarize the general construction procedures that will be common to construction activities at the Substation. Detailed site-specific construction drawings and plans are presented in Appendix B of this Volume. Actual sequences and methods of construction may vary based on the characteristics observed at the Substation and the final specific engineering designs.

The Substation modifications will be monitored by on-site Eversource Project personnel. based in the field who will provide construction oversight and observe and report to Eversource management on construction activities, including adherence to all Project requirements.

C.1 Construction Management and Contact Information

Prior to the commencement of construction work at Cos Cob Substation, Eversource will provide the Council with contact information for the prime construction contractors for the Project, consisting of name, corporate address, telephone number, and e-mail. The Project modifications at Cos Cob Substation will be monitored by Project personnel from Eversource including a dedicated Eversource construction manager. These personnel will be present on-site for the construction of the Project modifications at the Substation to report on construction activities, including adherence to engineering, safety, and environmental requirements.

C.2 General Construction Sequence

Eversource will construct the Project in several stages, some overlapping in time. The following sections summarize the sequence of activities for the modifications to the Substation.

C.2.1 Staging Area Identification

To support construction, areas used to store equipment and materials necessary for construction (staging areas) will be located within Cos Cob Substation and at the Eversource owned 281 Railroad Avenue property ("Pole Yard").

Cos Cob Substation: 12 Sound Shore Drive, Greenwich, Connecticut.

An approximate 11,000 square-foot area, which is located in the southeast corner of the Metro North Railroad ("MNR") portion of the yard, will be used as a temporary staging area used for parking, construction equipment and materials. Eversource's acquisition of a temporary work area easement is currently pending ConnDOT review. A temporary fence to protect the staging area would be installed. In addition, access to the Substation gates would be maintained for both MNR and ConnDOT. Refer to Figure A-2.

281 Railroad Avenue: Greenwich, Connecticut. The available area at 281 Railroad Avenue is approximately 32,670 square feet (0.75 acre).

Once the Project is complete, all construction related equipment and materials would be removed from the staging areas.

Eversource's selected contractor may need to evaluate additional sites for staging and laydown of materials. If additional sites were to be identified, the proposed locations would be submitted to the CSC for approval.

C.2.2 Site Preparation

Site preparation at Cos Cob Substation may include the following activities:

- Deploying temporary construction storage containers, and related equipment and materials to the Substation or associated staging areas and setting up temporary services required to support construction (e.g., portable toilets and office trailers).
- Establishing designated parking areas for construction workers. If sufficient parking is not available within the Cos Cob Substation site, workers will park at project staging areas or at the project office(s) and arrange for transportation to and from the construction site.
- Erecting "construction zone" warning signs on public roads (i.e. Sound Shore Drive) and the shared driveway entering Cos Cob Park in the immediate vicinity of the Substation.
- Placing a construction notification sign on the Substation fence, facing toward the Cos Cob Park to notify residents of planned work hours and contact information.
- Installing protective fencing (e.g., snow fence) around work sites as needed.
- Installing and maintaining, as necessary, temporary soil erosion and sedimentation controls (e.g., silt fence, straw bales) around areas of planned pavement/soil disturbance. Such controls would be maintained and replaced, as necessary, throughout the construction process. The primary objective

of these controls would be to minimize the potential for erosion and sediment migration away from construction activity.

- Removing and/or graveling over vegetation from work areas and equipment staging locations

Blasting is not anticipated for the planned modifications at the Substation. In general, site preparation work typically would involve the use of construction equipment such as cranes, backhoes, excavators, trucks (various sizes), compressors, and flat-bed trailers. Some grading will be required to expand the southern portion of the Substation to accommodate the new 1703, 1020-line terminals and 1750-line terminal relocation.

C.2.3 Grading

As noted above, work for the Cos Cob substation will be performed within the existing Substation Property bounded by the existing Town fence line. Grading will be required to accommodate the installation of new retaining walls along the southern portion of the Substation (refer to section C.2.6 of this Volume). Substation development will require limited grading in select areas to level conditions and match existing Substation yard elevation.

C.2.4 Soil Handling and Dewatering

Handling, transport, intermediate storage, and disposal of excavated material will be in accordance with *Eversource's Best Management Practices Manual for Massachusetts and Connecticut* (BMP Manual), dated September 2016 (Appendix C).

C.2.5 Erosion and Sediment Controls

To minimize the potential for erosion and sediment migration during construction, temporary erosion and sediment ("E&S") control measures will be placed around work sites prior to conducting any earth moving activities and will be inspected on a routine basis.

In addition, all construction activities will comply with the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control*, as amended and Eversource's BMP Manual. The proposed E&S control measures are depicted on the Substation Drawings provided in Appendix B of this Volume. Additional information pertaining to the anticipated E&S controls can be found in Section E.2.

C.2.6 Foundations and Equipment Installation

The process for installing structure and equipment foundations will generally involve excavation, concrete form installation, use of steel reinforcement, and concrete placement.

Approximately 280 linear feet of retaining wall, varying in height (not exceeding 5 feet), will be installed along the southern portion of the Substation to create a level yard in this area. A second retaining wall, measuring approximately 90 linear feet, and of varying in height (not exceeding 2 feet), will be installed along the border of the existing MNR substation. Construction of the retaining walls will involve cut and fill operations.

Based on existing subsurface investigations groundwater is unlikely to be encountered during construction. If sufficient rainfall occurs during excavations and excess surface water accumulates, the water will be pumped from the excavated area and discharged in accordance with applicable local and state requirements. The water may be discharged on-site into an appropriate sediment control basin; pumped into a temporary fractionization tank ("frac tank") and then discharged; or pumped into a tanker truck for disposal at appropriate wastewater treatment facilities. Residual silt/sediment collected at the bottom of the frac tanks will be disposed off-site at an appropriately designated disposal facility. In addition, a catch basin off the new access road located on the southern part of the site is proposed to accommodate runoff in this area, which would drain into a drywell and infiltrate into underlying soil (see Appendix B).

After the foundations are installed, construction activities will shift to the erection of structures and equipment as specified for the substation modification. Such structures and equipment include steel structures, bus and insulators, circuit breakers, switches, instrument transformers, cable trench, lightning arresters, conduits and cables. In addition, new relay panels and communications equipment will be installed within existing control enclosures.

Upon completion of the installation of the material mentioned above, a new permanent fence will be installed.

C.2.7 Structure and Equipment Removal

A single lattice tower, one guyed wood pole structure, two steel A-frame structures, and one wood H-frame structure will be removed as part of the modifications at Cos Cob Substation.

Several pieces of electrical equipment will also be removed from the Substation, including strain overhead bus sections, a line trap, and a manual disconnect switch.

This material will be disposed of in accordance with Eversource policy as well as all local, state, and federal requirements.

C.2.8 Restoration and Landscaping

Any paved areas damaged during construction will be restored. No landscaping is currently proposed at Cos Cob Substation.

C.2.9 Testing and Commissioning

All the new equipment in the Substation will be commission-tested prior to final connection to the transmission system.

C.2.10 Final Cleanup

As the final step in the construction process, all remaining construction debris will be collected and removed from Cos Cob Substation. Construction debris will be properly disposed of in accordance with local, state and federal regulations and Eversource BMPs.

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D. Construction Schedule, Outages and Work Hours

D.1 Construction Schedule

The Cos Cob Modifications will utilize a phased construction approach that will be periodically completed over a span of 18 to 24 months. Four separate outage seasons will be utilized to complete the work at Cos Cob Substation; spring 2018, fall 2018, spring 2019 and fall 2019. Exact outage dates have yet to be determined. In general, the work to be completed in each season is summarized by Table D-1 below:

Table D-1, Cos Cob Substation Construction Schedule

	Q1 2018	Q2 2018	Q3 2018	Q4 2018	Q1 2019	Q2 2019	Q3 2019	Q4 2019
Non-Outage Work								
Establish Staging Areas								
Establish Site controls								
Material Receipt								
Initial Cos Cob SS Expansion: build retaining walls, install two new breakers and associated equipment, construction of new 1703 terminal, equipment testing								
Demolish existing lattice tower								
Completion of Cos Cob SS Expansion: stabilize disturbed areas, remove construction debris								
Outage Work								
Outage 1: Rebuild 1020 Terminal								
Outage 2: Transfer existing 1750 line to new monopole and A-frame								
Outage 3: Connect new bus to the two new breakers								
Outage 4: Termination and testing of XLPE Cables to bring the new 1020 and 1703 lines into service								

D.2 Work Hours

With the exceptions noted below, construction activities that generate noise at Cos Cob Substation will conform to the Town's exemptions to its noise ordinance, and be limited to an 11-hour period occurring between the hours of 7:00 AM and 6:00 PM, five days per week (Monday through Friday) and an 8-hour period (between 9:00 AM and 5:00 PM) on Saturdays. Although construction workers may arrive for work and leave work just outside of these times, no noise-generating on-site construction activities will occur beyond these prescribed hours). Other activities, such as those that must be performed during outages and electrical modifications within the Substation control enclosures, may also involve work during outside these times. During the four outages, the work may need to occur on a continuous (24-hour) basis or on Sundays. Eversource would request permission from the Council prior to initiating any noise generating work outside of previously approved work hours.

E. Related Construction Procedures

E.1 Spill Prevention and Countermeasures Plan

Eversource's contractors working at the Substation will be responsible for following Eversource's BMP for spill containment (Appendix C Section 4.1.4 – Spills) in the event that a spill does occur. Fuel/petroleum products used to re-fuel vehicles and equipment would be utilized at the current location of the vehicle/equipment in need of re-fueling. In case of an on-site reportable spill, personnel will contact the on-site construction manager who will then immediately contact the CT DEEP and an on-call emergency response contractor. At a minimum, each site where a potential spill could occur will include the following provisions:

- Fuel/petroleum products used to re-fuel vehicles and equipment would be utilized at the current location of the vehicle/equipment in need of re-fueling;
- Spill kits consisting of emergency clean up and spill contaminant materials that can be used in the event of a fuel or other chemical spill;
- Spill kits must be kept on site and accessible at all times in case of an emergency spill;
- Such kits should generally contain multiple absorbent socks and/or pillows and wipes and temporary disposal bags; and,

Eversource is in the process of developing a Spill Prevention, Control and Countermeasures Plan ("SPCCP") that will address all other areas of the Project. The SPCCP will describe processes to minimize the potential for a spill of petroleum products or a hazardous or toxic substance and, in the event that a spill does occur, measures to contain and control the release to minimize the effects. Eversource requires all construction contractors to adhere to procedures outlined in the SPCCP during all construction activities. At a minimum, the SPCCP will include the following provisions:

- The identification of petroleum products and materials classified as hazardous or toxic that are likely to be used during Project construction;
- The transport, storage, and disposal procedures for these substances;
- Training, equipment inspection and maintenance, and other procedures designed to minimize the potential for a spill; and,
- The procedures to be followed in the event of a release of a petroleum or hazardous / toxic substance to the environment, including a spill reporting protocol.
- The finalized SPCCP will be included in Volume I – Part 2 and Volume II DM Plans.

E.2 Erosion and Sedimentation Control Measures and Stormwater Management

Where appropriate, E&S control measures will be installed prior to the initiation of soil disturbing activities and will be inspected and maintained throughout construction. Temporary E&S controls will be left in place until the areas disturbed by construction activities are permanently stabilized.

Permanent stabilization will consist of the application of pavement or gravel (for areas within the substation fence lines), or reseeding to establish a uniform vegetative cover of 70% density on disturbed soils that will not otherwise be paved or graveled (e.g., staging areas, as applicable). After final stabilization is achieved, all temporary E&S controls will be removed and disposed of properly.

All E&S control practices will be in accordance with the following:

- *2002 Connecticut Guidelines for Soil Erosion and Sediment Control as* amended;
- *Eversource's Best Management Practices Manual for Massachusetts and Connecticut (Construction and Maintenance Environmental Requirements), September 2016* (Appendix C); and,
- *CT DEEP Contaminated Soil Transfer and Staging General Permit* (if necessary).

The Project construction contractors will be required to comply with all applicable regulatory requirements, as well as with the environmental permits and the Council-approved D&M Plans. Eversource will require construction contractors' personnel to attend training regarding Project-specific requirements, including the specifications of the D&M Plans.

E&S controls are depicted on the Substation Drawings included in Appendix B of this Volume.

E.3 Provisions for Winter Work

Work activities associated with modifications to Cos Cob Substation will be conducted during the winter months, and Eversource will implement best management practices designed to minimize or avoid adverse environmental impacts. Snow removal and the use of de-icing procedures will be in accordance with the BMP Manual (Appendix C).

If some clean-up or restoration work is completed too late in the season to initiate or complete permanent stabilization of disturbed areas (e.g., temporary staging areas that may require reseeding), temporary E&S controls will be left in place and augmented if necessary. These measures will be regularly inspected and maintained until permanent site stabilization can be completed, likely during the following spring.

All E&S control practices and over-winter monitoring will be in accordance with Eversource's BMP Manual and the *CT DEEP's 2002 Connecticut Guidelines for Soil Erosion and Sediment Control* as amended.

E.4 Air Quality Protection (Dust and Dirt Tracking) and Vehicle Idling Protocol

<u>Dust Suppression and Anti-Tracking Pads</u>

To minimize adverse effects to air quality, access roads and staging areas will typically be graveled and may be watered[5], as necessary, to suppress fugitive dust emissions. Additionally, anti-tracking pads will be installed on the site with the objective of minimizing tracking of soil onto Sound Shore Drive and vehicles will be inspected prior to leaving the Substation. Paved roads will be periodically swept as necessary to remove any excess dirt tracked onto the pavement.

<u>Construction Equipment: Idling[6] vs. Warm-Up During Cold Weather</u>

Unnecessary construction equipment and vehicle idling expends fuel, increases costs, and causes air pollution. Vehicle emissions will be limited by requiring contractors to properly maintain construction equipment and vehicles, and by minimizing the idling time of construction vehicles and equipment in accordance with applicable regulatory standards.

Pursuant to Connecticut requirements (RCSA 22a-174-18), the allowable idling time for vehicles of all kinds, including diesel construction equipment, is three minutes.

However, under winter work conditions (when the ambient temperature is below 20 degrees Fahrenheit) the following apply:

- Construction equipment may require longer periods to warm up after overnight shut down or other extended periods of inactivity. Such "warm up" periods, as required to bring the equipment up to a safe operating temperature (as defined by the equipment manufacturer), are exempt from the idling time limit. However, most diesel engines take three minutes or less to warm up (contractors should consult the engine manufacturer's recommendations).
- Construction equipment may have to idle for longer periods to operate defrosting or heating equipment to ensure the safety or health of the driver.

[5] All water sources must be pre-approved by Eversource.

[6] "Idling" is defined as the period when mobile construction equipment is not in motion or is not otherwise actively performing its designated function. Thus, "idling" does not apply to the use of certain types of mobile construction equipment (e.g., cranes, cement mixers) that may be stationary, but is actively operating, at a work site.

E.5 Handling and Disposition of Excavated Soil, Groundwater, Recyclable Materials, and Wastes

Eversource's construction contractors will be responsible for the proper handling and disposal of all soils, groundwater, recyclable materials, and other wastes generated during the construction process.

Based on our current understanding of site conditions, groundwater will not be encountered during the Substation modification construction activities. Excavated soil will be handled and disposed of in accordance with regulatory requirements (depending on the type of material) and Eversource's BMP Manual.

Based on initial soil sampling, historical uses of the area, and conversations with the Town, Eversource anticipates that excavated soils will need to be managed as polluted or contaminated. Therefore, soils will be live-loaded, covered and transported to a licensed third-party location outside of Greenwich for temporary staging and disposal characterization. Deployed E&S Controls will prevent migration of lose soils during construction.

Recyclable materials will be removed from the work area and transported off-site for appropriate re-use or salvage, pursuant to Eversource policies. General waste materials and trash will be collected in receptacles at the work sites or in secured containers, either at designated locations or at contractor staging areas or yards. Containers that are not removed or emptied at the end of the work day will be inspected regularly until removed for off-site disposal.

Although temporary material storage may be required during construction, in no case will solid or liquid wastes be disposed of at the site or at contractor staging areas or yards.

E.6 Construction Lighting and Noise Mitigation

Temporary lighting may be required to accommodate work that occurs after nightfall particularly during the winter months. Temporary lighting will be focused on the targeted work areas and result in a short-term, localized effect. Post construction, Substation lighting will be similar to current operating conditions.

Construction activities will result in localized and short-term increases in ambient noise levels in the vicinity of Cos Cob Substation. Construction-related noise will result from the operation of equipment and vehicles, including vegetation removal equipment, jackhammers, drilling rigs, and cranes.

Because noise attenuates with distance, the effects of construction-generated noise will depend on the noise source location in relation to noise receptors.

The performance of these activities during non-typical work hours will be critical for completing the required work within the outage timing constraints. Eversource would request approval from the Council prior to initiating any noise generating work outside of previously approved work hours.

E.7 Site Access, Traffic Control and Construction Signs

During construction, access will be gained via the existing driveway into the Cos Cob Substation site off Sound Shore Drive. This is a shared drive with the adjacent Cos Cob Park. Peak activity will occur from June through September 2018. During this timeframe there will be an increased amount of truck traffic for removing spoils, pouring concrete, and delivering materials. Section D.1 of the draft Cos Cob D&M Plan provides the high-level construction schedule.

To minimize the potential for traffic issues during construction, Eversource (or Eversource's construction contractors) will implement access and traffic control measures, working with representatives of the Town of Greenwich, as necessary. Such measures will be implemented by Eversource's construction contractors and will include procedures for safe ingress and egress of construction equipment and other vehicles. Signs will be erected to indicate active construction and if necessary, flaggers or police personnel would be used to direct traffic. Construction signage will be consistent with the federal *Manual of Uniform Traffic Control Devices* ([MUTCD], 2009 edition, as revised May 2012, or the latest version).

Major equipment and materials (i.e. steel pole and circuit breakers) will be delivered directly to the Substation or at other approved staging areas, where it will be stored until needed. During construction there will be an increased amount of truck traffic for delivering materials, pouring concrete, and removing spoils. Please note the ingress/egress of large trucks and equipment may require momentary traffic stops at the entrance. To help mitigate potential traffic issues at the Cos Cob Park and Substation shared entrance, a Greenwich police officer or a flagger will be posted, depending on the type and level of activity.

Eversource will provide notice to the Town of any projected heavy truck traffic days (e.g., material deliveries involving semi-trucks, large concrete pours or hauling out large amounts of spoils [more than 2 trucks per/hour].) Truck traffic to support construction at Cos Cob Substation is proposed to be confined to Sound Shore Drive and the I-95 exit area(s) off Indian Field Road. Other, smaller material items such as hardware and control cable may be stored at 281 Railroad Avenue. This material would be brought to the substation as needed by the construction contractor. The contractor will generally use smaller, single axle flat-bed trucks or pick-up trucks when traversing between Cos Cob Substation and the Eversource Pole Yard or other approved staging areas. These vehicles would use Railroad Avenue to Arch Street to the I-95 exit area(s) off Indian Field Road and Sound Shore Drive. Eversource will prohibit the contractor from traversing through Bruce Park.

E.8 Construction Equipment and Vehicle Washing

With the exception of concrete trucks, no construction equipment or vehicle washing will be allowed on the Substation site or at associated staging areas. Concrete truck wash-out will be allowed only in a designated location, which will be selected to minimize the potential for off-site environmental impacts.

E&S controls deployed at the wash-out area will conform to the relevant provisions of the *2002 Connecticut Guideline for Soil Erosion and Sediment Control* as amended, and *Eversource's BMP Manual*. Excess concrete will be removed for disposal from the wash out area on a daily basis.

Water may be required for dust suppression or other construction activities. All water sources must be pre-approved by Eversource.

E.9 Post-Construction EMF Monitoring Plan

Pursuant to Condition 3(k) of the Council's Decision and Order, Eversource has prepared for the Council's review a post-construction electric and magnetic field ("EMF") monitoring plan for the entire Project. This plan is included in Appendix D.

F. Notices and Reports

F.1 Notices to the Council: Start and Completion of Construction (Including Access and Vegetation Clearing)

Pursuant to RCSA Section 16-50j-62(b)(1) and Condition 10 of the Council's Decision and Order, Eversource will provide written notification to the Council ***within two weeks prior to the commencement of the Project.***

Pursuant to RCSA Section 16-50j-62(b)(4) and Conditions 10 and 3(h) of the decision, Eversource also will provide written notification to the Council of the completion of the Project (including site restoration/rehabilitation) and the commencement of site operation.

F.2 Changes to the D&M Plan

Pursuant to RCSA Section 16-50j-62(b)(2), the Council must pre-approve any significant changes to this D&M Plan. Eversource (or its agent) will identify, track, and approve all changes, whether significant or minor. *No changes to this D&M Plan will be implemented without such documented approvals.*

Eversource will provide the Council with advance written notice whenever a significant change of an approved D&M Plan is necessary. If advance written notice is impractical, Eversource will provide immediate verbal notice to the Council, followed by written notice no later than 48 hours after the verbal notice.

RCSA Section 16-50j-62(b)(2) defines a "significant" change to and approved D&M Plan as including, but not limited to, Project modifications that entail a change in:

- The location of a wetland or watercourse crossing.
- The location of an accessway or structure in a regulated wetland or watercourse area.
- The construction or placement of any temporary structures or equipment.
- Structure type or location including, but not limited to, towers, guy wires, associated equipment, or other facility structures.
- Use of additional mitigation measures or elimination of mitigation measures.

In addition to the above criteria, Eversource proposes to define a "significant" Project change as one that would substantially reduce the amount of protection to the environment, substantially increase potential public concern, or would otherwise potentially result in a meaningful effect on the environment, the public, or other Project permits and approvals.

A request for a change to the D&M Plan may originate from the Project team, construction contractors, or others, or be driven by regulatory agency approvals issued after the Council's approval of the D&M Plans, with which the D&M Plans must be consistent. The following procedures will be used to identify, track, and obtain the approval of the Council, if required, for changes to the D&M Plans:

1. **<u>Identify Proposed Project Change.</u>** A proposed change is identified and described by the change originator and provided to Eversource. Data to be provided to Eversource by the change originator may include, for example:

- Description of the change (location, type);
- Reason/need for the change;
- Date by which the change is required (timing);
- Project schedule and cost implications (if applicable); and
- Identification of effects (if any) on the environment, cultural resources, and the public.

The Project change request will be supported by maps and drawings, as appropriate.

2. **<u>Assess Significance of Proposed Change.</u>** Eversource will evaluate each proposed change to determine whether it either:

- Qualifies as a significant change to the approved D&M Plans and thus requires advance notification to and approval by the Council; or
- Constitutes a minor change requiring only Eversource approval and subsequent reporting to the Council.

3. **<u>Significant Changes Requiring Notice to and Prior Approval by the Council.</u>** After Eversource determines that a proposed change represents a significant change to a D&M Plan requiring notification to the Council and the Council's pre-approval, Eversource will categorize each proposed change as either "urgent" or "non-urgent", based on the following:

- Urgent. A Project change will be considered "urgent" if waiting until the next regularly-scheduled Council meeting to obtain approval of the change would have a negative impact on Project construction costs or scheduling, for "urgent" changes, Eversource will provide verbal notification of the change to Council staff and will request that the Council approve the change expeditiously. Eversource will promptly implement the D&M Plan change in accordance with the Council's expedited approval (verbal or written). Not later than 48 hours after the provision of verbal notice of the D&M Plan change request to the Council, Eversource will submit written notice to the

Council. If the Council elects not to act on the proposed D&M Plan change request pursuant to the urgent (verbal) notice, Eversource will provide the Council with written notice of the proposed Project Change within 48 hours and will defer any construction activities related to the change request pending the Council's determination.

- Non-Urgent. If Eversource determines that a D&M Plan change request is "non-urgent", Eversource will provide a written request to the Council, seeking the Council's consideration of the proposed D&M Plan change at the next regularly-scheduled Council meeting.

  Pursuant to RCSA Section 16-50j-61(d), notice of a filing of changes to the D&M Plan that require Council approval will be provided to the service list and the property owner of record, if applicable, at the time that the filing is made with the Council.

4. **Non-Significant D&M Plan Change.** No Council Pre-Approval Required. Minor changes to the approved D&M Plans will require Eversource approval prior to implementation, as well as Project documentation. Documentation of minor changes will be provided in the monthly construction progress reports that will be submitted to the Council.

Figure F-1 provides a flow chart illustrating this change approval process.

F.3 Notices and Reports

Table F-1 identifies the written notices and reports that will be provided to the Council regarding the Project. Eversource will provide general updates regarding the status of the Project in the required Monthly Construction Progress Reports.

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Figure F-1, D&M Plan Change Process

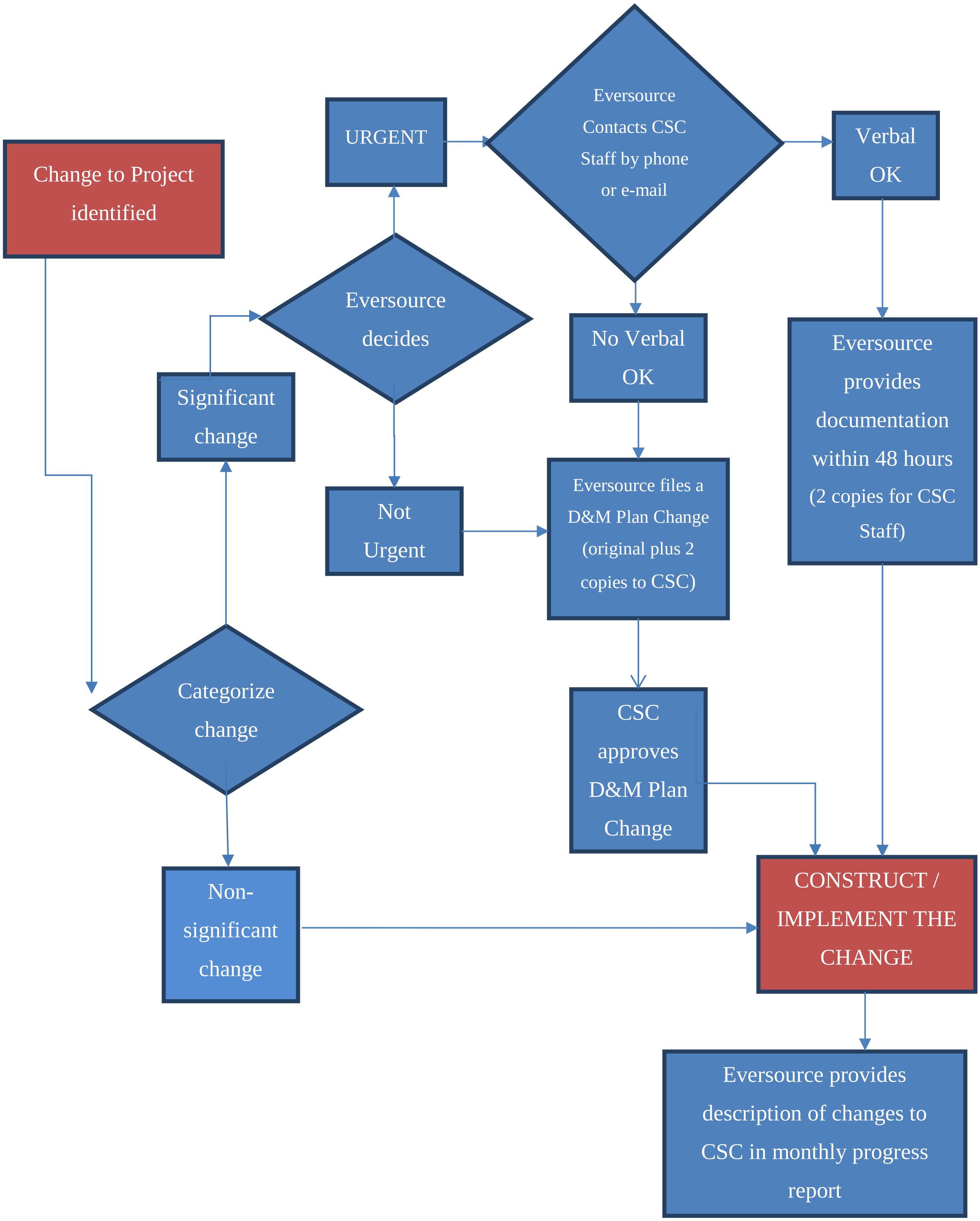

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Table F-1, Reports/Notices to be Provided to the Council

Report/Notice Type	Content
Commencement of Site Construction Activities (RCA Section 16-50j-62 & Docket No. 461A, Decision & Order, Condition 10)	The Certificate Holder shall provide the Council with written notice two weeks prior to the commencement of site construction activities.
Monthly Construction Progress Report (RCSA Section 16-50j-62(b)(3))	Monthly construction progress report will summarize the status of the Project construction (by location, percent complete) and will identify modifications to the approved D&M Plan, including both significant changes involving Council pre-approval and minor changes that did not require Council action.
Final Report (RCSA Section 16-50j-62(c))	Eversource will provide to the Council a final report no later than 180 days after the completion of all site construction and rehabilitation. The report will identify the following: 1 All agreements with abutters or other property owners regarding special maintenance precautions 2 Significant changes to the D&M Plan that were required because of property rights or underlying and adjoining owners or for other reasons 3 The location of construction materials that have been left in place, including but not limited to, culverts, erosion control structures along watercourses and steep slopes, and corduroy roads in regulated wetlands 4 The location of areas where special plantings and reseeding have been performed 5 The actual construction cost of the facility, including but not limited to the following costs: a. Clearing and access; b. Construction of the facility and associated equipment; c. Rehabilitation; and d. Property acquisition for the site or access to the site.
Completion of Site Construction, and the Commencement of Site Operation. (RCA Section 16-50j-62 & Docket No. 461A, Decision & Order, Condition 10)	The Certificate Holder shall provide the Council with written notice of the completion of site construction, and the commencement of site operation.
Operating Report (Docket No. 461A, Decision and Order, Condition 6)	Within three months after the conclusion of the first year of the operation of all Project facilities, and annually thereafter for three years, Eversource will provide to the Council a report that describes the overall condition, safety, reliability, and operation of the transmission systems.

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G. Stakeholder Outreach

G.1 Community Outreach on D&M Plan

Pursuant to Condition 3 of the Council's Decision and Order, Eversource served the D&M Plan on the Town of Greenwich for comment and all parties and intervenors as listed in the service list. Further, Eversource provided a draft copy of this D&M Plan to Town officials for review and comment in advance of submittal to the Council and offered to meet with Town Officials and brief them on the Plan and respond to questions and comments. In addition to offering meetings with town officials regarding the draft D&M Plan, in conjunction with the submission of the D&M Plan to the Council, Eversource will post the filed D&M Plan on the Project website and will provide the D&M Plan to the Town and the service list for the Project (Council Docket No. 461a). This website is accessible from the Eversource homepage (www.eversource.com). From this homepage, Project information can be accessed by clicking the "About" tab, then the "Projects and Infrastructure" tab, then select "Connecticut Transmission Projects" to view a list of the Company's ongoing and proposed projects, including this Project. Included on the website is an e-mail address (transmissioninfo@eversource.com) and a telephone number (800-793-2202) to contact Eversource for more Project information or to provide comments about the Project.

G.2 Community Outreach During Construction

Eversource will continue its outreach efforts with the Town throughout the Project's construction phases and will also notify affected stakeholders of upcoming construction activities. In addition, as described above, the Transmission Information Line phone number and email address are currently in operation and will continue to provide a means for residents, businesses, and other stakeholders to contact Project representatives during construction of the Project. The public can also access the Project website, which provides an overview of the Project, a map of the Project facilities, and contact information.

Prior to work commencing at the Substation site, a letter will be sent to abutting property owners of record (refer to Figure G-1 and Table G-1) notifying them of the upcoming work, associated schedule and Project contact information. In addition, a field outreach representative will go door-to-door to deliver additional information on what to expect during construction, as well as provide their direct contact information to these abutting property owners and businesses. Briefings will be offered to nearby residents and businesses affected by construction activities to review the construction process, key construction stages, and expected timelines. Project representatives will also contact adjacent and nearby residents and businesses to notify them of upcoming construction activities and address any specific questions or concerns. This outreach will continue throughout the extent of the work at the Substation, with project update notifications being provided via door-to-door outreach in advance of any new, noticeable work starting such as delivery of large equipment or extended work hours, among other activities. Upon speaking with abutting property owners and businesses, should a request be made for contact and updates to be made by phone or e-mail rather than by door-to-door outreach, Eversource will accommodate those requests.

G.3 Coordination with Rail Entities

The work at Cos Cob Substation will require close coordination with MNR and ConnDOT Rails. Eversource will meet with MNR and ConnDOT Rails prior to initiation of construction and throughout the duration of the Project.

C:\Users\NicoleCastro\Dropbox (APT GIS)\APT GIS Team Folder\Projects\Eversource\Greenwich_SS_Route_2017\mxd\Petition_Figures\Approved_Route\Figure G-1 Cos Cob Substation Abutters Map.mxd

Legend

- Substation Termination
- Proposed Substation Modifications
- Proposed Anti-Tracking Pad
- Proposed Cos Cob Temporary Easement (Staging Area)
- Substation Property Boundary
- Parcel Boundary
- State-Owned Property

Figure G-1
Cos Cob Substation
Abutters Map

Sound Shore Drive
Greenwich, Connecticut

EVERSOURCE ENERGY

ALL-POINTS TECHNOLOGY CORPORATION

N W E S

200 100 0 200 Feet

Map Notes:
Parcel/LLN information provided by Cornerstone in Jan. 2018.
Base Map: 2016 Orthophotography (CTECO Map Service)
Map Scale: 1 inch = 200 feet
Map Date: February 2018

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Table G-1, Cos Cob Substation Abutters List

Line List Number	Parcel Address	City	State	Owner Name
100	12 SOUND SHORE DRIVE	Greenwich	CT	CONNECTICUT LIGHT & POWER COMPANY (EVERSOURCE)
101	SOUND SHORE DRIVE	Greenwich	CT	STATE OF CONNECICUT FINANCE DEPARTMENT
102	SOUND SHORE DRIVE	Greenwich	CT	TOWN OF GREENWICH
103	SOUND SHORE DRIVE	Greenwich	CT	STATE OF CONNECICUT FINANCE DEPARTMENT
104	STRICKLAND ROAD	Greenwich	CT	METRO-NORTH RAILROAD
107	8 SOUND SHORE DRIVE	Greenwich	CT	8 SOUND SHORE ASSOCIATES LLC C/O EUGENE A. HOFFAN MANAGEMENT INC.
114	4 SOUND SHORE DRIVE	Greenwich	CT	4 SOUND SHORE DRIVE CONDO (24 UNITS - SEE INDIVIDUAL UNIT LISTING)
114.01	4 SOUND SHORE DRIVE, UNIT 1	Greenwich	CT	BRUCE L & ANN MARGARET WARWICK
114.02	4 SOUND SHORE DRIVE, UNIT 2	Greenwich	CT	IGOR TULCHINSKY
114.03	4 SOUND SHORE DRIVE, UNIT 3	Greenwich	CT	TDC JR FAMILY INVESTMENT LLC C/O CABOT-WELLINGTON LLC
114.04	4 SOUND SHORE DRIVE, UNIT 4	Greenwich	CT	ALICE P MELLY & BENSLEY TRUSTEES
114.05	4 SOUND SHORE DRIVE, UNIT 5	Greenwich	CT	VJHC DEVELOPMENT CORP C/O MOTT & PRINCE MANAGEMENT INC
114.06	4 SOUND SHORE DRIVE, UNIT 6	Greenwich	CT	LILLIAN C ANDERSON REVOCABLE TRUST
114.07	4 SOUND SHORE DRIVE, UNIT 7	Greenwich	CT	ROBERT F FULLER REVOCABLE TRUST
114.08	4 SOUND SHORE DRIVE, UNIT 8	Greenwich	CT	GENSSLER ENTERPRISES LLLP
114.09	4 SOUND SHORE DRIVE, UNIT 9	Greenwich	CT	ROBERT H, JR & ROSLIE CLARK
114.10	4 SOUND SHORE DRIVE, UNIT 10	Greenwich	CT	DAVID J & DONALD T MACNAUGHTON
114.11	4 SOUND SHORE DRIVE, UNIT 11	Greenwich	CT	HENRY VOLQUARDEN
114.12	4 SOUND SHORE DRIVE, UNIT 12	Greenwich	CT	KELESHIAN INVESTMENTS LLC
114.13	4 SOUND SHORE DRIVE, UNIT 13	Greenwich	CT	HOLLIANN LLC
114.14	4 SOUND SHORE DRIVE, UNIT 14	Greenwich	CT	MAUREEN R SMITH & RYAN J. JAMES TRUST C/O RYAN J. JAMES
114.15	4 SOUND SHORE DRIVE, UNIT 15	Greenwich	CT	JAMES A LASH & DEBORAH JONES
114.16	4 SOUND SHORE DRIVE, UNIT 16	Greenwich	CT	LUCY F GREENE TRUST C/O LUCY F GREEN
114.17	4 SOUND SHORE DRIVE, UNIT 17	Greenwich	CT	LYNDA M BRIGGS TRUST
114.18	4 SOUND SHORE DRIVE, UNIT 18	Greenwich	CT	JONATHAN P & LAURIE P NELSON, THE WATERFORD
114.19	4 SOUND SHORE DRIVE, UNIT 20	Greenwich	CT	DONALD C WAITE III LIVING TRUST
114.20	4 SOUND SHORE DRIVE, UNIT 19	Greenwich	CT	FRED G & REGINE LANGHAMMER
114.21	4 SOUND SHORE DRIVE, UNIT 21	Greenwich	CT	BOBTERRI REALTY LLC
114.22	4 SOUND SHORE DRIVE, UNIT 22	Greenwich	CT	HEIDENREIGH REAL ESTATE INVESTMENTS LLC
114.23	4 SOUND SHORE DRIVE, UNIT 23	Greenwich	CT	PER & ASTRID HEIDENREIGH
114.24	4 SOUND SHORE DRIVE, UNIT 24	Greenwich	CT	JOSEPH J SHROPSHIRE TRUST

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Appendix A: The Council’s Decision and Order and Opinion for the Project (Docket No. 461A)

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STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL
Ten Franklin Square, New Britain, CT 06051
Phone: (860) 827-2935 Fax: (860) 827-2950
E-Mail: siting.council@ct.gov
www.ct.gov/csc

November 14, 2017

Kathleen Shanley
Manager-Transmission Siting
Eversource Energy
56 Prospect Street
Hartford, CT 06103

RE: **DOCKET NO. 461A** - Eversource Energy application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance, and operation of a 115-kilovolt (kV) bulk substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation, Greenwich, Connecticut, and related substation improvements. Reopening of this docket based on changed conditions pursuant to Connecticut General Statutes §4-181a(b).

Dear Ms. Shanley:

By its Decision and Order dated November 9, 2017, the Connecticut Siting Council (Council) granted a Certificate of Environmental Compatibility and Public Need (Certificate) for the construction, maintenance, and operation of a 115-kilovolt (kV) bulk substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation, Greenwich, Connecticut, and related substation improvements.

Enclosed are the Council's Certificate, Findings of Fact, Opinion, and Decision and Order.

Very truly yours,

James J Murphy, Jr. MAB

James J. Murphy, Jr.
Vice Chairman

JJM/RDM/laf

Enclosures (4)

c: Parties and Intervenors (without Certificate enclosure)
State Documents Librarian (without Certificate enclosure)

CSC
CONNECTICUT SITING COUNCIL
Affirmative Action / Equal Opportunity Employer

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STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL
Ten Franklin Square, New Britain, CT 06051
Phone: (860) 827-2935 Fax: (860) 827-2950
E-Mail: siting.council@ct.gov
www.ct.gov/csc

CERTIFICATE

OF

ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED

DOCKET NO. 461A

Pursuant to General Statutes §4-181a(b), as amended, the Connecticut Siting Council hereby issues a Certificate of Environmental Compatibility and Public Need to Eversource Energy for the construction, maintenance, and operation of a 115-kilovolt (kV) bulk substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation, Greenwich, Connecticut, and related substation improvements. This Certificate is issued in accordance with and subject to the terms and conditions set forth in the Decision and Order of the Council on November 9, 2017.

By order of the Council,

James J. Murphy, Jr., Vice Chairman

November 9, 2017

CONNECTICUT SITING COUNCIL

CONNECTICUT SITING COUNCIL
Affirmative Action / Equal Opportunity Employer

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STATE OF CONNECTICUT)

: ss. New Britain, Connecticut November 14, 2017

COUNTY OF HARTFORD)

I hereby certify that the foregoing is a true and correct copy of the Findings of Fact, Opinion, and Decision and Order issued by the Connecticut Siting Council, State of Connecticut.

ATTEST:

Melanie A. Bachman
Executive Director
Connecticut Siting Council

I certify that a copy of the Findings of Fact, Opinion, and Decision and Order in Docket No. 461A has been forwarded by Certified First Class Return Receipt Requested mail, on November 14, 2017, to all parties and intervenors of record as listed on the attached service list, dated July 11, 2017.

ATTEST:

Lisa Fontaine
Fiscal Administrative Officer
Connecticut Siting Council

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LIST OF PARTIES AND INTERVENORS
SERVICE LIST

Status Granted	Document Service	Status Holder (name, address & phone number)	Representative (name, address & phone number)
Applicant	☒ E-Mail	Eversource Energy	Kathleen Shanley Manager-Transmission Siting Eversource Energy 56 Prospect Street Hartford, CT 06103 kathleen.shanley@eversource.com Raymond Gagnon Director – Transmission Projects Eversource Energy 56 Prospect Street Hartford, CT 06103 Raymond.gagnon@eversource.com Jeffery Cochran, Esq. Senior Counsel, Legal Department Eversource Energy 107 Selden Street Berlin, CT 06037 jeffery.cochran@eversource.com Marianne Barbino Dubuque Carmody Torrance Sandak & Hennessey LLP 50 Leavenworth Street Waterbury, CT 06702 mdubuque@carmodylaw.com Anthony M. Fitzgerald, Esq. Carmody Torrance Sandak & Hennessey LLP 195 Church Street New Haven, CT 06509 afitzgerald@carmodylaw.com
Party Approved on July 23, 2015	☒ E-Mail	Office of Consumer Counsel	Lauren Henault Bidra, Esq. Staff Attorney Office of Consumer Counsel Ten Franklin Square New Britain, CT 06051 Lauren.bidra@ct.gov

Status Granted	Document Service	Status Holder (name, address & phone number)	Representative (name, address & phone number)
Party Approved on July 23, 2015	☒ E-Mail	Office of Consumer Counsel continued	Joseph A. Rosenthal, Esq. Principal Attorney Office of Consumer Counsel Ten Franklin Square New Britain, CT 06051 Joseph.rosenthal@ct.gov
Intervenor Approved on September 1 , 2015	☒ E-Mail	Parker Stacy 1 Kinsman Lane Greenwich, CT 06830 pstacy@optonline.net	
Intervenor Approved on September 1, 2015	☒ E-Mail	Field Point Estate Townhouses, Inc.	Carissa Depetris Dwight Ueda Field Point Estate Townhouses 172 Field Point Road, #10 Greenwich, CT 06830 carissa.depetris@gmail.com d_ueda@yahoo.com
Intervenor Approved on September 1, 2015	☒ E-Mail	Christine Edwards 111 Bible Street Cos Cob, CT 06807 SeeEdwards@aol.com	
Intervenor Approved on September 1, 2015	☒ E-Mail	Richard Granoff, AIA, LEED AP Granoff Architects 30 West Putnam Avenue Greenwich, CT 06830 rg@granoffarchitects.com	
Grouped Intervenor Approved on September 1, 2015	☒ E-Mail	Anthony Crudele Bella Nonna Restaurant & Pizzeria 280 Railroad Avenue Greenwich, CT 06830 bellanonnagreenwich@gmail.com	
Intervenor Approved on September 1, 2015	☒ E-Mail	Cecilia H. Morgan 3 Kinsman Lane Greenwich, CT 06830 cecimorgan@aol.com	

Status Granted	Document Service	Status Holder (name, address & phone number)	Representative (name, address & phone number)
Grouped Intervenor Approved on September 17, 2015	☒ E-Mail	Joel Paul Berger 4208 Bell Boulevard Flushing, NY 11361 communityrealty@msn.com	
Grouped Intervenor Approved on October 1, 2015	☒ E-Mail	Meg Glass 9 Bolling Place Greenwich, CT 06830 glass50@hotmail.com	
Party Approved on January 12, 2016	☒ E-Mail	The Honorable Peter J. Tesei First Selectman Town of Greenwich 101 Field Point Road Greenwich, CT 06830 ptesei@greenwichct.org	David A. Ball, Esq. David E. Dobin, Esq. Cohen and Wolf, P.C. P.O. Box 1821 Bridgeport, CT 06601 dball@cohenandwolf.com ddobin@cohenandwolf.com (203) 368-0211 (203) 394-9901 – fax
Intervenor Approved on May 25, 2017	☒ E-Mail	Morningside Circle Association	P. Jude Collins, President Morningside Circle Association 67 Circle Drive Greenwich, CT 06830 (203) 918-1076 Mail@morningsidecircle.org

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DOCKET NO. 461A - Eversource Energy application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance, and operation of a 115-kilovolt (kV) bulk substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV underground transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation, Greenwich, Connecticut, and related substation improvements. Reopening of this docket based on changed conditions pursuant to Connecticut General Statutes §4-181a(b).	} } }	Connecticut Siting Council November 9, 2017

Findings of Fact

Introduction

1. On June 26, 2015, The Connecticut Light and Power Company doing business as Eversource Energy (Eversource), applied to the Connecticut Siting Council (Council) for a Certificate of Environmental Compatibility and Public Need (Certificate) for the construction, maintenance, and operation of a new 115-kilovolt (kV) bulk substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV underground transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation including related substation improvements in Greenwich, Connecticut (Greenwich Substation and Line Project or GSLP). (Council Administrative Notice Item No. 43)

2. The parties in the original Docket 461 proceeding were Eversource, the Office of Consumer Counsel (OCC) and the Town of Greenwich (Town). The intervenors were Parker Stacy; Pet Pantry Super Discount Stores LLC; Field Point Estate Townhouses, Inc.; Christine Edwards; Richard Granoff; Bella Nonna Restaurant and Pizzeria; Cecilia Morgan; Greenwich Chiropractic & Nutrition; Joel Paul Berger; and Meg Glass. (Record)

3. During the original Docket 461 proceeding, the Council grouped the following intervenors with the same interests pursuant to Connecticut General Statutes (C.G.S.) §16-50n(c): Bella Nonna Restaurant and Pizzeria, Greenwich Chiropractic & Nutrition, Joel Paul Berger and Meg Glass (Grouped Intervenors). (Council Administrative Notice Item No. 43)

4. On May 12, 2016 the Council voted to deny without prejudice a Certificate to Eversource for the GSLP. (Council Administrative Notice Item No. 43)

5. On May 5, 2017 Eversource submitted a Petition for Reconsideration of the Denial of a Certificate of Environmental Compatibility and Public Need for the GSLP to the Council and the service list for the original Docket 461 proceeding based on changed conditions pursuant to C.G.S. §4-181a(b) (Motion to Reopen). The Motion to Reopen requested the Council to reconsider the denial without prejudice and provided additional direct testimony on the GSLP. (Eversource 1, Vol. 1, Motion to Reopen p. 1)

6. On May 5, 2017, the Council issued a memorandum to the service list for the original Docket 461 proceeding requesting comments or statements of position in writing with respect to whether the Motion to Reopen should be granted or denied by May 18, 2017. The Town, Meg Glass, Cecilia Morgan, Field Point Estate Townhouses, Inc., and Parker Stacy submitted comments in opposition to the Motion to Reopen. (Record)

7. At a meeting held on May 25, 2017, the Council voted to grant Eversource's Motion to Reopen. The reopening allows the Council to consider changed conditions, public need and alternate locations for the proposed electric substation and electric transmission circuits (Modified GSLP). (Council Memorandum re Docket 461A, dated May 26, 2017)

8. The Modified GSLP consists of the installation of a new 115-kV bulk power substation, referred to as the Greenwich Substation, a new 115-kV electric transmission line, and modifications to the existing Cos Cob and Prospect Substations. Two project variations were proposed for the Modified GSLP: the Proposed Modified Project (PMP) and Alternate Modified Project (AMP). (Eversource 1, Motion to Reopen, pp. 6-7)

Procedural Matters

9. During a regular Council meeting on May 25, 2017, the Council voted to approve the schedule for consideration of the reopened proceeding with a public field review of the Modified GSLP and public hearing in the Town of Greenwich on July 13, 2017. On May 26, 2017, all parties and intervenors to the original Docket 461 proceeding were notified of the reopening. (Record)

10. On May 25, 2017, the Council granted intervenor status to Morningside Circle Association. (Record)

11. On May 26, 2017, pursuant to C.G.S. §16-50m, the Council sent a letter to the Town to provide notification of the scheduled public hearing and to invite the Town to participate in the proceeding. (Record)

12. Pursuant to C.G.S. §16-50m, the Council published legal notice of the date and time of the public hearing in The Greenwich Time on May 31, 2017. (Record)

13. On June 14, 2017, the Council held a pre-hearing conference on procedural matters at the office of the Council, 10 Franklin Square, New Britain, Connecticut, for parties and intervenors to discuss the requirements for pre-filed testimony, exhibit lists, administrative notice lists, expected witness lists, filing of pre-hearing interrogatories and the logistics of the public inspection of the project. (Council Pre-Hearing Conference Memoranda, dated June 2, 2017 and June 16, 2017).

14. On June 15, 2017 Greenwich Chiropractic & Nutrition withdrew their Intervenor Status. (Record)

15. On July 11, 2017, Pet Pantry Super Discount Stores LLC withdrew their Intervenor Status. (Record)

16. Pursuant to R.C.S.A. §16-50j-21, Eversource installed eleven signs, measuring four feet by six feet at various locations along the project route and at the proposed substation locations, notifying the public of the type of facility proposed, the public hearing date and contact information for the Council. (Eversource 3)

17. The Council and its staff conducted a public inspection of portions of the Modified GSLP on July 13, 2017, beginning at 2:00 p.m. Eversource provided bus transportation along the AMP transmission line route and to the existing Cos Cob substation and proposed AMP and PMP substation locations. (Council Hearing Notice dated July 24, 2015; Council Field Review Notice Memoranda, dated June 28, 2017; Transcript, July 13, 2017, 6:30 p.m. [Tr. 1], pp. 4-5)

18. Pursuant to C.G.S § 16-50m, the Council, after giving due notice thereof, held a public comment hearing session on July 13, 2017, beginning at 6:30 p.m., at the Greenwich Library, Cole Auditorium, 101 West Putnam Avenue, Greenwich, Connecticut. (Council Hearing Notice dated May 26, 2017; Tr. 1, pp. 1-5)

19. The Council continued the public hearing by holding evidentiary sessions on July 25, August 29, and September 5, 2017 at the office of the Council at 10 Franklin Square, New Britain, Connecticut. (Council Hearing Notice dated May 26, 2017; Council Continued Hearing Memoranda of July 25 and August 30, 2017; Transcript, July 25, 2017, 11:00 a.m. [Tr. 2], pp. 1-5; Transcript, August 29, 2017, 11:00 a.m. [Tr. 3] p. 1-5; Transcript, September 5, 2017, 1:00 p.m. [Tr. 4] pp. 1-4)

20. During the evidentiary hearing sessions, the Council, parties and intervenors were afforded opportunities to cross examine the applicant and other parties and intervenors. Also prior to and during the evidentiary hearing sessions, the applicant, parties and intervenors were afforded opportunities to submit pre-filed testimony and exhibits. (Tr. 2, pp. 180-190; Tr. 3, p. 120; Tr. 4 pp. 10-11, 48, 71, 81; Council Memoranda dated July 25, 2017; August 30, 2017)

21. The following parties and intervenors did not appear at any of the public hearings: Office of Consumer Counsel, Christine Edwards, Richard Granoff, Grouped Intervenors and Morningside Circle Association. (Tr. 2, pp. 180-190; Tr. 3, p. 120; Tr. 4 pp. 10-11, 48, 71, 81; Council Hearing Programs dated July 13, 2017; July 25, 2017; August 29, 2017; September 5, 2017)

22. The following intervenors did not submit any pre-filed testimony or exhibits, but availed themselves of opportunities to cross examine the applicant and other parties and intervenors during the evidentiary hearing sessions: Cecilia Morgan and Field Point Estate Townhouses, Inc. (Tr. 2, pp. 180-190; Tr. 3, p. 120; Tr. 4 pp. 10-11, 48, 71, 81; Council Hearing Programs dated July 13, 2017; July 25, 2017; August 29, 2017; September 5, 2017)

23. The following party and intervenor submitted pre-filed testimony and exhibits, and availed themselves of opportunities to cross examine the applicant and other parties and intervenors during the evidentiary hearing sessions: Town and Parker Stacy. (Tr. 2, pp. 180-190; Tr. 3, p. 120; Tr. 4 pp. 10-11, 48, 71, 81; Council Hearing Programs dated July 13, 2017; July 25, 2017; August 29, 2017; September 5, 2017)

24. The Connecticut Supreme Court acknowledges that constitutional principles permit an administrative agency to organize its hearing schedule so as to balance its interest in reasonable, orderly and non-repetitive proceedings against the risk of erroneous deprivation of a private interest. (*Concerned Citizens of Sterling v. Connecticut Siting Council*, 215 Conn. 474 (1990); *Pet v. Department of Public Health*, 228 Conn. 651 (1994); *FairwindCT, Inc. v. Connecticut Siting Council*, 313 Conn. 669 (2014))

Municipal Consultation and Community Outreach

25. Prior to submitting the Modified GSLP, Eversource, in consultation with the Town, reconsidered both distribution and transmission solutions that would meet the redefined need. Additionally, proposals for demand side measures to mitigate future load growth were discussed. (Eversource 1, Vol. 1, PFT p. 15)

26. Consultation with the Town began in late June 2016 and continued until April 21, 2017. Multiple meetings, conference calls and exchange of correspondence occurred during this time. (Eversource 1, Vol. 1, PFT p. 16)

27. During the consultation process, eight potential distribution alternatives, with variations, were discussed with various Town representatives and its consultant, Mr. Mitchell Mailman. Through its analysis, Eversource determined these potential distribution solutions were impractical, ineffective, or unreasonably expensive (refer to Attachment 3). (Eversource 1, Vol. 1, PFT p. 17)

28. Two transmission line routes were ultimately developed and submitted as part of the Modified GSLP; the PMP, preferred by Eversource, consisting of an overhead-underground transmission line route and a new air insulated substation at 290 Railroad Avenue, and the AMP, preferred by the Town, consisting of an all

underground transmission route extending from Cos Cob Substation to a new "indoor substation" at 281 Railroad Avenue. (Eversource 1, Vol. 1, PFT pp. 17-18)

29. Once details of the Modified GSLP were developed, Eversource notified property owners along the routes of both the PMP and the AMP and the abutters of the proposed and alternate locations of the new Greenwich Substation that the Petition would be filed. (Eversource 1, Vol. 1, PFT p. 22)

30. Eversource notified federal and state elected officials of the Modified GSLP during Project development. (Eversource 1, Vol. 1, PFT p. 22)

State Agency Comment

31. Pursuant to C.G.S § 16-50j(g), on May 26, 2017, the following State agencies were solicited by the Council to submit written comments regarding the proposed facility: Department of Energy and Environmental Protection (DEEP); Department of Public Health (DPH); Council on Environmental Quality (CEQ); Public Utilities Regulatory Authority (PURA); Office of Policy and Management (OPM); Department of Economic and Community Development (DECD); Department of Agriculture (DOAg); Department of Transportation (DOT); Connecticut Airport Authority (CAA); Department of Emergency Services and Public Protection (DESPP); and State Historic Preservation Office (SHPO). (Council State Agency Memorandum, dated May 26, 2017)

32. On August 31, 2017, the DOT Bureau of Public Transportation submitted correspondence to Eversource indicating that the DOT will not grant Eversource a license to install the overhead transmission line portion of the PMP within the Metro-North Railroad (MNRR) right-of-way. This determination in effect makes the AMP transmission line route the only route for Council consideration. (Eversource 5)

33. On August 31, 2017, the DOT Bureau of Engineering and Construction submitted correspondence to Eversource indicating certain project design preferences and adherence to DOT approval and permit requirements. DOT's design preferences are presented in FOF # 230, 231, 237. (DOT comments of August 31, 2017)

34. No other state agencies commented on the Modified GSLP. (Record)

Changed Conditions

35. Eversource's Motion to Reopen identifies the following changed conditions since the Council's May 12, 2016 denial without prejudice decision:
    a. Altered the design of the GSLP to account for current electric needs rather than to provide improvements with a 30 to 40 year planning horizon;
    b. Designed a system to meet reliability needs based on 130.5 MVA of peak load on the Greenwich 27.6-kV system;
    c. No longer use a ten year load growth forecasting that anticipated one percent load growth per year;
    d. Two potential GSLP project routes and substation sites were developed for consideration; the PMP which was developed based on inquiries from the Council during the Docket 461 proceeding, and the AMP which was developed upon Eversource's consultation with the Town after the Council's Docket 461 decision;
    e. Developed a transmission line route that avoids, to the extent possible, environmental impact to the Town-owned Bruce Park;
    f. Reduced costs of both the PMP and AMP from than the original GSLP presented in Docket 461;

g. Redesigned the GSLP substation that does not use costly Gas-insulated switchgear;
h. Use of Cross-linked Polyethylene (XLPE) cable instead of a High Pressure Fluid Filled cable design for all underground transmission line installations;
i. Consultations with the Town in an attempt to develop feasible alternatives as well as a feasible GSLP route; and
j. Consultations with the Town to develop demand side management programs to promote energy efficiency.

(Eversource 1, Vol. 1 Motion to Reopen pp. 1-8, PFT p. 15; Vol. 1, Ex. B, p. C-12; Tr. 2, pp. 88-89; Tr. 3, pp. 15-22)

System Planning

36. The Independent System Operator of New England (ISO-NE), a regional reliability council, is responsible for the reliable and economical operation of New England's electric power system, which includes managing the comprehensive, long-term planning of the regional power system to identify the region's electricity needs and plans for meeting those needs. (Council Administrative Notice 43, FOF # 28)

37. ISO-NE would have to review and approve the Modified GSLP to ensure it has no impact on the bulk power system. ISO-NE approved the original Docket 461 design. The Modified GSLP is a smaller design so would have less of an impact on the bulk power system than the previous project. (Tr. 2, pp. 155-156)

38. No regional planning criteria apply to the distribution voltage elements of the GSLP or to the related distribution elements of the Greenwich distribution system. ISO-NE criteria does apply to the Cos Cob Substation as it is classified as a regional network transmission facility. The Modified GSLP 115 kV lines and the new Greenwich Substation are not part of the regional transmission system. (Eversource 2, response 4)

39. The Modified GSLP is identified in the ISO-NE Regional System Plan as project no. 1533. (Eversource 2, response 5)

40. ISO-NE would also determine the appropriate cost recovery allocation for the regional transmission portion of the Project. (Tr. 2, p. 156)

41. Connecticut's Comprehensive Energy Strategy proposes further investments in grid reliability and identifies three important components to grid reliability: resource adequacy, transmission security and distribution resiliency. (Council Administrative Notice 43, FOF #30)

42. Reliability can be looked at in three parts - assuring adequate supply; frequency of interruptions; and duration of outages. The existing electric system in the Town of Greenwich is unacceptable in all three aspects. (Council Administrative Notice 43, FOF #110)

43. The distribution network in Greenwich is under PURA regulatory authority. PURA periodically reviews electric system operations. If reliability concerns are not addressed, PURA could open a docket to determine if certain measures are necessary to ensure the distribution system is operated appropriately. The North American Electric Reliability Corporation has jurisdiction over the reliable operation of a transmission system. (Tr. 2, pp. 107-108)

Public Need

Greenwich Area Electric System

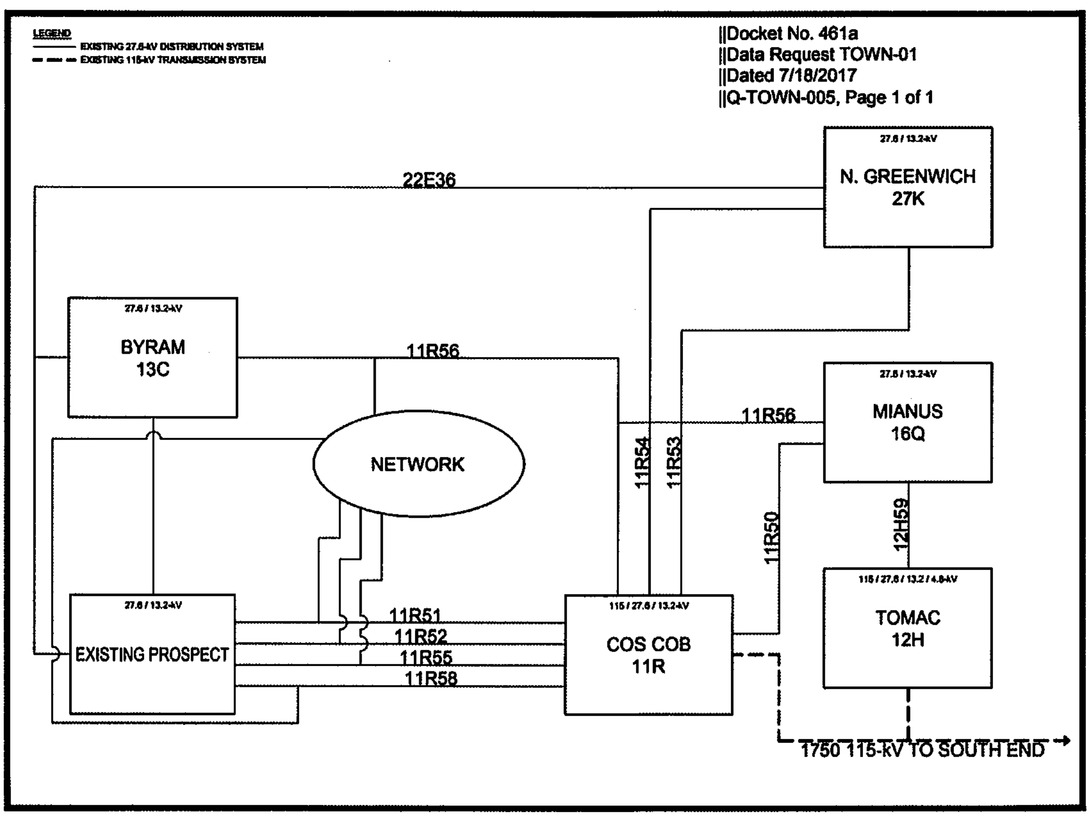
44. The electric distribution system in Greenwich was designed over 50 years ago to serve much lower load levels than those that exist today. (Council Administrative Notice 43, FOF #49)

45. Greenwich is at the farthest southwest extent of Eversource's electric network in Connecticut and is electrically isolated. There is no transmission tie to New York in the Greenwich area. (Council Administrative Notice 43, FOF # 50, #192)

46. Greenwich relies heavily on one bulk substation, the Cos Cob Substation, to provide power to three distribution substations in Greenwich; the Prospect, Byram and North Greenwich Substations. (Council Administrative Notice 43, FOF # 50)

47. A small portion of Greenwich load, in the southeast area of Town, is served by the Tomac Substation from a single 115-kV to 13.2-kV transformer. The Tomac Substation was added in the early 1990's to alleviate load at the Cos Cob Substation. It was designed as a temporary installation that did not incorporate a standard design. (Council Administrative Notice 43, FOF # 51; Tr. 3, p. 37)

48. A simplified line drawing of the existing Greenwich area electric system is presented below:



A diagram depicting the approximate service territory of each substation in Greenwich is provided in Attachment 1. (Eversource 9, response Town 5)

49. The diagram above does not depict the 1740 115-kV transmission line that also feeds the Cos Cob Substation from Stamford. Both the 1740 and 1750 lines are located on common structures. The loss of

both the 1740 and 1750 lines servicing the Cos Cob Substation would also result in the loss of electric service to almost all of Greenwich. An outage in 2012 interrupted service for both the 1740 and 1750 lines. (Council Administrative Notice 43, FOF #123; Tr. 3, pp. 11, 65-69)

Existing Cos Cob Substation

50. The Cos Cob Substation serves approximately 176 megavolt amperes (MVA) of load, and as such, is the most heavily loaded substation in Connecticut. It provides 130.5 MVA of peak load at 27.6-kV to the Prospect, North Greenwich and Byram Substations, 29.5 MVA of peak load to 13.2-kV distribution feeders and 16.4 MVA of peak load at 115-kV to an adjacent Metro North Railroad (MNRR) substation. (Council Administrative Notice 43, FOF # 54, #55)

51. The Cos Cob Substation is one of two bulk substations in Eversource's service area that has three transformers serving 27.6-kV load. No bulk substation in Eversource's service area has four or more transformers serving 27.6-kV load. (Council Administrative Notice 43, FOF #56)

52. Typically, areas with large customer load have two or more bulk substations with multiple transmission supply lines to serve that load. Such a design allows for the transfer of load from one station to another if one of the transmission sources were interrupted. (Council Administrative Notice 43, FOF #61)

53. The Cos Cob Substation has three 115-kV to 27.6-kV transformers; 1X -50.4 MVA, 2X -46.7 MVA and 3X -46.7 MVA and two 115-kV to 13.2-kV transformers. (Eversource 1, Vol. 1, PFT p. 6; Eversource 2, response 19)

Existing Prospect Substation

54. The Prospect Substation is a non-bulk substation that was designed in 1954. It has 55 MVA of capacity, served by four 27.6-kV to 13.2-kV transformers: 1X -15 MVA, 2X -12.5 MVA, 3X -12.5 MVA, 4X -15 MVA. (Eversource 1, Vol. 1, PFT pp. 5-7)

55. The Prospect Substation is only served by Cos Cob Substation. In the event the Prospect Substation is lost from service, only one percent of the Prospect load can be supplied by other sources. (Council Administrative Notice 43; FOF #80; Tr. 2, p. 144)

Existing 27.6-kV Distribution Feeders

56. Four 27.6-kV distribution circuits from Cos Cob Substation provide power to the Prospect Substation; the 11R51, 11R52, 11R55, and 11R58 circuits. (Eversource 1, Vol. 1, PFT pp. 4-5)

57. In addition to the Prospect Substation, these four feeders are designed to also feed the Greenwich Network, certain large customers, and the Byram Substation. (Eversource 9, response Town 5, Town 21; Tr. 3, pp. 28, 36)

58. The current design of having distribution feeders to collectively serve substation load, network load, and large individual customer load is unique and not a good design. It was designed approximately 40 years ago to defer electric system investments. (Town 1, p. 17; Tr. 3. pp. 36-37)

59. The Greenwich Network generally consists of the downtown area of Greenwich with the feeders sharing a common bus and multiple transformers to create a grid distribution network. An additional feeder (11R-56) also serves the Greenwich Network but does not serve the Prospect Substation. (Eversource 9, response Town 1, Town 5; Tr. 2, pp. 20-21, 176)

60. If a common distribution feeder is de-energized to accommodate work at either the Prospect Substation or within the Greenwich Network, it affects both the substation and the network. The feeders cannot be isolated so that they can serve one or the other. (Eversource 9, response Town 2; Town 1, p. 17)

61. Eversource regularly schedules outages on the feeders typically once every 24 months to perform maintenance on the 22 transformers associated with the Greenwich network. (Eversource 9, response Town 2; Tr. 2, p. 25)

62. Certain sections of the four distribution feeders were installed in the 1950's to 1960's and are at the end of their useful life. Once the Project is operational, the feeders would continue to be repaired/replaced on an as needed basis. (Tr. 2, pp. 23-25)

63. In general, outages on feeders can be caused by age, loading, operational history, especially related to temperature, and weather events such as lightning. (Tr. 3, pp. 49-51)

64. An overload on a feeder results in a loss of service life of two percent per occurrence. (Tr. 4, p. 67)

GSLP Background

65. Eversource acquired the rights to the 290 Railroad Avenue location in 1971 in anticipation of a building a new substation. (Tr. 3, p. 37)

66. Eversource identified a need for a new substation in Greenwich in 1989. At that time, it was projected that the Cos Cob Substation would reach capacity in 1994. Many reliability and load demand measures subsequently were undertaken by Eversource to delay the need for a substation. In 2011 Eversource determined there were no more measures that could be undertaken to further delay the need for a new substation closer to the load in central Greenwich. (Council Administrative Notice 43, FOF # 63 – 68; Tr. 2, pp. 99-100)

67. Eversource publically announced its intent to construct a new substation west of Indian Harbor in 2011 in response to reliability concerns that were exposed by storm events in June 2011, before the Cos Cob Substation peak load of 130.5 MVA on the 27.6-kV system occurred in 2013. (Council Administrative Notice 43, FOF # 70; Tr. 2, pp. 13-15)

68. The June 2011 event interrupted service to over 5,000 customers due to multiple outages on the underground circuits emanating from Cos Cob Substation. (Council Administrative Notice 43, FOF # 71; Tr. 3, pp. 40-41)

69. This event demonstrated to Eversource an inadequate supply of power during contingency events, an unacceptable interruption of service (over 5,000 customers lost power) and cascading effects from the interruption in service, and the inability to recover from the interruption in a timely manner (75 minutes to 18 hours). (Council Administrative Notice 43, FOF #73; Tr. 3, pp. 40-41)

70. The GSLP was submitted to the Council on June 26, 2015 as a reliability project to provide immediate load relief and add transformer capacity to the electric distribution supply system in the Town of Greenwich by establishing a new bulk substation near the center of the customer electrical demand to avoid overloads on existing electric system equipment. The new substation at 290 Railroad Avenue would be connected to the Cos Cob Substation by installing two separate 115-kV transmission circuits that extended approximately 2.3 miles from Cos Cob Substation. (Council Administrative Notice 43, FOF #1, #2)

71. As part of Eversource's need analysis in Docket 461, Eversource used load forecasting that used one percent annual peak load growth on the Cos Cob 27.6-kV system beginning with the 2013 peak load of 130.5 MVA. Overloads were projected to occur in 2017 (135.7 MVA). The projected peak loading of 131.8 MVA in 2014, 133.1 in 2015, and 134.4 MVA in 2016 did not materialize. (Council Administrative Notice 43, FOF #97; Eversource 2, response 11; Town 1, p. 20; Tr. 3, pp. 15-18)

72. The peak load on the Cos Cob 27.6-kV system from 2004 to 2016 is presented in the table below :

Cos Cob 27.6-kV System Peak - actual values												
2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
96.8	117.9	125	116.1	112.1	107.7	119.7	121.8	128.2	130.5	107.7	114.8	115.6

(Eversource 2, response 11)

73. The 2013 peak occurred over a sustained period of high temperatures combined with high humidity. Year 2012 also experienced several days of high heat and humidity resulting in a peak load of 128.2 MVA. Although 2016 was extremely hot, based on average temperature, there were no sustained days of high temperatures coupled with high humidity, to cause a similar spike in peak load. (Council Administrative Notice 43, FOF #84; Tr. 2, pp. 15-16, 19-20)

74. There was a short duration heat wave starting around July 19, 2017 throughout the State that caused a cable fault on a 27.6-kV feeder (11R56) to Byram Substation on July 20. It occurred early in the morning with a load below the cable's normal rating. The cable fault caused an overload on the Prospect 2X transformer causing a load to be shed that affected 477 customers for approximately 2 hours. For this weather event, Eversource experienced outages throughout the State, but Greenwich was the only location where customers could not be restored because the feeder capacity was not available. (Tr. 2, pp. 16-19; Tr. 3, pp. 46-47, 51)

75. Cable failures also occurred under other non-peak load conditions. Several recent distribution feeder failures not related to loading occurred as follows:
    a) The 11R52 feeder failed in July 5, 2015 at 25 MVA, below its normal rating of 33.5 MVA;
    b) The 11R56 feeder failed on July 27, 2015 at a load of 7.5 MVA, below its cable rating of 15.9 MVA;
    c) The 11R55 feeder failed on July 28, 2015 at a load of 14 MVA, below its normal rating of 32.5 MVA.

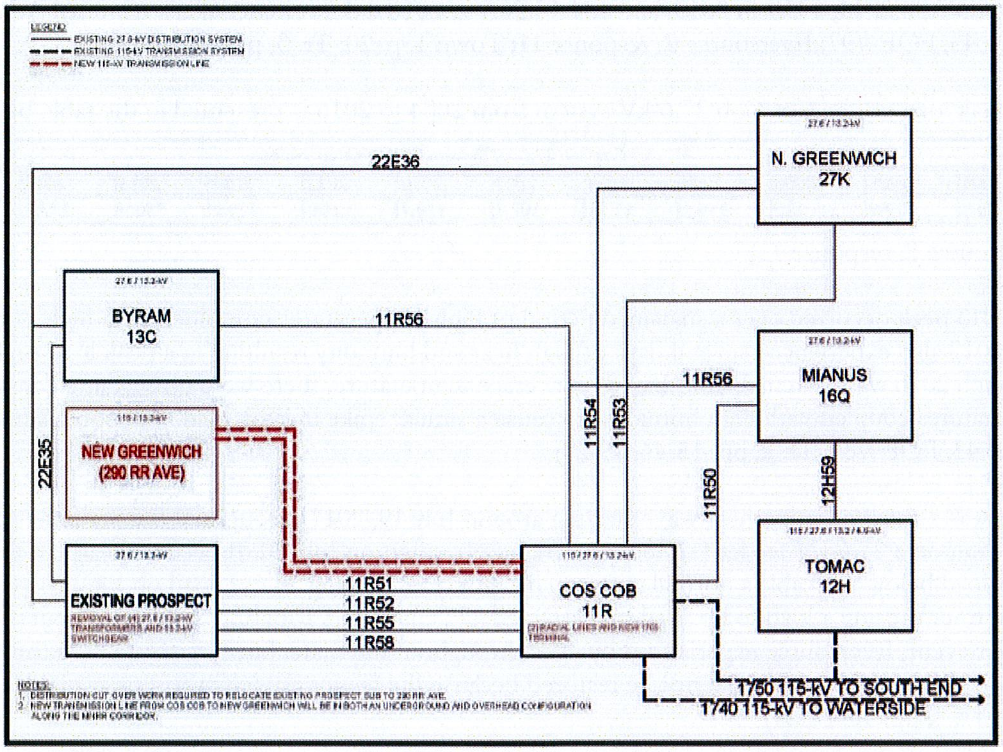
    A cable failure causes the other cables remaining in operation to carry more load. (Eversource 9, response Town 17; Tr. 3, pp. 52-57)

Modified GSLP Objectives

76. Unlike the original project, Eversource is no longer projecting load growth in this area and load growth is not part of the need for the Modified GSLP. (Eversource 1, Vol. 1, PFT, p. 15)

77. The Modified GSLP is designed to address the need for reliability improvements to the electric distribution system in Greenwich as previously identified by the Council in its Docket 461 decision. (Eversource 1, Vol. 1, PFT pp. 1-3)

78. The Modified GSLP would establish a new 115-kV to 13.2-kV substation west of Indian Harbor (Greenwich Substation), and a new 115-kV transmission line connection between the existing Cos Cob Substation and the new Greenwich Substation, as shown below:



(Eversource 10a, p. 10)

79. The Modified GSLP would function reliably with peak loads of approximately 195 MVA, representing a permissible load of 135 MVA at Cos Cob and a permissible load of 60 MVA at the new Greenwich Substation. (Eversource 1, Vol. 1, PFT pp. 8-9; Eversource 2, response 23)

80. The Modified GSLP would extend transmission level supply to the new Greenwich Substation, allowing Eversource to transfer load between the Cos Cob Substation and proposed Greenwich Substation and provide automatic electric supply backup to most of the customers in Greenwich in the event of an outage. There is no capability in the current electric system for this redundancy. This capability is consistent with Eversource's current electric system design in that if one power supply source is unavailable, the remaining bulk substation would be able to supply necessary power. (Council Administrative Notice 43, FOF # 118)

81. Two 60 MVA transformers would be installed at the new Greenwich Substation and both would operate and share the load at all times. The load at the new Greenwich Substation is expected to be approximately 51 MVA. (Eversource 9, response Town 13; Tr. 2, pp. 30-31)

82. The substation would be rated at 60 MVA, based on the loss of one transformer. (Tr. 2, pp. 30-31)

83. In the event of the loss of a single transformer (N-1) at Cos Cob Substation under 2013 peak conditions, load would be automatically transferred to the new Greenwich Substation, and the capacity of the remaining transformers at Cos Cob and the transformers at the new Greenwich Substation could serve 100 percent of the load. (Eversource 1, Vol. 1, PFT pp. 10-11)

84. In the event of a loss of one of the two transformers (N-1) at the new Greenwich Substation, the remaining transformer would be able to carry 100 percent of the load until the failed transformer was repaired/replaced. (Eversource 1, Vol. 1, PFT pp. 10-11)

85. In the event that two transformers were lost at either the Cos Cob or the new Greenwich Substation, approximately 80 percent of the load would automatically be transferred to other substations and the remaining 20 percent of the load could be restored quickly by operator adjustment. (Eversource 1, Vol. 1, PFT pp. 10-11)

86. The transmission level connection between the two substations is an improved design in that the new transmission line would provide a direct connection to the new Greenwich Substation, reducing the loading on the 27.6-kV feeder system. (Eversource 9, response Town 2)

87. This project is similar to other projects in the State to improve system reliability. In the last ten years, Eversource has constructed new substations and rebuilt others throughout the State, including in areas near the State boundary line. The new substations have been built in mostly rural areas and did not have the same physical property constraints as the two proposed locations. (Tr. 2, pp. 105-107, 114-115)

88. In most cases, the new substations are adjacent to existing transmission lines. The new Greenwich Substation is different in that a new transmission line would be extended to the new substation. (Tr. 2, pp. 106-107)

89. After the Modified GSLP is constructed, Eversource would still operate and maintain the 27.6-kV distribution feeders to serve 11 large customers out of the Prospect Substation, Byram Substation and the Greenwich Network. From 2011 to 2016, the average annual peak load from the 11 large customers is 18.4 MVA. (Eversource 9, response Town 20, response 21)

90. The Prospect Substation would be modified to a 27.6-kV switching station by removing the transformers and associated switchgear. (Eversource 1, Vol. 1, PFT, p. 9)

91. It is anticipated that by significantly offloading demand on the distribution feeders, the feeders would be able to operate with enough capacity to operate normally even under N-1 conditions, reducing the likelihood of outages that have historically occurred with this electric supply configuration. There would be enough capacity to operate in a N-2 condition. (Eversource 1, Vol. 1, PFT pp. 9-10; Council Administrative Notice 43, FOF #41, #76; Eversource 9, response Town 3, response 20; Tr. 2, p. 23; Tr. 3, p. 64, 97-98)

92. Eversource ultimately intends to serve load in Greenwich at the 13.2-kV level and retire other voltages. The Project serves as a foundation to accomplish this goal. For example the Byram Substation is not included within the Modified GSLP. Eversource would continue to examine load at both the new Greenwich Substation and the Byram Substation. If load is stable or declines due to energy efficiency measures, demand response and distributed generation initiatives, the Byram substation may be retired with the load served from the new Greenwich Substation. If load increases significantly, Eversource could recondition the substation to meet demand needs. (Tr. 2, pp. 26-27, 148-149)

93. The new Greenwich Substation would be connected through the Cos Cob Substation. The loss of both the 1740 and 1750 lines from Stamford would still cause the loss of service to most of Greenwich, including customers served by the new Greenwich Substation. (Tr. 3, pp. 67-69)

94. The GSLP would not extend existing circuits, add new circuits or provide any electrical connections or electrical supply to New York or any other area beside the Town of Greenwich. (Council Administrative Notice 43, FOF #192)

Eversource Reliability Planning

95. Eversource is not projecting load growth in this area. According to Eversource's recent evaluation and recent ISO-New England forecasts, current load growth is flat mainly due to energy efficiency, demand response and distributed generation. (Eversource 1, Vol. 1, PFT p. 15; Tr. 2, pp. 12, 88-90; Tr. 3, pp. 15-23)

96. Eversource used the 2013 peak load of 130.5 MVA on the 27.6-kV system served by the Cos Cob Substation as a baseline to conduct contingency planning studies to design the project since it was a recently recorded value that has the potential to reoccur. The 2013 peak load occurred over a sustained period of high temperatures combined with high humidity. (Council Administrative Notice 43, FOF #84; Eversource 1, Vol. 1, PFT p. 4)

97. Electric system elements of concern were studied first with all elements in service ("N-0" condition), and second, with each of the system elements out of service ("N-1" conditions). (Eversource 1, Vol. 1, PFT p. 5)

98. The results of those simulations confirmed the same reliability deficiencies in the existing electric system identified in the original Docket: potential transformer overloads at both the Cos Cob and Prospect Substations and potential overloads of the 27.6-kV distribution feeders supplying power to Prospect Substation. (Eversource 1, Vol. 1, PFT p. 5)

99. The Town concurs that utilities should plan for multiple contingencies. (Town 1, p. 15)

100. To measure reliability, Eversource predominately uses two metrics; the frequency of interruptions and the duration of interruptions. The analysis is based on circuits, not by Town. Based on these metrics, Town of Greenwich customers experience reliability far below the state average. The average customer in Connecticut has an interruption every 16 months with an average interruption time of approximately 80-85 minutes. Greenwich customers experience an interruption average below ten months with an average interruption time of approximately 110 minutes. (Tr. 2, pp. 102-104)

101. Approximately half of the outages in Greenwich are related to storm events affecting the overhead 13.2-kV distribution system. The 13.2-kV distribution system is regulated by PURA and is not the subject of the Modified GSLP. (Tr. 3, pp. 81-88, 98-99)

Contingency Modeling - Cos Cob Substation

102. Contingency modeling indicates if one of the three Cos Cob transformers is lost from service (N-1), the remaining two transformers would have to operate at their emergency ratings to carry the substation load. With the loss of the largest transformer (50.4 MVA), the substation would have a nameplate rating of 94 MVA. (Eversource 1, Vol. 1, PFT p. 6; Tr. 3, p. 17)

103. Electric power at 27.6-kV cannot be transferred to another substation to reduce power demand on the transformers; however, 6 MVA of load can be transferred to the 115-kV to 13.2-kV transformers within the substation. This small amount of load transfer is currently sufficient to relieve overloads on the two remaining transformers to enable them to operate within their normal ratings. This small reliability margin could be reduced or entirely disappear with load growth on the 13.2-kV system served directly from the Cos Cob Substation. (Eversource 1, Vol. 1, PFT pp. 7, 8)

104. In the event of a transformer outage requiring a prolonged repair, only a 30 MVA (maximum) mobile transformer can be temporarily installed within the substation, which is insufficient to support the 2013 peak loading on either the 2X or 3X transformers. Under this circumstance, the substation would have to be manually reconfigured to redistribute loading. (Eversource 1, Vol. 1, PFT pp. 7, 8)

105. The permissible load rating at Cos Cob is 135 MVA for the 27.6-kV system based on a 2-hour emergency rating. It is based on the loss of the largest transformer (50.4 MVA) where the remaining two transformers would have to operate 145 percent above their nameplate rating in order to maintain electric service. After two hours, the load on the remaining two transformers must be reduced to a 22 hour rating. Although Eversource is willing to operate equipment above nameplate ratings for short intervals, it cannot operate its equipment in their emergency ratings for extended periods of time without permanent damage to equipment. (Council Administrative Notice 43, FOF #88, #89; Tr. 3, p. 18)

Contingency Modeling - Prospect Substation

106. Prospect Substation would experience overloaded transformers at the 2013 peak load levels under N-0 conditions. One transformer (4X) would exceed its current rating at this load level. Additionally, since one transformer (3X) is not connected to any other transformer, its loss would result in service interruption (N-1 condition). If one of the other three transformers is lost (1X, 2X, 4X), the remaining two would have to operate above their ratings (N-1 condition). One of the three connected transformers (2X) is prone to failure during overload conditions. (Eversource 1, Vol. 1, PFT pp. 5-7)

107. The Modified GSLP would be able to provide 100 percent of the load in the event the Prospect Substation was lost from service. (Tr. 2, p. 144)

Contingency Modeling – 27.6-kV Feeder System

108. When the loss of one of Cos Cob to Prospect feeders (N-1) was modeled at the peak load of 130.5 MVA, the remaining cables would be overloaded, as shown below:

	Load relative to Normal cable ratings			
	O.O.S.	151%	140%	122%
	117%	O.O.S.	109%	95%
	114%	117%	O.O.S.	97%
	73%	73%	69%	O.O.S.

Normal ratings are based on a 75 percent load factor. Contingency modeling does not account for load redistribution to other circuits in the Greenwich electric system that can occur to protect system elements. (Eversource 1, Vol. 1, PFT p. 5; Tr. 3, p. 32; Tr. 4, pp. 61-62)

109. The length and impedance differences of the parallel feeders limit the capability of each feeder to accept flow from another feeder that is out of service. (Eversource 1, Vol. 1, PFT p. 5)

110. Overloads on one or more of the feeders occur on loads as low as approximately 82 MVA. (Eversource 1, Vol. 1, PFT p. 5; Eversource 2, response 16)

111. If two of the circuits are out, load would have to be shed to protect system components. (Council Administrative Notice 43, FOF #79)

112. In 2015, the Cos Cob peak demand reached 114.8 MVA and a cable fault occurred on the 11R52 feeder. Under contingency modeling the loads on the remaining three feeders would have been as follows:
   - 11R51 - overloaded by 36 percent.
   - 11R55 - overloaded by 4 percent.
   - 11R58 - loading at 65 percent of cable rating.

   In actual conditions with the loss of the 11R52 feeder, the load was redistributed to the three remaining feeders as well as to the 11R53 and the 11R54 feeders serving North Greenwich Substation. Eversource accepted overloads on the 11R53 and 11R54 feeders to minimize overloads on the 11R51 and 11R55 feeders. Even though the load was re-distributed in this fashion, the 11R51 feeder was overloaded by approximately 17 percent. No customers lost service during this fault event. (Eversource 2, response 1, Eversource 15; Tr. 4, pp. 54-62)

Project Alternatives

113. Project Alternatives were examined in detail during the original Docket 461 proceeding and included transmission, distribution, interconnection, generation, demand side management alternatives as well as energy efficiency measures. (Council Administrative Notice 43, FOF #s 132- 210)

114. In OCC's Docket 461 Post-Hearing brief of April 11, 2016, the OCC mentioned two potential alternatives they believed were not addressed sufficiently during the original proceeding: replacing the existing transformers at Cos Cob Substation with larger transformers, and retrofit the Prospect Substation in conjunction with switching some load to other substations. These potential alternatives were rejected as described below:
   a. Eversource examined the feasibility of replacing the existing Cos Cob 46.7 MVA and 50.4 MVA transformers with two 80 MVA transformers but after contacting four different manufacturers, determined there is not enough space within the substation to accommodate the physically larger replacement transformers.
   b. There is not enough room within the Prospect Substation to install an additional transformer and associated bus connection. Any load transfer to another distribution substation supplied from Cos Cob would not reduce the load on the Cos Cob 115-27.6 kV transformers. Transfer of load to Byram is not practical since it does not relieve load on the 27.6 kV circuits from Cos Cob. Transfer of load to North Greenwich is not practical since it would add load to the North Greenwich 13.2 kV feeders which would reduce the ability to accept load during contingencies. In addition, additional feeders would need to be installed to transfer load to the substation due to existing feeder constraints.

   (Eversource 2, response 27; Council Administrative Notice 43 – OCC brief)

115. After the Council's final May 2016 decision, Eversource consulted with the Town to examine potential projects to improve reliability in Greenwich. Eversource determined the eight distribution alternatives examined were inferior to the Proposed Project due to cost concerns, inferior reliability, or engineering difficulties. These rejected distribution alternatives are provided in Attachment 3. (Eversource 1, Vol. 1, PFT p. 17; Eversource 2, response 26)

116. Rebuilding the existing 27.6-kV system in Greenwich, as examined in the eight distribution alternatives, would cost more, and offer less electric system flexibility when compared to the Project, and is incompatible with Eversource's plan to convert 27.6- kV system to a multi-grounded system at 23-kV or 13-kV across its service territory in Connecticut. (Eversource 9 response Town 12)

Energy Efficiency Measures

117. Discussions with the Town also included energy efficiency initiatives for both Town owned facilities and private investments to mitigate the electrical demand and usage within the Town. The types of investments presented included energy storage, as well as distributed generation and demand response programs. A variety of incentives are available within federal and state programs for these types of investment. (Eversource 9, response Stacy 1)

118. Load demand has been offset in the Greenwich area through energy efficiency and distributed generation projects. Continued use of these measures as well as incorporation of demand response projects could lead to further decline in load demand. Future demand is expected to be flat or negative with utilization of energy efficiency, distributed generation and demand response programs. (Tr. 2, p. 12; Tr. 3, pp. 24-25)

119. Some energy efficiency results from the replacement of older residential structures with new structures that are built with improved or new building codes that can lead to energy savings when compared to older homes built to older codes. (Tr. 3, p. 199)

120. Despite energy efficiency for new residential construction, new and upgraded residential electrical service requests are for electric service that is similar to what would be considered a medium sized commercial building in other areas of the State. (Council Administrative Notice 43, FOF #47)

121. In Eversource's service territory, Greenwich residential customers use more than two times the electricity of the average Connecticut residential customer. (Council Administrative Notice 43, FOF #46)

122. The Town has undertaken some of its own measures to improve energy efficiency including five recent projects that reduced load from Town facilities by 2.3 percent. (Tr. 2, p. 163)

123. In 2016, 36 businesses participated in Eversource sponsored energy efficiency programs and through June 2017, 33 businesses participated. (Tr. 2, pp. 165-166)

124. Eversource has been sponsoring a residential weatherization/efficiency program that averaged about 150 residences per year up to 2014. In 2014, Eversource created a new program, the Clean Energy Communities Pledge that increased participation to 225 customers in 2015, and 255 customers in 2016. For year to date (July 2017) 164 customers participated. (Tr. 2, p. 166)

125. Energy efficiency for businesses in Greenwich is mostly through LED lighting upgrades. Eversource currently has six projects underway with industrial and commercial users that would result in 108 kW of demand savings. (Tr. 2, p. 167)

126. Energy efficiency measures alone cannot solve electric system reliability issues and does not eliminate the need for the Project. These measures would extend the life of the Project so that additional projects necessary to accommodate future load growth would be delayed. (Eversource 9, response Stacy 1, slide 2; Tr. 2, pp. 93-94)

127. Eversource has met with the Town five times to discuss energy efficiency within the Town and at Town facilities. (Tr. 2, pp. 90-91)

128. Measures undertaken so far include mailings to Town residences, identification of Town facilities that could be candidates for energy efficiency measures, and working with the Chamber of Commerce to establish a business outreach program. (Tr. 2, pp. 91-92)

129. Two light bulb swaps were conducted in Greenwich, one on October 25, 2016 and one on April 22, 2017. From the two events, 2,785 light bulbs were distributed and a total of 66 customers enrolled in the Home Energy Solutions program for energy efficiency services. (Eversource 12, response 62; Tr. 2, p. 112; Town 4, Schedule B, p. 3)

130. The Town of Greenwich has improved energy efficiency and reduced demand via the following:
- 1,958-kW of renewable energy capacity has been installed between 2014 and 2016.
- The Town is a "Clean Energy Community" and it has committed to a 20 percent reduction in energy use by 2018.
- Since 2008, the Town has participated in the CT Clean Energy Community, including the Solarize CT and C-PACE programs.
- The Town participated in the Sunshot Grant program aimed at streamlining the process and lowering the cost for solar PV installation and local permitting.
- The Town is working to identify distributed generation projects that produce clean energy and reduce loads and peak loads on the grid.
- Since October 2016, the Town has been partnering with Eversource and Energize Connecticut to launch the Home Energy Solutions (HES) program and the Town is encouraging Town residents to take advantage of the services. By the end of April 2017 approximately 200 audits of residences were conducted.
- Light bulb exchange program.

(Town 1, pp. 20-21; Town 3, pp. 2-6: Town 4, Schedule B, p. 3)

131. The Town has reduced municipal building energy consumption as follows:
- Over 17 percent reduction in usage at the Grass Island Wastewater Treatment Plant for years 2011 to 2016.
- Installation of solar energy at two schools, including Greenwich High School, which experienced a usage reduction of eight percent in only one year from 2014 to 2015.
- Eversource recently conducted an energy audit of the Greenwich Town Hall and expects to achieve a ten to 25 percent reduction in usage at Town Hall in the coming year.

(Town 4, Schedule, A and Schedule B)

132. Greenwich ranks 40th of 169 municipalities in the State of Connecticut and ranks 3rd of 23 municipalities in Fairfield County for installed renewable energy capacity. (Town 4, Schedule B, p. 3)

Demand Response – Distributed Generation

133. Non-transmission alternatives must be able to provide reliable power. For this project, non-transmission alternatives do not provide a viable alternative to improve the reliability issues that currently exist. (Eversource 13, response Stacy 3)

134. For distributed generation (DG), 15 customers representing approximately 0.12 MW of DG connected to Eversource's electric network from January through June 2016. There are 24 pending customer requests representing a total of 0.282 MW. (Eversource 9 - response Stacy 1, slide 14)

135. In 2015, the Council approved a 525-kW fuel cell installation at the Greenwich Hyatt Hotel. Fuel cells of this size are beneficial in reducing electric demand on a certain area since they operate as a base load unit. In comparison, a solar installation is too variable to rely on for base load reduction. (Tr. 2, pp. 131-133; Council Petition No. 1190)

136. Eversource did offer to facilitate the installation of a 10 to 15 MW fuel cell facility within the Town but the Town was not interested at this point in time. (Tr. 2, p. 133)

137. Eversource is advocating for legislation that would allow electric utilities to own and operate fuel cells. (Tr. 2, p 132)

138. Mr. Stacy requested that Eversource examine battery storage systems to provide for electrical capacity in Greenwich. Through legislative action in 2015, DEEP opened a docket requesting information on energy storage systems. As part of that docket, in 2016 Eversource requested information, including costs, from 19 manufactures of battery storage systems. Tesla was solicited for information but Eversource did not receive a response. Based on the information received, battery storage units would not be cost effective in meeting the needs of the Project. (Stacy 1; Eversource 13, response Stacy 1, response Stacy 2; Tr. 4, pp. 13-14, 16)

139. Based on the DEEP docket, Eversource, along with United Illuminating, submitted proposals for energy storage projects in the State but the proposals were rejected for being too costly. (Tr. 4, pp. 30-31)

140. Eversource had a general discussion with the Town regarding battery systems on how to potentially use a better system in conjunction with industrial sized solar installations. No specific location or user was discussed. (Tr. 2, pp. 129-130)

Modified GSLP Description

141. The Modified GSLP consists of the installation of a new 115-kV bulk power substation, referred to as the Greenwich Substation, a new 115-kV double-circuit electric transmission line, and modifications to the existing Cos Cob, and Prospect Substations. (Eversource 1, Motion to Reopen pp. 6-7)

142. The Modified GSLP proposes two new project designs for consideration; the PMP and the AMP. (Eversource 1, Motion to Reopen pp. 6-7)

143. The Modified GSLP does not include improvements to the Byram Substation. Although the equipment is obsolete, and was scheduled for removal in the original project with load transferred to the new Greenwich Substation, Eversource intends to replace aging equipment through future distribution projects not subject to Council jurisdiction. (Eversource 1, Motion to Reopen p. 6; Eversource 9, response Town 27)

144. The Modified GSLP does not include any improvements to the existing Tomac Substation nor is the substation the subject of the Modified GSLP. Tomac Substation is a single transformer bulk substation that serves a limited area of southeastern Greenwich. Tomac is served by a 115-kV transmission line (#1750) and not from Cos Cob Substation. It was designed to be supplied from a single transmission source, therefore, it cannot supply load if this single source was lost. (Eversource 9, response Town 9, response Town 11, response Town 29; Tr. 3, pp. 71-72)

145. Although not part of the Modified GSLP, Eversource intends to upgrade the transmission line feed into Tomac by replacing the existing three terminal line with two, two terminal lines. Eversource, in accordance with a system priority list, would most likely undertake this project within 10 years. (Tr. 4, pp. 38-39)

146. In addition to loads at 13.2-kV, Tomac serves approximately 1,100 customers in the Old Greenwich area at 4.8 kV with the ability for a backup of about half of the customers at peak load if the 4.8-kV transformer was lost. A project is currently proposed for 2018-2019, separate from the Modified GSLP, to improve distribution reliability by converting the 4.8-kV system to 13.2-kV, creating automatic and

manual backup for customers. (Eversource 9, response Town 17, response Town 29; Town 1, pp. 14-15; Tr. 3, pp. 72-76)

Proposed Modified Project

147. The PMP consists of an overhead-underground transmission line route and a new air insulated substation at 290 Railroad Avenue. (Eversource 1, Vol. 1, Ex. A, pp. A-5, A-11)

148. The PMP transmission line route consist of an overhead segment extending from Cos Cob Substation along the north side of the MNRR ROW to Indian Field Road, cross the MNRR and follows the south side of the MNRR to Steamboat Road. From Steamboat Road, the transmission line extends underground within Railroad Avenue to the new Greenwich Substation. (Eversource 1, Vol. 1, Ex. A, Fig. A-1)

149. Eversource developed the PMP based on direction from the Council in Docket 461 where the Council requested Eversource to examine in detail the feasibility of constructing an overhead route along portions of the MNRR. At the time of the Council's decision, this potential route was not engineered to a point where enough detail was available for full consideration by the Council. (Eversource 1, Vol. 1, Motion to Reopen p. 3)

150. The PMP design is consistent with the Federal Energy Regulatory Commission Guidelines for the Protection of Natural, Historic, Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities (FERC Guidelines) as this proposed, alternate route jointly utilizes existing rights-of-way that are occupied by different kinds of utility services. (Council Administrative Notice 9)

151. Eversource consulted with the DOT during initial development of an overhead route along the MNRR ROW, referred to as the Hybrid Alternative, during the Docket 461 proceeding. At the time of the consultation, this potential route seemed feasible. (Eversource 4, p. 2)

152. After the Council's denial of Docket 461 without prejudice, Eversource held a series of meetings with DOT representatives from October 2016 through April 2017. On April 27, 2017, Eversource and DOT came to an agreement regarding co-location issues and it appeared a DOT license for Eversource's to use the MNRR ROW would be issued. (Eversource 4, p. 2)

153. After the filing of the Motion to Reopen, Eversource was contacted by DOT Rails informing Eversource that DOT opposes installation of the PMP transmission line within the MNRR ROW. (Eversource 4, p. 3)

154. On June 14, 2017, Eversource met with a senior official at DOT Rails who indicated that the DOT would not grant Eversource a license for use of the MNRR in that such a license is inconsistent with DOT's needs and policies. (Eversource 4, Ex. A; Tr. 2, pp. 100-101)

155. On July 5, 2017 the DOT's Assistant Rail Administrator provided written correspondence to Eversource confirming the DOT's new position. The correspondence indicated the DOT is specifically opposed to 1) rail outages that will impact rail service, 2) lack of manpower to support outages and transmission line construction, 3) lack of space on exiting catenaries to support new lines, and 4) the congested nature of the existing rail corridor where the placement of a non-rail related transmission line would encumber the future expansion of rail service. (Eversource 4, Ex. A)

156. Due to the DOT's July 5, 2017 correspondence, Eversource notified the Council on July 10, 2017 that it is withdrawing the PMP transmission line route from consideration, but would continue to offer the AMP as a viable candidate for the Modified GSLP. (Eversource 5)

157. If the PMP was a viable option, its cost would have been approximately $78 million. (Eversource 1, Vol. 1, PFT p. 11)

158. The Council acknowledged withdrawal of the PMP transmission line route at the July 13, 2017 public hearing session. (Tr. 1, pp. 4-5)

Alternate Modified Project

159. The AMP consists of a 2.3 mile underground transmission route extending from Cos Cob Substation to a new "indoor substation" at 281 Railroad Avenue. A portion of the underground route extends through Town-owned Bruce Park. (Eversource 1, Ex. B, Fig A-1)

160. The AMP design is inconsistent with the FERC Guidelines as the use of park and recreation lands for ROWs are to be avoided, where practical, but if ROWs must be routed through parks and recreation lands, they should be placed in a manner so as to be least visible from public view. (Council Administrative Notice 9)

161. On July 17, 2017, Eversource submitted correspondence to the Council indicating that the AMP would now be referred to as the Proposed Project and that both the 290 Railroad Avenue and 281 Railroad Avenue parcels are viable locations for the Project substation. Details of each portion of the proposed Project are described in the following sections. (Eversource 8)

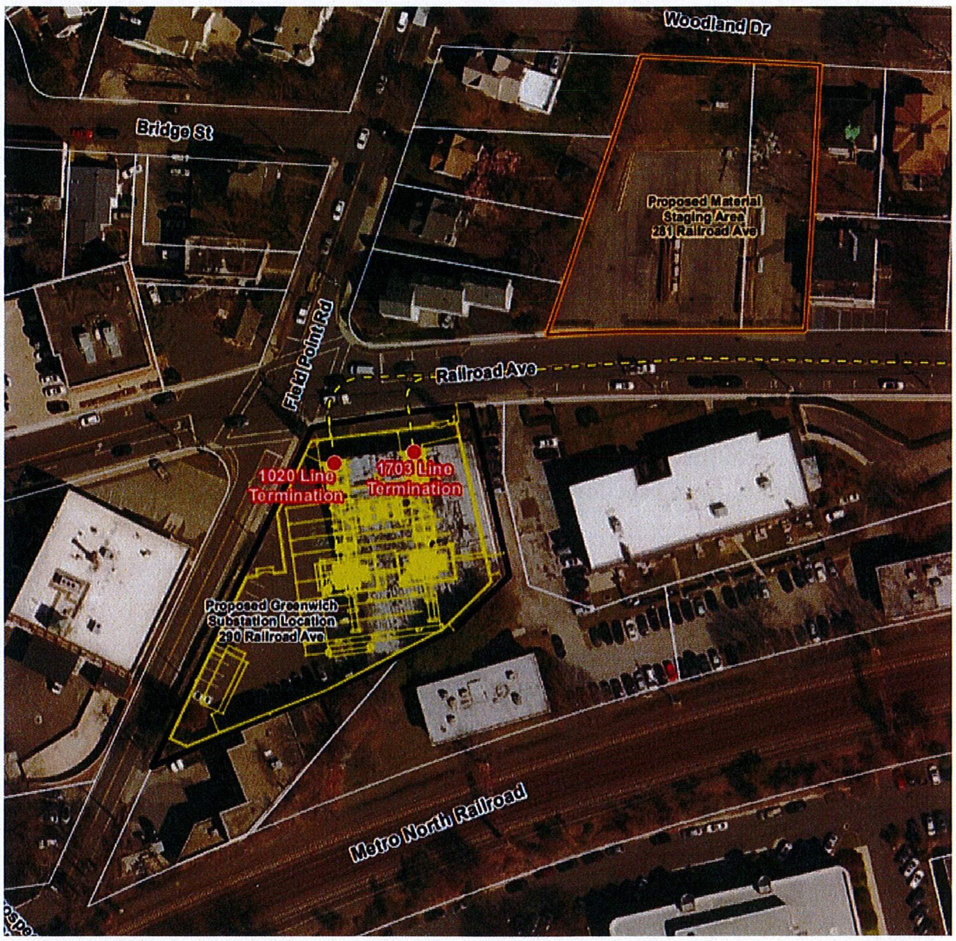
(continued next page)

Proposed Project - Description

New Greenwich Substation – 290 Railroad Avenue

162. The proposed Greenwich Substation is located on a 0.81-acre parcel within a General Business Zone at 290 Railroad Avenue in Greenwich. (Council Administrative Notice Item 43, FOF #212)

163. The parcel is located on the corner of Railroad Avenue (to the north) and Field Point Road (to the west.), The site location and general substation layout is shown below:



(Eversource 2, response 55)

164. The parcel is approximately 40 feet above mean sea level and is generally flat. (Council Admin. Notice Item 43, FOF #214)

165. The parcel is almost entirely developed with a commercial building and associated parking lot. Developed commercial properties are located across both roads and abut the parcel directly to the east and south. (Council Admin. Notice Item 43, FOF #215)

166. The area in the vicinity of the site is heavily developed consisting of a mix of industrial, commercial and residential land uses. The MNRR and Interstate 95 are to the south. (Council Admin. Notice Item 43, FOF #216)

167. The proposed 290 Railroad Avenue substation would be of an open-air insulated design. It would contain two 60 MVA 115-kV/13.2-kV transformers, one 115-kV circuit breaker, two 115-kV termination structures, four circuit switches, two disconnect switches, two terminal structures, a switchgear enclosure, a control enclosure, one lightning mast and other associated equipment. (Eversource 1, Vol. 1, p. A-6, Vol. 2, App. 4)

168. The underground transmission lines would enter the substation along Railroad Avenue to the 115-kV termination structures. (Eversource 1, Vol. 1, p. A-6, Vol. 2, App. 4)

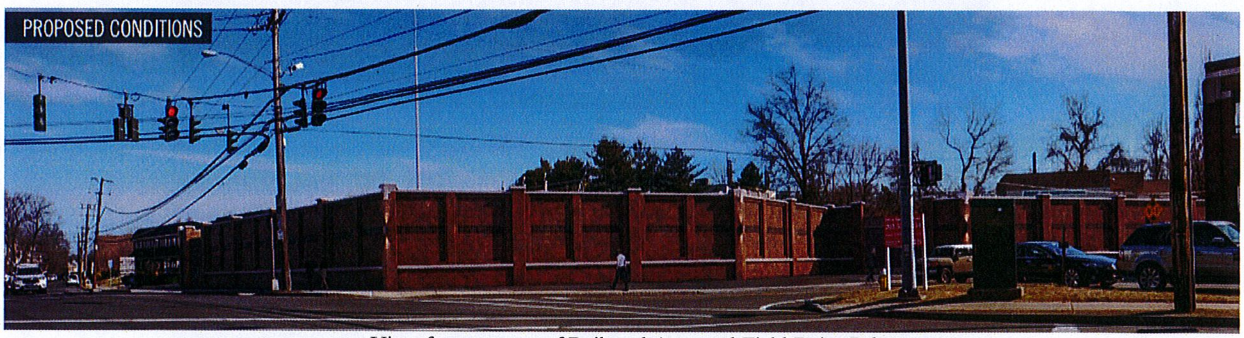
169. The distribution switchgear enclosure is located to the south of the two transformers and measures 24 feet wide by 85 feet long by 11.3 feet high. (Eversource 1, Vol. 1, p. A-6, Vol. 2, App. 4)

170. The control enclosure measures 14 feet wide by 42 feet long by 12 feet high and would be located at the southwest end of the substation. (Eversource 1, Vol. 1, p. A-6, Vol. 2, App. 4)

171. Each transformer, approximately 21.5 feet in height, would be enclosed by 22.5-foot tall firewalls on three sides. The north side of each transformer would remain open for buswork connections to each transformer. The outer firewall at each transformer would be removable to allow for maintenance access. (Eversource 1, Vol. 2, App. 4)

172. The proposed lightning mast would be 65 feet in height and would be located in the northern end of the substation, between two circuit switchers. (Eversource 1, Vol. 1, p. A-6, Vol. 2, App. 4)

173. The substation would be enclosed by a 15-foot tall brick veneer wall. The wall would be decorative in that it would utilize columns and a sill to create horizontal separation between upper and lower sections as shown in the photo-simulation below.



View from corner of Railroad Ave. and Field Point Rd.

(Eversource 1, Vol. 2, App. 4, App. 5)

174. Eversource could move the wall fronting Railroad Avenue approximately 10 feet south to create more space between the wall and existing sidewalk. (Eversource 12, response 68)

175. Eversource would be willing to install simulated windows along the brick wall. The additional cost of incorporating simulated windows is minimal. (Tr. 2, p. 77)

176. Two substation access gates are proposed; one located in the northeast corner of the substation, exiting to Railroad Avenue; and the other in the western portion of the substation, exiting to Field Point Road. (Eversource 1, Vol. 2, App. 4)

177. The southwest portion of the substation yard would have space to accommodate a mobile transformer for use during emergency situations. The use of a mobile transformer is highly unlikely in that the new Greenwich Substation is being designed to handle the load with one transformer out. A mobile unit would only be used if both transformers were inoperable. (Eversource 1, Vol. 1, p. A-6; Tr. 2, pp. 75-76, 151)

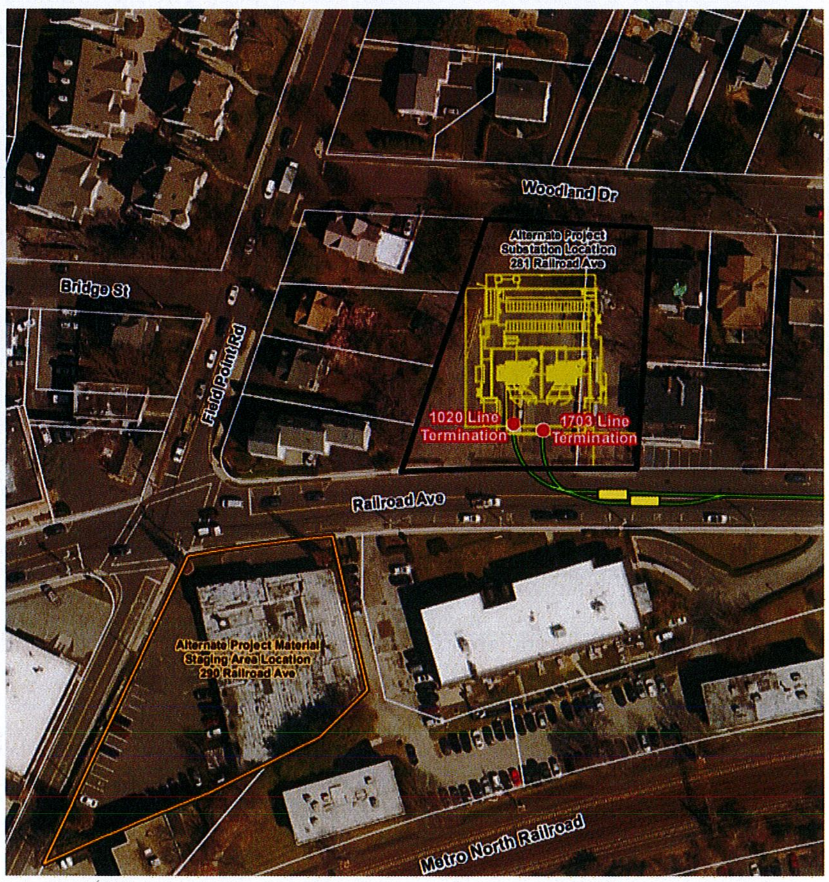
178. An "indoor substation" could be constructed at the 290 Railroad Avenue site. It would be similar in design to the alternate substation location proposed at 281 Railroad Avenue. (Eversource 1, Vol. 1, Ex. App. F-1, F-2)

179. The indoor substation is not designed for a mobile transformer. A temporary transformer could be set up on the parcel, outside of the indoor substation. Cables would have to be installed through or over the wall to connect the transformer to substation components. Temporary fencing would need to be installed to enclose the mobile transformer. (Tr. 2, pp. 81-82)

New Greenwich Substation – 281 Railroad Avenue

180. The 281 Railroad Avenue Substation site is located on a 0.75-acre parcel owned by Eversource and used to store utility infrastructure equipment. (Eversource 1, Vol. 1, Ex. B, pp. A-5, A-7, A-8)

181. Residential and mixed use development abut the site on the east and west sides. Three residential properties are located north of the site, across Woodland Avenue. A commercial plaza is located south of the site, across Railroad Avenue. The site location and general substation layout is shown below:



(Eversource 1, Vol. 1, Ex. B, pp. A-6 - A-8; Eversource 2, response 53)

182. Eversource proposes to construct an indoor substation on the parcel, measuring approximately 92 feet wide by 112.5 feet long. It would resemble a multiple unit residential building and feature a sloping, standing seam metal roof, with a maximum height of 20 feet above grade. (Eversource 1, Vol. 1 PFT, p. 15; Vol. 2, App. 9; Eversource 2, response 44)

183. Two 60 MVA 115-kV/13.2-kV transformers would be installed in the central portion of the structure and would not be covered by a roof. The roof opening above the transformers would measure approximately 80 feet by 40 feet. (Eversource 1, Vol. 2, App. 9)

184. A plug and switch system (PASS M0) would be used instead of a traditional air insulated circuit breaker. The PASS M0 design is a hybrid between a gas insulated and air insulated equipment and has a reduced footprint when compared to traditional open-air components of similar function. It contains internal current transformers, disconnect switches, and the circuit breaker. (Eversource 2, response 45)

185. The PASS M0, switchgear and control equipment would be installed within the roofed portion of the structure. (Eversource 1, Vol. 2, App. 9; Eversource 2, response 45)

186. The underground transmission lines would enter the substation from Railroad Avenue to the 115-kV termination points. (Eversource 1, Vol. 1, Ex. B, p. A-6; Vol. 2, App. 9)

187. Each transformer would be enclosed by 23.5 foot tall concrete firewalls on three sides, leaving the south side open to allow for transformer connection to the circuit breaker. The firewalls would have removable panels to facilitate transformer access, when necessary. (Eversource 1, Vol. 2, App. 9)

188. The open area above the transformers would be sufficient for air cooling. No fan units are necessary to provide additional transformer cooling during normal operations. (Tr. 2, p. 49)

189. Access to interior portions of the substation would be by six exterior doors and four roll-up doors. (Eversource 1, Vol. 2, App. 9)

190. The exterior of the substation would be designed to appear as a multistory condominium-style building with gabled roof lines, faux windows and doors and a nonflammable siding. The siding is pre-colored and may require periodic cleaning for maintenance. A photo-simulation of a potential exterior design is shown below:

View north from Railroad Avenue.
(Eversource 1, Vol. 2, App. 11; Eversource 2, response 44; Tr. 2, p. 48)

191. No perimeter fence around the substation building is proposed. All access doors would be secured from public entry. (Eversource 1, Vol. 2, App. 9; Tr. 2, pp. 51-52)

192. Lightning protection would be provided by 10-foot high air terminals around the perimeter of the roof. (Eversource 2, response 45)

193. Access to the substation would be from two paved driveways extending from Railroad Avenue to serve the east and west sides of the building. A third asphalt driveway would extend from Woodland Drive to serve the north side of the building. (Eversource 1, Vol. 2, App. 9)

194. A fully-enclosed indoor substation would have less visual impact than an open-air substation. (Eversource 14, response Town 82)

195. A mobile transformer may be able to fit on the parcel adjacent to the indoor substation. If there is limited space, Eversource would have to obtain temporary easements on adjacent property to create enough space for the transformer, cabling, and temporary fencing. (Tr. 2, pp. 81-83, 85-86)

196. An all open-air insulated substation could be constructed at the 281 Railroad Avenue site. The site is approximately 3,000 square feet smaller than the 290 Railroad Avenue site. (Eversource 1, Vol. 1, Ex. A, p. F-1, p. F-2; Tr. 2, p. 61)

197. The new Greenwich Substation is a distribution asset, and as such, the cost would have to be borne 100 percent by Connecticut ratepayers. The indoor substation design would cost approximately $1.2 million more than an open-air design with a perimeter brick wall. (Eversource 14, response 64, response 69; Tr. 2, pp. 116-117)

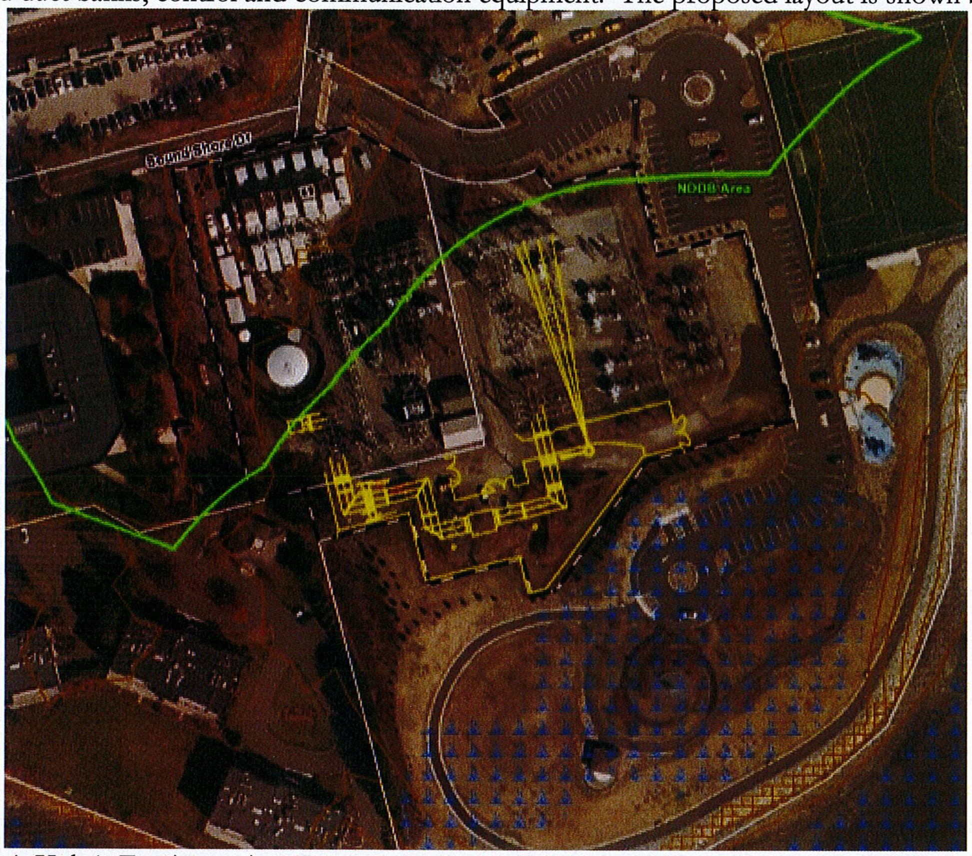
Cos Cob Substation Modifications

198. Cos Cob Substation is located off Sound Shore Drive and abuts Cos Cob Park to the east and south, a shared access driveway that serves the substation and park to the north, and a developed commercial property to the west. (Eversource 1, Vol. 2, App. 8)

199. Modifications to the Cos Cob Substation would require the substation to be expanded by 0.8-acre to the south. (Eversource 1, Vol. 1, p. A-7, Vol. 2, App. 4)

(continued next page)

200. Modifications include, but are not limited to, the addition of the following: expansion of the ring bus to install a new underground termination position, one new monopole line structure (90 feet tall), one new A-frame line structure (58 feet tall), reconstruction of the mobile transformer position, underground conduits and duct banks, control and communication equipment. The proposed layout is shown below:



(Eversource 1, Vol. 1, Ex. A, pp. A-8, B-4; Eversource 1, Vol. 2, App. 4)

201. Existing equipment that would be removed includes, but is not limited to, the following: two steel A-frames, one wood H-frame, one line trap, strain overhead bus sections, one disconnect switch, one wood pole, and one lattice structure. (Eversource 1, Vol. 1, Ex. A, p. A-8)

202. A new 7-foot tall perimeter chain link fence would be installed to enclose the expansion area. The fence would be located 6 feet from the existing Town park fence. (Eversource 2, response 30)

203. Access to the expanded portion of the substation would be from four new gates installed within the existing substation perimeter fence. (Eversource 1, Vol. 2, App. 4, App. 6)

Prospect Substation Modifications

204. Modifications at the Prospect Substation include the removal of four 27.6 kV to 13.2-kV transformers and associated 13.2-kV switchgear. The ties to the 27.6-kV feeders serving certain large customers would remain. (Eversource 1, PFT p. 9; Tr. 2, pp. 135-136)

205. The remaining equipment would not be damaged if flooding occurred. (Tr. 2, p. 147)

206. The project would require reconfiguration of the 13.2-kV feeder network in the area of the new Greenwich Substation and Prospect Substation so that the new substation connects to the existing feeders presently served from the Prospect Substation. (Eversource 9, response Town 28)

207. Seven existing 13.2-kV underground feeders serving the Prospect Substation would be relocated to the proposed Greenwich Substation. (Eversource 1, p. 9; Eversource 9, response Town 64)

115-kV Underground Transmission Line

208. The new substation would be supplied by a new underground 115-kV double circuit transmission line extending approximately 2.3 miles from the Cos Cob Substation. (Eversource 1, Vol. 1, Ex. B, p. A-8)

209. The underground route would extend from the north side of the Cos Cob Substation, head west on Sound Shore Drive, head south on Indian Field Road, crossing Interstate 95 either above ground or below ground, then head west on Bruce Park Drive, Woods Road, Davis Avenue and across Indian Harbor, then continuing west on Indian Harbor Drive, Museum Drive, Arch Street and Railroad Avenue to the new Greenwich Substation (refer to Attachment 2). (Eversource 1, Vol. 1, Ex. B, pp. A-3, A-10, A-11)

210. The underground transmission line would consist of two cross-linked polyethylene (XLPE) cable circuits, each composed of three phases. (Eversource 1, Vol. 1, Ex. B, p. A-8)

211. Each phase would consist of one 3500-kcmil copper conductor cable insulated with 0.75 inches of insulation. Each cable is approximately 4.5 to 4.6 inches in diameter. (Eversource 1, Vol. 1, Ex. B, p. A-8; Eversource 9, response Town 56)

212. The 115-kV transmission line would provide 192 megavolt amperes (MVA) of summer normal line capacity. (Eversource 1, Vol. 1, Ex. B, p. A-10)

213. The capacity of the transmission line (192 MVA) is being sized for the potential future installation of two 80 MVA transformers at the Greenwich Substation if the need arises. If two 80 MVA transformers were eventually installed, they could serve 120 percent of their normal rating (192 MVA) for up to two hours in the event of a contingency at the Cos Cob Substation. (Eversource 9, response Town 58)

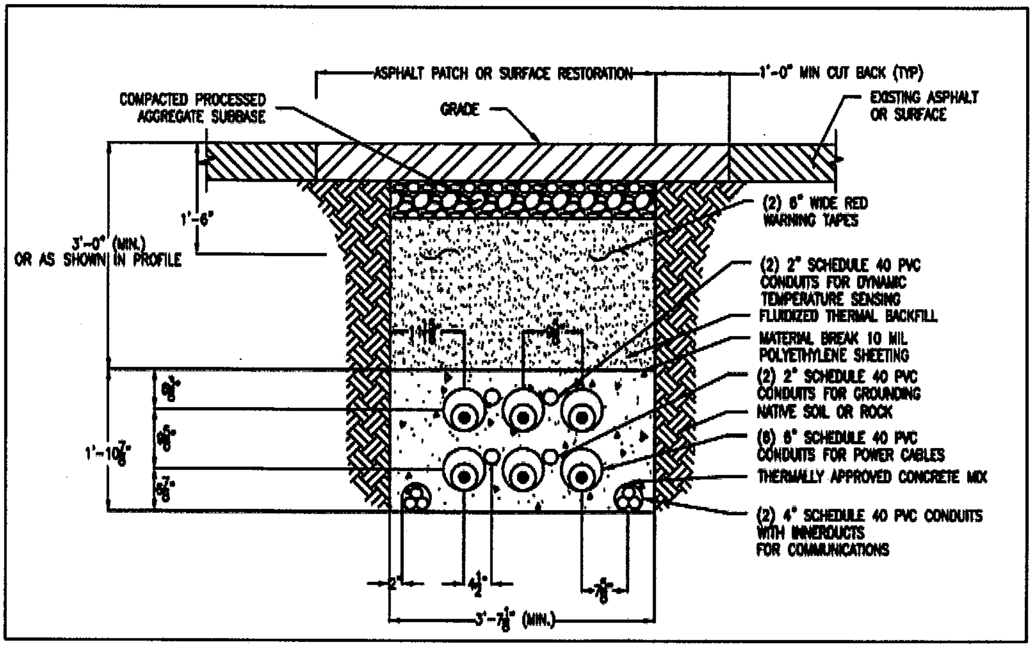
214. The size of the conductors would enable Eversource to eventually loop feed the Cos Cob Substation and the Tomac Substation. A smaller cable could be used (3,000 kcmil) to supply only the needs of the new Substation, but would not allow for a future loop feed. This proactive installation at a nominal cost (approx. $120,000) is consistent with other Eversource projects, such as Docket 474, to reduce the potential for more costly upgrades in the future. (Tr. 3, pp. 93-95)

215. For the underground installation, each cable would be installed in 6 inch diameter PVC ducts that are encased in a concrete duct bank, measuring approximately 3.6 feet wide by 4.9 feet deep. The concrete duct bank would enclose both circuits for most of the transmission line length, except near each substation where the circuits diverge from each other to reach different terminal points. (Eversource 1, Vol. 1, Ex. B, p. A-8; Eversource 9, response Town 59a, response Town 59c)

216. Smaller conduits would also be installed within the duct banks for communication, temperature monitoring and grounding. (Eversource 1, Vol. 1, p. A-8)

217. Installation of the transmission line would require a five foot deep trench that is approximately 3.6 feet wide for the double circuit duct bank, and two feet wide for the single circuit duct bank. (Eversource 1, Vol. 1, Ex. B, p. A-13; Eversource 9, response Town 59c; Tr. 2, p. 138)

218. A schematic of the duct bank with approximate dimensions is shown below:



(Eversource 1, Vol. 1, Ex. B, Figure A-3)

219. Open trenches would be covered by steel plates during non-work hours. (Tr. 2, p. 139)

220. The length of trenching and duct bank that could be installed per day would vary depending on specific subsurface conditions. Conditions could include the presence of existing subsurface infrastructure and utilities, rock and groundwater. Traffic management, material delivery and spoil removal are other site specific factors. In some areas, crews could install 50 to 75 linear feet per day but in other areas it would be significantly less. (Eversource 2, response 47)

221. Construction within Davis Avenue would require the closure of a 200 to 300-foot segment of the road each workday. There is not enough space to accommodate both traffic and construction equipment. (Tr. 2, pp. 74, 139)

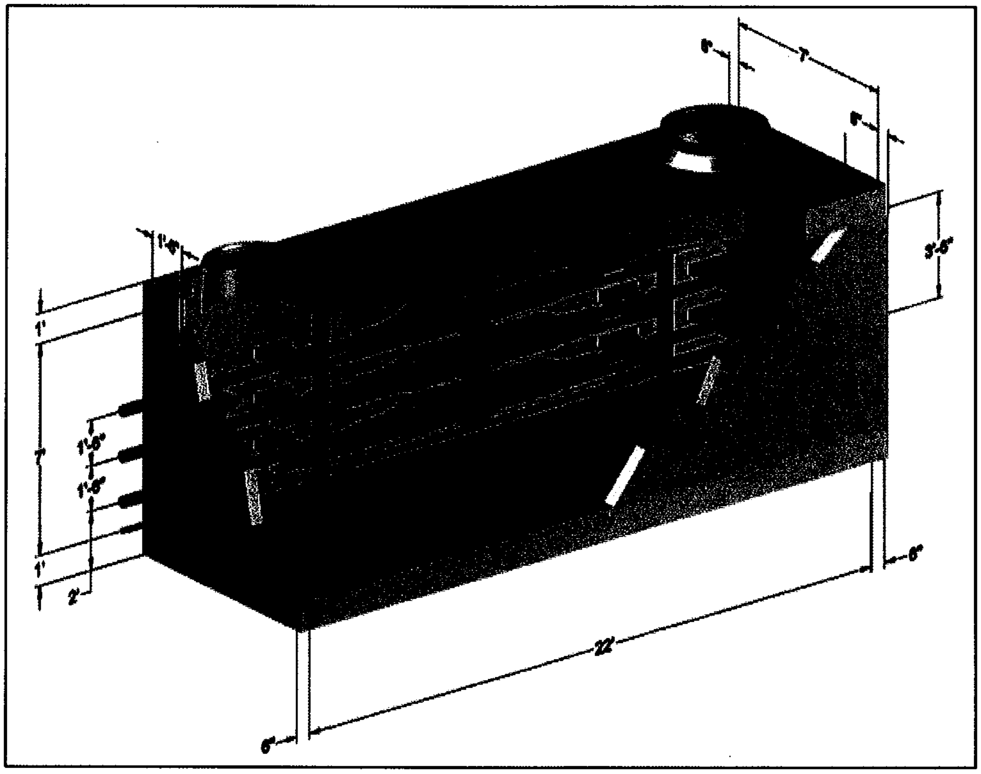
222. If work was conducted through Bruce Park in the winter, Woods Road could be closed entirely during construction to facilitate the trench installation as well as for use as a staging area. (Tr. 2, pp. 140-141)

223. The underground transmission line would require approximately six splice vault locations along the 2.3 mile route to connect segments of the transmission line. Additionally, there are two "pull through" vaults where splicing is not required but are used to facilitate connection to each substation. (Eversource 1, Vol. 2, App. 11; Eversource 9, response Town 25)

224. The average cable pull length between splice vaults is 1,800 feet (excluding "pull through" vaults). (Eversource 9, response Town 25)

225. Cable splicing would begin after the duct banks and splice vaults have been installed. One or two phases could be pulled through to each vault location per day. Cable splicing is expected to take up to two weeks at each vault location. (Eversource 2, response 47)

226. Each splice vault location consists of two separate vaults, once for each circuit, with each vault measuring approximately 23 feet long, by 8 feet wide by 9 feet high. A schematic showing the approximate dimensions of a splice vault is shown below:



(Eversource 1, Vol. 1, pp. A-9, A-10)

227. Tentative locations for splice vaults include the following; Cos Cob Substation property; off-road location on Sound Shore Drive, Indian Field Road south of I-95 Exit 4 (in-road), Woods Road (in-road), Davis Avenue west of Indian Harbor (in-road), Museum Drive near the Indian Harbor Drive intersection (in-road), Arch Street(in-parking lot), Railroad Avenue near new Greenwich Substation (in-road). (Eversource 1, Vol. 2, App. 11; Tr. 2, pp. 149-150)

228. The splice vaults would be located within road rights-of-way or on private property adjacent to road rights-of-way. Excavation for the vaults would reach about nine feet. (Eversource 1, Vol. 1, p. A-9; Tr. 2, p. 138)

229. With the exception of the Davis Avenue location, the DOT recommends installing all splice vaults outside of traveling roadways. (DOT comments of August 31, 2017)

230. The DOT recommends installing the splice vaults at Sound Shore Drive as close to the road as possible, thus maximizing the distance between the splice vaults and I-95. The splice vaults in this location are on DOT property and a DOT encroachments agreement would be required. (DOT comments of August 31, 2017; Tr. 2, p. 33)

231. The Town considers Bruce Park Drive, Woods Road, Davis Avenue, Indian Harbor Drive and Museum Drive as part of Bruce Park. The Town requests the installation of splice vaults within park roadways and not on adjacent lawn areas to avoid having permanent manhole covers within lawn areas and to avoid potential impacts to tree roots. (Tr. 3, pp. 228-231)

232. Eversource would coordinate road closures with the Town and any affected residents. (Tr. 2, pp. 75, 140)

233. The Town requests the complete repaving of all roads within Bruce Park that are disturbed during trench installation. Utility cuts within paved roads shorten their service life and reduce the investment made by the Town in paving the roads prior to the project. The roadways in Bruce Park were most likely paved five years ago and are currently in very good condition. (Tr. 3, pp. 244, 246-247)

Interstate 95 Crossing

234. Two options to cross I-95 at Field Point Road were initially presented; an above ground crossing where the transmission line is attached to the underside of the I-95 overpass bridge or a pipe jacking crossing where the transmission line would be installed under the highway. The pipe jacking method would cost $1.5 million more than the pipe attachment method. (Eversource 1, Vol. 1, Ex. B, pp. A-11, A-12; Eversource 14, response 69)

235. After the Modified GSLP was submitted, the DOT submitted correspondence on August 31, 2017 stating that it is opposed to any attachment of the transmission line to the Indian Field Road bridge. (DOT comments of August 31, 2017)

236. DOT also commented on the pipe jacking installation, stating that it requests an in-depth review of the transmission line crossing and associated jacking pit locations to ensure such installations are as far away from the I-95 travel way as possible. (DOT comments of August 31, 2017)

237. The pipe jacking installation would require 0.5-acre staging areas on each side of I-95, between the Exit 4 on and off-ramps. Vertical shafts, approximately 15 feet wide, 50 feet long, and up to 15 feet deep, would be excavated to accommodate a boring machine within the shaft pit. A 42-inch diameter bore would be made under the highway between the trench pits. A 42-inch diameter casing pipe would then be installed between the bore pits and the cable ducts pulled into the casing pipe. The remaining voids in the casing would be filled with thermal concrete. (Eversource 1, Vol. 1, Ex. B, p. A-12)

238. The pipe jacking installation is anticipated to take 30 days. No highway shutdowns are anticipated as the bore pit locations would be located as far from paved roadways as possible. (Tr. 2, p. 46)

239. To avoid the Exit 4 area of I-95, Eversource examined the feasibility of extending the transmission line along the south side of I-95. Due to limited space, an overhead route would not conform to DOT specifications. An underground route in this area would be challenging and costly to construct due to steep embankments. The existing tree buffer between the highway and abutting residences would have to be removed. (Eversource 12, response 66)

240. An option to cross under I-95 from Sound Shore Drive to Cobb Island Drive was examined and determined to be unfeasible given terrain challenges and the necessary acquisition of easements for the crossing of private property as well as along privately owned Cobb Island Drive. (Eversource 12, response 66)

241. An overhead highway crossing option was examined using tall transmission structures located in the grassed areas between the exit ramps and highway. Eversource did not pursue this option because DOT was not initially receptive and no cost savings would be gained given the structures required and highway-related construction constraints. (Tr. 2, pp. 35-36)

Indian Harbor Crossing

242. Two options were presented to cross Indian Harbor within Bruce Park, a trench crossing utilizing a cofferdam, or an above ground crossing utilizing a new transmission line/pedestrian bridge. Either crossing would be located to the north of the existing Davis Avenue bridge over Indian Harbor. The exact location of either crossing would be determined upon consultation with the Town. (Eversource 1, Vol. 1, p. A-11; Tr. 2, p. 63)

243. The existing Davis Avenue bridge has a concrete sidewalk on both sides of the road. (Tr. 3, pp. 245-246)

244. The Town requested the transmission line/pedestrian bridge crossing to avoid disturbance to Indian Harbor. The bridge would be composed of steel and concrete and would require on-site assembly. The bridge itself would have a lifespan of 50 years. The wood pedestrian decking would be approximately eight feet wide and would have a lifespan of 10 years. (Eversource 1, Vol. 1, p. A-11; Eversource 1, Vol. 2, App. 11; Eversource 2, response 48; Tr. 2, pp. 67, 69, 87)

245. The trench installation through Indian Harbor would also be located to the north of the Davis Avenue bridge. Construction through the harbor would require a cofferdam to facilitate excavation of harbor sediments and installation of the duct bank. (Eversource 2, response 49)

246. Under the FERC Guidelines, when necessary, cofferdam techniques to lay pipe or cable across streams or bodies of water should be used and banks should be stabilized to prevent erosion. (Council Administrative Notice 9)

247. The Town is not opposed to a cofferdam installation as long as it can be accomplished without the use of large cranes placed along the shoreline. (Town 1, p. 34; Tr. 3, p. 242)

248. The Indian Harbor transmission line crossing is considered a non-Pool Transmission facility, and as such, approximately 60 percent of the cost would be borne by Connecticut ratepayers. The pedestrian bridge crossing would cost approximately $1.8 million more than the trench/cofferdam crossing. (Eversource 14, response 64, response 69; Tr. 2, pp. 116-117)

Environmental Considerations

Soil and Earthwork

249. Eversource would deploy erosion and sedimentation controls in accordance with the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control* at the limits of work, adjacent to sensitive areas, and around adjacent catch basins. Erosion controls would be maintained until construction is completed and exposed soils in the work area have stabilized. (Eversource 1, Vol. 1, Ex. B, p. C-3)

250. Minimal grading would be required at the proposed substation locations. (Eversource 1, Vol. 1, Ex, A, p. B-7, Ex. B, p. C-5)

251. Trench construction in roads would be similar to other types of construction projects that occur in roads such as water main replacements or natural gas line installations. (Council Administrative Notice 43, FOF #384)

252. Trench and splice vault excavation would have minimal environmental effect as construction activities would be temporary and limited to the area in and adjacent to the trench. Suitable erosion and sedimentation controls for road excavation would be deployed, if necessary. (Eversource 1, Vol. 1 , Ex. B, p. C-3)

253. Trench backfill would be compacted to avoid subsidence. In road areas, backfilling and compaction would have to meet DOT standards. In non-paved areas, 12 to 18-inches of topsoil would be included to allow for enough soil for re-vegetation. (Council Administrative Notice 43, FOF #389)

254. Excess excavated materials and materials not suitable for trench backfill would be disposed of in accordance with applicable regulations. (Eversource 1, Vol. 1 , Ex. B, p. C-3)

255. Rock may be encountered during trench construction in off-roadway areas. Rock removal, if required, would be accomplished by mechanical methods such as rock chipping. (Tr. 2, p. 73)

Flood Zones

256. Both the 281 Railroad Avenue and 290 Railroad Avenue sites are not within the 100-year or 500-year flood zones. (Eversource 1, Vol. 1, Ex. A, p. B-8, Ex. B, p. B-2)

257. Both the 281 Railroad Avenue and 290 Railroad Avenue Substations are not within a Hurricane Surge Inundation Area as demarcated by the National Hurricane Center. (Eversource 1, Vol. 1, Ex. A, pp. B-8, B-9, Ex. B, p. B-8)

258. The Cos Cob Substation expansion area is not within a 100-year or 500-year flood zone or within a Hurricane Surge Inundation Area. (Eversource 1, Vol. 1, Ex. A, p. B-8)

259. The Project underground route would cross the 100 year flood zone in two different areas; generally along a substantial portion of Arch Street, between Steamboat Avenue and Railroad Avenue, and along Davis Avenue east and west of Indian Harbor. (Eversource 1, Vol. 2, App. 11)

260. Two splice vaults would be located within the flood zone areas. Vault components would be designed to be able to withstand flooding and saltwater intrusion. (Eversource 1, Vol. 2, App. 11; Tr. 2, pp. 153-153)

261. The underground transmission line route would extend approximately 780 feet through the 100-year flood zone and approximately 6,655 feet through Hurricane Surge Inundation Areas. The transmission lines and associated equipment would be designed to be protected from inundation. (Eversource 1, Vol. 1, Ex. B, p. C-6)

Freshwater Wetlands and Watercourses

262. Both the 281 Railroad Avenue and 290 Railroad Avenue Substation locations are used for commercial purposes and do not contain freshwater wetlands or watercourses. (Eversource 1, Vol. 1, Ex. A, p. A-26, B-9, Ex. B, p. B-2, C-4)

263. The expansion of the Cos Cob Substation would not affect any freshwater wetlands or watercourses. (Eversource 1, Vol. 1, Ex. A, Fig. B-2)

264. The Project underground route would not directly affect any freshwater wetlands. (Eversource 1, Vol. 1, Ex. B, p. C-4)

Coastal Area Resources

265. The Project is located within the coastal resource boundary, as defined by the Connecticut Coastal Management Act (CCMA). The goals and policies of the act are to "ensure that the development, preservation or use of the land and water resources of the coastal area proceeds in a manner consistent with the rights of private property owners and the capability of the land and water resources to support development, preservation or use without significantly disrupting either the natural environment or sound economic growth". (Eversource 1, Vol. 1, Ex. B, p. B-9)

266. None of the coastal resources identified by the CCMA would be adversely affected by construction or operation of the Project. (Eversource 1, Vol. 1, Ex. A, pp. C-5, C-6, Ex. B, pp. C-6 – C-8)

267. The Project transmission line route would cross Indian Harbor, a coastal resource within Bruce Park, either by a new transmission line/pedestrian bridge installation that spans the harbor or by a trench installation through the harbor. Both proposed installations would cross to the north of the Davis Avenue bridge crossing. (Eversource 1, Vol. 1, Ex. B, pp. A-11, C-4)

268. The existing Davis Avenue bridge provides some protection of areas north of the bridge from storm surge due to the presence of several culverts that restrict incoming flows. (Tr. 2, p. 64)

269. The banks of the harbor consist of stone armoring, maintained lawn, and bedrock outcrops. All disturbed areas along the banks of Indian Harbor would be protected from erosion and restored once construction is completed. (Eversource 1. Vol. 1, Ex. B, Fig. B-2, pp. B-9, C-3)

270. Construction of the transmission line/pedestrian bridge may require the installation of sheet piles of cofferdams on both banks of the harbor crossing to facilitate the installation of bridge abutment foundations. The bridge would be approximately 165 feet long. (Eversource 1, Vol. 1, Ex. B, pp. A-5, C-4)

271. The trench crossing would require cofferdams to allow for the excavation of approximately seven feet of harbor sediment to reach bedrock. The sediment displaced by the conduit/duct bank would trucked off-site, temporarily stockpiled, and characterized prior to disposal. (Eversource 1, Vol. 1, Ex. B, p. C-4; Tr. 2, p. 72)

272. The trench installation would have no effect on submarine topography or the current defined shoreline. Some leveling of the bedrock may be necessary to create a suitable surface for the duct bank. (Eversource 1, Vol. 1, Ex. B, p. C-8; Tr. 2, p. 72)

273. The trench would be installed in two parts, using two different cofferdams that extend from each shore so that the harbor would only be partially blocked at any given time, allowing for unimpeded tidal fluctuations. (Eversource 2, response 49; Tr. 2, pp. 65-66)

274. Floating work platforms may be used to install the cofferdams. (Tr. 2, pp. 67-68)

275. The proposed transmission line/ pedestrian bridge would be designed to match the existing park environment. (Eversource 1, Vol. 1, Ex. B, p. C-14)

276. Trench work within the tidal ponds would require a permit from DEEP Office of Long Island Sound Programs. The permit would detail the effects on benthic habitats and typically requires a three to one mitigation ratio for restoration activities. (Council Administrative Notice 43, FOF #415)

Groundwater

277. Groundwater in the Project area is classified as GA or GB. GA groundwater - fit for human consumption without treatment - is located primarily within the central portion of the transmission line route. GB groundwater - not fit for human consumption without treatment - is located in the western and eastern portions of the Project area. (Eversource 1, Vol. 1, Ex. B, p. B-8)

278. The Project route and facilities are not within a designated Aquifer Protection area or near any known water supply wells. (Eversource 1, Vol. 1, Ex. A, B-8, Ex. B, p. B-8)

279. Due to the highly urbanized nature of the Greenwich area, construction of the Project may encounter contaminated soils and/or contaminated groundwater. (Council Administrative Notice 43, FOF #390)

280. Groundwater may be encountered during installation of the transmission line, pipe jacking pits, or substation equipment foundations. If groundwater is encountered, appropriate sampling and dewatering would be performed in accordance with applicable regulatory agencies. Depending on the water characterization, groundwater may be discharged to catch basins, or pumped to temporary storage tanks for disposal off-site. (Eversource 1, Vol. 1, Ex. B, p. C-5)

281. Groundwater recharge would not be significantly altered by the construction of the Project. The two proposed substation sites currently consist of impervious and highly compacted surfaces. These surfaces would be replaced with trap rock in the substation yard, improving existing on-site drainage. The construction of the transmission line route would not substantially change existing drainage patterns or alter groundwater flow and recharge. (Eversource 1, Vol. 1, Ex. B, pp. C-7, C-8)

Fish, Wildlife and Habitat

282. Both the 281 Railroad Avenue and 290 Railroad Avenue Substation locations are used for commercial purposes and do not contain sensitive environmental features such as wildlife habitat, wetlands, watercourses or woodlands. (Eversource 1, Vol. 1, Ex. A, p. B-1, B-14, Ex. B, p. B-2, C-9)

283. The Cos Cob Substation area provides minimal wildlife habitat, although ospreys and other birds may use the taller structures to perch or nest. (Eversource 1, Vol. 1, Ex. A, p. B-14)

284. No State listed endangered, threatened or special concern species would be impacted by construction of the Project. (Eversource 1, Vol. 1, Ex. B, p. B-9, Vol. 2, App. 3)

285. Two federally-listed threatened species occur within the general area of the Project; the northern long-eared bat (NLEB) and the red knot, a shorebird. There are no known NLEB hibernacula or known maternity roost trees in close proximity to the Project area and adverse impacts to the NLEB are not anticipated. The red knot is found along the coastline, mostly in the intertidal zone where it forages for food or on barrier islands. Neither habitat type would be affected by the Project. (Eversource 1, Vol. 1, Ex. B, p. B-10, C-9)

286. The proposed Project would not impact any DEEP designated critical habitats. (Eversource 1, Vol. 1, Ex. A, p. B-14, Ex. B, p. B-9)

287. The proposed Project would not affect any DEEP Fisheries Management Areas. The nearest designated fishery area is associated with the Mianus River, approximately 1.2 miles northeast of the Cos Cob Substation. (Eversource 1, Vol. 1, Ex. A, p. B-16, Ex. B, pp. B-10, C-10)

288. The Project underground transmission line route would follow existing roadways adjacent to developed commercial, residential, transportation, and parkland uses. (Eversource 1, Vol. 1, Ex. A, p. B-3, Fig. B-3, Ex. B, p. C-9)

289. Use of the roadways within the park would lessen the impact on species that inhabit park grounds. (Tr. 2, p. 186)

Historic and Archeological Resources

290. No historic resources would be affected by construction of the Project. Due to previous impacts to subsurface areas, the Project would have a low probability of affecting subsurface archeological deposits. (Eversource 1, Vol. 1, Ex. A, p. C-10, Ex. B, pp. B-11, C-10, C-11)

Vegetation Management

291. Construction of the transmission line route within Bruce Park roadways is not expected to require the removal of any trees. Tree trimming, when necessary, would be conducted in consultation with the Town arborist. (Tr. 3, pp. 238-239)

292. Under the FERC Guidelines, clearing of natural vegetation should be limited to that which poses a hazard to the transmission line and determination of a hazard in critical areas, such as a park, should be a joint endeavor of the utility company and the land manager consistent with the National Electric Safety Code and other electric safety and reliability requirements. (Council Administrative Notice 9)

Parks and Recreational Resources

293. The original Project route through Bruce Park would have disturbed recreational park areas and used fluid filled piping beneath water resources. The Modified GSLP follows the existing roadways through the park to the extent practical, lessening disturbance on park lawn and recreational areas. The cable is solid, not containing any fluids that could leak if the cable was compromised. (Tr. 2, pp. 154-155)

294. The Town requests that the Project be constructed within Bruce Park in a way that is safe for the public and not detrimental to the aesthetics or use of the park. (Tr. 3, pp. 140-142)

295. Eversource has worked with the Town to lessen the impact on Bruce Park and would continue to develop the logistics of the Project with the Town prior to and during construction. (Tr. 2, pp. 184-188)

296. The Cos Cob Substation expansion area would remain on Eversource and State of Connecticut property and would not affect recreational facilities in Cos Cob Park. (Eversource 1, Vol. 1, Ex. A, p. B-3)

297. Temporary effects to park areas may include the disruption of land/recreation use proximate to construction activities. (Eversource 1, Vol. 1, Ex. A, p. C-12, Ex. B, pp. C-13, C-14)

Statutory Facilities

298. The Project area contains numerous statutory facilities that are defined under C.G.S § 16-50p(a)(3)(D) to include residential areas, private or public schools, licensed child day care facilities, licensed youth camps or public playgrounds adjacent to 345-kV transmission lines. (Eversource 1, Vol. 1, Ex. A, p. B-17, Ex. B, p. B-12, Vol. 2, Ex. 11)

299. The 290 Railroad Avenue Substation site is approximately 560 feet north of the Boys & Girls Club of Greenwich at 4 Horseneck Lane. The substation site predominately abuts commercial uses with the exception of a residential/commercial building located on the north side of Railroad Avenue, across from the site. (Eversource 1, Vol. 1, Ex. A, pp. B-17, C-12)

300. The 281 Railroad Avenue Substation is approximately 480 feet north of the Boys & Girls Club of Greenwich at 4 Horseneck Lane. The site abuts developed residential areas to the east and west. (Eversource 1, Vol. 2, Ex. 11)

301. The Project transmission line route would be installed within existing roadways adjacent to residential areas and through Bruce Park. It would be approximately 375 feet north of The Boys & Girls Club of Greenwich where it extends along Railroad Avenue and 225 feet west of a child daycare within the Putnam Indian Field School at 101 Indian Field Road. (Eversource 1, Vol. 1, Ex. B p. B-12, Vol. 2, App. 11)

302. Construction and operation of the Project would have no long term permanent effects on adjacent statutory facilities. (Eversource 1, Vol. 1, p. C-12)

Air Quality

303. Construction of the Project would have short-term, localized effect on air quality, mostly from dust and equipment emissions. In order to minimize dust, Eversource would limit the extent of exposed/disturbed areas and install temporary gravel tracking pads wherever necessary to prevent dirt from being tracked onto public roadways. Water may be used to control dust emissions, as needed. (Eversource 1, Vol. 1, Ex. A, p. C-12)

304. Construction vehicle emissions would be limited by requiring contractors to properly maintain construction equipment and vehicles, and by minimizing the idling time of diesel construction equipment in accordance with DEEP regulatory standards. (Eversource 1, Vol. 1, Ex. B, p. C-13)

Noise

305. The existing noise environment along the Project route is dominated by urban noise related to local and highway traffic, the MNRR rail corridor and residential and commercial land uses. (Eversource 1, Vol. 1, Ex. B, p. B-11)

306. Pursuant to R.C.S.A. §22a-69-1.8(h), noise created from construction activities is exempt from the State Noise Control Regulations. (Eversource 1, Vol. 1, Ex. B, p. C-11)

307. Post-construction noise from the new substations would be predominately from the new transformers. Additional noise would originate from infrequent switching and circuit breaker operations. (Eversource 1, Vol. 1, Ex. A, p. C-11, Ex. B, p. C-12)

308. The Town of Greenwich Noise Ordinance sets noise limits based on zoning districts. The 290 Railroad Avenue site is in a General Business (GB) zone and abuts property zoned GB. The permitted Greenwich noise level for a GB emitter to GB receptor is 62 dBA. (Eversource 2, response 54)

309. The 281 Railroad Avenue site is partially within a GB zone and a Residential zone (R-6) The site abuts both a GB zone, generally abutting Railroad Avenue, and a R-6 zone generally abutting Woodland Drive. The permitted Greenwich noise level for a GB emitter to a R-6 receptor is 55 dBa day/45 dBA at night. (Eversource 1, Vol. 1, p. B-1, C-12; Eversource 2, response 54)

310. Post-construction noise levels adjacent to the 290 Railroad Avenue open-air substation would not exceed the Town's regulatory level at the abutting GB-zoned properties (61 dBA). The projected noise levels would be less than 45 dBA, the most restrictive State and Town regulatory level. (Eversource 1, Vol. 1, Ex. A, p. C-11; Eversource 2, response 54)

311. Post-construction noise levels adjacent to the 281 Railroad Avenue "indoor substation" would not exceed 45 dBA, the most restrictive State and Town regulatory level. The transformer firewalls and a sound attenuation baffle installed along the north edge of the roof opening above the transformers would mitigate sound levels at adjacent residential properties. (Eversource 1, Vol. 1, Ex. B, p. C-12; Eversource 1, Vol. 2, App. 9; Eversource 2, response 54)

312. A fully-enclosed indoor substation would be significantly more effective at reducing sound levels from substation equipment than an open-air substation surrounded by a brick wall. (Eversource 14, response Town 82; Town 1, p. 28; Tr. 2, pp. 84-85)

313. An emergency generator would operate during emergencies such as "black out" conditions. The emergency generator would also operate occasionally for maintenance and testing purposes during normal business hours. According to R.C.S.A. §22a-69-1.8, noise created as a result of, or relating to, an emergency, such as an emergency backup generator, is exempt from the State Noise Control Regulations. (Eversource 1, Vol. 1, Ex. B, p. C-12)

314. Post-construction noise at the Cos Cob Substation would not increase current steady state noise emissions. (Eversource 1, Vol. 1, Ex. A, p. C-12)

Public Safety

315. The proposed 290 Railroad Avenue open-air substation would be enclosed by a 15-foot tall perimeter brick wall. The wall would serve as both a security fence and as a fire barrier. (Eversource 1, PFT, p. 9; Tr. 4, p. 45)

316. The proposed 281 Railroad Avenue "indoor substation" would have outer doors and roll up gates, preventing access. The exterior siding of the substation would be fireproof. (Eversource 1, Vol. 2, App. 9; Eversource 2, response 44)

317. A fully-enclosed indoor substation would have a higher level of security than an open-air substation. (Eversource 14, response Town 82)

318. The transformers at both substations would be enclosed by firewalls that extend slightly above the top of the transformers. (Eversource 1, Vol. 2, App. 4, App. 9)

319. The indoor substation would be designed in accordance with applicable safety codes. Additional training for Town emergency responders would be necessary to ensure safe entry into the indoor substation and for proper response to certain emergencies. (Tr. 2, pp. 49-50)

320. The indoor substation would feature heat detectors and water and chemical fire suppression systems. The type of system would depend on the components being protected as well as the on-site drainage system's ability to contain released water. (Tr. 2, pp. 50-51)

321. A pole-mounted transformer caught fire in June 2015 at the Cos Cob Substation. The fire was localized to the pole-mounted transformer. Protective systems de-energized the transformer and adjacent bus. The fire did not affect operation of Eversource's large bulk power transformers, DOT's MNRR transformers or equipment within an adjacent NRG substation. (Eversource 2, response 56; Tr. 2, pp. 52-53)

322. Emergency response to a substation requires an Eversource representative to be on-site to properly de-energize system components to ensure safety of the local emergency responders. Eversource's response time to the Cos Cob substation for the June 2015 pole-mounted transformer fire was over an hour. Since that time, Eversource has modified personnel dispatch times and has altered worker shifts to ensure there is more timely response to emergency calls at substations. (Tr. 2, pp. 53-55)

323. There are no standards or safety codes that would prevent an open-air substation from being constructed at 290 Railroad Avenue, adjacent to the AIRGAS commercial property. (Tr. 2, pp. 58-61, 126; Tr. 3, pp. 244-245)

324. Trees that overhang the perimeter substation fence would be trimmed as necessary. Trees that are deemed a hazard to the substation would be removed. (Eversource 12, response 67)

325. In December 2009, President Obama proclaimed power grids as critical infrastructure vital to the United States. The Department of Homeland Security, in collaboration with other federal stakeholders, state, local, and tribal governments, and private sector partners, has developed the National Infrastructure Protection Plan to establish a framework for securing our resources and maintaining their resilience from all hazards during an event or emergency. (Council Administrative Notice 3)

326. On February 12, 2013, President Obama signed Executive Order 13636 on Improving Cyber Security for Critical Infrastructure, along with an accompanying Presidential Policy Directive on Critical Infrastructure Security and Resilience. The order established the U.S. policy to "enhance the security and resilience of the nation's critical infrastructure." The Secretary of Homeland Security has been given the overall responsibility for critical infrastructure protection, and identifies the Department of Energy as the sector-specific agency responsible for the energy sector. The Department of Energy may draw upon the North American Electric Reliability Corporation's (NERC) expertise. (Council Administrative Notice 4; Council Administrative Notice 58)

327. NERC developed Physical Security Reliability Standard CIP-014-1 to address threats and vulnerabilities to the physical security of critical infrastructure on the bulk power system. CIP-014-1 consists of standards and requirements related to security of electronic perimeters, protection of critical cyber assets including personnel, training, security management and disaster recovery planning. CIP-014-1 requires transmission owners to deploy systems for monitoring security events and to have comprehensive contingency plans for cyberattacks, natural disasters and other unplanned events. (Council Administrative Notice 8; Council Administrative Notice 58, p. 9)

Electric and Magnetic Fields

328. Electric fields (EF) and magnetic fields (MF) are two forms of energy that surround an electrical device. Transmission lines are a source of both EF and MF. In North America, electric utilities provide power at 60 hertz (oscillates 60 times per second). (Council Administrative Notice Item 27; Eversource 1, Vol. 1, Ex. A, p. D-1)

329. Electric fields result from voltages applied to electrical conductors and equipment. Appliances within homes and the workplace are the major sources of electric fields indoors, and power lines are the major sources of electric fields outdoors. EF levels decrease rapidly with distance from the source, diminishing even faster when interrupted by conductive materials, such as buildings and vegetation. The scientific community does not regard EF levels to be a concern to the general public and thus studies of health effects from electrical transmission lines and equipment has focused on MF. (Council Administrative Notice Item 27; Eversource 1, Vol. 1, Ex. A, p. D-1)

330. Magnetic fields are produced by the flow of electric currents. The level of a magnetic field is commonly expressed as magnetic flux density in units called gauss, or in milliGauss (mG). The magnetic field level at any point depends on characteristics of the source, which can include the arrangement of conductors, the amount of current flow through the source, and its distance from the point of measurement. MF levels decrease rapidly with distance from the source but are not easily interrupted as they pass through most materials. ((Council Administrative Notice Item 27; Eversource 1, Vol. 1, Ex. A, p. D-1)

331. In the United States, no state or federal exposure standards for 60-hertz MF based on demonstrated health effects have been established. Nor are there any such standards established world-wide. However, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) has established a level of 2,000 mG, based on extrapolation from scientific experimentation, and the International Committee on Electromagnetic Safety (ICES) has calculated a guideline of 9,040 mG for exposure to workers and the general public. (Council Administrative Notice Item 27; Eversource 1, Vol. 1, Ex. A, p. D-1)

332. The Council has developed its *"Electric and Magnetic Field Best Management Practices for the Construction of Electric Transmission Lines in Connecticut"* (EMF BMPs) to address concerns regarding potential health risks from exposure to EMF from transmission lines. The document presents scientific knowledge about health risks, outlines the Council's policy of prudent avoidance, and describes a wide range of best-practice MF management designs. (Council Administrative Notice Item 27; Eversource 1, Vol. 1, Ex. A, p. D-1)

333. In accordance with the Council's EMF BMPs, Eversource is required to provide an analysis of recent scientific literature regarding MF exposure, an analysis of pre and post construction MF levels, and develop a Field Management Design Plan and associated MF reduction strategies in areas of particular interest, as long as such designs do not compromise system reliability or worker safety, or environmental and aesthetic project goals. (Council Administrative Notice Item 27)

334. Eversource has complied with the Council's EMF BMP by reviewing recent scientific literature and exposure standards related to MF in Docket 461, provided pre- construction measurement and post construction calculations, and reviewed the need for a Field Management Design Plan with MF reduction strategies. (Council Administrative Notice Item 27; Eversource 1, Vol. 1, Ex. A, p. D-19)

335. The existing distribution lines are the major source of MF in the project area. For example, measurements of existing MF collected near 281 Railroad Avenue range from 3.7 to 9.3 mG. Another source is the MNRR where measurements collected at the Indian Field Road overpass range from 1.5 to 23.1 mG. (Eversource 1, Vol. 1, Ex. A, pp. D-4, D-5, Ex. B, p. D-1)

336. MF from the Project underground transmission line during average annual load would be a maximum of 6.7 mG directly above the duct bank within the road, decreasing to 0.6 mG along the edge of the road. For splice vault locations, the MF would be a maximum of 28.7 mG above the vault decreasing to 8.1 mG along the edge of the road. (Eversource 1, Vol. 1, Ex. B, p. D-1)

337. MF for the transmission line installed within the optional pedestrian bridge over Indian Harbor would be 49.4 mG directly above the bridge travel surface during average annual load conditions. (Eversource 10a, pp. D-4)

338. Transformers and other equipment at the Cos Cob Substation and proposed Greenwich Substation are potential EMF sources. These sources, however, would be expected to cause little or no exposure to the general public because the strength of fields from typical substation equipment decreases rapidly with distance and reaches very low levels at relatively short distances beyond the substation perimeter. The exception to the normally low levels of EMF associated with substations is where transmission and distribution lines enter the substation. (Council Administrative Notice 43, FOF #456)

Project Cost and Cost Allocation

339. The estimated costs of the Proposed Project with certain variations are summarized below:

	281 Railroad Avenue	**290 Railroad Avenue**
Transmission line with trench/cofferdam crossing at Indian Harbor and jack piping under I-95	$52,215,678	$53,115,678
Cos Cob and Prospect Substation work and distribution feeder modifications	$18,208,282	$16,512,750
Open-air Substation w/brick wall	$27,792,801	$28,136,179
Total	**$98,216,761**	**$97,764,607**
Optional Additional Costs		
Indoor Substation design	+ $1,200,000	+$1,400,000
Pedestrian/transmission line bridge over Indian Harbor	+$1,800,000	+$1,800,000

Detailed cost tables are provided in Attachment 4. (Eversource 14, response 69)

340. Costs of the Project would be recovered through regionalized and localized cost allocation. Project costs are regionalized among the ISO-NE states if the project will improve reliability and provide a benefit throughout the New England region. A State's share of the regionalized costs is proportionate to its electricity demand. Project costs, or portions of project costs, are localized if they do not provide a regional reliability benefit and are typically recovered through local transmission and distribution rates of the transmission owner. (Eversource 2, response 58, response 59)

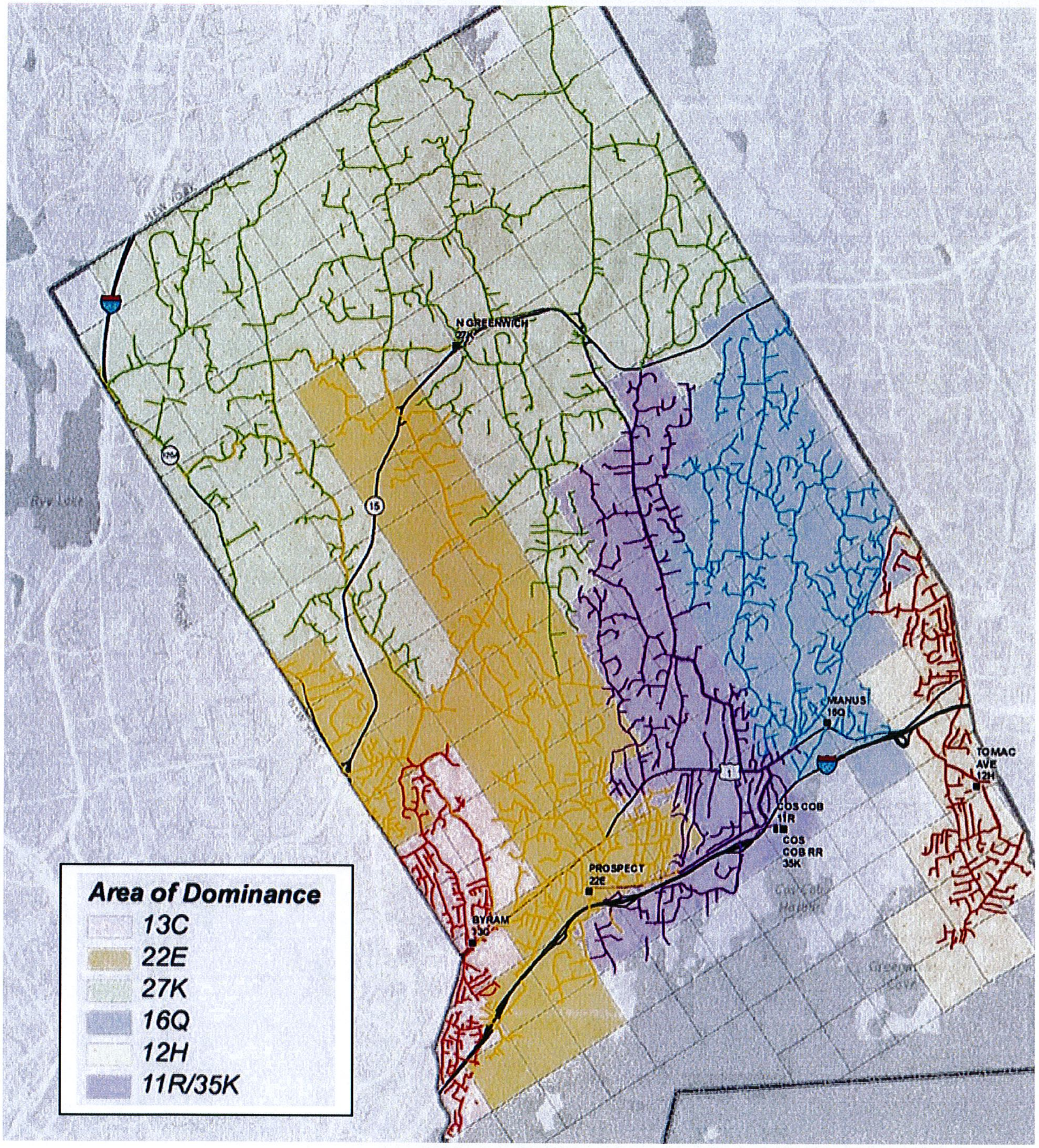
341. The Cos Cob Substation modifications are considered to be ISO-NE Pool Transmission Facilities (PTF) and as such, costs would be regionalized with Connecticut ratepayers responsible for approximately 20 percent of the costs. (Eversource 2, response 4, response 59)

342. The 115-kV transmission lines are non-PTF and costs would be recovered through Eversource's Local Network Service rates with Connecticut ratepayers responsible for approximately 60 percent of the cost. (Eversource 2, response 4, Tr. 2, pp. 115-117)

343. Distribution costs - bulk power transformers and switchgear at the new Greenwich Substation and the 13.2-kV interconnection - would be recovered 100 percent from Connecticut ratepayers. (Eversource 2, response 4; Tr. 2, pp. 115-117, 157-158)

344. Distribution costs for the 281 Railroad Avenue site are slightly higher than the 290 Railroad Avenue site (approx. $1.7 million) since the feeder connection is longer (approx. 750 feet) and two additional manholes would be required. (Eversource 9, response 70; Tr. 2, pp. 125, 178-179)

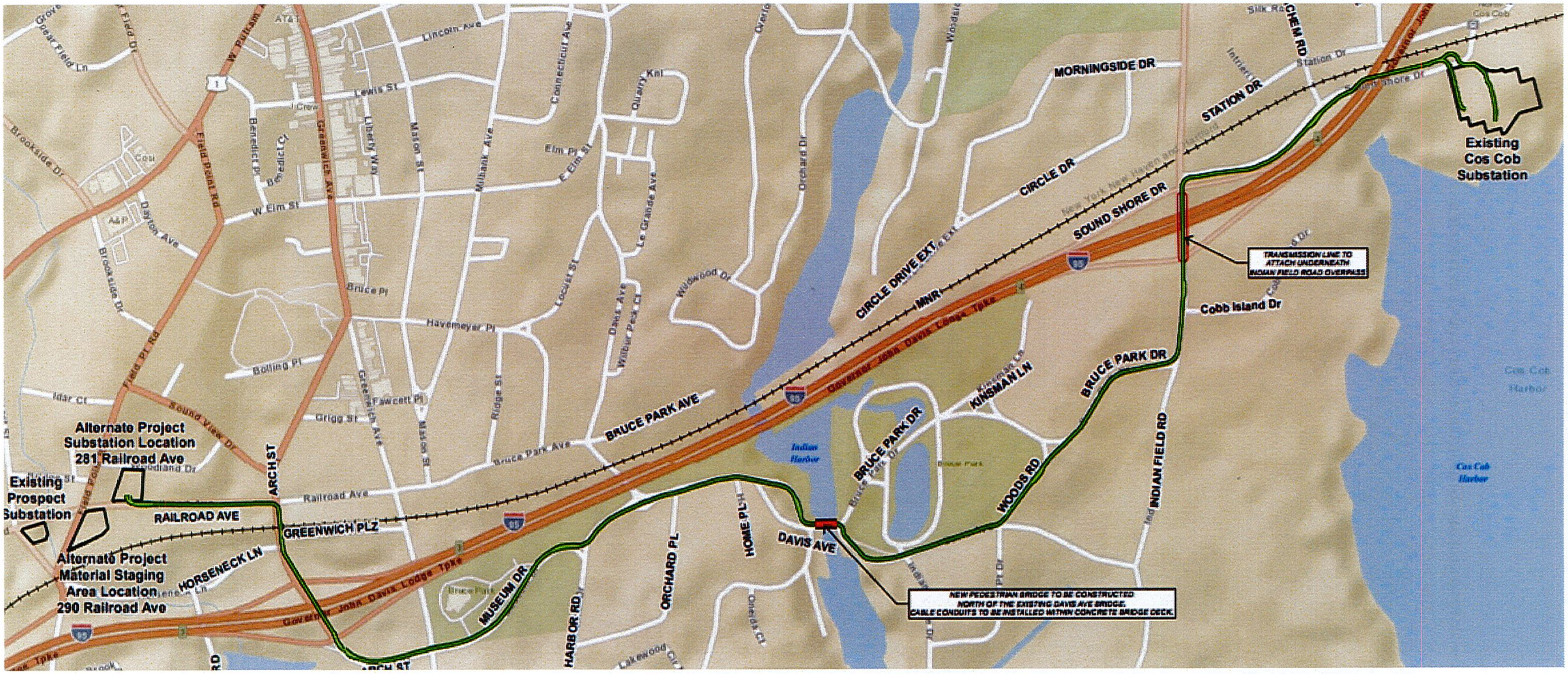
Attachment 1 – Approximate Substation Service Territories



13C = Bryam	22E = Prospect
27K =North Greenwich	16Q = Mianus
12 H = Tomac	11R/35K = Cos Cob

(Eversource 14, response 79)

Attachment 2: Project Route



(Eversource 1, Vol. 1, App. B, Fig. A-1)

Attachment 3

Distribution Alternatives Analyzed			
Distribution Alternatives	Scope	Explanation for Dismissal	Cost[1]
Distribution Option 1: Reconductoring of existing feeders from Cos Cob to Existing Prospect SS	*Reconductor four (4) existing underground feeders from Cos Cob to Existing Prospect SS *Feeders would be reconductored from 500 kcmil Cu to 750 kcmil Cu	*Due to the length and impedance differences of the parallel feeders, the upgraded feeders continue to be overloaded. To avoid overload in contingency, the normal load on the feeders must be reduced. Because of this fatal flaw, no cost estimate for this option was developed	N/A
Distribution Option 2: Addition of fifth feeder from Cos Cob to Existing Prospect SS	*Addition of fifth feeder from Cos Cob to Existing Prospect SS in an underground configuration utilizing 1000 kcmil Cu conductor	*Addition of a fifth feeder did not alleviate overloads on other feeders due to the length and impedance differences of the parallel feeders. Because of this fatal flaw, no cost estimate for this option was developed	N/A
Distribution Option 3: Two Feeders from Cos Cob to Byram & New Prospect S/S	*Install (2) 27.6-kV feeders from Cos Cob Substation to Byram Substation in an underground/overhead configuration. The overhead portion would utilize 750 AL aerial insulated cable for 3.5 miles, while the underground portion would utilize 1000 kcmil Cu conductor for 0.7 miles *Add 27.6-kV switchgear at Cos Cob Substation to accommodate new feeders. *Reconfigure existing feeders *Build new 27.6/13.2-kV Substation on Railroad Ave; Install two 80 MVA 27.6/13.2-kV transformers *Remove existing Prospect Substation *Upgrade two transformers at Byram Substation from 12.5 MVA to 25 MVA.	*This configuration does not avoid loss of load in the event of loss of two or more transformers at Cos Cob. The loss of load in that event could be up to 92% of the Cos Cob 27.6 kV system *In addition, in order to reconfigure the 27.6 kV design at Cos Cob, a new bulk substation is needed	$102M
Distribution Option 4: Four feeders from Cos Cob SS to Prospect SS	*Install (4) 27.6-kV feeders from Cos Cob SS to New Prospect SS in an underground configuration utilizing 1000 kcmil Cu Conductor for approximately 3 miles *Build new 27.6/13.2-kV indoor substation on Railroad Ave with two 80 MVA transformers *Reconfigure existing 2-27.6-kV feeders and 7-13.2kV feeders from Prospect to the new substation *Reconfigure and up-grade the existing 13.2-kV feeders that currently initiate at Byram SS and existing Prospect SS to initiate at the new Prospect SS *Re-route and up-grade existing 11R58 27.6-kV feeder to new Prospect SS *Remove existing Prospect *Remove existing Byram	*This configuration does not avoid loss of load in the event of loss of two or more transformers at Cos Cob. The loss of load in that event could be up to 92% of the Cos Cob 27.6 kV system *In addition, in order to reconfigure the 27.6 kV design at Cos Cob, a new bulk substation is needed	$122M
Distribution Option 5: Two Feeders from Cos Cob to Byram, One Feeder from Cos Cob to New Prospect S/S	*Install (2) 27.6-kV feeders from Cos Cob to Substation to Byram Substation and install (1) 27.6-kV feeder from Cos Cob Substation to New Prospect Substation in an underground configuration utilizing 1000 kcmil Cu conductor for 4.6 miles. All feeders would utilize the same ductbank *Add 27.6-kV switchgear at Cos Cob Substation to accommodate new feeders. *Reconfigure existing feeders *Build a new 27.6/13.2-kV Substation on Railroad Ave; Instal l two 80 MVA 27.6/13.2-kV transformers *Remove existing Prospect *Upgrade two transformers at Byram Substation from 12.5 MVA to 25 MVA.	*This configuration does not avoid loss of load in the event of loss of two or more transformers at Cos Cob. The loss of load in that event could be up to 92% of the Cos Cob 27.6 kV system *In addition, in order to reconfigure the 27.6 kV design at Cos Cob, a new bulk substation is needed	$109M
Distribution Option 6: Three Feeders from Waterside to New Prospect S/S	*Install (3) 27.6-kV feeders from Waterside Substation to New Prospect Substation in an underground configuration utilizing 1000 kcmil Cu conductor for 6.2 miles *Waterside Substation Modifications; expand 115-kV ring bus and add two 115/27.6-kV transformers and switchgear *Build a new 27.6/13.2-kV Substation on Railroad Ave; Install three 25 MVA 27.6/13.2-kV transformers *Remove four 27.6/13.2-kV transformers and 13.2-kV switchgear at Existing Prospect *Upgrade two transformers at Byram Substation from 12.5 MVA to 25 MVA.	*This option was dismissed for the following reasons: **Significantly higher cost compared to other alternatives **This configuration does not avoid loss of load in the event of loss of two or more transformers at Cos Cob. The loss of load in that event could be up to 39% of the Cos Cob 27.6 kV system	$163M

Attachment 3 (cont.)

Distribution Option 7: Fifth Feeder from Cos Cob to New Prospect S/S & Three Feeders from Cedar Heights to North Greenwich	*Add a fifth 27.6-kV feeder from Cos Cob Substation to New Prospect Substation in an underground configuration utilizing 1000 kcmil Cu conductor for 3.1 miles *Install (3) 27.6-kV feeders from Cedar Heights Substation to North Greenwich Substation in an underground configuration utilizing 1000 kcmil Cu conductor for 10.3 miles *Install one 115/27.6-kV transformer and switchgear at Cedar Heights Substation *Build new 27.6/13.2-kV Substation on Railroad Ave; Install three 25 MVA 27.6/13.2-kV transformers *Remove existing Prospect Substation *Upgrade two transformers at Byram Substation from 12.5 MVA to 25 MVA *Rebuild two 115-kV circuits from Cedar Heights Substation to Glenbrook Substation in an underground configuration utilizing 1000 kcmil Cu conductor for 4.9 miles	*This option was dismissed for the following reasons: **Significantly higher cost compared to other alternatives **This configuration does not avoid loss of load in the event of loss of two or more transformers at Cos Cob. The loss of load in that event could be up to 38% of the Cos Cob 27.6 kV system ** Community impact, which includes acquiring multiple easements, expansion of Cedar Heights Substation	$303M
Distribution Option 7A Variation: Fifth Feeder from Cos Cob to New Prospect S/S & Three Aerial Feeders from Cedar Heights to North Greenwich	*Addition of a fifth 27.6-kV feeder from Cos Cob Substation to New Prospect Substation in an underground configuration utilizing 1000 kcmil Cu for 3.1 miles *Install (3) 27.6-kV feeders from Cedar Heights Substation to North Greenwich Substation in an underground/overhead configuration. The underground portion would utilize 1000 kcmil Cu conductor for 3.1 miles, while the overhead portion would utilize 750 AL aerial insulated cable for 7.2 miles *Rebuild two 115-kV circuits from Cedar Heights Substation to Glenbrook Substation in an underground configuration utilizing 1000 kcmil Cu conductor for 4.9 miles *Expand Cedar Heights Substation, install two 115kV-27.6kV transformers and add two (2) 13.2-kV Feeder Positions *Build new 27.6/13.2-kV Substation on Railroad Ave; Install three 25 MVA 27.6/13.2-kV transformers *Upgrade two transformers at Byram Substation from 12.5 MVA to 25 MVA *Remove existing Prospect Substation	*This option was dismissed for the following reasons: **Significantly higher cost compared to other alternatives **This configuration does not avoid loss of load in the event of loss of two or more transformers at Cos Cob. The loss of load in that event could be up to 38% of the Cos Cob 27.6 kV system ** Community impact, which includes acquiring multiple easements, expansion of Cedar Heights Substation	$253M
Notes			
1	The above estimated costs were rough "order of magnitude" costs developed in the fall of 2016 for use in comparing the various conceptual distribution solutions against one another and against the estimated transmission costs. Since these comparisons were made, the estimated costs for the PMP and AMP have been refined		

(Eversource 2, response 26)

Attachment 4

The Table below presents a breakdown of the Modified GSLP with variations. Please note the "XLPE AMP Route" cost includes attachment to the Indian Field Road overpass (DOT is opposed) and the pedestrian bridge over Indian Harbor:

Component	Currently Proposed GSLP (XLPE AMP Route) - Term at 281 RR Ave (Pole Yard)	Currently Proposed GSLP (XLPE AMP Route)- Term at 290 RR Ave (Pet Pantry)
Transmission Line	$52,515,678	$53,415,678
Cos Cob Modifications / Distribution upgrades (incl Prospect)	$18,208,282	$16,512,750
New Greenwich S/S	$28,992,801	$28,136,749
Total	**$99,716,761**	**$98,065,177**
Project Component	**Additional Cost to GSLP**	**Additional Cost to GSLP**
Pipejacking Underneath I-95 (Vol 1, Ex. B, sec. A.5.1.1)	$1.5M	$1.5M
Architectural Building to replace wall enclosure	$0 (incl)	$1.4M
Project Component	**Reduced Cost to GSLP**	**Reduced Cost to GSLP**
Cofferdam Variation (Vol 1, Ex. B, sec. A.4)	$1.8M	$1.8M
Wall Enclosure only - no architectural building	$1.2M	$0 (incl)

(Eversource 14, response 69)

A breakdown of the approximate cost allocation for the AMP (Indoor Substation at 281 Railroad Ave, Field Point Rd. Bridge Attachment, pedestrian bridge crossing over Indian Harbor), is summarized in the chart below:

Project Estimates		GSLP Cost Component Allocation		
Project Component	**Currently Proposed GSLP**	**Transmission PTF (regional)**	**Transmission non-PTF (Network Service)**	**Distribution**
Transmission Line	$52,515,678		$52,515,678	
Greenwich Substation	$28,992,801			
Transmission Component	$12,291,549		$12,291,549	
Distribution Component	$16,701,252			$16,701,252
Cos Cob Substation	$12,669,170	$12,669,170		
Prospect Substation Modifications	$952,837			$952,837
Distribution Feeder Relocation	$4,586,275			$4,586,275
Project Total	**$99,716,760**	**$12,669,170**	**$64,807,227**	**$22,240,364**
Project Estimates		**Rate Impact**		
Percent of Project	100.00%	12.71%	64.99%	22.30%
CL&P Customer - % of Load		19.42%	60.44%	100.00%
Estimated Annual Retail Cost to CL&P Customers	9,849,000	$ 418,000	$ 5,719,000	$ 3,712,000
Average CL&P Retail Rate ($/kWh)	$ 0.000441	$ 0.000019	$ 0.000256	$ 0.000166
Estimated Average Monthly Impact to 700 kWh CL&P Retail Customer	$ 0.309	$ 0.013	$ 0.179	$ 0.116

(Eversource 14, response 63)

DOCKET NO. 461A - Eversource Energy application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance, and operation of a 115-kilovolt (kV) bulk substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV underground transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation, Greenwich, Connecticut, and related substation improvements. Reopening of this docket based on changed conditions pursuant to Connecticut General Statutes §4-181a(b).	} } }	Connecticut Siting Council November 9, 2017

Opinion

Introduction

On June 26, 2015, The Connecticut Light and Power Company doing business as Eversource Energy (Eversource), applied to the Connecticut Siting Council (Council) for a Certificate of Environmental Compatibility and Public Need (Certificate) for the construction, maintenance, and operation of a new 115-kilovolt (kV) bulk substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV underground transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation including related substation improvements in Greenwich, Connecticut (Greenwich Substation and Line Project or GSLP).

In addition to the applicant, 12 parties and intervenors participated in the original Docket 461 proceeding, which consisted of 6 evidentiary hearings and a public comment session. Common concerns shared and expressed by the parties, intervenors and other interested persons included, but were not limited to, impacts to the community, impacts to Bruce Park, lack of effective communication with the Town of Greenwich (Town), lack of demonstration of the public need for the GSLP, lack of exploration of potential alternatives and exorbitantly high project costs.

On May 12, 2016 the Council voted to deny without prejudice a Certificate to Eversource for the GSLP based on the following issues:

- The cost of the GSLP, as presented, was exceedingly high;
- The design and associated cost of the GIS substation, including a position for a third transmission line, was not warranted;
- The proposed GSLP route through Bruce Park would have an adverse environmental effect and did not conform to the Federal Energy Regulatory Commission Guidelines for the Protection of Natural, Historic, Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities (FERC Guidelines);
- An alternative transmission line route along the Metro-North Railroad (MNRR), referred to as the Hybrid Alternative, was not thoroughly developed for Council consideration. The Hybrid Alternative may be less costly and would be consistent with the FERC Guidelines;
- No immediate need for the GSLP was found as the projected load at the Cos Cob Substation and Prospect Substation in years 2014 and 2015 did not occur; and
- A lack of communication with the Town to develop a mutually suitable solution to meet the Town's electric needs.

Jurisdiction

The Council does not have jurisdiction over electric distribution facilities. The Council's jurisdiction under Connecticut General Statutes (C.G.S) §16-50i(a) extends over electric transmission line facilities with a design capacity of 69-kV or more and electric substation facilities designed to regulate the voltage of electricity at 69-kV or more. Under the Public Utility Environmental Standards Act (PUESA), the Council's charge is to balance the need for adequate and reliable public utility services at the lowest reasonable cost to consumers with the need to protect the environment and ecology of the state. A public need exists when a facility is necessary for the reliability of the electric power supply of the state. Although the Council's jurisdiction is limited to transmission level supply, in this case, electric distribution and electric transmission components are intertwined.

Under C.G.S §16-50p, the Council shall not grant a Certificate, either as proposed or modified by the Council, unless it shall find and determine the nature of the probable environmental impact of the facility alone and cumulatively with other existing facilities, including a specification of every significant adverse effect relative to electric and magnetic fields, impact on and conflict with the policies of the state concerning the natural environment, ecological balance, public health and safety, scenic, historic and recreational values, agriculture, forests and parks, air and water purity and fish, aquaculture and wildlife, and why the adverse effects are not sufficient reason to deny the application.

In the case of an electric transmission line, the Council shall also find and determine an appropriate design of the facility including what portion of the facility shall be located overhead; that the facility conforms to a long range plan for expansion of the electric power grid of the electric systems serving the state and interconnected utility systems and will serve the interests of electric system economy and reliability; that the facility design is cost effective and the most appropriate alternative based on a life-cycle cost analysis of the facility and are consistent with the purposes of the PUESA, the Council's Electric and Magnetic Fields Best Management Practices (EMF BMP) and FERC Guidelines.

Changed Conditions

On May 5, 2017 Eversource submitted a Petition for Reconsideration of the Denial of a Certificate of Environmental Compatibility and Public Need for the Greenwich Substation and Line Project to the Council and the original Docket 461 service list based on changed conditions pursuant to C.G.S. §4-181a(b) (Motion to Reopen).

In its Motion to Reopen, Eversource identified changed conditions to the Project's capacity, design and cost since the Council's May 12, 2016 denial without prejudice, including, but not limited to:

a. Altered the design of the GSLP to account for current electric needs rather than to provide improvements with a 30 to 40 year planning horizon;
b. Designed a system to meet reliability needs based on 130.5 MVA of peak load on the Greenwich 27.6-kV system;
c. No longer use a ten year load growth forecasting that anticipated one percent load growth per year;
d. Two potential GSLP project routes and substation sites were developed for consideration upon Eversource's consultation with the Town after the Council's Docket 461 decision; the Proposed Modified Project (PMP) and the Alternate Modified Project (AMP);
e. Developed a transmission line route that avoids, to the extent possible, environmental impact to the Town-owned Bruce Park, consistent with the FERC Guidelines;
f. Reduced costs of both the PMP and AMP from than the original GSLP presented in Docket 461;

g. Redesigned the new Greenwich Substation that does not use costly gas-insulated switchgear;
h. Use of Cross-linked Polyethylene (XLPE) cable instead of a High Pressure Fluid Filled (HPFF) cable design for all underground transmission line installations;
i. Consultations with the Town in an attempt to develop feasible alternatives as well as a feasible GSLP route; and
j. Consultations with the Town to develop demand side management programs to promote energy efficiency.

At a meeting held on May 25, 2017, after considering all comments submitted by parties and intervenors to the original proceeding regarding the Motion to Reopen, the Council voted to grant Eversource's Motion to Reopen. The reopening allowed the Council to consider changed conditions, public need and alternate locations for the proposed electric substation and electric transmission circuits (Modified GSLP).

The Council held one public comment hearing session in Greenwich and three public evidentiary hearing sessions at the Council's office in New Britain. All parties and intervenors had the opportunity to meaningfully participate in the re-opened proceedings.

Public Need

As stated in the Council's Docket 461 decision, *"the proposed GSLP, or some variation thereof, is necessary for the reliability of the electric power supply of the Town of Greenwich"*. The Council's position has not changed in this regard. Greenwich is at the farthest southwest extent of Eversource's electric network in Connecticut and is electrically isolated from other areas of the State. The geographic isolation resulted in a unique and unreliable electric system that was designed in the 1950's, where most of Greenwich is serviced by a single bulk power substation, the Cos Cob Substation. The Cos Sob Substation distributes power to three distribution substations in Greenwich; the Prospect, Byram and North Greenwich Substations through a system of 27.6-kV distribution feeders. The current system was designed to serve much lower load demands than exist today. The area of Greenwich with the highest load demand is west of Indian Harbor, in the vicinity of the existing Prospect Substation.

To examine the resiliency of an electric system, the loss of various electric system elements are modeled to determine electric system weaknesses and vulnerabilities. Good electric system planning attempts to resolve an identified contingency weakness or even multiple contingency events occurring at once.

Part of the reliability concerns for the Modified GSLP include a system of four 27.6-kV distribution feeders that emanate from the Cos Cob Substation and simultaneously serve the Prospect Substation, certain large customers, and the Greenwich Network, a distribution system that serves the downtown area of Greenwich. Certain contingency events can cause one or more of the feeders to operate above service limits or, during multiple contingency events, result in load shedding and the loss of power to customers. Operation of the feeders beyond their current design thresholds can shorten their operational life. These four feeders also have a history of not operating to design standards even under normal load conditions and as such, Eversource has made repeated repairs to the feeder network in an attempt to maintain system reliability.

Reliability concerns are also an issue at the Cos Cob Substation where contingency modeling for the loss of a 115-kV to 27.6-kV transformer could result in the remaining transformers serving the Greenwich 27.6-kV loads to operate beyond their nameplate ratings, shortening the operational life of the equipment. Finally, the existing Prospect Substation is currently at the end of its lifespan and, in its current design, would not be able to serve load within nameplate ratings during certain contingency events. Under a worst case contingency scenario of the loss of the entire Prospect Substation, 99 percent of the substation load cannot be served by other electric supply sources.

In the original Docket 461, in addition to reliability concerns associated with the current design of the Greenwich electric system, Eversource used load growth forecasting that anticipated one percent of peak load growth per year at both the Cos Cob Substation and Prospect Substation as part of the need for the GSLP. The projected peak loads did not materialize, but rather decreased significantly in Years 2014 and 2015. Part of the peak load demand has been offset in the Greenwich area through energy efficiency and distributed generation projects. Continued use of these measures, as well as incorporation of demand response projects, could lead to further decline in peak load demand. The other factor in the decrease in peak load demand was the absence of weather conditions that cause a dramatic increase in load over the past few years. Years 2012 and 2013 had some sustained periods of high heat and humidity which increases peak demand. Last year, although very hot, did not have sustained periods of high heat and humidity.

Eversource is proposing the Modified GSLP to address current distribution reliability concerns, as well as to address reliability issues identified through electric system contingency planning. Unlike the original Docket 461 project, Eversource is no longer projecting load growth in this area and load growth is not part of the need for the Modified GSLP.

Based on contingency modeling and the current operational design of the Cos Cob Substation power supply and feeder network, the Council finds, and the Town acknowledges, the current distribution feeder system is antiquated and subject to repeated failures during normal operation, as well as during contingency events. The Modified GSLP would alleviate loads on the existing feeder system by directly transferring the Prospect Substation load to a 115-kV transmission source rather than rely on a 27.6-kV distribution feeder source. The 27.6-kV distribution feeders would remain in place to serve the Greenwich Network, certain large customers, and the Byram Substation, creating less operational stress on the feeders under both normal and contingent conditions.

The Modified GSLP would allow Eversource to have the capability to transfer load between the Cos Cob Substation and the proposed Greenwich Substation at the transmission level and provide automatic electric supply backup to most of the customers in Greenwich in the event of an outage on one of the transformers at the Cos Cob Substation or at the new Greenwich Substation. There is no capability in the current electric system for this redundancy. This capability is consistent with Eversource's current electric system design in that if one power supply source is unavailable, the remaining bulk substation would be able to supply necessary power. This project is similar to other projects in the State where a new substation is constructed or an existing substation expanded to improve electric system reliability.

Eversource has anticipated a need for an additional substation in Greenwich since 1971 when it acquired the 290 Railroad Avenue property. Since that time, Eversource has undertaken multiple measures to defer the expense of a new substation. In 2011, Eversource announced plans for a new substation for the purpose of serving load west of Indian Harbor. The Town, in its 2011-2012, 2013-2014, 2014-2015, 2015-2016 Annual Reports, recognized the need for reliable energy as well as a new substation.

The Town has expressed concern regarding the reliability of the two 115-kV transmission circuits that feed the Cos Cob Substation, the 1740 and 1750 lines. Both circuits are located on common structures and are the only source of power to the Cos Cob Substation and as such, if both circuits were out of service, almost all of Greenwich would lose power. Contingency events associated with the 1740 and 1750 lines are not the subject of the Proposed Project. Additionally, the Town has not proposed any modifications to the 1740 and 1750 lines in its proposed reliability solutions and further, acknowledges separation of the lines to improve reliability would be very costly.

The Town has expressed concern regarding the reliability of the Tomac Substation, a 115-kV to 13.2-kV substation in the southeast area of town that serves a small portion of Greenwich load. It was built in the early 1990's to relieve load off of the Cos Cob Substation and is served by a single transmission source. Although the Proposed Project is not designed to address issues at Tomac, the Council notes Eversource has a project planned in the short term to improve distribution service out of Tomac by converting a 4.8-kV distribution system that serves about a thousand customers to a 13.2-kV distribution system[1], an upgrade that will provide backup power to these customers, and a project planned in the long term, in accordance with an electric system priority list, to provide two sources of transmission level service to Tomac instead of one.

The original Docket 461 application included the retirement of the obsolete Byram Substation, rated at 25 MVA of peak load, with load from the substation to be served by the new Greenwich Substation. The Proposed Project no longer includes the retirement of the Byram Substation. Eversource would continue to monitor the condition of the equipment at the substation and replace equipment, as necessary. Eversource may be able to retire the substation if load demand decreases, with load transferred to the new Greenwich Substation.

Project Alternatives

During the original Docket 461 proceeding, various alternatives to the GSLP were examined, including transmission, distribution, interconnection, generation, demand side management alternatives as well as energy efficiency measures. Prior to the submission of the Modified GSLP, Eversource met with the Town to discuss project alternatives, including potential distribution solutions, and energy efficiency measures within the Town. Due to the localized nature of the reliability issue, Eversource, with the Town's consultant, examined eight distribution alternatives prior to submission of the Modified GSLP to the Council. In addition, other distribution scenarios were explored during the re-opened proceeding. None of these potential distribution designs were deemed viable due to design flaws, reduced reliability, or excessive cost when compared to the Modified GSLP.

A simple rebuild of the Prospect Substation would be an expenditure to support the 27.6-kV system, a voltage Eversource intends to phase out over time, and would not resolve the current reliability issues associated with the current feeder design, or provide a reliable source of power during transformer contingency events at Cos Cob Substation, or prevent service interruption to customers resulting from the loss of the Prospect Substation itself.

Discussions with the Town also included energy efficiency initiatives for both Town-owned facilities and private investments to mitigate the electrical demand and usage within the Town. The Town has undertaken energy efficiency projects at Town-owned facilities, hosted community light-bulb swaps and is working with the Chamber of Commerce to establish a business outreach program. Larger projects, such as demand side energy sources, are not currently proposed. Another technology, battery storage systems, is currently being examined by DEEP but there are no projects currently being developed in Connecticut. Energy efficiency and demand side energy sources can be effective in reducing peak loads, but would not serve to eliminate the reliability issues associated with the current design of the Cos Cob to Prospect 27.6-kV distribution feeder system, the objective of the Modified GSLP.

[1] The Public Utilities Regulatory Authority has exclusive jurisdiction over electric distribution in the state.

Proposed Project

Two alternatives for the Modified GSLP were initially presented to the Council, the PMP and the AMP. The PMP consisted of an overhead-underground transmission line route and a new open-air insulated substation at 290 Railroad Avenue. It was developed in response to the Council's Docket 461 decision regarding the feasibility of constructing a less expensive overhead route along portions of the MNRR right-of-way that is consistent with the FERC Guidelines as it would utilize an existing right-of-way occupied by the MNRR and other utility services. The PMP route, initially referred to as the "Hybrid Alternative" during the original Docket 461 proceeding, would be north of Bruce Park, thus avoiding impacts on the sensitive environmental and recreational resources of the park. Upon initial consultation with Connecticut Department of Transportation (DOT) representatives, the PMP was deemed viable and the transmission line route was fully developed with details for overhead and underground transmission line segments and a new substation. The PMP estimated cost was $78 million.

After the filing of the Motion to Reopen, Eversource was contacted by DOT Rails informing Eversource that senior DOT officials oppose the installation of the PMP transmission line within the MNRR right-of-way. Written correspondence from DOT Rails was submitted to Eversource on July 14, 2017 indicating the DOT would not issue a license to Eversource for use of the MNRR right-of-way and stating there would be too many outages to existing rail service, manpower is not available to Eversource for necessary construction support, and the installation of the overhead transmission towers would exacerbate the already congested nature of the existing rail corridor, encumbering future expansion of the railroad.

On July 17, 2017, Eversource submitted correspondence to the Council indicating that it must withdraw the PMP from consideration and that the AMP would now be referred to as the Proposed Project. For the Proposed Project, both the 290 Railroad Avenue and 281 Railroad Avenue sites are viable locations for the Project substation, either as an open-air design or indoor design.

The AMP consists of an all underground transmission line route installed within roadways or adjacent road rights-of-way and includes a new substation at 281 Railroad Avenue. It was developed upon consultation with the Town prior to the filing of the Modified GSLP. Although the Town objected to the original GSLP route through Bruce Park and initially supported the concept of the Hybrid Alternative, Eversource designed the AMP to address Town concerns regarding visual impacts of the PMP on Bruce Park, as well as to avoid the Town's sewer main located adjacent to the PMP route within the MNRR.

Environmental Considerations

The Council finds there is no substantial adverse environmental impact associated with the Proposed Project transmission line route. Construction would be confined to paved roadways, parking lots or lawn areas immediately adjacent to roadways.

Although the Proposed Project route through Bruce Park is inconsistent with the FERC Guidelines, as the use of park and recreation lands for right-of-ways are to be avoided where practical, no other alternative currently exists. The Council's and Town's concerns regarding the original Bruce Park route included the use of a HPFF cable design and utilizing Horizontal Directional Drilling (HDD) for the installation of the transmission line through the park or in the park area. The HDD installation would have disrupted park recreational and scenic resources for months.

The Proposed Project uses an alternate design to address these concerns. Specifically, the transmission line would be composed of XLPE cable circuits. The transmission line would be installed underground, within park roadways, thus using previously disturbed areas and rendering the transmission line not visible from park areas. The Town has stated that it is amenable to these design changes. Construction of the project would disrupt park roads, except at Indian Harbor, and would be similar to other road construction projects.

The transmission line would cross Indian Harbor, a north-south oriented tidal waterbody in Bruce Park. Two crossing methods are proposed in the area north of the Davis Avenue bridge; an eight-foot wide pedestrian bridge, where the transmission line would be enclosed within the bottom of the bridge, or a trench installation within the harbor facilitated by cofferdams. After examining the environmental effects as well as the cost of both methods, the Council finds the trench installation preferable. The trench would have minimal environmental effect as it would temporarily disturb harbor sediment and would be installed using cofferdams that would not restrict tidal fluctuations. The trench installation would be approximately $1.8 million less than the pedestrian bridge installation and would not pose an ongoing maintenance issue. The Council appreciates the Town's willingness to accept a trench/cofferdam crossing in lieu of a more costly bridge installation, and is cognizant that the Town prefers a floating platform for construction purposes to minimize disturbance to adjacent shore and lawn areas to the extent possible.

In the area of Indian Field Road, two transmission line crossings of I-95 were initially proposed; an above ground crossing where the transmission line is attached to the underside of the I-95 overpass bridge or a pipe jacking crossing where the transmission line would be installed under the highway. Upon further review by the DOT, the DOT stated that it would only allow the pipe jacking transmission line crossing. The pipe jack locations would be within previously disturbed areas, adjacent to highway ramps, and no substantial adverse environmental effect is anticipated.

Development of a substation at either 290 Railroad Avenue or 281 Railroad Avenue would have no adverse environmental effect since both sites are already used for commercial purposes and are located in a heavily developed urban area. At either site, an open-air substation or an indoor substation could be developed. An indoor substation would cost approximately $1.2 to $1.4 million more than an open-air substation enclosed by a perimeter brick wall.

The 281 Railroad Avenue site, favored by the Town, is partially zoned General Business (GB) and Residential, and abuts predominately residential areas. Given its location and surrounding land use, the Town favors an indoor substation design so that it would appear as a condominium building to mitigate aesthetic and noise concerns. The 290 Railroad Avenue site is entirely zoned GB and abuts other commercial properties. An existing brick building on the parcel would be demolished.

After reviewing both substation locations, the Council finds the 290 Railroad Avenue location preferable as it is entirely zoned GB and is surrounded by established commercial uses, some of which are brick buildings. It is a larger parcel, by approximately 3,000 square feet, than the 281 Railroad Avenue parcel, and thus offers more flexibility in site layout, potential equipment additions, and an easier connection for an emergency mobile transformer. As for the substation design, the Council finds an open-air substation with a perimeter brick wall appropriate for a GB zone. Furthermore, the brick wall and fire walls surrounding the transformers within the substation would provide protection to adjacent properties. An indoor substation design at this location is not warranted given the higher threshold of noise for the surrounding GB zone, predominate commercial nature of the immediate area, and the additional cost that would be borne by Connecticut ratepayers. To increase the setback of the brick wall fronting Railroad Avenue, the Council will order that Eversource increase the setback distance by approximately ten feet.

The Council is satisfied that the Project's electric and magnetic fields have been demonstrated to be well below recommended exposure standards established by the International Commission on Non-Ionizing Radiation Protection and the International Committee on Electromagnetic Safety and are not of a concern.

Cost

The cost of the Proposed Project, with the Indian Harbor trench/coffer dam crossing, pipe jacking under I-95, and an open air-substation at 290 Railroad Avenue, is approximately $97.8 million. After the withdrawal of the PMP from consideration, with its estimated cost of $78 million, the Council examined the limited options available before it, and sought to reduce the Project cost to the greatest extent possible, as well as find the most equitable regional cost allocation. Since only one transmission route remained viable, overall Project cost savings were obtained by selecting the trench/cofferdam crossing of Indian Harbor instead of the pedestrian bridge installation ($1.8 million savings), and by selecting the 290 Railroad Avenue Substation with an open-air design rather than an indoor substation design ($1.4 million savings). Additionally, the 290 Railroad Avenue site would provide a modest savings on the distribution cost recovery component of the Project (recovered 100 percent by Connecticut ratepayers), as it is closer to the distribution feeder tie in points than the 281 Railroad Avenue location.

Conclusion

The Council finds the Proposed Project is necessary for the reliability of the electric power supply of the state, serving the interests of electric system economy and reliability, and as such, conforms to a long-range plan for expansion of the electric system serving the state and related interconnected utility systems[2]. The Project is consistent with the Connecticut's Comprehensive Energy Strategy which proposes further investments in grid reliability, and identifies three important components to grid reliability: resource adequacy, transmission security and distribution resiliency.

Although the Proposed Project is seemingly a localized issue, Eversource met with the Town to discuss Project alternatives beyond those initially discussed in the original proceeding. Multiple distribution alternatives were discussed in an attempt to find a local solution, and energy efficiency, demand response and battery storage measures were explored, but unfortunately, none of these alternatives and measures were deemed viable from a cost, reliability, or practicality perspective to solve the identified reliability issues. Quite simply, there are no localized solutions to resolve the identified reliability problems.

Based on the record of this proceeding, the Council finds that conditions have changed since the denial without prejudice of a Certificate in the original Docket 461 proceeding. The Council finds and determines that there is a public need for the facility. The Council also finds and determines that the Proposed Project is not in conflict with the policies of the state concerning the natural environment, ecological balance, public health and safety, air and water purity, and fish, aquaculture and wildlife, together with all other environmental concerns, including EMF, and balanced the interests in accordance with C.G.S §16-50p(a)(3)(B) and C.G.S §16-50p(a)(3)(C). The environmental effects that are the subject of C.G.S §16-50p (a)(3)(B) can be sufficiently mitigated and do not overcome the public need for the facility. Furthermore, the Council finds and determines that the location of the new transmission line will not pose an undue hazard to persons or property along the area traversed by the transmission line pursuant to C.G.S §16-50p (a)(3)(E).

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[2] The Proposed Project does not establish a new transmission tie to New York.

The Council will require Eversource to submit a D&M Plan for the Proposed Project to include, but not be limited to, provisions for municipal comment and review; detailed site plans identifying structure and equipment locations as well as temporary and permanent facilities and roadways; wetland mitigation methods for temporary and permanent effects, an erosion and sediment control plan consistent with the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control*; a Spill Prevention, Control, and Countermeasures Plan; identification of vegetative removal/trimming areas, provisions for post-construction restoration, provisions for inspection and appropriate monitoring of Project construction, and pre-construction and post-construction measurements of EMF.

With the conditions listed above, the Council will issue a Certificate of Environmental Compatibility and Public Need for the construction, maintenance, and operation of a new 115-kV bulk open-air substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV underground transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation, including related substation improvements in Greenwich, Connecticut.

DOCKET NO. 461A - Eversource Energy application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance, and operation of a 115-kilovolt (kV) bulk substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV underground transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation, Greenwich, Connecticut, and related substation improvements. Reopening of this docket based on changed conditions pursuant to Connecticut General Statutes §4-181a(b).	} } } }	Connecticut Siting Council November 9, 2017

Decision and Order

Pursuant to Connecticut General Statutes (C.G.S) §4-181a(b) and §16-50p, and the foregoing Findings of Fact and Opinion, the Connecticut Siting Council (Council) finds that there is a public need for the proposed facility and the effects associated with the construction of a new 115-kilovolt (kV) bulk substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV underground transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation, Greenwich, Connecticut, and related substation improvements (Project), including effects on the natural environment; ecological integrity and balance; forests and parks; agriculture; scenic, historic, and recreational values; air and water purity; fish and wildlife; and public health and safety are not disproportionate either alone or cumulatively with other effects compared to need, are not in conflict with the policies of the State concerning such effects, and are not sufficient reason to deny the application. Therefore, the Council directs that a Certificate of Environmental Compatibility and Public Need, as provided by C.G.S §16-50k, be issued to Eversource Energy (hereinafter referred to as the Certificate Holder) for the construction, maintenance and operation of the Project.

Unless otherwise approved by the Council, the Project shall be constructed, operated, and maintained substantially as specified in the Council's record in this matter, and subject to the following conditions:

1. The Certificate Holder shall construct the proposed substation at 290 Railroad Avenue, enclosed by a perimeter brick wall. The brick wall shall be relocated south by approximately 10 feet to increase the setback distance between the brick wall and Railroad Avenue.

2. The Certificate Holder shall construct the proposed underground electric transmission line along the proposed route using a pipe jack crossing of Interstate 95 and a trench/cofferdam crossing of Indian Harbor, and perform related Project improvements, as proposed, subject to modifications during final site design and approval of the Development and Management (D&M) Plan for the project.

3. The Certificate Holder shall prepare two D&M Plans for this Project; one specific to the proposed substation and other substation improvements, and one specific to the proposed construction of the new transmission line. Both D&M Plans shall be in compliance with Sections 16-50j-60 through 16-50j-62 of the Regulations of Connecticut State Agencies. The D&M Plans shall be served on the Town of Greenwich for comment, and all parties and intervenors as listed in the service list, and submitted to and approved by the Council prior to the commencement of facility construction. The D&M Plans shall include:

    a. A detailed site plan showing the placement of all substation equipment, structures, and buildings within the substation perimeter, access, provisions for storm water management and transformer oil containment and fencing;

b. A detailed site plan showing the underground transmission line route, splice vaults, traffic management plan, identification of pipe jacking sites, provisions for underground cable protection, substation improvements, and equipment and material staging areas;
c. An erosion and sediment control plan that includes provision for any areas for the temporary storage of fill materials and is consistent with the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control*, as amended;
d. A spill prevention and countermeasures plan;
e. Identification of areas for staging and equipment lay down, field office trailers, sanitary facilities and parking;
f. Details for the Indian Harbor crossing including related temporary and permanent construction impacts and methods to reduce such impacts;
g. A vegetative clearing/trimming plan;
h. Restoration plan for disturbed areas and roads;
i. A construction schedule, including construction hours;
j. A blasting plan, if necessary;
k. EMF Monitoring Plan; and
l. Submission of monthly construction progress reports.

4. The Certificate Holder shall obtain necessary permits from the Connecticut Department of Energy and Environmental Protection, Department of Transportation and other entities, as necessary, prior to the commencement of construction.

5. The Certificate Holder shall comply with all future electric and magnetic field standards promulgated by State or federal regulatory agencies. Upon the establishment of any new standards, the facilities granted in this Decision and Order shall be brought into compliance with such standards.

6. The Certificate Holder shall provide to the Council an operating report within three months after the conclusion of the first year of operation of all facilities herein, and annually thereafter for a period of three years, with information relevant to the overall condition, safety, reliability, and operation of the new transmission line.

7. Unless otherwise approved by the Council, this Decision and Order shall be void if all construction authorized herein is not completed within five years of the effective date of the Decision and Order, or within five years after all appeals to this Decision and Order have been resolved. Authority to monitor and modify this schedule, as necessary, is delegated to the Executive Director. The Certificate Holder shall provide written notice to the Executive Director of any schedule changes as soon as is practicable.

8. Any request for extension of the time period referred to in Condition 7 shall be filed with the Council not later than 60 days prior to the expiration date of this Certificate and shall be served on all parties and intervenors, as listed in the service list, and the Town of Greenwich.

9. This Certificate may be surrendered by the Certificate Holder upon written notification to the Council.

10. In accordance with Section 16-50j-62 of the Regulations of Connecticut State Agencies, the Certificate Holder shall provide the Council with written notice two weeks prior to the commencement of site construction activities. In addition, the Certificate Holder shall provide the Council with written notice of the completion of site construction, and the commencement of site operation.

11. The Certificate Holder shall remit timely payments associated with annual assessments and invoices submitted by the Council for expenses attributable to the facility under Conn. Gen. Stat. §16-50v.

12. This Certificate may be transferred in accordance with Conn. Gen. Stat. §16-50k(b), provided both the Certificate Holder/transferor and the transferee are current with payments to the Council for their respective annual assessments and invoices under Conn. Gen. Stat. §16-50v. In addition, both the Certificate Holder/transferor and the transferee shall provide the Council a written agreement as to the entity responsible for any quarterly assessment charges under Conn. Gen. Stat. §16-50v(b)(2) that may be associated with this facility.

We hereby direct that a copy of the Findings of Fact, Opinion, and Decision and Order be served on each person listed in the Service List, dated July 11, 2017, and notice of issuance published in The Greenwich Time.

By this Decision and Order, the Council disposes of the legal rights, duties, and privileges of each party named or admitted to the proceeding in accordance with Section 16-50j-17 of the Regulations of Connecticut State Agencies.

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CERTIFICATION

The undersigned members of the Connecticut Siting Council (Council) hereby certify that they have heard this case, or read the record thereof, in **DOCKET NO. 461A** - Eversource Energy application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance, and operation of a 115-kilovolt (kV) bulk substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation, Greenwich, Connecticut, and related substation improvements based on changed conditions pursuant to Connecticut General Statutes §4-181a(b), and voted as follows to approve the proposed facility:

Council Members	Vote Cast
Robert Stein, Chairman	Absent
James J. Murphy, Jr., Vice Chairman	Yes
Chairman Katie Dykes Designee: Larry Levesque	Yes
Commissioner Robert Klee Designee: Robert Hannon	Yes
Daniel P. Lynch, Jr.	Yes
Michael Harder	Absent
Dr. Michael W. Klemens	Yes
Robert Silvestri	Yes

Dated at New Britain, Connecticut, November 9, 2017.

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STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL
Ten Franklin Square, New Britain, CT 06051
Phone: (860) 827-2935 Fax: (860) 827-2950
E-Mail: siting.council@ct.gov
www.ct.gov/csc

VIA ELECTRONIC MAIL

November 14, 2017

TO: Classified/Legal Supervisor
461A170713
The Greenwich Time
Southern Connecticut Newspapers
20 East Elm Street
Greenwich, CT 06830

laf

FROM: Lisa Fontaine, Fiscal Administrative Officer

RE: **DOCKET NO. 461A** - Eversource Energy application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance, and operation of a 115-kilovolt (kV) bulk substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation, Greenwich, Connecticut, and related substation improvements. Reopening of this docket based on changed conditions pursuant to Connecticut General Statutes §4-181a(b).

Please publish the attached notice as soon as possible, but not on Saturday, Sunday, or a holiday.

Please send an affidavit of publication and invoice to my attention.

Thank you.

laf

CSC
CONNECTICUT SITING COUNCIL
Affirmative Action / Equal Opportunity Employer

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STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL
Ten Franklin Square, New Britain, CT 06051
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NOTICE

Pursuant to General Statutes §4-181a(b), the Connecticut Siting Council (Council) announces that, on November 9, 2017, the Council issued Findings of Fact, an Opinion, and a Decision and Order approving the Eversource Energy application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance, and operation of a 115-kilovolt (kV) bulk substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation, Greenwich, Connecticut, and related substation improvements. This application record is available for public inspection in the Council's office, Ten Franklin Square, New Britain, Connecticut.

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CONNECTICUT SITING COUNCIL
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Appendix B: Substation Drawings

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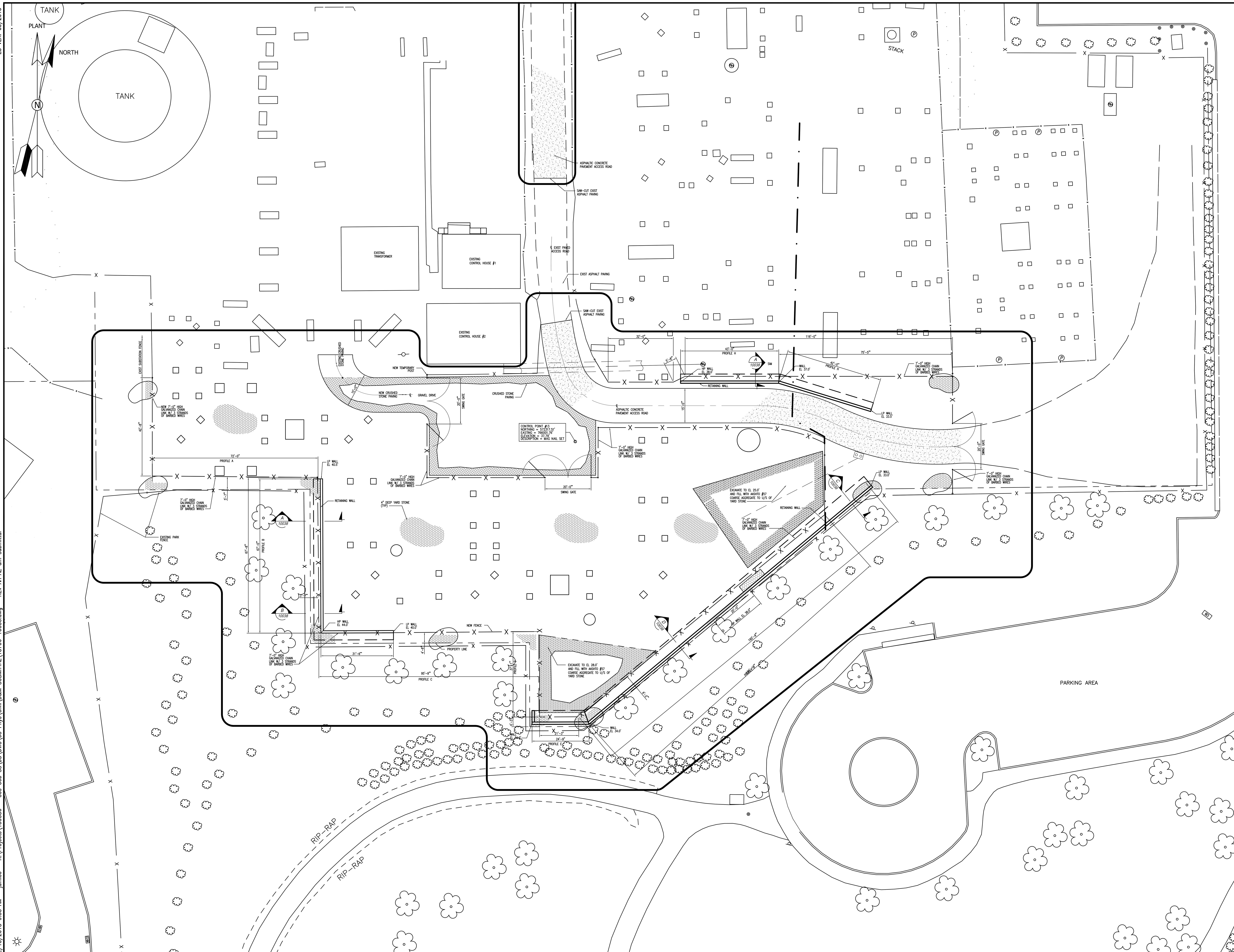

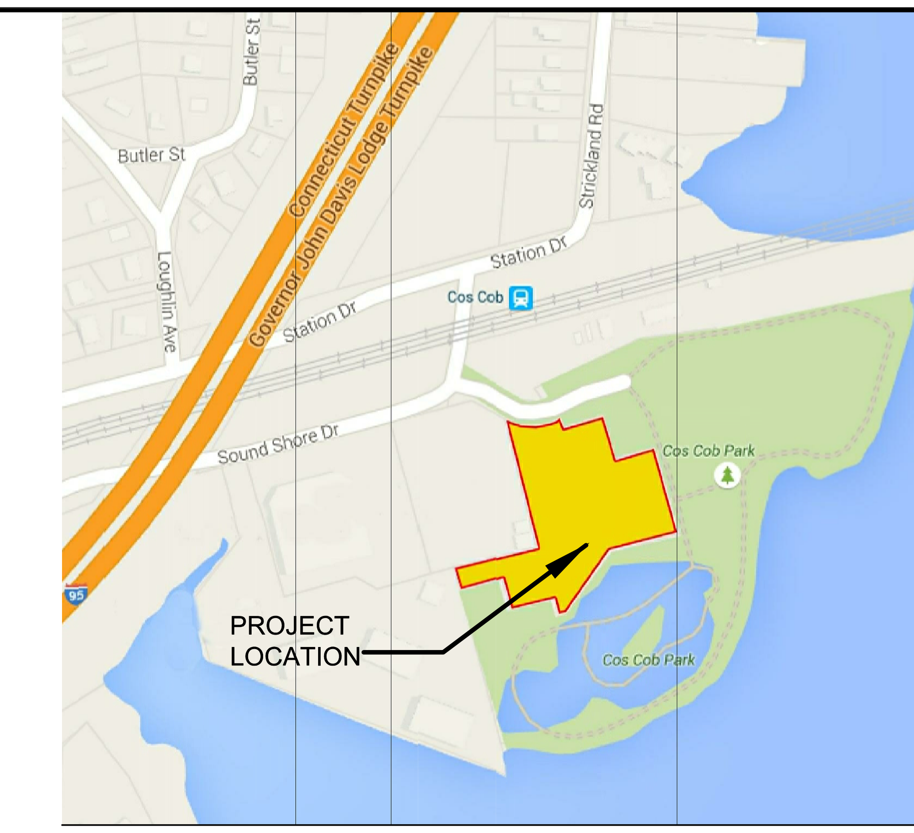

KEY PLAN

0 10 20 40 60 FEET

1" = 20'

D&M PLAN SUBMITTAL 02/15/2018

REVISIONS DURING CONSTRUCTION

EVERSOURCE ENERGY

TITLE

COS COB 11R
SITE DEVELOPMENT PLAN
CIVIL PLAN & DETAILS
GREENWICH, CT

BY PS (PEI)	CHKD	APP	APP
DATE	DATE	DATE	DATE
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V-SCALE	V.S.	R.E. DWG	
R.E. PROJ. NUMBER		DWG NO. 15706-10033	

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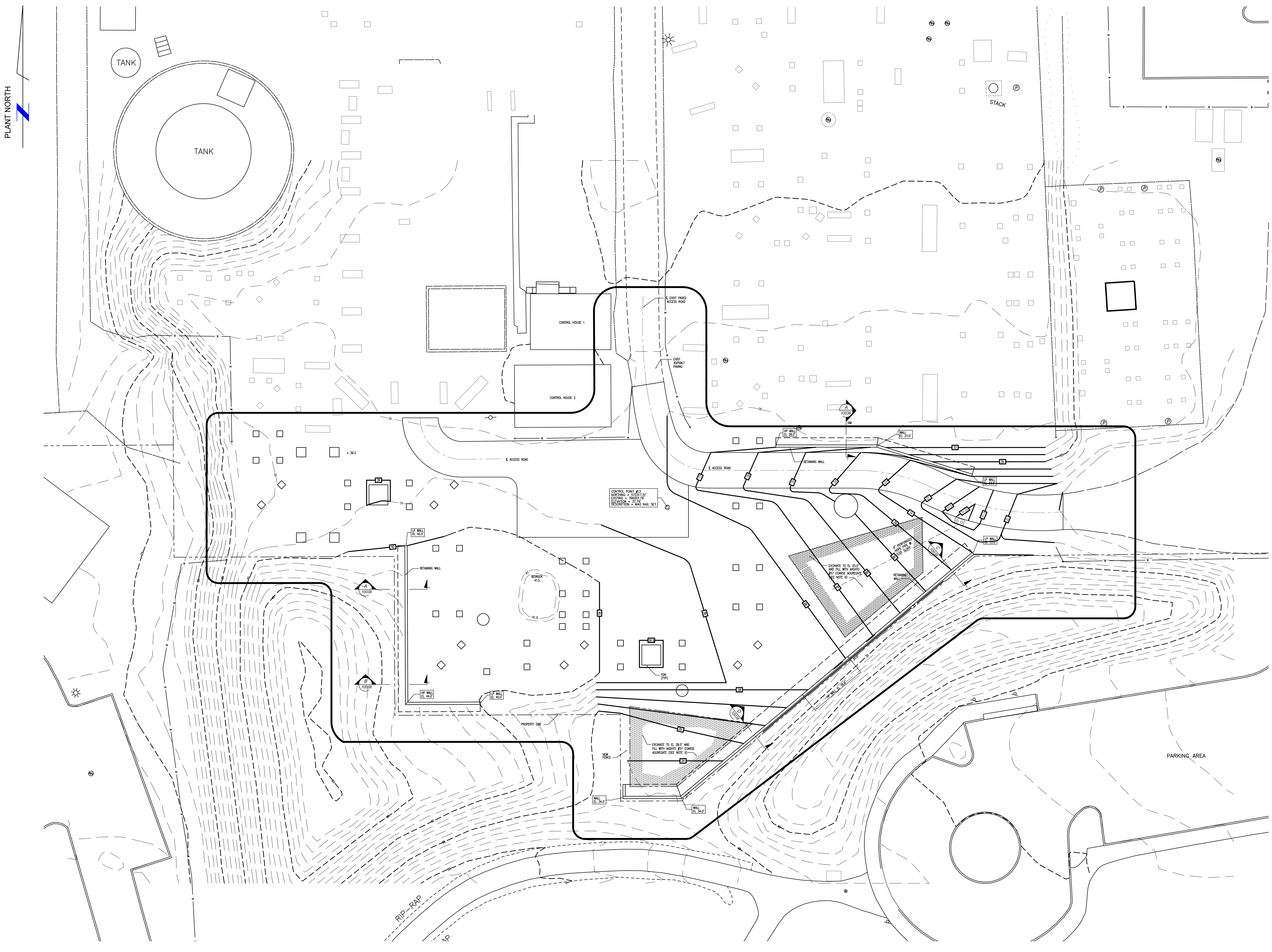

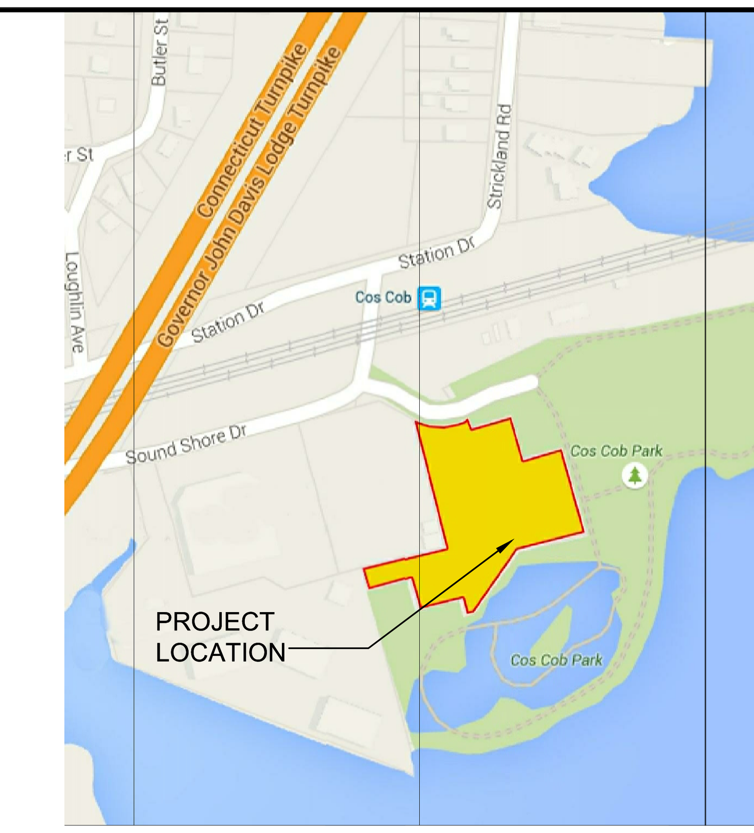

KEY PLAN

LEGEND:

- 00 EXISTING FINISH GRADE SPOT ELEVATION
- 00 EXISTING CONTOURS UNCHANGED BY NEW GRADING
- **00** NEW FINISH GRADE ELEVATION
- SOIL BORING LOCATION

0 10 20 40 60 FEET

1" = 20'

D&M PLAN SUBMITTAL 02/15/2018

REVISIONS DURING CONSTRUCTION

REV	DATE	DESCRIPTION	DRW	CHK	APP

EVERSOURCE ENERGY

TITLE

COS COB 11R
GRADING AND DRAINAGE PLAN
CIVIL PLAN & DETAILS
GREENWICH, CT

BY AMW (PEI)	CHKD	APP	APP
DATE	DATE	DATE	DATE
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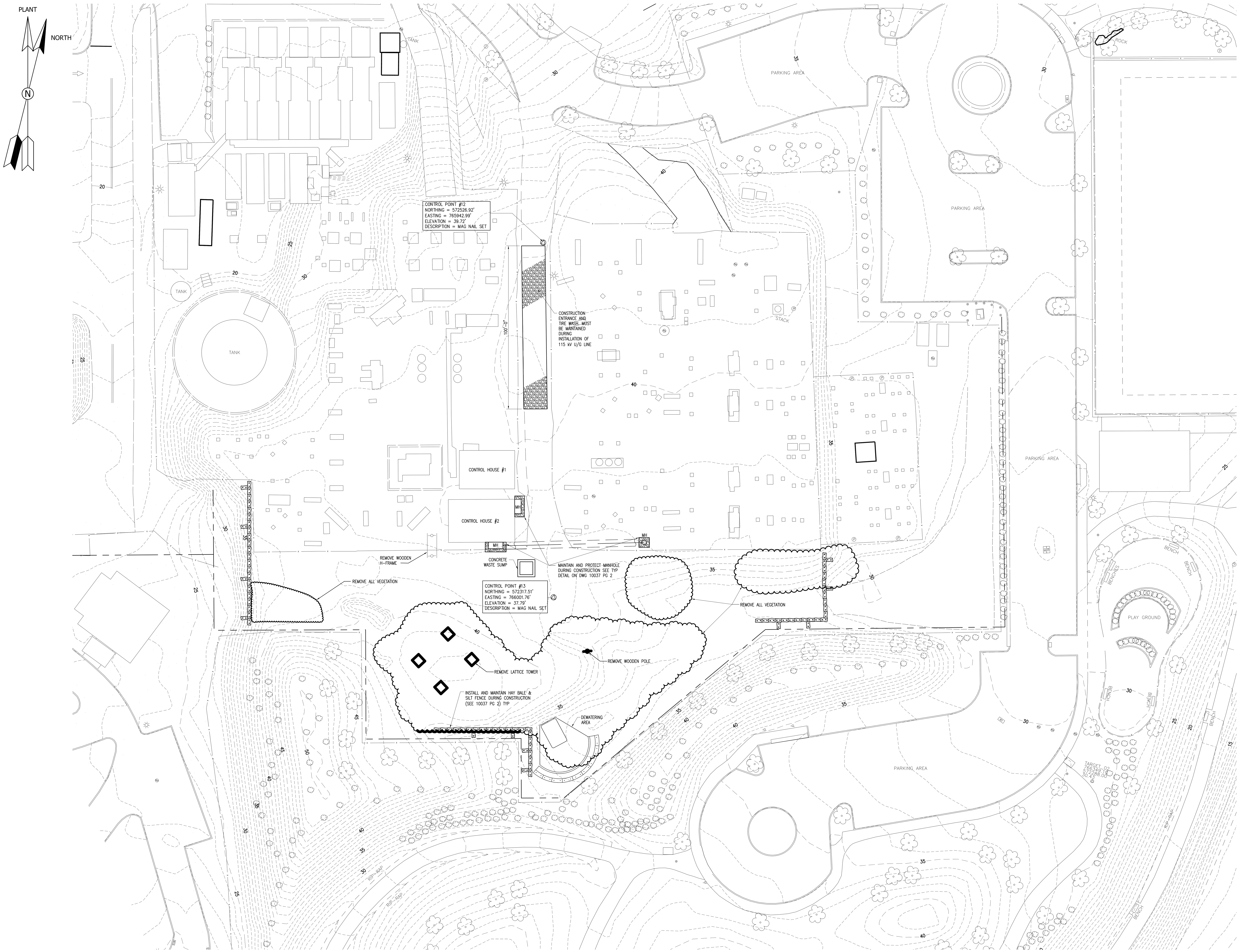
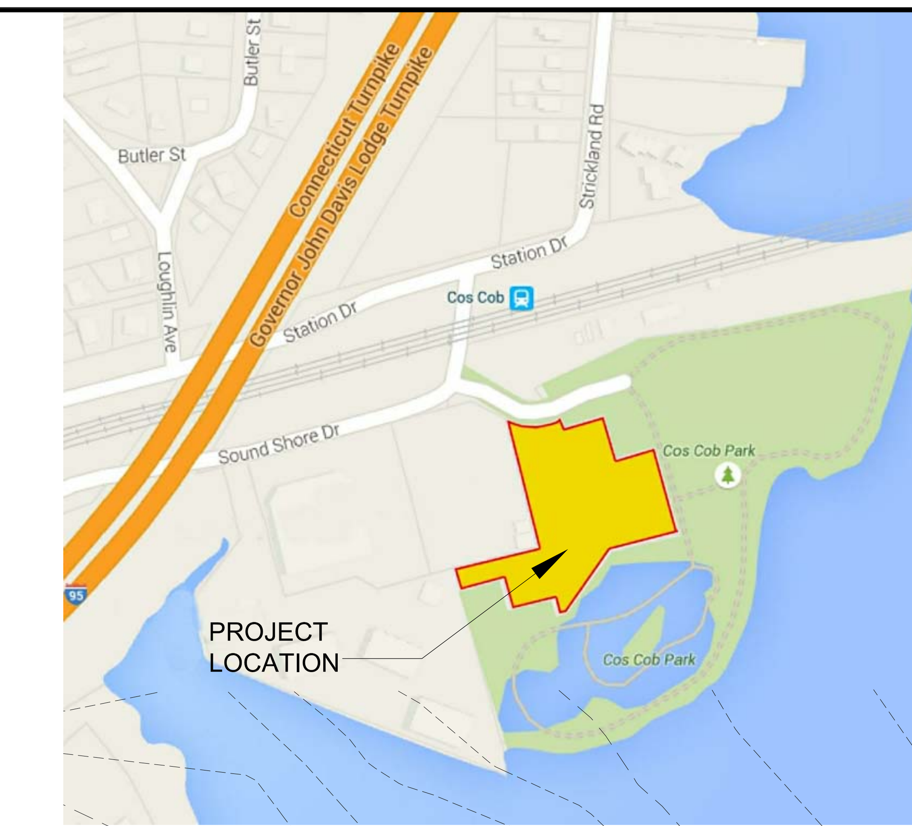
V-SCALE	V.S.	R.E. DWG	
R.E. PROJ. NUMBER		DWG NO.	15706-10034

ES VER: 05/2015





KEY PLAN

0 15 30 60 90 FEET

1" = 30'

D&M PLAN SUBMITTAL 02/15/2018

REVISIONS DURING CONSTRUCTION

EVERSOURCE ENERGY

TITLE
COS COB 11R
SOIL EROSION AND SEDIMENT CONTROL PLAN
CIVIL PLAN & DETAILS
GREENWICH, CT

BY PS (PEI)	CHKD	APP	APP
DATE	DATE	DATE	DATE
H-SCALE 1"=20'	SIZE D	FIELD BOOK & PAGES	
V-SCALE 1"=20'	V.S.	R.E. DWG	
R.E. PROJ. NUMBER		DWG NO. 15706-10036	

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PROJECT DESCRIPTION

1.1 COS COB 11R & 35K ARE EXISTING SUBSTATIONS IN THE GREENWICH AREA. THEY ARE LOCATED ADJACENT TO EACH OTHER ON SOUND SHORE DRIVE. IN ORDER TO SUPPORT TWO (2) NEW U/G TRANSMISSION CONNECTIONS TO THE NEW GREENWICH 28F SUBSTATION COS COB 11R WILL BE EXPANDED TO THE SOUTH AND TO THE EAST. THE EXPANSION INCLUDES: (2) CIRCUIT BREAKERS AND ASSOCIATED FOUNDATIONS; (5) MANUALLY OPERATED DISCONNECT SWITCHES AND ASSOCIATED STRUCTURES AND FOUNDATIONS; (2) MOTOR OPERATED DISCONNECT SWITCHES AND ASSOCIATED STRUCTURES AND FOUNDATIONS; (6) INSTRUMENTATION POTENTIAL TRANSFORMERS (PT) AND ASSOCIATED STRUCTURES AND FOUNDATIONS; (2) CABLE TERMINATION STRUCTURES WITH ASSOCIATED FOUNDATIONS; (12) BUS SUPPORT STRUCTURES AND FOUNDATIONS; (1) H-FRAME LINE STRUCTURE AND FOUNDATIONS; (1) MONOPOLE AND FOUNDATION; AND UNDERGROUND CONDUITS AND DUCT BANKS.

1.2 THE FOLLOWING EQUIPMENT WILL BE REMOVED: (2) A-FRAME STRUCTURES; (1) H-FRAME STRUCTURE; (1) STEEL FRAMED LATTICE TRANSMISSION/COMMUNICATION TOWER; AND (1) CABLE GUYED WOOD POLE.

1.3 THE EXISTING GRADING, DRAINAGE AND STORM WATER MANAGEMENT DEPENDS ON RECHARGING THE SITE; THE SYSTEM FOR THE NEW EXPANSION AREA WILL BE THE SAME. ON THE SOUTHERN AND WESTERN SIDES OF THE EXISTING LATTICE TOWER (TO BE DEMOLISHED) AND ALONG THE SOUTHEASTERN BORDER IT WILL BE NECESSARY TO BUILD RETAINING WALLS.

1.4 THE EXISTING COS COB SUBSTATION PROPERTY CONSISTS PRIMARILY OF PREVIOUSLY DISTURBED AND DEVELOPED LAND, WHERE BOTH EVERSOURCE AND THE METRO NORTH RAILROAD (MNRR) MAINTAIN EXTENSIVE SUBSTATION AND OTHER ELECTRICAL INFRASTRUCTURE. THE MNRR, ASSOCIATED PARKING LOTS AND THE TRAIN STATION ARE ALL LOCATED NORTH OF THE SUBSTATION. THE TOWN CREATED A PARK EAST AND SOUTH OF THE SUBSTATIONS. THE SUBSTATION PROPERTY IS SITUATED ON A 1.5 ACRE TAX LOT AND AN ADJACENT 1.65 ACRE PERMANENT EASEMENT. THE PROPOSED EXPANSION TO THE SOUTH WILL BE ON THE AFOREMENTIONED PERMANENT EASEMENT AND WILL DISTURB APPROXIMATELY 0.8 ACRES.

1.5 THE SITE OF THE PROPOSED SUBSTATION EXPANSION IS LOCATED AT A GRADE ELEVATION OF APPROXIMATELY 39 FEET ABOVE MEAN SEA LEVEL (MSL). THE SITE IS GENERALLY FLAT HOWEVER IS DOES SLOPE OFF TO THE SOUTH EAST TO APPROXIMATELY 33 FEET ABOVE MSL WITHIN THE PLANNED EXPANSION AREA. THE NORTHERN PORTION OF THE SITE SLOPES TO THE NORTH AND TO THE WEST. MOST OF THE AREA IS PAVED WITH GRAVEL; HOWEVER THERE IS ASPHALT PAVED ROAD THAT IS APPROXIMATELY 20' WIDE X 400' LONG. THERE IS ONE KNOLL THAT SUPPORTS AN EXISTING STEEL LATTICE TRANSMISSION/COMMUNICATIONS TOWER. THE KNOLL IS APPROXIMATELY 42 FEET ABOVE MEAN SEA LEVEL (MSL) AND BASED ON EXISTING FOUNDATION DRAWINGS, APPEARS TO BE SOLID ROCK.

1.6 THE SITE IS LOCATED WITHIN THE SOUTHWEST COAST MAJOR DRAINAGE BASIN AND COASTAL BOUNDARY. NO TIDAL OR FRESH WATER WETLANDS/WATERCOURSES OR COASTAL RESOURCES ARE LOCATED ON THE SITE. THE SITE IS LOCATED OUTSIDE THE 100-YEAR AND 500-YEAR FLOOD BOUNDARIES ASSOCIATED WITH COS COB HARBOR. THE NORTHWEST CORNER OF THE SUBSTATION IS LOCATED WITHIN CATEGORY 1, 2, 3, AND 4 HURRICANE SURGE INUNDATION AREAS. THERE ARE NO WETLANDS OR WATER COURSES LOCATED AT THE SUBSTATION.

DEWATERING NOTES

2.1 OPEN EXCAVATIONS SHALL BE DEWATERED AND KEPT FREE OF STANDING WATER AND MUDDY CONDITIONS AS NECESSARY FOR THE PROPER EXECUTION OF THE WORK. THE CONTRACTOR SHALL FURNISH, INSTALL, OPERATE, AND MAINTAIN ALL DRAINS, SUMPS AND ALL OTHER EQUIPMENT REQUIRED TO PROPERLY DEWATER THE SITE. DEWATERING SYSTEMS THAT CAUSE A LOSS OF SOIL FINES FROM THE FOUNDATION AREAS SHALL NOT BE PERMITTED.

2.2 INSTALL DIVERSION DITCHES OR BERMS IF NECESSARY TO MINIMIZE THE AMOUNT OF CLEAN STORM WATER RUN-ON ALLOWED INTO THE EXCAVATED AREA.

2.3 REMOVAL OF WATER FROM THE CONSTRUCTION SITE SHALL BE ACCOMPLISHED SO THAT EROSION AND THE TRANSPORTING OF SEDIMENT AND OTHER POLLUTANTS ARE MINIMIZED.

2.4 DEWATERING EFFLUENT DISCHARGE SHALL BE IN SHEET FLOW.

2.5 DEWATERING IN PERIODS OF INTENSE, HEAVY RAIN, WHEN THE INFILTRATIVE CAPACITY OF THE SOIL IS EXCEEDED, SHALL BE AVOIDED.

2.6 DEWATERING WASTEWATERS SHALL BE REMOVED FROM THE SITE.

ADJACENT PROPERTY

3.1 THE PROJECT PROPERTY IS IRREGULARLY SHAPED. THE SITE HAS FRONTAGE ON SOUND SHORE DRIVE TO THE NORTH. THE SITE BORDERS COMMERCIAL PROPERTIES TO THE WEST AND COS COB PARK TO THE SOUTH AND EAST.

GENERAL REQUIREMENTS

4.1 THE GENERAL CONTRACTOR IS A RESPONSIBLE PARTY FOR IMPLEMENTING THE EROSION AND SEDIMENT CONTROL PLAN. THE RESPONSIBILITY INCLUDES THE MAINTENANCE AND INSTALLATION OF CONTROL MEASURES AND INFORMING ALL PARTIES OF THE REQUIREMENTS AND OBJECTIVES OF THE PLAN. EROSION CONTROL MEASURES SHALL BE CHECKED WEEKLY AND AFTER EVERY STORM BY THE ON-SITE CONSTRUCTION MANAGER. ALL ITEMS IDENTIFIED REQUIRING MAINTENANCE/REPLACEMENT SHALL BE COMPLETED IMMEDIATELY.

4.2 CONSTRUCTION SHALL BE PHASED TO MINIMIZE LAND DISTURBANCE AT ANY GIVEN TIME TO REDUCE EROSION HAZARDS. SOIL STABILIZATION MUST BE IMPLEMENTED WITHIN THREE DAYS AFTER CONSTRUCTION ACTIVITIES HAVE PERMANENTLY CEASED OR HAVE BEEN TEMPORARILY SUSPENDED FOR SEVEN DAYS.

4.3 AREAS WHICH REMAIN INACTIVE FOR AT LEAST THIRTY DAYS SHALL. RECEIVE TEMPORARY SEEDING IN ACCORDANCE WITH THE GUIDELINES.

4.4 CONTRACTOR IS RESPONSIBLE TO ENSURE THAT NO DEBRIS, LITTER, OR OTHER MATERIALS ARE DISCHARGED IN THE WATERS OF THE STATE OF CONNECTICUT AND TO ADJACENT PROPERTIES.

SOIL EROSION AND SEDIMENT CONTROL DEVICES & MEASURES

5.1 THE SOIL EROSION AND SEDIMENT CONTROL DEVICES TO BE IMPLEMENTED AS PART OF THE SITE DEVELOPMENT SHALL BE INSTALLED WHERE INDICATED ON THE DRAWING 10036 AND DETAILED ON 10037 PG2 AND 10037 PG3 OR DESCRIBED BELOW. FOR FURTHER REFERENCE SEE THE STATE OF CONNECTICUT 2002 GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL (THE "GUIDELINES").

5.2 ORGANIC MULCHES (STRAW), AND/OR NETTING AND MATS ARE TO BE USED DURING CONSTRUCTION TO PREVENT EROSION BY PROTECTING THE EXPOSED SOIL AND TO PROMOTE THE GROWTH OF VEGETATION. ORGANIC MULCH MATERIALS AND APPLICATION RATES SHALL BE IN ACCORDANCE WITH <u>FIGURE 7-1</u> OF THE "GUIDELINES".

5.3 STRAW MUST BE ANCHORED IMMEDIATELY AFTER SPREADING USING APPROPRIATE MULCH ANCHORING TOOL, LIQUID MULCH BINDERS, NETTING OR OTHER MEANS OF ANCHORING ALLOWED BY THE "GUIDELINES." CONTROL MEASURES MUST BE INSPECTED PERIODICALLY AND, IN PARTICULAR, AFTER RAINSTORMS, AND RE-APPLIED IMMEDIATELY IF EROSION IS OBSERVED.

5.4 RIPRAP APRONS SHALL BE USED WHERE REQUIRED TO REDUCE RUNOFF VELOCITIES AND PROTECT EXPOSED SURFACES DURING CONSTRUCTION FROM CONCENTRATED FLOWS.

5.5 TEMPORARY AND PERMANENT VEGETATIVE COVERS SHALL BE INSTALLED TO STABILIZE SOIL AND REDUCE DAMAGE FROM SEDIMENT DEPOSITS, WIND AND/OR RUNOFF EROSION. VEGETATIVE COVERS SHALL BE INSTALLED ON ALL DISTURBED AREAS NOT PROTECTED BY OTHER EROSION CONTROL MEASURES AND ARE NOT INTENDED FOR PRIMARY CONSTRUCTION.

5.6 A CRUSHED STONE STABILIZED CONSTRUCTION ENTRANCE SHALL BE PLACED AT THE SITE ACCESS ONTO SOUND SHORE DRIVE.

5.7 FILTER FABRIC SILT FENCE SHALL BE INSTALLED ALONG THE DOWN GRADIENT SIDE OF ALL FILL SECTIONS. SILT FENCE WILL BE MAINTAINED IN PLACE UNTIL THE TRIBUTARY AREA PROTECTED BY THE FENCE IS RE-VEGETATED OR STABILIZED BY PERMANENT MEASURES. SYNTHETIC FILTER FABRIC, POST MATERIAL, SPACING AND EMBEDMENT, AND TRENCH DETAILS, SHALL BE AS SHOWN ON THE DRAWINGS. FILTER BARRIER SHALL BE INSPECTED IMMEDIATELY AFTER EACH RAINFALL GREATER THAN 0.1 INCH AND AT LEAST DAILY DURING PROLONGED RAINFALL. REFER TO THE CHAPTER 7 OF THE "GUIDELINES" FOR ADDITIONAL MAINTENANCE REQUIREMENTS.

5.8 DUST CONTROL MEASURES SHALL BE USED TO PREVENT BLOWING AND MOVEMENT OF DUST FROM EXPOSED SOIL SURFACES AND REDUCE THE PRESENCE OF DUST WHICH HAS THE POTENTIAL TO MIGRATE OFF-SITE. THE NEED FOR DUST CONTROL WILL BE MINIMIZED BY REDUCING AREA OF LAND DISTURBANCE AT ANY ONE TIME, MAINTAINING AS MUCH VEGETATION AS PRACTICABLE, USE OF MULCHING AND TEMPORARY VEGETATIVE COVER. THE CONTRACTOR SHALL USE VACUUM SWEEPERS ON PAVED AREAS AND UTILIZE FINE WATER SPRAYS NEAR SOURCES OF DUST. THE EXPOSED SOIL AREAS SHALL BE PERIODICALLY MOISTENED. SPRAY-ON ADHESIVES DILUTED IN WATER MAY BE USED.

5.9 EXCAVATED SOILS WILL BE LIVE-LOADED, COVERED AND TRANSPORTED TO A LICENSED THIRD-PARTY LOCATION OUTSIDE OF GREENWICH FOR TEMPORARY STAGING AND DISPOSAL CHARACTERIZATION.

5.10 TEMPORARY VEGETATIVE COVERS SHALL BE INSTALLED ON ALL DISTURBED AREAS NOT INTENDED FOR PRIMARY CONSTRUCTION AND HAVING THE POTENTIAL TO PRODUCE SEDIMENT AND CAUSE ON-SITE AND OFF-SITE DAMAGES. SUCH AREAS BASED ON RECOMMENDATIONS SHALL BE COVERED WITH TOPSOIL AND SEEDED PER FIGURE 8-1 OF THE "GUIDELINES." FOR ADDITIONAL SEEDING REQUIREMENTS REFER TO CHAPTER 6 OF THE "GUIDELINES."

5.11 STONE CHECK DAMS SHALL BE INSTALLED AT ANY EVIDENT CONCENTRATED FLOW DISCHARGE POINTS.

5.12 STORM DRAIN CATCH BASIN INLET PROTECTION SHALL BE PROVIDED THROUGH THE USE OF FILTER FABRIC FENCE OR OTHER SUITABLE BARRIERS AROUND THE CATCH BASINS AS INDICATED ON THE SEDIMENT AND EROSION CONTROL DRAWINGS. THE BARRIERS SHALL ONLY BE REMOVED WHEN THE TRIBUTARY DRAINAGE AREA HAS BEEN STABILIZED.

5.13 THE CONTRACTOR MUST INSTALL ANY ADDITIONAL TEMPORARY OR PERMANENT MEASURES NECESSARY TO CONTROL EROSION/SEDIMENTATION ON-SITE AND OFF-SITE DEPENDING ON WEATHER CONDITIONS AND WORK SEQUENCE.

5.14 SEQUENCE OF INSTALLATION

A. FIELD STAKEOUT THE LIMITS OF ALL CONSTRUCTION ACTIVITIES.
B. INSTALL TEMPORARY CONSTRUCTION FENCE AS REQUIRED TO MAINTAIN SAFETY AND SECURITY AT ALL PHASES OF CONSTRUCTION.
C. INSTALL ANTI-TRACKING PAD AT CONSTRUCTION ENTRANCE AS SHOWN ON THE PLAN.
D. INSTALL BARRIERS AS NECESSARY TO CONTROL DRAINAGE ALONG THE ENTRY DRIVE. AT THE END OF EACH WORKING DAY, ANY ACCUMULATED SILT SHALL BE SWEPT FROM THE EXISTING TOWN ROADS.
E. INSTALL HAYBALES AND/OR SILT FENCE AROUND BOUNDARY OF THE CONSTRUCTION AREA.
F. CLEAR ALL VEGETATION FROM THE CONSTRUCTION AREA.

STORM DRAINAGE SYSTEM MAINTENANCE

7.1 STORM DRAINAGE FEATURES SHALL BE INSPECTED ON A WEEKLY BASIS AND AS PREVIOUSLY STATED DURING CONSTRUCTION BY THE CONTRACTOR. ANY FLOATABLES, TRASH, DEBRIS OR SEDIMENT BUILD-UP SHALL BE REMOVED BY A LICENSED CONTRACTOR. GRASS-LINED SWALES IF CONSTRUCTED WILL BE MOWED.

7.2 THE ON-SITE STORM DRAINAGE FEATURES MUST BE MAINTAINED IN GOOD WORKING CONDITION IN ACCORDANCE WITH THE INTENT OF THESE PLANS.

D&M PLAN SUBMITTAL 02/15/2018

REVISIONS DURING CONSTRUCTION

EVERSOURCE ENERGY

TITLE: COS COB 11R
SOIL EROSION CONTROL NOTES AND NARRATIVE
CIVIL PLAN & DETAILS
GREENWICH, CT

BY PS (PEI)	CHKD	APP	APP
DATE	DATE	DATE	DATE
H-SCALE N.T.S.	SIZE D	FIELD BOOK & PAGES	
V-SCALE N.T.S.	V.S.	R.E. DWG	
R.E. PROJ. NUMBER		DWG NO. 15706-10037 PG 1	

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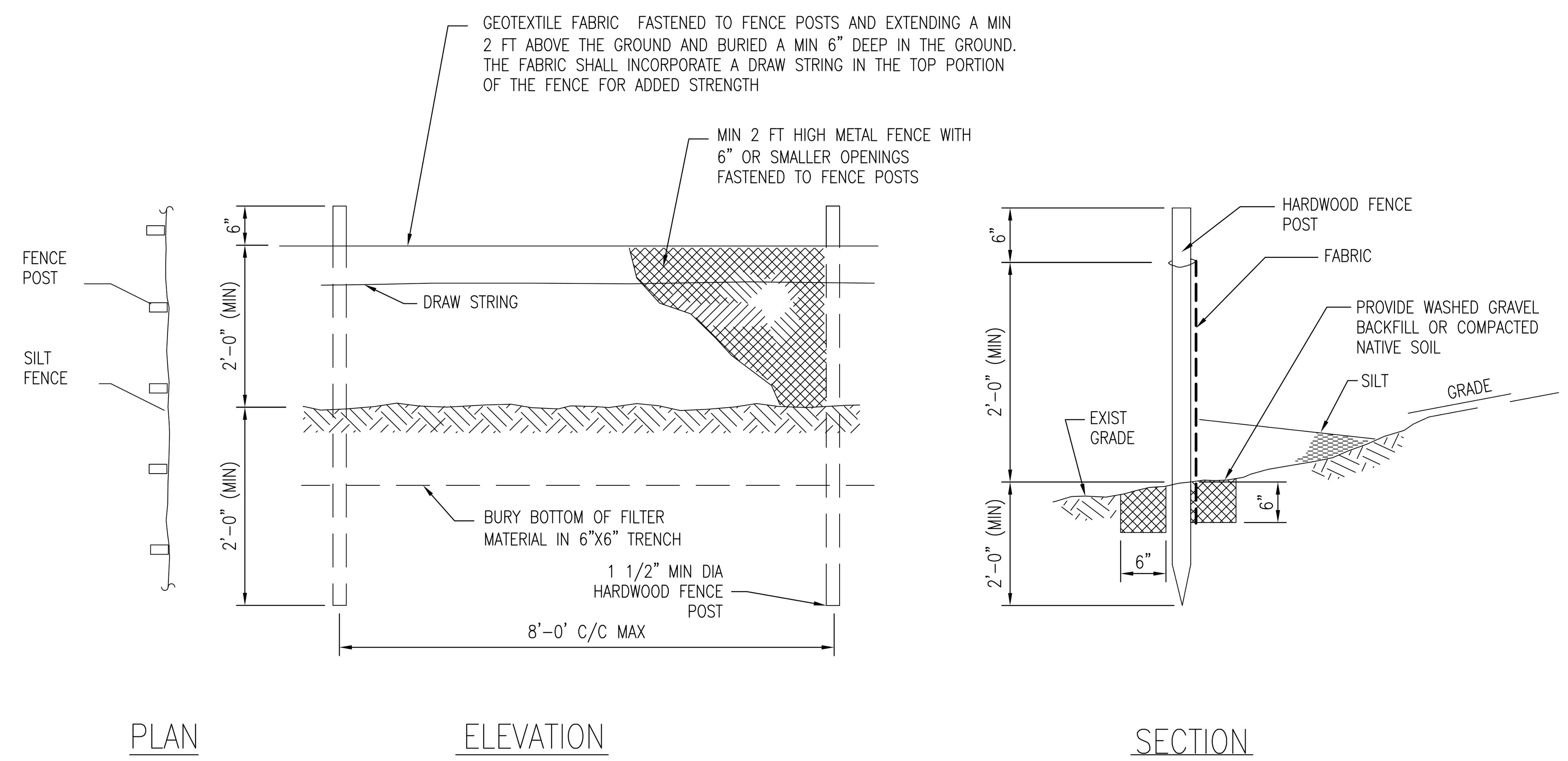
ES VER: 05/2015

2/15/2018 10:04 AM – jomico – R:\Projects\139586 – Cos Cob SS\DD\DWG\05 Phys\Civil\D&M SUBMITTAL\15706-10037p002.dwg – REV AA DM SUBMITTAL

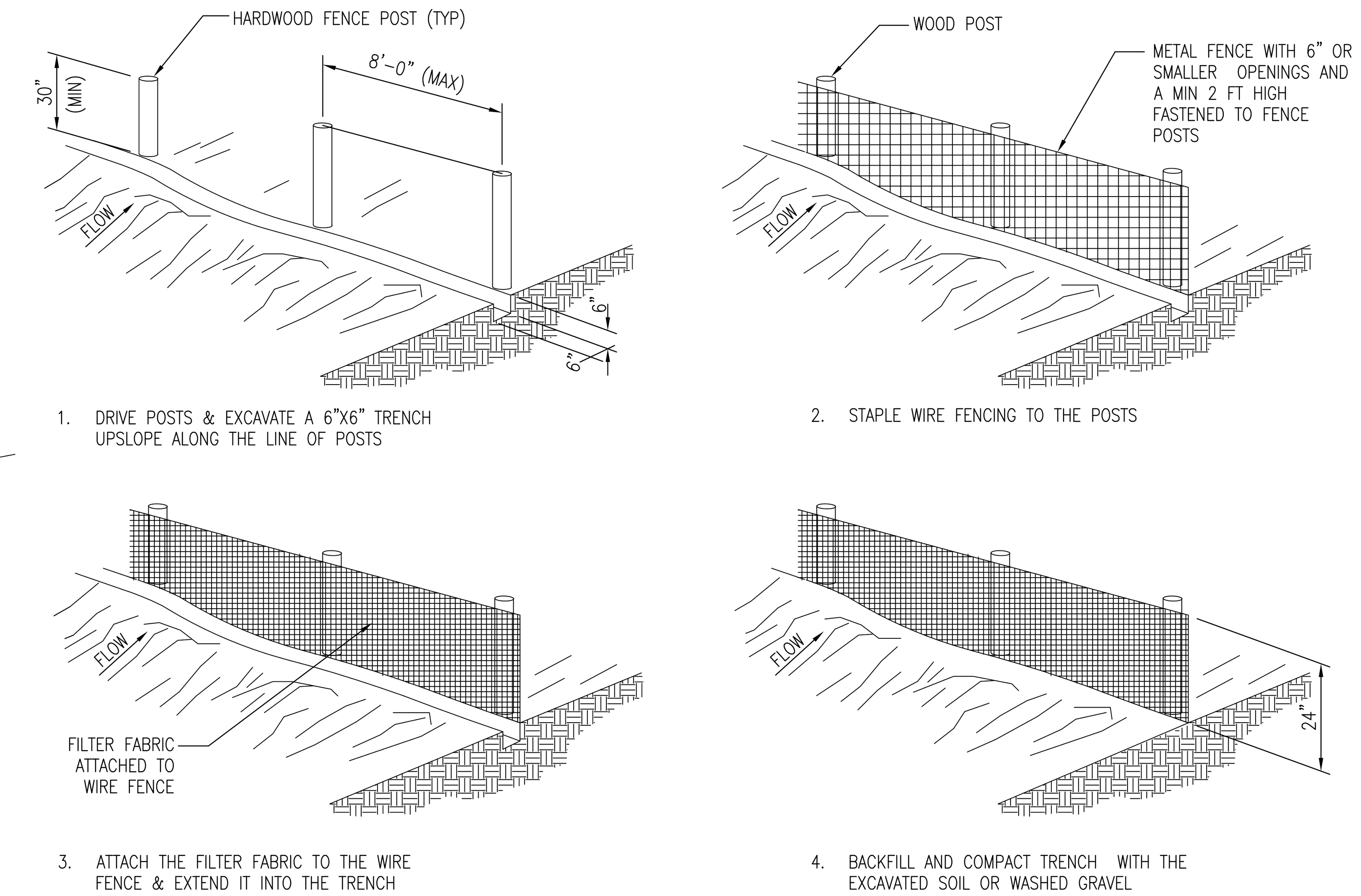
NOTES:

1. FOR SOIL EROSION NOTES SEE DWG 10037 PG1.



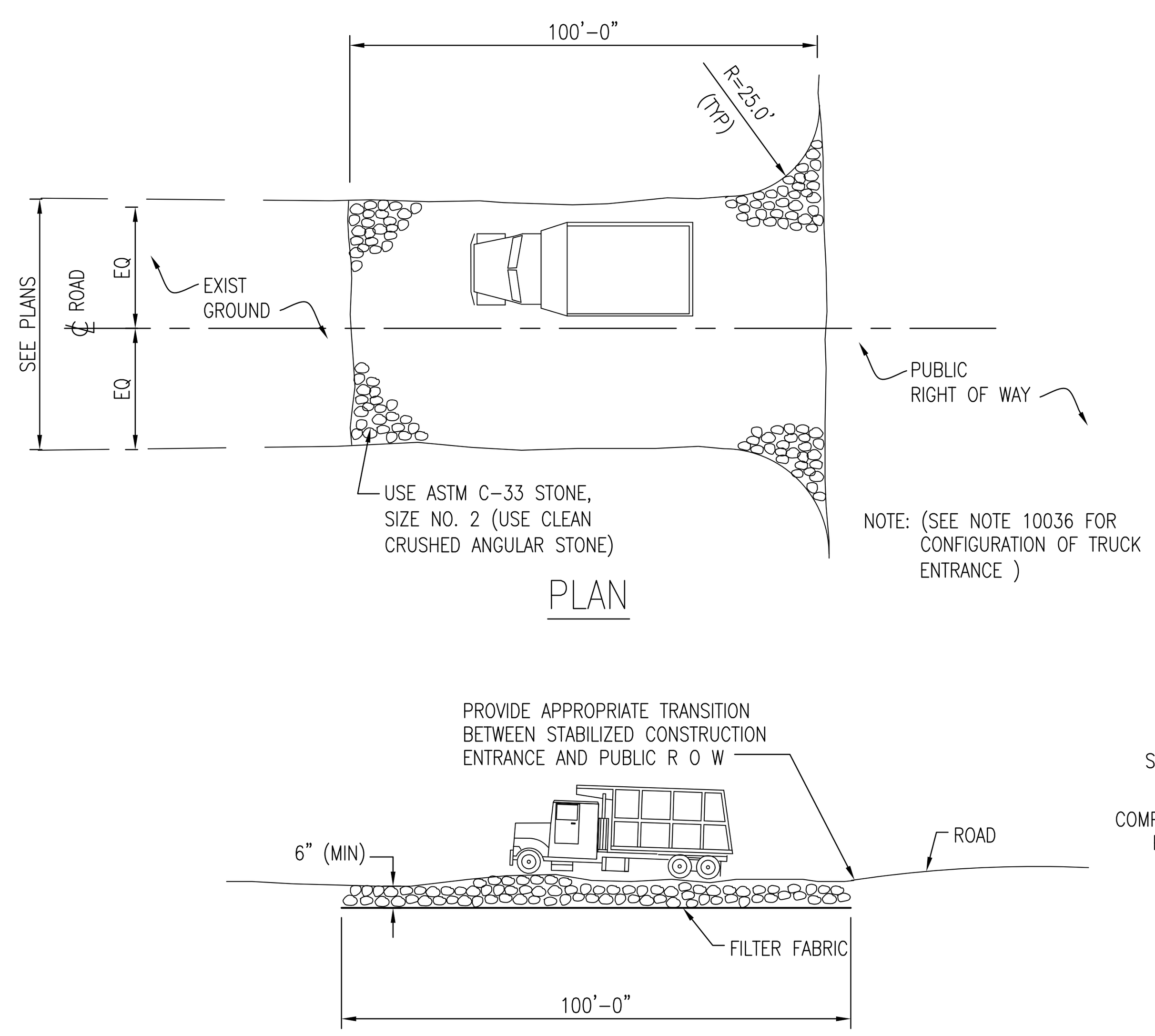
SILT FENCE

DETAIL 1



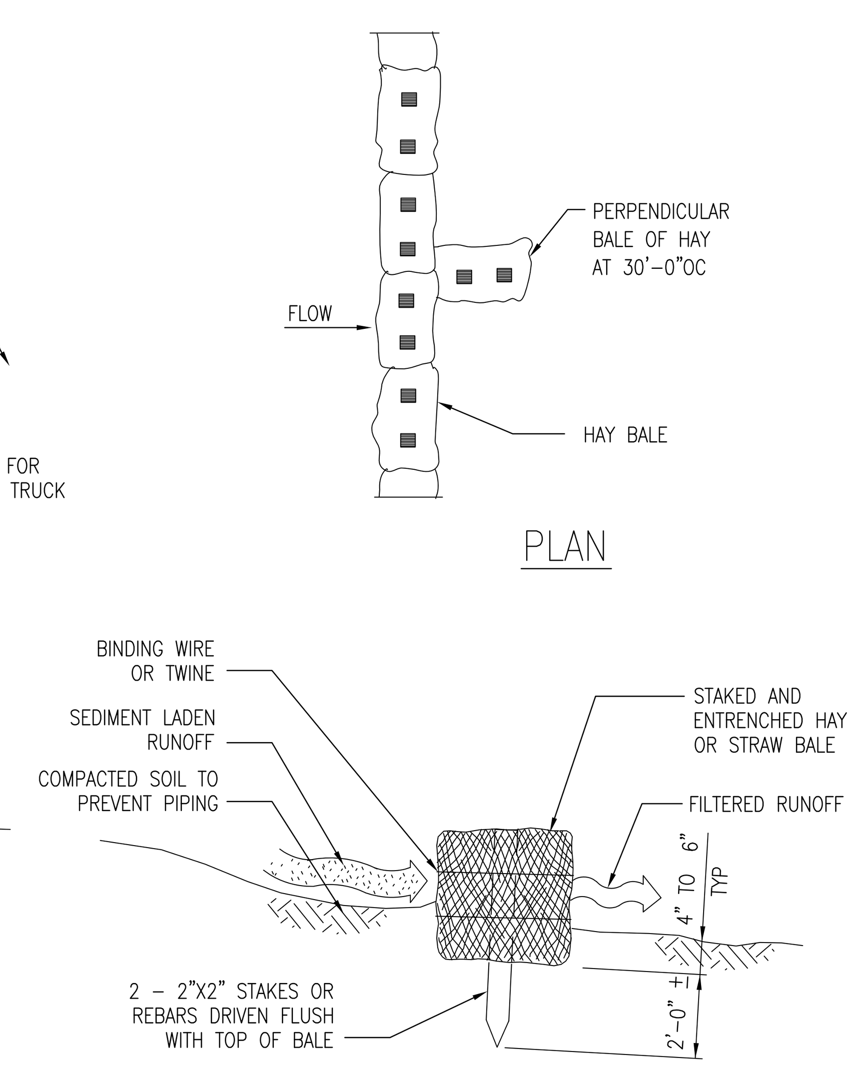
SILT FENCE CONSTRUCTION SEQUENCE

DETAIL 2



STABILIZED CONSTRUCTION ENTRANCE AND TIRE WASH

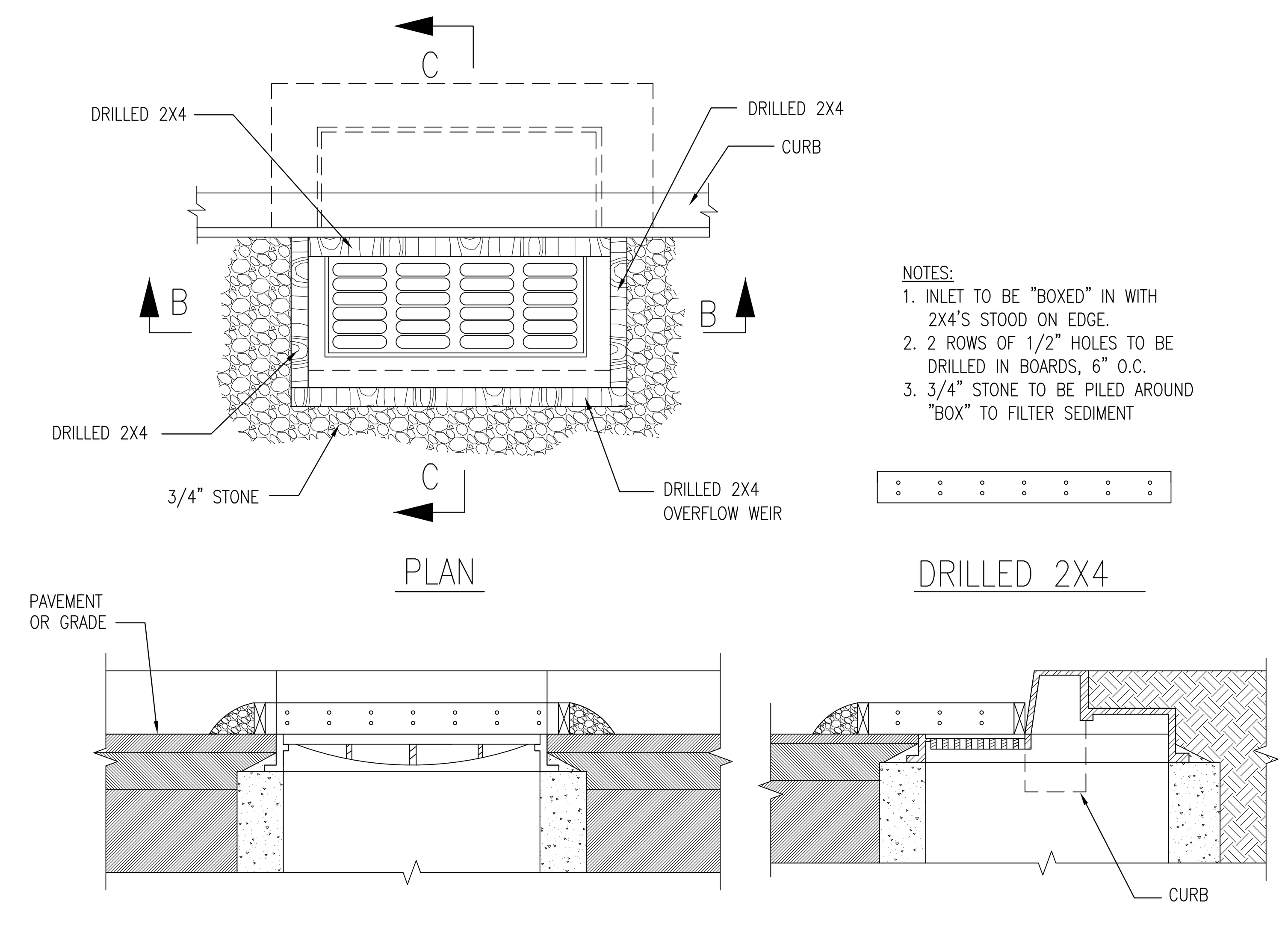
DETAIL 3



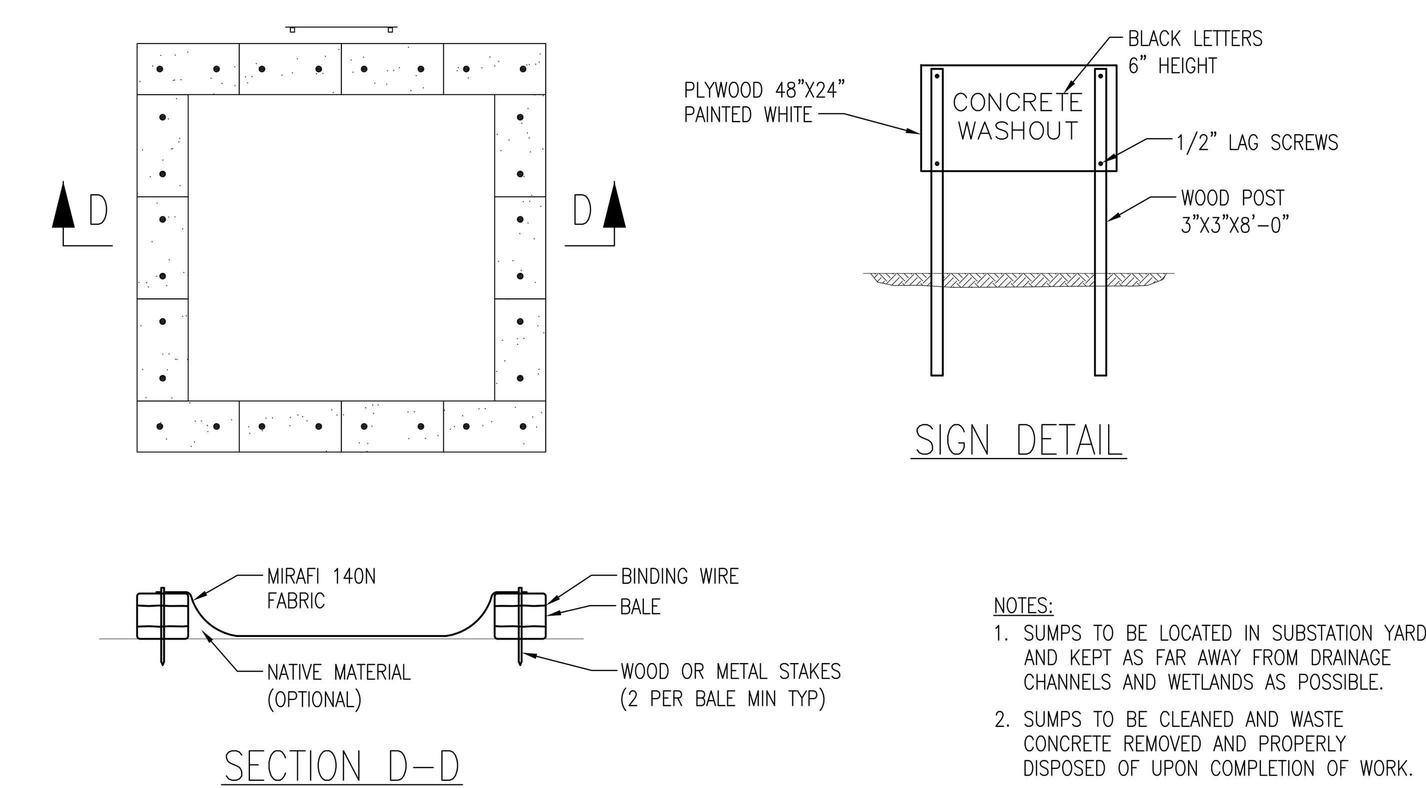
SECTION

HAY BALE BARRIER

DETAIL 4

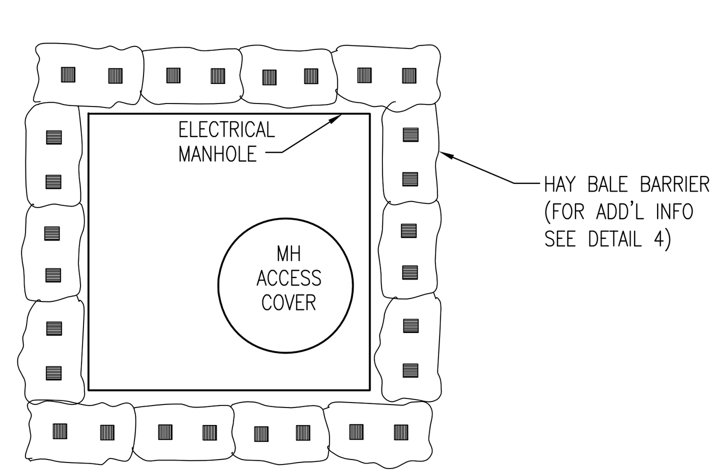


STORM SEWER INLET PROTECTION



CONCRETE WASTE SUMP DETAIL

N.T.S



ELECTRICAL MANHOLE PROTECTION

DETAIL 5

D&M PLAN SUBMITTAL 02/15/2018

REVISIONS DURING CONSTRUCTION

EVERSOURCE ENERGY

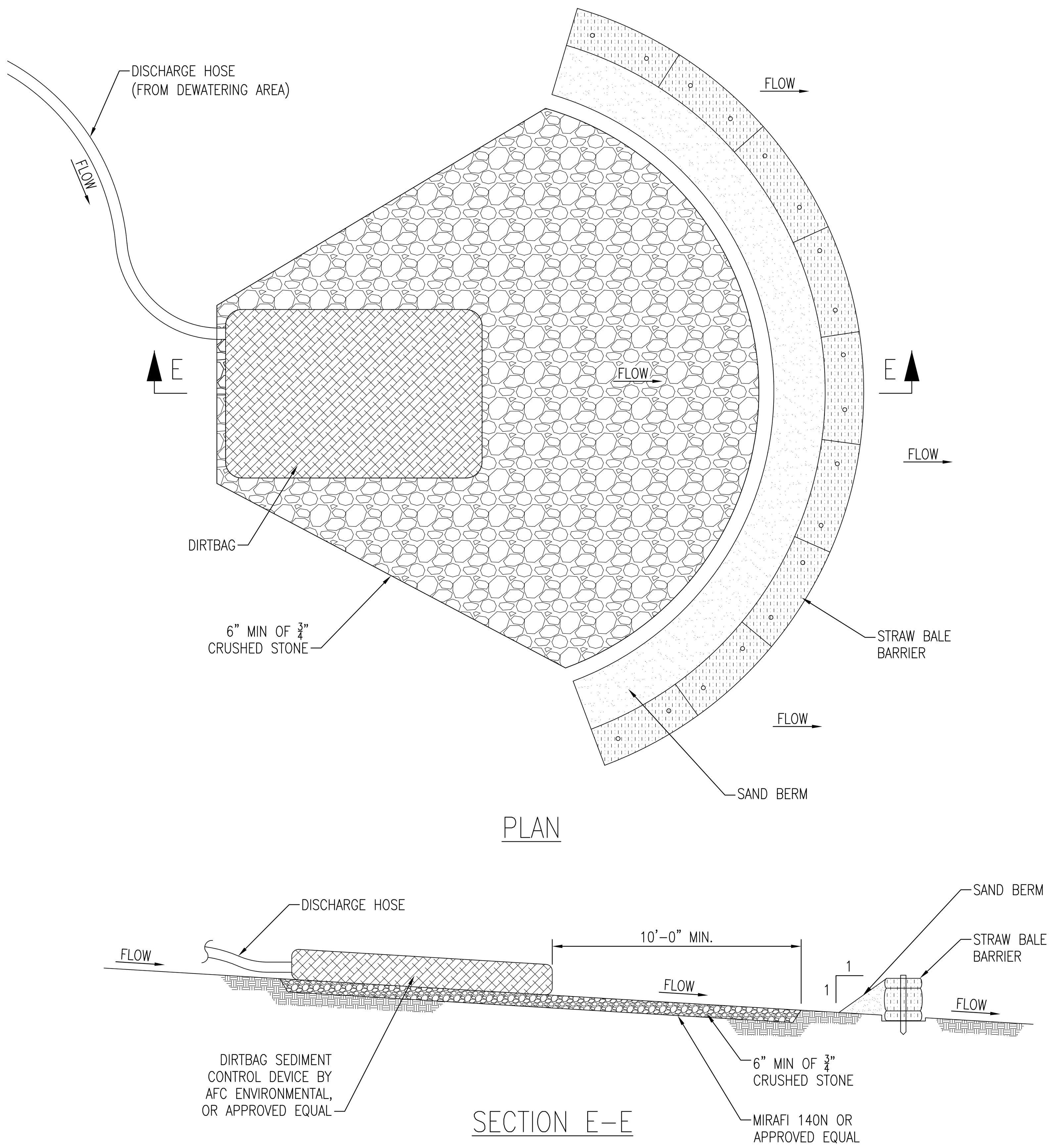
TITLE

COS COB 11R
SOIL EROSION CONTROL DETAILS
CIVIL PLAN & DETAILS
GREENWICH, CT

BY	PS (PEI)	CHKD		APP		APP	
DATE		DATE		DATE		DATE	
H-SCALE	N.T.S.	SIZE	D	FIELD BOOK & PAGES			
V-SCALE	N.T.S.	V.S.		R.E. DWG			
R.E. PROJ. NUMBER				DWG NO.	15706-10037 PG 2		

NOTES:

1. FOR SOIL EROSION NOTES SEE DWG 10037 PG1.



DEWATERING SYSTEM DETAIL

NTS

D&M PLAN SUBMITTAL 02/15/2018

REVISIONS DURING CONSTRUCTION

EVERSOURCE ENERGY

TITLE COS COB 11R
SOIL EROSION CONTROL DETAILS
CIVIL PLAN & DETAILS
GREENWICH, CT

BY JA (PEI)	CHKD	APP	APP
DATE	DATE	DATE	DATE
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V-SCALE N.T.S.	V.S.	R.E. DWG	
R.E. PROJ. NUMBER		DWG NO. 15706-10037 PG 3	

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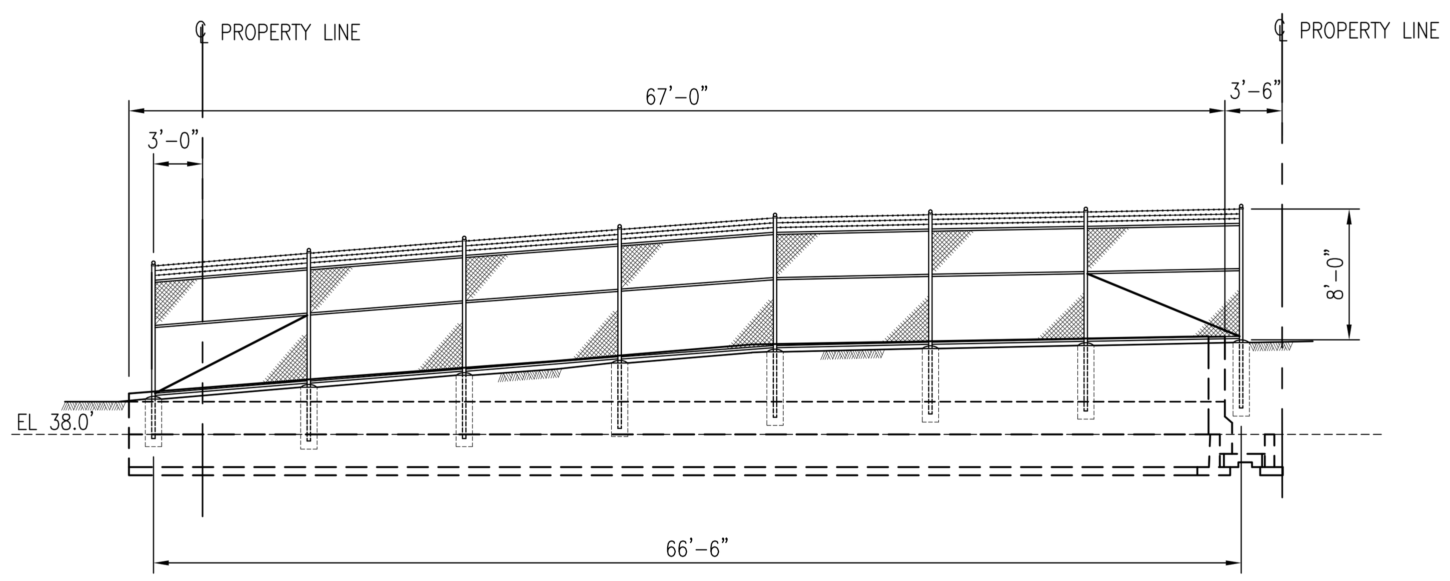
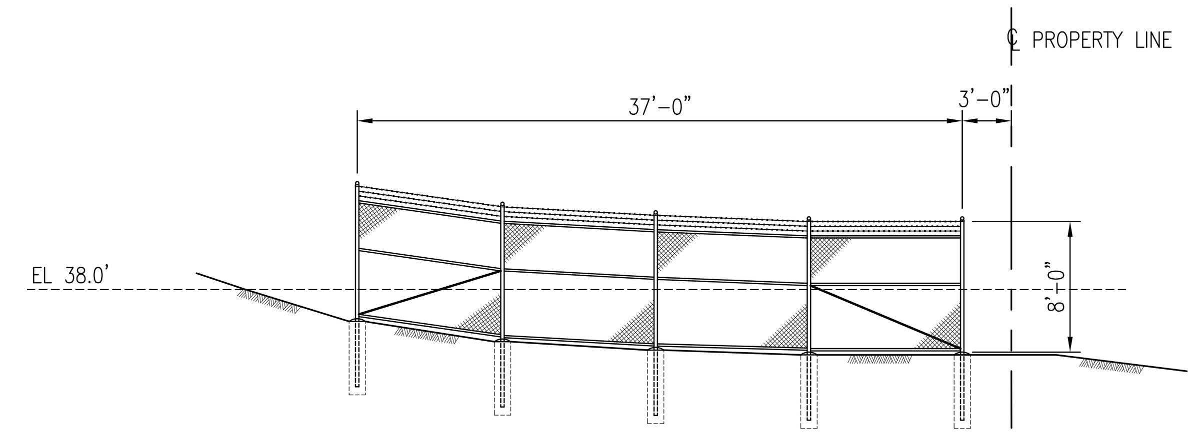
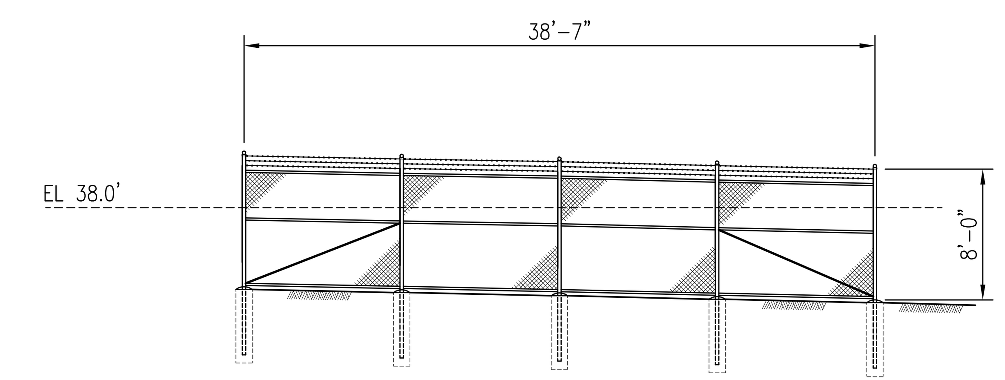


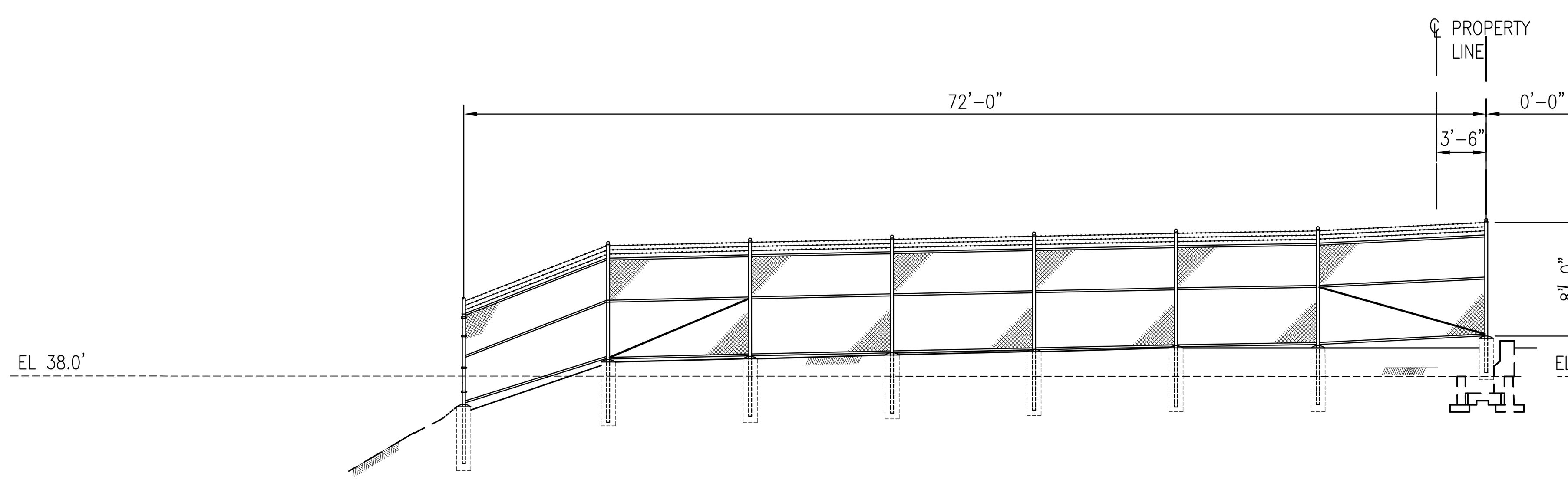
PROFILE B (LOOKING WEST)
(10033 & 10034)
SCALE: 1"=10'
NOTE: SEE DWG 10039 PG2 FOR FENCE DETAILS.

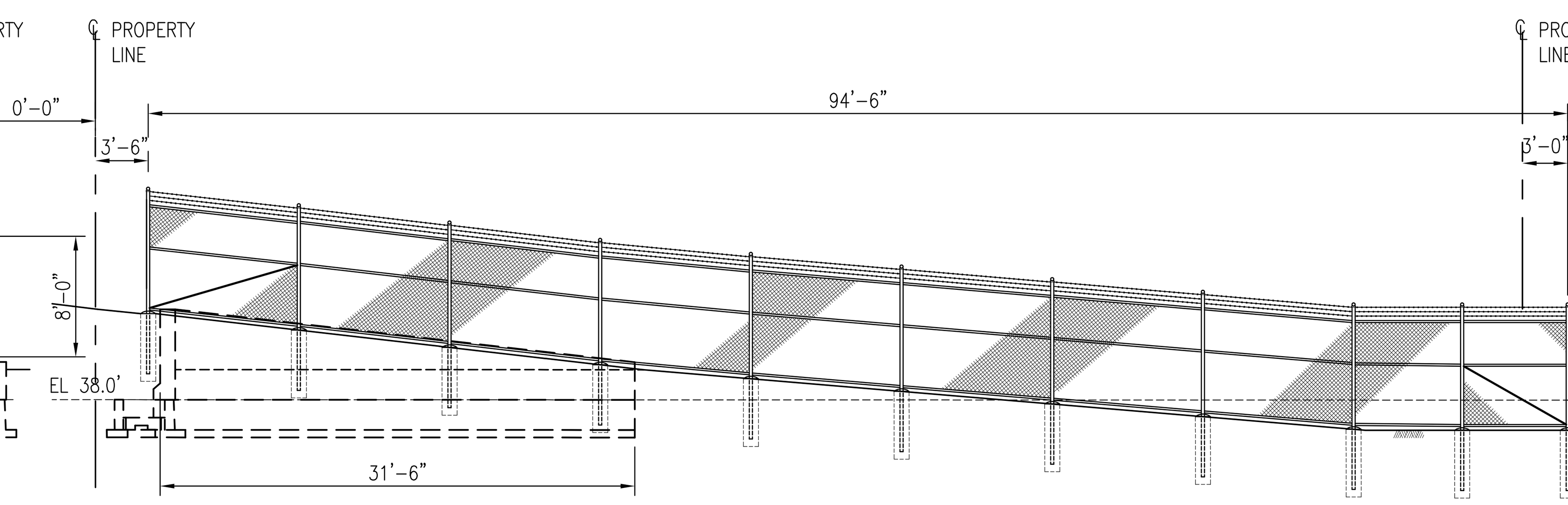


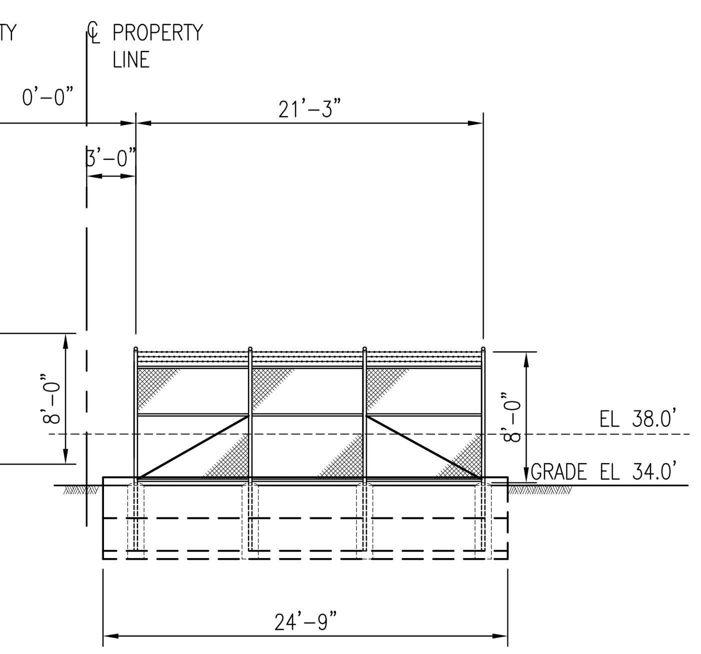
PROFILE D (LOOKING WEST)
(10033 & 10034)
SCALE: 1"=10'
NOTE: SEE DWG 10039 PG2 FOR FENCE DETAILS.



PROFILE G (LOOKING NORTH)
(10033 & 10034)
SCALE: 1"=10'
NOTE: SEE DWG 10039 PG2 FOR FENCE DETAILS.



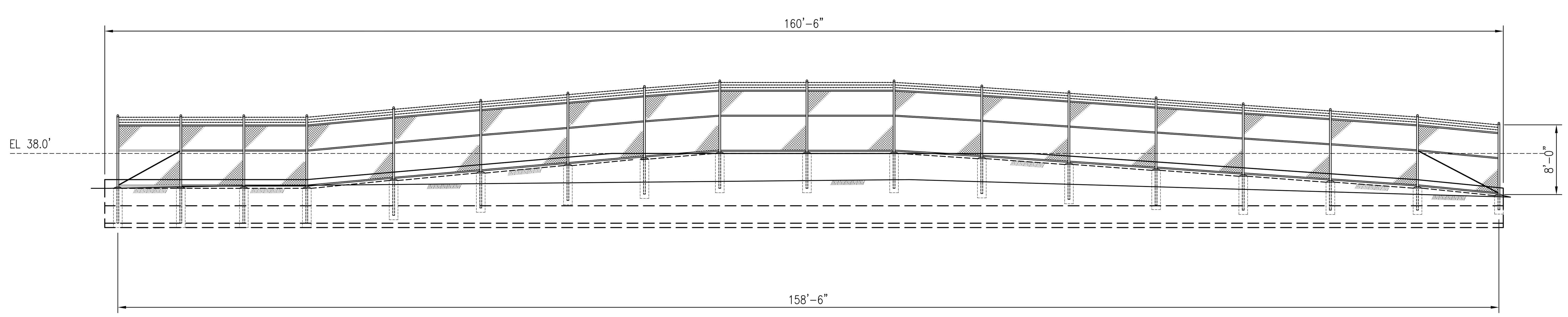




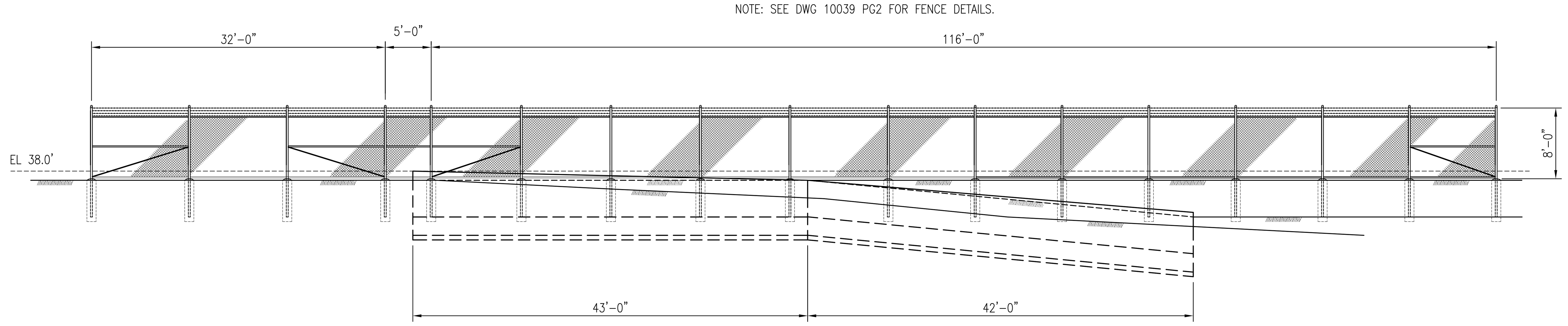
PROFILE A (LOOKING NORTH)
(10033 & 10034)
SCALE: 1"=10'
NOTE: SEE DWG 10039 PG2 FOR FENCE DETAILS.

PROFILE C (LOOKING NORTH)
(10033 & 10034)
SCALE: 1"=10'
NOTE: SEE DWG 10039 PG2 FOR FENCE DETAILS.

PROFILE E (LOOKING NORTH)
(10033 & 10034)
SCALE: 1"=10'
NOTE: SEE DWG 10039 PG2 FOR FENCE DETAILS.



PROFILE F (LOOKING NORTHWEST)
(10033 & 10034)
SCALE: 1"=10'
NOTE: SEE DWG 10039 PG2 FOR FENCE DETAILS.



PROFILE H (LOOKING NORTH)
(10033 & 10034)
SCALE: 1"=10'
NOTE: SEE DWG 10039 PG1 FOR FENCE DETAILS.

D&M PLAN SUBMITTAL 02/15/2018

REVISIONS DURING CONSTRUCTION

EVERSOURCE ENERGY

TITLE
COS COB 11R
FENCE & RETAINING WALL PROFILES & SECTIONS
ELEVATIONS & SECTIONS
GREENWICH, CT

BY AMW (PEI)	CHKD	APP	APP
DATE	DATE	DATE	DATE
H-SCALE AS NOTED	SIZE D	FIELD BOOK & PAGES	
V-SCALE AS NOTED	V.S.	R.E. DWG	
R.E. PROJ. NUMBER		DWG NO. 15706-10038 PG 1	

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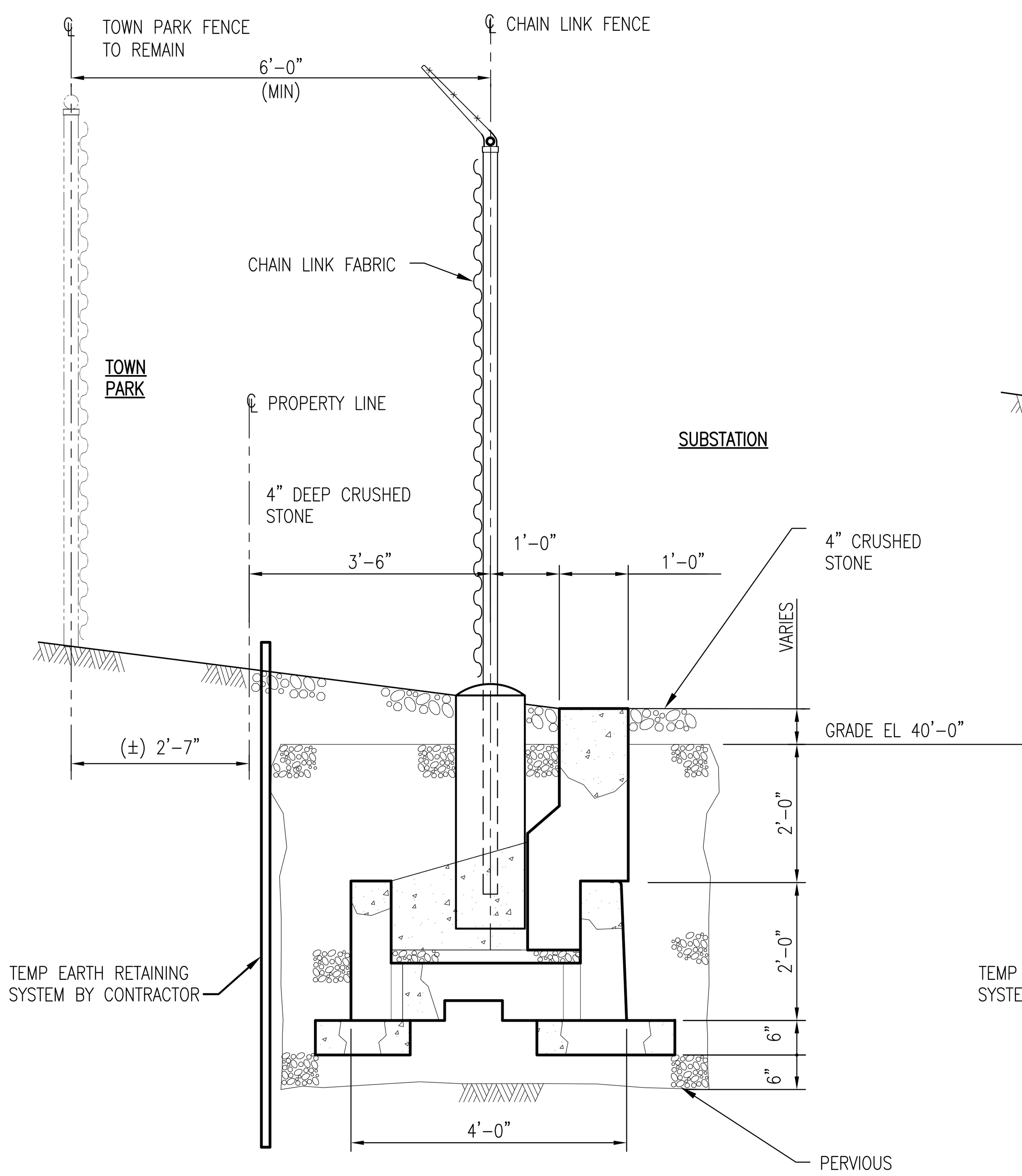
RETAINING WALL NOTES:

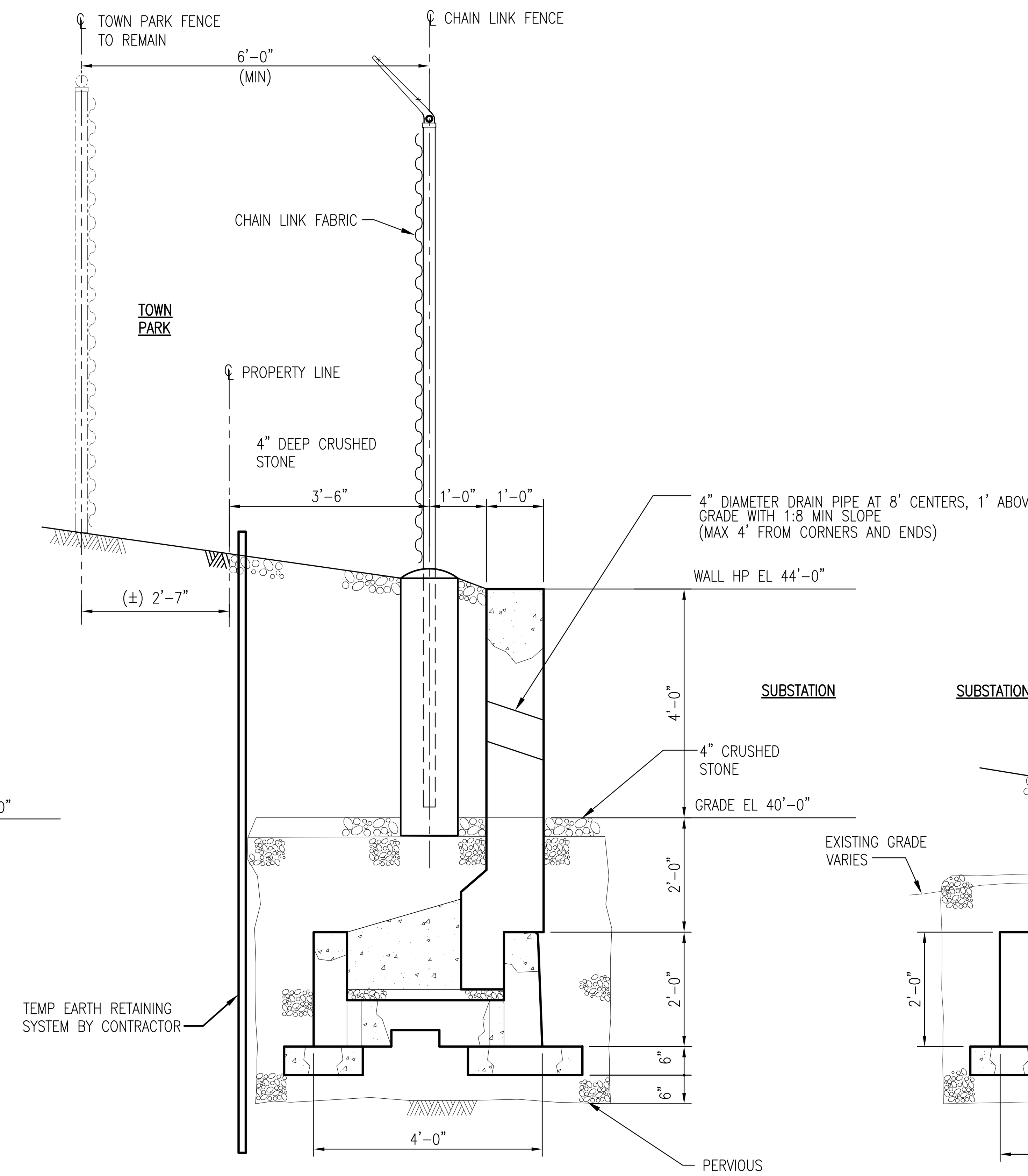
1. CONTRACTOR SHALL PROVIDE ENGINEERING AND DESIGN BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF CONNECTICUT FOR THE REQUIRED RETAINING WALLS.
2. DESIGN SHALL BE IN ACCORDANCE WITH ALL APPLICABLE CODES AND STANDARDS.
3. CONTRACTOR SHALL PROVIDE ALL MATERIAL, EQUIPMENT AND LABOR TO PROCURE AND INSTALL WALLS.
4. RETAINING WALL SECTIONS ARE CONCEPTUAL BASED ON USING DOUBLEWAL INTERLOCKING PRECAST MODULAR WALL SYSTEM AS MANUFACTURED BY UNITED CONCRETE PRODUCTS, INC. IN YALESVILLE, CONNECTICUT.
5. CONTRACTOR MAY PROVIDE AN ALTERNATE PROVIDED IT IS REVIEWED AND APPROVED BY THE OWNER'S ENGINEER.



NOTE:
FOR GROUNDING SEE DWG 33015 PG3.

LP WALL SECTION A-A @ PROFILE B & C

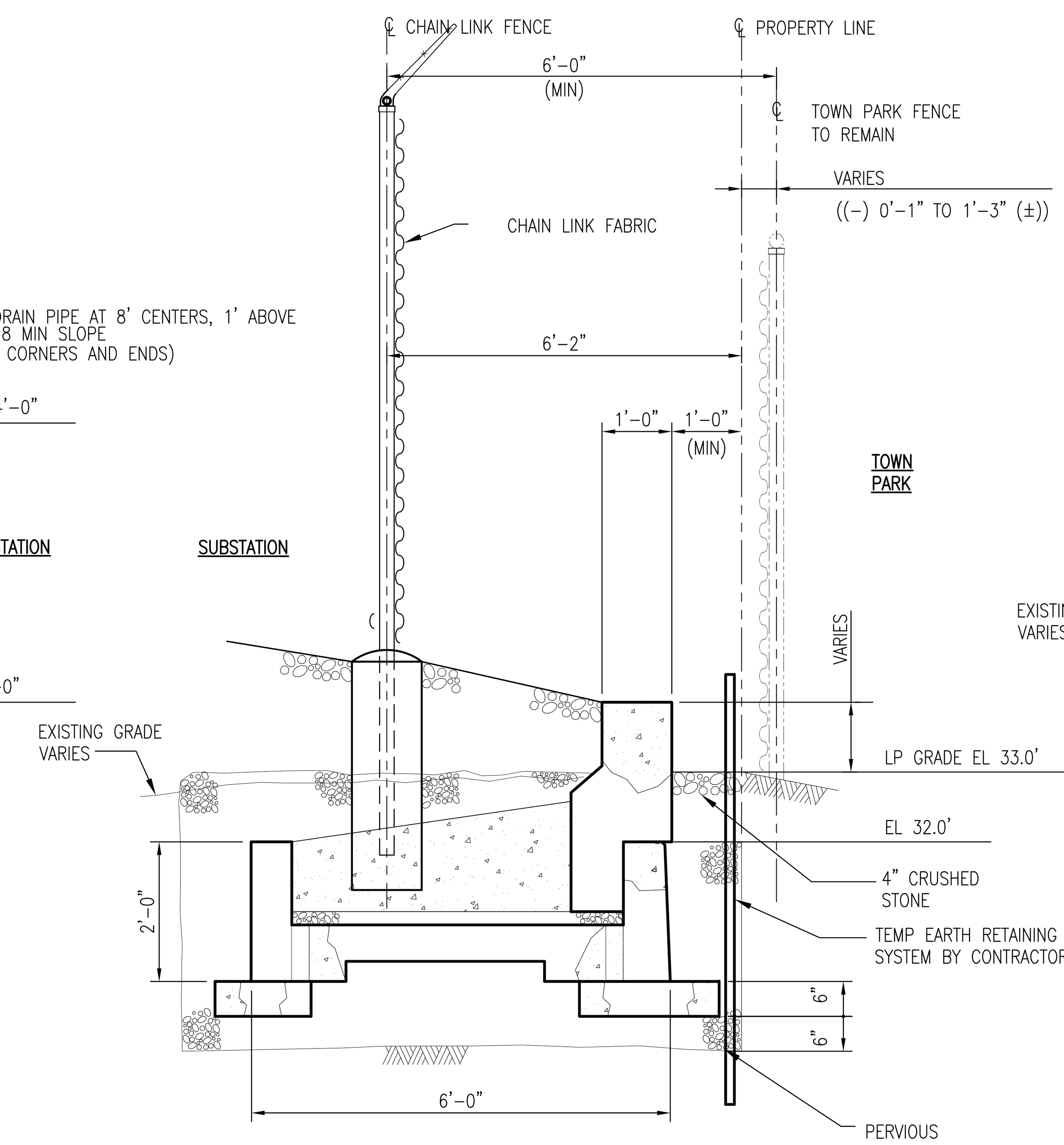
NTS



NOTE:
FOR GROUNDING SEE DWG 33015 PG3.

HP WALL SECTION B-B @ PROFILE B & C

NTS



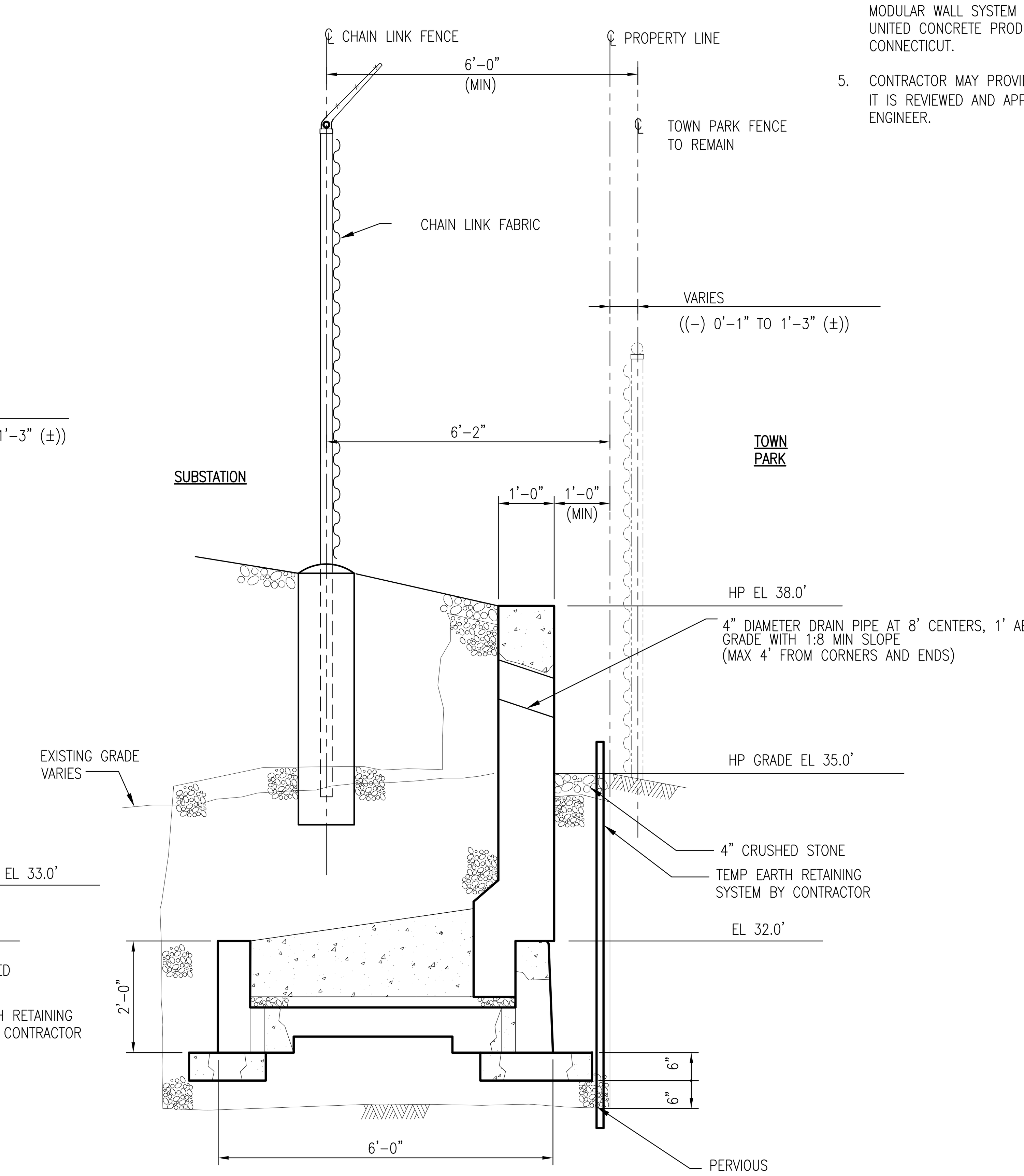
NOTE:
FOR GROUNDING SEE DWG 33015 PG3.

LP WALL SECTION C-C @ PROFILE F

NTS

NOTES:

INSTALL NEW RETAINING WALL PRIOR TO FILLING TO FINAL GRADE



NOTE:
FOR GROUNDING SEE DWG 33015 PG3.

HP WALL SECTION D-D @ PROFILE F (B)

NTS

NOTES:

INSTALL NEW RETAINING WALL PRIOR TO FILLING TO FINAL GRADE

D&M PLAN SUBMITTAL 02/15/2018

REVISIONS DURING CONSTRUCTION			

EVERSOURCE ENERGY

TITLE: COS COB 11R
FENCE & RETAINING WALL PROFILES & SECTIONS
ELEVATIONS & SECTIONS
GREENWICH, CT

BY AMW (PEI)	CHKD	APP	APP
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H-SCALE AS NOTED	SIZE D	FIELD BOOK & PAGES	
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R.E. PROJ. NUMBER		DWG NO. 15706-10038 PG 2	

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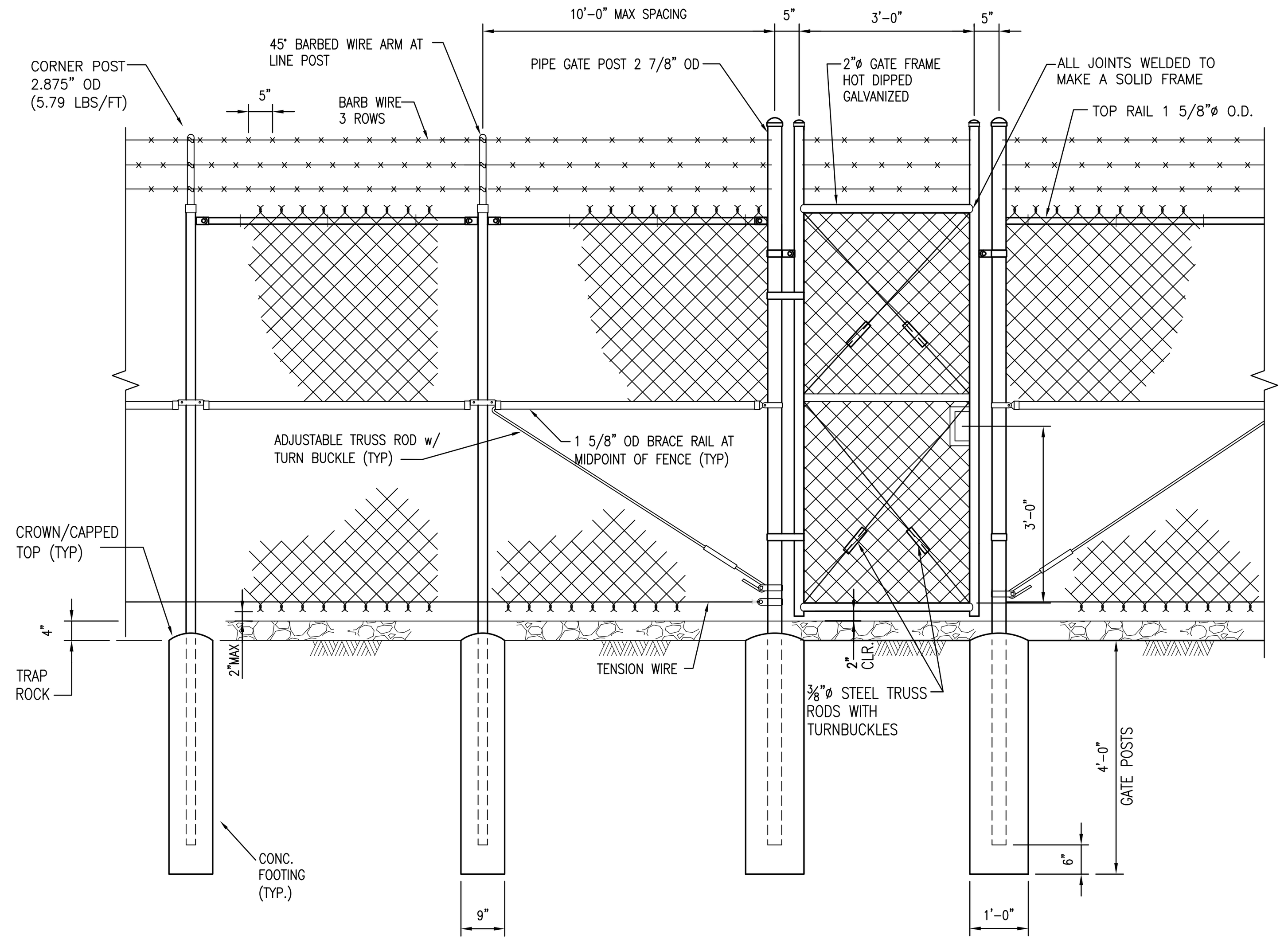
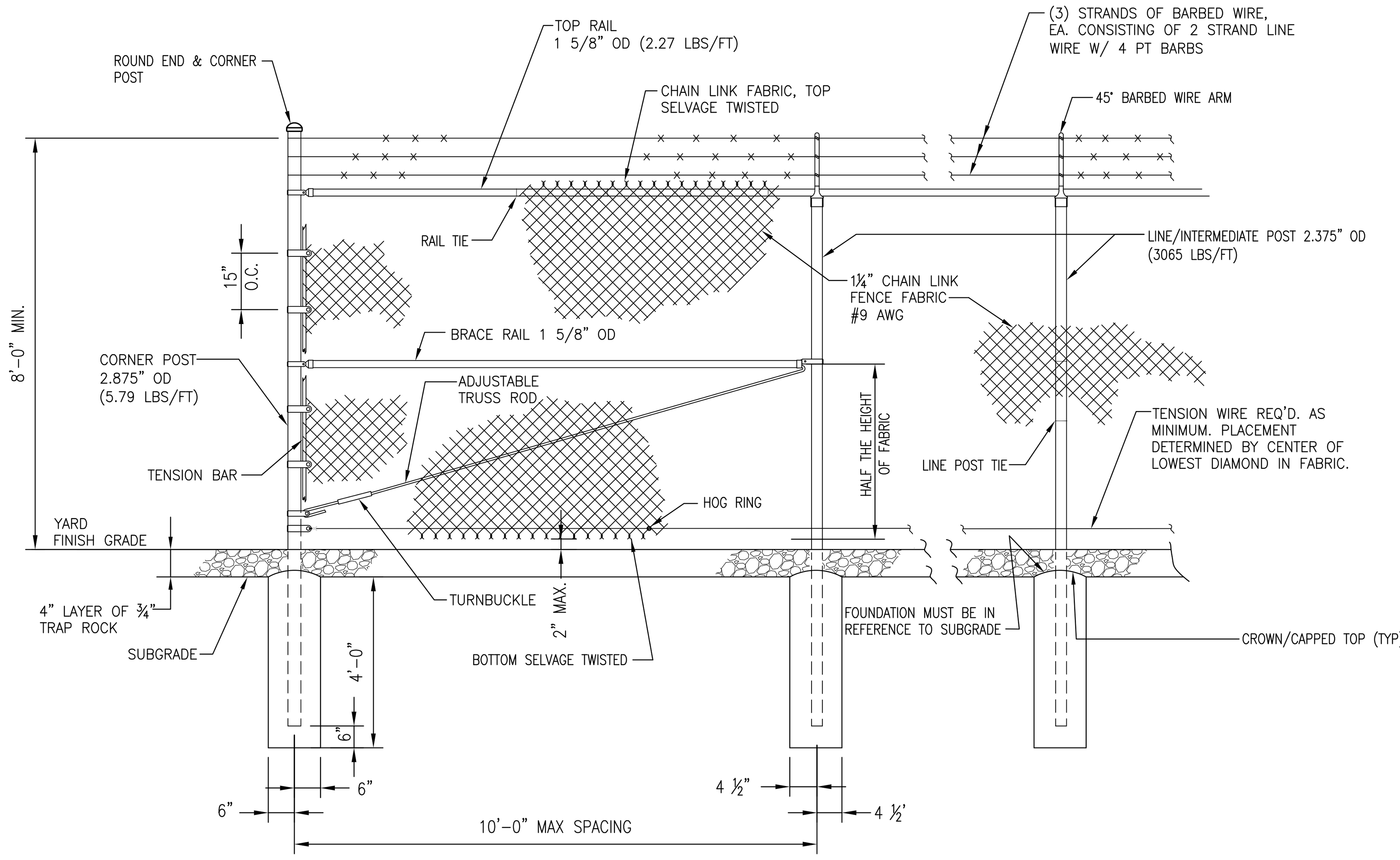
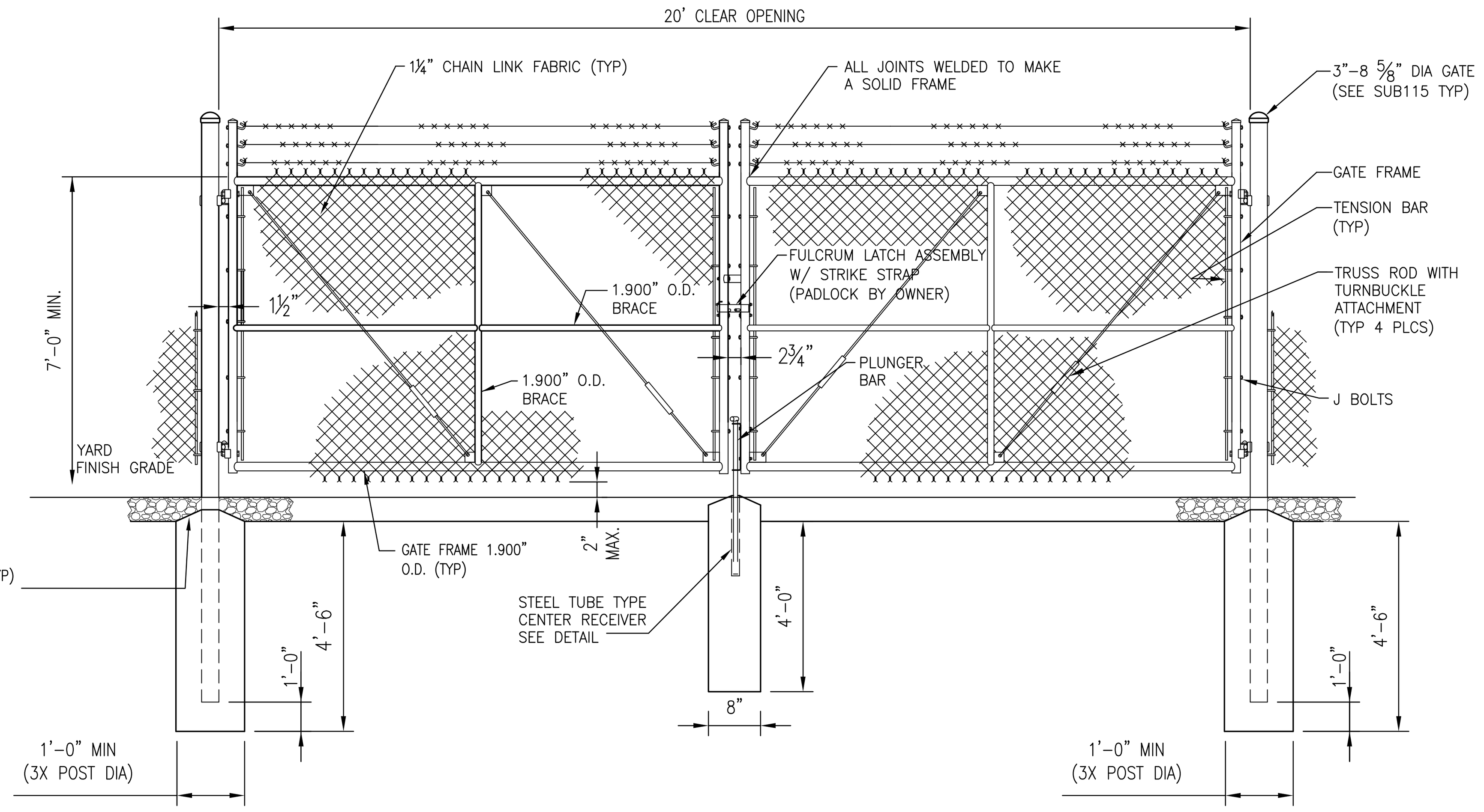


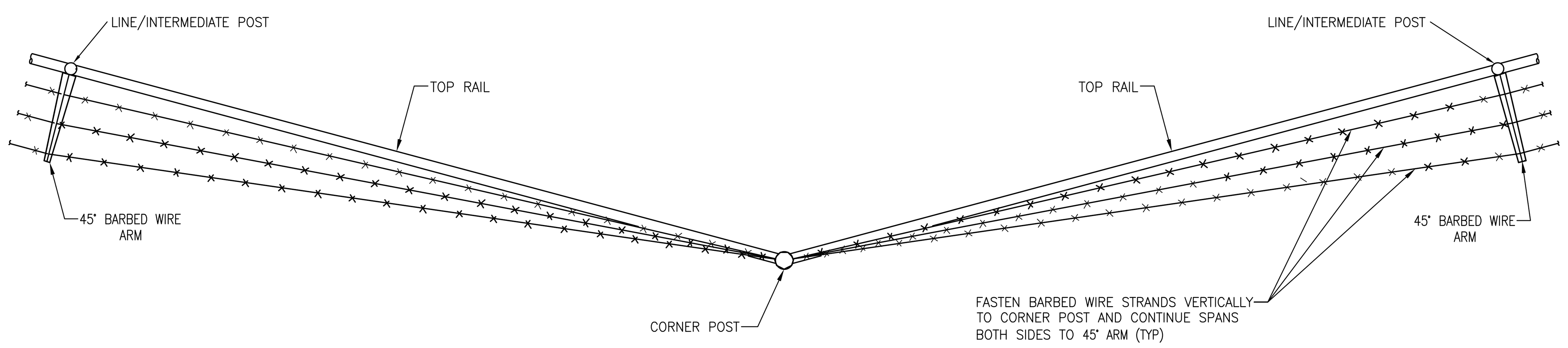
TYPICAL SECTION
FENCE SECTION WITH PERSONNEL GATE
SCALE: 1/2"=1'-0"



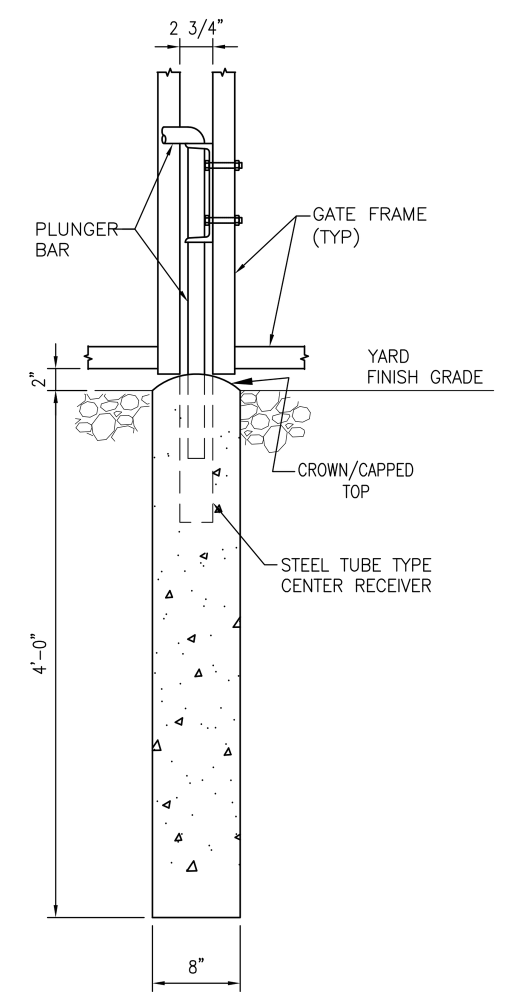
TYPICAL SECTION
CHAIN LINK FENCE
NTS



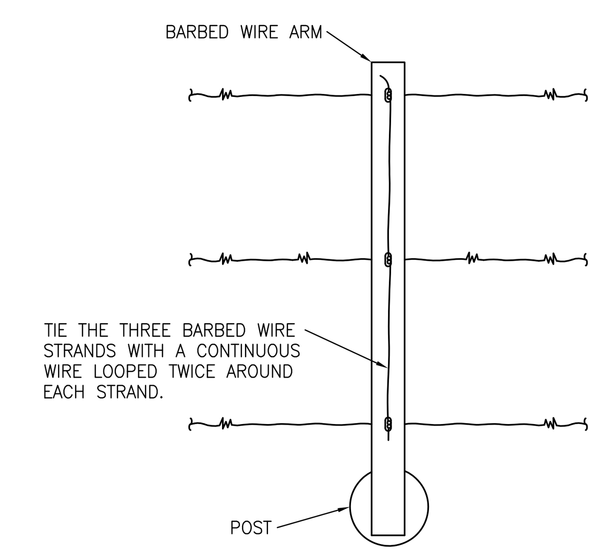
TYPICAL SECTION
CHAIN LINK FENCE SWING GATE
NTS



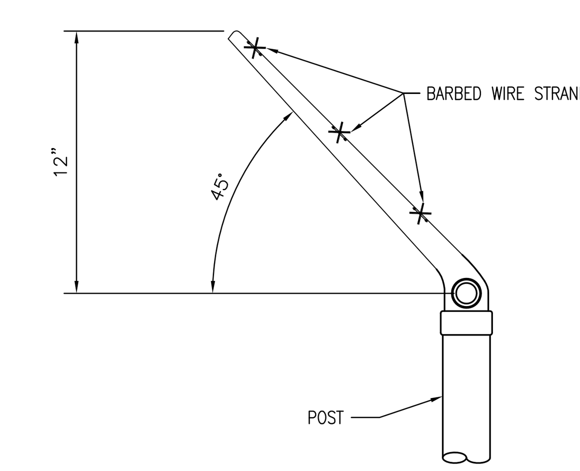
PLAN - BARBED WIRE ARRANGEMENT AT CORNER POST
SCALE: ¾" = 1'-0"



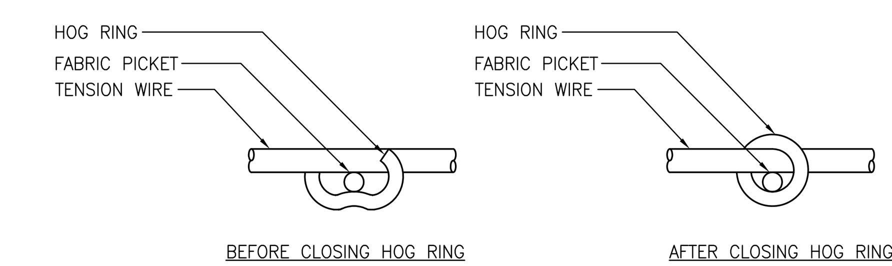
PLUNGER ASSEMBLY FOR DOUBLE LEAF GATE
SCALE: 1" = 1'-0"



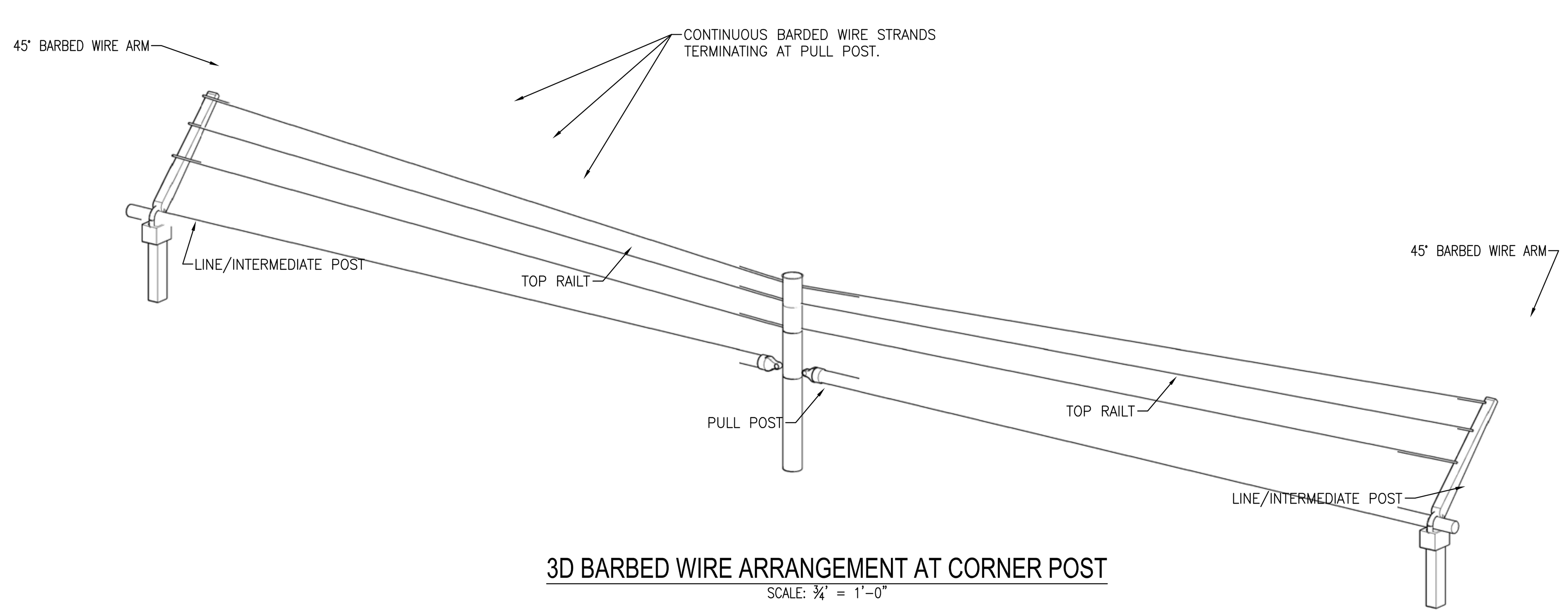
PLAN - BARBED WIRE ARM
SCALE: 3" = 1'-0"



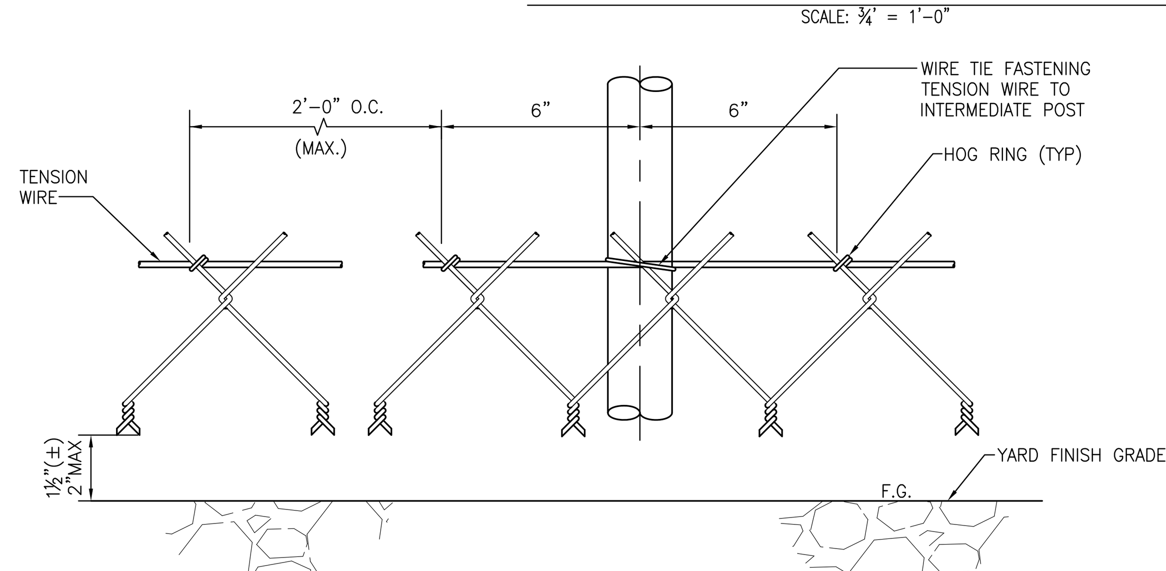
ELEV - 45° BARBED WIRE ARM
SCALE: 1½" = 1'-0"



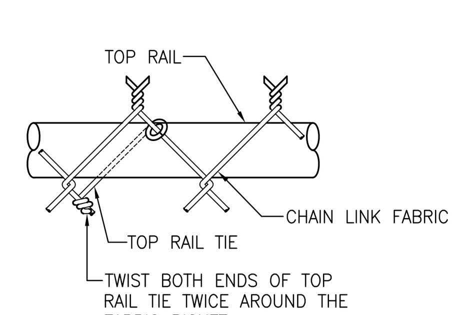
HOG RING ATTACHMENTS
SCALE: 1'-0" = 1'-0"



3D BARBED WIRE ARRANGEMENT AT CORNER POST
SCALE: ¾" = 1'-0"



ATTACHMENT OF FABRIC TO TENSION WIRE
SCALE: 3" = 1'-0"



ATTACHMENT OF FABRIC TO TOP RAIL
SCALE: 3" = 1'-0"

D&M PLAN SUBMITTAL 02/15/2018

REVISIONS DURING CONSTRUCTION

EVERSOURCE ENERGY

TITLE
COS COB 11R
TYPICAL CHAIN LINK GATE AND FENCE DETAILS
CIVIL PLAN & DETAILS
GREENWICH, CT

BY PS	CHKD	APP	APP
DATE	DATE	DATE	DATE
H-SCALE / V-SCALE AS NOTED	SIZE D	FIELD BOOK & PAGES	
	V.S.	R.E. DWG	
R.E. PROJ. NUMBER		DWG NO. 15706-10039 PG 1	

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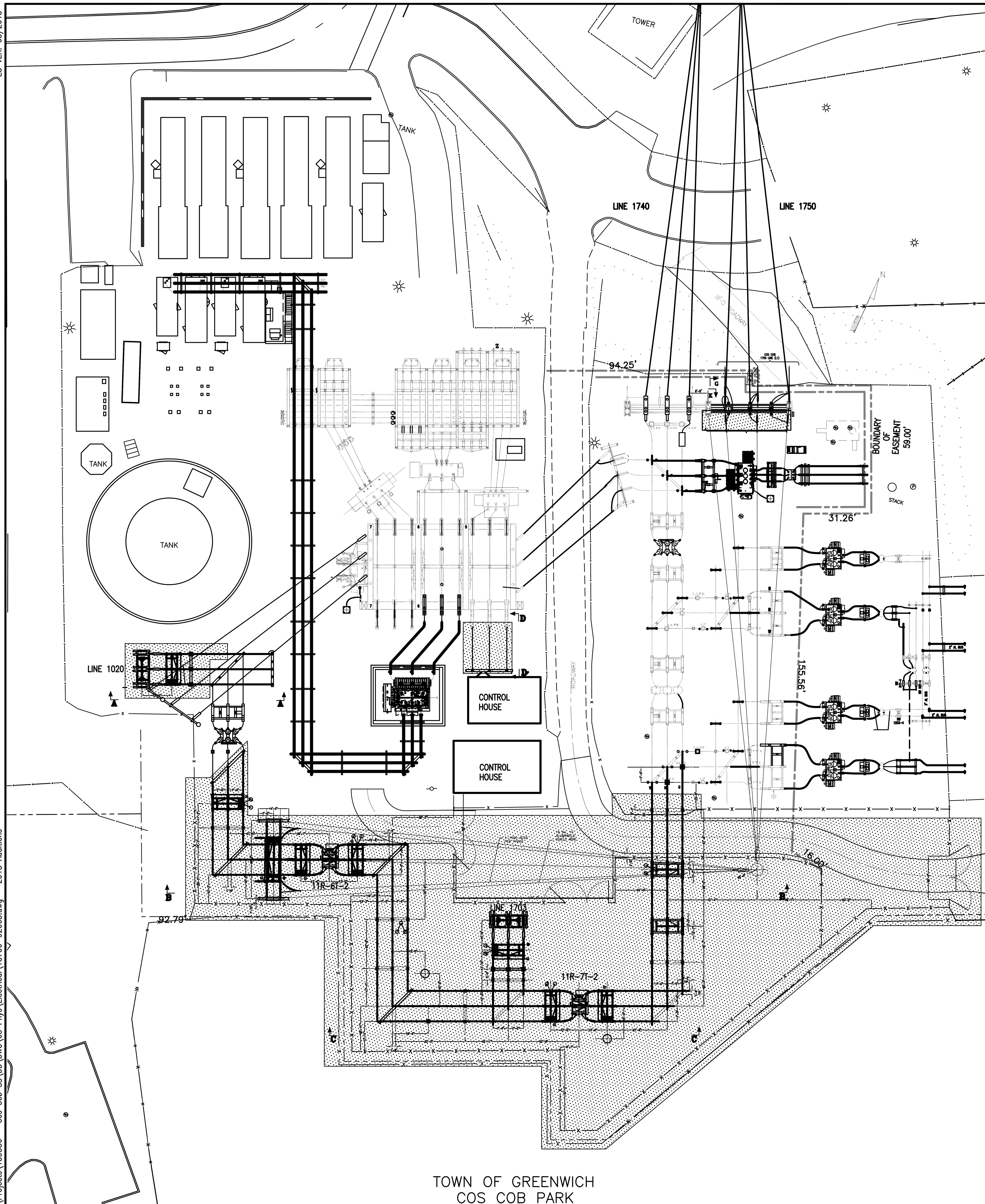
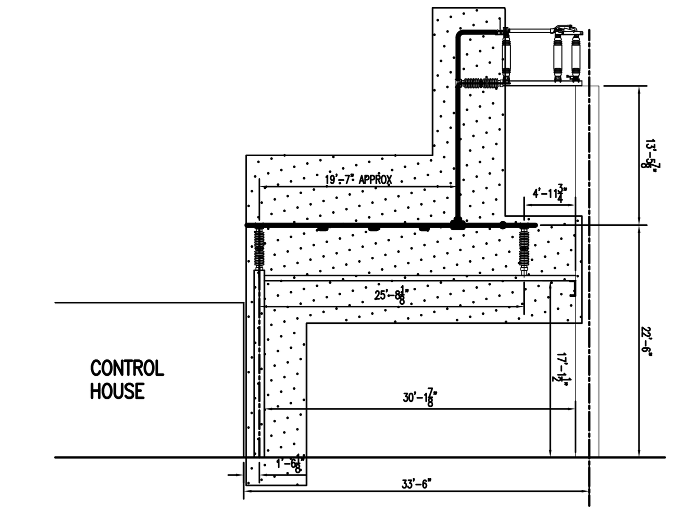
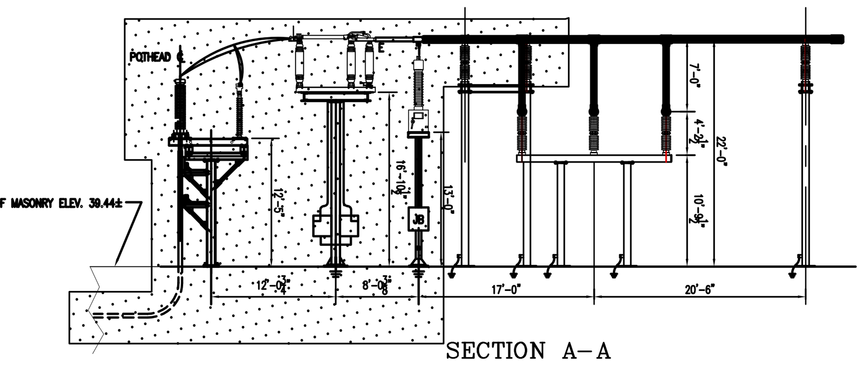


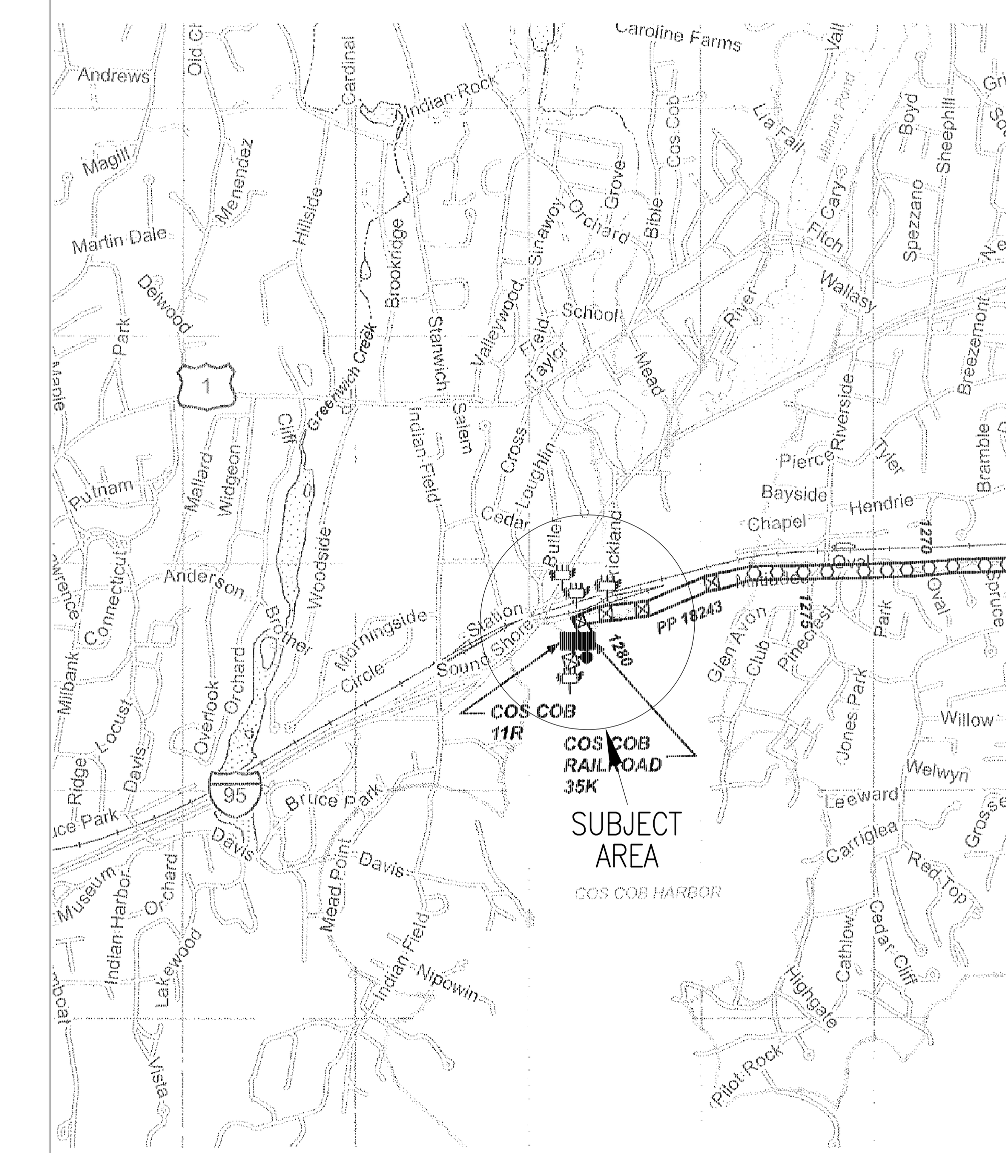
PLAN VIEW
SCALE
1 inch = 30 ft.



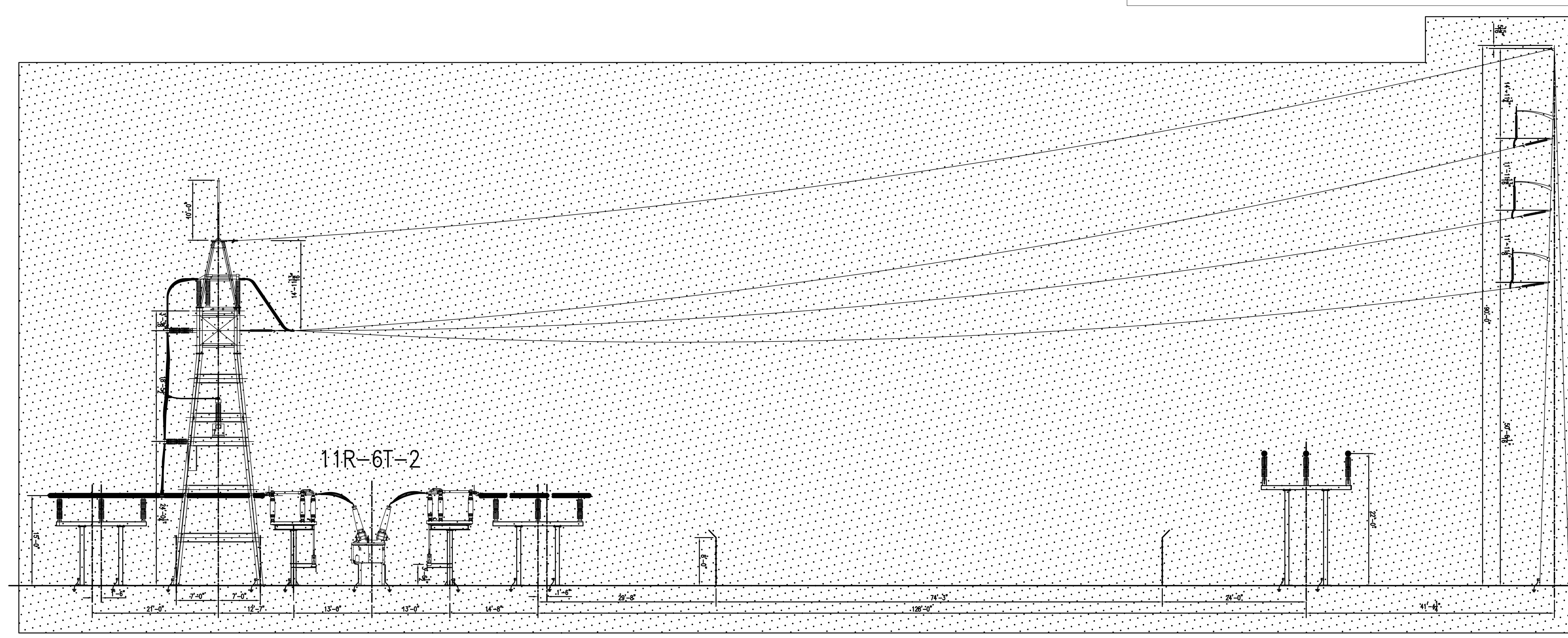
SECTION D–D
1/16 inch =1 ft.



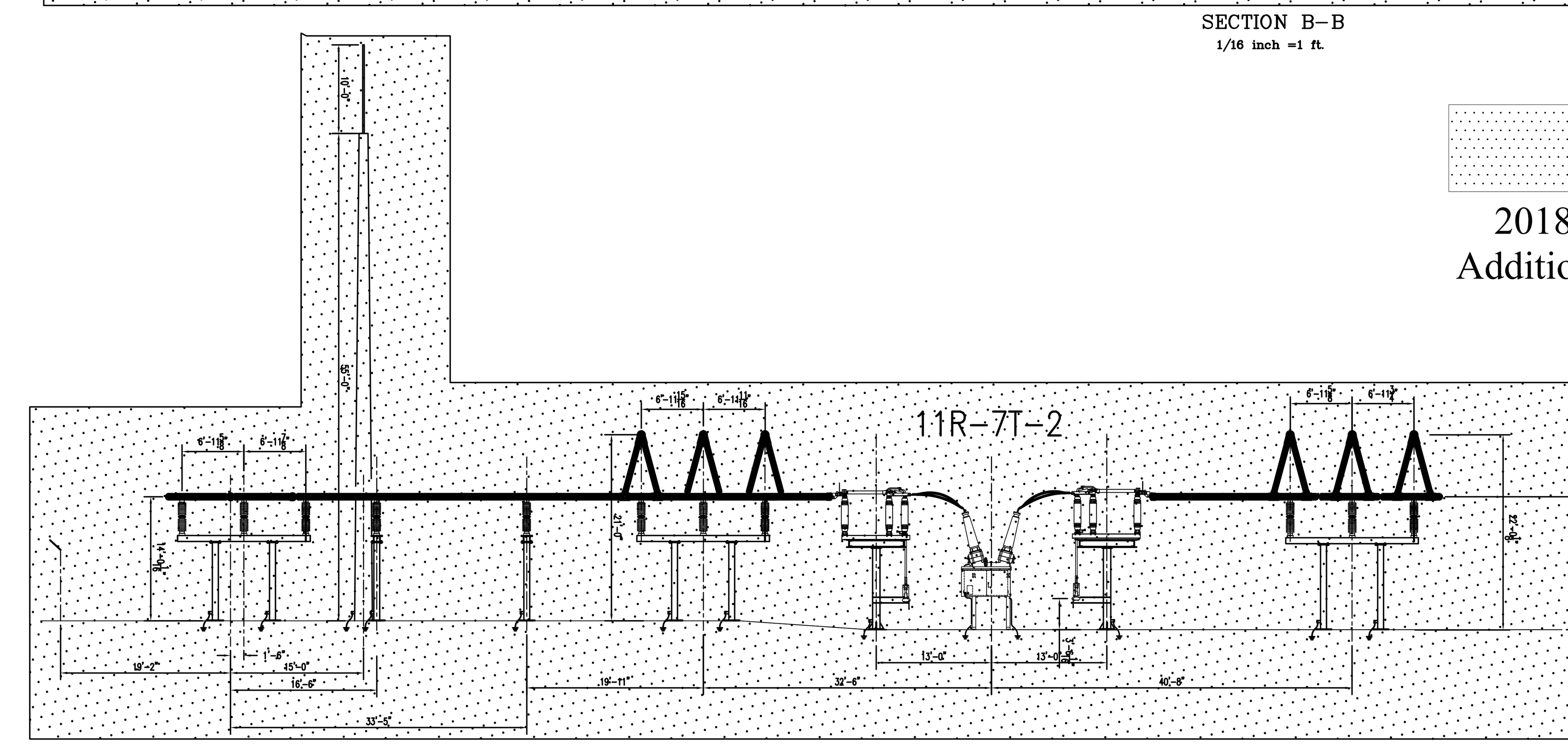
SECTION A–A
1/16 inch =1 ft.



COS COB SUBSTATION
KEY MAP
GREENWICH, CONNECTICUT
SCALE: 1"=100'



SECTION B–B
1/16 inch =1 ft.



SECTION C–C
1/16 inch =1 ft.

2018 Additions

D&M PLAN SUBMITTAL 02/15/2018

REVISIONS DURING CONSTRUCTION

EVERSOURCE ENERGY

TITLE			
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Appendix C: Eversource's Best Management Practices Manual for Massachusetts and Connecticut (Construction & Maintenance Environmental Requirements), September 2016

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Construction & Maintenance
Environmental Requirements

Best Management Practices Manual for Massachusetts and Connecticut

Prepared For:

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107 Selden Street
Berlin, CT

September 2016

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Table TOC-1
Best Management Practices Summary Table

	Area / Activity	Applicable BMPs	Tab	Tab Section
CONSTRUCTION	Upland	Construction Entrance Track Pad	1	A
	`	Stormwater Management BMPs (includes temporary water bars, drainage swales, and sedimentation basins)		B
	Wetland	Construction mats	2	A
		Permeable Road		B
	Watercourse Crossings	Without bridged crossings	3	A
		Bridged crossings		B
		Culverts		C
		Poled fords		D
	De-Energized	Construction mat workpads, including construction mats and lightweight mats	4	A
	Energized	Construction mat workpads		B
SOIL STOCKPILE MANAGEMENT	All	Soil Stockpile Management	5	A

Table TOC-2
Appendix A: Erosion / Sedimentation and Water Control Summary Table

Type	Applicable Control	Location
EROSION / SEDIMENTATION CONTROLS	Preservation of Existing Vegetation	
	Topsoil Segregation for Work in Wetlands and Agricultural Areas	
	Straw (or Hay) Bales*	Section I
	Silt Fence	
	Syncopated Silt Fence	
	Erosion Control Blankets	
	Straw/Compost Wattles	
	Wood Chip Bags	
	Catch Basin Protection	
	Loaming and Seeding	
	Mulching with Hay/Straw/Woodchips	
	Coir Log Use for Bank Stabilization	
	Level Spreader	
	Check Dams	
	Temporary and Permanent Diversions	
	Temporary and Permanent Trench Breaker	
WATER CONTROL	Dewatering Activities	
	- Overland Flow	
	- Frac Tank	
	- Filter Bags and Hay Bale Containment	
	- Discharge Hose Filter Socks	Section II
	Coffer Dam and Stream Bypass via Pumping	
	Coffer Dam and Stream Bypass via Gravity	
	Silt Barriers	

***** Straw bales preferred in wetlands, if allowed by permit, and hay bales in uplands

TABLE TOC-3
List of Acronyms

Acronym	Definition
ATV	All-Terrain Vehicle
BMP	Best Management Practices
ConnDOT	Connecticut Department of Transportation
ACOE	United States Army Corps of Engineers
CT	Connecticut
CTDEEP	Connecticut Department of Energy and Environmental Projection
EBT	Eastern Box Turtle
EPA	United States Environmental Protection Agency
Eversource	Eversource Energy
EL&P	Environmental Licensing and Permitting
FEMA	Federal Emergency Management Agency
HDD	Horizontal Directional Drilling
LGP	Low Ground Pressure
MA	Massachusetts
MassDEP	Massachusetts Department of Environmental Protection
MassDOT	Massachusetts Department of Transportation
MassWPA	Massachusetts Wetlands Protection Act
NDDB	Connecticut Natural Diversity Database
NHESP	Massachusetts Natural Heritage Endangered Species Program
OLISP	Office of Long Island Sound Programs
ORV	Off-Road Vehicle
PSI	Pounds per square inch
RIM	Record Information Management System
ROW	Right of Way
TOC	Table of Contents

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Section 1 Introduction

1.1 Purpose

As a matter of Eversource Energy (Eversource) policy regarding environmental stewardship and in accordance with local, state, and federal regulations, all construction and maintenance projects shall use environmentally sound best management practices (BMPs) to minimize or eliminate environmental impacts that may result from construction activities. Regardless of whether a specific permit is needed for the work, construction and maintenance projects must follow internal environmental performance standards, which is the purpose of these BMPs. In many cases, maintenance activities are exempt from regulatory authorization. Permits are usually required for new work. Contractors will be provided with copies of any project specific permits, and will be required to adhere to any and all conditions of the permit(s). Permit conditions that are more detailed than the BMPs outlined in this manual shall always be given priority. However, where certain construction elements are not addressed by permit conditions, or where permitting is not required, or for emergency situations where obtaining a permit before the work occurs may not be an option, these BMPs shall be considered as Eversource's standards. In some cases, and at the discretion of the Eversource Management, the BMPs presented herein may be modified to be more appropriate for site-specific conditions.

1.2 Scope and Applicability

These BMPs primarily address the disturbance of soil, water, and vegetation incidental to construction within on- and off-road utility corridors, substations, including the establishment of access roads and work areas, within rights of way (ROWs) and on private property, in and near wetlands, watercourses, or other sensitive natural areas (such as protected species), including storm drain systems (e.g., catchbasins). Types of construction include, but are not limited to, installation or maintenance of underground and overhead utilities, access road repair/improvement or installation, and upgrades or maintenance of substations and other facilities. Other common construction issues such as noise, air pollution, oil spill procedures, handling of contaminated soils, and work safety rules are addressed in the Eversource Energy Contractor Work Rules and related appendices.

1.3 Definitions

The following definitions are provided to clarify use of common terms throughout this document.

Best Management Practice (BMP): A means to reduce and minimize impact to natural resources.

Casing: A galvanized steel corrugated pipe that serves as the form for a utility structure foundation.

Emergency Projects: Actions needed to maintain the operational integrity of the system or activities necessary to restore the system and affected facilities in response to a sudden and unexpected loss of electric or gas service or events that affect public health and safety.

Embedded Culvert: A culvert that is installed in such a way that the bottom of the structure is below the stream bed and there is substrate in the culvert.

Environmentally Sensitive Areas: An area containing natural features, cultural features or ecological functions of such significance to warrant protection. Some examples are rivers, streams, ponds, lakes, wetlands, rare species habitat, water supply protection areas, cultural sites, parks, and agricultural land.

Erosion Control: A measure to prevent soil from detachment and transportation by water, wind, or gravity.

Existing Access Roads: Previously permitted or grandfathered access roads that are used to access structures that are clearly visible or can be found by mowing or by the presence of road materials in soil cores.

Grubbing: A site preparation method that is used to clear the ground of roots and stumps.

Intermittent Watercourse: An intermittent watercourse is broadly defined as a channel that a flowing body of water follows at irregular intervals and does not have continuous or steady flow. Regulatory definitions for intermittent water courses are:

- Connecticut—Per the Connecticut Inland Wetland and Watercourses Act, intermittent watercourses are delineated by a defined permanent channel and bank and the occurrence of two or more of the following characteristics: (A) Evidence of scour or deposits of recent alluvium or detritus, (B) the presence of standing or flowing water for a duration longer than a particular storm incident, and (C) the presence of hydrophytic vegetation.

- Massachusetts—Under the Massachusetts Wetlands Protection Act (MassWPA), a jurisdictional intermittent watercourse is defined as a body of running water which moves in a definite channel in the ground due to a hydraulic gradient, does not flow throughout the year, and which flows within, into or out of an area subject to protection under the MassWPA. Intermittent watercourses upgradient of any Bordering Vegetated Wetlands are not jurisdictional under the MassWPA. A watercourse can be determined to be intermittent if it meets MassWPA criteria in regards to watershed characteristics found on the Stream Stats website or documented observations of no flow.

Limit of Work/Disturbance: The boundaries of the approved project within regulated areas. All project related activities in regulated areas must be conducted within the approved limit of work/disturbance. The limit of work/disturbance should be depicted on the approved permit site plans, which may require the limits to be identified in the field by flagging, construction fencing, and/or perimeter erosion controls.

Low-Impact Vehicles: Vehicles that have a lesser impact on an environmentally sensitive area due to the vehicle being smaller, lighter, or different in another way than a vehicle which would have a greater impact. Low impact vehicles could include ORVs or

ATVs, tracked vehicles with low ground pressure, or vehicles with oversized balloon-type tires.

Maintenance Projects: Typically consist of activities limited to the repair and/or replacement of existing and lawfully located utility structures and/or facilities where no substantial change in the original structure or footprint is proposed. Maintenance activities also include vegetation management.

Minimization: Causing as little disturbance to an area as practicable during construction.

New Construction: Construction of new transmission or distribution facilities that previously did not exist or construction that substantially modifies existing facilities. All new (and existing) construction projects are required to go through a full permit review by the Eversource Environmental Licensing and Permitting Department.

Pre-Construction Notification (PCN): Project activities that do not qualify for SV or where otherwise required by the terms of the MA and CT GPs must submit a PCN and obtain written verification before starting work in ACOE jurisdiction. Refer to MA and CT GP appendices for PCN thresholds. Projects that cannot be completed under a PCN must file for an Individual Permit with the ACOE. In CT, for coastal projects, notification is provided to ACOE by CT DEEP, Office of Long Island Sound Programs (OLISP) or by applicants as necessary. Written approval from ACOE is required.

Restoration: To return a disturbed area to its former, original or unimpaired condition. A site is considered fully restored when it has returned (as closely as practicable) to its original state. Restoration of disturbed areas should occur as soon as practicable following the completion of activities at that location.

Re-Vegetation: Establishment of plant material for temporary or permanent soil stabilization.

Right of Way: A pathway, road, or corridor of land where Eversource Energy has legal rights (either fee ownership, lease, or easement) to construct, operator, and maintain an electric power line and/or natural gas pipeline.

Self-Verification (SV): Activities that are eligible for SV are authorized under the MA and CT GPs and may commence without written verification from the ACOE provided the prospective permittee has:

i. Confirmed that the activity will meet the terms and conditions of applicable MA and CT GPs

ii. Submitted the Self-Verification Notification Form (SVNF) to the ACOE.

In CT, coastal projects do not require filing of a Self-Verification Notification Form. ACOE relies on CT DEEP and OLISP submittals.

Stabilization: A system of permanent or temporary measures used alone or in combination to minimize erosion from disturbed areas.

Sediment Control: Control of eroded so that it does not wash off and pollute nearby wetland and water resources.

Vehicles with Low Ground Pressure: Vehicles which have tires or tracks that apply less than three pounds per square inch (psi) on the ground surface.

Work: For the purposes of this BMP Manual, the disturbance of soil, water, and vegetation incidental to construction within on- and off-road utility corridors, substations, including but not limited to the establishment of access roads and work areas, in and near wetlands, watercourses, or other sensitive natural areas, including storm drain systems (e.g., catch basins). Types of construction include, but are not limited to installation or maintenance of underground and overhead utilities, substations and other facilities.

1.4 BMP References

The following table lists the public guidance documents utilized during the preparation of this BMP manual. Refer to these documents for additional information.

TABLE 1-2

Document Title
General
Best Management Practices (BMPs) Manual for Access Road Crossings of Wetlands and Waterbodies, EPRI, Palo Alto, CA (2002) 1005188.
Gas Research Institute. Horizontal Directional Drilling Best Management Practices Manual (2002) ENSR Corporation, Westford, MA and Trenchless Engineering Corp., Houston, TX.
Connecticut
Connecticut Department of Transportation (ConnDOT). ConnDOT Drainage Manual (October 2000) http://www.ct.gov/dot/cwp/view.asp?a=1385&Q=260116
Connecticut Standard Specifications for Roads, Bridges and Incidental Construction, FORM 816 (2004) http://www.ct.gov/dot/cwp/view.asp?a=3609&q=430362
Connecticut Department of Energy & Environmental Protection. Connecticut Guidelines for Erosion and Sediment Control. (2002) http://www.ct.gov/deep/cwp/view.asp?a=2720&q=325660&deepNav_GID=1654%20
Connecticut Department of Energy & Environmental Protection, Bureau of Natural Resources, Division of Forestry. Best Management Practices for Water Quality While Harvesting Forest Products (2007) http://www.ct.gov/dep/lib/deep/forestry/best_management_practices/best_practicesmanual.pdf
Massachusetts
Commonwealth of Massachusetts Department of Public Works Standard Specifications for Highways and Bridges (1988) http://www.mhd.state.ma.us/default.asp?pgid=content/publicationmanuals&sid=about
Massachusetts River and Stream Crossing Standards (Revised March 1, 2011) http://www.nae.usace.army.mil/Portals/74/docs/regulatory/StreamRiverContinuity/MA_RiverStreamCrossingStandards.pdf
Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas. Original Print: March 1997. *Reprint: May 2003*. http://www.mass.gov/eea/docs/dep/water/essec1.pdf
The Massachusetts Unpaved Roads BMP Manual (Winter 2001) http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/dirtroad.pdf

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Section 2
Project Planning

After undergoing an initial screening review by the department conducting the proposed project, if resources are identified, the project is required to go through a permit review by the Environmental Licensing and Permitting Group. The permit review process is supported by Geographic Information Systems (GIS) or a similar program that references the most current spatial data for the project areas in question. Through the GIS review process various geo-processing tools are used to compose maps and provide a spatial reference to environmentally sensitive areas. In consultation with the Environmental Licensing and Permitting Group, the Project Engineer, permitting specialist, or other project planner should determine regulatory jurisdiction and which (if any) environmental permits or approvals are required before starting any project. Questions regarding which activities may be conducted in regulated areas or within environmentally sensitive areas should be referred to the Environmental Licensing and Permitting Group. Summaries of potentially applicable laws and regulations are provided in Appendices B and C of this document.

2.1 Types of Wetlands

Wetland areas common to New England and common to both Connecticut and Massachusetts include, but are not limited to, the following:

Forested Wetlands

Forested wetlands are wetlands that are dominated by trees that are 20 feet or taller. These wetlands are typically drier with standing water typically occurring during periods of high precipitation, seasonally high groundwater, snowmelt, and runoff (e.g., early spring through mid-summer). Tree species typical of this type of wetland include red maple (*Acer rubrum*) and eastern hemlock (*Tsuga canadensis*). "Pit and mound" topography is common in forested wetlands, where mature trees grow on the higher and drier mounds and obligate wetland species are found in the lower pits.

Scrub-Shrub Wetlands

Scrub-shrub wetlands are dominated by woody vegetation less than 20 feet tall, and may include peat bogs. Typical bog species include leatherleaf (*Chamaedaphne calyculata*), cotton grasses (*Eriophorum* sp.), cranberry (*Vaccinium macrocarpon, V. oxycoccus*), and black spruce (*Picea marina*). Other non-bog scrub-shrub wetlands are characterized by buttonbush (*Cephalanthus occidentalis*), alders (*Alnus* sp.), dogwoods (*Cornus* sp.), and arrowwoods (*Viburnum* sp.).

Marshes

Marshes are dominated by erect, herbaceous vegetation and appear as grasslands or stands of reedy growth. These wetlands are commonly referred to by a host of terms, including marsh, wet meadow, fen. These areas are flooded all or most of the year and, in New England, tend to be dominated by cattails (*Typha* sp.).

Wet Meadows

Typical wet meadow species include grasses such as bluejoint (*Calamagrostis canadensis*) and reed canary grass (*Phalaris arundinacea*), sedges (*Carex* sp.) and rushes (*Juncus* sp.), and various other forbs such as Joe-Pye-weeds (*Eupatorium* sp.) and asters (*Aster* sp.).

Floodplains

A floodplain is generally defined as an area of low-lying ground adjacent to a stream or river that is formed mainly of river sediments and is subject to flooding. State-specific regulatory definitions vary and are described as follows:

- In Connecticut, areas that contain alluvial or floodplain soils are regulated as wetlands. These areas may flood so infrequently or be so freely drained that hydrophytic vegetation and hydric soils are not present. Soils in these areas must be examined carefully to determine whether well drained alluvial or floodplain soils are present.

- In Massachusetts, a floodplain is a type of wetland resource are that floods following storms, prolonged rainfall, or snowmelt. There are three types of floodplain areas protected under the MassWPA: coastal areas, areas bordering rivers and streams, and isolated depressions that flood at least once a year.

Streams

A stream is any natural flowing body of water that empties to any ocean, lake, pond or other river. Perennial streams, or rivers, have flows throughout the year. Intermittent streams do not have surface flows throughout the year, though surface water may remain in isolated pockets.

Vernal Pools

Vernal pools are typically contained basin depressions lacking permanent aboveground outlets. These areas fill with water with the rising water table of fall and winter and/or with the meltwater and runoff of winter and spring snow and rain. The pools contain water for a few months in the spring and early summer. Due to periodic drying cycles, vernal pools do not support breeding fish populations and can thus serve as breeding grounds for a variety of amphibians, including some rare and protected species of frogs and salamanders.

Other Considerations

Other regulated factors taken into consideration during the project planning process include the presence of protected (i.e., threatened, rare or endangered) species, non-native invasive plant species and/or historical and archaeological resources. Special requirements may need to be evaluated as part of new construction and/or some maintenance activities.

2.2 Meetings

A pre-construction meeting is typically held prior to the commencement of all work with the purpose to appoint responsible parties, discuss timing of work, and further consider options to avoid and/or minimize disturbance to sensitive areas. The meeting confirms that there is consensus on work methods and responsibilities, and ensure that tasks will be fulfilled with as little disturbance to the environment as practicable. These meetings can occur on or off-site and should include all the applicable stakeholders (i.e., Eversource, contractors, consultants, inspectors and/or monitors, and regulatory agency personnel). A short and less formal briefing should suffice for smaller maintenance projects.

2.3 Site Staging and Parking

During the project planning and permitting process, locations should be identified for designated crew parking areas, material storage, and staging areas. Where possible, these areas should be located outside of buffer zones, watershed protection areas, and other environmentally sensitive areas. Any proposed locations should be evaluated for all sensitive receptors and for new projects requiring permitting, should be incorporated onto permitting and access plans.

2.4 Construction Monitoring

Construction projects require environmental monitoring, which can be conducted either internally or by consultants. Some permitted projects require oversight by designated and pre-approved compliance monitors. Environmental monitoring is a way to keep a chronological record of pre-construction site conditions, progress, and changes that are made, as well as to document issues and authorized solutions.

If work will occur in a wetland resource area or an area mapped or otherwise designated as rare or endangered species habitat, permit conditions may dictate that construction be monitored by a qualified and pre-approved wetland or wildlife specialist.

2.5 Signage / Limit of Boundaries

Where appropriate, wetland delineation flagging or signage shall be installed that makes clear where critical boundaries (i.e., the limits of jurisdictional wetland resource areas and/or rare species habitat) and setbacks occur, regulatory authorization by agencies, and certain uses on ROWs are prohibited, such as ORV traffic.

Where appropriate, signage shall be installed along sediment and erosion control barriers at appropriate intervals, heights and sizes to ensure that the presence and location of said barriers is clear to construction personnel during deep snow or other low visibility conditions. Inspection and maintenance of this signage shall be conducted on a regular basis to ensure effectiveness.

Photo provided courtesy Tighe & Bond/GSRP.

Photo provided courtesy of Tighe & Bond, Inc./PSg

Examples of signage at wetlands.

Section 3
Construction Considerations

During all project activities (e.g., maintenance, new construction), federal, state, and local regulatory authorities require steps be taken to avoid, minimize, and/or mitigate disturbance to the environment. Wetlands and other sensitive areas should be avoided whenever practicable. However, some work may require entrance into these areas in order to perform work. This section discusses measures that should be taken to minimize disturbance to if work must occur within sensitive areas.

BMPs were developed to aid in this process and should be carefully selected and implemented based on the proposed activities and the nature of sensitive area(s) encountered at each site. Proper selection of BMPs should take into consideration the project goals, permit requirements, and site specific information. Once an assessment of the area is made and requirements of the project are established, all BMPs should be considered and implemented as appropriate.

Tables TOC-1 and TOC-2 summarize BMP types. This section addresses BMPs specific to construction of new access roads, repair of existing access roads, the installation of work pads, structure-related work, and soil stockpile management. Information regarding recommended erosion and sedimentation controls or stormwater controls is also discussed. Please refer to Appendix A for typicals and representative photographs of BMPs used for erosion and sedimentation control and water diversion during construction.

3.1 Avoidance and Minimization

Avoidance and minimization should always be considered before beginning any construction or maintenance project. Take appropriate measures to avoid construction impacts to wetlands, waterways, rare species habitats, known below and above ground historical/archeological resources, and other environmentally sensitive areas. Use existing ROW access whenever practicable. Keep to approved routes and roads and do not widen or deviate from them. Consult with the Environmental Licensing and Permitting Group, when avoidance is not practicable, to determine measures to minimize the extent of construction impacts. Alternate access routes and/or staging areas that will minimize construction impacts to the natural environment may be considered.

3.2 Rare Species Habitat

The Environmental Licensing and Permitting Group coordinates with state and local agencies when work is within areas that are identified as rare species habitat. In Connecticut, the Natural Diversity Database (NDDB) is used to identify rare species habitat and is under the Department of Energy and Environmental Projection (CTDEEP). In Massachusetts, the Natural Heritage Endangered Species Program (NHESP) is consulted to identify rare species habitat, which is under the Department of Fisheries and Wildlife and part of the Natural Heritage network. State regulatory agencies may require crew training and turtle sweeps of work areas, botanist identification of rare plants for avoidance, and protection of vernal pools, prior to starting the work.

3.3 Vernal Pools

Construction within and across wetlands and in proximity to vernal pools should be limited to the extent practicable to avoid working in the periods between April 1st and June 1st. This will allow for obligate vernal pool species to emigrate to the breeding areas, deposit egg masses, and allow for hatching and development of juveniles. Silt fence should be installed at the limits of the construction to prevent individual reptiles and amphibians from entering the workspace, but in a manner that does not impede movement to and from pools from adjacent forested uplands. Consider installing syncopated silt fencing.

Protection Measures

When performing construction activities in proximity to vernal pools, a number protection measures should be implemented.

Vegetation Removal

- Maintain existing scrub-shrub vegetation (consistent with ROW vegetation management requirements) within 25 feet of vernal pools, except in areas where access roads and work pads must be installed.
- Minimize removal of low growing (scrub-shrub) vegetation surrounding vernal pools by utilizing construction matting where access is needed. If vegetation must be cut adjacent to vernal pools, the cut vegetation (slash) should be left in place to serve as recruitment for leaf litter and coarse woody debris.

Erosion and Sedimentation Control

- Install and maintain erosion and sedimentation control measures along construction access roads and work pads to protect water quality and to limit the potential for sediment transport to vernal pools.
- Promptly remove erosion and sedimentation control devices upon final revegetation and stabilization of the ROW.

Access Roads

- Use construction mats, corduroy roads, or clean materials (i.e., clean riprap, gravel, stone or equivalent and rock fords) in locations where existing on-ROW access roads must be improved and are adjacent to vernal pools.
- Man-made depressions along existing on-ROW access roads provide low-quality vernal pool breeding habitat (due to an insufficient hydroperiod). Access roads must be graded and/or improved to accommodate project construction vehicles and may eliminate these depressions and the associated potential for amphibian breeding habitat. Perform improvements to on-ROW access roads outside of the breeding and migration seasons of vernal pool species to avoid direct impacts to amphibians that may breed in the man-made depressions along existing on-ROW access roads.

Scheduling and Site-Specific Considerations

- To the extent practicable (considering circuit outages and other construction timing constraints), schedule access road and work pad installation in and around vernal pool habitats to minimize interference with amphibian breeding and migration seasons.

- For project activities that must occur adjacent to vernal pools during amphibian migration periods, implement measures on a site-specific basis to facilitate unencumbered amphibian access to and from vernal pools. Consider the site-specific conditions including the type of construction activity that will occur in proximity to a vernal pool, the amphibian species known to occur in the vernal pool, and seasonal conditions. Identify appropriate mitigation measures. Options to be evaluated to allow amphibian access to vernal pools may include, but not be limited to: syncopated silt fencing in the immediate vicinity of vernal pools; elevated construction matting; and aligning erosion and sedimentation controls to avoid bifurcating vernal pool habitat.

3.4 Access Roads

Existing construction access roads are unpaved roadways that work crews use to access a site within a ROW. These access roads were generally either permitted previously or constructed prior to the promulgation of regulations and are grandfathered in under past general permits.

3.4.1 New Access Roads

New access roads are generally associated with new or large-scale projects that have separate permitting requirements. Construction of new access roads will be based on plans that are reviewed and approved by applicable federal, state, and local agencies. If a new access road is needed and not associated with a large project, notify the Environmental Licensing and Permitting Group to make a decision on best access routes and identification of the necessary permits and approvals required to construct the new road. **Permit requirements must be followed.**

3.4.2 Existing Access Roads

The travel surface width of access roads in upland areas will not exceed 16 feet. This does not include side slopes. Maintaining existing access roads includes mowing of vegetation, grading, placement/replacement of stone, and the installation/maintenance of erosion control features (e.g., water bars, swales, sedimentation basins).

When access roads are in wetlands, measures should be taken to avoid disturbance to wetlands, waterways, and sensitive areas. If avoidance is not practicable, then measures should be taken to minimize the extent of disturbance. Alternate access routes should always be considered. Below is a list of methods that should be considered where disturbance is necessary:

- Minimize the width of typical access roads through wetlands. If an existing access road is evident in the wetland, the existing width of the access road must be maintained. If unable to ascertain the original width of the access, then do not make the road wider than 16 feet (including side slopes).

- To the extent practicable, use low-impact vehicles and/or vehicles with low ground pressure when driving through wetlands.
- Coordinate the timing of work to cause the least impacts during the regulatory low-flow period under normal conditions, when water/ground is frozen, after the spring songbird nesting season, and, outside of the anticipated amphibian migration window (mid- February to mid-June). The United States Army Corps of Engineers defines the low-flow periods for streams as follows:
    - Connecticut streams—July 1 through September 30
    - Massachusetts non-tidal streams—July 1 through September 30
    - Massachusetts tidal streams—November 16 to February 15
    - New Hampshire streams—July 15 through October 1
- Use construction mats in wetlands to minimize soil disturbance and rutting when work needs to occur during non-frozen ground conditions.
- If practicable, conduct work manually if warranted (decision to be made by Project Team).

Existing access roads that have become part of the wetland are considered previous fill that were either permitted or grandfathered and where it is evident that an access road exists, it is acceptable to place stone over the previously placed fill. Where the existing access road is not evident, Environmental Licensing and Permitting must be consulted to make a determination whether stone can be placed in the wetland. If stone is not evident, through soil cores, hand digging or other methods, construction mats will be used. If permanent access is warranted through the wetland, the new access road will need to have a permitting review and will likely require permits.

The access road in the wetland should not exceed 16 feet in width (unless there is evidence that the road was originally wider than 16 feet).

Over time, existing access roads require maintenance and repair. Travel by construction equipment and general traffic to reach a particular portion of the ROW must be via the designated access road and route. Changes in the location of the access road or the use of alternate roads must be reviewed and approved by the Project Team prior to their construction or use. Access road routes were selected to prevent degradation of the utility corridor, and must be constructed, used, and maintained in accordance with this manual, as well as federal, state, and local requirements, and other project plans.

Though, in some situations, they may be necessary, constructing duplicate access roads should be avoided to the extent practicable. Some appropriate reasons for suggesting alternate routes are:

- Poor site conditions along preferred route because of weather or season.
- Property rights constraints, or property owner's preference.
- Equipment requirements.
- Unanticipated off-site access limitations along existing roads.
- Unanticipated access opportunities (e.g., ice, snow, other developments) which may avoid environmental disturbance and/or reduce cost.

General Design: New and Existing Access Roads

Construction access roads that require new grading and/or filling, or are to be heavily used require the creation of a stable, tractable, load-bearing surface resistant to erosion. If the existing soil and subsoil are not well drained, it may be necessary to import an aggregate road base (i.e., gravel borrow) such as that meeting the requirements of aggregate found in the:

- *Commonwealth of Massachusetts Department of Public Works Standard Specifications for Highways and Bridges*, Section 400
- Connecticut *Standard Specifications for Roads, Bridges and Incidental Construction*, Section M1.02

When the construction access road follows the same route as the permanent design road, constructing the grades and subgrade for the permanent roadway early in the construction sequence is recommended.

The travel surface of construction access roads shall typically not exceed 16 feet in width except for passing points, where necessary. Subgrading shall not extend beyond the space required for the finished road and normal side slopes.

Where practicable, construction access roads should conform to the contours of the land, avoiding grades steeper than 10 percent and creating side slopes no steeper than a ratio of 2:1. If the side slopes are steeper than 2:1, then use of engineered slope stabilization methods may be necessary Consider the volume and type of construction traffic as well as the extent that natural ground must be altered to accommodate the traffic. If no grading is required and the construction traffic is very intermittent (i.e., access roads used to maintain utility lines) the measures used may be limited to water bars, or some top dressing with gravel or stone in areas where the vegetation over soft soil is destroyed by traffic.

During wet weather, these roadways can generate significant quantities of sediment if not constructed with adequate stormwater management and erosion control measures. During an active construction or maintenance activity, inspection of the construction access road and the associated erosion and sedimentation measures should be conducted by the person(s) designated at the pre-construction meeting, should occur regularly while the activity is occurring, and repairs to controls should be made in a timely matter. Repairs may include regrading and/or top dressing the traveled surface with additional aggregate to eliminate ruts, as well as those repairs required by each erosion and sedimentation measure used. When the roadway is no longer needed on a regular basis, the access road should be reviewed to ensure that the road is left in a condition that prevents future erosion and sedimentation (i.e., installation of water bars, gravel, etc.). In some cases, permit conditions may warrant that the access road be removed and that the disturbed area be seeded and mulched as required to match the pre-construction conditions.

Erosion and Sedimentation Controls

Construction personnel are reminded to control erosion and flow conditions during access road construction or maintenance by utilizing the following erosion and sedimentation measures which are described and illustrated further in Appendix A:

- **Outlet protection**, a **level spreader**, a **trench breaker**, a **sediment trap or basin**, or a **stone check dam** may be used to de-energize concentrated flows from diversions and in temporary channels.
- **Geotextile silt fencing**, **compost filter berms**, **straw wattles** and **hay/straw bale barriers** may be utilized to provide protection at the toe of fill slopes and discharges from water bars.
- Side slopes can be protected by installing **erosion control blankets** and **seeding** the area with a fast-growing native or annual grass mix.
- **Dust contro**l should be employed when construction access road conditions create airborne dust.
- **Geotextile fabric** shall be used beneath all new fill and construction entrances, where needed.

3.4.2.1 Best Management Practices – New Access Roads

The following are BMPs that are applicable to new access roads in uplands and are described at the following tabs:

Construction Entrance Track Pad – Tab 1A

Stormwater Management BMPs (includes Water Bars, Drainage Swales, and Sedimentation Basins) – Tab 1B

TAB 1A

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Construction Entrance Track Pad

Applications: Erosion and sedimentation control, roadway protection

Limitations:

- Maintenance is required if the pad becomes clogged with soil.
- Muddy conditions may warrant the use of a tire wash station.

Overview:

Where access roads or construction areas connect to paved roads, a stone track pad must be installed at the construction entrance to prevent construction machinery from tracking soil onto paved roadways. Materials appropriate to construction site soil conditions should be employed and/or replenished, as necessary.

Installation:

- Use 3- to 6-inch washed stone to install stone tracking pads at a minimum length of 50 feet and a minimum depth of 12 inches.
- On sites with clayey soils, underlay stone tracking pads with a geotextile liner to prevent the stone from sinking into the soil.

Maintenance:

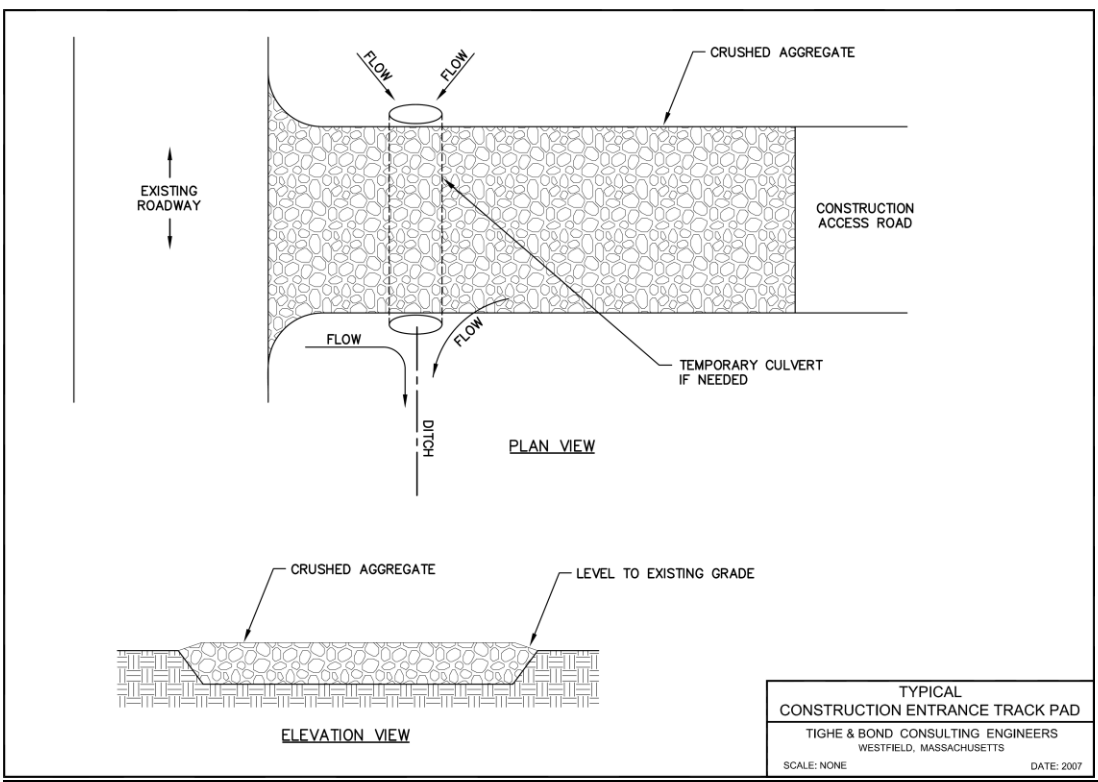
- Periodically inspect the stone in the entrance tack pad. If the pad becomes clogged with soil, remove and refresh and/or clean stone.

Additional Comments:

If muddy conditions warrant the use of a tire wash station, procedures should be established to ensure soils are not tracked off site.

Where appropriate and when safety and environmental conditions are considered, vehicle tires or tracks may be spun quickly ("burn out") on the track pad to further facilitate the removal of soil.

Construction entrance track pad.



TAB 1B

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Water Bar

Applications: Erosion and sedimentation control

Limitations:

- Should never be used to direct a watercourse into another waterbody or to divert unfiltered runoff to a wetland.
- Can impede vehicular movement.
- Damage from vehicle traffic and stormwater flow may require water bars to be reinstalled/reworked at the beginning and end of each construction season.

Overview:

Water bars are linear features built diagonally across access roads or ROWs to redirect waterflow off of the road surface at non-erosive intervals. In general, they consist of a trench dug at least 6 inches below grade followed by an earthen mound at least 6 inches above grade. Use water bars to prevent erosion on sloping roadways less than 100-feet wide. Water bars must be designed to be stable throughout their useful life and meet the criteria in the table below. The maximum capacity should be the peak runoff from a 10-year storm. Permanent diversions (Appendix A) may also be used if water bars are not suitable.

Installation:

- Set water bar direction to utilize stable outlets and do not allow upslope water bar runoff to converge with down slope water bars.
- Construct the bar immediately after vegetation has been cleared on constant or slightly increasing grades, not exceeding 2%. Avoid reverse grades.
- Mark the location and width of the ridge and disk the entire length.
- Fill ridge to above the design height and compact with wheeled equipment to the design cross section.
- Construct sediment traps or outlet stabilization measures, as needed.
- After the area has been permanently stabilized, remove the ridge and channel to blend with the natural ground level.
- Seed and mulch diversions that are intended for use for more than 30 days.

Minimum Cross Section

Top Width (ft)	Height (ft)	Side Slopes
0	1.5	4:1
4	1.5	2:1

Maximum Recommended Spacing

Land Slope (%)	Spacing (ft)
1 or less	300
2	200
3 to 5	150
Greater than 5	100

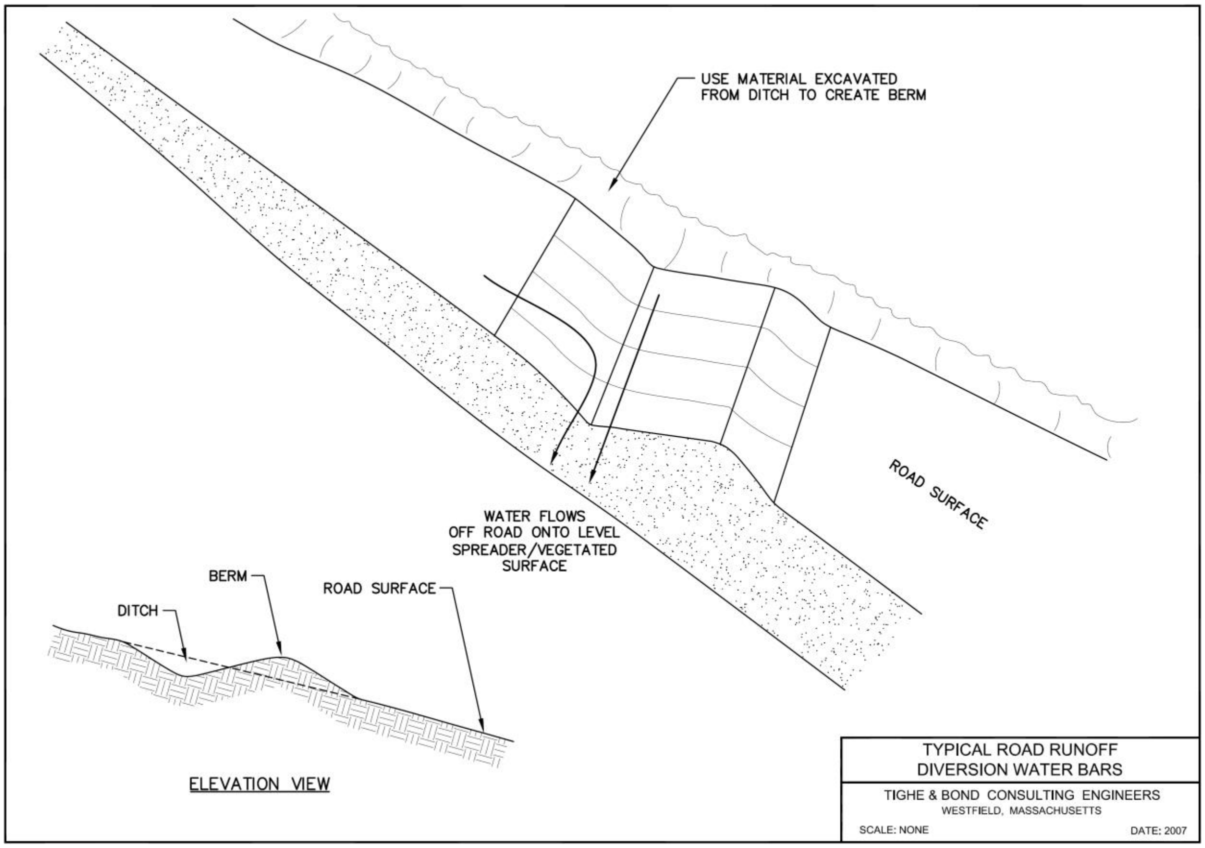
Maintenance:

- Inspect each week and after rain events. Repair damage caused by construction traffic or erosion.
- Remove accumulated sediment and debris from the trench and stabilize outlets.
- If necessary, repair ridge to a positive grade and cross section, and add gravel at crossing areas.
- Use routine inspections to determine if the original spacing is adequate or if additional water bars need to be constructed.

Additional Comments:

Water bars may include the use of hardwood logs to provide structural stability.

Diversion waterbar.


USE MATERIAL EXCAVATED FROM DITCH TO CREATE BERM
ROAD SURFACE
WATER FLOWS OFF ROAD ONTO LEVEL SPREADER/VEGETATED SURFACE
BERM
DITCH
ROAD SURFACE
ELEVATION VIEW
TYPICAL ROAD RUNOFF DIVERSION WATER BARS
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2007

Drainage Swales

Applications: Convey stormwater away from work area and/or improve water quality and reduce peak runoff.

Limitations:

- Vegetated swales need to have adequately established vegetation before flow is diverted to them.
- Need to have adequate bottom stabilization to prevent scouring.

Overview:

Drainage swales usually consist of a ditch that is either vegetated or lined with rip rap, erosion control blankets, or other materials. They are natural or constructed waterways/outlets that intercept, redirect, and convey stormwater away from the work area to a stable location and are used in areas where concentrated runoff would otherwise cause erosion/flooding. Swales can be used to reduce erosion in uplands and/or prior to discharge of stormwater flows to natural receiving waters (e.g., wetlands or streams). They also help to reduce surface flow velocity and turbidity.

Grass Lined Channels (Stabilized with vegetation)

- Use where vegetative lining will provide sufficient stability, slopes are less than 5%, and space is available for large cross section.

Installation:

- Remove trees, brush and stumps.
- Excavate and shape channel to dimensions on plans. Overcut 0.2 ft for vegetative growth.
- Install temporary liner or riprap at inflows and stabilize outlets.
- Vegetate immediately after construction and divert water until grass establishes. Install matting if flow cannot be diverted.
- Install sod rather than seeding where slopes approach 5%.
- Spread topsoil to a minimum of 4 inches where soil conditions are unfavorable. Seeded channels should be mulched.

Vegetated Swales (Stabilized with dense vegetation)

- Use for water quality improvement and peak runoff reduction. Applicable for small drainage areas with relatively small amount of impervious cover. The grassed waterway is used to convey runoff at a non-erosive velocity. Dense vegetation can be established and a stable outlet constructed.

Installation:

- General design parameters are as follows: minimum capacity 10-year, 24-hour storm; design slopes to prevent erosion during the 2-year storm event; maximum side slopes 3:1; bottom width 2 to 8 feet.
- Vegetate with water resistant grasses and divert flow until established.

Riprap Lined Channels (Contains lining of riprap or stone)

- Use on sites where channel flow velocities exceed those acceptable for grass lined waterway. Applicable where vegetative establishment is not possible or there are steep grades, wetness, highly erodible soils, seepage or prolonged base flow.

Installation:

- Remove trees, brush, and vegetation from channel area.
- Stabilize inlets and install outlet protection.
- Construct channel and install filter and lining as shown on plan.
- Use the maximum stone size for riprap plus thickness of filter.

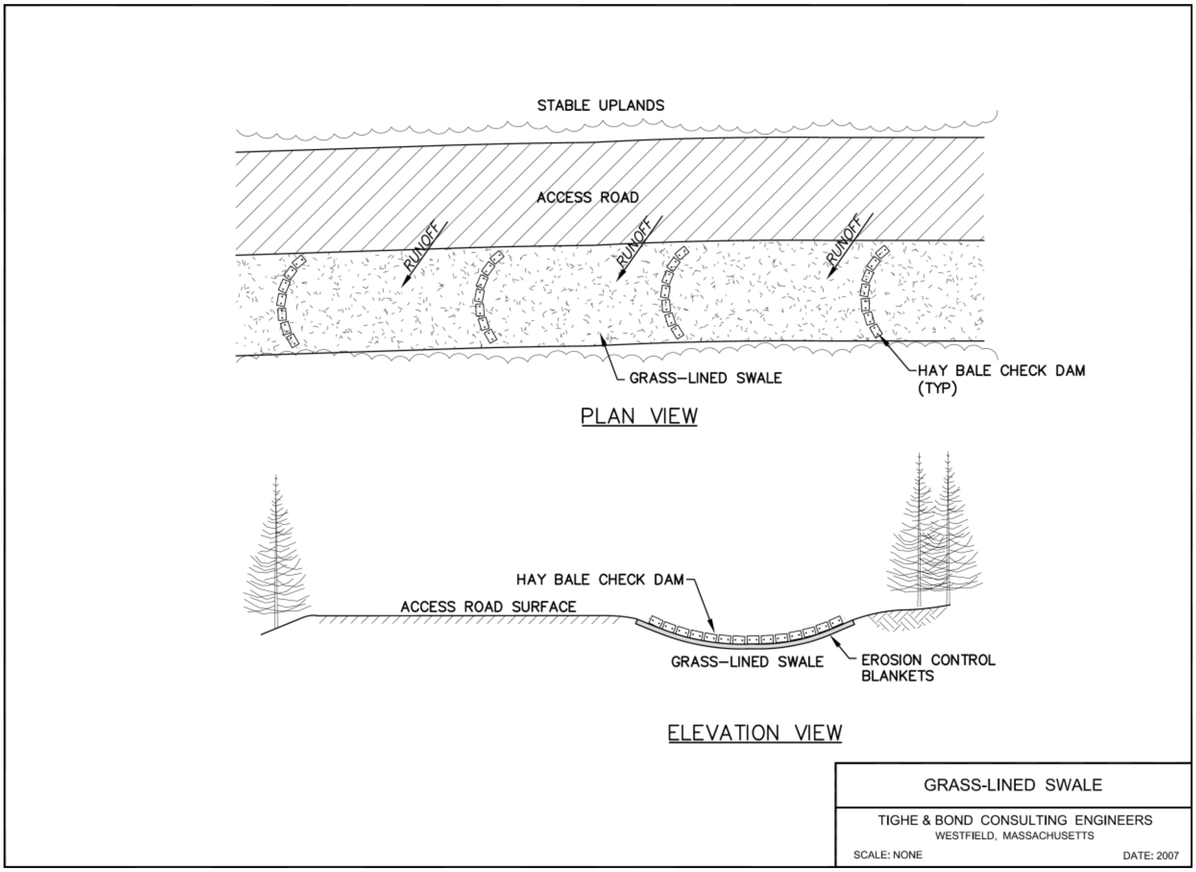
Maintenance:

- Swales need to be routinely maintained to prevent brush/sediment buildup. Inspect swale regularly and after every rain event (0.25 inches or greater). Repair and/or re-seed rill or gully erosion. Remove accumulated sediments and brush before it reaches a depth of six inches.

Additional Comments:

- Depth and spacing of swales should be dependent on runoff conditions of the specific site.
- If required, install check dams constructed of rip rap or other materials to slow flows along certain reaches of a swale.
- Remove temporary swales once construction is complete or areas are stabilized. If leaving swales in place will allow for long-term benefits and be compatible with the ultimate use of the site, then they may remain in place.

Grass-lined swale underlain with erosion control blanket and containing hay bale check dams; used to quickly stabilize soils along a construction access road subjected to significant stormwater runoff. Blue arrow indicates direction of flow.



Sedimentation Basins

Applications: Erosion and sedimentation control

Limitations:

- Traps and basins need to be adequately sized based on expected rain events and the contributing drainage area.

Overview:

Sediment traps and basins are used to filter and settle out sediment in stormwater runoff before water is released into a wetland or other unprotected and/or sensitive area. A sediment trap is a temporary measure installed during construction to detain runoff, while a basin is a more permanent measure. Basins are also used where other erosion control measures are not adequate to prevent off-site sedimentation.

A sediment traps and basins should have three components: a forebay, a check dam, and a basin. Debris and some sediments begin to settle out of the water in the forebay. The stone or hay bale check dam filters more sediments as water flows through. The actual basin is a low velocity pool where sediments settle out of the water column before the water is released at the outlet.

Based on the size of the project area, a qualified engineer may be required to calculate the appropriate size of the basin. State-specific guidance for basin sizing can be found in the following locations:

- *Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas* (Page 140); http://www.mass.gov/eea/docs/dep/water/esfull.pdf
- *2002 Connecticut Guidelines for Soil Erosion and Sediment Control* (Section 5-11-1); http://www.ct.gov/dep/cwp/view.asp?A=2720&Q=325660.

Installation:

Drainage area of 5 acres or less

- Install to direct stormwater runoff to the sedimentation trap or basin. Form basin by excavating a depression similar to a small pond or by placing an earthen embankment across an existing drainage swale or naturally low area.
- The ratio between the basin length and width should be greater than 3:1 (L:W). A ratio of 9:1 is recommended.
- Clear, grub, and strip all vegetation and root material from area of embankment and place embankment fill in lifts (<9″/lift, max). Compact fill and construct side slopes 2:1 or flatter. Excavate rectangular outlet section from compacted embankment.
- Filter fabric may be installed on bottom and sides of basin and covered by riprap.
- Extend outlet apron/spillway below toe of dam on level grade until stable conditions are reached (5 feet minimum). Cover inside face of stone outlet section with a 1-foot layer of ½- to ¼-inch aggregate.
- Use permanent or temporary seeding to vegetate embankments, spillways, and disturbed areas downgradient of the basin.

Drainage area of 10 acres or less

- Locate the basin in an easily accessible upland area, not a wetland area.
- Install the basin so that it intercepts the largest possible amount of runoff from the disturbed area.
- Divert sediment-laden water to the upper end of the sediment pool to improve trapping effectiveness.
- Basin should have a minimum volume based on ½-inch of storage for each acre of drainage area.
- Size basin to provide a minimum detention of 12 to 24 hours at the maximum runoff quantity expected for the duration of the basin's use.

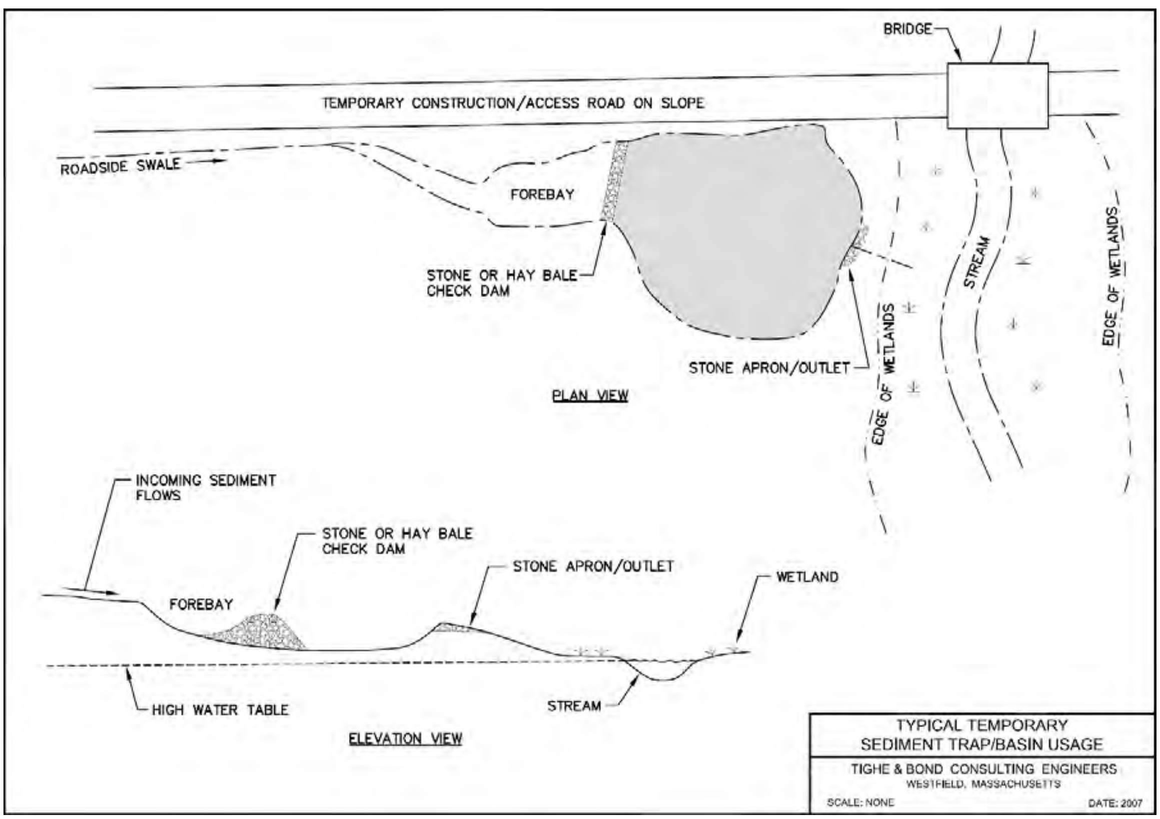
Maintenance:

- Monitor the amount of sedimentation in the trap/basin. Install a stake with a marking at half the design depth. Remove sediment when it reaches this mark.
- Inspect after every rain event.
- Clean or replace the spillway gravel and re-seed/plant vegetation, as needed.
- Monitor embankment, spillway, and outlet for erosion. Repair erosion problems immediately.

Additional Comments:

Construction of sediment traps and/or basins should occur before primary construction on a project begins. They are often a critical stormwater management component for larger construction sites and/or those with poorly drained upland soils. If compatible with the post-construction site use, it may be appropriate to leave sediment basins in place indefinitely.

Sedimentation basin with hay bale filters.



3.4.3 Construction in Wetlands

Access roads that are constructed in or across wetlands require the following considerations in addition to the considerations for access roads in uplands:

- Construction of new access roads in wetlands, whether temporary or permanent, that do not utilize construction mats (e.g., earthen and/or rock fill roads, corduroy roads) require considerable project specific permitting and design. These kinds of projects should comply with project specific permits and plans, while only using this BMP manual as a general reference source. Permits often also require wetlands replication when permanent new access roads are constructed in wetlands.
- Avoid putting the construction access road in a wetland whenever practicable. Explore all feasible and prudent alternatives before determining that a wetland crossing is necessary. When avoidance is not practicable, consider crossings that will result in the least amount of disturbance. This may involve locating the construction access road so that it crosses the wetland at its narrowest width or uses areas previously disturbed for access or other purposes.
- Minimize the width of the temporary construction access road through the wetlands (generally no wider than 16 feet when using construction mats). It is preferable to have a passing point created before and after the wetland crossing, but internal passing points may be needed if the crossing is very long or critical sight line restrictions exist.
- Construct access roads so that wildlife is able to pass under or go through the road. In areas where the road is only one construction mat thick, allow for passageways or "gaps" between construction mats. In locations where the access road is greater than one mat thick, install elevated construction mat road crossings or "bridges." Gaps and/or bridges are to be placed along the access road at intervals no less than 50 feet.
- Consider the soil conditions. Expect deep organic wetland soils to require geotextiles, construction mats, or other materials during use to keep imported road materials separated from wetland soils. In shallow organic or saturated soils, thick plywood sheets or AlturnaMATS® may be sufficient to support a stable travel surface for small, lightweight vehicles. In addition, in areas which are inundated or have deep organic wetland soils, it may be necessary to use more than one layer of construction mats.
- Prevent obstructions to surface and subsurface flow across and through the construction access road. Provide adequate drainage. This may require the use of crushed stone, a layer of log corduroy, construction mat bridges, or multiple cross culverts, particularly if the wetland does not contain a well-defined watercourse channel and/or the wetland crossing is long. If the wetland soils are susceptible to seasonal high groundwater tables or flooding, then give additional consideration for maintaining flows across and/or over the construction access road without causing erosion or siltation during such times.
- Plan in advance how the construction access road will be removed and the wetland restored. A road stabilization geotextile can facilitate the segregation of imported soils and crushed stone and/or log corduroy from the native wetland soils and make wetland restoration easier. However, after the end of an extensive project and a highly traveled crossing, stone removal from the wetland surface will still usually have to occur, even when placed in conjunction with geotextile.

In some cases, access roads may not need to be constructed in a wetland to get access into or through a wetland if the work can be designed such that disturbance to the wetland are avoided or negligible. Options to be considered are presented below.

Equipment Selection and Usage

- **Low ground pressure equipment**. Using equipment that reduces the pressure it exerts on the ground can minimize disturbance to sensitive areas. Employing the use of equipment with wide tires, rubberized tracks, and low ground pressure (<3 psi) can help minimize soil compaction.
- **Wide tires**. Increasing the width of tires will increase traveling surface area and therefore reduce the amount of ground compaction that the equipment will cause. Ultimately, this will reduce rutting, and allow for easier maneuvering of the vehicle. However, wide tires may be costly and will require a wider travel area.
- **Rubberized tracks**. Equipment with rubberized tracks spreads the weight of the vehicle over a much larger surface, reducing ground pressure and enabling the vehicle to move more freely through wet substrates. Each track can be between 1.5 and 3 feet wide, length depending on the width of the vehicle. This can greatly reduce rutting and allow the vehicle to move with less difficulty through wet substrates.
- **Lightweight equipment**. Disturbance in a wetland area can be lessened by reducing the size of equipment (e.g., ORVs, Gator™) used in sensitive areas. This reduces the amount of pressure to the travel surface as well as the necessary width of access ways.

Equipment with rubberized tracks.

Timing of Work

- **Work during frozen conditions**. Activities conducted once wetland areas are frozen can minimize rutting and other disturbance to the surrounding environment. Work during this time also generally reduces disturbance of aquatic and terrestrial wildlife movement by avoiding sensitive breeding and nesting seasons.
- **Work during the "low flow" period**. Conducting work during the low flow period can reduce disturbance to surface water and generally avoids spawning and breeding seasons of aquatic organisms. The United States Army Corps of Engineers defines the low-flow periods for streams as follows:
  - Connecticut streams—July 1 through September 30
  - Massachusetts non-tidal streams—July 1 through September 30
  - Massachusetts tidal streams—November 16 to February 15
  - New Hampshire streams—July 15 through October 1

Alternate Access

- **Manual access.** Consider accessing work areas on foot through terrestrial areas and/or by boat through open water or ponded areas. Smaller projects (e.g., repairs to individual structures or parts of structures) do not categorically require the use of heavy machinery and should be accessed manually to the extent practicable.

- **Limit trips.** Multiple trips through a wetland have shown to increase the potential for damage and requirement for matting. Try to limit trip to one in and one out.

Use of overhead/aerial access (e.g., helicopters)

- Using overhead or aerial equipment can be expensive and is not always feasible, but it may be appropriate in some situations in order to get vehicles and other equipment to a site that may be otherwise very difficult to access. The use of overhead and/or aerial equipment may be beneficial for work in areas where large water bodies, deep crevices, or mountainous areas hinder ground access.

Erosion and Sedimentation Controls

Construction personnel are reminded to control erosion and flow conditions during new access road construction by utilizing the following erosion and sedimentation measures which are described and illustrated further in Appendix A:

- **Straw wattles, Geotextile silt fencing** and **hay/straw bale barriers** may be installed at the edges of earthen roads or construction mat roads to prevent erosion of soil into wetlands from the road fill or tracked soil on construction mats.
- In areas where silt fencing is required for more than one activity season, **syncopated silt fencing** may be installed to permit animal crossings.
- Side slopes of earthen roads can be protected by installing **erosion control blankets** and **seeding** the area with a fast-growing native or annual grass mix.
- **Dust control** should be employed as necessary when construction access road conditions create airborne dust when necessary.

3.4.3.1 Best Management Practices – Construction in Wetlands

The following are BMPs that are applicable to new access roads in wetlands and are described at the following tab:

Construction Mats (includes Elevated Construction Mats and AlturnaMATs) – Tab 2A

Permeable Road- Tab 2B

Dewatering – Appendix A Section II

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TAB 2A

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Construction Mats (i.e., timber or swamp mats)

Applications: Wetland crossings, rut minimization

- Used for access where the ground surface is unstable due to shallow, standing water, saturated soils, or other substrates not suitable for heavy vehicles.

Limitations:

- Only for temporary use. Generally mats should be removed upon construction completion.
- May float away in high water conditions.
- Need to be installed with heavy machinery.
- AlturnaMATs® limited to smaller vehicles and equipment.
- Equipment operators should remain cautious so as not to drive off or slip off the side of the mats.
- In winter, mats must be plowed and sanded or heated to prevent equipment from sliding off mats. Use of a deicing agent requires approval by the Environmental Licensing and Permitting Group.

Installation:

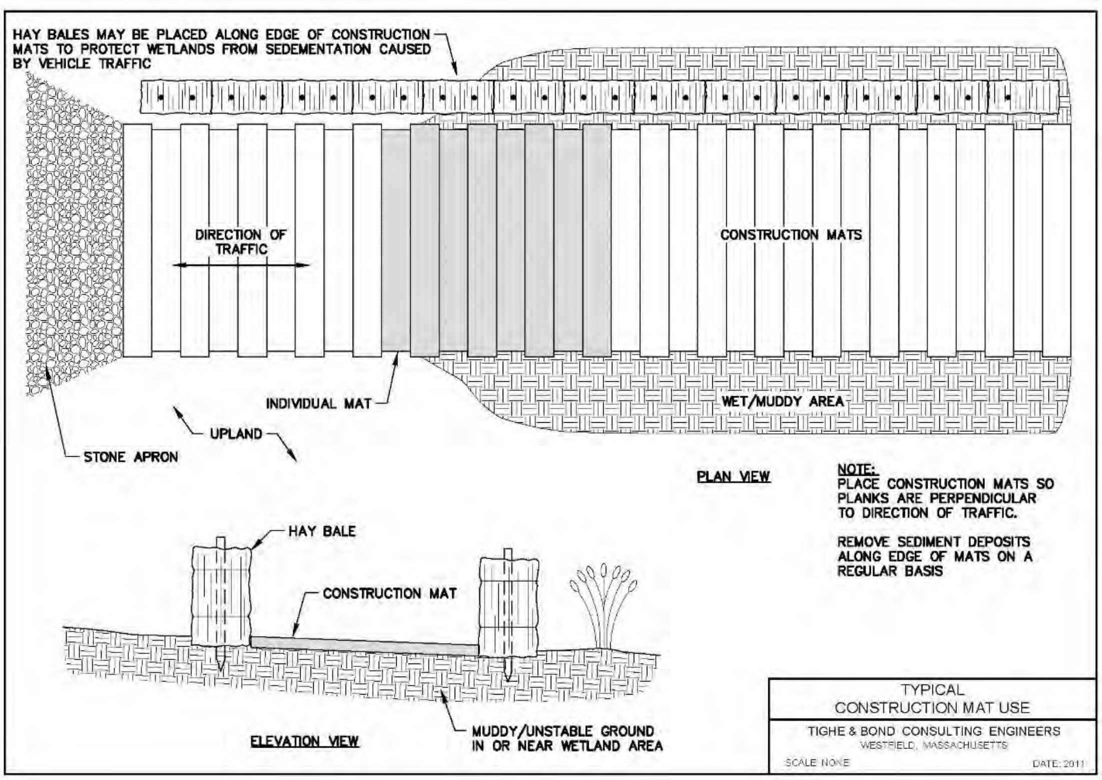
- Place mats along the travel area without any gaps and so that each board is positioned perpendicular to the direction of traffic. Position mats so that they are offset far enough from the resource area so that ruts are not created when equipment enters and exits a sensitive area.
- Remove mats by "backing" out of the site and removing mats one at a time. Regrade soils to pre-existing contours while taking care not to compact soils.
- Clean mats after use to remove any invasive plant species seed stock. Cleaning methods may include, but are not limited to, shaking or dropping mats in a controlled manner with a piece of machinery to knock off attached soil and debris, spraying with water or air, sweeping, or exposing the mats to high temperatures.
- Clean mats that were used in wetlands dominated by invasive species using brooms, shovels, and compressed air, if needed.

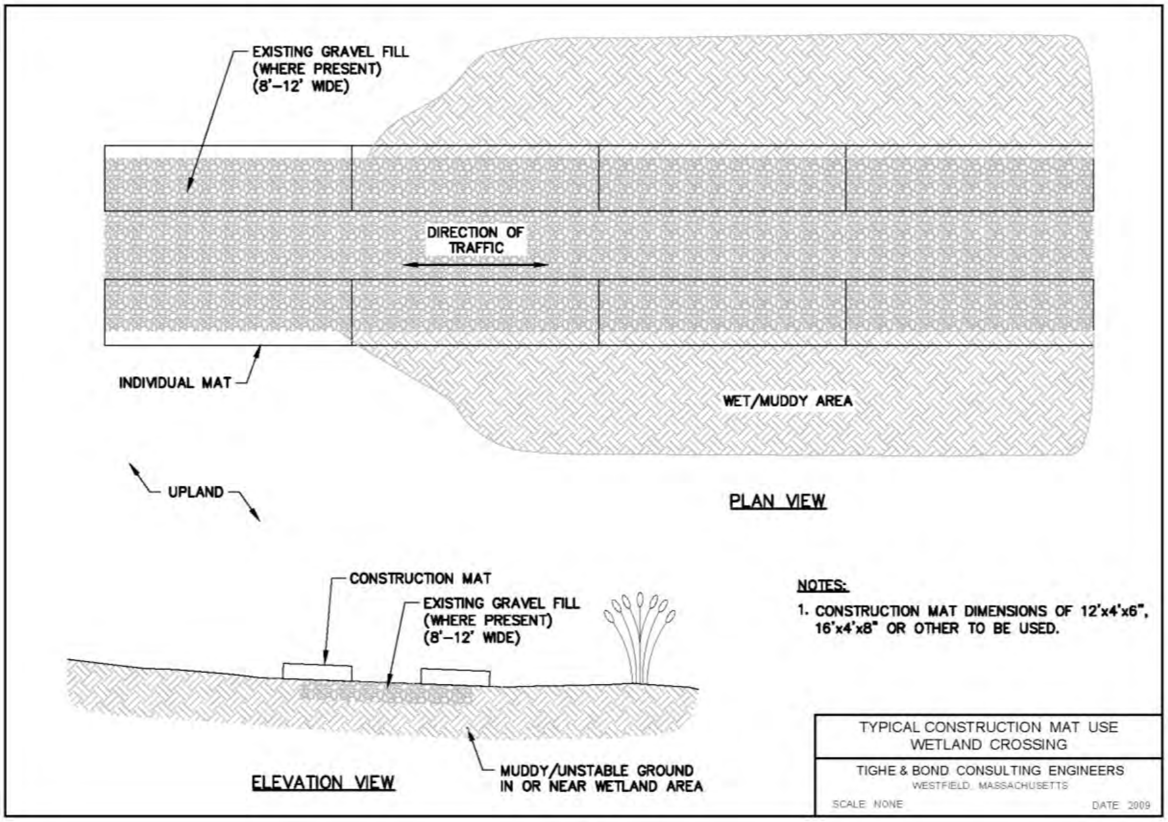
Additional Comments:

Lightweight, easy to maneuver alternatives to traditional mats are available. For example, AlturnaMATS® are half-inch thick polyethylene slip-resistant ground protection mats available in dimensions up to 4 feet by 8 feet and weigh between 21.5 and 86 pounds.

See photograph and typical sheet on following pages.

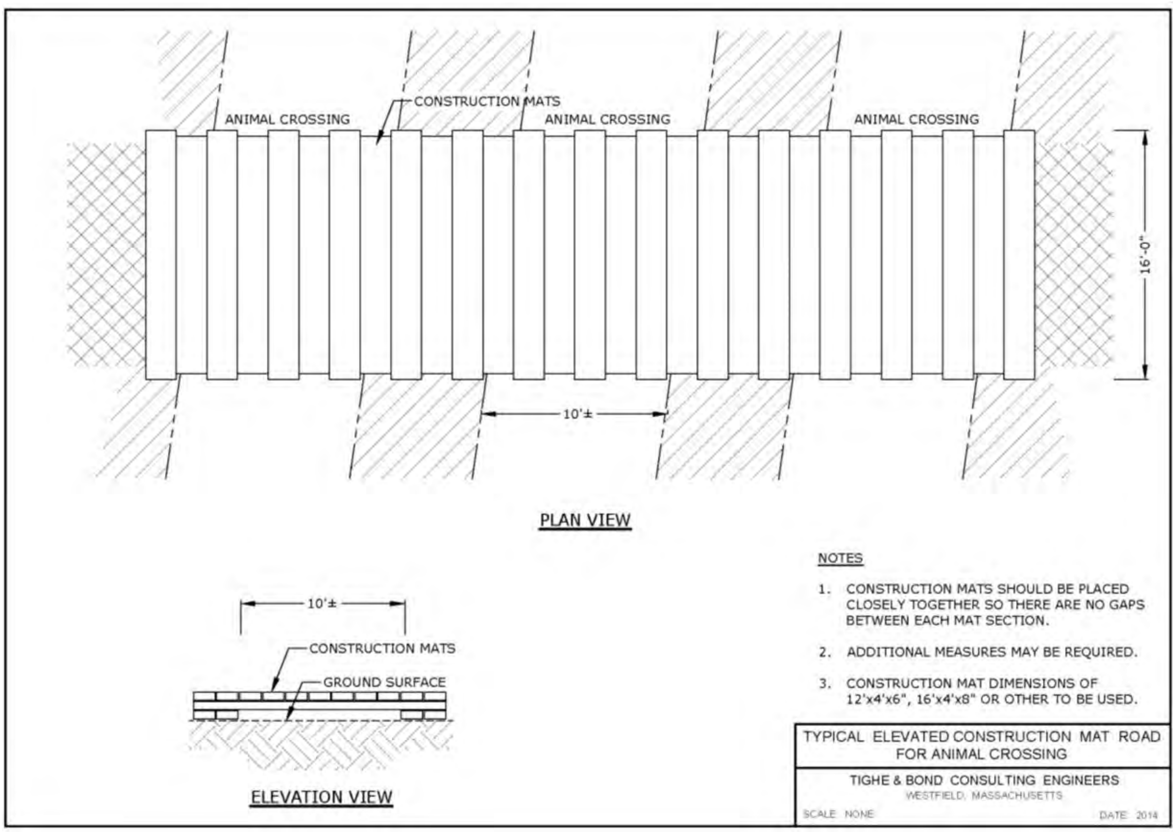
Construction mat access road.



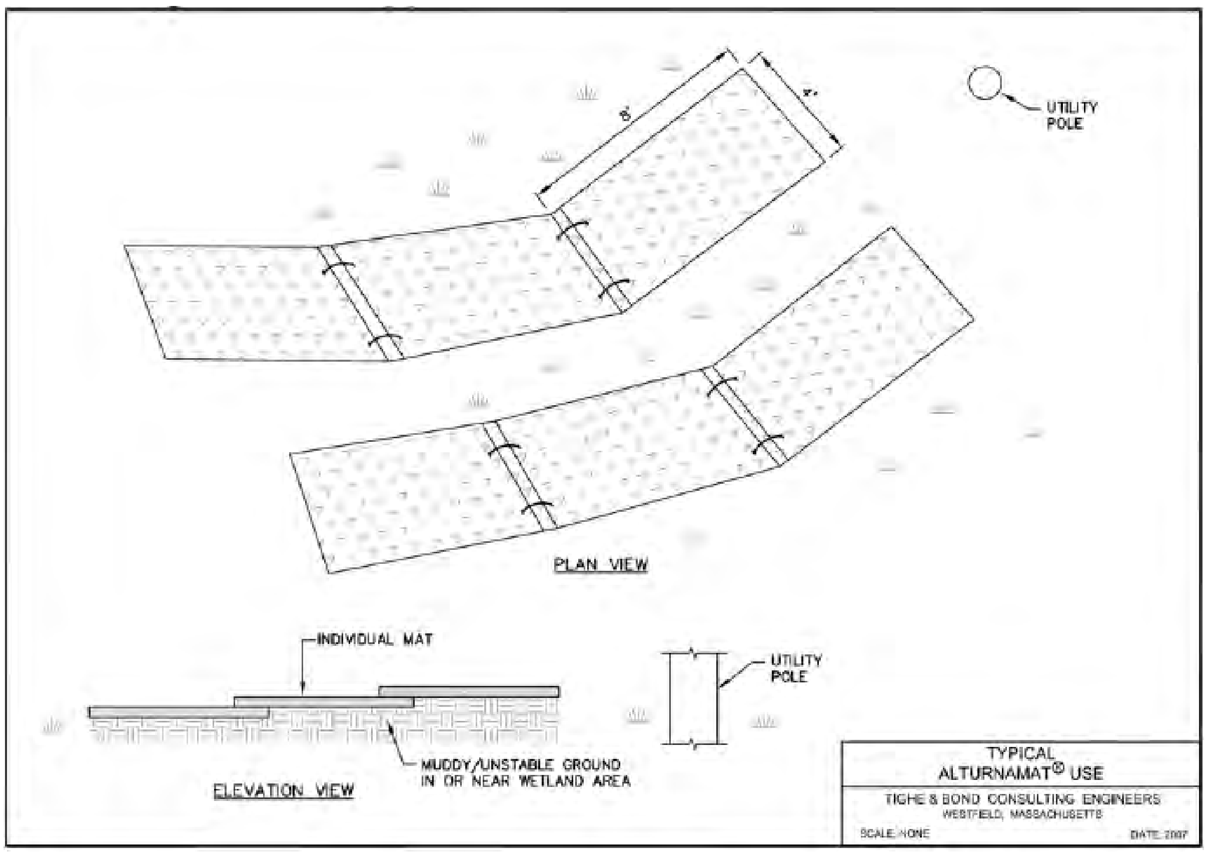


EXISTING GRAVEL FILL (WHERE PRESENT) (8'–12' WIDE)
DIRECTION OF TRAFFIC
INDIVIDUAL MAT
WET/MUDDY AREA
UPLAND
PLAN VIEW
CONSTRUCTION MAT
EXISTING GRAVEL FILL (WHERE PRESENT) (8'–12' WIDE)
NOTES:
1. CONSTRUCTION MAT DIMENSIONS OF 12'x4'x6", 16'x4'x8" OR OTHER TO BE USED.
ELEVATION VIEW
MUDDY/UNSTABLE GROUND IN OR NEAR WETLAND AREA
TYPICAL CONSTRUCTION MAT USE WETLAND CROSSING
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2009

Elevated construction mat road with bridging for animal crossing.



AlturnaMAT® tracks to utility pole in wetland.



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TAB 2B

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Permeable Road (i.e., rock sandwich, French Mattress, or road with continuous cross-drainage)

Applications: Wetland crossings, rut minimization

Limitations:

- Not appropriate for areas where concentrated, high volume and/or velocity water flow will intersect the road (i.e., stream crossings).
- Need to be installed with heavy machinery.
- Equipment operators should remain cautious so as not to drive or slip off the side of the road.

Overview:

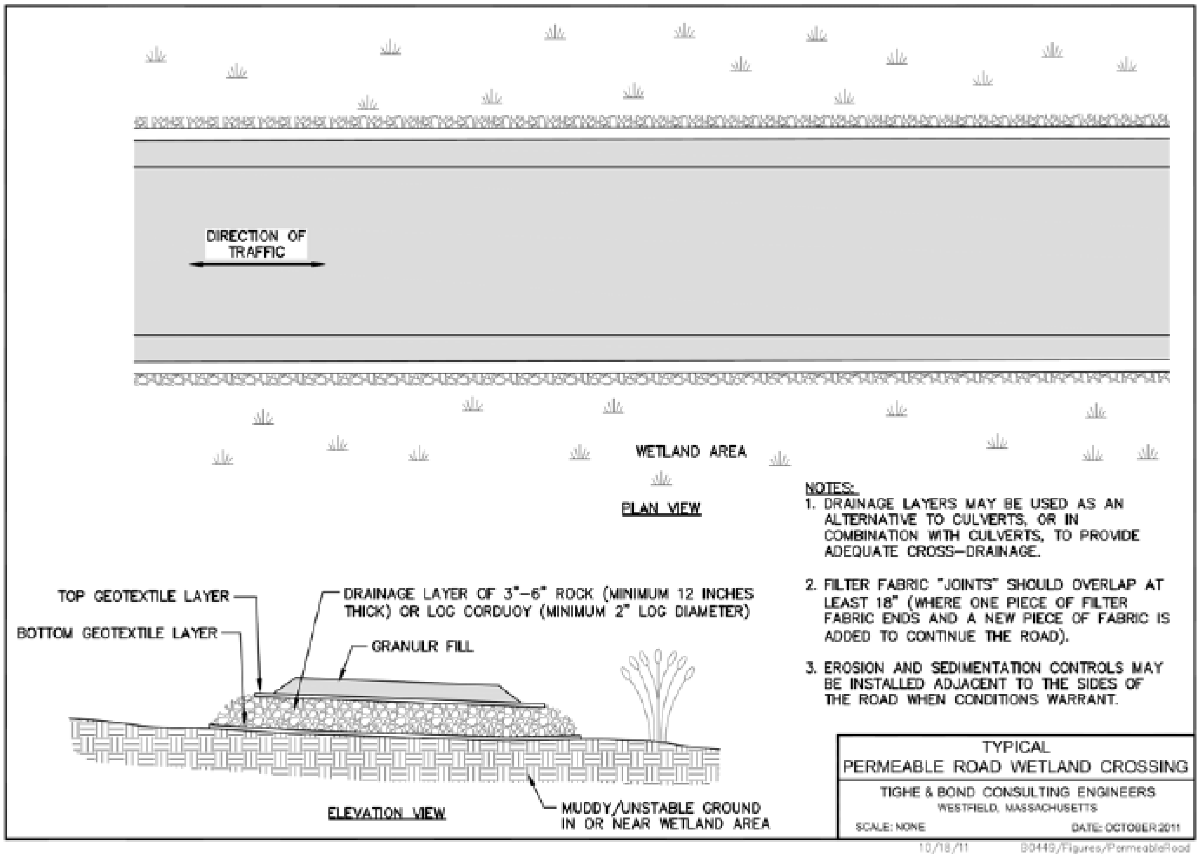
Permeable roads are used for access in situations not suitable for heavy vehicle use often due to unstable ground surfaces with shallow standing water, saturated soils, or other unstable substrate. Installation of a permeable road can also help reduce the potential for frost action and pothole creation by preventing groundwater from wicking up into the road fill material.

Installation:

- Cover existing soil with a geotextile fabric prior to road construction. Excavation of existing soil is generally not recommended in order to minimize impacts to the resource area. Construct road on top of the soil surface, as shown on the typical on the next page. Drainage layer materials include 3- to 6-inch rock (12-inch minimum depth) or log corduroy (2-inch minimum diameter).
- Install the road so that it is offset far enough from the resource area so that ruts are not created when equipment enters and exits a sensitive area.
- Remove road by "backing" out of the site and removing road one section at a time. Regrade soils to pre-existing contours while taking care not to compact soils.

Maintenance:

- Regularly inspect and clean edges of cross-drainage layer along the sides of the road to prevent clogging by debris, leaf litter, sediment, etc.


DIRECTION OF TRAFFIC
WETLAND AREA
PLAN VIEW
NOTES:
1. DRAINAGE LAYERS MAY BE USED AS AN ALTERNATIVE TO CULVERTS, OR IN COMBINATION WITH CULVERTS, TO PROVIDE ADEQUATE CROSS-DRAINAGE.
2. FILTER FABRIC "JOINTS" SHOULD OVERLAP AT LEAST 18" (WHERE ONE PIECE OF FILTER FABRIC ENDS AND A NEW PIECE OF FABRIC IS ADDED TO CONTINUE THE ROAD).
3. EROSION AND SEDIMENTATION CONTROLS MAY BE INSTALLED ADJACENT TO THE SIDES OF THE ROAD WHEN CONDITIONS WARRANT.
TOP GEOTEXTILE LAYER
BOTTOM GEOTEXTILE LAYER
DRAINAGE LAYER OF 3"-6" ROCK (MINIMUM 12 INCHES THICK) OR LOG CORDUOY (MINIMUM 2" LOG DIAMETER)
GRANULR FILL
ELEVATION VIEW
MUDDY/UNSTABLE GROUND IN OR NEAR WETLAND AREA
TYPICAL
PERMEABLE ROAD WETLAND CROSSING
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: OCTOBER 2011
10/18/11
80449/Figures/PermeableRoad

3.4.4 Watercourse Crossings

There are a number of BMPs that can be used to minimize disturbance to streams. For each application, consider the site and project needs to select a method that is cost effective and will incur the fewest secondary disturbances. Additional erosion and sedimentation controls (e.g., hay or straw bales) may be required in conjunction with the stream crossing BMPs to protect sensitive areas. The stream crossing methodology chosen will depend largely on the equipment required for a particular task, the existing environmental conditions, and the duration of the crossing. In constructing any stream crossing, care should be taken to limit disturbance to the extent practicable within 100 feet of the stream banks (the riparian area). The riparian area provides habitat to a number of species and provides protection and shading to the stream.

Erosion and Sedimentation Controls

Construction personnel are reminded to control erosion and flow conditions during new watercourse crossings by utilizing the following erosion and sedimentation measures which are described and illustrated further in Appendix A:

- **Straw wattles, Geotextile silt fencing** and **hay/straw bale barriers** may be installed at the edges of earthen roads or construction mat roads to prevent erosion of soil into watercourses from the road fill or tracked soil on construction mats. These controls however should generally not be placed within a watercourse.
- Side slopes of earthen roads can be protected by installing **erosion control blankets** and **seeding** the area with a fast-growing native or annual grass mix.

3.4.4.1 Best Management Practices – Watercourse Crossings

The following are BMPs that are applicable to new access roads watercourse crossings and are described at the following tabs:

Stream Crossings without Bridges (includes limiting turbidity and stone crossing) – Tab 3A

Bridged Crossings (includes construction mat bridges and rail car frame bridges) – Tab 3B

Culverts – Tab 3C

Poled Fords – Tab 3D

Dewatering – Appendix A Section II

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TAB 3A

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Stream Crossings Without Bridges: Limiting Turbidity

Applications: Stream crossing, turbidity control

Limitations:

- Limited to areas where stream banks and bottoms will not be significantly damaged by the crossing.

Overview/Use:

- In some situations, such as routine or emergency maintenance with small ORVs, pickup trucks or tracked equipment, it may be acceptable for equipment to simply travel (perpendicularly) through a stream.
- Crossings are generally considered acceptable in situations where there is an existing or historic access road, a stable rock or sand/gravel stream bottom, and/or the crossing is at a relatively narrow reach of the stream and any adjacent wetlands.
- Cross streams slowly to minimize in-stream turbidity.

Stream Crossings Without Bridges: Stone Crossings

Applications: Stream crossing, turbidity control

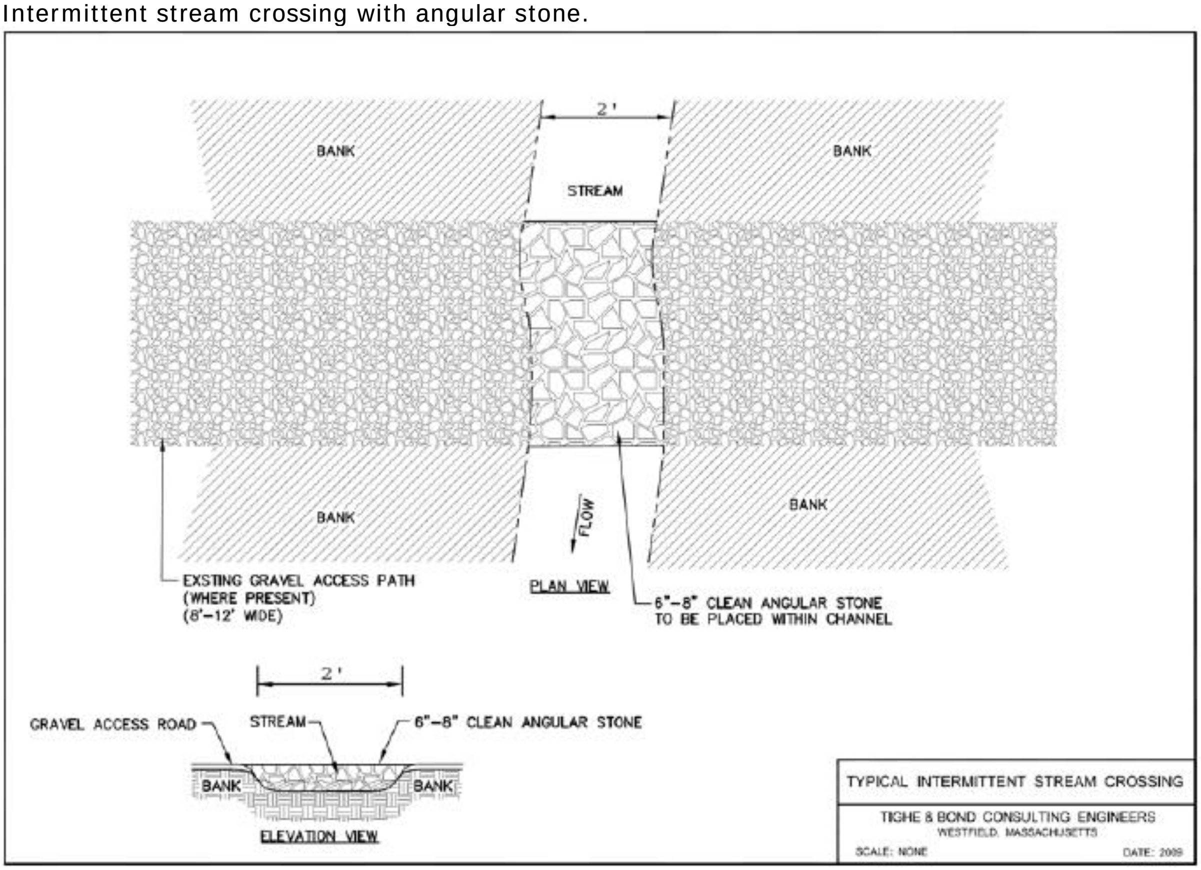
Limitations:

- Only use in small (less than 2-feet wide or braided) intermittent streams which do not appear on USGS topographic maps, and have a downstream section with a gradient greater than 20%.
- Not suitable in areas where there could be a potential for fish passage.
- Stone size should be sufficient to allow for macroinvertebrate passage.
- Not preferred for new access road crossings. Generally is a BMP more suitable for existing access road crossings.

Overview/Use:

- Use to cross small streams with stable stream bottoms.
- Carefully place 6-inch to 8-inch clean angular stone within stream at crossing. Limit width of stone to that needed for widest vehicle/equipment to crossing the stream.
- Drive over stone slowly.
- Leave riprap in intermittent streams for future use. More damage will occur by removing stone.

Intermittent stream crossing with angular stone.



TAB 3B

Bridged Crossings: Construction Mats as Temporary Bridge

Applications: Watercourse crossings

Limitations:

- Installation requires machinery.
- May become unstable under high flows.

Overview/Use:

- Untreated wooden construction mats may be used as a temporary bridge over a stream to allow construction vehicles access to the work site. Construction mat bridging is suitable for crossing intermittent and perennial streams. Before constructing a stream crossing, confirm that the construction mats are capable of supporting the equipment to be used.
- Place small sections of matting on either side of the stream parallel to the flow of water at top of banks to act as supports. Then place mats perpendicular to the stream and resting on top of the initial construction mat supports.
- It may be necessary to place a large steel plate along the top of the construction mats for extra stability and to minimize the amount of sediment that could fall between the spaces of each timber.

Construction mat bridge.

Bridged Crossings: Rail Car Frame as Temporary Bridge

Applications: Watercourse crossings

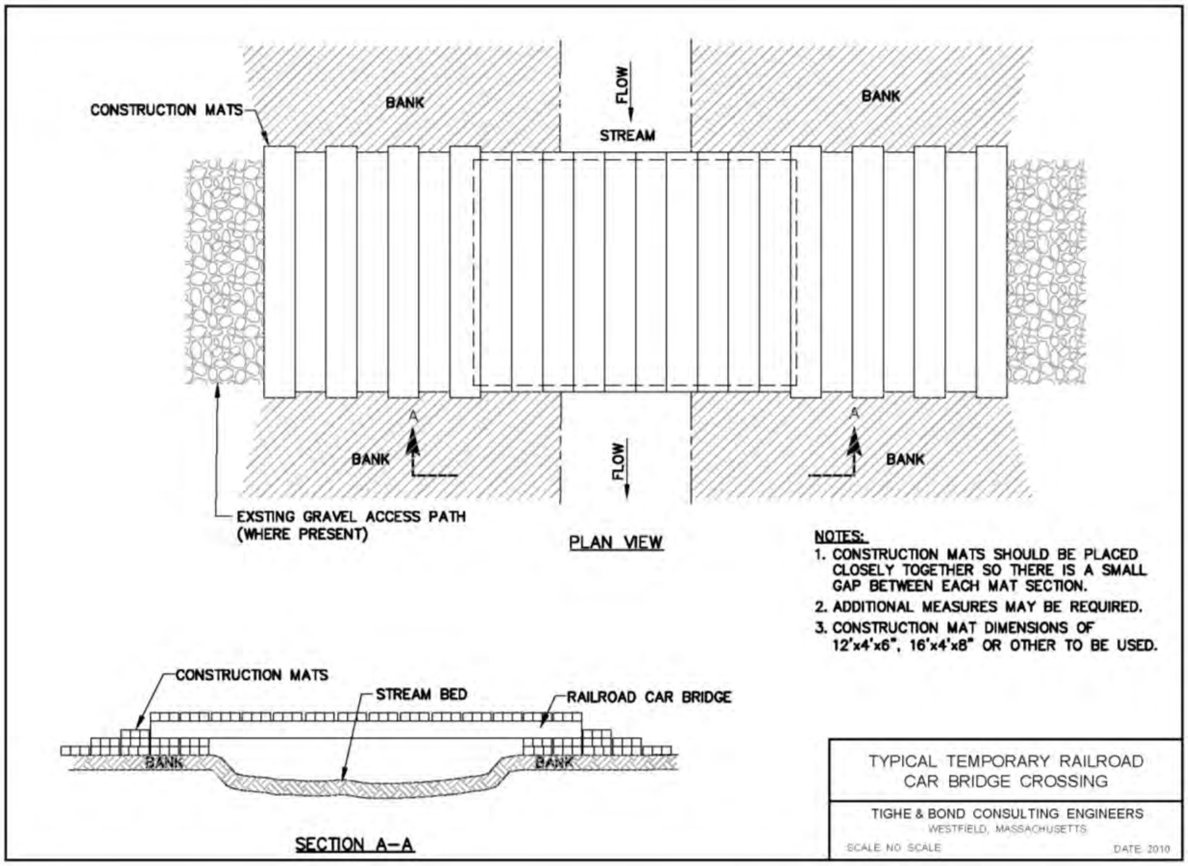
Limitations:

- Requires heavy equipment for transport and installation.
- Expensive.
- Banks must be stable to support heavy loads.

Overview/Use:

- Used rail car frames can be used for crossing larger and deeply incised streams where construction mats are unsuitable.
- Place the rail car frame perpendicular to the stream flow and between opposing banks. Use timber frame footings, if necessary. Next, place construction matting on the rail car frame to provide vehicle access.

Rail car frame bridge crossing.


CONSTRUCTION MATS
BANK
FLOW
STREAM
BANK
A
BANK
FLOW
A
BANK
EXSTING GRAVEL ACCESS PATH
(WHERE PRESENT)
PLAN VIEW
NOTES:
1. CONSTRUCTION MATS SHOULD BE PLACED CLOSELY TOGETHER SO THERE IS A SMALL GAP BETWEEN EACH MAT SECTION.
2. ADDITIONAL MEASURES MAY BE REQUIRED.
3. CONSTRUCTION MAT DIMENSIONS OF 12'x4'x6", 16'x4'x8" OR OTHER TO BE USED.
CONSTRUCTION MATS
STREAM BED
RAILROAD CAR BRIDGE
BANK
BANK
SECTION A–A
TYPICAL TEMPORARY RAILROAD CAR BRIDGE CROSSING
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE NO SCALE
DATE 2010

TAB 3C

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Culvert Installation/Repair/Replacement

***Contact Environmental Licensing and Permitting prior to performing any culvert installations or replacements.**

Applications: Stream and wetland crossings

Limitations:

- Permitting and design are required for new culvert installation or expansion of existing culvers over streams and wetlands. Significant regulatory requirements must be followed. Permitting restrictions on time of year use.
- Installation may require in-stream work; dewatering and sedimentation concerns.
- Culverts are susceptible to washouts, sedimentation, erosion, and failure during heavy wet-weather events and flooding.
- Culverts require routine and long-term maintenance because they often become clogged with debris or other obstructions.

Overview:

Culverts are installed to maintain wetlands or streams at road crossings. Hydraulic calculations are required at all crossings to determine the area that will drain to the culvert.

General Design Guidelines:

- Size culverts to handle the maximum expected flow of the wetland or watercourse. It is preferable to one large culvert rather than multiple culverts. Corrugated culverts are favored because they slow the water velocity. Plastic pipes are preferred to metal.
- Design culverts to withstand and accommodate high flows while maintaining existing low flows and not impeding on the movement of indigenous aquatic life. Culverts must be sized to accommodate flows from at least the 100-year storm and preferably 500-year storm.
- The maximum velocity at the culvert outlet should be consistent with the velocity of the natural channel. To mitigate higher velocities, use outlet protection measures, energy dissipation, and channel stabilization, if necessary.
- Refer to state specific stream crossing guidance documents for additional design requirements:
    - Connecticut: Stream Crossing Guidelines, CT DEEP, Inland Fisheries Division Habitat Conservation and Enhancement Program, February 26, 2008, www.ct.gov/deep/lib/deep/fishing/restoration/streamcrossingguidelines.pdf
    - Massachusetts: Massachusetts River and Stream Crossing Standards, River and Stream Continuity Partnership, March 1, 2006, Revised March 1, 2011, www.nae.usace.army.mil/Portals/74/docs/regulatory/StreamRiverContinuity/MA_RiverStreamCrossingStandards.pdf

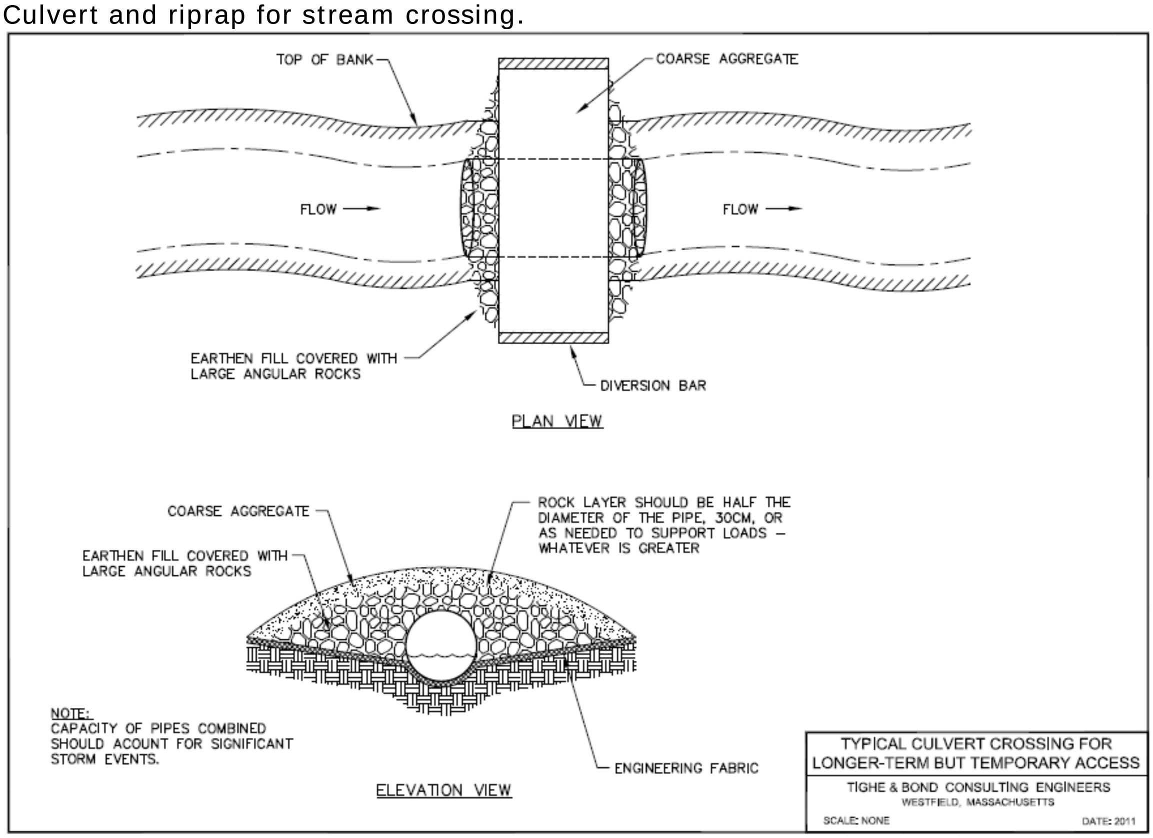
Installation:

- Construction mats may be placed over culverts to provide structural protection from heavy loads.
- Backfill culverts with natural substrate matching the upstream and downstream streambed substrate, even when fish passage is not a concern. Other aquatic organisms rely on natural streambed sediment to aid their movement.
- Strive to install culverts with minimal disruption to the watercourse and riparian buffer zone.
- Culvert length should be as short in length as practicable. Cut culverts to size if they are protruding into the natural streambed.

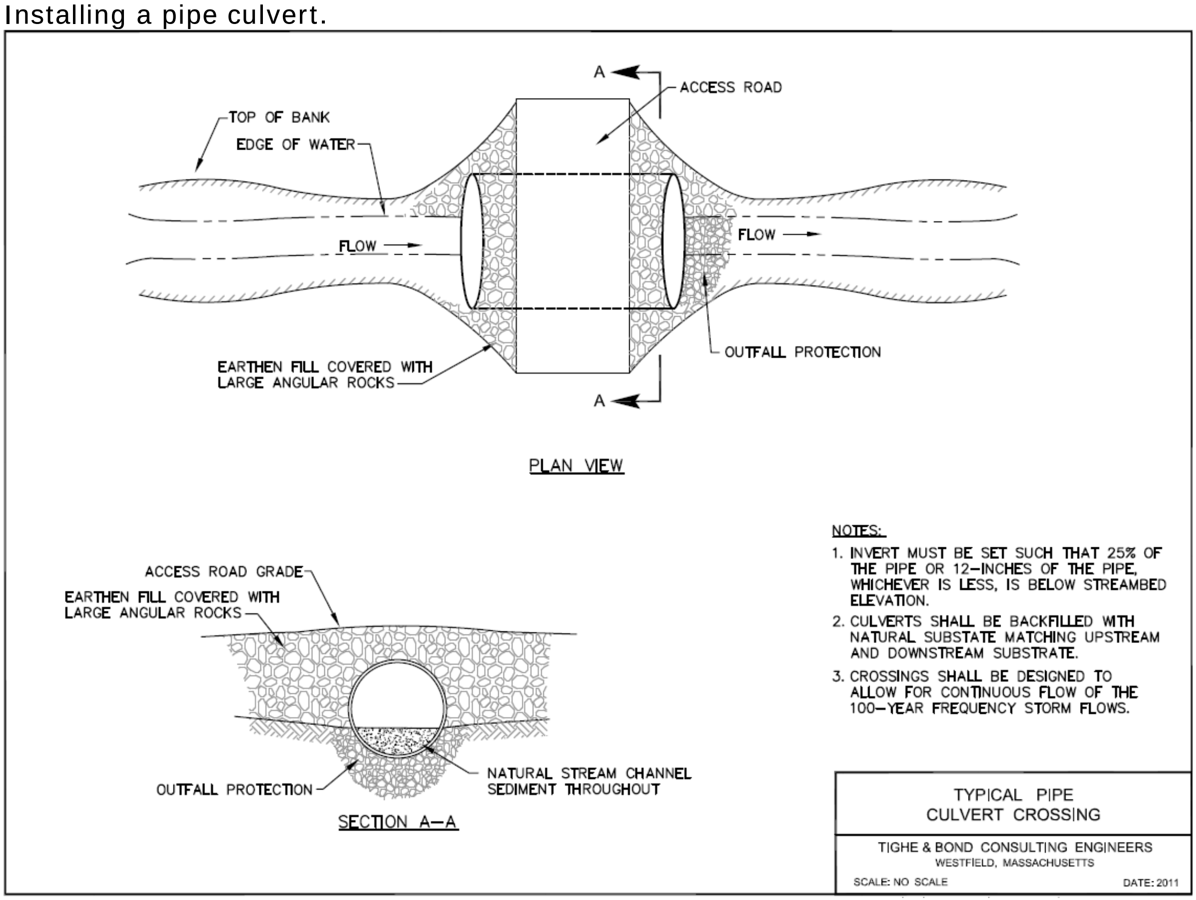
Maintenance:

- Remove debris and sediment from culverts to maintain an open channel for flow. A clogged culvert could result in flooding and washout.

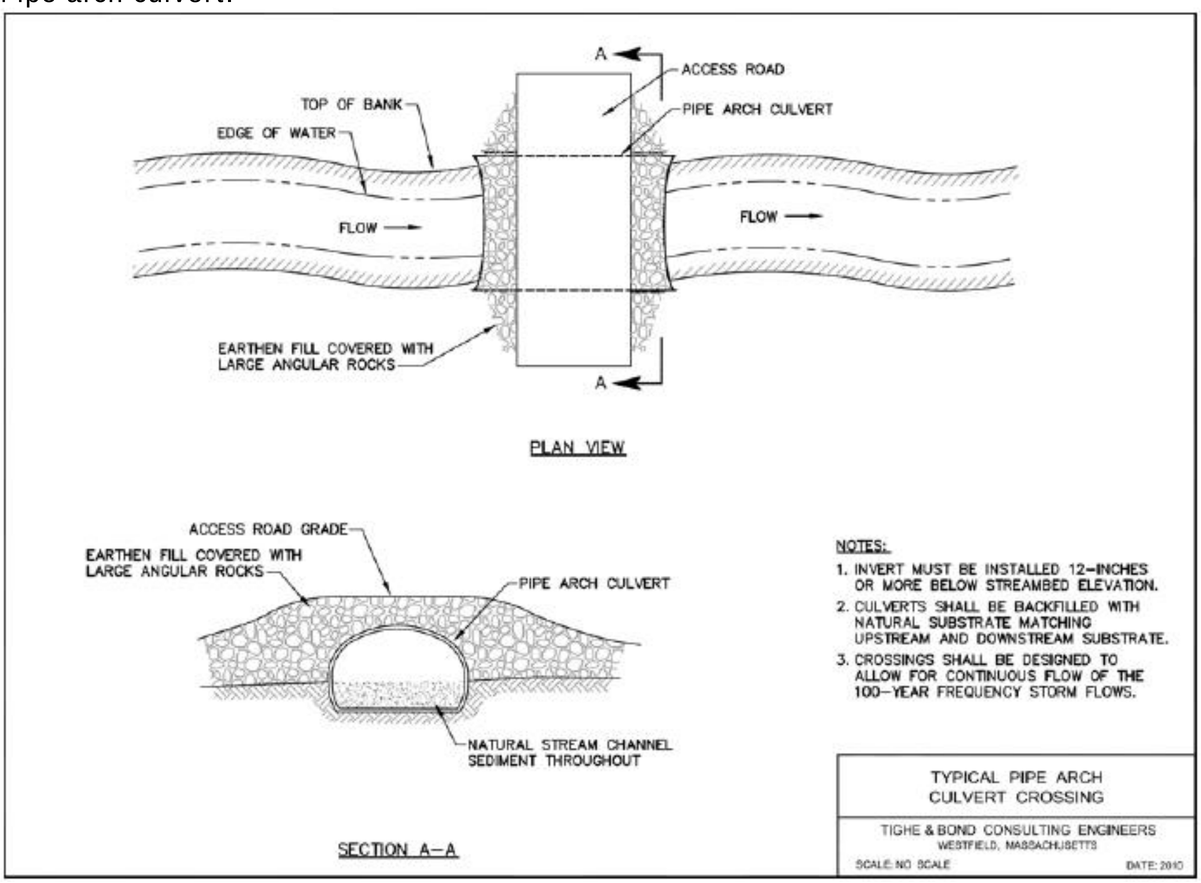
Culvert and riprap for stream crossing.



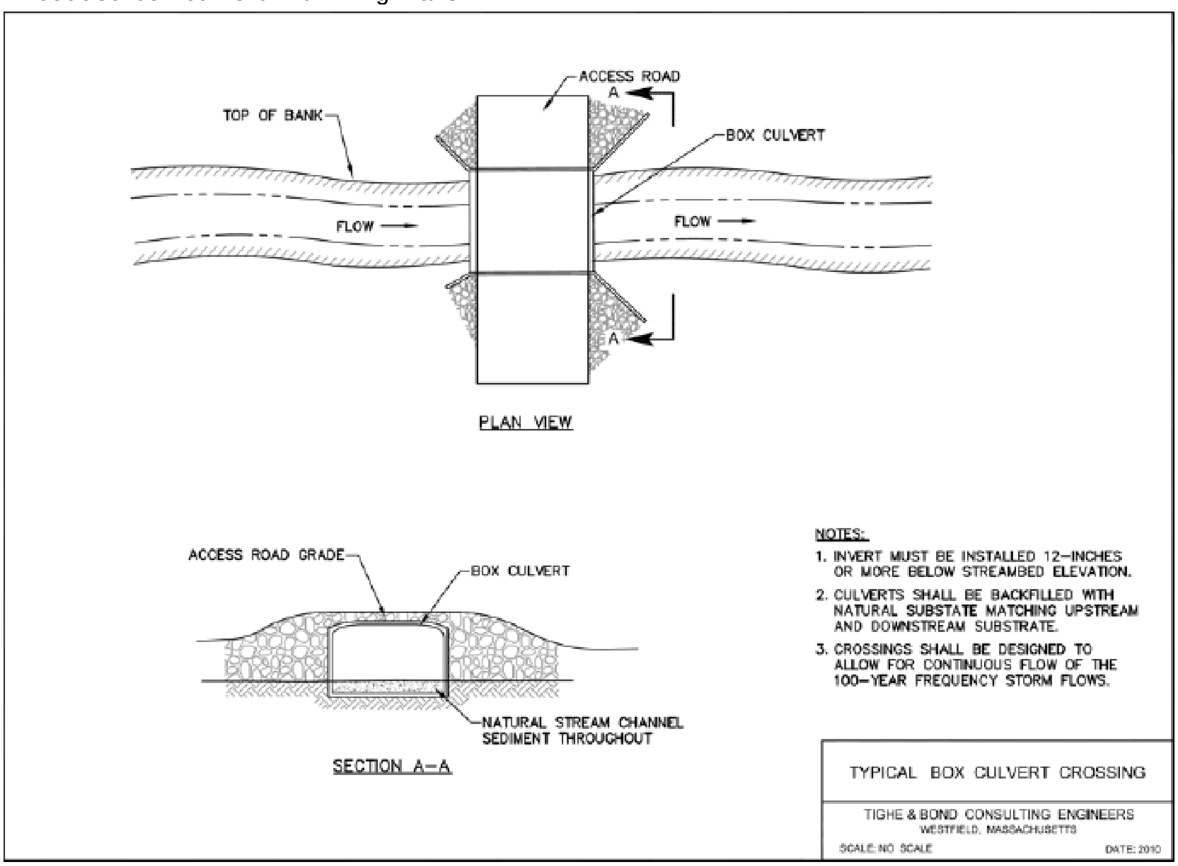
Installing a pipe culvert.



Pipe arch culvert.



Embedded box culvert with wing walls.



TAB 3D

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Poled Fords

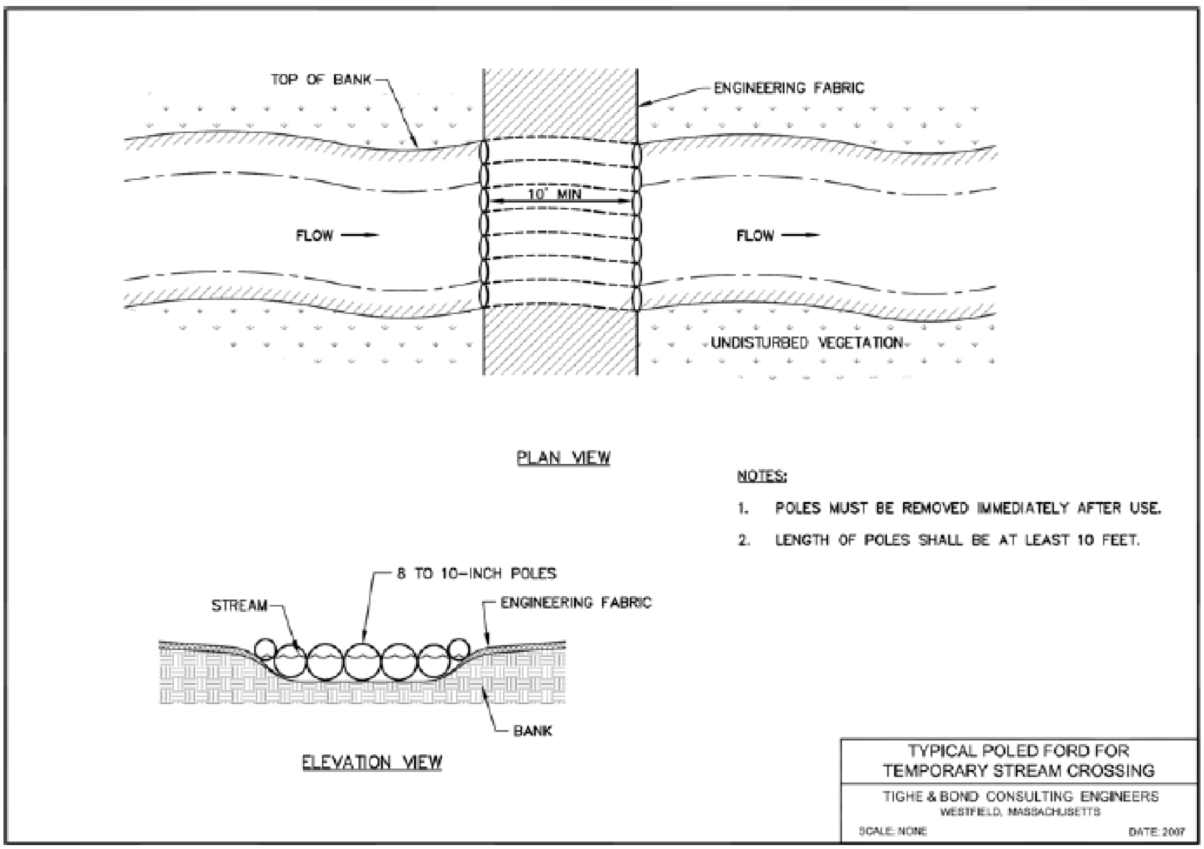
Applications: Stream Crossings

Limitations:

- Limited to streams with gently sloping adjacent land.

Overview/Use:

- Poled fords are used in remote locations where a stream crossing requires a functional BMP, but it is impractical to bring in larger materials. Sufficiently sized wood poles or saw logs of may be laid in the streambed parallel to the flow.
- Gently slope the road to and from the streambed at a maximum ratio of 1:5 (V:H). To limit disturbance to the riparian area, install engineering fabric and cover with an aggregate bed at the approach and exit.
- Use poles with a minimum length of ten feet.
- Remove poles immediately after use.



3.5 Slope Excavation

Engineering designs may be required for any upland changes that could potentially direct or channel water across the face of a terrace escarpment slope. No snow or soil piles, construction materials, or equipment should be stored in the immediate vicinity at the top of the terrace escarpment slope.

3.6 Vegetation Removal and Preservation

Care should be taken to limit disturbance to the extent practicable when removing vegetation. Grubbing is not preferred as it results in considerable erosion and should be avoided to the extent feasible. Utilize grubbing only when all other methods cannot be used to prepare stable and safe work areas. If grubbing is necessary, the area must be covered with seed and mulch to protect it prior to the end of the work day. During mowing and trimming, woody debris greater than two (2) inches in diameter should not be placed in wetlands, and no woody debris should be placed in standing water. All woody debris must be removed from wetlands if required by a permit condition. Mowing must be kept to a minimum, particularly at road crossings.

3.6.1 Right of Way (ROW) Vegetation and Eastern Box Turtle (EBT)

Eastern box turtles (EBT) are often found near small streams and ponds and inhabit old fields, deciduous forests, and logged woodlands. Adults are completely terrestrial, while the young may be semiaquatic and hibernate on land by digging down in the soil between October and April. EBTs have an extremely small home range and can usually be found in the same area year after year. EBT populations have been negatively impacted by the loss of suitable habitat. Some turtles may be killed directly by construction activities, but many more are lost when important habitat areas for shelter, feeding, hibernation, or nesting are destroyed. As remaining habitat is fragmented into smaller pieces, turtle populations can become small and isolated. Therefore, vegetation removal in ROWs should be performed in a manner that minimizes impacts to turtle populations.

Cleared and Maintained ROW—EBTs have been found to use existing ROWs for foraging and nesting. Whenever feasible, perform maintenance mowing in identified habitat during inactive periods (November 1 to April 1). If mowing during the active turtle season (April 1 to November 1) is required, mow vegetation to no lower than seven (7) inches. Use Brontosaurus or Fecon mower heads to minimize the impact to identified habitat areas. Do not used Flail-type mowers during the active season.

Uncleared ROW—When project work requires vegetation removal in an uncleared ROW, cut and mow uncleared portions of EBT habitat during the active season (April 1 to November 1). If clearing must be conducted during hibernation periods, pre-planning will involve conducting a turtle survey and the possible use of telemetry. Consult Environmental Licensing and Permitting before performing work because this activity may not be covered under the Operation and Maintenance Plan and may require a permit.

		Recommended Maintenance Activity if the Existing ROW is:	
Time Period	Turtle Status	Cleared and Maintained	Uncleared
April 1 to November 1	Active	*Perform only if required*—Mow vegetation no lower than seven (7) inches and use recommended mower heads	*Recommended*—Cut and mow uncleared areas
November 1 to April 1	Inactive	*Recommended*—Perform maintenance mowing	*Not recommended*—Requires turtle survey at minimum before removing vegetation

General Construction Recommendations –The following are general construction guidelines for protecting turtles:

- Install silt fencing around the work area prior to construction activity. Consider using syncopated silt fencing (Appendix A).
- Turtle training is required for all contractors. Apprise workers of the possible presence of turtles and provided a description of the species. Include a turtle sweep reminder on the Tail Board.
- Conduct a turtle sweep after installing silt fencing and before conducting work.
- Perform daily turtle sweeps in work areas before performing any work.
- Carefully move any turtles that are discovered to an area immediately outside of the fenced area. Position turtle in the same direction that it was walking.
- Perform work with caution during early morning and evening hours. Take special care not to harm basking or foraging individuals.
- Remove silt fencing after work is completed and soils are stable so that reptile and amphibian movement between uplands and wetlands is not restricted.
- Return temporary cross country access routes to pre-construction grade, seed if adequate root and seed stock are absent, and mulch. Do not seed pre-existing sandy soils that are within mapped rare turtle habitats unless directed by Environmental Licensing and Permitting in order to avoid altering nesting habitat

3.6.2 Preservation of Existing Vegetation

Preserve the existing vegetation (i.e., groundcovers, vines, shrubs, trees) on a site when practicable to improve soil stability and decrease the runoff volume and velocity. Identify and protect specified trees for erosion and sediment control benefits and/or aesthetic purposes. Consider saving trees that provide shading or screening benefits, particularly in residential areas. Preserve existing vegetation by reducing the width of a cleared ROW at stream crossings. See Appendix A for preserving existing vegetation BMP.

3.7 Work Pads

3.7.1 De-Energized and Energized

Applications: Work in wetlands

- Reconnaissance of each workpad area in or adjacent to wetlands should be performed to determine if the construction mat workpad areas could be located outside of wetland resource areas. Wetland disturbances should be avoided or minimized where practicable. Contact Environmental Permitting and Licensing.

Limitations:

- Requires heavy machinery for installation.
- Significant amount of time required for installation and removal.
- Pads for live line work require a considerably larger footprint.
- Several layers of matting may be needed in deep, construction areas.
- Animals may be injured or killed when attempting to cross workpads.
- May not be suitable in deep/open water wetlands.

How to Use:

- Work at structures may require placement of construction mats to provide safe and stable workpad areas for employees and contractors.
- Live line work, which is work that is done while the line is energized, requires a much larger workpad area. Efforts should be made to stay out of wetland areas to the extent practicable.
- Sizes of workpads vary based on the type of work being proposed.
- Workpad areas may extend into wetlands where structures that require maintenance either fall within or are in close proximity to wetlands. In these cases, untreated wooden construction mats shall be used to limit disturbance.
- Install silt fencing around work pads in identified amphibian and reptile priority habitat and where matting is greater than one mat thick. The exclusionary silt fencing will deter animals from moving across workpads and reduce the likelihood of being crushed by heavy equipment.
- Following construction activities all mats at each workpad and vehicle access locations must be removed.
- Remove mats by "backing" out of the site and removing mats one at a time. Regrade soils to pre-existing contours while taking care not to compact soils.
- In areas with invasive species, plant material should be removed from mats following removal from the infested area to prevent the spread of invasive species.

3.7.1.1 Best Management Practices – Work Pads

De-energized work requires small workpad areas, while live line work (i.e., work that is done while the line is energized) requires a much larger workpad areas.

De-energized construction mat workpads – Tab 4A

Energized construction mat workpads – Tab 4B

TAB 4A

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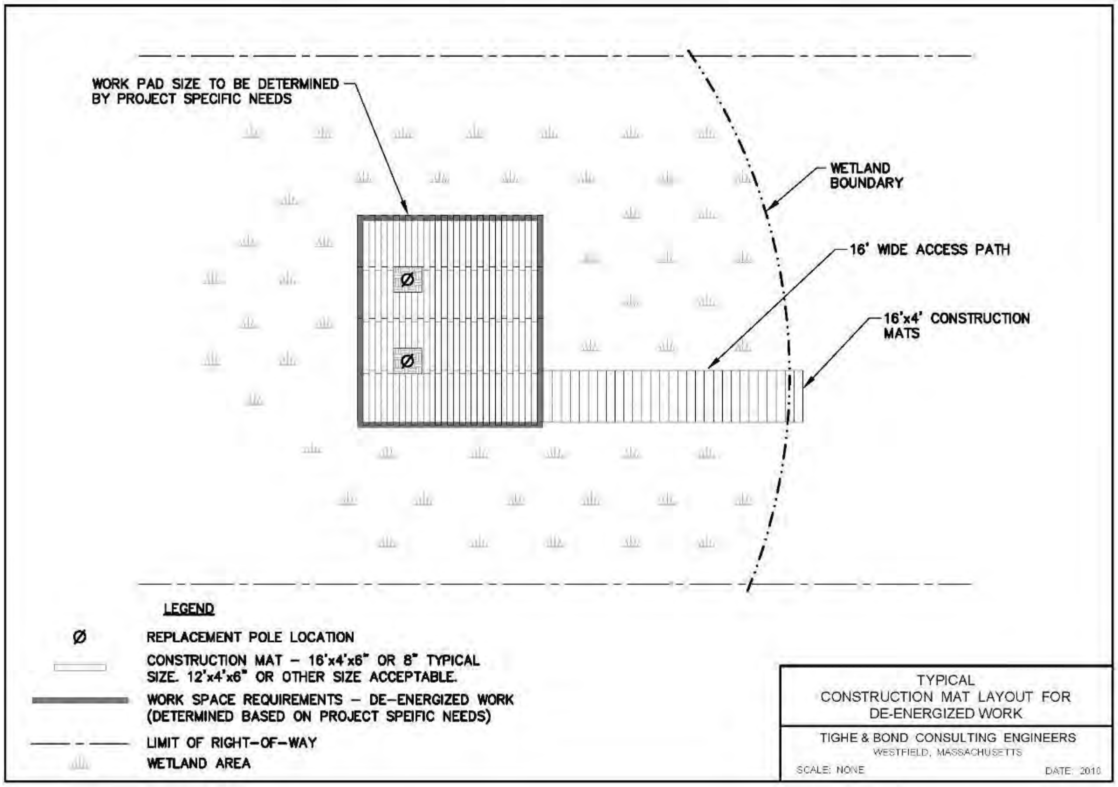

Construction mat wetland work-pad for de-energized work.

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TAB 4B

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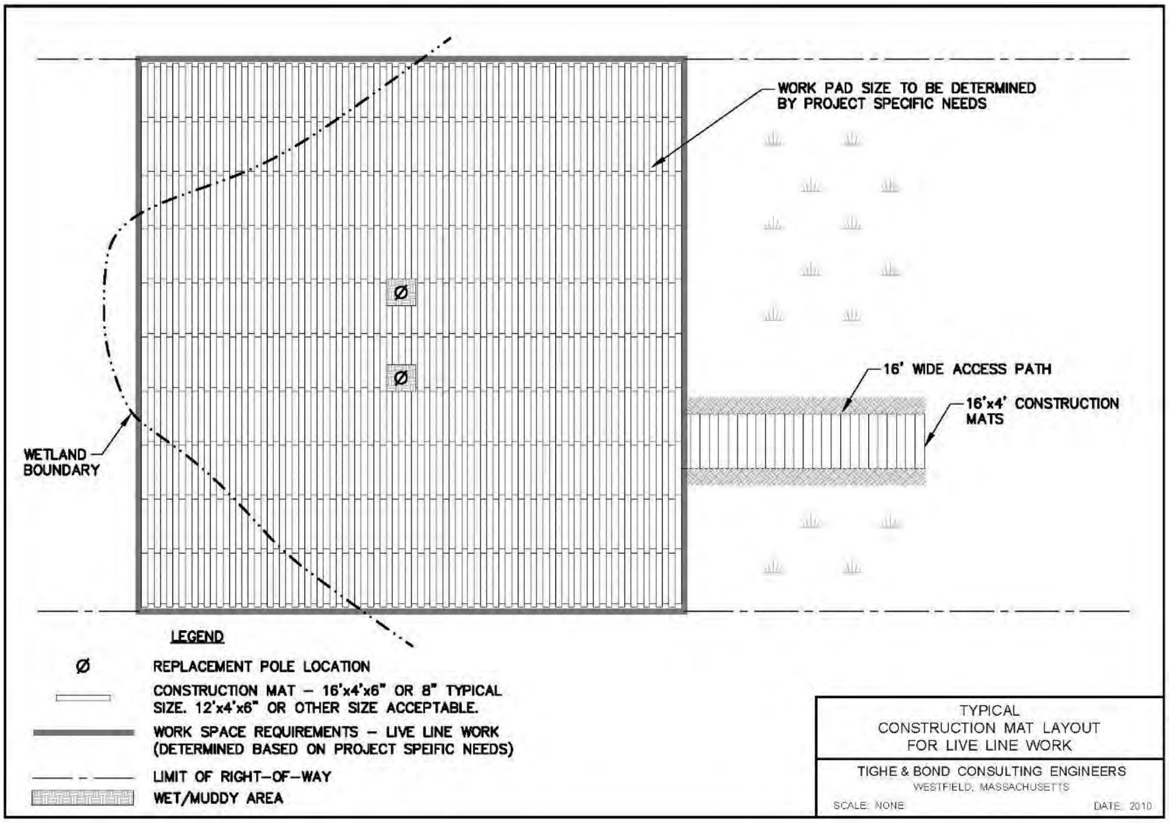

Construction mat wetland workpad for live line work.

3.8 Structure-Related Work

3.8.1 Wetland

Structure-related activities that may occur in wetlands include structure replacement/ installation (including casing installation), guy wire anchor installation, counterpoise installation, and pole butt removal. Access to these areas and completion of the activities can cause disturbance to wetland vegetation and soils. Therefore, structure-related activities in wetlands should entail use of adequately sized work-pads and proper dewatering methods. Inspection of the construction access and associated dewatering measures should occur daily during construction to ensure that controls are in working order, and repairs to damaged/deteriorating controls are made in a timely matter. Repairs may include regrading the traveled surface to eliminate ruts as well as those repairs required by each erosion and sedimentation measure used.

Structure Replacement/Installation

Structure replacement may require impacts to wetlands to install new poles and their casings. Poles that are significantly damaged must be replaced to comply with engineering and safety standards. Not replacing damaged structures could result in the eventual failure of one or more structures within or adjacent to wetlands.

Replacement structures will often be replaced within a few feet of the original structure to maintain the required distances and line sags between other existing structures. Therefore, options for relocating proposed replacement structures are limited. Pole replacement will also require placement of construction mats in wetlands to provide a safe workpad for the required structure replacement activities. Usually, there are no alternatives to conduct this work from nearby upland areas or to install the replacement structures in upland areas. Each structure replacement area should be assessed to determine the required footprint needed for construction mat workpads. Typical installation is as follows:

- At each pole location, remove wetland topsoil with an excavator and stockpile.
- If a borehole is drilled, collect and dispose of drilling spoils in an upland area.
- A galvanized steel casing is then driven into place at least 12 inches below the ground surface. The new pole is installed within the casing with a crane. The casing is then backfilled with crushed rock and compacted.
- Stockpiled wetland topsoil is placed above the casing to the ground surface. No net fill in wetlands occur, as the original poles are removed.
- Following installation of the new structures, the old structures are removed. Each pole is cut with a chainsaw and allowed to fall to the ground, which in wetland areas is protected by construction mats. Pole butts will remain in place; if removing the pole butt will cause more damage than if left in place.
- Remove the pole and all appurtenant accessories (e.g., cross-arms, insulators) and properly dispose off-site. Remove each pole butt by pulling with an excavator positioned on a construction mat. If it is apparent that pole removal will compromise the integrity of the new pole installation, or that removal will result in additional disturbance to wetland areas, cut off the old pole at least 12 inches below ground level.

Guy Wire Anchor Installation

Guy wire anchors supporting the structures may also require replacing. There are two types of anchors: 1) helical and 2) plate type. The helical anchor is preferred over the plate anchor because the installation of the helical anchor results in less disturbance to the wetland.

- Load test the existing anchor to 15,000 pounds to determine whether it will support the pole structure. In the event the existing anchor cannot be re-used, remove it and install a new anchor.
- Screw in place a special triple helix ("screw type") anchor with 1 ½-inch square rods with an anchor installation rig operated from the matting area. Add rod sections in five foot increments as needed until proper holding capacity of the anchor is achieved.
- Helical anchors are turned into the ground with only the rods protruding. Disturbance to the wetland from the helical anchor is minimal.
- Plate anchors are used in wetlands when proper holding cannot be achieved with screw anchors. To install a plate anchor, a pit is excavated to a sufficient depth and if necessary a concrete footing would be installed several feet below surface grade.
- When excavating to install plate anchors, segregate the top 12 inches of wetland topsoil from the underlying material. When the plate anchor has been set, backfill the excavation with underlying material. Then following the backfilling of underlying material return the segregated topsoil to the surface of the excavation.

Counterpoise Installation/Grounding

To install grounding equipment in wetlands, use hand digging or minimally invasive methods to dig around the structure and restore soil to previous grades. In some cases, grounding rods can be driven directly into the ground with hand tools. Where work is occurring in the vicinity of wetland areas, sedimentation and erosion controls will be used to limit disturbance to wetlands.

Underground facility repair/replacement

Underground facilities such as cables and conduits may be present beneath wetland areas. In the event underground facilities require repair, BMPs are required for both access and construction. Construction mats are used for access where warranted, and sedimentation and erosion controls are used to isolate the work area. During excavation activities, excavate wetland topsoil and store separately from subsurface soils. Dewatering is often required during excavation and repair activities.

An alternative to repairing a subsurface line by excavation would be to install a new line via trenching or horizontal directional drilling. The decision to use one of these alternatives is made on a case by case basis. Consult with Environmental Licensing and Permitting to determine if any permits will be needed.

Pole Butt Removal

When transmission poles are decommissioned or otherwise taken out of service, in most cases the entire pole shall be removed. Treated wood pole butts shall be removed completely from the ground and properly disposed at an off-site location. Locations where the removal of pole butts may cause significant disturbance to wetlands or other sensitive areas will be considered for exception to this practice on a site-by-site basis. The Transmission Line Construction and Maintenance Manager, in consultation with Environmental Licensing and Permitting, will be responsible for determining if a pole butt can be removed if located in a sensitive area.

All pole butt holes must be backfilled and compacted (every 3′) with appropriate fill material. Existing material on-site can be reused if it does not include materials that can rot (e.g., vegetation) and cause sink holes.

Disposal

Treated and non-treated wood products owned by the Transmission Group shall be stored in an area(s) designated by the Transmission Line Construction/Contract Field Services Supervisor until collected by an approved disposal vendor.

3.9 Gas Piping-Related Work

Gas piping-related activities will typically occur within roadways or along roadway shoulders. There may be some instances where wetland permitting is required when wetlands are located adjacent to or in the vicinity of roadways. However, when work is performed within the roadway/shoulder, no permitting is typically required. In all cases, BMPs should be followed to ensure environmental compliance.

Roadways and Shoulders

When working in roadways, particularly in residential areas, the following activities should be performed in addition to standard construction BMPs:

- Repave disturbed paved areas and return to original elevations on the same day that construction is performed.
- Restore all non-paved areas to preexisting or better conditions. Replace any sod or other plantings in kind or with an acceptable alternative.
- Employ dust control as necessary to minimize airborne dust.

Under certain circumstances, gas piping must be installed beneath existing culverts within roadways. Take care to ensure that any saturated material excavated from the trench be properly stored and disposed as to not cause sedimentation issues. Implement dewatering methodologies, as required.

There may be cases where a drainage ditch or swale must be crossed to gain construction access from paved roads onto ROWs along the roadway shoulder. Install construction mats, mat bridges, or temporary culverts, as necessary, to facilitate access. Culverts should be for temporary use, sized for peak flow, and removed after construction is complete. Consult with Environmental Licensing and Permitting prior to installation.

Bridges and Culverts

Attachment of gas piping to bridges or culverts is the environmentally preferable method for crossing a wetland or watercourse. Consult with the appropriate people (engineers, the Department of Transportation (DOT), etc.) to determine if attachment to a bridge or culvert is a technically feasible option at the desired crossing location. Environmental Licensing and Permitting should also evaluate the impacts to FEMA flood storage quantities and potential Coast Guard permitting requirements. Ensure that proper erosion and sedimentation controls are in place on either side of the bridge or culvert throughout construction.

Rivers and Streams

There are two primary approaches for crossing a river or stream with a gas pipeline: direct bury (open trenching) and trenchless methods (e.g., horizontal directional drilling, standard bore/pipe jacking).

Direct bury methods involve erecting a coffer dam to isolate the work area and redirecting water flow using gravity or pumping to move water from one side of the work area to the other. Direct bury methods have larger direct environmental impacts than trenchless methods. Typical coffer dam examples are included in Appendix A.

Trenchless methods use specialized equipment to install piping beneath a waterbody (or a major roadway, railroad, etc.). The most common method used for gas piping is horizontal directional drilling (HDD) which uses remote controlled, steerable drilling equipment to install pipe along a long arc alignment. The drilling process can be divided into three steps: pilot, reaming, and pull-in. The first step is to drill a pilot bore-hole. Next, a larger diameter fly cutter is used to enlarge the opening. A specialized bentonite slurry drilling fluid is injected into the bore-hole to stabilize the surrounding soil and to lubricate and cool the drill bit. For the final step, a barrel reamer is used to further enlarge the bore-hole and to pull the pipe into place.

A notable environmental concern with HDD is called "frac-out." This occurs when drilling fluid breaks through the soil surface and into the waterbody. Regulatory agencies may require a "frac-out plan" which details preventative controls and response measures should frac-out occur. A typical frac out plan is included in Appendix D.

3.10 Construction Material along the Right of Way (ROW)

Once a site is prepared by clearing and/or installing erosion and sediment controls, materials may be stored along the ROW prior to the start of construction. Such materials may include the following: piping, poles, cross-arms, cable, insulators, stone, and other engineered backfill materials. In general, the stockpiling of stone and other unconsolidated material on construction mats should be avoided. If it is determined necessary due to access and workpad constraints, the material should be placed on a geotextile fabric and be properly contained with a sedimentation barrier such as straw wattle or hay bales. No construction materials should be placed in wetlands or other sensitive resource areas.

3.11 Winter Construction

3.11.1 Snow Management

Snow should not be stockpiled or disposed in any waterbody or near water supply sources. These include wetlands, rivers/streams, the ocean, reservoirs, ponds, stormwater catch basins, wellhead protection area, in high or medium yield aquifer, or within 200 feet of a private well. In addition to water quality impacts and flooding, snow disposed in surface water can cause navigational hazards when it freezes into ice blocks. Maintain a minimum buffer of 25 feet between any snow disposal area and the high water mark of any surface water. A silt fence or equivalent barrier should be installed between the snow storage area and the high water mark of rivers, streams, ponds, or the ocean. Consult with Environmental L&P regarding any specific state and local snow management requirements.

Avoid disposing of snow on top of storm drain catch basins or in storm water drainage swales or ditches. Snow combined with sand and debris may block a storm drainage system and cause localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water and could also result in fines or a violation.

All debris in a snow storage area should be cleared from the site and properly disposed of no later than May 15th of each year. Care shall be taken not to plow road materials away when removing snow.

3.11.2 De-Icing

Where permitted, calcium chloride is the preferred de-icing agent when applied according to manufacturer's guidelines in upland areas. Sand should be used on construction mats through wetland areas. Consult with Environmental Licensing and Permitting on de-icing agents when working in a facility or substation near resource areas. Many municipalities have specific de-icing agent requirements for work within 100 feet of wetland resources and other sensitive areas.

3.11.3 Snow and Ice Management on Construction Mats

Promptly and properly remove snow from construction mats to avoid ice formation. Remove snow from construction mats before applying sand to avoid forming ice. A round street sweeping brush mounted on the front of a truck may be an effective way to remove snow from construction mats. Propane heaters may also be suitable solutions for snow removal and/or de-icing of construction mats. Sand should be collected from the construction mats and disposed of in an upland area prior to removing construction mats from wetlands. Once construction mats are removed, wetlands shall be inspected for sand buildup that may have fallen through construction mats.

3.12 Dust Control

Dust control measures are used to reduce surface and air movement of dust from exposed soil surfaces during land disturbance, demolition, and construction activities. These practices reduce the amount of dust in the air and decrease the potential for accidents, respiratory problems, and airborne sedimentation. Construction activities should be scheduled appropriately to minimize the amount of site surface exposed at one time in order to reduce the amount of areas requiring dust control. Use dust control measures on disturbed soil surfaces and exposed soil surfaces, especially during hot or dry weather periods and in areas with excessively well-drained soils. Repetitive treatments should be used as needed, or required by permits, and until the surface is permanently stabilized.

Type	Description / Use
Vegetative Cover	• Most effective and practical method. • Use in disturbed areas not subject to traffic. • Follow seeding requirements as directed by local guidelines or permit requirements.
Stone	• Cover soil surface with crushed stone/coarse gravel.
Water/Sprinkling	• Sprinkle exposed soils until wet (Water trucks may be used depending on size of the site). • Do not excessively wet the soil as this causes run-off and also wastes water.
Barriers	• Board fences, wind fences, and sediment fences control air currents and blowing soil. • Wind barriers protect soil downgradient for a distance of ten times the barrier height. • Perennial grasses and stands of existing trees also serve as wind barriers, stressing the importance of planning work phasing properly and minimizing the amount of exposed soil.
Plastic Covering	• Cover soil piles with sheets of plastic/tarp to minimize dust.
Calcium Chloride	• Loose, dry granules of calcium chloride may be applied with a mechanical spreader. • Apply at a rate that keeps the surface moist but not high enough to cause water pollution or plant damage. This method should be done under consultation with an expert in order to maintain this balance and to determine if the site is applicable.

3.13 Soil Stockpile Management

Some projects may involve excavation and stockpiling of soil. Stockpiles should be located outside sensitive areas to the extent practicable and managed to prevent erosion and sedimentation of adjacent areas. Typical measures include the installation of protective measures (e.g., siltation fence and/or hay bales) around the perimeter of the stockpile. The stockpile must be seeded if left in place for more than 30 days. No snow or soil piles, construction materials, or equipment should be stored in the immediate vicinity at the top of a terrace escarpment slope.

When polluted/contaminated soil is encountered, it must be handled in accordance with the appropriate regulatory requirements. In addition to the measures discussed above, contaminated soils should be stockpiled on and covered by polyethylene sheeting. Sheeting used to cover the stockpile should be weighted down to prevent the wind migration of contaminated dust.

For soil stockpiles in substations, contact Environmental Licensing and Permitting. If soil/water must be stored and/or disposed, comply with existing soil and groundwater management guidelines. Coordinate with the Environmental Affairs Department (EAD) to ensure appropriate procedures are followed.

3.13.1 Best Management Practices – Soil Stockpile Management

The following BMP is applicable to soil stockpile management and is described at the following tab:

Soil Stockpile Management – Tab 5A

TAB 5A

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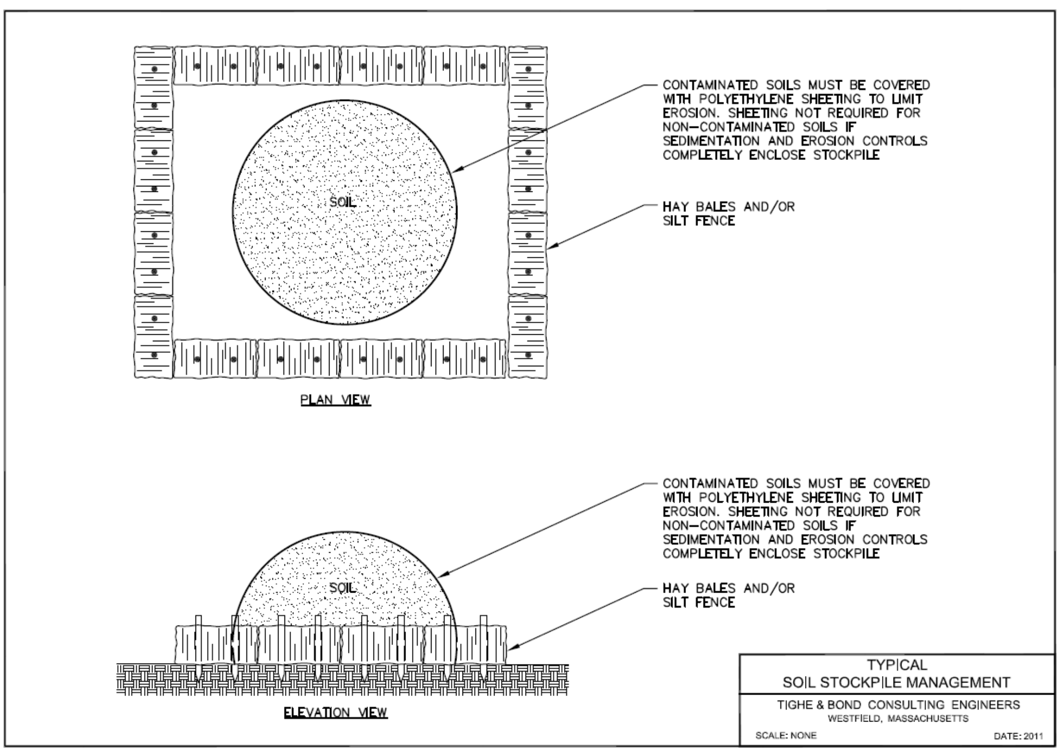
Soil stockpile management.



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Section 4
Inspection and Maintenance

A pre-construction meeting will be held to discuss how often and who will be checking that all erosion and sedimentation controls are in working order. All BMPs will be inspected at least once per week during construction and at least once per month during restoration. Construction sites will be inspected after major storm events (rainfall events greater than 0.25 inches).

4.1 During Construction

Construction sites, construction access roads, and the associated erosion and sedimentation controls should be inspected by the person(s) designated at the pre-construction meeting, as required by permit conditions. Any damage observed must be repaired in a timely matter, at least within 48 hours of observation. Repairs may include regrading and/or top dressing the surface with additional aggregate to eliminate ruts as well as those repairs required by each erosion and sedimentation measure used.

All inspections will be documented in the project folder.

4.1.1 Maintenance of E&S Controls

Spare erosion and sedimentation control materials such as straw wattles, hay/straw bales and silt fencing should be kept on site or readily available so they may be replaced if they become non-functional due to deterioration or damaged during a storm, extreme water or wind, or other unexpected events.

4.1.2 Rapid Wetland Response Restoration

In the event of unintended discharges of sediment into wetlands, Eversource will quickly control, contain and remove sediment using non- or marginally invasive methods. Responding quickly to unintended discharges minimizes the difficulty and cost of restoration if the sediment is left in place for an extended period of time. Eversource will conduct sediment removal activities at the time of discharge and will notify the appropriate regulators of the discharge and the restoration process.

4.1.3 Vehicle Storage

All storage and refueling of vehicles and other equipment must occur outside of and as far away as practical from sensitive areas such as wetlands, unless specifically agreed by the Project Team and an alternate protocol is developed and approved internally. Refueling for larger, less mobile equipment such as drill rigs or large cranes, may be allowed within wetland resources only with prior approval and if specified precautions and protocols are followed. A proper location for refueling should be identified and designated before site work begins. The recommended minimum distance from wetland areas for storage of fuel and refueling is 100 feet. Additionally, equipment should be checked regularly for evidence of leaks. Construction material storage should also be located at least 100 feet from wetlands.

4.1.4 Spills

Spill kits consist of emergency cleanup and spill containment materials that can be used in the event of a fuel or other chemical spill. Spill kits must be kept on site and accessible at all times in case of an emergency spill. Such kits should generally contain multiple absorbent socks and/or pillows and wipes and temporary disposal bags. Follow the applicable Eversource Contractor Work Rules.

4.1.5 Post Construction

Post-construction inspections of restored areas will be conducted at regular intervals throughout the growing season, as required by any applicable permits, and/or after major storm events. Sites should be inspected for success or failure of revegetation, invasive species colonization, and erosion and sedimentation. In the event additional measures are required to achieve site restoration and stabilization, corrective actions shall be identified and implemented.

All information collected during inspections, regular maintenance, and repair procedures should be documented in project folders. In addition, photographic or diagrammatic logs may be kept to help record certain events and for documentation of project progress and any noteworthy observations.

The construction work is not complete until all areas are restored.

Section 5
Rehabilitation and Restoration

5.1 Restoration

All areas disturbed by construction, repair, and maintenance activities shall be substantially restored to pre-construction conditions. Please refer to Appendix A Section I for photos and typicals for loaming, seeding, and mulching. Prompt restoration minimizes the extent and duration of soil exposure and protects disturbed areas from stormwater runoff. Stabilization should be conducted as soon as practicable. Where appropriate, it is preferable to allow wetlands to naturally revegetate.

5.1.1 Seed Mixes

Several different seed mixes are available for upland and wetland restoration. State-specific comprehensive summaries of seed mixes for both temporary and permanent seeding of disturbed sites can be found within the following documents:

- Massachusetts: Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas, page 157: http://www.mass.gov/eea/docs/dep/water/essec1.pdf

- Connecticut: 2002 Connecticut Guidelines for Soil and Erosion Sediment Control, page 5-3-8: http://www.ct.gov/deep/cwp/view.asp?A=2720&Q=325660

Upland Seed Mix: If significant grading or upland alteration has occurred, annual rye grass seed shall be placed following manufacturer's recommendations after regrading activities.

Wetland Seed Mix: If significant grading or wetland alteration has occurred, a wetland seed mix shall be placed following manufacture's recommendations after regrading activities.

5.1.2 Upland

The following restoration techniques apply to restoration projects in upland areas.

- Soil excavated during construction and not used as backfill must be evenly spread onto disturbed areas to restore grades. Topsoil shall be stripped and separated to the extent practical, for re-use. Permanent soil protection shall be provided for all areas disturbed by construction activities. All areas will be seeded either by Hydro-seeding or broadcast seeding. If areas cannot be seeded due to the time of year, then mulch (hay or straw) is still required prior to the next precipitation event.
- Topsoil removed during construction activities will be replaced, seeded, and mulched.
- All areas that are broadcast seeded shall be treated with a layer of mulch, such as hay, but preferably straw, up to one inch thick to enhance moisture retention, dissipate disturbance from precipitation, and detract birds foraging on broadcast seed.

- Rehabilitation of access routes and other areas must be performed as soon as practicable after construction is completed, including reestablishment of water bars or other BMPs to control erosion of the access road, and the removal and restoration of temporary wetland or waterway crossings.
    - Temporary breaks in construction activities may warrant seeding and mulching of disturbed areas as interim erosion control measures.
- Erosion control measures shall remain in place until soils are clearly stabilized. Once soils are stable, erosion controls – especially silt fence, which presents an obstacle to movement of small animals shall be removed and properly disposed. Stakes should be removed from hay bales and spread as mulch to remove barriers to wildlife movement.
- Straw is preferred over hay to prevent the spread of invasive plant species seed stock.
- If a grading operation at a site shall be suspended for a period of more than 29 consecutive days, the disturbed area shall be stabilized by seeding, mulching, and/or other appropriate means within the first 7 days of the suspension of grading.
- Within 7 days after a final grade is established in any grading operation the disturbed area shall be stabilized by seeding, loaming, and/or other appropriate means.

5.1.3 Wetland / Watercourses

Regrading of Ruts: Upon removal of construction mats, or other BMPs, the wetland resource area should be inspected for rutting or disturbance from eroded upland soils. Any rutting should be regraded to pre-existing contours and upland soils removed from wetland areas while taking care not to compact soils.

The following restoration techniques apply to restoration project in wetlands:

Maintenance, Repair, and Emergency Projects (When No Permit is Required)

- Remove mats by "backing" out of the site and removing mats one at a time. Regrade soils to pre-existing contours while taking care not to compact soils.
- Soils excavated from wetland areas shall be segregated and stockpiled separately (i.e., topsoil/muck apart from mineral subsoil) in a dry/upland area at least 100 feet from wetland boundaries unless other provisions have been made to facilitate restoration activities.
- Excavated wetland soils that have been stockpiled during underground utility installations within wetlands shall be replaced in the same order (i.e., mineral subsoil beneath organic topsoil/muck) to the extent practicable and restored to pre-disturbance grades.
    - Grading activities should include the elimination of ruts within the area to be restored.
- If replacement of soil associated with temporary wetland or watercourse crossings for access roads is necessary, disturbed areas must be restored to pre- disturbance grades, either seeded and mulched, or allowed to revegetate from the natural seed bank.

- Disturbed wetland areas shall generally be allowed to revegetate from the natural seed bank. Measures to discourage the establishment or spread of plant species identified as non-native, invasive species by federal or state agencies shall be utilized. Environmental Licensing and Permitting can evaluate whether to let the wetland vegetate naturally.
- Any restoration plantings or seed mixes used in restoration shall consist of species native to the project area and, if feasible, from local nursery stock.
- Any stream banks and beds damaged shall be restored through use of geotextile erosion control blankets, and/or coir logs.
- All seeded areas shall be treated with a layer of mulch (i.e., hay, but preferably straw) up to one inch thick to enhance moisture retention, dissipate disturbance from precipitation, and detract songbirds foraging on broadcast seed.

5.2 Private Property

5.2.1 Improved Areas

Access to and along the ROW over private property must be improved to the extent necessary to ensure suitable passage for construction equipment, provide erosion control, and maintain proper drainage. Upon completion of construction activities, altered yards, lawns, agricultural areas, and other improved areas must be restored to a condition equal to or better than before their use for the construction project. If access is over a property off the transmission easement, then it is the responsibility of a construction representative to determine if legal access rights are available to cross the property.

5.2.2 Overall Work Site

Construction personnel should remove all work-related trailers, buildings, rubbish, waste soil, temporary structures, and unused materials upon satisfactory completion of work. All areas should be left clean, without any litter or equipment (wire, pole butts, anchors, insulators, cross-arms, cardboard, coffee cups, water bottles, etc.) and restored to a stable condition and close to the original condition. Debris and spent equipment should be returned to the operating facility or contractor staging area for disposal or recycling as appropriate.

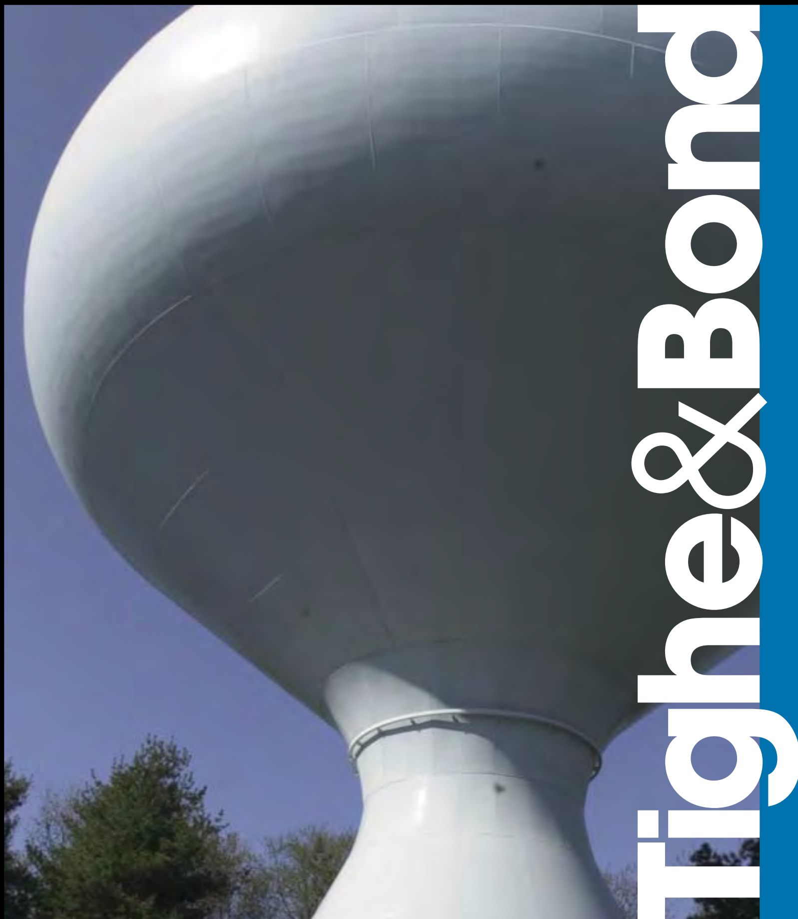
5.2.3 Material Storage/Staging and Parking Areas

Upon completion of all work, all material storage yards, staging areas, and parking areas shall be completely cleared of all waste and debris. Unless otherwise directed or unless other arrangements have been made with an off ROW or off-property owner, material storage yards and staging areas shall be returned to the condition that existed prior to the installation of the material storage yard or staging area. Regardless of arrangements made with a landowner, all areas shall be restored to their pre-construction condition or better. Also any temporary structures erected by the construction personnel, including fences, shall be removed by the construction personnel and the area restored as near as possible to its original condition, including seeding and mulching as needed.

5.3 Work in Agricultural Lands

Transmission lines often cross agricultural lands. In some instances, this may affect ongoing agricultural activities in and around the ROWs. If a construction or maintenance project occurs on agricultural lands, Eversource will work closely with landowners, licensees and stakeholders to minimize agricultural impacts. Whenever practical, Eversource will make reasonable efforts to coordinate the schedule of construction-related activities around the growing and harvest seasons to minimize the impacts on agricultural operations. When this is not practical, Eversource will pursue reasonable measures to mitigate any impacts.

Eversource recognizes that disturbed soils, or soils compacted by heavy construction equipment, may affect the soil's ability to support certain agricultural activities. Eversource will take reasonable steps to avoid or minimize soil compaction, and will restore soils that are compacted by construction equipment. Eversource will also work with affected landowners to determine the appropriate method for restoring the soils, and is open to discussing and implementing the landowners' alternative restoration suggestions. After the transmission improvement is complete, Eversource will remove all construction-related equipment and debris from the ROW.



APPENDIX A

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Section 1 Erosion and Sedimentation Controls

Section 2 Water Control

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Introduction

Adequate erosion and sedimentation control management measures shall be installed and properly maintained to reduce erosion and retain sediment on site during and after construction. These devices shall be capable of preventing erosion, collecting sediment (suspended and floating materials) and filtering fine sediment. Sediments collected by these devices shall be removed and placed in an upland location beyond buffer zones/upland review areas and any other regulatory setbacks preventing later migration into a waterway or wetland. Once work has been completed, all areas shall be stabilized with erosion control blankets and/or robust vegetation and erosion control devices shall then be removed. Erosion and sedimentation controls are provided in Section I of this Appendix. Note that stormwater management is an important part of erosion and sedimentation control. Accordingly, temporary stormwater management measures are outlined in Section II of this Appendix. Please refer to the below table for a complete list of BMP typicals and photos provided in this appendix.

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Appendix A

Section I

Section 1
Erosion and Sedimentation Controls

1.1 Preservation of Existing Vegetation

Applications: Erosion and sedimentation control, habitat and aesthetic preservation, reduce landscaping and restoration costs

Limitations:

- Access needs on ROWs.
- Required distances between underground utilities and mature trees.

Overview:

Examine the area to identify vegetation (i.e., groundcovers, vines, shrubs, trees) that may be saved. Focus on preserving vegetation on steep slopes, near drainage ways, and/or drainage swales in order to help increase soil stability and decrease runoff volume and velocity. Use construction phasing to preserve vegetation in areas where activities are not scheduled to occur or will occur at a later time.

Identify and protect specified trees for erosion and sediment control benefits and/or aesthetic purposes. Consider saving trees that provide shading or screening benefits, particularly in residential areas.

Installation:

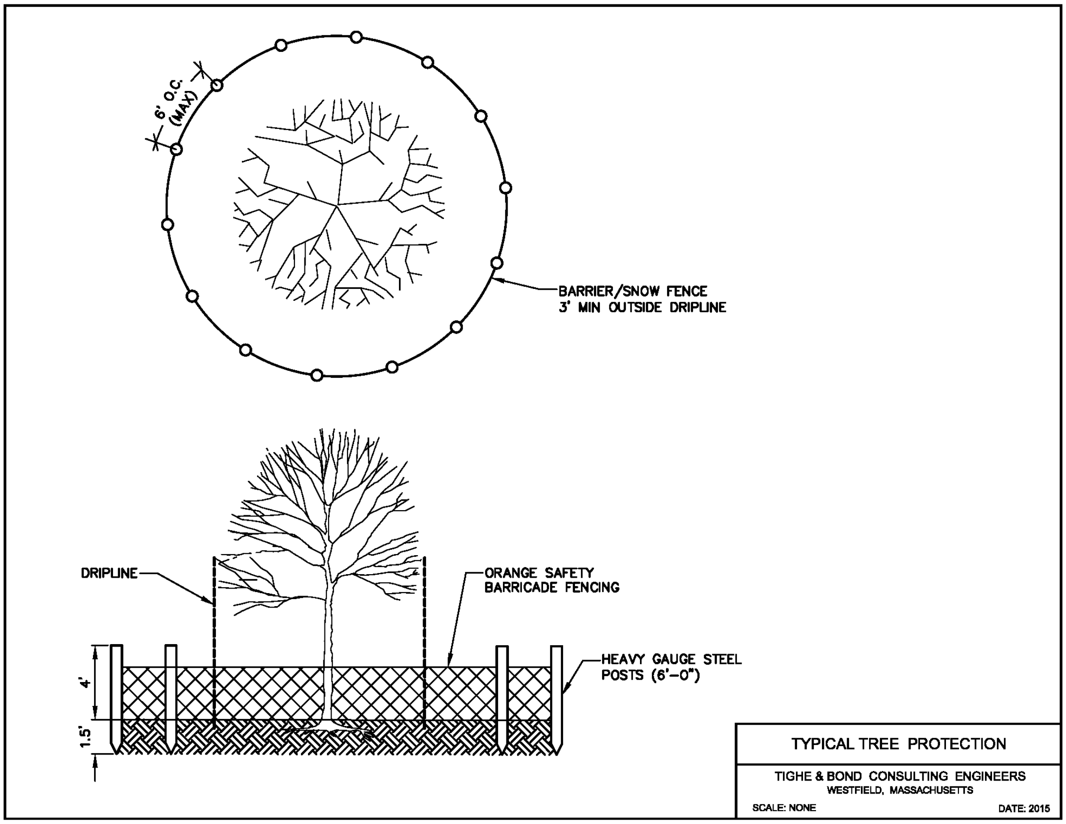
- Select healthy, relatively young trees (less than 40 years old) and vegetation that will not interfere with the installation or maintenance of utilities. Pay attention to the aesthetics of trees along roadways and preserve wherever practicable.
- Place barriers around trees least three feet from the drip line or five feet from the trunk (whichever is greater) using wooden and wire fencing made from scrap lumber or snow fencing. If fencing is not feasible, mark the selected trees with bright flagging.
- Construct the barrier (or place the flags) before heavy equipment arrives to the site and leave in place until the last piece of machinery is gone.
- Dig trenches as far from the trunks and outside of the canopy drip line as practicable. If large roots are encountered, consider trenching under them.
- The width of the ROW will vary depending on the corridor’s designated use. Federal guidelines suggest that 15 feet on either side of a buried pipeline should remain clear of mature trees.

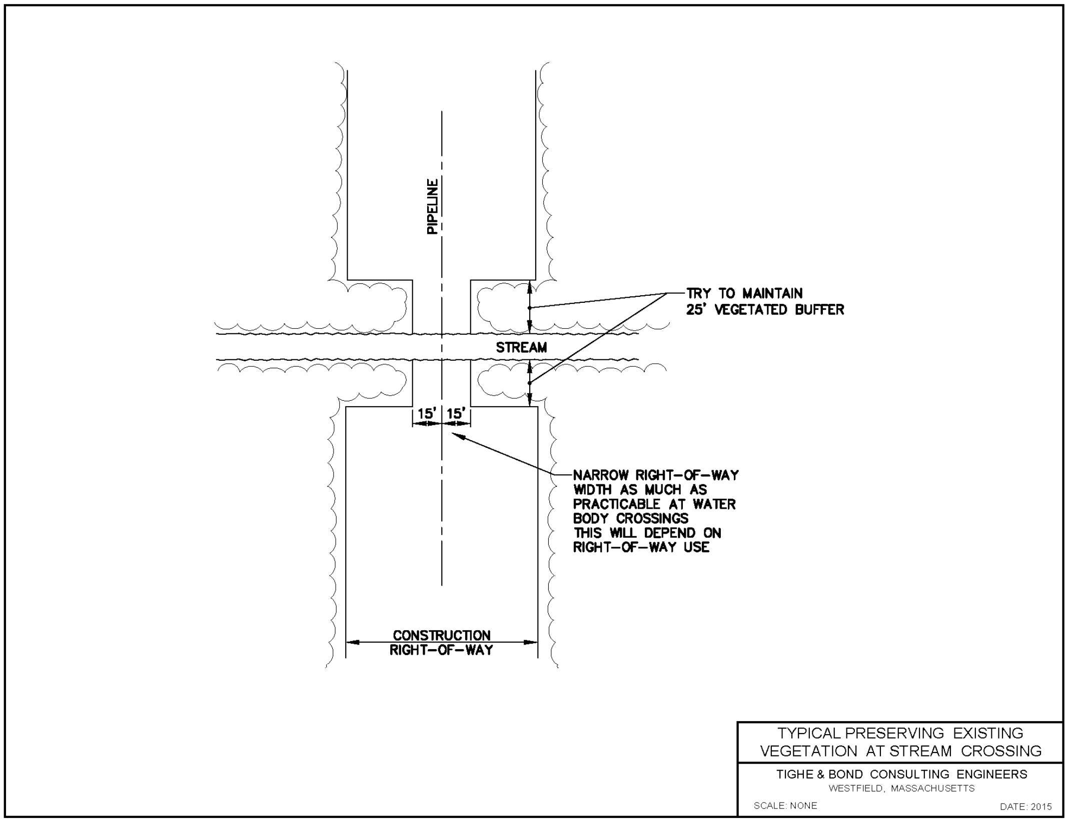
Maintenance:

- Inspect flagged and/or barricaded areas throughout construction. Replace flagging and repair/replace barriers as needed.
- Inspect exposed tree roots. Re-cover or re-seal roots that have been exposed and/or injured by construction activity.

Additional Comments:

When approaching a stream crossing, limit the amount of clearing of the existing stream bank and riparian vegetation to only the areas essential for construction and maintenance. Maintain a 25-foot wide vegetated buffer between the stream bank and the cleared ROW, except in locations where the line is directly installed.




PIPELINE
TRY TO MAINTAIN
25' VEGETATED BUFFER
STREAM
15'
15'
NARROW RIGHT-OF-WAY
WIDTH AS MUCH AS
PRACTICABLE AT WATER
BODY CROSSINGS
THIS WILL DEPEND ON
RIGHT-OF-WAY USE
CONSTRUCTION
RIGHT-OF-WAY
TYPICAL PRESERVING EXISTING
VEGETATION AT STREAM CROSSING
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2015

1.2 Topsoil Segregation for Work in Wetlands and Agricultural Areas

Applications: During excavation in wetlands and agricultural areas

Limitations:

- May be site-specific limitations; otherwise none.

Overview:

The top 12 inches of soil are the most important for providing nutrients and a suitable growth medium to the existing vegetative cover in an area, as well as containing the root stock and seed bank of the plant community. Topsoil segregation is recommended for the first 12 inches of soil in all wetlands and agricultural land, but is also a good practice in any area, including uplands in order to provide a suitable growth medium and more rapid revegetation and restoration of the original plant species.

When digging a trench for installation or maintenance of a pipeline or conduit, or excavating for the installation or replacement of the base of a utility pole, it is good practice to segregate the first 12 inches of topsoil and stockpile it separately from the subsoil until the layers can replaced into the excavation in the proper order. In some cases, it may be necessary to strip topsoil off the areas where the subsoil will be stockpiled as well. Additional topsoil can also be brought into an upland or residential area if necessary where the existing soil is too shallow to provide adequate rooting depth, moisture and nutrients, or too much topsoil was lost during construction.

Installation:

- Set up proper erosion control (i.e., hay bales, silt fence) around the work area before beginning any excavation near wetland areas.
- Identify the stockpile locations near the trench or excavation.
- Locate stockpiles from active work areas to the extent practicable.
- Remove the top 12 inches of topsoil from the trench or excavation. If less than 12 inches are available, remove the entire layer of soil.
- Place the topsoil in a separate stockpile than the layers of excavated subsoil.
- Place additional lines of erosion control around the stockpiles to control sedimentation, if necessary.
- Side slopes of soil stockpiles should not exceed 2:1.
- Stabilize stockpiles with temporary seeding or plastic covering if they will remain exposed for more than 21 days.
- Backfill the trench with the proper soil layers, subsoil followed by topsoil, when work activities are completed. Backfilling should take place immediately after activities are completed, and grading and site stabilization should take place within 10 days following backfilling.

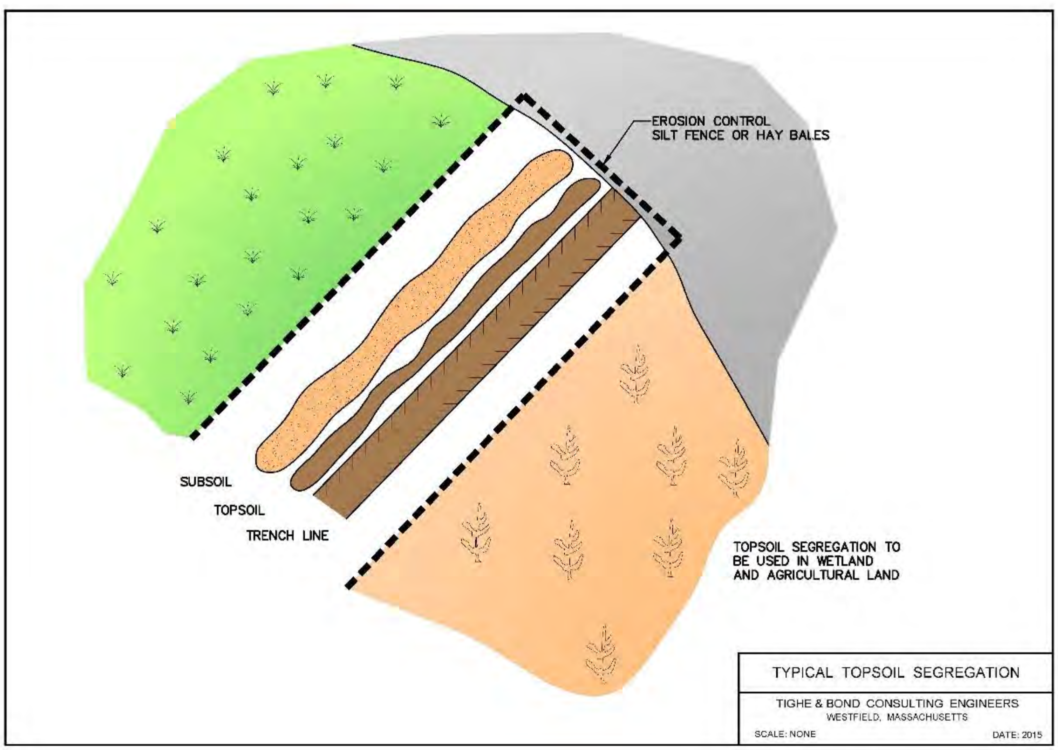
Maintenance:

- Inspect and maintain erosion control on a regular basis and observe the stockpiles for any signs of sedimentation or mixing.
- In residential and agricultural areas, make a reasonable effort to remove all rocks larger than 4 inches in diameter from the topsoil that have been turned up during construction.

Additional Comments:

If the topsoil and subsoil stockpiles are mixing:

- The piles are located too close together. Try placing the separate stockpiles on opposite sides of the trench or work area.
- The topsoil stockpile could also be individually enclosed in hay bales or silt fence. This will help create a barrier, keeping it separate from the subsoil.
- Avoid working with large amounts of trench or excavation open when heavy rains are predicted.
- If polluted/contaminated soil is encountered, handle in accordance with appropriate regulatory requirements. Stockpile contaminated soil on and cover with polyethylene sheeting. Weigh down sheeting covering contaminated soil to prevent the wind migration of contaminated dust.



1.3 Straw (or Hay) Bales

Applications: Erosion and sedimentation control, mulch

Limitations:

- Hay bales degrade quickly.
- Hay bale height can provide an obstacle to movement of smaller wildlife.
- Should not be used as a temporary check dam/ stormwater control within waterways.
- Difficult to install during frozen conditions.
- Generally only effective for 3-6 months (hay) or 6-12 months (straw) before replacement.

Overview:

Hay/straw bales should be placed end-to-end to form a temporary sedimentation control barrier. This barrier should run perpendicular to the slope and direction of runoff, and should be installed downgradient of the disturbed site (i.e., construction area). Hay/straw bales are intended to slow flow velocity and trap sediments to prevent siltation in sensitive areas, specifically downgradient areas with open and/or flowing water. Barriers should be removed once the project is complete and soils are stabilized with erosion control blankets and/or well-established vegetation.

Installation:

- Install hay/straw bales end-to-end lengthwise along the toe of a slope or along a slope contour being sure the bales are butted tightly against each other without gaps between them. The outer ends of the barrier should be turned slightly upslope.
- Entrench to a minimum depth of 4 inches and backfill around the base of the bale. If additional protection is needed, backfill both upslope and downslope to create better ground contact and reduce sediment passage through or beneath hay/straw bales.
- Stake each hay/straw bale into the ground by two stakes each approximately 3 feet long
- If a silt fence is being used with the hay/straw bale barrier, position the silt fence downgradient of the hay/straw bales (hay bales filter first).
- Since hay/straw bales degrade quickly, check barriers often and replace as needed. Routinely remove and dispose of sediment buildup in a stable upland area.
- The hay/straw bale barrier should be as far away from downgradient sensitive areas, and as close to the work areas as construction limitations allow, in order to minimize the total work area and disturb as little area as possible.
- Once the project is complete and soils are stabilized, hay/straw bales should generally be compacted and allowed to decay in place, as their height can provide an obstacle to movement of smaller wildlife. Spreading hay bales around a site as mulch could introduce weed seeds. Using hay/straw as mulch is not generally

problematic if the site is already colonized by invasive species. Plastic bailing twine should be removed from hay/straw bales. Wooden stakes should also be removed.

Maintenance:

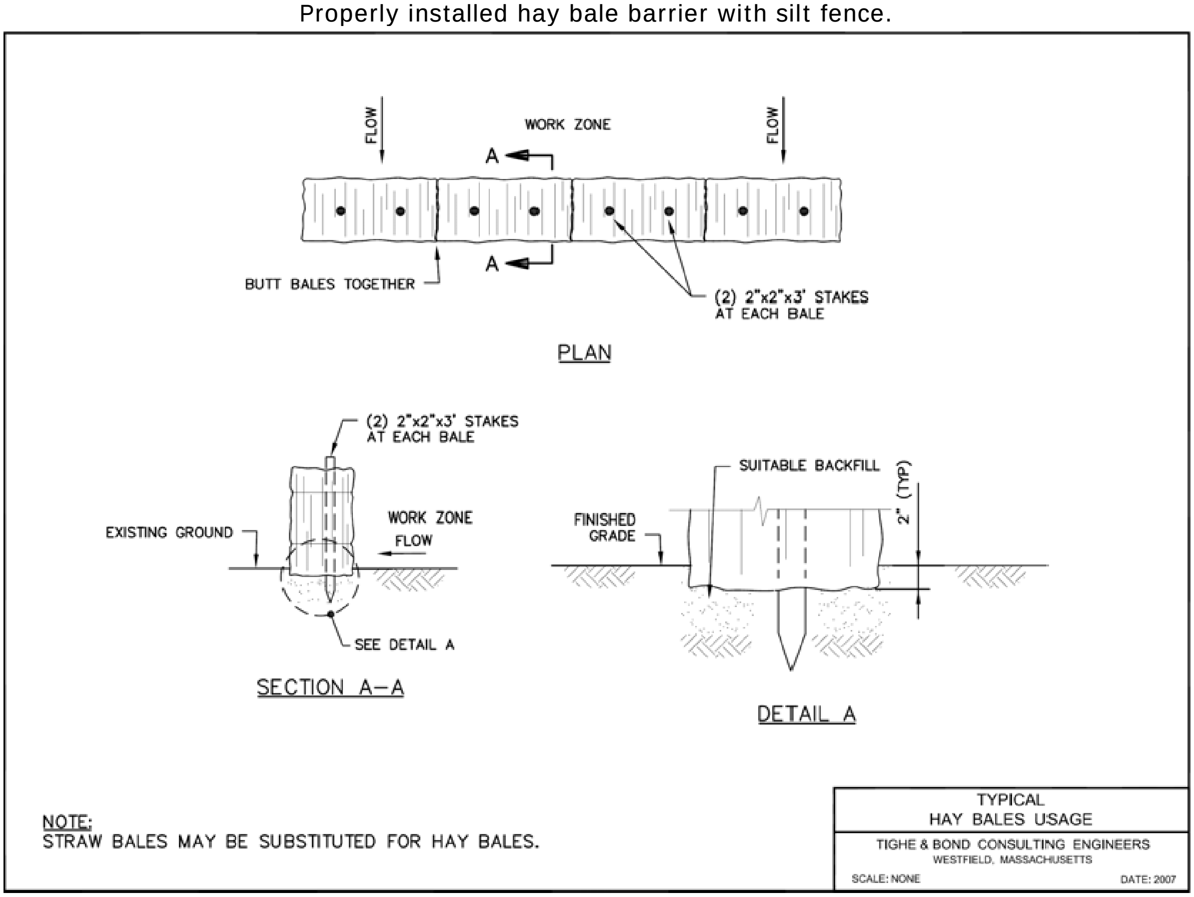
- Inspect before a forecasted storm event and daily during a prolonged rain event.
- Remove accumulated sediment and properly disposed outside sensitive areas when it has reached a thickness of ½ to ⅔ the height of the bale.
- Replace rotted or sediment-covered bales when necessary.

Additional Comments:

Straw bales are favored over hay bales for use as erosion control barriers. Since straw bales are composed of the dried stalks left over after a grain is harvested, they do not contain the plant's seeds and therefore will not spread growth of such species, some of which may be exotic, invasive or otherwise undesirable. Hay bales are generally less expensive, but consist of the seed heads and the upper, thinner portion of the stems which generally decay faster than straw.

Properly installed hay bale barrier with silt fence.

Properly installed hay bale barrier with silt fence.



1.4 Silt Fence

Applications: Sedimentation control, work limits, temporary animal barrier, slows flow on steep slopes

Limitations:

- Frozen or rocky ground (for installing stakes).
- May prevent critical movements of sensitive wildlife species.
- Disposal.

Overview:

Silt fence is constructed of a permeable geotextile fabric secured by wooden stakes driven into the ground. It is installed as a temporary barrier to prevent sediments from flowing into an unprotected and/or sensitive area from a disturbed site. A silt fence should be installed downgradient of the work area. Once the project is complete and soils are stabilized, silt fence materials (i.e., geotextile fabric and wooden stakes) must be removed and properly disposed off-site (see environmental scientist to determine if area is stabilized).

Installation:

- Install silt fence along the toe of a slope or along a fairly level contour with the outermost ends directed upslope. The fabric should be laid into a 6-inch wide by 6-inch deep trench dug on the upslope side of the fence and tamped down with fill material to ensure a sturdy base and so sediments will not flow beneath the fabric. Use of a Ditch Witch® or similar equipment is suggested for this task.
- Drive the silt fence stakes into the ground until secure (≥6 inches below grade).
- If a hay bale or straw bale barrier is being used with the silt fence, position the silt fence downgradient of the bales.
- The silt fence should be as far away from downgradient sensitive areas, and as close to the work areas as construction limitations allow, in order to disturb as little area as possible.

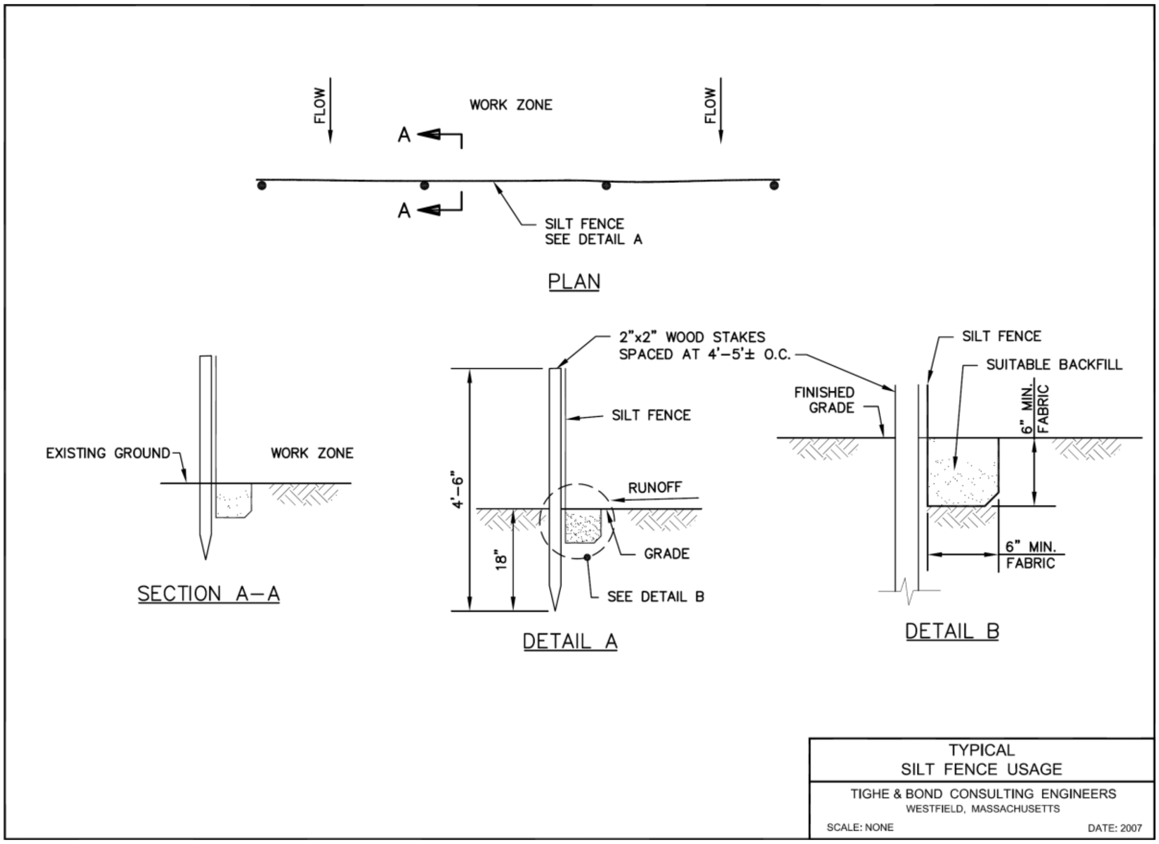
Maintenance:

- Inspect frequently and replace or repair as needed, especially during long-term projects.
- Routinely remove and properly dispose of sediment buildup in a stable upland area, outside of sensitive areas. Remove sediment when it has accumulated to a thickness of ½ the height of the silt fence.

Additional Comments:

A silt fence must be installed in an excavated trench and located where shallow pools can form so sediment can settle. The fence must be placed along the contour. If placed otherwise, water may concentrate to a low point and is likely to flow beneath the fence.

Properly installed and functioning silt fence. Direction of flow indicated by blue arrow.


FLOW
WORK ZONE
FLOW
A
A
SILT FENCE
SEE DETAIL A
PLAN
EXISTING GROUND
WORK ZONE
SECTION A–A
2"x2" WOOD STAKES
SPACED AT 4'–5'± O.C.
SILT FENCE
4'–6"
RUNOFF
18"
GRADE
SEE DETAIL B
DETAIL A
SILT FENCE
SUITABLE BACKFILL
FINISHED
GRADE
6" MIN.
FABRIC
6" MIN.
FABRIC
DETAIL B
TYPICAL
SILT FENCE USAGE
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2007

1.5 Syncopated Silt Fence

Applications: Sedimentation control, work limits, slow flows on steep slopes, and permit wildlife movement.

Limitations:

- Frozen or rocky ground (for installing stakes).
- Complex installation compared to standard silt fence.
- Disposal.

Overview:

Syncopated silt fence refers to silt fence that is installed in a specific layout that permits wildlife movement. Many construction projects continue over at least one wildlife activity season, and silt fence may impede the movement of animals. Syncopated silt fencing is to be installed in areas where silt fencing may impede wildlife access to a resource (i.e., vernal pool, wooded area). These areas will be identified when developing wetland protection measures.

Installation:

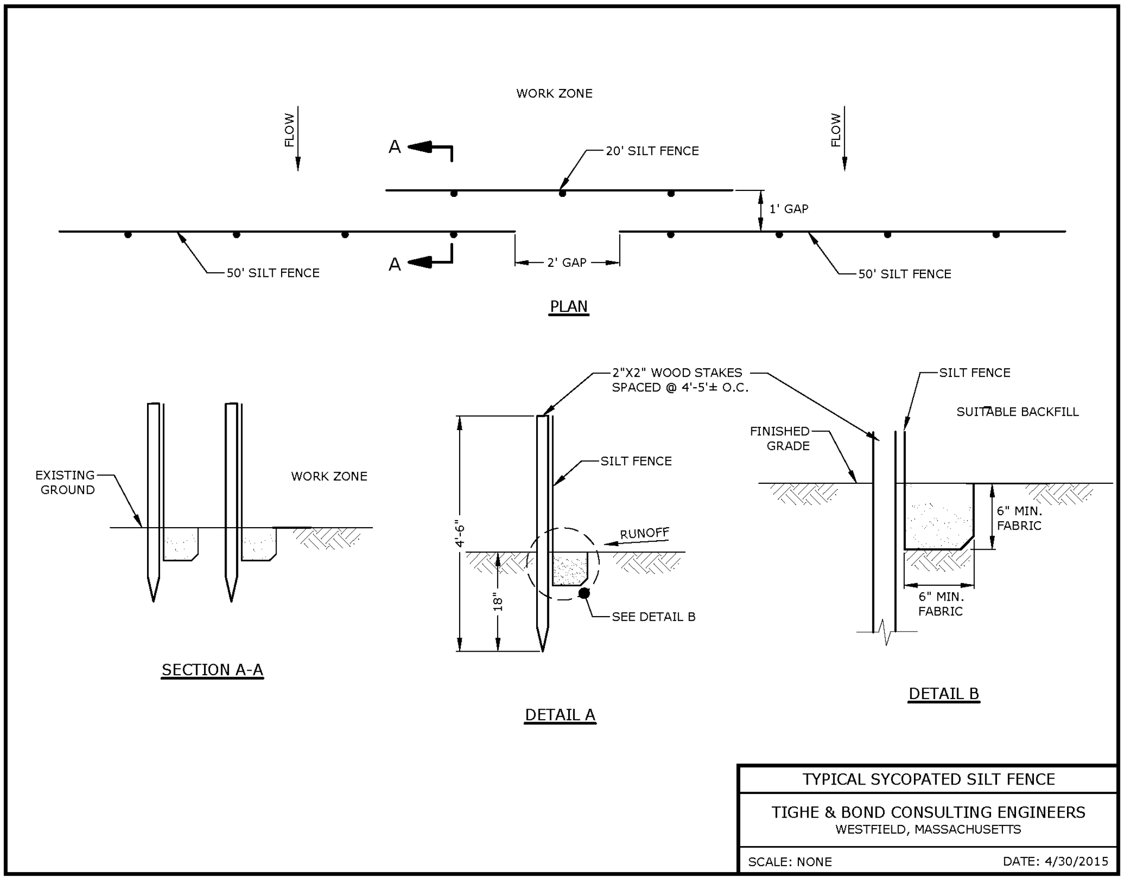
- The syncopated silt fence layout is shown on the typical below. For every 50 feet of siltation fence installed, allow for a gap of two feet before installing the next section. The gap allows wildlife movement One foot behind the main silt fence line, install a second row of silt fence approximately 20 feet in length and centered at the gap.
- Install silt fence along the toe of a slope or along a fairly level contour with the outermost ends directed upslope. The fabric should be laid into a 6-inch wide by 6-inch deep trench dug on the upslope side of the fence and tamped down with fill material to ensure a sturdy base and so sediments will not flow beneath the fabric. Use of a Ditch Witch® or similar equipment is suggested for this task.
- Drive the silt fence stakes into the ground until secure (≥6 inches below grade).
- If a hay bale or straw bale barrier is being used with the silt fence, position the silt fence downgradient of the bales.
- The silt fence should be as far away from downgradient sensitive areas, and as close to the work areas as construction limitations allow, in order to disturb as little area as possible.

Maintenance:

- Inspect frequently and replace or repair as needed, especially during long-term projects.
- Routinely remove and properly dispose of sediment buildup in a stable upland area, outside of sensitive areas. Remove sediment when it has accumulated to a thickness of ½ the height of the silt fence.

Additional Comments:

A silt fence must be installed in an excavated trench and located where shallow pools can form so sediment can settle. The fence must be placed along the contour. If placed otherwise, water may concentrate to a low point and is likely to flow beneath the fence.



1.6 Erosion Control Blankets

Applications: Slope stabilization, erosion and sedimentation control

Limitations:

- Can be used on steep (i.e. greater than 45°) slopes but not on rocky soils.
- Mulches may be more cost effective on flatter areas.

Overview:

Erosion control blankets are generally composed of biodegradable or synthetic materials and are used as a temporary or permanent aid in the stabilization of disturbed soil on slopes. These blankets are used to prevent erosion, stabilize soils, and protect seeds from foragers while vegetation is recolonized.

Installation:

- Always follow manufacturer's instructions for properly installing erosion control blankets. Different composition blankets are recommended for site-specific conditions (slope grades, contributing watershed areas) and use requirements (biodegradable, photodegradable, non-biodegradable).
- Prior to installation, clear the slope of any rocks, branches, or other debris.
- Rolled out blankets in a downward direction starting at the highest point of installation. Secure blankets above the crest of the slope using a berm tamped down along the top of the disturbed area.
- Tack down blankets with stakes or staples every 11 to 12 inches (or closer) horizontally and every 3 feet (or closer) vertically. Biodegradable staples are preferred.
- Overlap each blanket section horizontally with the next section by approximately 2 or 3 inches. Vertical overlaps should be approximately 6 inches, with the upslope section overlaying that of the down-slope section.

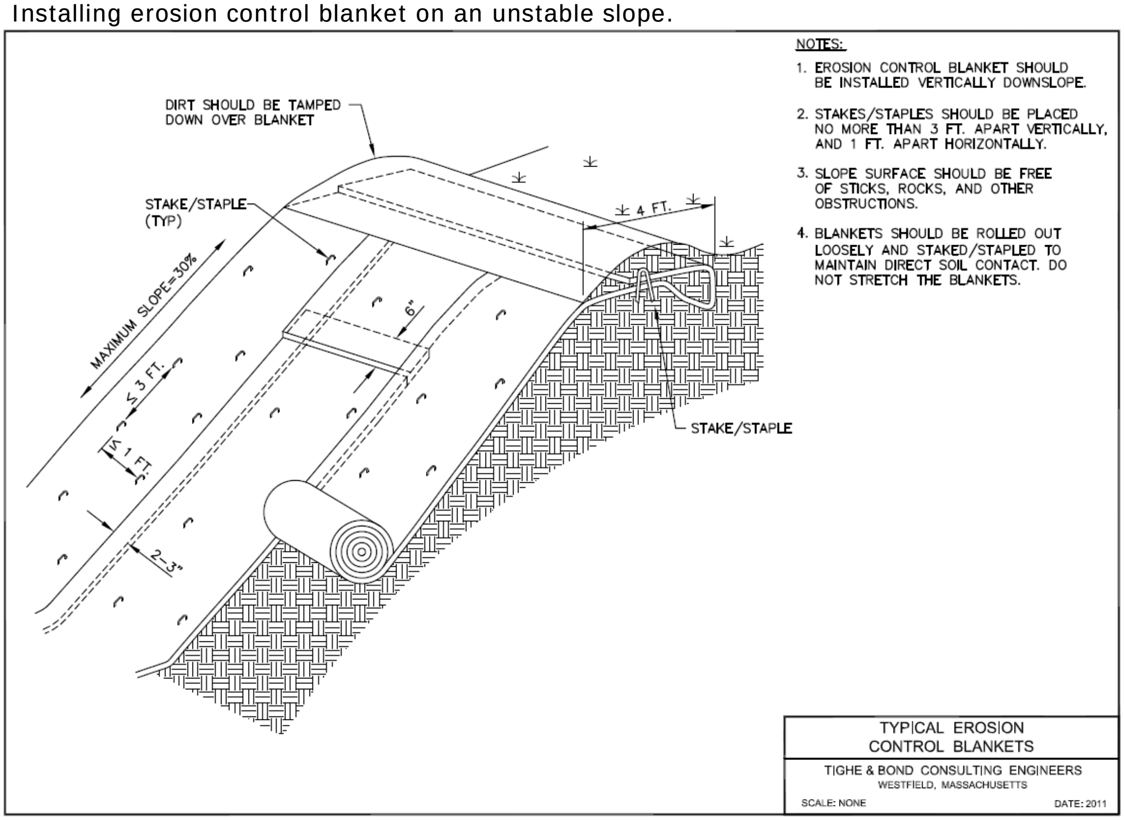
Maintenance:

- Inspect for movement of topsoil or erosion weekly and after major precipitation events. Inspect until vegetation is firmly established.
- Repair surface, reseed, replace topsoil, and install new netting if washout, breakage, or erosion occurs.

Additional Comments:

Additional materials used for erosion control with a continuous sheet or material include Jute Mats (sheets of woven jute fiber) and Turf Reinforcement Matting (geotextile matrix most effective for channels).

Installing erosion control blanket on an unstable slope.



1.7 Straw/Compost Wattles

Applications: Erosion and sedimentation control, work limits

Limitations:

- Not recommended for steep slopes.

Overview:

Straw wattles are used as an erosion control device to slow runoff velocities, entrain suspended sediments, and promote vegetation growth until an area is stabilized. They are not generally intended for steep slopes, but rather, to stabilize low to moderate grades where there is a broad area of disturbance. Straw wattles may also be used along small stream banks to protect areas before vegetation has stabilized the soils. The wattles are constructed from a biodegradable netting sock stuffed with straw and may be left to biodegrade in place once a project is complete.

Wattles should be placed lengthwise, perpendicular to the direction of runoff. The wattles are typically spaced about 10 to 40 feet apart, depending on the slope angle. Additionally, the soil texture should be considered – for soft, loamy soils, wattles should be placed closer together; for coarse, rocky soils, they may be placed further apart.

Installation:

- Install prior to disturbing soil in the upgradient drainage area.
- Install so that the ends of each row of wattles on a slope are slightly turned downhill to prevent ponding behind them.
- Where straw wattles are installed end-to-end, butt the wattles tightly together so as not to allow water/sediments to flow between them.
- Place straw wattles in a shallow trench to assure stabilization and soil should be packed against the wattle on the uphill side.
- Securely stake straw wattles to the ground by driving a stake directly through the wattle approximately every four feet. A portion of each stake should remain approximately 2 to 3 inches above the wattle.
- Use *without* silt fence reinforcement: at the base of shallow slopes, on frozen ground, bedrock, and rooted, forested areas.
- Use *with* silt fence reinforcement: at low points of concentrated runoff, below culvert outlets, at the base of slopes more than 50 feet long, and in places where standalone mulch wattles have failed.

Maintenance:

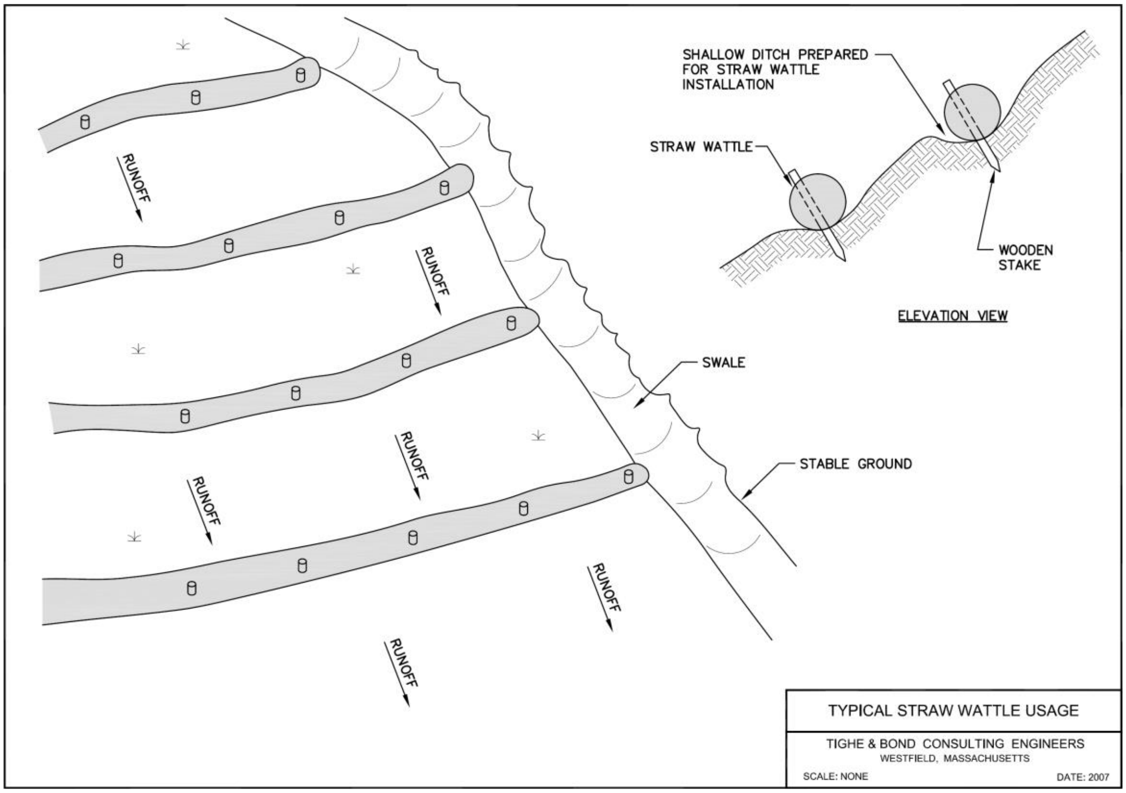
- Routinely inspect wattles and after rain events. Repair as needed with additional wattles and/or stakes.
- Remove sediment deposits when they reach half the height of the wattle. Repair or reshapes wattles when they have eroded or have become sediment clogged or ineffective.

- If flow is evident around the edges, extend the barriers or evaluate replacing them with temporary check dams.

- Reinforce the berm with an additional sediment control measure, such as silt fence or a temporary rock check dam, if there is erosion or undercutting at the base or sides of the berm or if large volumes of water are being impounded behind the berm.

Additional Comments:

Woody vegetation and tall grasses may need to be removed before installing the berm to prevent voids that allow sediment under the berm. Wattles can also be planted with woody vegetation and seeded with legumes for additional stability.



TYPICAL STRAW WATTLE USAGE	
TIGHE & BOND CONSULTING ENGINEERS WESTFIELD, MASSACHUSETTS	
SCALE: NONE	DATE: 2007

1.8 Wood Chip Bags

Applications: Erosion and sedimentation control, mulch

Limitations:

- Frozen or rocky ground (for installing stakes).
- Can pose a barrier to small animal movements.
- Requires close attention for maintenance and repair.

Overview:

Wood chip bags are perimeter barriers that intercept, filter, and reduce the velocity of stormwater run-off. They may be used separately or in conjunction with hay/straw bales and are installed and maintained in a similar manner. Wood chip bags should be staked in a line around perimeters of disturbed areas, especially those adjacent to wetlands, waterways, roadways or at the base of slopes.

Installation:

- Install wood chip bags end-to-end lengthwise in a single row along the toe of a slope or along a slope contour. Ensure that the bags are butted tightly against each other without gaps between them.
- Entrench to a minimum depth of 4 inches and backfill around the base of the bag.
- Stake each hay/straw bale into the ground using two stakes each that are approximately 3 feet long.

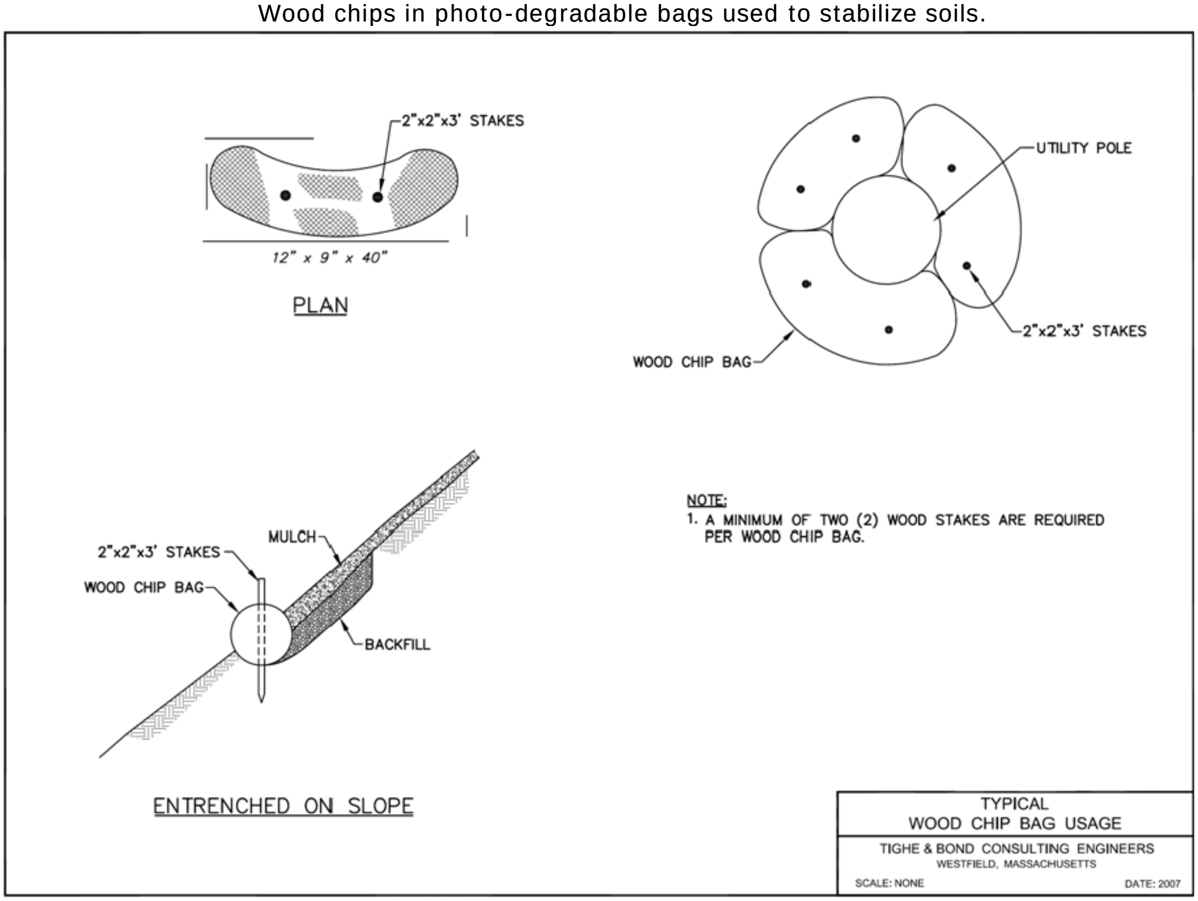
Maintenance:

- Inspect before a forecasted storm event and daily during a prolonged rain event.
- Remove accumulated sediment and properly disposed outside sensitive areas when it has reached a thickness of ½ to ⅔ the height of the bag.
- Replace rotted or sediment-covered bag when necessary.

Additional Comments:

Wood chip bags can stabilize soils in a number of applications. They may be left in place as they eventually photo-degrade, as long as they do not pose a barrier to small animal movements.

Wood chips in photo-degradable bags used to stabilize soils.



1.9 Catch Basin Protection

Applications: Erosion and sedimentation control

Limitations:

- For small quantity and low velocity stormwater flows.
- Hay/straw bales hard to stake into paved areas.
- Ineffective for very silty water.
- May require authorization from local government for discharge to municipal system.
- Fabric drop inlet should be used where stormwater runoff velocities are low and where the inlet drains a small, nearly level area.
- Undercutting and erosion under filter fabric if fabric is not buried at bottom.

1.9.1 Hay/Straw Bales, Filter Fabric, and Filter Baskets

Overview:

Hay bales, filter fabric, and filter baskets are all temporary devices placed around and within existing catch basin inlets to protect the stormwater management system from high sediment loads and high velocities during construction. Use in areas where stormwater runoff is relatively small and velocities are low and where shallow sheets of run-off are expected.

Hay/Straw Bales Installation: Hay/straw bales are recommended for areas which have the storage space to allow temporary ponding since they are one of the least permeable protection methods.

- Installation is similar to perimeter hay/straw bale barriers.
- Use bales that are wire bound or string tied. Place bales so that the bindings are on the sides of the bales rather than against the ground.
- Install hay/straw bales in a box configuration around the drop inlet with the ends of the bales placed tightly against each other.
- If the area is unpaved, anchor bales using two stakes driven through the bale and into the ground.
- Hay bales can be placed around the perimeter of the inlet in order to extend the life of the filter fabric and/or basket by removing much of the sediment before-hand.

Filter Fabric Installation: Filter fabric is used to protect catch basins from excessive sediment.

- Cut fabric from a single roll.
- Place fabric beneath catch basin grate.
- Avoid setting top of fabric too high, which will lead to flow bypassing the inlet.

Filter Baskets/Bags Installation: Install filter baskets/bags within catch basins in combination with hay bales, fabric, stone or sod drop inlets. They may be used alone where drainage area is small with shallow flows.

- Install per manufacturer's instructions.
- Filter baskets typically consist of a porous fabric bag which is fitted under the catch basin grate.
- Sediments are filtered out of the stormwater and accumulate in the basket or bag.

Maintenance:

- Inspect weekly and after each major rain event.
- Remove accumulated sediment on a regular basis.
- Replace or make repairs as needed.
- Remove after area is permanently stabilized.

Additional Comments:

Discharge of clean water into municipal system catch basins may be an option for certain sites. However, this activity must be coordinated with the municipality and shall not occur without their written consent.

1.9.2 Sod or Stone Mound Drop Inlets

Overview:

Sod or stone mound drop inlets are temporary devices placed around and within existing catch basin inlets to protect the stormwater management system from high sediment loads and high velocities. They are used in areas where stormwater run-off is relatively heavy and overflow capacity is necessary. Sod should only be used in well vegetated areas and when the general area around the inlet is planned for vegetation and is well suited for lawns. Stone mounds are well suited for the heaviest flows.

Installation:

- For Sod: Place a mound of permanently vegetated sod around the perimeter of the inlet to a minimum height of 6 inches.
- For Stone: Stone can be used alone or in combination with stacked concrete blocks. Gravel alone will slow drainage time and increase settlement.
- Place wire mesh with ½" openings over the inlet with 1 foot extending on each side. Overlay with filter fabric.
- Surround inlet with mound of gravel, 1" diameter or smaller, to a minimum height of 6", placed over the mesh.
- If blocks are used, stack them around the inlet, between 12 and 24" high, place mesh over the openings and pile the gravel against the outside face of the blocks.

Maintenance:

- Inspect weekly and after each major rain event.
- Remove accumulated sediment when it reaches ½ of the height of the filter mound. Stone especially must be regularly maintained.

- Repair erosion as necessary.
- If the storm flow bypasses inlet and causes erosion, the top of the structure is too high.
- If the trap is not efficient and/or there is sediment overload, the drainage area is too large to handle load. Consider constructing a temporary sediment trap.
- If scour holes develop (if blocks are being used), blocks are not placed snugly against the inlet grate.

Filter Baskets/Silt Bags

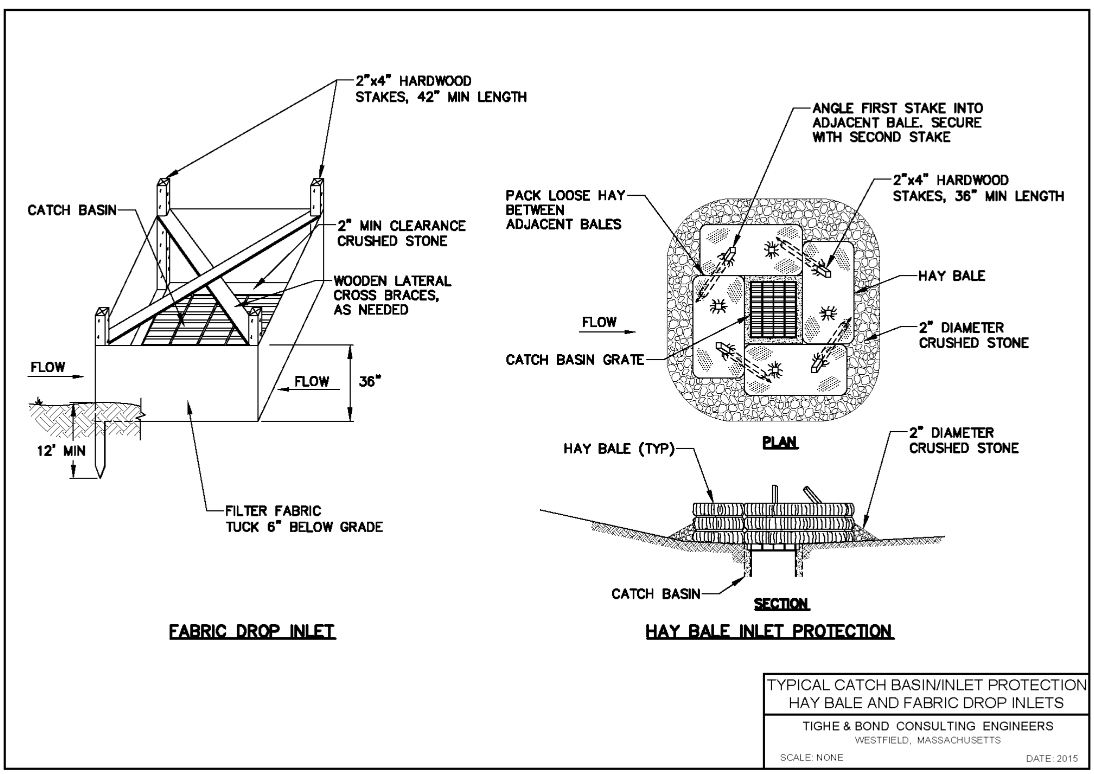
Filter baskets/silt bags are installed within catch basins in combination with hay bales, fabric, stone or sod drop inlets. They can potentially be used alone where drainage area is small with shallow flows. They may cause ponding or may rip under heavier flows without the additional external filtering method.

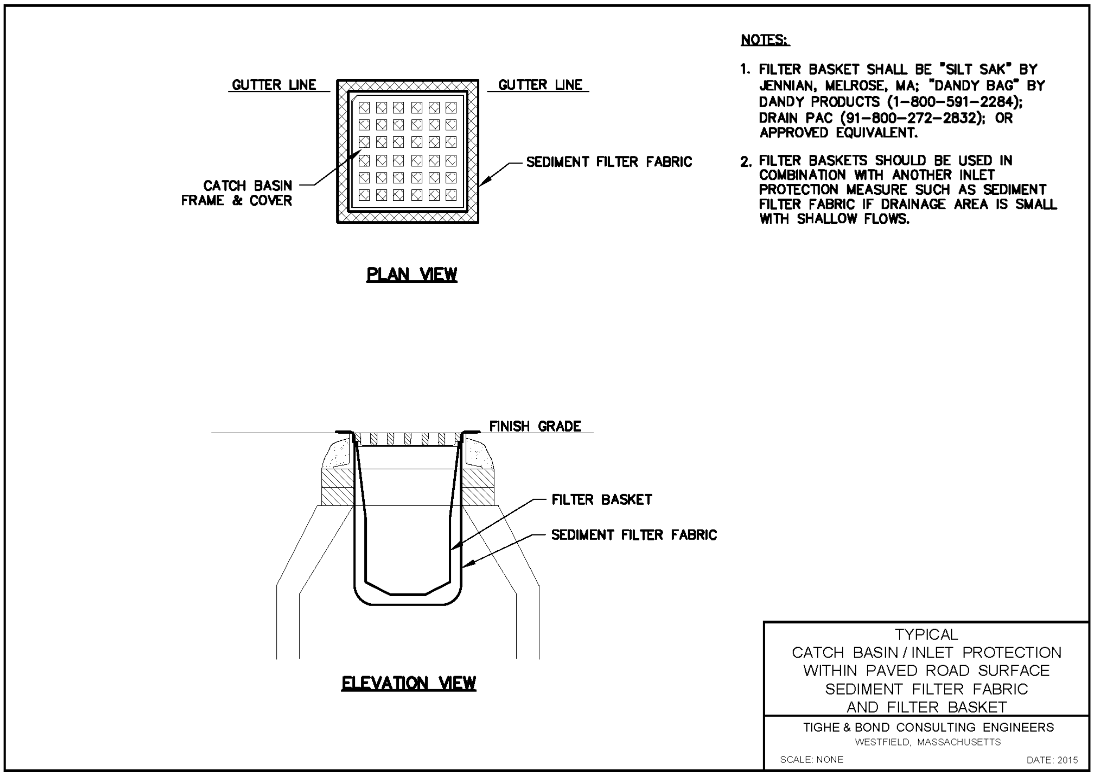
Installation:

- Several trademarked/name brand filter/silt bags exist and should be installed per the manufacturer's instructions. Almost all consist of a porous fabric bag which is fitted under the catch basin grate. Sediments are filtered out of the stormwater and accumulate in the bag.

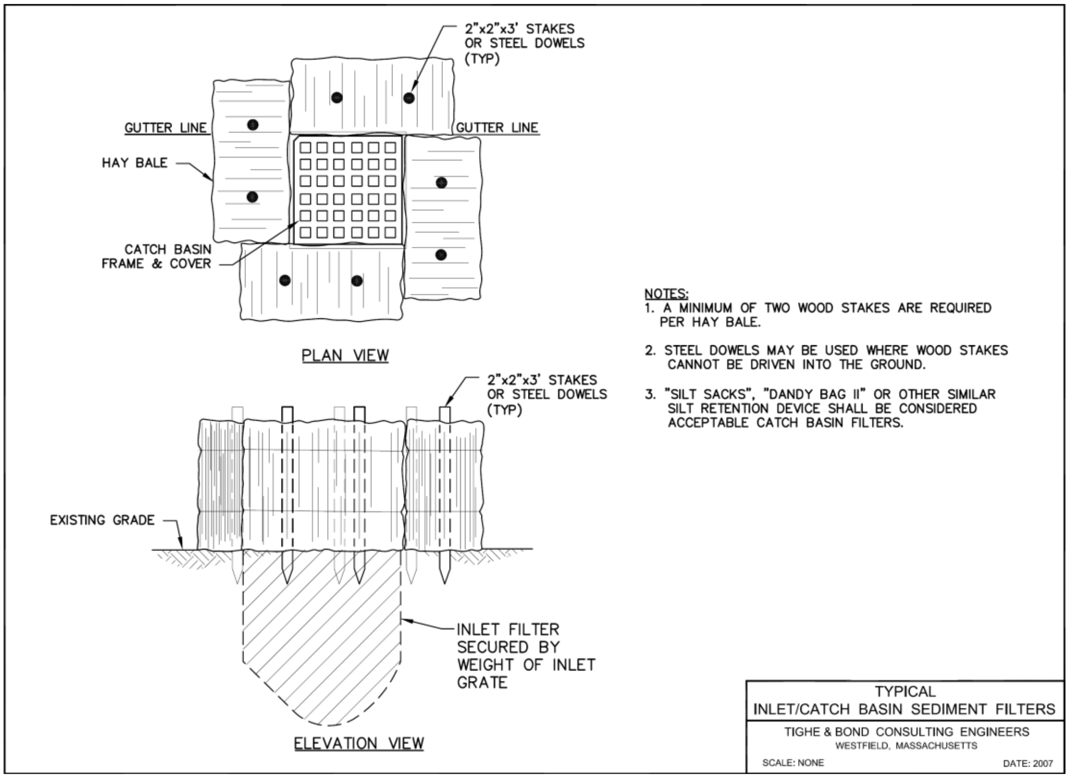
Maintenance:

- Inspect inlet and fabric weekly and after each major rain event.
- Remove sediment when the bag is halfway full.
- Replace bags as necessary due to wear or ripping.





Catchbasin protected from sedimentation by filter fabric.


2"x2"x3' STAKES
OR STEEL DOWELS
(TYP)
GUTTER LINE
GUTTER LINE
HAY BALE
CATCH BASIN
FRAME & COVER
PLAN VIEW
2"x2"x3' STAKES
OR STEEL DOWELS
(TYP)
EXISTING GRADE
INLET FILTER
SECURED BY
WEIGHT OF INLET
GRATE
ELEVATION VIEW
NOTES:
1. A MINIMUM OF TWO WOOD STAKES ARE REQUIRED PER HAY BALE.
2. STEEL DOWELS MAY BE USED WHERE WOOD STAKES CANNOT BE DRIVEN INTO THE GROUND.
3. "SILT SACKS", "DANDY BAG II" OR OTHER SIMILAR SILT RETENTION DEVICE SHALL BE CONSIDERED ACCEPTABLE CATCH BASIN FILTERS.
TYPICAL
INLET/CATCH BASIN SEDIMENT FILTERS
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2007

1.10 Loaming and Seeding

Applications: Erosion control, soil stabilization, site restoration

Limitations:

- May be site specific limitations (e.g. permit or State requirements).
- Applies to upland areas only.

Overview:

Permanent seeding is appropriate for vegetated swales, steep slopes, or filter strips. Temporary seeding is used if construction has ceased and if an area will be exposed.

Installation:

- Apply loam/ topsoil prior to spreading seed mix per manufacturer's recommendations. Apply water, fertilizer, and mulch to seedbed, as needed.
- Plant native species of grasses and legumes where practicable.

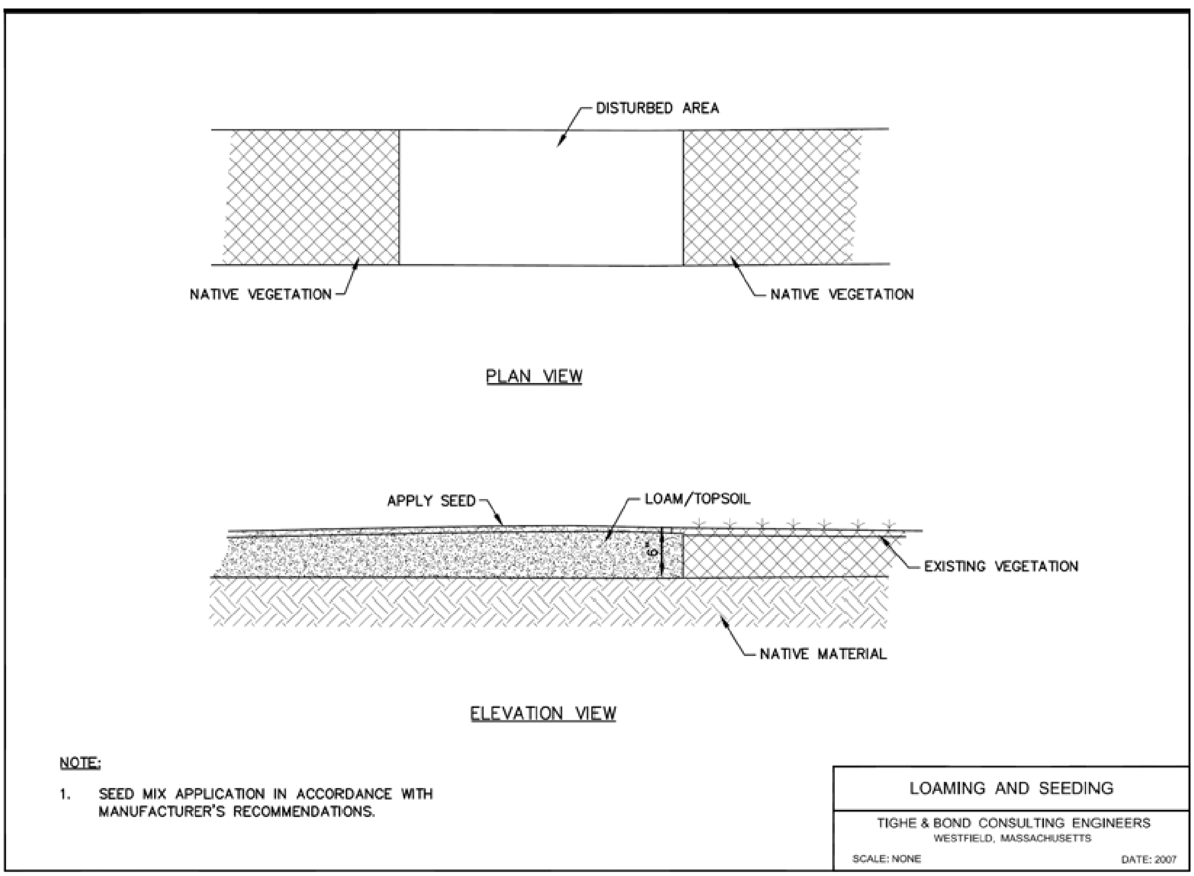
Maintenance:

- Inspect on regular basis until vegetation has established.
- If washout or erosion occurs, repair surface, re-seed, re-mulch and install new netting.
- Follow permit requirements regarding use of wetland seed mix in wetlands where required.

Additional Comments:

Cool Season Grasses	Warm Season Grasses
• Best growth in the cool weather of fall and spring, set seed in June and July. • Seed April 1-May 31 and Aug 1-Sept 10.	• Growth begins in the spring, accelerates in the summer, and plants set seed in the fall. • Seed April 1-May 15, dormant seeding Nov 1-Dec 15.

Loaming and seeding of recently disturbed right of way.



1.11 Mulching with Hay / Straw / Woodchips

Applications: Erosion control, soil stabilization, site restoration

Limitations:

- May be site specific limitations (e.g. permit or State requirements).
- Applies to upland areas only.
- Thick mulch may prevent seed germinations.
- Mulch on steep slopes must be secured with netting to prevent it from being washed away.

Overview:

Mulching consists of an application of a protective blanket of straw or other plant residue, gravel, or synthetic material to the soil surface to provide short term soil protection. It enhances plant establishment by conserving moisture and moderating soil temperatures, and anchors seed and topsoil in place. Mulch also reduces stormwater runoff velocity.

Application rates and technique depend on material used. Select mulch material based on soil type, site conditions and season. Straw/hay provides the densest cover if applied at the appropriate rate (at least ½ inch) and should be mechanically or chemically secured to the soil surface. Woodchip application can be less expensive if on-site materials are used.

Installation:

- Use in areas which have been temporarily or permanently seeded.
- Use mulch netting on slopes greater than 3% or in concentrated flows.
- Mulch prior to winter (ideally in mid-summer).

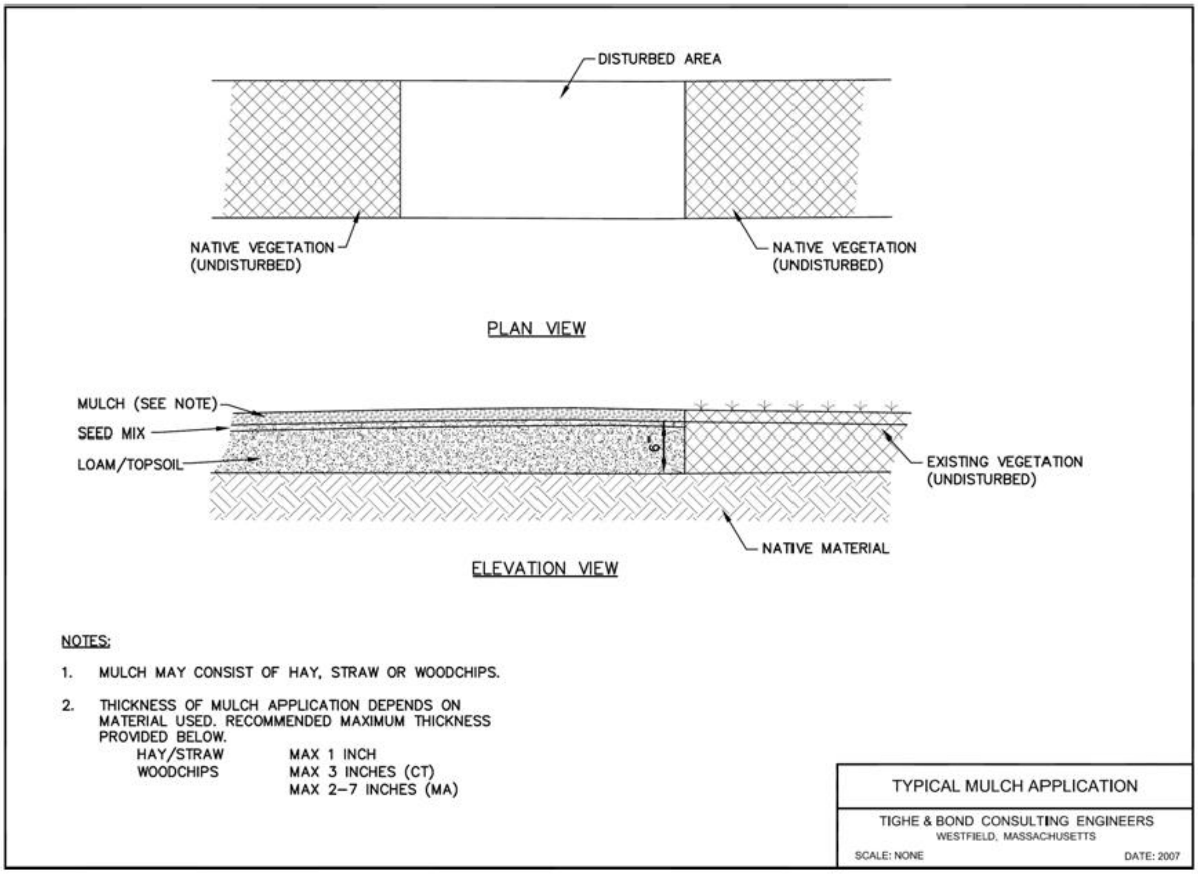
Maintenance:

- Inspect on regular basis until vegetation has established.
- If washout or erosion occurs, repair surface, re-seed, re-mulch, and install new netting.

Additional Comments:

Type	Description / Use
Straw/Hay	• Straw or hay applied to surface at 2-4 tons per acre • Mechanically or chemically secured to soil surface • Provides the densest cover to protect soil and seeds
Wood Fiber/Hydraulic Mulch	• Chopped up fibers applied to the soil surface with a hydroseeder • Tackifier when necessary can be applied with fiber, seeds and fertilizer in one step. This is best when done with fast growing seeds
Compost	• Compost acts as a soil amendment but is more expensive than most mulches • Its efficiency is comparable to wood fiber
Wood Chips	• Use of wood chips as a mulch saves money if on-site materials are used • Effective when applied at high levels (6 tons per acre) and on up to 35% slopes

Typical view of light mulching atop unstable, seeded soils.



1.12 Coir Log Use for Bank Stabilization

Applications: Bank stabilization, wetlands and watercourse restoration

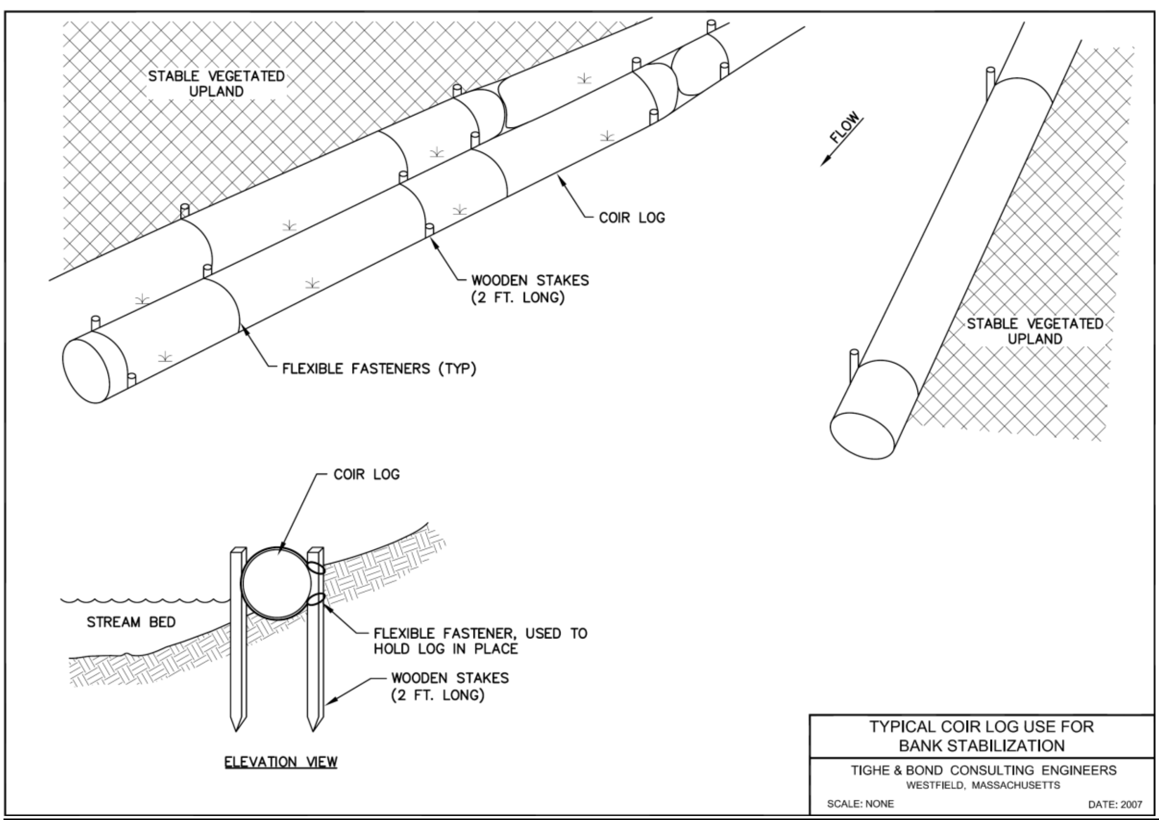
Limitations:

- Moderately expensive.

Overview:

- Refer to permit requirements (if applicable) and manufacturer's specifications.
- Install along banks between upland and watercourse using wooden stakes (2 foot long) and flexible fasteners (to hold log in place).

Coir logs used to restore a stream bed and banks.



1.13 Level Spreader

Applications: Erosion and sedimentation control

Limitations:

- Downgradient area must be adequately vegetated and have minimum width of 100 feet before surface water
- No vehicle traffic over level spreader

Overview:

Level spreaders, also called grade stabilization structures, are excavated depressions constructed at zero percent grade across a slope. They convert concentrated flow into sheet flow and discharges to stable areas without causing erosion.

Level spreaders are not applicable at all locations. Some general site requirements include:

- Drainage area of 5 acres or less
- Undisturbed soil (not fill)
- A level lip that can be installed without filling
- Area directly below is stabilized by existing vegetation
- At least 100 feet of vegetated area between the spreader and surface waters
- Slope of the area below the spreader lip is uniform and a 10% grade or less
- Water won't become concentrated below the spreader and can be released in sheet flow down a stabilized slope without causing erosion
- There will be no construction traffic over the spreader

Installation:

- Set the channel grade to be no steeper than 1% for the last 20 feet entering the level spreader.
- Install level spreader using the suggested dimensions: length—5 to 50 feet, width—at least 6 feet, and depth—approximately 6 inches (measured from the lip) and uniform.
- Stabilize the level spreader with an appropriate grass seed mixture and mulch, if necessary. Protect the level lip with an erosion stop and jute netting/excelsior matting. The downgradient area should have stable, complete, erosion resistant vegetative cover.

Maintenance:

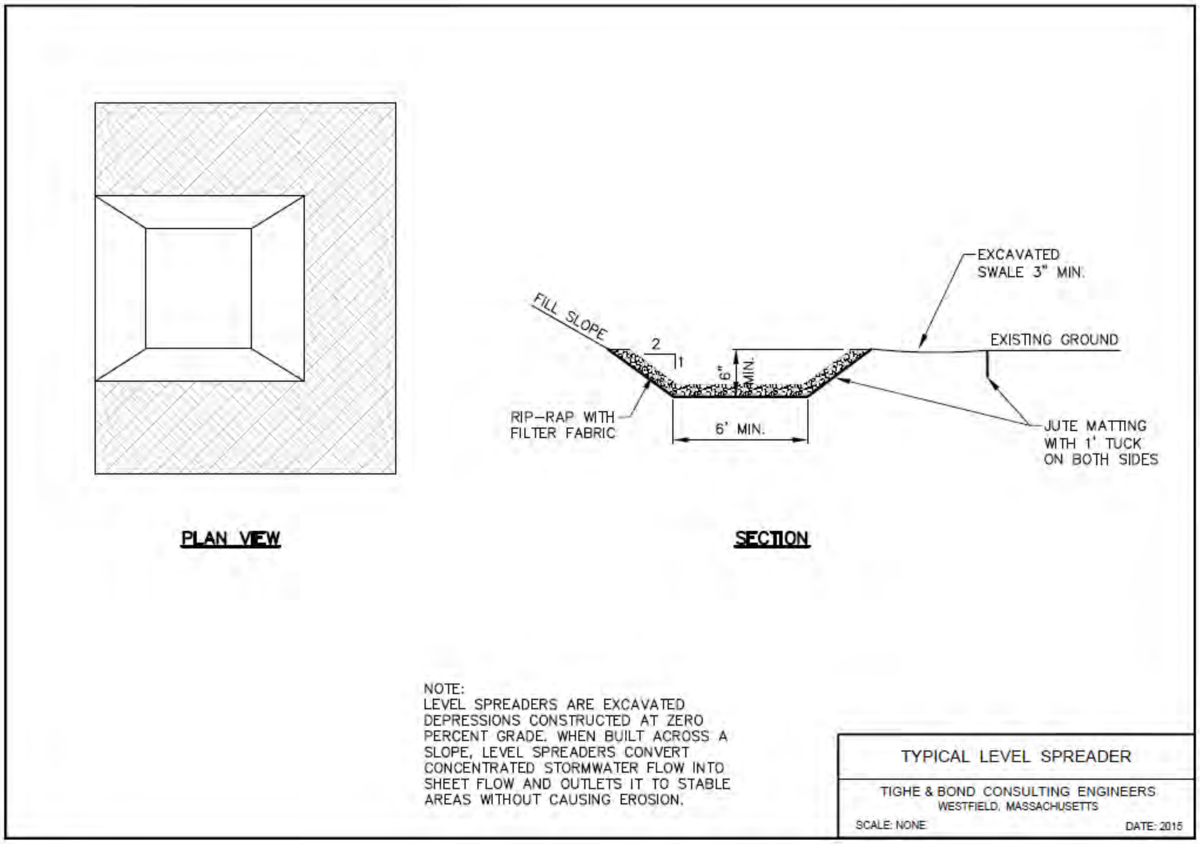
- Inspect after every rain event and remove accumulated sediment. Repair erosion damage and re-seed as necessary.

- Mow vegetation occasionally to control weeds and the encroachment of woody vegetation.

Additional Comments:

If channels form and erosion is evident in level spreader, the level spreader is not uniformly flat. Repair the low spots in the level spreader.

If erosion is occurring downgradient of the level spreader, the level spreader is not long enough or not wide enough. Alternatively, the vegetation is not stable. Re-seed the area.



1.14 Check Dams

Applications: Stormwater management, erosion control

Limitations:

- Need to be adequately sized based on expected rain events.

Overview:

Check dams are porous physical barriers placed across a drainageway to reduce the velocity of concentrated stormwater flows and erosion. Check dams also temporarily pond stormwater runoff to allow sediment in the water column to settle out. Permanent or long-term check dams are typically constructed of rip rap or other stone material. Short-term check dams can be constructed of rip rap. Rip rap check dams are preferred over hay bales.

Installation:

- Place stone by hand or machine, making side slopes no steeper than 1:1 and with a maximum height of 3 feet at the center of the check dam. A geotextile may be used under the stone to provide a stable foundation and/or to facilitate removal of the stone.
- The minimum height of the check dam shall be the flow depth of the drainageway, but shall not exceed 3 feet at the center.
- Install the check dam so that it spans the full width of the drainageway, plus 18 inches on each side. Leave the center of the check dam approximately 6 inches lower than the height of the outer edges.
- The maximum spacing between check dams should be such that the toe of the upstream check dam is at the same elevation as the top of the center of the downstream check dam.

Maintenance:

- For permanent stone check dams, inspect and maintain the check dam in accordance with the standards and specifications provided in the design for the site.
- For temporary check dams, inspect at least once per week and within 24 hours of the end of a precipitation event of 0.5 inches or more to determine maintenance needs.
- Maintenance may include, but are not limited to, the replacement of stone, repair of erosion around or under the structure, and/or the removal and proper disposal of accumulated sediment.

Problem	Solution / Explanation
Stone displaced from face of dam	Stone size too small and/or face too steep
Erosion downstream from dam	Install stone lined apron
Erosion of abutments during high flow	Rock abutment height too low
Sediment loss through dam	Inadequate layer of stone on inside face or stone too coarse to restrict flow through dam

Stone check dams at construction site.


Stone check dam at construction site.

1.15 Temporary and Permanent Diversions

Applications: Stormwater management, erosion control

Limitations:

- Need to be adequately sized based on expected rain events and the contributing drainage area.

Overview:

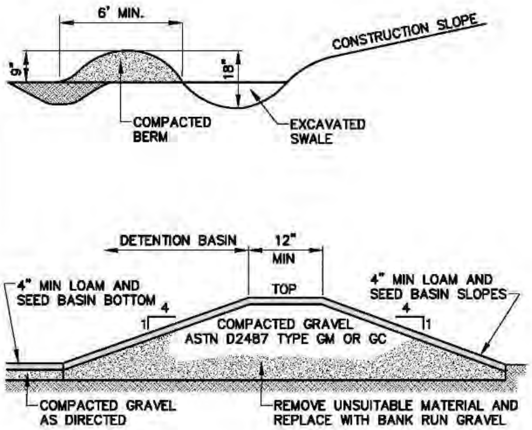
Temporary and permanent diversions are ridges or channels constructed across steep slopes that convey the runoff to a stable outlet at a non-erosive velocity. Use permanent diversions on slopes with high runoff velocities to break up concentrated flow. They can be installed as temporary diversion and completed as permanent when the site is stabilized or can be installed in the final form initially.

Installation:

- Remove woody vegetation and fill and compact the ditches and gullies that must be crossed before construction.
- Remove vegetation around the proposed location of the base of the diversion ridge to form a strong bond between the ground and fill material.
- Stabilize the outlet of the diversion channel using sediment traps, natural or constructed vegetated outlets, or level spreaders.
- Stabilize the diversion channel with riprap, vegetation, paving, or stone.
- Install a filter strip of close growing grass above the channel to prevent sediment accumulation.
- Seed and mulch diversions that are intended for use for more than 30 days.
- After the area has been permanently stabilized, remove the ridge and channel to blend with the natural ground level.

Maintenance:

- Inspect bi-weekly and repair any erosion problems.
- Remove accumulated sediment and debris.



DETENTION BERM

SLOPE %	DISTANCE APART
< 5	125
5–10	100
10–20	75
30–35	50
> 35	25

NOTE:
FILL FOR BERMS SHALL BE A COMBINATION OF GRAVEL, SAND AND SILT TO ENSURE WATER TIGHTNESS AND STABILITY.

TYPICAL TEMPORARY AND PERMANENT DIVERSIONS

TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS

SCALE: NONE DATE: 2016

1.16 Temporary and Permanent Trench Breakers (Trench Plugs)

Applications: Keeping work areas dry, long-term stabilization of soil (prevents sinkholes)

Limitations:

- Water that accumulates behind the trench breaker requires pumping to a filtering device, preferable in a well-vegetated, upland area.

Overview:

Trench breakers (trench plugs) are temporary or permanent measures used to slow the movement of groundwater and surface runoff within a trench. They are often used when runoff draining to downgradient work areas causes problems within the trench. Trench breakers may be placed adjacent to waterways and wetlands to prevent water from seeping into work areas or disrupting the hydrology of the resource areas. They can be used on slopes throughout all types of land uses (including agricultural and residential). Trench breakers should be installed upslope of each permanent slope breaker or waterbar.

Temporary Trench Breakers (Trench Plugs)

Temporary trench plugs may consist of hard or soft plugs. Hard plugs leave small portions of the ditch unexcavated at certain intervals. Soft plugs involve placing compacted subsoil or sandbags into the ditch following excavation.

Installation:

- Install temporary trench plugs at the same intervals as temporary slope breakers or water bars (see table).

Maintenance:

- Inspect trench breakers regularly for signs of any instability, and repair any erosion problems.
- If water accumulates behind the trench breaker, pump to a filtering device, preferably in a well-vegetated, upland area.

Permanent Trench Breakers

Permanent trench breakers are left in the trench and backfilled to slow the movement of subsurface water along the trench. This helps prevent undermining the stability of the right of way that may lead to sinkholes or erosion.

Installation:

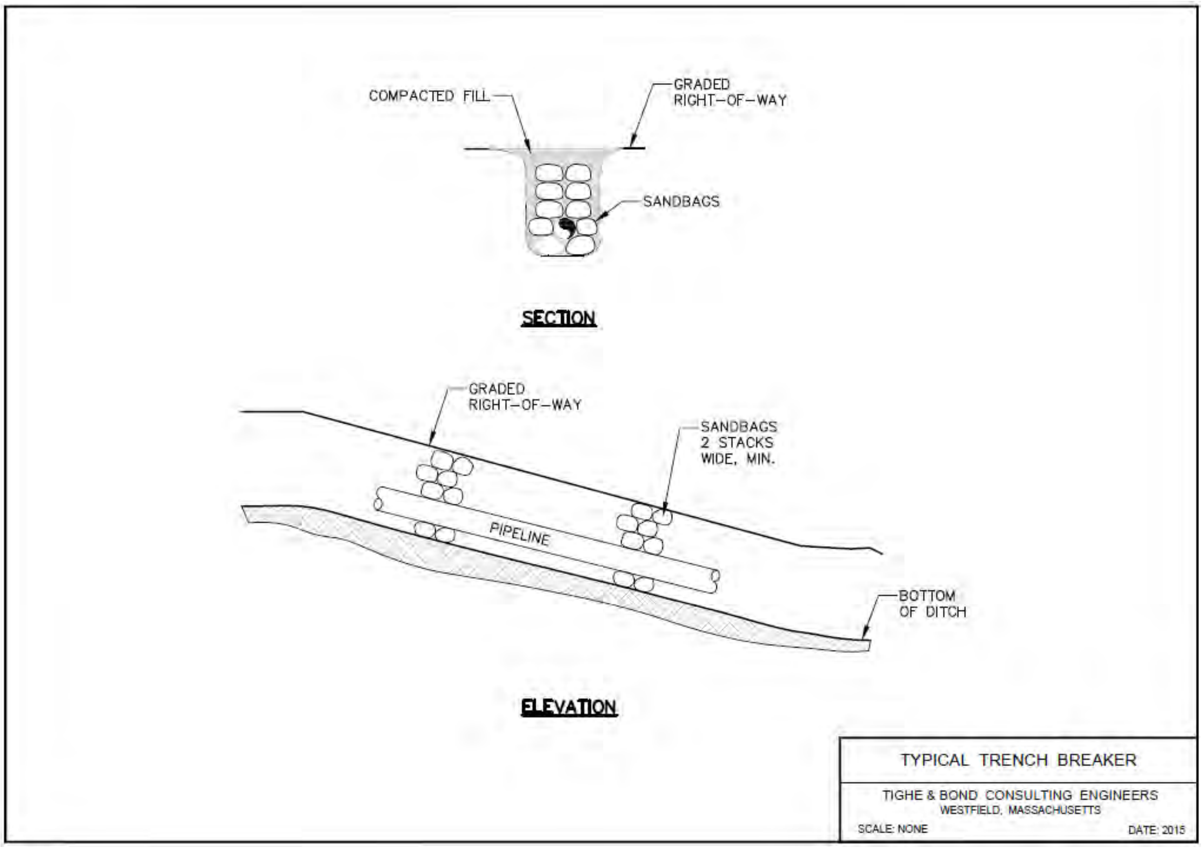
- Trench breakers can be composed of sandbags or polyurethane foam. Do not use topsoil to construct trench breakers.
- Build the trench breaker under and around the pipeline at intervals specified by the local soil conservation service or as shown in the table below.
- Install temporary trench plugs at the same intervals as temporary slope breakers or water bars (see table).
- When using sandbags, construct the trench breakers to be a minimum of two bags wide.
- Backfill the top of the trench breakers along with the rest of the trench. Grade the entire area to the original contours and stabilize.

Maintenance:

- Inspect trench breakers for stability and effectiveness before the trench is backfilled.
- During future inspections of the completed right of way, observe the ditch line for any unusual settling or erosion.
- Inspect wetlands and waterways for any change to their original hydrology.

Additional Comments:

Recommended Spacing	
Land Slope	**Spacing (ft)**
5-15%	300
>15-30%	200
>30%	100


COMPACTED FILL
GRADED RIGHT-OF-WAY
SANDBAGS
SECTION
GRADED RIGHT-OF-WAY
SANDBAGS 2 STACKS WIDE, MIN.
PIPELINE
BOTTOM OF DITCH
ELEVATION
TYPICAL TRENCH BREAKER
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2015

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Appendix A

Section II

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Section 2
Water Control

Several methods exist for temporarily diverting and dewatering surface water from work areas. No untreated groundwater shall be discharged to wetlands or water bodies. A variety of methods may be employed to prevent sedimentation due to dewatering. These methods, which are primarily appropriate during construction of capital projects, are described below.

2.1 Dewatering Activities

Applications: Dewatering

Limitations:

- Overland flow limited to sites with appropriate upland area.
- Frac tanks have limited capacity and are expensive.
- Pumps require oversight at all times.
- Filter bags clog and require replacement.

Overview:

Dewatering activities may be necessary to expose the ditch line and provide drier workspace when high groundwater or saturated soil is present. This condition often occurs in wetlands or near streambanks during excavation activities for installing or replacing utility poles or natural gas pipelines. *Under no circumstances should trench water or other forms of turbid water be directly discharged onto exposed soil or into any wetland or waterbody.*

2.1.1 Overland Flow

Applications: Dewatering

Limitations:

- Space constraints and adjacent wetlands or watercourses may prevent use of this dewatering method.

Overview:

Overland Flow may be used if a discharge location is available where there is no potential for discharged water to flow overland into wetlands or waterbodies. Discharge water overland without any filtering to well-drained, vegetated upland areas and allow to naturally infiltrate into soils.

2.1.2 Frac Tank

Applications: Dewatering, managing contaminated groundwater

Limitations:

- Expensive
- May be site specific limitations (e.g. extremely unlevel ground)
- May require proper disposal at a regulated facility (in cases of contaminated groundwater)

Overview:

Frac Tanks are pre-fabricated and self-contained units that contain a series of baffles that allow fine materials to settle out of the water column. Use frac tanks when the work requires dewatering in an area with very silt laden water and/or contaminated groundwater.

Frac tank on-site for dewatering activities.

2.1.3 Filter Bags and Hay Bale Containment Area

Applications: Dewatering

Limitations:

- Pumps require oversight at all times.
- Filter bags clog and require replacement.

Overview:

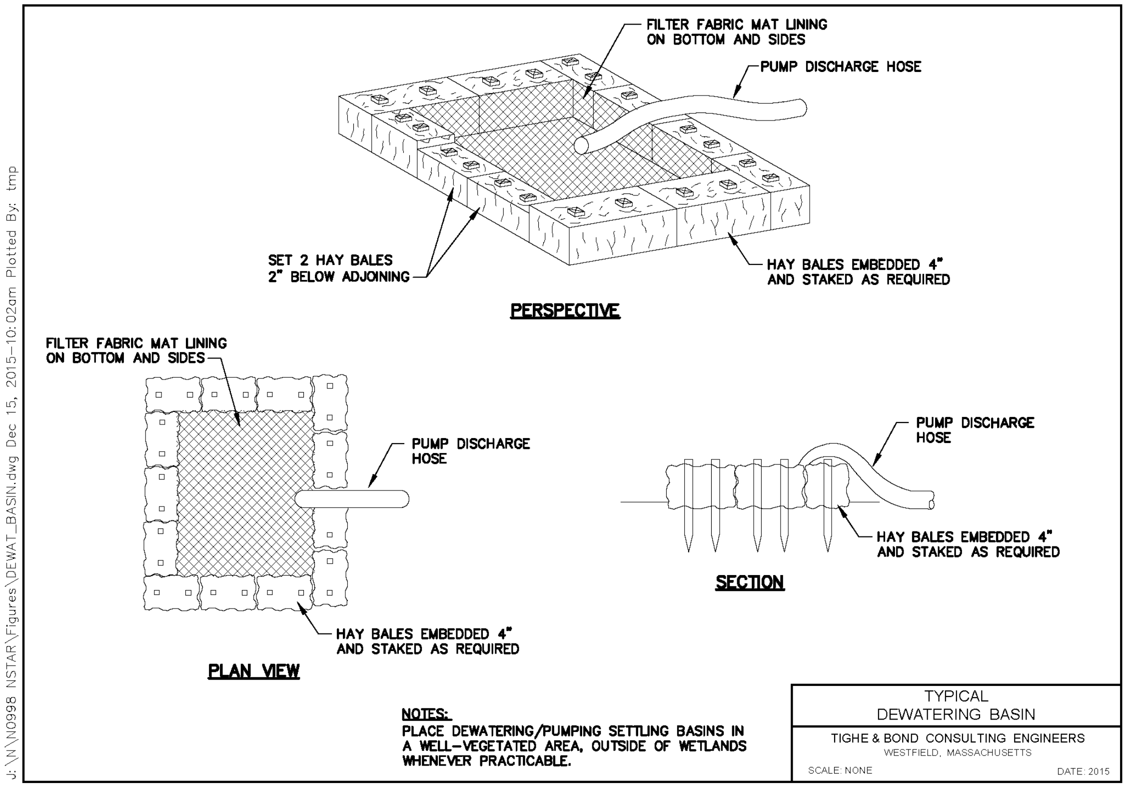
Use filter bags with hay bale containment area for dewatering when there is the potential for discharged water to flow overland into wetlands or waterbodies. Locate dewatering sites in well-vegetated areas within the right of way or approved work areas. Locate discharges outside of wetlands and over 100 feet from a streambank or waterbody, if practicable.

Installation:

- Place pump in a containment structure (i.e., child-sized plastic pool) to avoid fuel leakage to the wetlands or waterways.
- Properly place the discharge hose into a pre-manufactured, geotextile filter bag per the manufacturer's instructions.
- Place the filter bag in a well-vegetated area outside of a wetland area and over 100 feet from a waterbody, if practicable.
- Elevate the intake hose off the trench bottom and create a sump with clean rock in order to avoid pumping additional sediment.
- Build a hay bale corral for the filter bag if the water must be discharged within 100 feet of a wetland, waterbody, or other sensitive area.
- Stake a double vertical line of hay bales in an "L" or "U" shape on the downgradient sides of the bag to further filter the discharge water.

Maintenance:

- Man the pump at all times.
- Refuel pump within a plastic containment structure and/or over 100 feet from the wetland or waterbody.
- Routinely check the filter bag during pumping activities to ensure that it is not reaching its holding capacity.
- If the bag appears to be nearing its limits, stop dewatering until more water has filtered out and the bag can be replaced.
- Properly dispose of used filter bags and trapped sediment.


FILTER FABRIC MAT LINING
ON BOTTOM AND SIDES
PUMP DISCHARGE HOSE
SET 2 HAY BALES
2" BELOW ADJOINING
HAY BALES EMBEDDED 4"
AND STAKED AS REQUIRED
PERSPECTIVE
FILTER FABRIC MAT LINING
ON BOTTOM AND SIDES
PUMP DISCHARGE
HOSE
PUMP DISCHARGE
HOSE
HAY BALES EMBEDDED 4"
AND STAKED AS REQUIRED
SECTION
HAY BALES EMBEDDED 4"
AND STAKED AS REQUIRED
PLAN VIEW
NOTES:
PLACE DEWATERING/PUMPING SETTLING BASINS IN
A WELL-VEGETATED AREA, OUTSIDE OF WETLANDS
WHENEVER PRACTICABLE.
TYPICAL
DEWATERING BASIN
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2015
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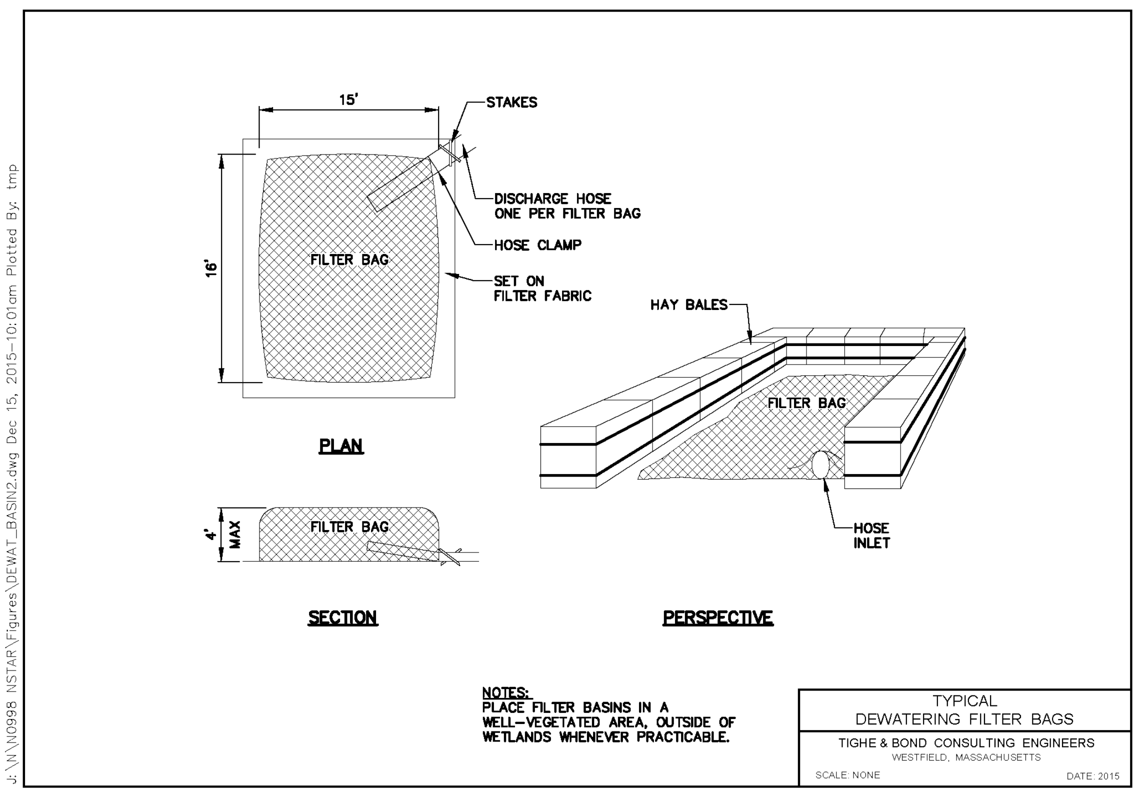
15'
STAKES
DISCHARGE HOSE
ONE PER FILTER BAG
HOSE CLAMP
16'
FILTER BAG
SET ON
FILTER FABRIC
HAY BALES
FILTER BAG
PLAN
4' MAX
FILTER BAG
HOSE
INLET
SECTION
PERSPECTIVE
NOTES:
PLACE FILTER BASINS IN A
WELL-VEGETATED AREA, OUTSIDE OF
WETLANDS WHENEVER PRACTICABLE.
TYPICAL
DEWATERING FILTER BAGS
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2015
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2.1.4 Discharge Hose Filter Socks

Applications: Dewatering

Limitations:

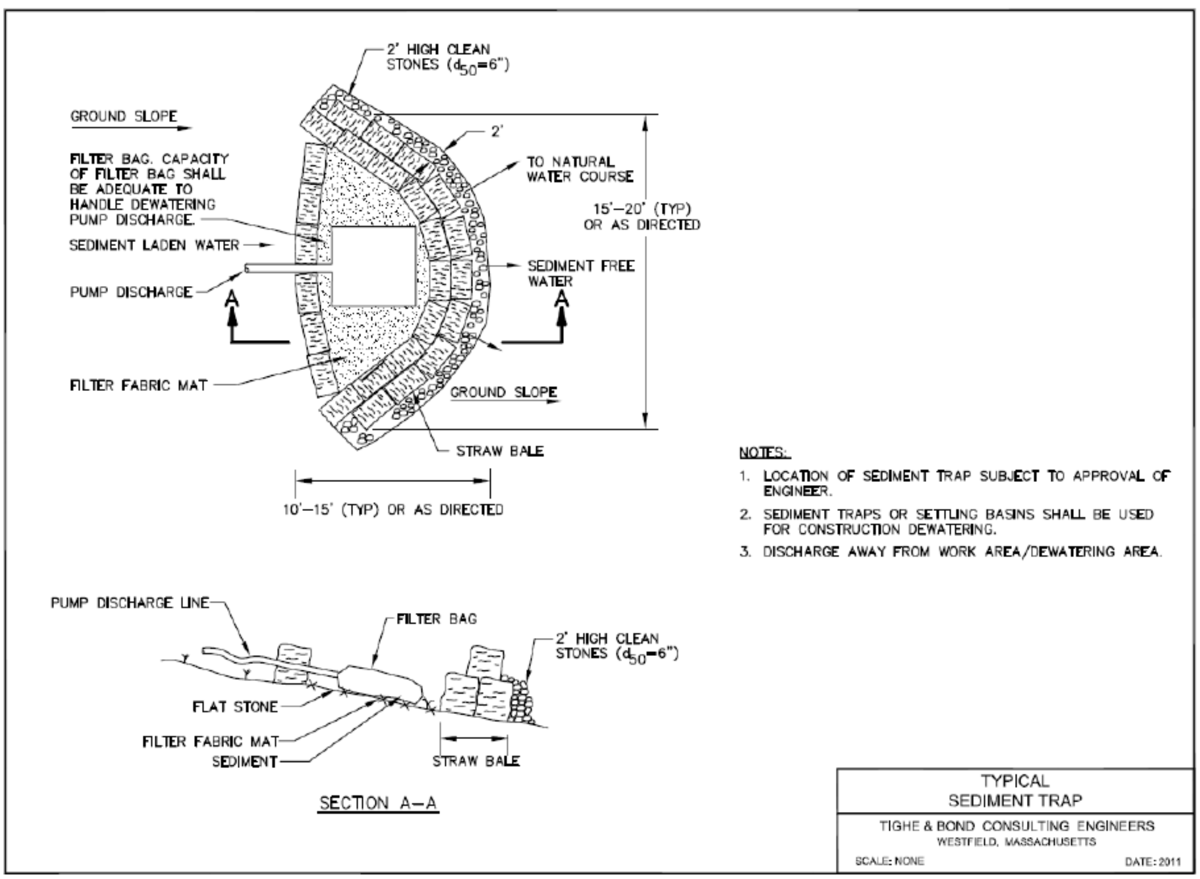
- Ineffective for very silty water

Overview:

Use discharge hose filter socks at sites where there is insufficient space to construct sediment basins or enough suitable uplands for overland flow and infiltration. Filter "socks" or bags may be affixed to the end for the discharge hose of the pump and used for dewatering. It is important that enough socks be on hand at the site to accommodate the anticipated need, as they fill fast with more turbid water. Additional measures such as hay or straw bales can be installed around the filter device for added protection.

Dewatering to filter "sock" surrounded by hay bales.

Riprap underlain by geotextile fabric



2.2 Coffer Dam and Stream Bypass Pumping

Applications: Dewatering/water diversion, turbidity control

Limitations:

- Pipes need to be adequately sized to accommodate heavy rain events.
- Coffer dams require careful maintenance at all times.

Overview:

A coffer dam is a temporary structure used during instream work to enclose a work area by diverting stream flow using pumps (or gravity) while containing sediment and turbidity. Coffer dams make an impoundment upstream of a work area and then use pumps to remove the water from inside the dammed (isolated) area to beyond the work area. They are used in areas with high flows where siltation barriers are not effective. Coffer dams can consist of sandbags, concrete structures, or pre-manufactured products and should be used on a site-by-site basis according to engineering specifications and/or manufacturer's instructions.

Dewatering measures may be necessary if groundwater is encountered within an excavation (e.g., during installation or repair of a buried cable, footings, foundations or structure replacement) or other area if the presence of water is incompatible with construction. In rare cases, surface water diversions will be necessary in order to create dry working conditions for subsurface work in water bodies.

Installation:

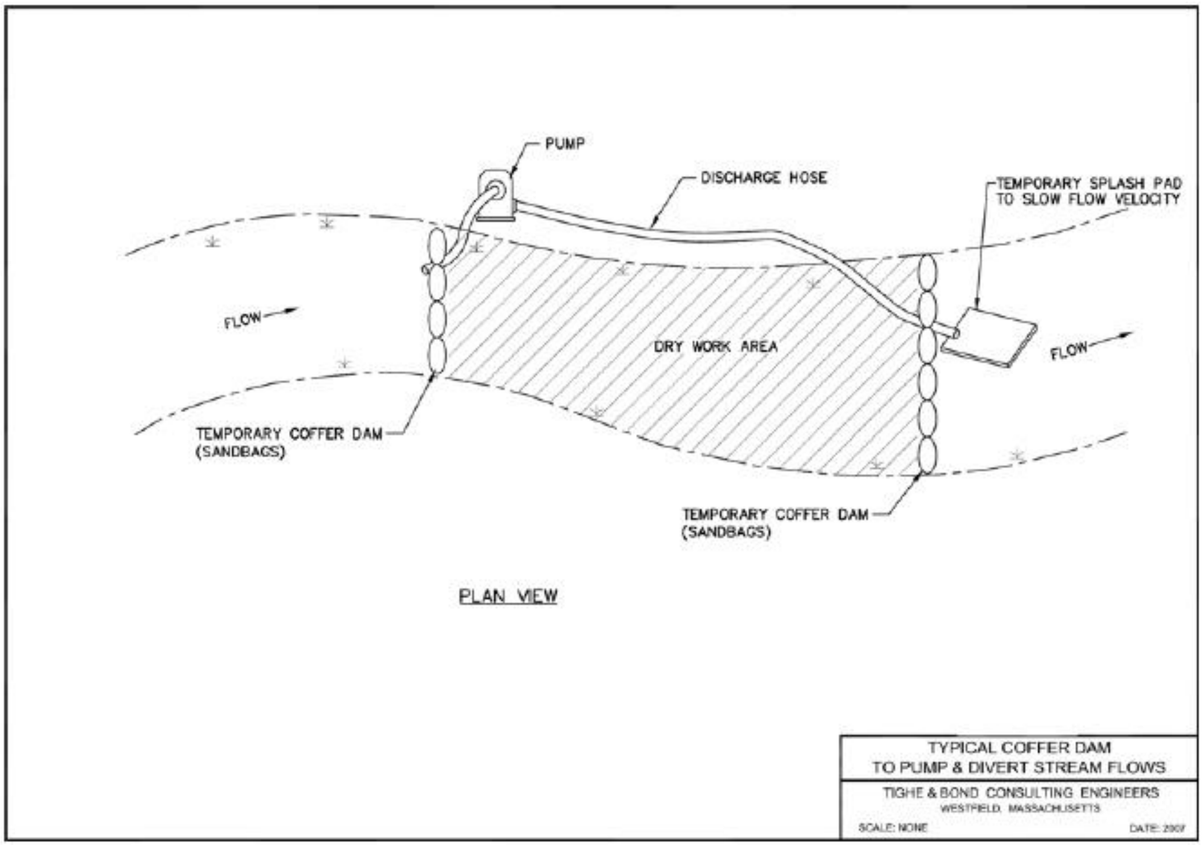
- All cofferdam installations should be designed and approved by engineering staff following geotechnical and hydrological studies. If using a pre-fabricated product, follow manufacturer's instructions and engineer's guidance.
- Place hay bales or silt fence along the streambanks approaching the edges of the workspace.
- Coffer dams should be a semicircle or U-shaped and lined with a geotextile. Use clean durable rockfill or large pre-cast concrete blocks for construction.
- Locate the geotextile outside of the dam for the upstream half and inside for the downstream half to prevent displacement of the geotextile. Place the geotextile with a short flap (1 foot) at the base of the dam, weighted down with clean rockfill.
- Dewatering of the isolated work area may or may not be necessary or even possible. If dewatering is necessary, install an impermeable liner or clay plug.
- After the sediment in suspension has settled out, remove the cofferdam carefully so that sediment disturbance is minimized.
- Do not install in channels where dams would hinder the passage of boats or fish.

Maintenance:

- Cofferdams require careful maintenance at all times.
- Observe the stream flow for any turbidity as a result of the construction activities.

Additional Comments:

Where use of pumps is impractical, coffer dams and temporary pipes can be used to divert flows via gravity and dry out a work area. The instream constriction caused by the cofferdam should be small in order to avoid generating unacceptable scour velocities in the remaining channel section.



2.3 Coffer Dam and Stream Bypass via Gravity

Applications: Dewatering/water diversion, turbidity control

Limitations:

- Pipes need to be adequately sized to accommodate heavy rain events.
- Coffer dams require careful maintenance at all times.

Overview:

A coffer dam is a temporary structure used during instream work to enclose a work area by diverting stream flow via gravity (or using pumps) while containing sediment and turbidity. Coffer dams make an impoundment upstream of a work area and then use a piping and gravity to remove the water from inside the dammed (isolated) area to beyond the work area. They are used in areas with high flows where siltation barriers are not effective. Coffer dams can consist of sandbags, concrete structures, or pre-manufactured products and should be used on a site-by-site basis according to engineering specifications and/or manufacturer's instructions.

Dewatering measures may be necessary if groundwater is encountered within an excavation (e.g., during installation or repair of a buried cable, footings, foundations or structure replacement) or other area if the presence of water is incompatible with construction. In rare cases, surface water diversions will be necessary in order to create dry working conditions for subsurface work in water bodies.

Installation:

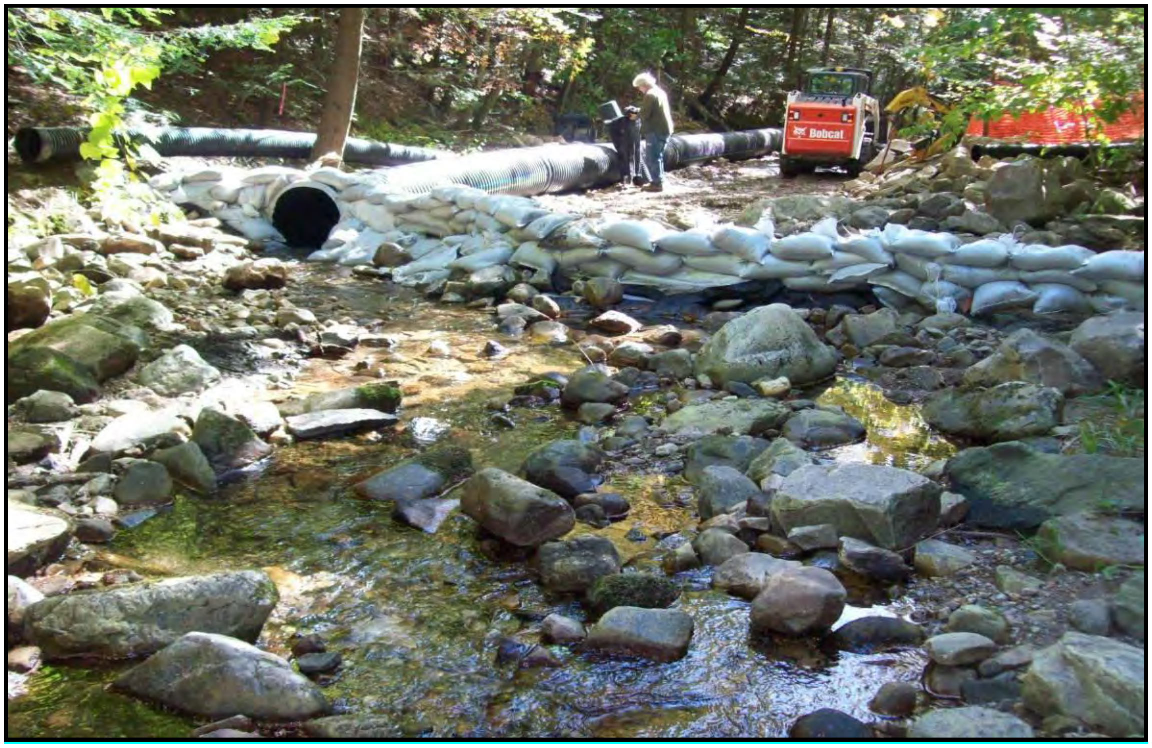
- All cofferdam installations should be designed and approved by engineering staff following geotechnical and hydrological studies. If using a pre-fabricated product, follow manufacturer's instructions and engineer's guidance.
- Place hay bales or silt fence along the streambanks approaching the edges of the workspace.
- Coffer dams should be a semicircle or U-shaped and lined with a geotextile. Use clean durable rockfill or large pre-cast concrete blocks for construction.
- Locate the geotextile outside of the dam for the upstream half and inside for the downstream half to prevent displacement of the geotextile. Place the geotextile with a short flap (1 foot) at the base of the dam, weighted down with clean rockfill.
- Dewatering of the isolated work area may or may not be necessary or even possible. If dewatering is necessary, install an impermeable liner or clay plug.
- After the sediment in suspension has settled out, remove the cofferdam carefully so that sediment disturbance is minimized.
- Do not install in channels where dams would hinder the passage of boats or fish.

Maintenance:

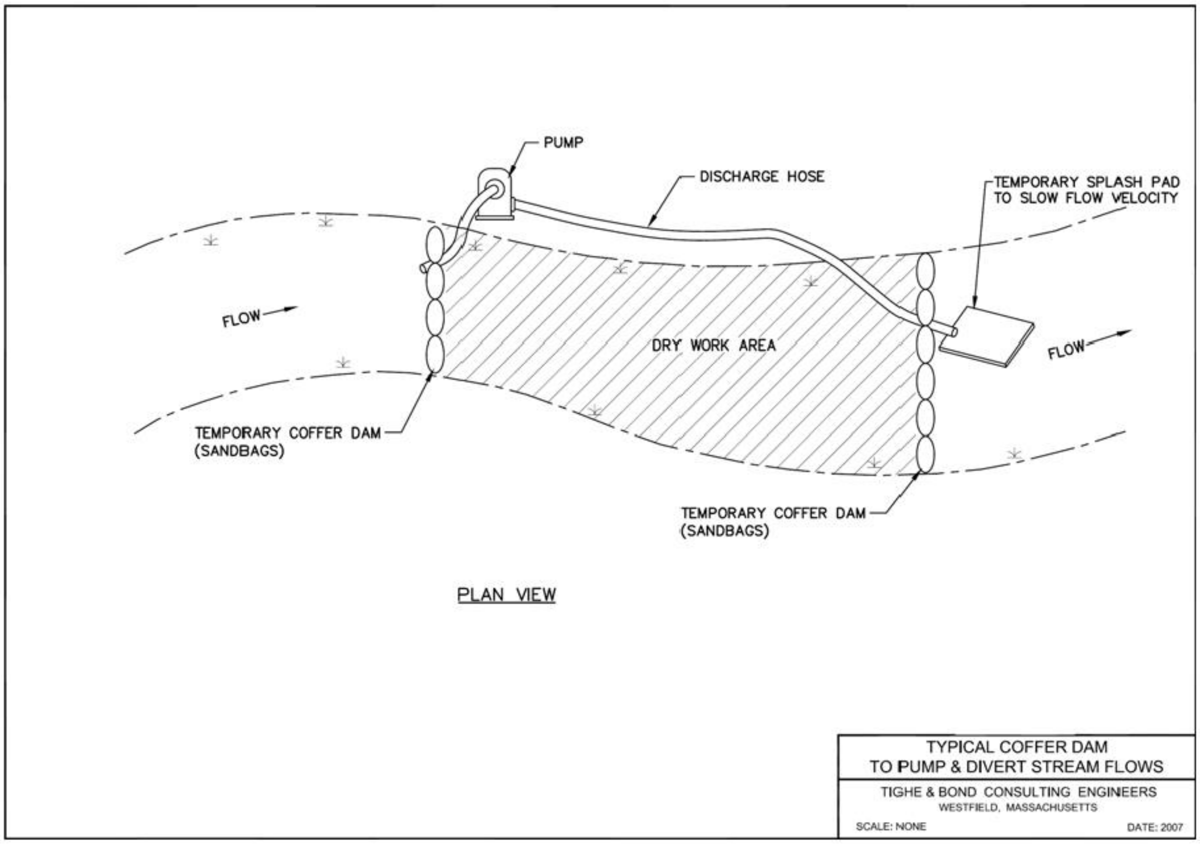
- Cofferdams require careful maintenance at all times.
- Observe the stream flow for any turbidity as a result of the construction activities.

Additional Comments:

Where gravity flows cannot be circumvented through a coffer dam and temporary flexible pipe via gravity, use a pump, discharge hose and downstream temporary splash pad to slow flow velocity can be used. The instream constriction caused by the cofferdam should be small in order to avoid generating unacceptable scour velocities in the remaining channel section.



Sand bag coffer dam and streamflow gravity bypass.


PUMP
DISCHARGE HOSE
TEMPORARY SPLASH PAD
TO SLOW FLOW VELOCITY
FLOW
DRY WORK AREA
FLOW
TEMPORARY COFFER DAM
(SANDBAGS)
TEMPORARY COFFER DAM
(SANDBAGS)
PLAN VIEW
TYPICAL COFFER DAM
TO PUMP & DIVERT STREAM FLOWS
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2007

2.4 Silt Barriers

Applications: Turbidity control

Limitations:

- Must be rated to withstand anticipated flow velocity and quantity.

Overview:

Staked and floating silt barriers are temporary flexible barriers used within a waterbody to separate or deflect natural flow around a work area. Barriers are placed around the sediment source to contain the sediment-laden water, allowing suspended soil particle to settle out of suspension and stay in the immediate area. The staked barrier consists of geotextile fabric attached to support posts and a wire support fence and a chain sewn into a sleeve along the bottom edge to allow the barrier to conform to the channel.

The floating silt barriers are often called silt or turbidity curtains, and can be purchased from manufacturers or can be made on site. Construction generally includes a skirt (geotextile fabric) that forms the barrier, flotation segments such as styrofoam sealed in a seam along the top of the fabric, a ballast chain sealed into a sleeve along the bottom edge of the fabric, a loadline built into the barrier above or below the floatation segments, and piles or posts tied back to underwater or on shore anchor points.

Staked Silt Barriers

- For installations which only isolate a part of the stream, barriers can be used in higher flows (shallow streams with currents less than 0.5 ft/s).
- Do not use in streams/river with strong currents, strong waves, ice, floating debris, or boats and do not place barriers completely across stream channels unless they are minor or intermittent streams with negligible flow.

Installation:

- Place the staked barrier and wire support fence at least 1 foot above the waterline. Do not install in a waterbody deeper than 4 feet.
- Place support stakes 10 feet apart and drive them 2 feet into the channel bottom.
- Fasten the wire mesh securely against the fabric with heavy duty wire staples at least 1″ long. If possible, use a continuous roll of fabric and fasten securely to the posts with heavy duty staples with a maximum spacing of 2″.
- Where possible, prefabricate a staked barrier on shore. Carefully roll it up lengthwise and move it into place.
- Secure the bottom edge of fabric to the channel bottom by placing a heavy chain into a sewn sleeve along the fabric edge, or by placing clean rockfill over the edge.

Floating Silt Barriers

- Use only in negligible or low flow conditions. Can be used for instream areas between 2.6 feet and 6 feet deep and with waves potentially up to 10 feet.

- Do not use to stop, divert, or filter a significant volume of water.

Installation:

- Purchasing a pre-manufactured silt curtain such as Siltmaster® will save time constructing the barrier. Follow manufacturer's advice for the area.

- Enclose the smallest area as practicable. Locate the barrier far enough away from construction equipment to avoid damage.

- Launch the furled barrier from a ramp, pier or shore. Set the shore anchor points and tie off one end of the barrier to the stream anchor point and the downstream end to a boat. Bring to the downstream point to be anchored.

- Anchor the barrier in the desired formation and make sure the skirt is not twisted around the flotation.

- Cut the furling ties and let the ballast sink to its maximum depth.

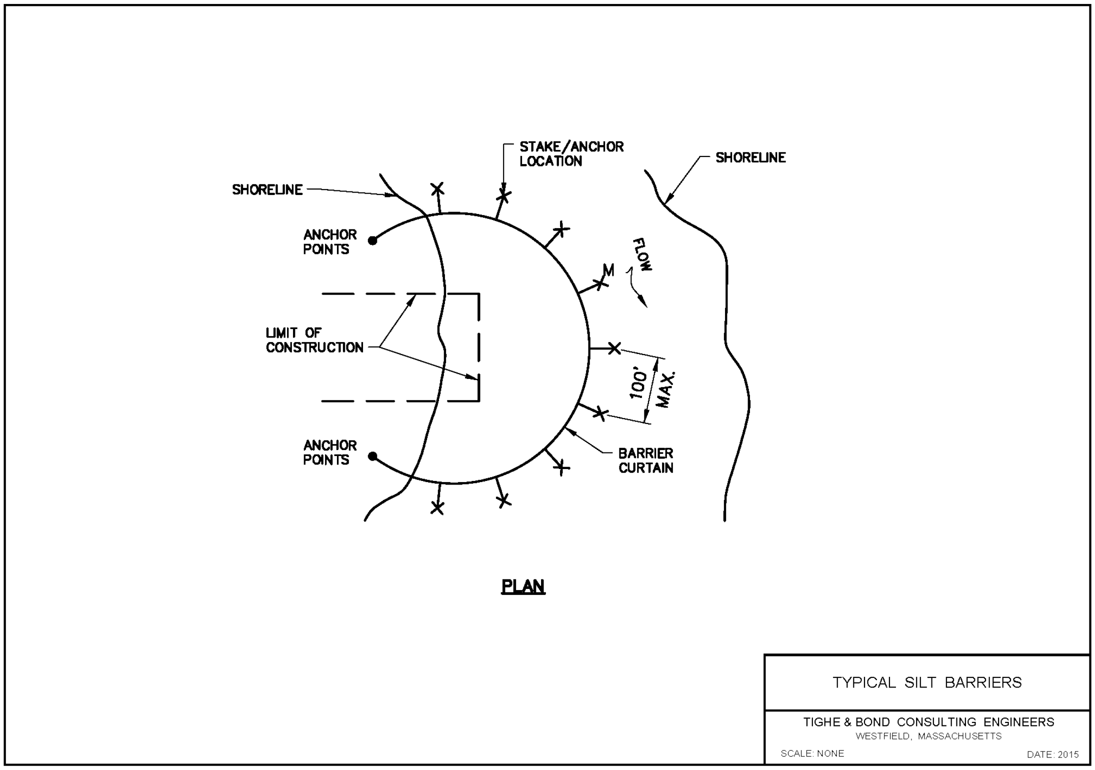
- Slant the barrier at an angle, not perpendicular to the flow. If the barrier will be exposed to reversing currents, anchor it on both sides.

Maintenance for both:

- Inspect daily for any rips or tears or turbidity in the stream flow. Repair immediately with overlapping pieces of geotextile fabric.

- Remove accumulated sediment from the base of the barrier. If necessary, dewater turbid water to an onshore filter bag before removing the barrier.

- Remove the barrier carefully when the work is completed and after suspended sediments have time to settle out.


STAKE/ANCHOR LOCATION
SHORELINE
SHORELINE
ANCHOR POINTS
FLOW
LIMIT OF CONSTRUCTION
100' MAX.
ANCHOR POINTS
BARRIER CURTAIN
PLAN
TYPICAL SILT BARRIERS
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2015

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APPENDIX B

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Appendix B

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Appendix B

B.1 Applicable Laws / Regulations

In Connecticut, there are no fewer than eight potentially pertinent regulatory programs associated with activities proposed in environmentally sensitive areas. The following list of laws and regulations are most likely to apply to electrical utility projects in the State.

- Connecticut Inland Wetlands and Watercourses Act (C.G.S. §§ 22a-36 through 22a-45a)
- Municipal inland wetland and zoning regulations
- Connecticut General Permit for Water Resource Construction Activities (C.G.S. §§ 22a-6, 22a-45a and 22a-378a)
- Connecticut Environmental Policy Act (C.G.S. §§ 22a-1a through 22a-1h)
- Connecticut Coastal Management Act (C.G.S. §§ 22a-359 through 22a-363; 22a-28 through 22a-35; 22a-90 through 22a-112; 33 U.S.C. § 1314)
- Connecticut Water Diversion Policy Act (C.G.S. §§ 22a-365 through 22a-379)
- Connecticut Endangered Species Act (C.G.S. §§ 26-303 through 26-315)
- Section 10 of the Rivers and Harbors Act of 1899 (C.G.S. §§ 22a-426; 33 U.S.C. § 403)
- Section 401 of the Clean Water Act (33 U.S.C. § 1251)
- Section 404 of the Clean Water Act (33 U.S.C. § 1344)

B.2 Geographic Areas Subject to Jurisdiction

The following areas are subject to regulatory jurisdiction by at least one of the regulatory programs discussed in this section: It is important to note that more than one jurisdictional resource type may be present at any given location.

- Inland wetlands, watercourses (rivers, streams, lakes, ponds), and floodplains
- Areas subject to municipal wetlands bylaws or ordinances. (These vary by town.)
- Coastal Resource Areas (beaches, dunes, bluffs, escarpments, coastal hazard areas, coastal waters, nearshore waters, offshore waters, estuarine embayments, developed shorefront, intertidal flats, islands, rocky shorefronts, shellfish concentration areas, shorelands, and tidal wetlands)
- Navigable waters
- Essential Fish Habitat (EFH)
- Rare species habitat as mapped by the Connecticut Natural Diversity Database

B.3 Applicable Regulatory Agencies

Activities subject to jurisdiction under the above-referenced programs will generally be subject to review by one or more regulatory agencies (refer to list below). Most stream and wetland crossings will require notification or consultation with municipal Inland Wetland and Watercourses Agencies, and may require permitting with the U.S. Army Corps of Engineers (Corps) and Connecticut Department of Energy & Environmental Protection (CT DEEP) under Sections 404 and 401 of the Clean Water Act. Coordination with CT DEEP may also be required for projects located within areas mapped by the Connecticut Natural Diversity Database. For work within tidal, coastal or navigable waters or in tidal wetlands, permitting will be required with the Connecticut Department of Energy & Environmental Protection (CT DEEP) Office of Long Island Sound Program (OLISP).

- Municipal Conservation Commissions
- Connecticut Department of Energy & Environmental Protection (CT DEEP) Bureau of Water Management, Inland Water Resources Division
- CT DEEP Wildlife Division
- CT DEEP Office of Environmental Review
- CT DEEP Office of Long Island Sound Programs (OLISP)
- United States Army Corps of Engineers (Corps) New England District

The State of Connecticut and the Federal Government define wetlands differently. According to the Inland Wetlands and Watercourses Act, inland wetlands are defined as "land, including submerged land, not regulated pursuant to Sections 22a-28 through 22a-35 of the Connecticut General Statutes, as amended, which consists of any of the soil types designated as poorly drained, very poorly drained, alluvial, and floodplain by the National Cooperative Soil Survey, as it may be amended from time to time by the United States Department of Agriculture Natural Resource Conservation Service. Such areas may include filled, graded, or excavated sites which possess an aquic (saturated) soil moisture regime as defined by the National Cooperative Soil Survey." State wetland identification is based solely on the presence of these soil types.

"Watercourses" means rivers, streams, brooks, waterways, lakes, ponds, marshes, swamps, bogs and all other bodies of water, natural or artificial, vernal or intermittent, public or private, which are contained within, flow through or border upon this state or any portion thereof. Intermittent watercourses shall be delineated by a defined permanent channel and bank and the occurrence of two or more of the following characteristics: (A) Evidence of scour or deposits of recent alluvium or detritus, (B) the presence of standing or flowing water for a duration longer than a particular storm incident, and (C) the presence of hydrophytic vegetation.

The Federal Government defines wetlands as "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Federal wetland identification is based on a three parameter approach, where a prevalence of hydrophytic vegetation, hydric soils, and wetland hydrology is used to make a wetland determination.

B.4 Maintenance, Repair, or Emergency Projects

Most regulatory programs contain provisions that allow normal maintenance of existing structures and/or response to emergency situations that require immediate attention.

Prior to commencement of new construction, all jurisdictional wetland areas within the work corridor should be delineated by a qualified wetland and soil scientist. The specialist shall delineate areas in accordance with the General Statutes of Connecticut (revised January 1, 2007) as set forth at Title 22a Chapter 440 "Inland Wetlands and Watercourses Act", the U.S. Army Corps of Engineers 1987 Wetland Delineation Manual, and any local inland wetland regulations, ordinances or bylaws that may exist. Refer to each set of regulations regarding applicable wetland definitions. Wetland areas shall be clearly demarcated using appropriate flagging tape or similar means. It is important to note that certain jurisdictional wetland areas in Connecticut can actually occur in uplands, such as floodplains. In addition, Upland Review Areas generally apply to work activities and vary in each community. This makes consultation with a wetland specialist particularly important.

B.4.1 Maintain, Repair and/or Replace

Exemptions or considerations for maintenance, repair, and/or replacement of existing electrical utility structures exist in some environmental regulations, but not all. The exemptions are limited to work related to existing and lawfully located structures where no change in the original structure or footprint is proposed. It is not for the selected contractor of a particular project to make a determination as to whether an activity is exempt. This determination will be made prior to work by the Eversource project manager, in consultation with Eversource environmental staff.

These exemptions/considerations are afforded at:

- CT Inland Wetlands & Watercourses Act (RCSA § 22a-39-4)
- CT General Permit (Section 3)
- CT Coastal Management Act (RCSA § 22a-363b)
- CT GP [33 CFR 323.4(a)(2)]
- CT Water Diversion Policy Act (RCSA § 22a-377(b)1)

B.4.2 Emergency Projects

Emergency provisions are generally afforded to activities that need to abate conditions that pose a threat to public health or safety. These provisions generally do not allow work beyond what is necessary to abate the emergency condition, and will generally require an after-the-fact permit. It is not for the selected contractor of a particular project to make a determination as to whether an activity is an emergency. This determination will be made prior to work by the Eversource project manager, in consultation with Eversource environmental staff.

It is important to note that invocation of an emergency provision does not release the project proponent from reporting requirements.

Emergency provisions are afforded at:

- CEPA (RCSA § 22a-1a-3)
- CT Coastal Management Act (RCSA § 22a-29)
- CT GP [33 CFR Part 323.4(a)(2)]

B.5 Municipal Permitting

Work within wetlands, watercourses and designated Upland Review Areas typically requires notification to municipal staff, (Department of Public Works and/or the Inland Wetland and Watercourse Agency staff). In October 1996 the Connecticut Department of Public Utility Control opened a docket (Docket Number 95-08-34) to conduct a generic investigation on the allocation of siting jurisdiction over utility plant facilities. This included an investigation as to whether local authorities (including local Inland Wetlands and Watercourses Agencies) have jurisdiction over public utility projects.

The investigation resulted in several orders which provide guidance on how public utility companies should coordinate with municipalities on the construction of new facilities, upgrades, significant maintenance activities, and routine maintenance activities.

- For the construction of new facilities, alterations to existing facilities (including upgrades) or significant maintenance involving substantial disturbance of soil, water or vegetation which would regularly fall under the review requirements of certain local authorities (ie. Planning and Zoning Authority; Inland Wetlands Commission; Public Works Department; Historic District Commission), the utility shall at least notify and consult with such local authority, or its designated agent or staff, toward the development of mutually agreeable schedules and procedures for the proposed activity.
- For routine maintenance activities or alterations to existing facilities (including upgrades) involving minor disturbance of soil, water or vegetation which would regularly fall under the review and approval requirements of certain local authorities, the utility shall make local authorities or their designated agent or staff aware of such ongoing activities.

B.6 CT Department of Energy & Environmental Protection

If the project requires formal permitting with the Corps (Category 2 or Individual Permit), copies of the application should be forwarded to CT DEEP for review under Section 401 of the Clean Water Act. The CT DEEP requires that a GP Addendum form be completed and submitted along with the Corps application. If the project qualifies as Category 1 under the Corps GP, the project also is granted authorization (Water Quality Certification, WQC) with no formal application under Section 401 of the Clean Water Act, provided the project meets the additional WQC general conditions. The general conditions commonly applicable to utility projects include:

- Prohibiting dumping of any quantity of oil, chemicals, or other deleterious material on the ground;

- Immediately informing the CT DEEP Oil and Chemical Spill Response Division at (860) 424-3338 (24 hours) of any adverse impact or hazard to the environment including any discharge or spillage of oil or chemical liquids or solids;

- Separating staging areas at the site from the regulated areas by silt fences or stray/hay bales at all times;

- Prohibiting storage of any fuel and refueling of equipment within 25 feet from any wetland or watercourse;

- Following the document "Connecticut Guidelines for Soil and Erosion Control," inspecting employed controls at least once per week, after each rainfall, and at least daily during prolonged rainfall, and correcting any deficiencies within 48 hours of being found.

- Prohibiting the storage of any materials at the site which are buoyant, hazardous, flammable, explosive, soluble, expansive, radioactive, or which could in the event of a flood be injurious to human, animal or plant life, below the elevation of the 500 year flood. Any other material or equipment stored at the site below this elevation must be firmly anchored, restrained or enclosed to prevent flotation. The quantity of fuel for equipment at the site stored below such elevation shall not exceed the quantity of fuel that is expected to be used by such equipment in one day.

- Immediately informing DEEP at (860) 424-3019 and the Corps at (617) 647-8674 of the occurrence of pollution or other environmental damage in violation of the WQC, and within 48 hours support a written report including information specified in the general conditions.

If the project falls within areas mapped by the Connecticut Natural Diversity Database, or is less than 0.50 miles upstream or downstream of a mapped area, a data request and possible coordination will be required with the Natural Diversity Database.

If a project is located within tidal, coastal or navigable waters of the state or in tidal wetlands, permitting may be required with the CT DEEP OLISP. For the routine maintenance of previously permitted structures or structures that were in place prior to June 24, 1939, no permitting is required. For significant maintenance of previously permitted structures or structures that were in place prior to June 24, 1939, a Certificate of Permission is required. For new projects a Structures, Dredging and Fill Permit and/or a Tidal Wetlands Permit may be required. The CT DEEP OLISP should be consulted prior to preparing permits to conduct a pre-application meeting and determine the appropriate permitting route.

B.7 U.S. Army Corps of Engineers

Work within wetlands and waters of the United States is subject to jurisdiction under Section 404 of the Clean Water Act, which is administered by the Corps. Work within navigable waters is also administered by the Corps under Section 10 of the Rivers and Harbors Act of 1899. The Corps has issued a General Permit (GP) which establishes categories for projects based on their nature of impacts. The current permit was issued on July 15, 2011, and expires on July 15, 2016. The permit will be reissued by July 15, 2016 for another five years. Applications are not required for Category 1 projects, but submittal of a Category 1 Form before the work occurs and submittal of a Compliance Certification Form within one month after the work is completed is required. The Category 1 Form and Compliance Certification Form entails self-certification by applicants that their project complies with the terms and conditions of Category 1 of the GP. Category 2 projects require the submittal of an application to the Corps, followed by a screening of the application by the Corps, the U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, National Marine Fisheries Service and CT DEEP, and consultation with the Connecticut Commission on Culture and Tourism and Tribal Historic Preservation Officers. Category 2 projects may not proceed until written approval from the Corps is received. Written approval is generally provided within 45 days of the multi-agency screening. After written approval is received, a Work-Start Notification Form must be submitted before the work occurs, and a Compliance Certification Form must be submitted within one month after the work is completed.

For work proposed within a FEMA floodway or floodplain, the Corps recommends that the applicant apply for and receive a Flood Management Certification (if required), prior to applying to the Corps. Additionally, applications for Category 2 inland projects that propose fill in Corps jurisdiction must include an Invasive Species Control Plan (ISCP), unless otherwise directed by the Corps.

An Individual Permit requires a formal permit application to be submitted to the Corps. The application is reviewed in detail by both state and federal agencies, and a Public Notice is released for public comment. Projects which trigger an Individual Permit generally result in significant impacts to wetlands and/or watercourses.

Stream and wetland crossings are only subject to jurisdiction under the Corps if there is **a discharge of dredge or fill material into wetlands or waters of the United States**. Equipment access through a stream or wetland with no structural BMP is not regulated by the Corps if there is no discharge of dredge or fill material (note that equipment rutting as a result of not using an appropriate BMP can be considered a "discharge of dredge material"). Similarly, the use of a timber or rail car bridge that extends from bank to bank with no stream impacts is not regulated by the Corps. Additionally, the use of timber mats and stone is considered "fill material" by the Corps, and must be calculated to determine overall impacts. Temporary mats are not counted towards the 1 acre threshold under Category 2 if they are adequately cleaned after previous use, removed immediately after completion of construction and disposed of at an upland site.

Maintenance, including emergency reconstruction of currently serviceable structures, is exempt from Corps jurisdiction and does not require formal permitting. Maintenance does not include any modification that changes the character, scope, or size of the original fill design. Emergency reconstruction must occur within a reasonable period of time after damage occurs to qualify for this exemption.

Stream and wetland crossings that involve the discharge of dredge and fill material may be conducted under Category 1 if the work complies with the general conditions and Category 1 criteria of the GP. The following are Category 1 criteria that are commonly applicable to stream and wetland crossings in utility rights of way. See Section 1.8 for additional criteria for culvert crossings:

- The work results in less than 5,000 square feet of impacts to wetlands or waters of the United States. Replacement of utility line projects with impacts solely within wetlands greater than 5,000 square feet may be eligible for Category 1 Authorization after consultation with the Corps about the specific project;

- Temporary fill, with the exceptions of swamp and timber mats, discharged to wetlands shall be placed on geotextile fabric laid on the pre-construction wetland grade. Unconfined temporary fill discharged into flowing water (rivers and streams) shall consist only of clean stone. All temporary fill shall be removed as soon as it is no longer needed, and disposed of at an appropriate upland site.
- Any unconfined in-stream work, including construction, installation or removal of sheet pile cofferdam structures, is conducted during the low-flow period between July 1 and September 30. However, installation of cofferdams, other than sheet pile cofferdams, is not restricted to the low-flow period;
- No work will occur in the main stem or tributary streams of the Connecticut River watershed that are being managed for Atlantic salmon (*Salmo salar*). (Work of this nature requires screening for potential impacts to designated Essential Fish Habitat.);
- The work does not result in direct or secondary impacts to Special Wetlands, Threatened, Endangered or Special Concern Species, or Significant Natural Communities identified by the Connecticut Natural Diversity Database. Work within 750 feet of vernal pools shall be minimized;
- The project does not require a Corps permit with associated construction activities within 100 feet of Special Wetlands;
- The project does not result in fill placed within a FEMA established floodway, unless the applicant has a State of Connecticut Flood Management Certification pursuant to Section 25-68d of the Connecticut General Statutes;
- The project does not result in fill placed within a FEMA established floodplain that would adversely affect the hydraulic characteristics of the floodplain;
- The project does not entail stormwater detention or retention in inland waters or wetlands;
- The project is not located in a segment of a National Wild and Scenic River System (includes rivers officially designated by Congress as active study status rivers for possible inclusion) or within 0.25 miles upstream or downstream of the main stem or tributaries to such a system;
- The project has no potential for an effect on a historic property which is listed or eligible for listing in the National Register of Historic Places;
- The project does not impinge upon the value of any National Wildlife Refuge, National Forest, or any other area administered by the U.S. Fish and Wildlife Service, U.S. Forest Service or National Park Service;
- Section 106 needs to be taken into account for all work that requires federal permitting – including Category 1;
- The project does not use slip lining, plastic pipes, or High Density Polyethylene Pipes (HDPP).
- Appropriate BMPs are employed in regards to heavy equipment in wetlands (General Condition 16) and sedimentation and erosion controls (General Condition 20).

- Disturbed inland wetland areas are restored in accordance with General Condition 18.

Stream and wetland crossings that involve the discharge of dredge and fill material may be conducted under Category 2 if the work complies with the general conditions and Category 2 criteria of the GP. The following are Category 2 criteria that are commonly applicable to stream and wetland crossings in utility right of ways. See Section 1.8 for additional criteria for culvert crossings:

- The work results in less than one acre of impacts to wetlands or waters of the United States;
- The project does not result in fill placed within a FEMA established floodplain that would adversely affect the hydraulic characteristics of the floodplain;
- The project does not entail stormwater detention or retention in inland waters or wetlands.
- Temporary fill, with the exceptions of swamp and timber mats, discharged to wetlands shall be placed on geotextile fabric laid on the pre-construction wetland grade. Unconfined temporary fill discharged into flowing water (rivers and streams) shall consist only of clean stone. All temporary fill shall be removed as soon as it is no longer needed, and disposed of at an appropriate upland site.
- Appropriate BMPs are employed in regards to heavy equipment in wetlands (General Condition 16) and sedimentation and erosion controls (General Condition 20).
- Disturbed inland wetland areas are restored in accordance with General Condition 18.

Stream and wetland crossings that cannot meet Category 1 or Category 2 criteria may require review under an Individual Permit. The Corps should be consulted before assuming an Individual Permit will be required, as exceptions can be made under certain circumstances.

B.8 Culvert Installation

New culvert installation or existing culvert replacements will require notification or consultation with municipal staffers which might include the Department of Public Works and/or the inland wetlands officer, and may require permitting with the Corps under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act of 1899, and the CT DEEP under Section 401 of the Clean Water Act. Coordination with CT DEEP may also be required for projects located within areas mapped by the Connecticut Natural Diversity Database. For work within tidal, coastal or navigable waters or in tidal wetlands, permitting will be required with the CT DEEP Office of Long Island Sound Program (OLISP).

B.8.1 Municipal Permitting

See Section 1.5 for general local permitting guidance.

- For the installation of new culverts and the replacement of culverts that involve substantial disturbance of soil, water or vegetation which would regularly fall under the review and approval requirements of certain local authorities (ie.

Planning and Zoning Authority; Inland Wetlands Commission; Public Works Department; Historic District Commission), the utility shall at least notify and consult with such local authority, or its designated agent or staff, toward the development of mutually agreeable schedules and procedures for the proposed activity.

- For the replacement of culverts involving only minor disturbance of soil, water or vegetation which would regularly fall under the review and approval requirements of certain local authorities, the utility shall make local authorities or their designated agent or staff aware of such ongoing activities.

B.8.2 CT Department of Energy & Environmental Protection

If the project requires formal permitting with the Corps, copies of the application should be forwarded to CT DEEP for review under Section 401 of the Clean Water Act. The CT DEEP requires that a PGP Addendum form be completed and submitted along with the Corps application.

If a culvert project falls within areas mapped by the Connecticut Natural Diversity Database, or falls within 0.50 miles upstream or downstream of a mapped area, a data request and possible coordination will be required with the Natural Diversity Database.

If a culvert project is located within tidal, coastal or navigable waters of the state or in tidal wetlands, permitting will be required with the CT DEEP OLISP. For new projects a Structures, Dredging and Fill Permit and/or a Tidal Wetlands Permit will be required. For replacement structures which were previously permitted, or which were in place prior to June 24, 1939, a Certificate of Permission may only be required, which entails a shorter permitting process.

B.8.3 U.S. Army Corps of Engineers

See Section 1.7 for general Corps permitting requirements. Open bottom arches, bridge spans or embedded culverts are preferred over traditional culverts and are required for Category 1 projects. However, where site constraints make these approaches impractical, the Corps should be consulted.

New bridge or open-bottom structure crossings may be conducted under Category 1 or Category 2 if the following criteria are met in addition to meeting any applicable general criteria listed in section 1.7 of this manual:

- The work spans at least 1.2 times the watercourse bank full width;
- The structure has an openness ratio equal to or greater than 0.25 meters;
- The structure allows for continuous flow of the 50-year frequency storm flows.

New culvert installations may be conducted under Category 1 if the work complies with the general conditions and Category 1 criteria of the GP. The following are Category 1 criteria that are commonly applicable to new culvert installations in utility right of ways:

- Work is conducted in accordance with the design requirements listed in Section 3.1.3 of the Best Management Practices Manual;
- Plastic and High Density Polyethylene Pipes (HDPE) are not used;

- The work results in less than 5,000 square feet of impacts to wetlands or waters of the United States;
- Any unconfined in-stream work, including construction, installation or removal of sheet pile cofferdam structures, is conducted during the low-flow period between July 1 and September 30, except in instances where a specific written exception has been issued by the Connecticut Department of Energy & Environmental Protection. However, installation of cofferdams, other than sheet pile cofferdams, is not restricted to the low-flow period;
- No open trench excavation is conducted within flowing waters. Work within flowing waters can be avoided by using temporary flume pipes, culverts, cofferdams, etc. to isolate work areas and maintain normal flows;
- The tributary watershed to the culvert does not exceed 1.0 square mile (640 acres);
- The culvert gradient (slope) is not steeper than the streambed gradient immediately upstream or downstream of the culvert;
- For a single box or pipe arch culvert crossing, the inverts are set not less than 12 inches below the streambed elevation;
- For a multiple box or pipe arch culvert crossing, the inverts of one of the boxes or pipe arch culverts are set not less than 12 inches below the elevation of the streambed;
- For a pipe culvert crossing, the inverts are set such that not less than 25% of the pipe diameter or 12 inches, whichever is less, is set below the streambed elevation;
- The culvert is backfilled with natural substrate material matching upstream and downstream streambed substrate;
- The structure does not otherwise impede the passage of fish and other aquatic organisms;
- The structure allows for continuous flow of the 50-year frequency storm flows;
- The work does not result in direct or secondary impacts to Special Wetlands, Threatened, Endangered or Special Concern Species, or Significant Natural Communities identified by the Connecticut Natural Diversity Database. Work within 750 feet of vernal pools shall be minimized;
- The project does not require a Corps permit with associated construction activities within 100 feet of Special Wetlands;
- The project does not result in fill placed within a FEMA established floodway, unless the applicant has a State of Connecticut Flood Management Certification pursuant to section 25-68d of the Connecticut General Statutes;
- The project does not result in fill placed within a FEMA established floodplain that would adversely affect the hydraulic characteristics of the floodplain;
- The project does not entail stormwater detention or retention in inland waters or wetlands;
- The project is not located in a segment of a National Wild and Scenic River System (includes rivers officially designated by Congress as active study status

rivers for possible inclusion) or within 0.25 miles upstream or downstream of the main stem or tributaries to such a system;

- The project has no potential for an effect on a historic property which is listed or eligible for listing in the National Register of Historic Places;
- The project does not impinge upon the value of any National Wildlife Refuge, National Forest, or any other area administered by the U.S. Fish and Wildlife Service, U.S. Forest Service or National Park Service.
- Appropriate BMPs are employed in regards to sedimentation and erosion controls (General Condition 20).

New culvert installations may be conducted under Category 2 if the work complies with the general conditions and Category 2 criteria of the GP. The following are Category 2 criteria that are commonly applicable to new culvert installations in utility right of ways:

- Work is conducted in accordance with the design requirements listed in Section 3.1.3 of the Best Management Practices Manual;
- The work results in less than one acre of impacts to wetlands or waters of the United States;
- The project does not result in fill placed within a FEMA established floodplain that would adversely affect the hydraulic characteristics of the floodplain;
- There is no practicable alternative location for the crossing that would have less environmental impacts;
- The use of a bridge or open-bottom structure is determined to be not practicable;
- For a single box or pipe arch culvert crossing, the inverts are set not less than 12 inches below the streambed elevation;
- For a multiple box or pipe arch culvert crossing, the inverts of one of the boxes or pipe arch culverts are set not less than 12 inches below the elevation of the streambed;
- For a pipe culvert crossing, the inverts are set such that not less than the pipe diameter or 12 inches, whichever is less, is set below the streambed elevation;
- The culvert is backfilled with natural substrate material matching upstream and downstream streambed substrate;
- The culvert has an openness ratio equal to or greater than 0.25 meters;
- The structure does not result in a change in the normal water surface elevation of the upstream waters or wetlands;
- The structure allows for continuous flow of the 50-year frequency storm flows;
- Appropriate BMPs are employed in regards to sedimentation and erosion controls (General Condition 20).

New culvert installations that cannot meet Category 1 or Category 2 criteria may require review under an Individual Permit. The Corps should be consulted before assuming an Individual Permit will be required, as exceptions can be made under certain circumstances.

In-kind replacement of culverts using the same materials is exempt from Section 404 of the Clean Water Act, and does not require permitting with the Corps. The Corps, however, should be consulted before assuming an activity is exempt from their jurisdiction. Consult with Siting and Permitting.

Bridge or open-bottom structure replacements may be conducted under Category 1 if the conditions for a new bridge or open-bottom structure replacement have been met. In addition, bridge or open-bottom structure replacements should not result in a change in the normal surface elevation of the upstream waters or wetland, and the replacement structure should have a riparian bank on one or both sides for wildlife passage. Culvert replacements may be conducted under Category 1 if the conditions for new culvert installation are met.

Bridge or open-bottom structure replacements may be conducted under Category 2 if the conditions for a new bridge or open-bottom structure replacement have been met. Culvert replacements may be conducted under Category 2 if the following conditions are met:

- The work results in 5,000 square feet to less than one acre of impacts to wetlands or waters of the United States;
- The use of a bridge or open-bottom structure is determined to be not practicable;
- For a single box or pipe arch culvert crossing, the inverts are set not less than 12 inches below the streambed elevation;
- For a multiple box or pipe arch culvert crossing, the inverts of one of the boxes or pipe arch culverts are set not less than 12 inches below the elevation of the streambed;
- For a pipe culvert crossing, the inverts are set such that not less than the pipe diameter or 12 inches, whichever is less, is set below the streambed elevation;
- The culvert is backfilled with natural substrate material matching upstream and downstream streambed substrate;
- The culvert has an openness ratio equal to or greater than 0.25 meters;
- The structure does not result in a change in the normal water surface elevation of the upstream waters or wetlands;
- The structure allows for continuous flow of the 50-year frequency storm flows.
- Appropriate BMPs are employed in regards to sedimentation and erosion controls (General Condition 20).

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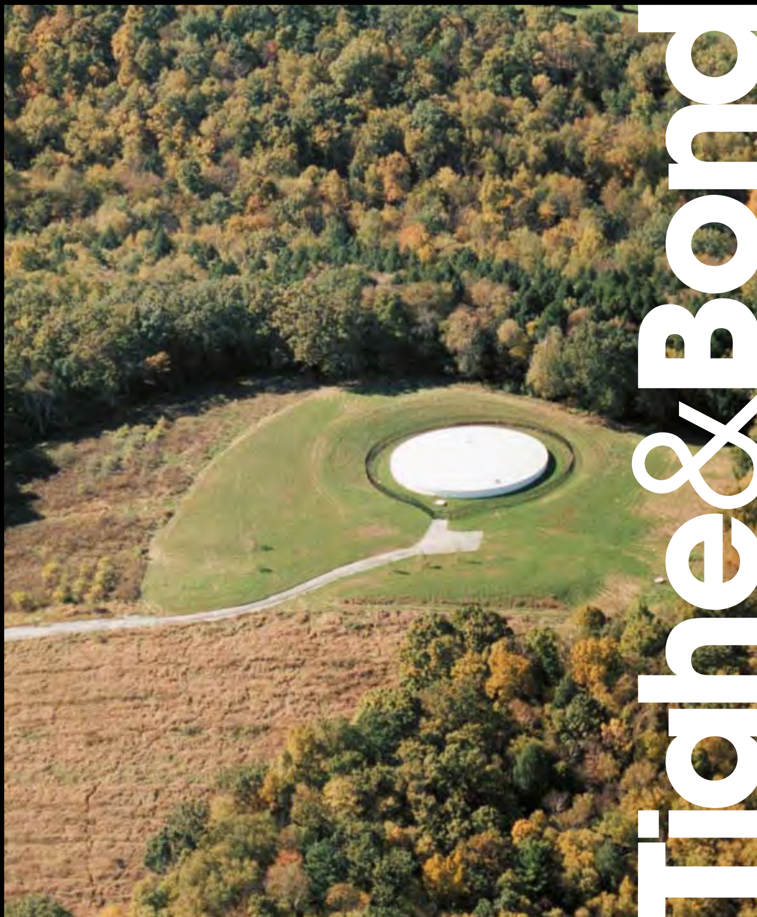

APPENDIX C

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Appendix C

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Appendix C

C.1 Applicable Laws/Regulations

In Massachusetts, there are no fewer than seven potentially pertinent regulatory programs associated with activities proposed in environmentally sensitive areas. The following list of laws and regulations are most likely to apply to electrical utility projects in the Commonwealth.

- Massachusetts Wetlands Protection Act (M.G.L. 131 § 40) (MA WPA)
- Municipal wetland bylaws (varies by town)
- Massachusetts Endangered Species Act (M.G.L. 131A) (MESA)
- "Chapter 91" Public Waterfront Act (M.G.L. c. 91 §§ 1 through 63)
- Massachusetts Environmental Policy Act (M.G.L. c. 30 §§ 61 through 62H) (MEPA)
- Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. § 403)
- Section 401 of the Clean Water Act (33 U.S.C. § 1251)
- Section 404 of the Clean Water Act (33 U.S.C. § 1344)
- Massachusetts Watershed Protection Act (M.G.L. 92A §1/2) (MA WsPA)

C.2 Geographic Areas Subject to Jurisdiction

The following areas are subject to regulatory jurisdiction by at least one of the regulatory programs discussed in this section: It is important to note that more than one jurisdictional resource type may be present at any given location. Further, while coastal wetland resource areas are jurisdictional under the Massachusetts Wetlands Protection Act (MAWPA), Eversource's territory does not extend into these areas at the present time. Therefore, these areas are not discussed in detail below.

- Massachusetts Wetlands Protection Act Resource Areas:
    - (Inland). Bordering Vegetated Wetland; Bank; Land Under Water Bodies and Waterways; Land Subject to Flooding; 200-foot Riverfront Area and associated 100-foot Buffer Zones.
- Areas subject to municipal wetlands bylaws or ordinances. (These vary by town.)
- Estimated and/or Priority Habitat of State-listed Rare Species
- Outstanding Resource Waters (ORWs = certified vernal pools and public surface drinking waters)
- Essential Fish Habitat (EFH)
- Cold Water Fisheries Resources (CFRs)
- Areas of Critical Environmental Concern (ACECs)
- Great Ponds
- Navigable waterways

- Quabbin Reservoir, Ware River and Wachusett Reservoir watersheds

C.2.1 Endangered Species

The Massachusetts Natural Heritage and Endangered Species Program (NHESP) maintains the current list of rare and endangered species and species of special concern in Massachusetts. Publically available data only allows for identification of Priority Habitats for the listed species, not specific species information. Priority Habitat location information is available on the NHESP website.

Species specific information is provided for planned linear maintenance activities which are submitted to NHESP in WMECO's annual O&M Plan. Projects/ activities which are not covered in the O&M Plan must file an independent request for information.

Applicable regulations and agency are listed below:

- Massachusetts Endangered Species Act: 321 CMR 10.00 – Division of Fish and Wildlife – NHESP

C.2.2 Vernal Pools

NHESP maintains a database of certified and potential vernal pools in Massachusetts. These data are available on the NHESP website and MassGIS. Certified vernal pools are considered Outstanding Resource Waters. The Corps' GP modified July 28, 2011 includes provisions for protection of certified vernal pools and potential vernal pools, including the vernal pool depression, the vernal pool envelope (area within 100 feet of the vernal pool depression's edge), and the critical terrestrial habitat (area within 100-750 feet of the vernal pool depression's edge). Temporary impacts associated with timber (construction) mats in previously disturbed areas of existing utility projects rights-of-way are exempt from GP requirements regarding work in the vernal pool envelope or critical terrestrial habitat, provided that a Vegetation Management Plan exists that avoids, minimizes and mitigates impacts to aquatic resources. Applicable regulations and agencies for certified vernal pools are listed below:

- Wetlands Protection Act: 310 CMR 10.00 – MassDEP and local Conservation Commissions

- 401 Water Quality Certification for Discharge of Dredged or Fill Material, Dredging, and Dredged Material Disposal in Waters of the U.S. within the Commonwealth: 314 CMR 9.00 – MassDEP

- Department of the Army General Permit Commonwealth of Massachusetts - Corps

C.2.3 Essential Fish Habitat and Wild & Scenic River Designation

Essential Fish Habitat is a habitat essential for spawning, breeding, feeding, or growth to maturity of federally managed species. This website provides more information: www.greateratlantic.fisheries.noaa.gov/habitat. Consultation with the Corps is recommended to confirm the location of Essential Fish Habitat with respect to a proposed project.

Currently portions of the Westfield River and its tributaries, the Farmington River, West Branch, portions of the Sudbury, Assabet, and Concord Rivers, and the Taunton River are designated as National Wild and Scenic Rivers (www.rivers.gov/wildriverslist.html) in

Massachusetts. The Lower Farmington and Salmon Brook and Nashua Rivers are under study to determine consideration for National Wild and Scenic designation (www.rivers.gov/study.html). The Corps reviews projects for impacts to both Essential Fish Habitat and National Wild & Scenic Rivers.

- Department of the Army General Permit Commonwealth of Massachusetts – Corps

C.2.4 Cold Water Fisheries Resources

The Massachusetts Division of Fisheries and Wildlife maintains a list of waters that are known to have cold water fisheries resources (CFRs). This list is useful in highlighting environmental sensitive areas which could be avoided during project planning. The MassDEP reviews projects for potential impacts to CFRs.

- 401 Water Quality Certification for Discharge of Dredged or Fill Material, Dredging, and Dredged Material Disposal in Waters of the U.S. within the Commonwealth: 314 CMR 9.00 – MassDEP

C.2.5 Outstanding Resource Waters

Outstanding Resource Waters include Certified Vernal Pools (CVPs), surface drinking water supplies and tributaries to surface drinking water supplies. CVPs are determined by NHESP and locations are available through MassGIS. Locations of surface water supplies and other Outstanding Resource Waters are also available through MassGIS. The applicable regulations and agency are listed below:

- 401 Water Quality Certification for Discharge of Dredged or Fill Material, Dredging, and Dredged Material Disposal in Waters of the U.S. within the Commonwealth: 314 CMR 9.00 – MassDEP

C.2.6 Historic and Cultural Resources

The Massachusetts Historic Commission (MHC) is the State Historic Preservation Office (SHPO) and is responsible for protecting the state’s historic and cultural resources. In addition, four Native American tribes have interests in Massachusetts, and the Board of Underwater Archaeological Resources (BUAR) protects underwater resources in Massachusetts’ lakes, ponds, rivers and coastal waters. Historic and cultural concerns are typically associated with maintenance activities that may require excavation (i.e. new poles, new roads, guy wire installations, etc.).

C.3 Applicable Regulatory Agencies

Activities subject to jurisdiction under the above-referenced programs will generally be subject to review by one or more regulatory agencies (refer to list below). New stream and wetland crossings not related to maintenance will require permitting with municipal Conservation Commissions, and may require permitting with the U.S. Army Corps of Engineers (Corps) and Massachusetts Department of Environmental Protection (MassDEP) under Sections 404 and 401 of the Clean Water Act. Any non-maintenance work within Land Under Water will require permitting with the MassDEP Wetland and Waterways Division. Coordination with the NHESP may also be required for projects located within areas mapped as priority and/or estimated habitat for state-listed rare species. For work within navigable waters, consultation may be required with the Massachusetts Office of Coastal Zone Management (MA CZM).

- Municipal Conservation Commissions
- Massachusetts Department of Environmental Protection (MassDEP) Wetlands and Waterways Program
- Massachusetts Division of Fish and Wildlife: Natural Heritage and Endangered Species Program (NHESP)
- Massachusetts Executive Office of Environmental Affairs (EOEA)
- United States Army Corps of Engineers (Corps) New England District
- Massachusetts Office of Coastal Zone Management (MA CZM)
- Massachusetts Division of Conservation and Recreation (MA DCR)

C.4 Maintenance, Repair, or Emergency Projects

Most regulatory programs contain provisions that allow normal maintenance of existing structures and/or response to emergency situations that require immediate attention.

C.4.1 Maintain, Repair and/or Replace

Exemptions or considerations for maintenance, repair, and/or replacement of existing electrical utility structures exist in some environmental regulations, but not all. The exemptions are limited to work related to existing and lawfully located structures where no change in the original structure or footprint is proposed. It is not for the selected contractor of a particular project to make a determination as to whether an activity is exempt. This determination will be made prior to work by the Eversource project manager, in consultation with Eversource environmental staff.

These exemptions/considerations are afforded at:

- MAWPA (M.G.L Chapter 131, § 40, paragraph 1)
- MAWPA regulations for Riverfront Area (310 CMR 10.58(6))
- MEPA regulations (301 CMR 11.01(2)(b)(3))
- 33 CFR Part 323.4(a)(2)
- MA 401 WQC (314 CMR 9.03(1))
- MESA (M.G.L. Chapter 131A, § 3; 321 CMR 10.14(5-7) and (12)
- MAWPA (350 CMR 11.05(11) and (12))
- National Pollutant Discharge Elimination System (NPDES), Construction General Permit (as modified effective February 16, 2012)

However, certain operations and maintenance activities which impact Waters of the United States are subject to Sections 401 and 404 of the Clean Water Act, per Sections 1.6 and 1.7 below.

C.4.2 Emergency Projects

Emergency provisions are generally afforded to activities that need to abate conditions that pose a threat to public health or safety. These provisions generally do not allow work beyond what is necessary to abate the emergency condition, and will generally require an after-the-fact permit. It is not for the selected contractor of a particular project to make a determination as to whether an activity is an emergency. This determination will be made prior to work by the Eversource project manager, in consultation with Eversource environmental staff.

It is important to note that invocation of an emergency provision does not release the project proponent from reporting requirements.

Emergency provisions are afforded at:

- MAWPA regulations (310 CMR 10.06)
- MEPA (301 CMR 11.00)
- MA 401 WQC (314 CMR 9.12)
- Chapter 91 (310 CMR 9.20)
- MESA (321 CMR 10.15)

C.5 Municipal Permitting

Work within wetlands, watercourses and Buffer Zones typically requires permitting with municipal Conservation Commissions. Work that entails "maintaining, repairing or replacing, but not substantially changing or enlarging, an existing and lawfully located structure or facility used in the service of the public and used to provide electric service" is exempt under the Massachusetts Wetlands Protection Act (MA WPA) per MGL Chapter 131 Section 40. However, individual municipalities may establish their own wetlands bylaws under Home Rule authority which could require permitting for operation and maintenance activities. The table below lists communities which have a wetland bylaw in which Eversource Energy operates and maintains infrastructure. Appropriate municipal permitting or notification should be completed in these towns as required prior to conducting operation and maintenance activities.

TABLE C-1
Eversource Energy Communities with Municipal Wetland Bylaws[1]

Community	Date of Bylaw	Utility Maintenance Exemption	Notification Required
Acton	7/8/2003	Yes	No
Amherst	9/27/2006	Yes	Yes
Ashland	5/6/2009	Yes	Yes
Auburn	5/1/2012	Yes	Yes
Bedford	1987/rev. 1995	Yes	Yes
Belchertown	5/3/2006	Yes	No
Bellingham	As of 12/2015	No	Yes
Bolton	5/7/2012	Yes	No
Brookline	12/2009 (regs)	Yes	Yes
Burlington	5/20/2013	Yes	Yes
Canton	4/29/1989	Yes	Yes
Carlisle	2009	Yes	No
Carver	As of 12/2015	Yes	Yes
Chicopee	4/3/2002	Yes	No
Chilmark	10/12/1993	No	Yes
Dedham	11/182013	Yes	Yes
Deerfield	11/6/1989	Yes	Yes
Dover	5/2/1994	Yes	Yes
East Longmeadow	10/1992	Yes	Yes
Framingham	4/26/2005	Yes	Yes
Grafton	5/11/1987	Yes	Yes
Greenfield	11/23/2001	Yes	No
Hadley	5/1/2008	No	Yes
Holden	2011	Yes	Yes
Hopkinton	5/2/1995	Yes	Yes
Hampden	8/5/1992	Yes	Yes
Holyoke	11/2005	Yes	Yes
Kingston	2004	No	Yes
Leicester	11/2015	Yes	Yes
Lexington	5/3/1982	No	Yes
Lincoln	3/24/2007	No	Yes
Longmeadow	10/2000	Yes	No
Ludlow	5/1/2002	Yes	No
Maynard	12/3/2005	Yes	Yes
Medway	7/2014	Yes	Yes
Milford	5/2010	Yes	No
Millis	5/13/1191	Yes	No
Millville	5/13/2013	Yes	Yes

Community	Date of Bylaw	Utility Maintenance Exemption	Notification Required
Natick	4/27/2000	Yes	No
Needham	9/1/1988	Yes	Yes
Norfolk	11/9/2010	Yes	Yes
Northampton	8/17/1989	Yes	Yes
Northborough	5/21/1990	Yes	Yes
Northbridge	5/6/2008	Yes	Yes
Pelham	5/2/1987	Yes	Yes
Pembroke	4/22/2008	Yes	No
Plympton	5/16/2012	Yes	Yes
Richmond	5/2015	Yes	Yes
Rochester	As of 12/2015	Yes	Yes
Sharon	As of 12/2015	Yes	No
Sherborn	2013	Yes	No
Shutesbury	5/2/1987	Yes	Yes
Southborough	4/10/1995	Yes	Yes
South Hadley	12/27/2005	No	Yes
Southwick	6/6/1989	Yes	Yes
Springfield	5/5/1993	Yes	Yes
Stoneham	4/2013	Yes	Yes
Stow	5/21/2003	No	Yes
Sunderland	4/27/1990	Yes	Yes
Sutton	5/11/2015	Yes	Yes
Truro	9/30/2010	No	Yes
Upton	2009	Yes	Yes
Walpole	2002	Yes	Yes
Wayland	5/1/2002	Yes	No
Wendell	3/10/1988	Yes	Yes
West Tisbury	6/3/2004	Yes	Yes
Westborough	10/20/2008	Yes	Yes
Westfield	5/20/2003	Yes	Yes
Westwood	1989	Yes	Yes
Wilbraham	5/27/1997	Yes	Yes
Worcester	7/1/2007	Partial	Yes

[1]According to Massachusetts Association of Conservation Commissions website as of December, 2015 and Town/City websites.
[2]Refer to municipal bylaws prior to conducting work in the community.

C.6 MA Department of Environmental Protection

Review and approval under the Commonwealth's Water Quality Certification Regulations is required for "*discharge of dredged or fill materials, dredging, and dredged material disposal activities in waters of the United States within the Commonwealth which require federal licenses or permits and which are subject to state water quality certification* *under 33 U.S.C. 1251, et seq. The federal agency issuing a permit initially determines the scope of geographic and activity jurisdiction"* (314 CMR 9.01(2)). An individual Water Quality Certification is required from the Massachusetts Department of Environmental Protection (MassDEP) for any activity identified at 314 CMR 9.04. In accordance with 314 9.04 (4) activities which are exempt from MGL Chapter 131 Section 40 but are subject to 33 U.S.C. 1251, *et seq.*, and will result in any discharge of dredge or fill material to bordering vegetated wetlands or land under water require an individual 401 Water Quality Certification. Temporary fill placed within an Outstanding Resource Water shall require the filing of an Individual WQC and a Variance Request when required pursuant to 314 CMR 9.06(3). Activities which are exempt from Section 404 of the Clean Water Act and any other federal permit or license do not require 401 authorization.

Work within certain Outstanding Resource Waters, such as certified vernal pools, are prohibited unless a variance is obtained under 314 CMR 9.08. However, under 314 CMR 9.06(3)(c), maintenance, repair, replacement and reconstruction but not substantial enlargement of existing and lawfully located structures or facilities including roads and utilities are allowed to occur within ORWs when authorized by a Water Quality Certification.

C.7 U.S. Army Corps of Engineers

Work within wetlands and waters of the United States is subject to jurisdiction under Section 404 of the Clean Water Act, which is administered by the Corps. Work within navigable waters is also administered by the Corps under Section 10 of the Rivers and Harbors Act of 1899. The Corps has issued a General Permits (GPs) for Massachusetts which establishes categories for projects based on their nature of impacts. The General Permits were issued on February 4, 2015, and expire on February 4, 2020. Certain minor activities are eligible for Self-Verification, which requires submittal of a Self-Verification Notification Form (SVNF) before the work occurs. Activities eligible for Self-Verification are authorized under the general permit and may proceed without written verification from the Corps as long as the SVNF has been submitted and the activity meets the terms and conditions of the applicable GPs. Activities requiring Pre-Construction Notification (PCN) require the submittal of an application to the Corps, followed by a screening of the application by the Corps, the U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, National Marine Fisheries Service, MassDEP, and consultation with the Massachusetts Historical Commission, Tribal Historic Preservation Officers and the Massachusetts Board of Underwater Archaeological Resources (BUAR). PCN projects may not proceed until written verification from the Corps is received. An Individual Permit requires a formal permit application to be submitted to the Corps. The application is reviewed in detail by both state and federal agencies, and a Public Notice is released for public comment. Projects which trigger an Individual Permit generally result in significant impacts to wetlands and/or watercourses.

Corps permitting does not apply to activities that fall under the maintenance exemption set forth at 33 CFR 323.4(a)(2) – Discharges Not Requiring Permits:

"Maintenance, including emergency reconstruction of recently damaged parts, of currently serviceable structures such as dikes, dams, levees, groins, riprap, breakwaters, causeways, bridge abutments or approaches, and transportation structures. Maintenance does not include any modification that changes the character,

scope, or size of the original fill design. Emergency reconstruction must occur within a reasonable period of time after damage occurs in order to qualify for this exemption."

Maintenance projects that occurred prior to the Corps jurisdiction over fill activities, or that were properly permitted, can proceed under the maintenance exemption noted above, provided that the same temporary fill areas are used. However, it is recommended that a formal determination be requested from the Corps to confirm these activities are exempt. The repair, rehabilitation or replacement of a previously authorized, currently serviceable structure or fill (with some minor deviations in the structure's configuration or filled area) are regulated under GP1 and subject to Self-Verification or Pre-Construction Notification.

Also, operation and maintenance related activities that do not meet the above exemption may qualify for Self-Verification. In that case, it is recommended that a copy of the SVNF be submitted to MassDEP.

The Massachusetts General Permits are listed below. GPs specifically applicable to utility projects are bolded and italicized:

GP1. Repair, Replacement and Maintenance of Authorized Structures and Fills
GP2. Moorings
GP3. Pile-Supported Structures, Floats and Lifts
GP4. Aids to Navigation, and Temporary Recreational Structures
GP5. Dredging, Disposal of Dredged Material, Beach Nourishment, and Rock Removal and Relocation
GP6. Discharges of Dredged or Fill Material Incidental to the Construction of Bridges
GP7. Bank and Shoreline Stabilization
GP8. Residential, Commercial and Institutional Developments, and Recreational Facilities
GP9. Utility Line Activities
GP10. Linear Transportation Projects Including Stream Crossings
GP11. Mining Activities
GP12. Boat Ramps and Marine Railways
GP13. Land and Water-Based Renewable Energy Generation Facilities and Hydropower Projects
GP14. Temporary Construction, Access, and Dewatering
GP15. Reshaping Existing Drainage Ditches, New Ditches, and Mosquito Management
GP16. Response Operations for Oil and Hazardous Substances
GP17. Cleanup of Hazardous and Toxic Waste
GP18. Scientific Measurement Devices
GP19. Survey Activities
GP20. Agricultural Activities
GP21. Fish and Wildlife Harvesting and Attraction Devices and Activities
GP22. Habitat Restoration, Establishment and Enhancement Activities
GP23. Previously Authorized Activities

In general the following cumulative thresholds apply for determining the level of Corps permitting required:

Table C-2
Corps Permits Limits

Resources	SV Limits (SV Eligible)	PCN Limits (PCN Eligible)	IP Limits (IP Required)
Non-tidal waters of the US	0 to 5,000 sf	5,000 sf to 1 acre	>1 acre
Tidal waters of the US	Not eligible	All discharges ≤1/2 acre	>1/2 acre
SAS in tidal waters of the US excluding vegetated shallows	Not eligible	All discharges ≤1,000 sf	>1,000 sf
SAS in tidal waters of the US consisting of vegetated shallows only	Not eligible	All discharges ≤100 sf (compensatory mitigation is required	>100 sf

*Special Aquatic Sites (SAS) consist of wetlands, mud flats, vegetated shallows, sanctuaries and refuges, coral reefs, and riffle and pool complexes. These are defined at 40 CFR 230 Subpart E.

Stream and wetland crossings are only subject to jurisdiction under the Corps if there is **a discharge of dredge or fill material into wetlands or waters of the United States**. Equipment access through a stream or wetland with no structural BMP is not regulated by the Corps if there is no discharge of dredge or fill material (note that equipment rutting as a result of not using an appropriate BMP can be considered a "discharge of dredge material"). Similarly, the use of a timber or rail car bridge that extends from bank to bank with no stream impacts is not regulated by the Corps. The use of timber mats, stone, and log corduroy is considered "fill material" by the Corps MA GPs, and must be calculated to determine overall impacts.

Maintenance, including emergency reconstruction of currently serviceable structures, is exempt from Corps jurisdiction and does not require formal permitting. Maintenance does not include any modification that changes the character, scope, or size of the original fill design. Emergency reconstruction must occur within a reasonable period of time after damage occurs to qualify for this exemption.

New culvert installation or existing culvert replacements may require permitting with local Conservation Commissions under the MA WPA, and may also require permitting with the Corps under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act of 1899, and the MassDEP under Section 401 of the Clean Water Act.

Stream and wetland crossings (including culvert installations) that involve the discharge of dredge and fill material may be conducted under Self-Verification if the following criteria are met.

- The use of construction mats of any area can be used to conduct activities that were previously authorized, authorized under Self-Verification, or not subject to regulation. Other temporary or permanent fill and associated secondary impacts must meet the SV limits.
- Authorized construction mats must be removed immediately upon work completion, and the wetlands must be restored per the General Conditions.
- The project has no potential for an effect on a historic property within the permit area or any known historic property that may occur outside the permit area.

- Any in-water work is limited to Time of Year windows appropriate for the spawning, breeding and migration of present species specified by the Massachusetts Division of Marine Fisheries. The TOY restriction for any inland stream not specified by MA DMF is October 1 to June 30. Activities within water proposed during these TOY restrictions are ineligible for Self-Verification authorization.
- The work does not result in direct or secondary impacts to Special Aquatic Sites.
- No work occurs in navigable waters of the U.S.
- Span streams or size culverts or pipe arches such that they are wider than bankfull width (BFW). Spans are strongly preferred as they avoid or minimize disruption to the streambed, and avoid entire streambed reconstruction and maintenance inside the culvert or pipe arch, which may be difficult in smaller structures. Footings and abutments for spans and scour protection should be landward of 1.2 times BFW. The width of culverts and arches at bankfull elevation should be ≥1.2 times BFW.
- Embed culverts or pipe arches below the grade of the streambed. This is not required when ledge/bedrock prevents embedment, in which case spans are required. The following depths are recommended to prevent streambed washout, and ensure compliance and long-term success:
    - ≥ 2 feet for box culverts and pipe arches, or
    - ≥ 2 feet and at least 25% for round pipe culverts.
- Match the culvert gradient (slope) with the stream channel profile.
- Construct crossings with a natural bottom substrate within the structure matching the characteristics of the substrate in the natural stream channel and the banks (mobility, slope, stability, confinement, grain and rock size) at the time of construction and over time as the structure has had the opportunity to pass substantial high flow events.
- Construct crossings with appropriate bed forms and streambed characteristics so that water depths and velocities are comparable to those found in the natural channel at a variety of flows at the time of construction and over time. In order to provide appropriate water depths and velocities at a variety of flows and especially low flows, it is usually necessary to reconstruct the streambed (sometimes including a low flow channel), or replicate or preserve the natural channel within the structure. Otherwise, the width of the structure needed to accommodate higher flows will create conditions that are too shallow at low flows. Flows could go subsurface within the structure if only large material is used without smaller material filling the voids.
- Openness, which is the is the cross-sectional area of a structure opening divided by its crossing length when measured in consistent units, is > 0.82 feet (0.25 meters).
- Banks on each side of the stream inside the crossing matching the horizontal profile of the existing stream and banks outside the crossing are recommended. To prevent failure, all constructed banks should have a height to width ratio of no greater than 1:1.5 (vertical:horizontal) unless the stream is naturally incised. Tie these banks into the up and downstream banks and configure them to be stable during expected high flows.

- The project is not located within a vernal pool depression, or vernal pool envelope, and does not individually or cumulatively impact greater than 25% of the vernal pool critical terrestrial habitat. It is feasible for some temporary impacts associated with the use of construction mats in previously disturbed right-of-ways to occur within the vernal pool envelope or critical terrestrial habitat if a Vegetation Management Plan demonstrates avoidance, minimization and mitigation impacts to aquatic resources.
- Culvert extensions do not qualify for Self-Verification.
- Culvert projects using slip lining do not qualify for Self-Verification, either as new work or maintenance activities.
- No open trench excavation in flowing waters. No work in riffles and pools.
- The project does not entail stream relocation.
- Work is not conducted within riffles or pools.
- Normal flows within the stream boundary's confines must be maintained, i.e., temporary flume pipes, culverts, cofferdams, etc.
- Water diversions (i.e., bypass pumping or water withdrawals) may be used immediately up and downstream of the work footprint.
- The project is (a) not located in the designated main stem of, or within 0.25 miles up or downstream of the designated main stem of, or in tributaries within 0.25 miles of the designated main stem of a National Wild and Scenic River System; (b) not in "bordering or contiguous wetlands" that are adjacent to the designated main stem of a National Wild and Scenic River; or (c) does not have the potential to alter flows within a river within the National Wild and Scenic River System.
- The project is not located within areas containing USFWS or National Marine Fisheries Service (NMFS)-listed species or critical habitat. The project is not "likely to adversely affect" listed species or habitat per the federal Endangered Species Act (ESA) or result in a "take" of any federally-listed threatened or endangered species of fish or wildlife.
- The project does not impinge upon the value of any National Wildlife Refuge, National Forest, National Marine Sanctuary, or any other area administered by the U.S. Fish and Wildlife Service, U.S. Forest Service or National Park Service.
- The project is not located on Corps properties and Corps-controlled easements.
- The project does not propose temporary or permanent modification or use of a federal project beyond minor modifications required for normal operation and maintenance.
- The project minimizes use of heavy construction equipment, and, where required, either has low ground pressure (typically less than 3 psi) or it must be placed on construction mats.
- Construction mats must be placed in the wetland from the upland or from equipment positioned on swamp mats if working within a wetland.
- Temporary fill must be stabilized. Unconfined, authorized temporary fill must consist of clean material that minimizes impacts to water quality. Temporary fill

placed during the growing season must be removed before the beginning of the next growing season. If temporary fill is placed during the non-growing season, it may remain throughout the following growing season but must be removed before the beginning of the next growing season.

- Appropriate erosion, sedimentation and turbidity controls are used and maintained during construction.

- Appropriate measures must be taken to minimize flooding to the maximum extent practicable.

Wetland and stream crossings may be authorized under Pre-Construction Notification if the following criteria are met:

- The work results in less than one acre of impacts to inland, non-tidal, wetlands or waters of the United States.

Stream and wetland crossings that cannot meet Self-Verification or Pre-Construction Notification criteria may require review under an Individual Permit. The Corps should be consulted before assuming an Individual Permit will be required, as exceptions can be made under certain circumstances.

C.8 Temporary Stream Crossings

C.8.1 U.S. Army Corps of Engineers

See Section C.7 for general Corps permitting requirements for stream crossings. To qualify for Self-Verification, temporary stream crossings (typically culverts) that are not spans must be designed in accordance with below.

1) Installed outside of the TOY restrictions and must be removed before the beginning of the TOY restriction of that same season. Temporary crossings that must remain into the TOY restriction will require Pre-Construction Notification review.

2) Impacts to the streambed or banks require restoration to their original condition (see "Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings," for stream simulation restoration methods). Use geotextile fabric or other appropriate bedding for stream beds and approaches where practicable to ensure restoration to the original grade. The requirements in GCs 17, 18 and 19 are particularly relevant.

3) Avoid excavating the stream or embedding crossings.

4) For Culverts:

    a. The water height should be no higher than the top of the culvert's inlet and the culvert is large enough to pass debris.

    b. Install energy dissipating devices downstream if necessary to prevent scour.

   c. The TOY restrictions in GC 18 and the restrictions in GC 17(f) are particularly relevant.

5) Removed upon the completion of work. Impacts to the streambed or banks requires restoration to their original condition using stream simulation methods.

In-kind repair, replacement and maintenance of currently serviceable, authorized fills are eligible for Self-Verification. However, the conditions of the original authorization apply, and minor deviations in fill design are allowed. In-kind repair and maintenance of culverts that includes an expansion or change in use requires Pre-Construction Notification. Replacement of non-serviceable fills, including an expansion or change in use, also requires Pre-Construction Notification. In-kind replacement using the same materials is exempt from Section 404 of the Clean Water Act, and does not require permitting with the Corps. The Corps, however, should be consulted before assuming an activity is exempt from their jurisdiction.

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APPENDIX D

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Horizontal directional drilling (HDD) for subsurface utility installations is considered to be the most effective and least environmentally damaging technique when compared to traditional mechanical dredging and trenching. This method ensures the placement of the pipeline at the target burial depth with no wetland or water body disturbance. HDD installation is the preferred method for crossing sensitive resources–the alternative is open cut trenching.

The HDD procedure uses bentonite slurry, a fine clay material as a drilling lubricant. Directional drilling has the small potential to release bentonite slurry into the surface environment through frac-outs. This term describes the situation caused when the drilling head and its accompanying inert clay lubricant slurry, hits a subterranean fractured substrate. When the pressurized lubricant slurry reaches the fracture it can follow the fracture up or otherwise force itself to the surface or into the water if drilling is occurring under a waterbody. If a "frac-out" occurs under these water features, the potential exists for the inert clay (a non-toxic bentonite-based substance) to be released into the water column. In large quantities, the release of drilling mud into a waterbody could affect fisheries or other aquatic organisms by settling and temporarily inundating the habitats used by these species. Properly monitoring the slurry pressures and amounts significantly decreases risk of significant quantities of drilling fluid being released into the environment.

Frac-out is most likely to occur near the bore entry and exit points where the drill head is shallow. Should a frac-out occur during HDD operations, the following measures will be taken.

- Temporarily suspend forward drilling progress.
- Monitor frac-out for 4 hours to determine if the drilling mud congeals. (Bentonite will usually harden, effectively sealing the frac-out location.)
- If drilling mud congeals, take no other action that would potentially suspend sediments in the water column.
- If drilling mud does not congeal, erect appropriate isolation/containment measures (i.e. turbidity curtains and/or underwater boom and curtain).
- If the fracture becomes excessively large, a spill response team would be called in to contain and clean up excess drilling mud in the water. Phone numbers of spill response teams in the area will be on site.
- Following containment, evaluate the current drilling profile (i.e. drill pressures, pump volume rates, drilling mud consistency) to identify means to prevent further frac-out events.
- If the fracture is mitigated and controlled, forward progress of the drilling may resume.

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Appendix D: Post-Construction Electric and Magnetic Field Monitoring Plan

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I. Introduction and Purpose

In accordance with the November 9, 2017 Decision and Order of the Connecticut Siting Council (the "Council") in Docket 461A, the Connecticut Light & Power Company dba Eversource Energy (the "Company") proposes the following post-construction electric and magnetic field measurement plan for the Greenwich Substation and Line Project (the "Project"). The Project includes the construction and operation of a new approximately 2.3-mile underground, double-circuit, 115-kilovolt ("kV") transmission line, consisting of cross-linked polyethylene ("XLPE") cable, as well as modifications to the existing Eversource Cos Cob Substation and the construction of a new Greenwich Substation Located at 290 Railroad Ave in Greenwich, CT.

A primary purpose for electric and magnetic field ("E & MF") measurements near transmission lines and substations is to make comparisons to levels predicted by calculations. This purpose is best served for an underground transmission line by selecting post-construction measurement locations where conductor configurations and depths are typical and representative, and where few if any confounding field sources and objects exist. Because there are no external electric fields associated with underground cables, the Company proposes to measure electric fields only at Cos Cob Substation.

A secondary purpose for such measurements can be to make comparisons between levels measured at points of interest before and after new line construction. However, those points of interest may not be at locations which best serve the primary purpose. Also, measurements of magnetic fields should not be so compared to predicted levels because power-flow circumstances can be significantly different at the times of these before and after measurements.

II. Measurement Locations

The Company's proposed measurement locations for electric and magnetic fields along the Project are listed in Table 1, below, and are illustrated on the aerial-photography based maps in Attachment G.1. The identified measurement locations were selected to provide representative data regarding the underground portions of the transmission line, including near Cos Cob and Greenwich substations. The table also identifies locations which measurements will be performed at each location.

Table 1
Project Post-Construction E&MF Measurement Locations

Site	Municipality	EF	MF	Location
1	Greenwich	X	X	Cos Cob Substation
2	Greenwich		X	Wood Road
3	Greenwich		X	Arch Street
4	Greenwich		X	Greenwich Substation (290 Railroad Ave)

Additional considerations in the selection of the measurement locations are as follows:

Measurement Location Characteristics and Criteria
The Company chose at least one readily accessible measurement location on transmission line route and around both substations.

At each of the two-line measurement locations listed in Table 1, measurements will be made on public roadways, and not on nearby private property outside of the public way, absent landowner approval.

To the extent possible, the Company chose measurement locations where: (1) cable configurations and depths are typical and representative; and (2) where possible, few if any confounding sources, such as local distribution lines, and objects exist, other than the existing substations and parallel distribution lines.

For the locations selected to meet the criteria identified previously, the Company will measure magnetic fields along a transect (i.e., profile) passing perpendicularly above the underground transmission line of the new 115-kV line. At each listed location, the measurement path will extend to a minimum of 25 feet from either side of the new transmission line.

The Company will take a post-construction measurement of magnetic fields twice at each of the listed locations within 10 months of commencement of new 115-kV line operation. In addition, the Company will take electric field measurements along around the perimeter of Cos Cob Substation at least once within 10 months of commencement of 115-kV line operation.

III. Measurement Instrumentation and Recording

The Company will record all electric and magnetic field measurements at a height of one meter (3.28 feet) above ground in accordance with the industry standard protocol for taking measurements near power lines (IEEE Std. 644-1994 [R2008], "*IEEE Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields From AC Power Lines*").

The resultant magnetic field will be measured with a 3-axis, recording digital meter (EMDEX II). Electric fields will be measured with an E-Probe attachment accessory to the EMDEX II meter. This accessory enables the EMDEX II to make single-axis measurements of the electric field. Both the EMDEX II magnetic field meter and the E-probe accessory meet the IEEE instrumentation standard for obtaining valid and accurate field measurements at power line frequencies (IEEE Std. 1308-1994, *"IEEE Recommended Practice for Instrumentation: Specifications for Magnetic Flux Density and Electric Field Strength — 10 Hz to 3 kHz."*) With this instrumentation, magnetic fields can be recorded continuously while walking and then plotted, whereas electric fields can be measured at spots and then recorded by hand in a data table and then plotted.

IV. Reporting

Within twelve months of the in-service date of the new 115-kV line, the Company will provide to the Council a report on these measurements with "true-up" comparisons to predicted values.

"True-ups" are electric and magnetic field calculations that are based on site-specific conditions, including the actual conductor heights and depths at a location at the time the measurement is made, current flows on the lines at the time the measurement is made, and the terrain. These calculations are then compared with the measurements taken at the location. True-up comparisons of measurements with calculations will be performed and reported for some locations to demonstrate model accuracy

The report will also include aerial photographs from Google Earth to mark each measurement location. For each magnetic field measurement, the coincident transmission line currents, as recorded by the CONVEX SCADA system, will be noted and reported. Additionally, for each measurement location, the size of transmission line conductor types will be reported.

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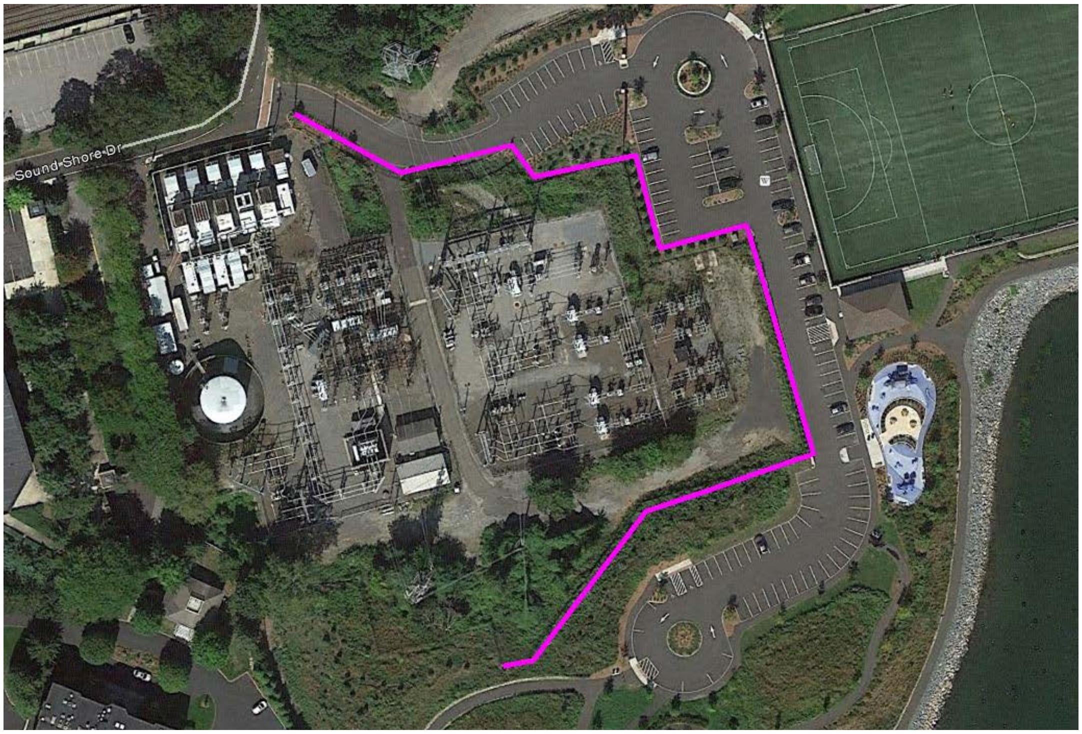
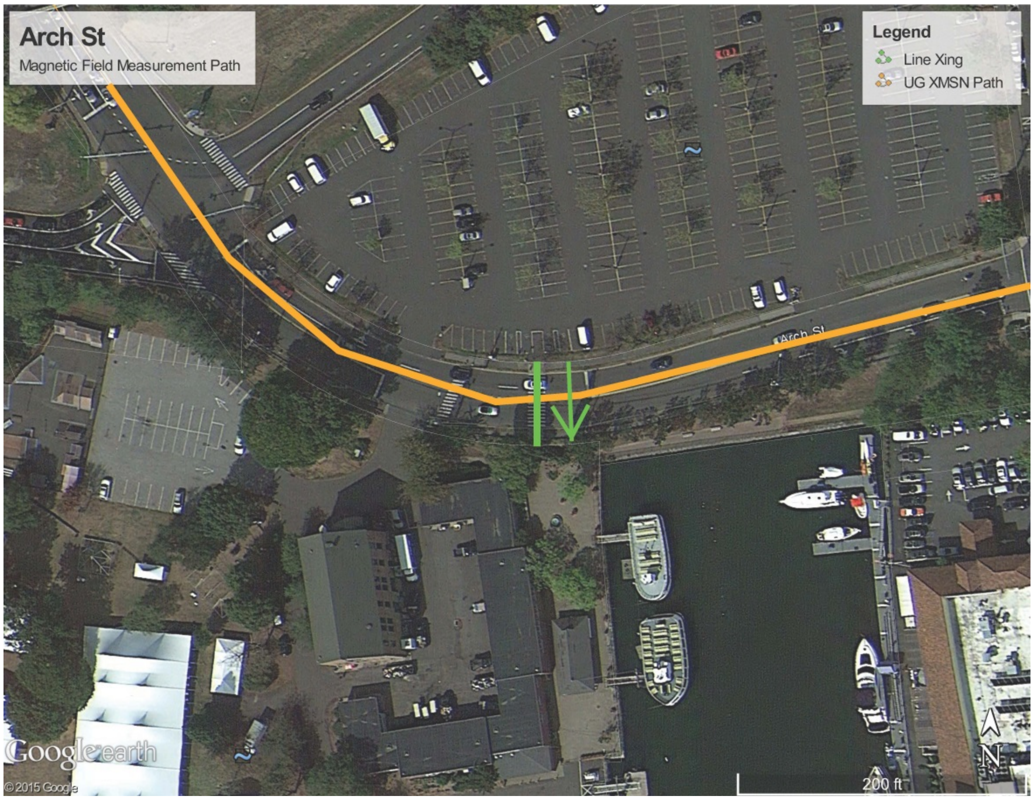
ATTACHMENT G.1
GOOGLE EARTH AERIAL IMAGES
OF PROPOSED POST-CONSTRUCTION E&MF MEASUREMENT LOCATIONS

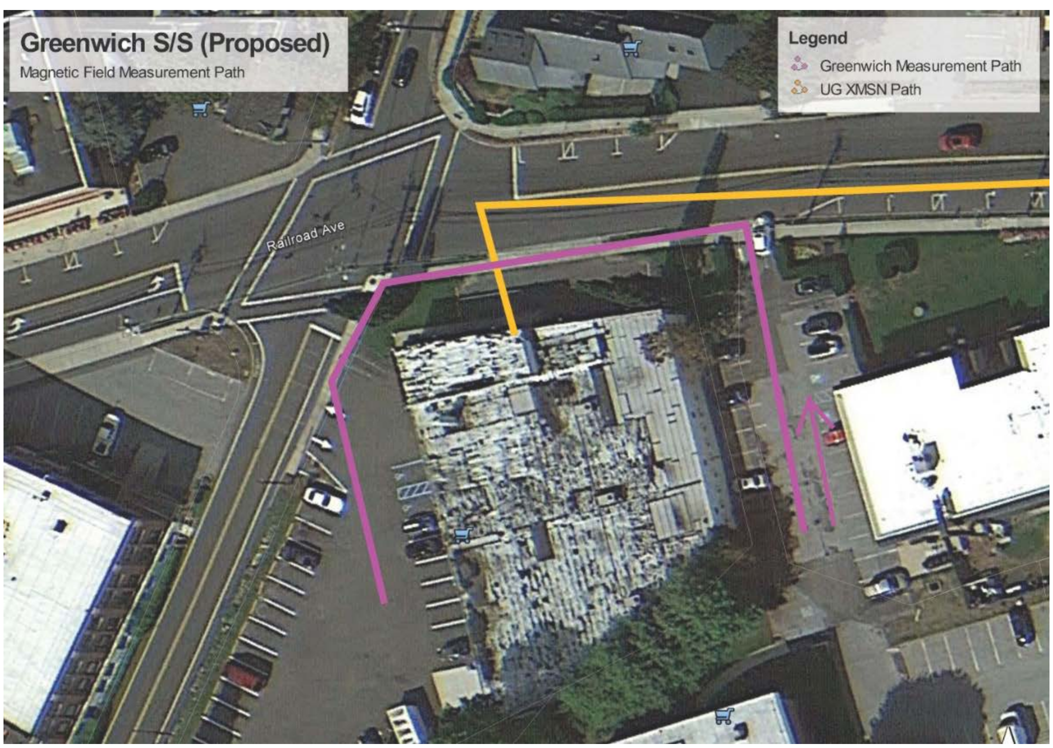


Cos Cob Substation (Greenwich, CT)

Wood Road (Greenwich, CT)



Arch St (Greenwich, CT)



Greenwich Substation (Greenwich, CT)