

**U.S. Army
Corps of Engineers**
New England District
Concord, Massachusetts

**SPECIFICATIONS FOR PHASE 2
STATIONS 527+60 TO 543+50
1.5-MILE REACH REMOVAL ACTION**

DCN: GE-022004-ACBA

February 2004

**Site-Specific Environmental Remediation Contract
General Electric (GE)/Housatonic River Project
Pittsfield, Massachusetts**

Contract No. DACW33-00-D-0006
Task Order 0005

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STATIONS 527+60 TO 543+50,
1.5-MILE REACH REMOVAL ACTION**

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Prepared for

**U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT**
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Prepared by

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February 2004

W. O. No. 20125.257.103.1641

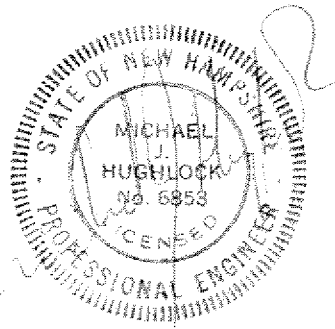
Final Specifications for Phase 2
Stations 527+60 to 543+50
1.5-Mile Reach Removal Action
Site-Specific Environmental Remediation Contract
General Electric (GE)/Housatonic River Project
Pittsfield, Massachusetts
Stamp Sheet

Specifications Sections: 01010, 01025, 01330, 01410, 10100, 11800



Weston Solutions, Inc.
Richard Anthony. Delano, P.E.

Specifications Sections: 11000, 15064

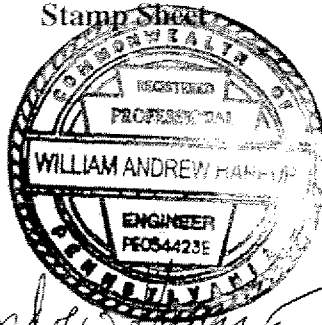


Weston Solutions, Inc.
Michael Hughlock, P.E.

Final Specifications for Phase 2
Stations 527+60 to 543+50
1.5-Mile Reach Removal Action
Site-Specific Environmental Remediation Contract
General Electric (GE)/Housatonic River Project
Pittsfield, Massachusetts

Stamp Sheet

Specifications Section: 02300



Andrew Harpur 2/20/04

Weston Solutions, Inc.
William Andrew Harpur, P.E.

TABLE OF CONTENTS

Section	Title	Status
DIVISION 1-GENERAL REQUIREMENTS		
01010	Summary of Work	Revised
01015	General Conduct of Work	See October 2003 Specs
01025	Measurement and Payment and Bid Schedule	Revised
01080	Codes and Standards	See April 2003 Specs
01090	Abbreviations and Symbols	See April 2003 Specs
01300	Construction Progress and Schedules	See April 2003 Specs
01330	Submittal Procedures and Register	See April 2003 Specs for Text, Register Revised
01340	Construction Surveys	See October 2003 Specs
01355	Environmental Protection	See October 2003 Specs
01410	Environmental and Conditions Monitoring	Revised
01451	Contractor Quality Control	See October 2003 Specs
01500	Temporary Construction Facilities	See April 2003 Specs
01562	Dust Control	See April 2003 Specs
DIVISION 2-SITE WORK		
02111	Handling of Excavated Material and Backfill	See October 2003 Specs
02230	Clearing and Grubbing and Site Preparation	See October 2003 Specs
02300	Earthwork	Revised
02370	Stormwater and Erosion Control: In-River Work	See October 2003 Specs
02371	Erosion Control-Support Areas, Access Roads, and Staging Areas	See April 2003 Specs
02372	Contingency Plan Specification for Managing NAPL Contamination Encountered During	See October 2003 Specs

TABLE OF CONTENTS (Continued)

Section	Title	Status
	Construction Activities	
02450	Cellular Confinement System ("Geocell")	See April 2003 Specs
02930	Bank Revegetation Phase 2	Revised
DIVISION 3-CONCRETE		
03100	Structural Concrete Formwork	See April 2003 Specs
03200	Concrete Reinforcement	See April 2003 Specs
03250	Expansion Joints, Contraction Joints, and Waterstops	See April 2003 Specs
03300	Cast-in-Place Structural Concrete	See April 2003 Specs
03410	Structural Precast Concrete	See April 2003 Specs
DIVISION 10-SPECIALTIES		
10100	Traffic Control	Revised
DIVISION 11-EQUIPMENT		
11000	Housatonic River Bypass Gravity Flow System	Revised
11160	Slide Gates	See April 2003 Specs
11800	Water Treatment System	Revised
DIVISION 15-MECHANICAL		
15064	Plastic Pipe	Revised

TABLE OF CONTENTS (Continued)

Section	Title	Status
Attachment 1	Project ARARs Tables	See April 2003 Specs
Attachment 2	Letter Regarding Absence of Threatened and Endangered Species in the 1 ½-Mile Reach	See April 2003 Specs
Attachment 3	State Register of Historic Places	See April 2003 Specs

DIVISION 1—GENERAL REQUIREMENTS

FINAL

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 SCOPE OF WORK

These Drawings and Specifications describe a portion of Phase 2 of a Removal Action within the 1.5-Mile Reach of the Housatonic River, to be conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The design drawings and specifications generally cover Phase 2 excavation and backfilling/restoration from approximately Station 527+60 (approximately 530 feet downstream of the Elm Street Bridge) to Station 543+50 (downstream side of the Dawes Avenue Bridge). The specific scope of work included in Section 01025 MEASUREMENT AND PAYMENT AND BID SCHEDULE is from approximately Station 527+60 to a point approximately 150 feet upstream of the Dawes Avenue Bridge (approximately Station 541+50) . The general work activities included in the Drawings and Specifications include site preparation, surveying, monitoring, river diversion, dewatering and water treatment, soil and sediment excavation and disposal, river channel restoration, and site restoration.

The removal action addresses polychlorinated biphenyl (PCB)-contaminated riverbank soil and riverbed sediments that have been determined to exceed allowable risk levels. To accomplish excavation and removal of these materials, a temporary dam installed at Station 514+00 will impound the river during relatively low flows (approximately 200 cfs as measured at the Coltsville U.S. Geological Survey [USGS] gauging station).

The existing river diversion system consists of a removable stop log dam and a piping system consisting of 54-inch high-density polyethylene (HDPE) pipe, and associated valves, controls, and other appurtenances. This work scope includes the operation and maintenance of these items and extension of the 54-inch HDPE pipes to accomplish the work from approximately Station 527+60 to Station 541+50.

The temporary dam/piping system, including all necessary equipment and structures, will be operated and maintained by the Excavation Subcontractor. While the dam is in place, the river water upstream of the dam will be diverted into pipes around the downstream work area and returned to the river downstream. Diversion of river water will be accomplished using gravity flow. In general, each work cell or excavation will be segregated from the river both at the upstream and downstream ends by secondary, movable dams as necessary throughout Phase 2. Once an excavation area is prepared, it will be dewatered and subsequently surveyed, and soil and sediment within the area will be excavated and removed. Because the gravity diversion pipes will rest in the riverbed, half of the riverbed will be completed before it is necessary to move the pipe to the restored portion of the river. In areas where access is limited, ramps constructed of earth, concrete blocks, and large timbers or other suitable means will be used to allow equipment to cross the pipes. In general, when river flows

FINAL

exceed or are expected to exceed the capacity of the diversion system, excavation will be suspended, the work areas will be secured and prepared for flooding, and the temporary dam, or a portion of it, will be removed.

In general, soil and sediment will be excavated to a depth of 1 to 3 feet in layers of 1-foot minimum thickness by disposal category (Toxic Substances Control Act [TSCA] or non-TSCA) as noted on the Drawings. Specific excavation depths for each area are indicated on the Drawings. After excavation and removal is completed within a particular area, the removed soil and sediment will be replaced with appropriate backfill materials and hard structures, and restoration of the banks via replanting and installation of slope reinforcing structures will be conducted. Riverbed habitat enhancement structure installation will follow the completion of Phase 2 and is not included as part of this Scope of Work. Excavated materials will be segregated at the soil staging areas before disposal in accordance with their pre-excavation classification (TSCA or non-TSCA). TSCA materials will be disposed of on-site at the Building 71 Landfill. Non-TSCA materials will be disposed of on-site at the Hill 78 Landfill or re-characterized as necessary for off-site disposal. In general, work will proceed sequentially down the river, with each area being successively isolated, remediated, backfilled, and restored.

1.2 DIVISION OF WORK

The General Contractor for the work is Weston Solutions, Inc. (WESTON). WESTON has formed a team of subcontractors with differing specialties to accomplish the project. Table 01010-1 provides a breakdown of the major construction work tasks and entities that are expected to conduct them. WESTON and each of its subcontractors is responsible for complying with all contract Quality Control/Quality Assurance and Safety and Health requirements.

FINAL

Table 01010-1

**1.5-Mile Removal Action—Phase 2
Station 527+60 to Station 543+50
Division of Major Work Tasks**

Work Task	Executing Party
Out-of-River Site Preparation	Sevenson (Excavation Subcontractor)
River Diversion System Operation and Maintenance	Sevenson
Soil/Sediment Excavation	Sevenson
Material Transport from Excavation to Stockpile Area, Stockpile Area Management, and Material Transport from Stockpile Area to On-Plant Consolidation Areas (OPCAs)	Sevenson
Off-Site Transportation and Disposal of Excavated Materials	Charter
Water Treatment	Sevenson
Restoration—Revegetation and Hard Structures	Sevenson
Restoration – Plant Installation	WESTON/Planting Subcontractor
Surveying	WESTON
Site Monitoring	WESTON or Subcontractor

The work division depicted above forms part of the basis for the structure of the Drawings and Specifications, and in particular, the Measurement and Payment specification section.

1.3 MAJOR WORK TASK DESCRIPTIONS

- a. Site Preparation—This activity will include, but not be limited to, clearing (and grubbing as necessary) for access roads and staging areas(not shown on plans, to be determined following submittal of Excavation Subcontractor’s Excavation Plan); clearing on riverbanks; building of access roads and staging areas/stockpile areas, including truck wash pads and decontamination pads; out-of-river erosion control measures; and coordination and maintenance of traffic control and details (Excavation Subcontractor).
- b. River Diversion System Operation and Maintenance—The temporary dam/piping system will be operated and maintained (including removal and restoration of stop logs, monitoring of river levels, and emergency response activities related to high flow events). This activity will include operation and maintenance of the removable

FINAL

dam and extension of the 54-inch HDPE river diversion pipes and other associated support equipment and systems for the river diversion system. (Excavation Subcontractor).

- c. Soil/Sediment Excavation—This activity will include, but not be limited to, in-river site preparation (including those activities incidental to providing adequate access to the river, e.g., crane/excavator pad construction and removal), secondary dam installation and removal (includes on-site handling of removed material), temporary and permanent outfall relocation/redirection as described in the Drawings and as necessary, cell dewatering and conveyance of water to the water treatment plant, in-river erosion control measures, soil and sediment excavation and removal and loading into trucks for transport, moving of 54-inch HDPE pipes as necessary to accomplish excavation, testing (excluding chemical analyses, which will be performed by the General Contractor) and supply of backfill, backfilling excavated areas, and placement of bank and riverbed armor and geocell systems as shown on the Drawings (Excavation Subcontractor).
- d. Material Transport from Excavation to Stockpile Area, Stockpile Area Management, and Material Transport from Stockpile Area to OPCAs—These activities include, but are not limited to, transport of material from the excavation area (via direct loading from in-river excavating equipment) to stockpile areas, maintenance and management of the stockpile areas, transport of contaminated material from stockpile areas to GE's OPCAs, load-out of material for off-site transport, and transport of clean backfill from borrow locations to the river work areas for placement (Excavation Subcontractor).
- e. Off-Site Transportation and Disposal of Excavated Materials—This activity includes off-site transportation and disposal of materials classified as non-TSCA. All required manifesting and other paperwork, coordination with disposal facilities, and coordination with the Excavation Subcontractor and the General Contractor are included in this task (Charter).
- f. Water Treatment—This activity includes, but is not limited to, operation and maintenance to treat water pumped from the excavation cells to meet applicable discharge standards and return of treated water to the river. Includes installation and maintenance of discharge structure(s) to minimize erosion in accordance with Applicable or Relevant and Appropriate Requirements (ARARs) (Excavation Subcontractor).
- g. Restoration (Revegetation and Hard Structures)—This activity includes, but is not limited to, seeding and erosion control measures for upper bank areas as shown on the Drawings and Specifications (Excavation Subcontractor).
- h. Restoration (Plant Installation)—This activity includes, but is not limited to, providing, installing, and maintaining all containerized plants and cuttings as required (General Contractor/Planting Subcontractor).

FINAL

- i. Surveying—This activity includes, but is not limited to, surveying of riverbed and riverbank elevations, and locations of relevant structures at several junctures during the construction work. This will include pre-excavation survey of dewatered areas, interim surveys to determine excavated amounts as a basis for payment and respective amounts of TSCA and non-TSCA regulated materials, and final survey after backfilling and restoration (General Contractor).
- j. Site Monitoring—This activity includes, but is not limited to, a number of different types of monitoring activities to be conducted before, during, and following construction. Includes air monitoring; water column monitoring; vibration monitoring; settlement monitoring; water treatment system testing; all chemical testing of backfill, nonaqueous phase liquid (NAPL)-impacted material, and other material generated during the work; and conditions monitoring, as described in detail in the specifications (General Contractor).

END OF SECTION

FINAL

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 BASIS OF PAYMENT

- a. The following paragraphs describe the measurement and payment for work to be performed under the respective items listed in the Bid.
- b. Each unit or lump sum price stated in the Bid shall constitute full compensation for each completed item of the work as indicated on the Drawings and as specified. Quantities on the attached bid schedule are based upon excavation and restoration work to be performed between Stations 527+60 and 541+50 and pipe installation to be completed between approximately Stations 528+00 and 542+00.

The actual number of units of each unit price item of work may be more, less, or never stated in the bidding schedule of the Bid or included in the Contract. No variation in the contract unit price will be made until the original quantities installed are varied by more than 25% and a hardship exists for the Excavation Subcontractor or the Government. Payment will be made monthly only for the actual number of units or work performed, and at the contract unit price for each such unit with measurement for payment made as defined in the following paragraphs.

1.1.1 Bonds and Insurance

- a. Unit of Measure: Bonds and Insurance will be paid as a lump sum.
- b. Payment shall be at the Contract lump sum price, which shall constitute full compensation for all costs associated with providing the required performance and payment bonds and insurance as specified in the General Conditions.

1.1.2 Site Preparation at Project Startup

- a. Unit of Measure: Mobilization and Site Preparation at Project Startup will be paid as a lump sum.
- b. Payment shall be at the Contract lump sum price, which shall constitute full compensation for all labor, materials, equipment, and tools required to complete all work associated with clearing and grubbing; access/haul roads and staging areas (not shown on Drawings, detail to be provided during Excavation Plan development); welding and installation of 54-inch HDPE pipe (to Station 542+00) and all associated appurtenances and controls.

FINAL

1.1.3 River Diversion System Gravity Operation

- a. Unit of Measure: River Diversion System Gravity Operation will be measured on lump sum basis.
- b. Payment shall be at the Contract lump sum, which shall constitute full compensation for all labor, materials, equipment, and tools required to complete all work associated with operation and maintenance of the gravity diversion system, including monitoring of system controls (staff gauges at various locations), removal of accumulated debris, and operation of slide gate valves, etc. Removal and replacement of stop logs is not included in this item and will be paid as an extra work item for each event.

1.1.4 Relocation of 54-inch HDPE Pipes

- a. Unit of measure: Relocation of 54-inch HDPE Pipes will be measured as one unit for each event.
- b. Payment shall be made at the Contract fixed unit price for each complete relocation of the 54-inch HDPE pipes and shall constitute full compensation for all labor, materials, equipment, and tools required to complete all work associated with the pipe relocation, including detaching and re-attaching the pipes to the pipe anchoring system as required.

1.1.5 Water Treatment System Operation

- a. Unit of measure: Water Treatment System Operation will be measured on a lump sum basis.
- b. Payment shall be made at the Contract lump sum for complete operation of the water treatment system, including all labor, materials, equipment, and tools required to complete all work associated with successful operation (meeting the specified treatment standards) of the system. Influent and effluent testing (performed by the General Contractor) is not included in this item. Prior to beginning the work, the Excavation Subcontractor shall submit a payment schedule for this item.

1.1.6 Soil/Sediment Excavation and Transport (includes stumps and debris)

- a. The unit of measurement for excavation, stockpiling, handling, and transport (not including off-site transport) of soil and sediment will be the cubic yard, computed by the average end area method or other appropriate method from elevation surveys taken before and after the excavation operations.
- b. Payment will be made for the number of cubic yards of material measured in situ and removed from the excavation areas, including the excavation for required

FINAL

ditches, gutters, and channel changes. Volumes excavated beyond the neatline and outside of the limits of excavation will not be paid, with the exception of volumes removed beyond the neatline as part of stump removal. (Penalties for excavation beyond neatline are discussed in Specification Section 02300, EARTHWORK.) Payment will be made for the volume occupied by stumps below the surrounding existing grade, which shall be considered part of the soil and sediment excavation volume (stumps will be required to be separated from soil and sediment for disposal purposes and “shaken” of all loose soil at the time and location of removal).

- c. Measurement for payment will not include the volume of any excavation performed prior to the taking of elevations and measurements of the undisturbed grade. Payment includes careful placement of excavated materials into trucks. Payment includes segregation of materials in accordance with the requirements of Specification Section 02111, HANDLING OF EXCAVATED MATERIAL AND BACKFILL and placement into separate trucks; transport by truck from the excavation to the staging area; stockpiling, dewatering, and handling (testing of the material will be performed by the General Contractor); loading of materials into trucks for transport to the GE On-Plant Consolidation Areas (OPCAs) and off-site facilities, and transport from the staging area to the OPCAs. (Transport to off-site disposal facilities will be performed by other subcontractors. Payment for transport to the OPCA will be held as a percentage of the item until the transport is complete.) Transport will include handling of all necessary manifesting and associated coordination with the General Contractor and the Government to obtain manifest authorization.
- d. Payment will include installation and removal of all temporary dams at upstream and downstream ends of the work cells and all dewatering (including storm water) required of work cells and other areas to maintain a dry excavation. Payment includes all labor, equipment, and materials required for excavation and backfill of ditches, swales, and sumps, and setup of pipes, hoses, generators, and pumps etc. to provide a fully functioning dewatering system. No separate payment will be made for excavations and fill materials required for installing dewatering systems.
- e. Payment will include excavation of soil, sediment, tree stumps, loose rocks and boulders, and all debris collected within the limits of excavation.
- f. The measurement for payment will not include the volume of subgrade material or other material that is scarified or plowed and reused in-place, and will not include the volume excavated without authorization (excavations beyond the neat line) or the volume of any material used for purposes other than as directed.

1.1.7 Geocell Installation

- a. Unit of measure: Geoweb Installation will be measured to the nearest square yard parallel to the slope.

FINAL

- b. Payment shall be made for all geoweb slope restoration acceptably placed in areas as required on the plans and by the specifications. Payment shall constitute full compensation for all labor, materials, equipment, and incidentals required to install the geoweb in accordance with the Drawings and Specifications to the limits shown. Payment for the geoweb restoration shall be based on the number of square yards and shall include all labor, specialty subcontractor personnel, equipment, materials (including top soil), and any other items necessary or incidental to provide, place, grade, compact as specified, and test the geoweb slope restoration system and any incidentals necessary to complete backfilling.

1.1.8 Backfill Materials (Items 1.1.8a through 1.1.8e on Bid Schedule)

- a. Unit of measure: The unit of measure for supply, testing, placement, and compaction of backfill will be to the nearest 0.1 cubic yard of compacted backfill in place as computed by the average end area method or other suitable calculation method.
- b. Payment is limited to backfill supplied and placed to the thicknesses shown on the plans or specified. No additional payment shall be made for placing excess fill or for providing and placing fill needed for the Excavation Subcontractor dewatering system (including trenches, sumps, and other components of the system). The contractor shall remove or regrade fill placed to a greater thickness than shown or specified, unless otherwise directed by the Engineer.
- c. Backfill shall not be measured until tests conducted by the Excavation Subcontractor and approved by the Engineer demonstrate that it has been compacted as specified. The Engineer shall complete all surveys required for measurement of backfill.
- d. Payment shall constitute full compensation for all labor, equipment, tools, supplies, and incidentals necessary to complete the work. Payment for backfill shall be based on a unit price per cubic yard, as measured in place after grading and compaction, for each material specified (Bid Schedule Items 1.1.8a through 1.1.8e). This unit price shall include all labor, equipment, materials, and any other items necessary or incidental to provide, place, grade, compact as specified, and test backfill materials and any incidentals necessary to complete backfilling.
- e. Supply and delivery of the backfill materials are specified in Sections 02111, HANDLING OF EXCAVATED MATERIAL AND BACKFILL and Section 02300, EARTHWORK. All supply and testing of backfill will be conducted by the Excavation Subcontractor, except for chemical testing, which will be conducted by the General Contractor.

FINAL

1.1.9 Geotextile Fabric

- a. Unit of measure: The geotextile shall be measured by the square yard of surface area covered, as measured parallel to the ground surface measured to the nearest 0.1 foot.
- b. Payment shall be made at the unit price for all geotextile fabric acceptably placed in areas as required on the plans and by the specifications. Payment shall constitute full compensation for all labor, materials, equipment, and incidentals required to install the geotextile in accordance with the specifications to the limits shown.

1.1.10 Erosion Control Blankets

- a. Unit of measure: The erosion control blankets shall be measured by the square yard of surface area covered, as measured parallel to the slope along the finished surface to the nearest 0.1 foot.
- b. Payment shall be made at the unit price for all erosion control blanket acceptably placed in areas as required on the plans and by the specifications. Payment shall constitute full compensation for all labor, materials, equipment, and incidentals required to install the erosion control blanket in accordance with the specifications to the limits shown.

1.1.11 Temporary Erosion Control – Riprap

- a. Unit of measure: Riprap temporary erosion control shall be measured by the cubic yard placed. The riprap will be measured prior to installation in the delivery vehicle to the nearest 0.25 cubic yard.
- b. Payment will be for riprap placed for temporary erosion control at the direction of the Engineer at the unit price bid and shall constitute full compensation for providing, installing, and removing riprap; cleaning sediment from riprap; and reinstalling to the next location shown, as directed by the Engineer. No separate payment shall be made for subgrade preparation or installation of underlying geotextile fabric. Riprap materials will be provided by the Excavation Subcontractor initially and as needed to supplement the materials recovered.
- c. Payment at the unit price bid will constitute full compensation for all labor, equipment, and incidentals to remove/replace/relocate riprap as needed for work to progress. No separate payment shall be made for subgrade preparation.

FINAL

1.1.12 Seed

- a. Unit of measure: The unit of measure will be the area of acceptably seeded surface in units of square yards. Measurements will be made parallel to the surface to the nearest 0.1 foot.
- b. Seeding will be paid for at the contract price per unit area of acceptably seeded surface of the riverbank surface. Payment shall constitute full compensation for all labor, materials, and equipment to furnish and install the specified seed mix, fertilizer, and lime, and watering until specified plant coverage is established.

1.2 INCIDENTAL WORK

- a. The following incidental work items will not be measured for separate payment and should be included in the above payment items:
 1. Submittals.
 2. Grubbing, stump excavation, and metallic debris excavation.
 3. Temporary Construction Facilities, including electrical power and other utilities and construction and office trailers and storage containers.
 4. Cleanup.
 5. Restoration of property outside the limits of payment.
 6. Cooperation with other contractors and others as required.
 7. Minor items such as replacement of fences, guardrails, rock walls, etc.
 8. Temporary erosion controls such as silt fence, straw bale, rock check dam installation, and other miscellaneous controls not otherwise paid for directly under the above items.
 9. Dewatering not specifically included in the above payment items.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01025 ATTACHMENT

BID SCHEDULE

FINAL

BID SCHEDULE FORM

The following Bid shall be completed in ink, typewritten, or keyed in electronically with appropriate calculations included. The amount of each Bid total shall be shown in both words and figures. The successful Bidder will be required to furnish a Bid breakdown in accordance with the following:

BID SCHEDULE

The BIDDER agrees to perform all the work described in the CONTRACT DOCUMENTS for the following lump sum and unit prices:

ITEM NUMBER	BRIEF DESCRIPTION OF ITEM WITH UNIT BID IN WORDS	UNIT BID PRICE IN FIGURES	QUANTITY	TOTAL AMOUNT IN FIGURES
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EXCAVATION SUBCONTRACTOR BID ITEMS (1 THROUGH 12)

1.1.1	Bonds and Insurance			
	_____	_____	1 L.S.	\$ _____
	Lump Sum			
1.1.2	Site Preparation at Project Startup			
	_____	_____	1 L.S.	\$ _____
	Lump Sum			
1.1.3	River Diversion System Gravity Operation			
	_____	_____	1 L.S.	\$ _____
	Lump Sum			
1.1.4	Relocation of 54-inch HDPE Pipes			
	_____	_____	9 EA	\$ _____
	Each			

FINAL

ITEM NUMBER	BRIEF DESCRIPTION OF ITEM WITH UNIT BID IN WORDS	UNIT BID PRICE IN FIGURES	QUANTITY	TOTAL AMOUNT IN FIGURES
1.1.5	Water Treatment System Operation			
	_____	_____	1 L.S.	\$ _____
	Lump Sum			
1.1.6	Soil/Sediment Excavation and Transport (includes stumps and debris)			
	_____	_____	17,900 C.Y.	\$ _____
	Cubic Yard			
1.1.7	Geocell Installation			
	_____	_____	415 S.Y.	\$ _____
	Square Yard			

FINAL

ITEM NUMBER	BRIEF DESCRIPTION OF ITEM WITH UNIT BID IN WORDS	UNIT BID PRICE IN FIGURES	QUANTITY	TOTAL AMOUNT IN FIGURES
1.1.8	Backfill Materials			
	a. Common Fill			
	_____	_____	6,875 C.Y.	\$ _____
	Cubic Yard			
	b. Filter Material			
	_____	_____	2,019 C.Y.	\$ _____
	Cubic Yard			
	c. 12-inch Riprap			
	_____	_____	4,128 C.Y.	\$ _____
	Cubic Yard			
	d. 18-inch Riprap			
	_____	_____	2,462 C.Y.	\$ _____
	Cubic Yard			
	e. Topsoil			
	_____	_____	916 C.Y.	\$ _____
	Cubic Yard			
1.1.9	Geotextile Fabric			
	_____	_____	370 S.Y.	\$ _____
	Square Yard			
1.1.10	Erosion Control Blankets			
	_____	_____	5500 S.Y.	\$ _____
	Square Yard			
1.1.11	Temporary Erosion Control – Riprap			
	_____	_____	250 C.Y.	\$ _____
	Cubic Yard			

FINAL

ITEM NUMBER	BRIEF DESCRIPTION OF ITEM WITH UNIT BID IN WORDS	UNIT BID PRICE IN FIGURES	QUANTITY	TOTAL AMOUNT IN FIGURES
1.1.12	Seed			
	<hr/> Square Yard	<hr/>	5500 S.Y.	\$ <hr/>

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
2	TITLE AND LOCATION: Final Submittal, 1.5-Mile Reach Removal Action - Phase 2, Stations 527+60 to 543+50 GE/Housatonic River Project, Pittsfield, Massachusetts														CONTRACTOR										CONTRACT NO.		
3	TRANSMITTAL NO.	ITEM NO.	SPECIFICATION PARAGRAPH NO.	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL											CLASSIFICATION	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS		
4					SD-01 PRECONSTRUCTION SUBMITTALS	SD-02 SHOP DRAWINGS	SD-03 PRODUCT DATA	SD-04 SAMPLES	SD-05 DESIGN DATA	SD-06 TEST REPORTS	SD-07 CERTIFICATES	SD-08 MANUFACTURER'S INSTRUCTIONS	SD-09 MANUFACTURER'S FIELD REPORTS	SD-10 OPERATION AND MAINTENANCE DATA	SD-11 CLOSEOUT SUBMITTALS	FOR INFORMATION ONLY	GOVERNMENT APPROVAL	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERNMENT	CODE	DATE	
5			01015, 1.3	Record Drawings											X		X										
6			01300, 1.3	Project Schedules	X											X											
7			01300, 1.3	Monthly Project Report						X						X											
8			01300, 1.3	Final Project Report											X		X										
9			01340, 1.3	Cell by Cell Survey Updates						X						X											
10			01410, 1.4	Air Monitoring Daily Report						X						X											
11			01410, 1.4	Monthly Project Report						X						X											
12			01410, 1.4	Water Column Monitoring Daily Report						X						X											
13			01410, 1.4	Final Project Monitoring Report											X		X										
14			01451, 1.2	Daily CQC Report										X	X	X											
15			02111, 1.1	Excavation Plan	X												X										
16			02111, 1.1	Analytical Test Reports for Backfill Materials						X							X										
17			02111, 1.1	Paint Filter Test Results						X						X											
18			02111, 1.1	Geotechnical Test Reports for Backfill Materials						X						X											
19			02111, 1.1	Wipe Sampling Data						X						X											
20			02230, 1.2	Materials Proposed for Off-Site Disposal	X												X										
21			02300, 1.2	Excavation Plan	X												X										
22			02300, 1.2	In-place compaction testing data						X						X											
23			02300, 1.2	Visual Inspection Reports						X						X											
24			02370, 1.3	Mulch, Geotextile Fabric, Erosion Control Fabric, Fertilizer		X										X											
25			02370, 1.3	Synthetic Soil Binders						X						X											
26			02370, 1.3	Installer's Qualifications						X						X											
27			02370, 1.3	Mulch						X						X											
28			02370, 1.3	Asphalt Adhesive						X						X											
29			02370, 1.3	Tackifier						X						X											
30			02370, 1.3	Wood Byproducts						X						X											
31			02370, 1.3	Certificate Form for Erosion and Sediment Controls							X					X											
32			02370, 1.3	Daily Forecast Reports										X	X												
33			02370, 1.3	Average Daily Flow - Newell Street										X	X												
34			02370, 1.3	Rainfall Snowpack Measurements										X	X												
35			02370, 1.3	Daily Records for limitation of storm/high flow damage										X	X												
36			02370, 1.3	Monthly Inspection Report for E&S Controls										X	X												
46			02930, 1.2	Planting Subcontractor Oversight Personnel Qualifications	X												X										
47			02930, 1.2	Equipment for revegetation		X										X											
48			02930, 1.2	Delivery Schedules		X										X											
49			02930, 1.2	Plant Establishment Period		X										X											
50			02930, 1.2	Maintenance Record		X										X											
51			02930, 1.2	Invasive Plant Control		X											X										
52			02930, 1.2	Plant Material						X							X										
53			02930, 1.2	Seed Mix						X							X										
54			02930, 1.2	Erosion Control Blankets						X							X										
55			02930, 1.2	Mulch Mats						X							X										
56			02930, 1.2	Fertilizer						X							X										
57			02930, 1.2	Compost						X							X										
58			02930, 1.2	Herbicide						X							X										
59			02930, 1.2	Maintenance Instructions										X	X												
60			02930, 1.2	Planting Record Drawings										X	X												
61			10100, 1.2	Traffic Control Police Detail Invoices										X	X												

FINAL

SECTION 01410

ENVIRONMENTAL AND CONDITIONS MONITORING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced.

CODE OF FEDERAL REGULATIONS (CFR)

- | | |
|--------------------------|--|
| 33 CFR 328 | Definitions. |
| 40 CFR 50,
Appendix B | USEPA Reference Method for the Determination of Suspended Particulates (TSP) in the Atmosphere (High Volume Method). |
| 40 CFR 300.430(e)(9) | National Contingency Plan. |
| 40 CFR 355 | Emergency Planning and Notification. |

ENGINEERING MANUALS (EM)

- | | |
|--------------|--|
| EM 385-1-1 | (1996) U.S. Army Corps on Engineers Safety and Health Requirements Manual. |
| EP 1110-1-21 | Air Pathway Analysis (APA) for the Design of HTRW Remedial Action Project. |

EPA TECHNICAL DOCUMENTS (TO)

- | | |
|-------------------|--|
| EPA/625/R-96/010b | Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air - Second Edition - Compendium Method TO-4A Determination of Pesticides and Polychlorinated Biphenyls in Ambient Air Using High Volume Polyurethane Foam (PUF) Sampling Followed by Gas Chromatographic/Multi-Detector Detection (GC/MD). |
|-------------------|--|

PROJECT PLANNING AND GUIDANCE DOCUMENTS

Final Quality Assurance Project Plan (QAPP), Weston Solutions, Inc., General Electric (GE) Housatonic River Project, Pittsfield, Massachusetts, DCN: GE-022803-ABLZ, May 2003.

Final Quality Assurance Project Plan (QAPP), Roy F. Weston, Inc., General Electric Housatonic River Project, Contract No. 68-W7-0026, DCN: RFW033-2E-AEOQ, November 2000.

FINAL

Monitoring Plans, 1.5-Mile Removal Action – Phase 1, Roy F. Weston, Inc., Environmental Remediation Contract General Electric/ Housatonic River Project, Pittsfield, MA, Contract No. DACW33-00-D0006, Task Order No. 0005, DCN: GE-060302-ABAU, June 2002.

Final Quality Assurance Project Plan (QAPP), Volumes I, II, IIA, and IV, Roy F. Weston, Inc., DCN: GE-021601-AAHM, March 2001.

Final Quality Assurance Project Plan (QAPP), Volume III, and IV, Roy F. Weston, Inc., DCN: GEP2-123098-AAET, January 1999, and DCN: GEP2-060499-AAIY, October 1999.

Draft Field Sampling Plan (FSP), Roy F. Weston, Inc., Environmental Remediation Contract General Electric/ Housatonic River Project, Pittsfield, MA, Contract No. DACW33-00-D0006, Task Order No. 0002, DCN: GE-091200-AADI, November 2000.

Final Field Sampling Plan (FSP), Roy F. Weston, Inc., DCN: GE-053001-AAMA, 30 July 2001.

Final Field Sampling Plan (FSP) Addendum, Weston Solutions, Inc., DCN: GE-091102-ABES, September 2002, revised August 2003.

Field Sampling Plan (FSP) Addendum, Weston Solutions, Inc., DCN: GE-081203-ABSP, 12 August 2003.

Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD), USEPA, May 1987.

On-Site Meteorological Program Guidance for Regulatory Modeling Applications, USEPA, June 1987, EPA-450/4-87-013.

Summary of Structural Conditions and Utility Survey from Lyman St. Bridge to Elm St. Bridge along Housatonic River, Pittsfield, Massachusetts, Hart Crowser, September 28, 2000.

1.2 GENERAL REQUIREMENTS

The General Contractor shall perform environmental and conditions monitoring during the construction work being performed in Phase 2 of the 1.5-Mile Reach of the Housatonic River and surrounding area to identify and mitigate conditions that may result in increased risks to the local community, the ecological receptors, or the environment. In addition, the General Contractor shall perform monitoring of buildings and structures in the vicinity of the construction work to identify any adverse affects that may have resulted from the construction activities. This specification is not intended to address health and safety of the construction workers. Construction worker health and safety shall be addressed in the Site Safety and Health Plan for the project.

FINAL

The monitoring activities that shall be performed include:

- Air Monitoring: Sampling and analysis of ambient air for PCBs and PM₁₀ (particulates 10 microns and less).
- Water Column Monitoring: Sampling and analysis of surface water upstream and downstream of the work area in the Housatonic River.
- Noise Monitoring: Monitoring the noise created by construction activities directly adjacent to work areas.
- Settlement Monitoring: Monitoring the elevations of designated points on the foundations of local buildings and structures.
- Vibration Monitoring: Monitoring of the intensity of vibrations in local buildings and on local structures as the result of sheet pile driving and other construction activities.
- Conditions Monitoring: Video documentation of the conditions of local structures and environmental conditions before commencement of construction work and at the conclusion of the construction work.

1.3 QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

All work included in the specification shall comply with Volume I (Sections A-D) and Appendices A and B of the SSERC Project QAPP.

Standard Operating Procedures (SOPs) for field screening instruments, decontamination, documentation, sampling, sample identification, sample packing and shipping, and surveying are included in the FSP. The following is a list of SOPs that shall be followed for Environmental and Conditions Monitoring:

<u>SOP No.</u>	<u>Task</u>
G-1	Calibration of Field Screening Instruments
G-2	Decontamination
G-3	Field Documentation
G-4	Field Filtration
G-5	Field Measurements
G-6	Field Sample Numbering
G-7	Management of Investigation Derived Wastes (IDW)
G-9	Quality Assurance/ Quality Control Sampling
G-10	Sample Documentation
G-11	Sample Packing and Shipping
G-12	Surveying

Additional SOPs for specific activities are referenced in the sections below.

FINAL

1.4 SUBMITTALS

Government approval is required for submittals with a “G” designation; submittals not having a “G” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Monitoring Plan Supplement; G

SD-06 Test Reports

Air Monitoring Daily Report

Monthly Project Report – Includes Air, Water Column, Noise, and Vibration Monitoring Results; G.

Water Column Monitoring Daily Report

SD-11 Closeout Submittals

Final Project Monitoring Report – Summary of Air, Water Column, Noise, Settlement, Vibration and Conditions Monitoring Program Results; G.

1.5 AIR MONITORING

1.5.1 Air Monitoring Data Deliverables

1.5.1.1 Daily and Monthly Reports

A Daily Data Report shall be prepared summarizing each of the PM₁₀ ambient air monitoring sampling events. The reports shall contain the following information:

- Map of the site detailing the location of the PM₁₀ ambient air monitors. The site map shall also include the forecasted wind direction, comments on excursions, and any problems with sampling equipment.
- Wind rose for the sample period obtained from the United States Weather Page on the Internet for the Pittsfield area, navigate to <http://www.uswx.com/us/wx/MA/01201/>
- Summary graph of sample results for the sample period for each location. Summary table of the maximum instantaneous reading, the maximum 15-minute average, hourly average readings for the entire sampling period, and the overall sampling period average for each location.

For monthly polychlorinated biphenyl (PCB) Air Monitoring, copies of the sample attribute forms completed shall be included in the daily report on the day the samples are collected.

FINAL

An Air Monitoring section shall be included in the Monthly Project Report, and will summarize the PM₁₀ and PCB ambient air sampling results. Each monthly Air Monitoring Report shall contain the following information:

- PCB Monitoring
 - Summary of PCB sampling events including the date of sampling, comments on excursions, problems with sampling equipment, site activities, laboratory problems, and results of samples.
 - Site map detailing the location of sampling locations.
 - Summary table of results received in a given month.
- PM₁₀ Monitoring
 - Summary of PM₁₀ data for the month including daily average PM₁₀ concentrations and total hours monitored for each PM₁₀ monitoring location.

1.5.1.2 Final Air Monitoring Report

The Final Air Monitoring Report shall be a section of the Final Project Monitoring Report and shall include both PCB and PM₁₀ ambient air monitoring data. The report shall contain the following information:

- Summary of the PCB and PM₁₀ sampling events for the duration of the construction work (date and time of sampling, sampling locations, number of samples collected, PCB analytical results or PM₁₀ 10-hour average readings, and meteorological data summary). In addition, the sample dates, PCB analytical results, and PM₁₀ 10-hour average readings shall be summarized in an electronic data deliverable (EDD) as described in Subsection 5.4 of the QAPP.
- Calibration and Maintenance Activities.
- Discrepancies noted in the data.
- Summary of all notification level and action level excursions for both PCB and PM₁₀ ambient air monitoring including date and time of sampling, sampling locations, and results.

FINAL

1.6 WATER COLUMN MONITORING

1.6.1 Water Column Monitoring Data Deliverables

1.6.1.1 Daily and Monthly Reports

A Daily Water Column Monitoring Report shall be submitted summarizing calculated flow based on a rating curve correlated to the Coltsville gauge, hourly water temperature from each turbidity monitoring location, and turbidity measurements including daily averages for each location (upstream and downstream of construction activities). The daily report shall also note when turbidity levels exceeded applicable action levels, notification steps taken, and additional water column monitoring conducted. Sample attribute forms and a summary table for water column samples shall be submitted as part of the daily report on the day the samples are collected.

A Water Column Monitoring section shall be included in the Monthly Project Report and will summarize the water column monitoring sampling events. The reports shall contain the following information:

- Summary of the polychlorinated biphenyl/total suspended solids (PCB/TSS) sampling events (conducted twice per month and on specific events) and daily monitoring activities including the date of sampling, comments on excursions, problems with sampling equipment, site activities, laboratory problems, and results of samples).
- Summary table of results for turbidity measurements for the month including daily average, maximum, and minimum turbidity measurements for each location (upstream and downstream), and daily flow from the Coltsville gauging station.
- Summary table of PCB/TSS sampling including any results available at the time of submittal; date samples were collected; flows from Coltsville location and each of the sampling locations; water temperatures from each sampling location; correlated turbidity measurements, including high, low, and average readings from the day of each sampling event; and any additional PCB/TSS sampling conducted during the period.
- Summary of all action level excursions for PCBs and turbidity including date and time of sampling, sampling locations, and results.
- The initial laboratory reports.

1.6.1.2 Final Water Column Monitoring Report

A Final Water Column Monitoring Report shall be prepared which summarizes the water column monitoring sampling events. The report shall contain the following information:

FINAL

- Summary of the water column monitoring sample events for the duration of the construction work (date and time of sampling, sampling locations, number of samples collected, water quality results, and PCB and TSS analytical results). In addition, the sample dates and analytical results shall be summarized in an electronic data deliverable (EDD) as described in Subsection 5.4 of the QAPP.
- Calibration and Maintenance Activities.
- Discrepancies noted in the data.
- Summary of all action level excursions for PCBs and turbidity including date and time of sampling, sampling locations, and results.

1.7 NOISE MONITORING

1.7.1 Noise Monitoring Data Deliverables

1.7.1.1 Monthly Reports

A Monthly Noise Monitoring Report shall be prepared as a section of the Monthly Project Report and shall summarize the results of noise monitoring. The report shall contain the following information:

- Summary of the monitoring events including problems with sampling equipment and site activities.
- Summary table and/or graph of noise monitoring results reported as daily averages.

1.7.1.2 Final Noise Monitoring Report

A Final Noise Monitoring Report section shall be included in the Final Project Monitoring Report and shall summarize the noise monitoring data for all construction activities. The report shall contain the following information:

- Description of the monitoring locations.
- Summary table and/or graph of noise results for the duration of the construction activities.

In addition, these data shall be summarized in an electronic data deliverable (EDD) as described in Subsection 5.4 of the QAPP.

FINAL

1.8 SETTLEMENT MONITORING

1.8.1 Settlement Monitoring Initial Report

An Initial Settlement Monitoring Report shall be prepared summarizing the initial survey results. The report shall contain the following information:

- Name and description of the structure surveyed.
- Physical location description of the survey point.
- Coordinates and elevation of the survey point.

In addition, these data shall be summarized in an electronic data deliverable (EDD) as described in Subsection 5.4 of the QAPP.

1.8.2 Settlement Monitoring Final Report

A Final Settlement Monitoring Report section shall be included in the Final Project Monitoring Report and shall summarize the final survey results. The report shall contain the following information:

- Name and description of the structure surveyed.
- Physical location description of the survey point.
- Coordinates and elevation of the survey point.
- Location discrepancies between the initial and final survey points.

The surveyed elevation data shall be presented in spreadsheet format and shall be clearly catalogued by the name of the structure surveyed, the location on the structure (i.e., middle of east foundation wall, 2 feet from ground surface, etc.) and the x and y coordinates of the specific survey point. Data shall be provided in State Plane Coordinates. In addition, these data shall be summarized in an electronic data deliverable (EDD) as described in Subsection 5.4 of the QAPP.

1.9 VIBRATION MONITORING

1.9.1 Vibration Monitoring Data Deliverables

1.9.1.1 Monthly Reports

A Monthly Vibration Monitoring Report shall be prepared as a section of the Monthly Project Report and shall summarize each monthly vibration monitoring event. The report shall contain the following information:

FINAL

- Summary of the sampling events including problems with sampling equipment, exceedances of action levels, and site activities.
- Summary table of vibration monitoring results for each structure being monitored including the maximum particle velocity in inches per second every 6 hours.

1.9.1.2 Final Vibration Monitoring Report

A Final Vibration Monitoring Report section shall be included in the Final Project Monitoring Report and shall summarize the vibration monitoring data for all construction activities. The report shall contain the following information:

- Description of the monitoring locations.
- Summary table of vibration monitoring results for the duration of the construction activities.

In addition, these data shall be summarized in an electronic data deliverable (EDD) as described in Subsection 5.4 of the QAPP.

1.10 CONDITIONS MONITORING

1.10.1 Initial Conditions Survey Deliverables

An Initial Conditions Survey videotape shall be prepared. The video shall document the condition of the local structures and locations along the river as described in Part 3. The video shall incorporate notes, labels, or signs to clearly indicate the location or structure being videotaped. The General Contractor shall keep a chain-of-custody of the Initial Conditions Survey videotape.

The format for the taping shall be as follows:

- Title frame showing the contract title and number, and the name and address of the structure or location shown on the film.
- A general view of the structure with a reference point established (i.e., right or left hand corner of the structure).
- An audio and video recording record of exterior of the structure and surrounding grounds, outbuildings, pools, and fences shown from the established reference point.
- The interior portions of the structure shall then be recorded in the same fashion from the same reference point. Every effort shall be made not to record personal property. A written log shall be maintained to pinpoint areas of interest such that it shall not be necessary to review the entire tape to view information on a particular structure.

FINAL

- When the survey is complete, the General Contractor shall provide two copies to the Government.

1.11 FINAL CONDITIONS SURVEY DELIVERABLE

A Final Conditions Survey videotape shall be prepared. The video shall document the condition of the local structures and locations along the river included in the Initial Conditions Survey. The video shall incorporate notes, labels, or signs to clearly indicate the location or structure being videotaped. The format for the taping shall be as described above for the initial video survey.

1.12 FINAL PROJECT MONITORING REPORT

The Final Project Monitoring Report will include summaries of all of the project monitoring data as described in the previous sections for the entire construction project. The Final Project Monitoring Report will be submitted in Draft form to the Government within 60 days of receipt of the final construction monitoring data. The Final Project Monitoring Report will be revised and submitted in final form within 30 days of receipt of comments on the draft report from the Government.

1.13 SECURITY

The General Contractor shall be responsible for security of all sampling equipment and sampling stations. Control of all persons performing maintenance of the sampling equipment and operating the sampling equipment shall be provided by the General Contractor.

The General Contractor shall maintain security provisions to assure that system failure, vandalism, or other incident will be addressed in a timely fashion.

1.14 APPENDICES

Copies of all raw data, certifications, calibration logs, and other pertinent documents shall be attached as an appendix to the plans and final reports, as appropriate.

PART 2 PRODUCTS

2.1 AMBIENT AIR MONITORING

2.1.1 PCB Monitoring

A high-volume PUF sampler utilizing sample media consisting of a glass fiber filter with a PUF backup absorbent cartridge drawing air at a rate of 0.20-0.280 m³/min. (General Metal

FINAL

Works Model GPS-1 or equivalent) shall be used for monitoring PCB concentrations in ambient air. Sampling will be conducted based on USEPA's Organic (TO) Compendium of Methods for Air Toxics – Method TO-4A and SOP A-1.

Calibrations and maintenance shall be conducted at the frequency and in accordance with the procedures in the FSP SOP A-1. All calibration and maintenance activities shall be documented.

2.1.2 PM₁₀ Monitoring

A MIE data RAM Model PDR-1200 real time PM₁₀ monitor shall be used to monitor and record particulate concentrations with a mean diameter of 10 microns or less (PM₁₀). These instruments are not designated as USEPA reference methods for the collection and determination of PM₁₀ as specified under 40 CFR, Part 50, Appendix J. These instruments provide approximate measurement of the sum of particulates and aerosol PM₁₀ concentrations.

Calibrations and maintenance shall be conducted at the frequency and in accordance with the procedures recommended by the manufacturer. All calibrations and maintenance activities shall be documented.

2.2 WATER COLUMN MONITORING

Surface water sampling equipment appropriate for automated grab and composite sampling of river water shall be utilized. The sampling shall utilize the techniques described in the FSP and relevant WESTON SOPs.

2.3 NOISE MONITORING

An Extech Model 407764 Sound Level Meter or equivalent shall be used to monitor noise levels adjacent to the areas of construction. Calibrations and maintenance shall be conducted at the frequency and in accordance with the procedures recommended by the manufacturer. All calibrations and maintenance activities shall be documented.

2.4 SETTLEMENT MONITORING

Standard land surveying equipment shall be used to monitor elevations of designated points on structures as described in Part 3. Deformation Monitoring Points (DMPs) shall be used to monitor vertical and/or horizontal deformation of various facilities at selected locations as described in Part 3. The DMPs shall include a 5/16-inch-diameter by 1½-inch-long stainless steel socket-head cap bolt, screwed into a 1-inch-long by 5/16-inch-diameter tamp-in screw anchor. A 4-inch (or longer) bolt may be used at locations where overhanging obstructions prevent the placement of the level rod on the DMP. A 5/16-inch-diameter by ¾-inch-long carriage bolt shall replace the 1½-inch-long socket-head bolt when readings are not being

FINAL

taken. These tamp-in screw anchors shall typically be installed into vertical surfaces of buildings and structures.

2.5 VIBRATION MONITORING

BlastMate Series III vibration monitoring equipment manufactured by InstanTel, Inc., or equivalent, shall be used for the vibration monitoring described in Part 3.

- Seismic range: 0.01 to 8 inches per second with an accuracy of 5% and no more than a 3-dB roll off at the low frequency end.
- Flat frequency response: 2 to 200 Hz.
- Three component sensor.
- Two power sources: Internal rechargeable battery and charger and 115 volts AC. Battery shall be capable of supplying power to monitor vibrations continuously for up to 1 week.
- Sufficient memory to allow vibration data to be collected continuously for a minimum of 1 week before downloading.
- Capable of internal dynamic calibration.
- Direct writing to printer and electronic storage media. Instruments shall be capable of producing strip chart recordings of readings on-site within 1 hour of obtaining the readings. Provide computer software to perform frequency analyses of data obtained on electronic storage media.
- Continuous monitoring mode shall be capable of recording peak velocities.

2.6 CONDITIONS MONITORING

A standard VHS video camera and VHS videotape shall be used to document the structural and environmental conditions of the structures and areas identified in Part 3. A digital camera shall be used to produce digital photographs of site and structural features.

PART 3 EXECUTION

3.1 AMBIENT AIR MONITORING

For the protection of public health, the General Contractor shall monitor and control contaminant emissions to the air from hazardous, toxic or radiological waste (HTRW) remedial action area sources to minimize short term risks that might be posed to the community during implementation of the remedial alternative in accordance with the FSP,

FINAL

the QAPP, and the following requirements. Results from perimeter air monitoring shall supplement on-site health and safety information in order to determine the need for and type of response actions. Results will also be used to determine the need for and to evaluate corrective actions to address exceedances of applicable ambient air standards.

3.1.1 Perimeter Air Contaminant of Concern

PCBs and PM₁₀.

3.1.2 Time Averaged Perimeter Action Levels

Any excursions of either the notification levels or the action levels listed below shall be reported immediately to the Government, who will discuss the need for and type of response actions.

3.1.2.1 PCBs

Notification Level (Time-Weighted Average)

a. Concentration: 0.05 µg/m³

b. Time: 24 hours

Action Level (Time-Weighted Average)

a. Concentration: 0.1 µg/m³

b. Time: 24 hours

3.1.2.2 PM₁₀

Notification Level (Time-Weighted Average, 80% of 24-hour National Ambient Air Quality Standard [NAAQS] for PM₁₀)

a. Concentration: 120 µg/m³

b. Time: 10 hours

Action Level (Time-Weighted Average, 24-hour NAAQS for PM₁₀)

a. Concentration: 150 µg/m³

b. Time: 10 hours

FINAL

These levels are more conservative than the NAAQS for PM₁₀, which average the instantaneous concentrations over a 24-hour period, rather than a 10-hour period. This level has been selected to allow notice to the Government before concentrations reach the level of the 24-hour NAAQS.

3.1.3 Sampling/Monitoring Locations

The purpose of this sampling program is to monitor levels of PCBs and particulates that migrate off-site; therefore, sampling stations shall be located at the perimeter of the site, on or near the property boundary. Samplers will be moved to new locations as construction-related activities progress. An additional monitor will be operated at an appropriate location in Pittsfield that is representative of background PCB concentrations. The specific sampling locations for these monitors will be determined at a later date.

3.1.4 Frequency of Sampling

Ambient air monitoring for PCBs shall be conducted for one 24-hour period every month during construction activities in the Housatonic River.

Real-time ambient PM₁₀ monitoring shall be conducted during all construction-related activities. Monitoring shall be performed for approximately 10 hours per day or as the length of the workday dictates. PM₁₀ data shall be recorded and averaged by a datalogger for each hour of the day.

3.1.5 Monitoring Instruments/Sampling and Analysis Methods

3.1.5.1 PCBs

Method: USEPA Compendium Method TO-4B, Method for the Determination of Organochlorine Pesticides and Polychlorinated Biphenyls in Ambient Air

Analytical Method: USEPA Method 608/8088, with analysis for the following PCB Aroclors: 1016, 1221, 1232, 1242, 1248, 1254, and 1260.

Sampling Rate: 0.25 – 0.26 m³/min.

Average Sample Volume: 370 m³

3.1.5.2 PM₁₀

A MIE data RAM Model PDR-1200 real time PM₁₀ monitor shall be used to monitor and record particulate concentrations with a mean diameter of 10 microns or less (PM₁₀). These instruments are not designated as USEPA reference methods for the collection and

FINAL

determination of PM₁₀ as specified under 40CFR, Part 50, Appendix J. These instruments provide approximate measurement of the sum of particulates and aerosols PM₁₀ concentrations.

3.1.5.3 Meteorological Monitoring

Meteorological data shall be obtained from the United States Weather Page on the Internet (<http://www.uswx.com/us/wx/MA/01201/>) for the Pittsfield area. Decoded observations for wind speed and direction shall be utilized in constructing daily wind rose diagrams.

3.1.6 Notification of Action Level Exceedances and Sampling for Evaluation of Corrective Actions

If action levels for PCBs or PM₁₀ are exceeded, the Government shall be notified immediately. The General Contractor shall: (1) perform an evaluation of ongoing remediation activities to determine if engineering controls were properly implemented; (2) attempt to determine the cause of the exceedance; (3) consult with the Government in developing a plan of action for additional sampling and analysis, and in identifying corrective actions to be implemented in construction activities to address the issue. Development and implementation of the plan of action is not included in the scope of this specification. Scope and funding for plan of action development, corrective action implementation, and additional sampling in response to exceedances will be handled separately on a case-by-case basis.

3.2 WATER COLUMN MONITORING

The purpose of the Water Column Monitoring program shall be to identify, evaluate, and remedy any potential negative impacts to the Housatonic River that may result from remedial activities. The Water Column Monitoring shall be performed in accordance with the project FSP and QAPP, and the following sections of this specification.

3.2.1 Parameters of Concern

PCBs – Total and Dissolved
Turbidity
Total Suspended Solids (TSS)
Temperature
Water Flow
Stage Height

3.2.2 Action Levels

Any excursions of either the action levels listed below shall be reported to the Government immediately.

FINAL

PCBs-Total (10-hour composite or 4 part grab): Downstream (Pomeroy Avenue) \geq Upstream (Lyman Street) + 5 ug/L

Turbidity: Downstream (Pomeroy Avenue) \geq Upstream (Lyman Street) + 50 NTU (13 Hour Daily Average)

3.2.3 Sampling/Monitoring Locations and Frequencies

A total of three sampling locations shall be included in the Water Column Monitoring Program as follows (with frequencies and types of sampling):

- Newell Street Bridge – Monthly PCB and TSS sampling plus water temperature and stage height measurement.
- Lyman Street Bridge – Daily turbidity; twice monthly PCB and TSS sampling plus water temperature.
- Pomeroy Avenue Bridge – Daily turbidity; twice monthly PCB and TSS sampling plus water temperature and stage height measurement.

In addition, monitoring shall be performed at the Newell Street, Lyman Street, and Pomeroy Avenue monitoring stations for PCBs and TSS during approximately three specific events. For example, monitoring will be performed during the following: a high flow event, excavation of NAPL-impacted sediments, and installation or removal of sheet pile, etc.

Water column monitoring shall be initiated once the first intrusive activities have commenced in the Housatonic River and shall continue to be performed for the duration of the removal and replacement activities in the river.

3.2.4 Sampling Procedures

Sample collection activities shall include standard methods for collection and analysis of samples at an off-site laboratory for total and dissolved PCBs. Activities shall follow the procedures outlined in SOP SW-6 of the Addendum to the Final FSP dated September 2002 (DCN: GE-091102-ABES), revised September 2002. Flows shall be downloaded during each day of construction from the Coltsville records on the USGS web site.

Staff gage readings will be measured at the Newell Street and Pomeroy Avenue locations and converted to elevations during the beginning and end of each sampling events. Rating curves for each location will be used to determine the flows during that sampling event. River cross-sections and rating curves currently exist for both the Pomeroy Avenue and Newell Street locations.

Composite samples shall be collected monthly at each location. At each station per sampling event, an ISCO sampler shall be utilized to collect a 10-hour (during construction) composite surface water sample. Sample collection shall be conducted according to procedures outlined

FINAL

in SOP SW-6 of the Field Sampling Plan November 2000 (DCN: GE-091200-AADI), revised July 2001. However, in the event of extreme cold weather conditions or conditions that do not allow for normal sampling procedures to be utilized, four manual grab samples will be collected over the course of the work day and composited into one sample for PCB and TSS analysis.

Turbidity will be measured according to procedures outlined in SOP SW-6 of the FSP.

Sample processing will follow the procedures outlined in SOP SW-6 of the FSP. Any deviations from the procedures outlined in the FSP shall be noted in the Final Water Column Monitoring Report.

3.2.5 Notification of Action Level Exceedances and Sampling for Evaluation of Corrective Actions

If action levels for Total PCBs or Turbidity are exceeded, the Government shall be notified immediately. The General Contractor shall: (1) perform an evaluation of ongoing remediation activities to determine if engineering controls were properly implemented; (2) attempt to determine the cause of the exceedance; (3) consult with the Government in developing a plan of action for additional sampling and analysis, and in identifying corrective actions to be implemented in construction activities to address the issue. Development and implementation of the plan of action is not included in the scope of this specification. Scope and funding for plan of action development, corrective action implementation, and additional sampling in response to exceedances will be handled separately on a case-by-case basis.

3.2.6 Analytical Methods

The General Contractor shall follow the procedures for sample analysis and QA/QC as outlined in the Project QAPP. Any deviations from these procedures shall be noted in the Final Water Column Monitoring Report.

3.3 NOISE MONITORING

Noise monitoring will be conducted to meet the standards established in the City of Pittsfield Noise Ordinance. Noise levels produced by construction activities will be kept at or below a 65-decibel-average (dBA) over the course of a workday. Instantaneous noise levels will also be monitored. Noise readings will be obtained at property boundaries adjacent to work areas as necessary.

3.3.1 Action Levels

Readings indicating exceedances of the 65-dBA will be reported immediately to EPA, and an evaluation of construction activities will be conducted to determine potential corrective

FINAL

measures. Instantaneous exceedances or complaints from nearby residents will be evaluated accordingly.

3.3.2 Monitoring Locations

The purpose of this monitoring program is to monitor noise levels that may affect property owners adjacent to construction activities; therefore, monitoring stations shall be located at the perimeter of the site, on or near the property boundary. Monitors will be moved to new locations as construction-related activities progress. The specific locations for these monitors will be determined at a later date.

3.3.3 Frequency of Sampling

Real-time noise monitoring shall be conducted only as necessary or when noise levels created by construction-related activities are considered to be excessive per the Engineer. When noise monitoring is deemed necessary, monitoring shall be performed for approximately 10 hours per day or as the length of the workday dictates. Noise level data shall be recorded and averaged by a datalogger for each hour of the day.

3.3.4 Monitoring Instruments/Sampling and Analysis Methods

An Extech Model 407764 Sound Level Meter or equivalent shall be used to monitor noise levels adjacent to the areas of construction. Calibrations and maintenance shall be conducted at the frequency and in accordance with the procedures recommended by the manufacturer. All calibrations and maintenance activities shall be documented.

3.3.5 Notification of Action Level Exceedances

If action levels for noise levels are exceeded, the Government shall be notified immediately. The General Contractor shall: (1) perform an evaluation of ongoing remediation activities to determine if engineering controls were properly implemented; (2) attempt to determine the cause of the exceedance; (3) consult with the Government in developing a plan of action for additional monitoring, and in identifying corrective actions to be implemented in construction activities to address the issue. Development and implementation of the plan of action is not included in the scope of this specification. Scope and funding for plan of action development, corrective action implementation, and additional monitoring in response to exceedances will be handled separately on a case-by-case basis.

3.4 SETTLEMENT MONITORING

3.4.1 Structures to be Monitored

Three survey points shall be established on each of the following structures:

FINAL

- Building A: 10 Lyman Street
- Building B: 55 Root Place
- Building F: 103 Elm Street, Elm Street Laundromat
- Building G: 14 Hathaway Street, Residence and In-Ground Pool
- Lyman Street Bridge
- 37 Elm Street, Harry's Supermarket and Billboards
- 103 Elm Street, Elm Street Self-Car Wash, including three vacuums at the top of bank
- 41 Root Place
- 48 Root Place
- 50 Root Place
- 50-60 Elm Street
- Elm Street Bridge
- Flow Deflection Structure for Culvert downstream of the Elm Street Bridge
- Utilities along High and Caledonia Streets (to be identified on a site walk to be conducted by the General Contractor prior to the start of work)
- Gabion baskets installed by GE during a previous remediation along the west bank of the river
- 139 Deming Street (Wahconah Welding)
- 19 Dawes Avenue (Dawes Avenue Variety)
- Dawes Avenue Bridge
- 198 Appleton Street (Garage immediately downstream of Dawes Avenue Bridge on east bank)

3.4.2 Scheduling

Two elevation surveys shall be performed to identify settlement in the structures listed above. The first elevation survey shall be conducted prior to commencement of construction work. The second elevation survey shall be conducted at the completion of the construction work.

FINAL

3.4.3 Methods

The locations of the survey points (DMPs) on the structures listed above shall be designated by the Government and a representative will accompany the General Contractor on the initial elevation survey. During the initial elevation survey, the General Contractor shall survey the locations (X and Y coordinates) of each of the survey points, as well as the elevations.

The X and Y coordinates shall be within 0.1-foot accuracy and the elevations shall be within 0.01-foot accuracy.

3.5 VIBRATION MONITORING

3.5.1 Structures to be Monitored

- 103 Elm Street, Elm Street Laundromat
- 103 Elm Street, Elm Street Self Car Wash
- 37 Elm Street, Harry's Supermarket and Billboards
- Elm Street Bridge
- 50-60 Elm Street
- Utilities along High and Caledonia Streets (to be identified on a site walk to be conducted by the General Contractor prior to the start of work)
- Gabion baskets installed by GE during a previous remediation along the west bank of the river
- 139 Deming Street (Wahconah Welding)
- 19 Dawes Avenue (Dawes Avenue Variety)
- Dawes Avenue Bridge
- 198 Appleton Street (Garage immediately downstream of Dawes Avenue Bridge on east bank)

3.5.2 Scheduling of Vibration Monitoring Activities

Vibration monitoring shall be completed during any sheet piling or other heavy or intrusive construction activities completed within 200 feet of the structures listed above.

FINAL

3.5.3 Security and Coordination with Property Owners

Based on proximity to the work, and an evaluation by the Project Engineer, monitoring devices shall be placed on each of the structures listed above at appropriate times and shall be secured from theft and protected from the weather. The location of the monitoring devices on each structure shall be approved by the appropriate parties of interest (owners, City of Pittsfield).

3.5.4 Collection and Downloading of Data

Data from the vibration monitoring devices shall be downloaded on a weekly basis. The monitoring devices shall have sufficient memory to record data on a continuous basis and sufficient battery life to operate for 10 days without battery replacement or recharging.

3.5.5 Action Levels

A maximum vibration limit of 0.5-inch-per-second peak particle velocity is suggested for sensitive structures where:

- The foundation type is unknown.
- The foundations are known to be wood piles but the condition is poor or unknown.
- The foundations or foundation walls are in poor condition.

For structures with reinforced concrete foundation walls and steel or concrete foundations structurally connected to the walls, it is suggested that a maximum vibration limit of 1.0-inch-per-second for all other structures be used.

3.6 CONDITIONS MONITORING

3.6.1 Structures and Areas to be Monitored

The following structures and areas shall be included in the conditions monitoring survey:

- The east and west banks of the Housatonic River from the Lyman Street Bridge to the Dawes Avenue Bridge
- Building A: 10 Lyman Street
- Building B: 55 Root Place
- Building F: 103 Elm Street, Elm Street Laundromat
- Building G: 14 Hathaway Street, Residence and In-Ground Pool
- Lyman Street Bridge

FINAL

- 37 Elm Street, Harry's Supermarket and Billboards
- 103 Elm Street, Elm Street Self-Car Wash, including three vacuums at the top of bank
- 41 Root Place
- 48 Root Place
- 50 Root Place
- 50-60 Elm Street
- Elm Street Bridge
- Flow Deflection Structure for Culvert downstream of the Elm Street Bridge
- Utilities along High and Caledonia Streets (to be identified on a site walk to be conducted by the General Contractor prior to the start of work)
- Gabion baskets installed by GE during a previous remediation along the west bank of the river
- Support and access areas located on Parcels I8-4-2, I8-4-3, and I8-4-4 (107 Deming St.), Parcel I8-4-6 (87 Deming St.), and Parcel I8-4-7 (Deming St.)
- 87 Deming Street
- 107 Deming Street
- 139 Deming Street (Wahconah Welding)
- 19 Dawes Avenue (Dawes Avenue Variety)
- Dawes Avenue Bridge
- 198 Appleton Street (Garage immediately downstream of Dawes Avenue Bridge on east bank)

3.6.2 Scheduling of Conditions Monitoring Surveys

Prior to commencement of construction work, and after completion of the construction work, the General Contractor shall be notified to conduct a conditions survey.

3.6.3 Methods

Prior to the performance of any construction work, the General Contractor shall discuss with the Government the property and structures to be surveyed by videotape (VHS Format) and

FINAL

the extent of the survey, but generally all structures within 100 feet of the work area will be completely surveyed as herein defined.

The Government will obtain permission from the property owners and provide contacts with which the General Contractor shall coordinate monitoring activities. Each property owner shall then be contacted by the General Contractor and informed as to the reason for the survey and an appointment requested with every reasonable effort made to accommodate the property owner's schedule. If the General Contractor is refused entry, he will notify the Government and request direction.

The foundation of each structure shall be videotaped by the General Contractor with special attention to any cracking or structural defects in the foundations or walls of the structures, including but not limited to, binding doors and windows, cracked or broken glass, etc. The conditions of the riverbanks shall be videotaped from the water to the top of the bank, with special attention to areas of erosion, retaining walls, riprap, vegetation, and other features requested by the Government. The video shall incorporate some type of notes, labels, or signs to clearly indicate the location or structure being videotaped. Rulers or gauges shall be placed next to cracks or structural defects to provide a semi-quantitative indication of size of these features. Videotaping of the riverbanks shall be conducted from a boat in the Housatonic River.

END OF SECTION

DIVISION 2—SITE WORK

FINAL

SECTION 02300

EARTHWORK

PART 1 GENERAL

Work covered by this section includes measures to support remediation work within the Transition Area and restoration construction along the riverbed and riverbank (see Section 02930 BANK REVEGETATION TRANSITION AREA) and as shown on the Drawings. The work consists of excavation of TSCA and non-TSCA materials (see Section 02111 HANDLING OF EXCAVATED MATERIAL AND BACKFILL), subgrade preparation, backfilling of the riverbed, retaining wall construction and other measures required to complete the work. Earthwork shall be accomplished by means selected and designed by the Excavation Subcontractor and acceptable to the General Contractor and the Government.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33	Concrete Aggregates
ASTM C 97	Absorption and Bulk Specific Gravity of Natural Building Stone
ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	Particle-Size Analysis of Soils
ASTM D 1140	Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2974	Moisture, Ash, and Organic Matter of Peat and Other Organic Materials

FINAL

- ASTM D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
- ASTM D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D 5519 Particle Size Analysis of Natural and Man-Made Soils

COMMONWEALTH OF MASSACHUSETTS, DEPARTMENT OF HIGHWAYS

State Specifications (1995) Standard Specifications for Highways and Bridges, as amended. The publication will be referred to as the "State Specifications"

ENGINEERING MANUALS (EM)

EM 1110-2-1906 Laboratory Soils Testing

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals: G

Excavation Plan

- a. Proposed construction sequence shall address the following: Protection of utilities and structures; excavation of channel sediment and bank soil; method to minimize conveyance of contaminated material over remediated areas; sequence for drilling caissons, if required; and installing soldier piles, lagging, and anchors and permanent steel sheet pile retaining walls and anchors. Means, methods, and sequence for the backfill placement methods and equipment shall be specified. The means and methods for incorporating and sequencing the temporary erosion control measures specified in 02370 STORMWATER AND EROSION CONTROL: IN-RIVER WORK shall be included.
- b. The method for coordinating survey control (real-time) with the General Contractor during construction, and minimizing excavation volumes while ensuring that the work conforms to excavation grades shown in the Plans in accord with the tolerances listed in this Specification, shall be described.
- c. A dewatering plan that shows the location of all temporary dams, pumps, sumps, pipelines, filters, sedimentation basins, and other equipment necessary to handle leakage through and around the dam and infiltration of groundwater into the work area. The plan shall address the installation of a temporary dam at the downstream (discharge) end of the by-pass pipes to prevent the flow of water into the work area. The plan shall include a list of the products to be used for dewatering,

FINAL

subject to the approval of the Engineer. The piping materials, route to discharge to the river, and route to the water treatment system shall also be included in the plan. The plan shall include methods to minimize leakage into work areas and to prevent the discharge of suspended sediment to the treatment system. The plan may be modified and resubmitted as work proceeds in the event the Excavation Subcontractor elects to revise the work or materials described in the plan.

- d. A schedule for all specified earthwork and riverbank inspections that includes inspection frequencies and reporting, the names and addresses of all testing/inspection firms, qualifications of their personnel, and applicable permits and licenses.
- e. See additional requirements for the Excavation Plan listed in Specification Section 02111, HANDLING OF EXCAVATED MATERIAL AND BACKFILL.

SD-06 Test Reports

In-place compaction testing data.

Visual inspection reports.

1.3 SUBSURFACE DATA

Subsurface soil boring logs are available in the Pre-Design Summary, 1.5-Mile Removal Action - Phase 2. These data represent the subsurface information available; however, variations may exist in the subsurface between boring locations.

1.4 SOIL AND SEDIMENT EXCAVATION

Soil and sediment excavation shall include the satisfactory removal of all materials not classified as boulder excavation, concrete excavation, embedded debris, or ordered excavation. Soil and sediment excavation shall include earthen and fill material located within the Limit of Excavation shown on the Drawings, except those specified below. As indicated on the subsurface investigation logs available in the Pre-Design Summary, 1.5-Mile Removal Action - Phase 2, soil and sediment includes boulders and debris less than 5 feet in nominal diameter, concrete of less than 1 cubic yard volume, alluvial cobbles, gravel, sand, silt, clay, glacial till, and fill. Additionally, stumps and roots are considered incidental to the excavation of sediment and soil and are, therefore, included in this classification of excavation but must be kept segregated from soil and sediment. Metallic debris is considered incidental to soil and sediment excavation.

1.5 BLASTING

Blasting will not be permitted.

FINAL

1.6 UTILIZATION OF EXCAVATED MATERIALS

Unless otherwise directed, materials removed from excavations shall be carefully placed in sealed trucks provided by the Excavation Subcontractor such that contamination of the outside of the vehicle and leakage from the vehicle does not occur. Segregation of the various types of materials (TSCA and non-TSCA soil and sediment, stumps, boulders, and concrete) shall be maintained by placing these materials in designated trucks. Unless otherwise approved by the Engineer, no excavated material shall be reused on-site for fill of any sort, or disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

1.7 CONSTRUCTION TOLERANCES

The finished excavation surface and fill/stone layer thickness shall not deviate from the lines and grades shown on the Drawings unless directed by the Engineer. Excavation beyond the neatline will not be paid. The Excavation Subcontractor will be responsible for off-site transport and disposal of contaminated material resulting from unapproved over-excavation beyond the neatline tolerances provided below, as well as associated additional backfill costs. Tolerances are measured perpendicular to the indicated neatlines. Extreme limits of the tolerances given shall not be continuous in any direction for more than five times the nominal stone dimension nor for an area greater than 1,000 square feet of the surface.

Material	Deviation (feet)
Excavation/Subgrade	-0.15 to 0
Filter Material	-0.15 to +0.15
Common/Structural Fill	-0.15 to +0.15
Riprap	$-25\%d_{\max}$ to $+15\%d_{\max}$
Topsoil	0 to +0.15

Note: d_{\max} is the maximum nominal riprap size in feet.

Due to the shape and size of riprap and the inherent difficulties associated with fine-grading riprap, a range of surface tolerance has been provided. Measurements of finished elevations for riprap shall be taken within a 12-inch radius of the horizontal location established on the subgrade.

The work shall be built to the required elevations, slope, and grade, and the outer surfaces shall be even and present a neat appearance. Placed material not meeting these limits shall be removed or reworked as directed by the Engineer. Payment will not be made for excess material that the Engineer leaves in-place.

FINAL

Excavation shall conform to the grades shown on the drawings. In the event of overexcavation beyond the neatline, the work shall be stopped.

PART 2 PRODUCTS

The backfill materials will be tested, procured, and delivered to the worksite by the Excavation Subcontractor in accordance with this specification and with Section 02111 HANDLING OF EXCAVATED MATERIAL AND BACKFILL. Physical/geotechnical testing shall be performed by the Excavation Subcontractor. Chemical testing shall be performed by the General Contractor. Test samples shall be representative samples taken in the presence of the Contracting Officer. The Excavation Subcontractor shall place the backfill materials in accordance with the Drawings and Specifications.

2.1 COMMON FILL

Common fill shall be obtained or produced from approved sources and shall consist of durable (non-calcareous) mineral soil and rock products. Common fill shall be free of organic materials, loam, wood, trash, or other objectionable materials which may be decomposable, compressible, or which cannot be properly compacted.

Material shall classify as SC, SM, SW, SP-SM, GC, GM, or GW according to the Unified Soil Classification System (USCS), unless otherwise approved by the Engineer for use to construct a specific work element.

Liquid limit shall not exceed 40% and plasticity index shall not exceed 10%.

Maximum clod size shall not exceed 4 inches.

Material shall have an organic content less than 6% as measured by ASTM D 2974.

Material shall have a maximum dry density not less than 110 pounds per cubic foot (pcf) as determined by American Society for Testing and Materials (ASTM) D 1557, Method C, except for manufactured topsoil.

Common fill placed on riverbanks shall contain no rocks or rock fragments larger than one-half of the compacted thickness of the lift (refer to Paragraph 3.6 for lift thickness requirements) in which the material is placed and shall be such that no voids are left in the fill as constructed. Common fill shall have physical properties which permit its ready spreading and compacting. The moisture content of common fill shall be adjusted to provide the specified compaction and ensure a stable embankment.

2.2 STRUCTURAL FILL

Structural fill shall meet the quality, durability, and composition, i.e., gradation requirements for State Specification M2.01.7 Dense Graded Crushed Stone.

FINAL

Sieve Size	Percent Finer by Weight
3-inch	100
2-inch	75 to 100
No. 4	40 to 100
No. 40	10 to 45
No. 200	0 to 12

2.3 FILTER MATERIAL

The filter material shall be well-graded and composed of hard, durable particles, and shall not contain organic matter; thin, flat, and elongated pieces; or soft, friable particles in quantities considered objectionable by the Engineer. The aggregate shall meet the quality requirements of ASTM C 33 and the gradational requirements specified in the following tables.

2.3.1 Filter Material

Filter material shall conform to the following gradational requirements and shall satisfy the State Specification for quality, durability, etc. as specified in Section M2 of the State Specifications:

Sieve Size	Percent Finer by Weight
7-inch	100
4-inch	80-100
2½-inch	68-88
½-inch	20-50
No. 4	5-40
No. 40	0-15

2.4 STONE

Stone protection materials shall consist of hard, durable, and sound quarried rock fragments furnished by and at the expense of the Excavation Subcontractor. Each stone shall have a density of not less than 165 pcf based on the saturated surface dry specific gravity determined in accordance with ASTM C 97. The stones shall be irregular and angular in shape and shall be free from open or incipient cracks, seams, structural planes of weakness, or other defects that would tend to increase unduly their deterioration from natural causes and from handling and placing. No stone in the material shall have its long dimension exceeding

FINAL

3 times its short dimension. Stone protection material shall be well-graded between the maximum and minimum stone sizes furnished. The maximum and minimum sizes furnished shall be selected to produce a material without “skip gradation” with stone sizes within the limits specified. All stones for the production of stone protection material shall be obtained from one general rock type in one quarry. The rock shall be selected and placed so that the entire finished surface of stone protection will be of uniform appearance.

2.4.1 Riprap

Only quarried stone shall be used. The minimum stone density shall be 165 pcf. Stone shall be hard, durable, and angular in shape; resistant to weathering; and shall conform to the tables below. Material shall be well-graded and free of overburden, spoil, shale, and organic material.

In the following tables, the “(max)” size stone is the permissible maximum stone size and the “(min)” size stone is the permissible minimum size stone. Stone protection materials may contain up to 10%, by weight, of air-dried rock fragments, spalls, and dust with each particle weighing less than the permissible minimum stone size. No particles weighing less than the permissible minimum stone size shall be defined as a stone in stone protection materials. In computing percentages by weight of stone in the preceding table, the weight of particles weighing less than the permissible minimum stone size shall not be included in the total weight. Approximate stone size is provided for information only and is based on a specific gravity of 2.65.

9-inch Riprap

Approximate Stone Size in inches	Limits of Stone Weight in lb.	Percent Lighter by Weight
6.7 to 9.0	15 to 36(max)	100
5.2 to 6.0	7 to 11	50
3.4 to 4.6	2(min) to 5	15

12-inch Riprap

Approximate Stone Size in inches	Limits of Stone Weight in lb.	Percent Lighter by Weight
8.9 to 12.0	35 to 86(max)	100
7.0 to 8.0	17 to 26	50
4.6 to 6.0	5(min) to 13	15

FINAL

18-inch Riprap

Approximate Stone Size in inches	Limits of Stone Weight in lb.	Percent Lighter by Weight
13.3 to 18.0	117 to 292(max)	100
10.5 to 12.0	58 to 86	50
7.1 to 9.5	18(min) to 43	15

2.5 SELECT GRANULAR FILL

Select granular fill shall be natural mineral soil consisting of durable (non-calcareous) granular aggregates. The gradation of the soil shall conform to the limits specified in the following tables and the maximum size of any stone or fragment shall not exceed two-thirds of the compacted thickness of the layer being placed. The material shall be obtained from sources approved by the Engineer.

2.5.1 Bank Run Gravel

Sieve Size	Percent Finer by Weight
6-inch	100
No. 4	25 to 70
No. 200	0 to 12

2.5.2 Select Gravel

Material shall conform to requirements of Massachusetts Highway Department (MHD), State Specification for Material M1.03.0, Type b.

Sieve Size	Percent Finer by Weight
3-inch	100
1/2-inch	50 to 85
No. 4	40 to 75
No. 50	8 to 28
No. 200	0 to 10

FINAL

2.6 PROCESSED AGGREGATES

Processed aggregates shall be obtained or produced from sources approved by Engineer, and shall consist of granular mineral soils having gradations as specified below:

2.6.1 Sand

Sieve Size	Percent Finer by Weight
3/8-inch	100
No. 200	0 to 10

2.6.2 Processed Gravel

Material shall conform to requirements of State Specification for Material M1.03.1 Processed Gravel for Sub-base. (Material meeting State Specification M2.01.7 Dense Graded Crushed Stone for Sub-base will also be acceptable for gravel roadway applications.)

Sieve Size	Percent Finer by Weight
3-inch	100
1 1/2-inch	70 to 100
1/4-inch	50 to 85
No. 4	30 to 60
No. 200	0 to 10

2.6.3 Screened or Crushed Stone

Screened or crushed stone shall consist of clean, durable fragments of either ledge, rock, or boulders, or both, of uniform quality, reasonably free from thin or elongated pieces. Material shall conform to the gradation requirements of Massachusetts Highway Department (MHD) State Specification for Material M2.01.1, M2.01.2, and M2.01.4.

FINAL

Sieve Size	Percent Finer by Weight	
	3/4-inch Crushed Stone	1 1/2-inch Crushed Stone
2-inch	--	100
1 1/2-inch	--	95 to 100
1-inch	100	35 to 70
3/4-inch	90 to 100	0 to 25
1/2-inch	10 to 50	--
3/8-inch	0 to 20	--
No. 4	0 to 5	--

2.7 TOPSOIL

Replacement topsoil as specified on the Drawings will be derived from approved off-site sources. Topsoil sources shall include, but not be limited to, those created by natural geological processes or those manufactured by the addition of compost to a base soil. Topsoil shall have a texture of a loose friable loam with no admixture of refuse or material toxic to plant growth. Topsoil shall be free of stones, lumps, stumps, or similar objects larger than 2 inches in greatest diameter, subsoil, roots, weeds, sticks, leaves, paper, or any other deleterious materials.

Topsoil for this project is intended for application to well-drained side slopes. The presence of the correct nutrients and pH status in the soil is necessary for healthy plant growth. All topsoil shall comply with the ASTM D 5268 standard. As specified in the standard a sample of material must first be screened over a No. 4 sieve. The material retained on the No. 4 sieve shall be considered deleterious material and shall not exceed 5% of the sample by mass. The material passing the No. 4 sieve shall then be tested for each of the following characteristics and meet the requirements specified:

FINAL

Compositional Category	Test Method/Calculation	Percentage by Mass/pH
Organic Material	ASTM D 2974	2 to 20
Sand Content	ASTM D 1140 (percent retained on No. 200 sieve)	20 to 60
Silt and Clay Content	Difference between 100 and the sum of sand and organic material percentages.	35 to 70
pH	ASTM D 4972	5 to 7

The total organic matter content can be amended with compost from approved sources. If topsoil is to be amended with compost, the compost shall be free of weak seeds and comply with EPA Chapter 40 CFR Part 503 (e.g., pathogens, metals). Compost shall be an organic substance produced by the biological and biochemical decomposition of source-separated compostable materials that may include, but are not limited to, leaves and yard trimmings, food scraps, food processing residues, manure and/or other agricultural residuals, and/or wood chips. The compost shall have a loose and granular texture with the following characteristics or properties:

- 30 to 60 % organic matter content.
- 0.5 to 2.0 % total Kjeldahl nitrogen content.
- 6.5 to 7.5 pH.
- Maximum particle size less than 1 inch.
- Conductivity of less than 5 mmhos/cm.

Samples of the compost must be tested and approved for use by the Engineer prior to blending with soil. After blending is complete, the product shall be tested to ensure it meets the physical and chemical requirements stated herein.

2.8 GEOTEXTILE

Geotextile to be used in conjunction with general site construction (e.g., temporary applications, drainage swales, etc.) shall conform to the following mechanical and hydraulic properties. The geotextile manufacturer shall furnish a certificate of compliance (letter) that states that the geotextile manufactured and delivered to the site meets or exceeds the requirements of this specification along with quality control test results and the manufacturer's recommendations for handling, storage, and installation.

FINAL

Geotextile

Property	ASTM Test Method	Unit	Required Value ¹
Matrix	--		Nonwoven
Unit Weight ²	D 4833	oz/sy	8
Puncture Strength	D 4751	lbs	100
Apparent Opening Size	D 4632	min.	≤ No.80 sieve
Grab Strength (MD)	D 4632	lbs	200
Grab Elongation	D 4632	%	> 50
Trapezoidal Tear Strength	D 4533	lbs	80
Mullen Burst Strength	D 3786	psi	325
Permittivity	D 4491	sec ⁻¹	≥ 0.8
UV Resistance ³ (@500 hours)	D 4355	% strength retained	> 70

NOTES:

¹Minimum average roll value (MARV).

²For information only, not a required property.

³Manufacturer's certification required that states product meets or exceeds required value for typical roll values.

2.9 DEWATERING SYSTEM

The dewatering system shall consist of pumps, sumps, pipelines, sediment filters, sedimentation basins, and other equipment necessary for the collection, removal, and disposal of surface water and groundwater within each containment cell. Dewatering shall be accomplished with sumps and pumps, and/or such other means selected and designed by the Excavation Subcontractor and acceptable to the Engineer.

PART 3 EXECUTION

3.1 GENERAL EXCAVATION

The Excavation Subcontractor shall perform excavation of each type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified. Unsatisfactory materials encountered within the limits of the work shall be stabilized in-place or excavated below grade and replaced as directed by the Engineer. During construction,

FINAL

excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times.

Excavation along the riverbank toe and within the riverbed shall proceed in a manner such that any area that has been excavated can be protected and/or stabilized in advance of an anticipated storm event during which the dam may be overtopped. The Excavation Subcontractor shall have materials, equipment, and personnel on-hand to implement protection and/or stabilization measures if and when directed by the Engineer. Protection and/or stabilization may be in the form of final restoration or in the use of temporary materials such as sacrificial riprap, articulating concrete block, plastic sheeting, etc.

During and following completion of excavation along and in close proximity to the riverbank toe and before final restoration, the Excavation Subcontractor shall implement a riverbank inspection program, which shall consist of visual inspections of the riverbank, roadways, utilities, and structures immediately adjacent to the excavated area at least twice daily, and more frequently if warranted by conditions and as directed by the Engineer.

Due to the potential for snow to accumulate on the riverbanks, both from natural deposition and snow plowing operations on adjacent streets and properties, the Excavation Subcontractor must be particularly vigilant of potential slope instabilities at this time. The snow, acting as a surcharge load, could cause slope instabilities and because the ground will not be visible, it will not be possible to observe the formation or development of tension cracks on the ground surface. The Excavation Subcontractor should also be aware of the potential for snow to slide into the work area from the riverbanks. Based on these conditions and the above-mentioned site inspections, the Engineer may implement additional conditions monitoring activities such as vibration and settling monitoring at specific locations to support slope stabilization implementation decision-making.

If areas of potential instability are observed, the Excavation Subcontractor shall immediately notify the Engineer. It is anticipated that, at a minimum, immediate placement and compaction of structural fill at the toe of the riverbank will be required to stabilize the riverbank. However, required actions will be directed by the Engineer on a case-by-case basis. Temporary closure of roadways, driveways, and parking lots may also be required.

3.1.1 Excavation of Riverbanks and Channel

Excavation of riverbanks and channel shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown, or as directed. Excavation shall be initiated at the top of bank and shall proceed down slope unless otherwise approved by the Engineer. Riverbanks and channel shall not be excavated below grades shown. Excessive excavation shall be backfilled to grades shown with compacted common fill at the Excavation Subcontractor's expense. The Excavation Subcontractor shall maintain excavations free from detrimental quantities of water, leaves, brush, sticks, trash, and other debris until final acceptance of the work.

FINAL

3.1.2 Excavation for Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Excavations shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped, or serrated surface. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed.

3.1.3 Excavation to Till or Bedrock

Excavations shall be made to the lines, grades, and elevations shown. If till or bedrock is encountered, the Excavation Subcontractor shall terminate excavation work and notify the Engineer. The Engineer may elect to continue excavation of the material to a specified depth or to terminate excavation activities.

3.2 SELECTION OF FILL MATERIAL

Fill material shall be selected to meet the requirements and conditions of the particular fill for which it is to be used. Fill material will be provided by the Excavation Subcontractor as described in Section 02111 HANDLING OF EXCAVATED MATERIAL AND BACKFILL.

3.3 OPENING OF EXCAVATION

The Excavation Subcontractor shall notify the General Contractor sufficiently in advance of the opening of any excavation to permit elevations and measurements of the undisturbed ground surface to be taken.

The Excavation Subcontractor shall prepare plans detailing the proposed sequence of work. In-river work will be divided appropriately in accordance with these plans and shall proceed from one area to the next as indicated in the plan. Riverbank work shall proceed in coordination with in-river work to limit migration or erosion of existing bank soil into the work areas. Additionally, the work shall be coordinated such that conveying of contaminated material over restored areas is minimized to prevent releases of contaminated material to restored areas. Limits of riverbank work and final grades shall conform to the Drawings.

3.4 DEWATERING AND CONVEYING

The Excavation Subcontractor shall remove river water and provide adequate dewatering to prevent standing water in the excavation. Excavation Subcontractor shall be responsible for water management of all outfall pipes that discharge into the excavation area.

The initial dewatering sequence shall include the following tasks:

FINAL

- a. Pump the water from within the work area using a pump intake and flow rate to minimize suspending and entraining solids.
- b. Water pumped from within the work area shall be discharged to the river until 6 inches of water remains in the work area near the pump intake.
- c. Water pumped from the work area shall be routed to the treatment system when the water depth in the containment cell is decreased to 6 inches, or if the Engineer determines that excess turbidity or sheens are visible in the water discharged from the containment cell.
- d. The Excavation Subcontractor shall isolate the terminus of outfalls from the work area using sheet pile, sumps and pumps, and other methods as approved in the dewatering plan as shown on the Drawings. Accumulated storm water may be discharged to the river.
- e. The Excavation Subcontractor shall provide temporary rock outlet protection at the terminus of all dewatering discharge lines that discharge to the river and other erosion-sensitive areas. This work will not be paid for separately and will be included as part of the unit price for Excavation as described in Section 01025 MEASUREMENT AND PAYMENT.

The dewatering system shall conform to the following general guidelines:

- a. Design dewatering system to maintain water levels such that excavation is generally dry so that the work is not impeded, to limit movement of soil fines, and to allow excavation and placement of fill without damaging subgrade, subject to approval of the Engineer.
- b. Grade and ditch the site as necessary to direct surface runoff away from open excavations and subgrade surfaces.
- c. Provide and maintain temporary trenches, drain pipes, sumps, pumps, and other equipment to keep all excavations generally dry. The Excavation Subcontractor is responsible for collecting and removing all groundwater seepage, surface water runoff, and wastewater from construction activities to the wastewater treatment facility.
- d. Provide means to minimize silt and fine sand from being transported with the water to the treatment system.
- e. Provide stormwater runoff control to prevent upland runoff from entering the work area during remediation.
- f. After initial dewatering of the work area to within 6 inches of the riverbed, pumped surface water and groundwater shall be conveyed to the water treatment system. The Excavation Subcontractor shall size equipment appropriately, based on past experience on the 1.5-Mile Removal Action between Lyman Street and Elm Street

FINAL

and the anticipated conditions for areas of the reach between Elm Street and Dawes Avenue. The current water treatment system is permitted to discharge up to 500 gpm of treated water.

- g. On-site groundwater recharge pits will not be permitted.
- h. Under no circumstances place fill, place concrete, or install piping and appurtenances in excavations containing standing water without permission to proceed from the Engineer.
- i. The Excavation Subcontractor shall control groundwater so as to prevent softening of the bottom of excavations, or formation of “quick” conditions or “boils” during excavation. The Excavation Subcontractor shall design, install, maintain, and operate dewatering systems so as to minimize removal of the natural soils (e.g., by “piping”).
- j. The Excavation Subcontractor shall operate dewatering pumps in the work areas so as to minimize noise and in compliance with applicable State of Massachusetts provisions for noise control.

3.5 PREPARATION OF GROUND SURFACE FOR BACKFILL

3.5.1 General Requirements

Ground surface on which fill is to be placed shall be free of standing water; live, dead, or decayed vegetation; rubbish; debris; other unsatisfactory material; and compacted to a reasonably firm and stable surface. If excessively soft, yielding, and unstable areas are encountered, the Excavation Subcontractor shall, at the direction of the Engineer, undercut the soft material and replace it with 3-inch processed gravel or other engineer-approved material as required to achieve a stable subgrade surface. This material shall be placed and compacted to return the subgrade surface to the required elevation. Alternately, a soft area may be stabilized using a chocking technique which shall require the placement of gravel, as directed by the Engineer, on the soft area. The gravel shall be pushed into the soft material until a stable surface is achieved. The stabilized surface shall meet the permissible excavation tolerances.

3.5.2 Frozen Material

Backfill to support structures shall not be placed on a foundation that contains frozen material. All material below structures that freezes or has been subjected to freeze-thaw action during the construction work shall be thawed, dried, reworked, and recompacted to the specified criteria before additional fill material or the structure is placed.

FINAL

3.6 BACKFILL PLACEMENT AND COMPACTION

The Excavation Subcontractor shall obtain approval for each work area excavation prior to backfilling. Structural fill and/or common fill shall be used except where other materials are directed, specified, or shown on the plans. Compaction shall be accomplished with equipment acceptable to the Engineer. Backfill material shall not contain frozen clumps of soil, snow, or ice. Minimum compaction requirements expressed as a percentage of maximum density for various backfill types are as indicated in the following table and text:

Backfill Type	Compaction in Percent Maximum Dry Density	Maximum Loose Lift Thickness (inches)	
		Hand-Operated Compaction Equipment	Heavy-Duty Compaction Equipment
Structural fill	95	6	12
Common fill	95	6	12
Filter material	90	6	12

Structural fill and common fill shall be placed in loose, horizontal lifts and uniformly compacted to the percent maximum dry density, based on ASTM D 1557 Method C, as required in the table. Fill placed on slopes may be accepted if the surface density is less than 95%, at the discretion of the Engineer.

Filter material soils shall be placed in horizontal, loose lifts and uniformly compacted to at least 90% of maximum density according to ASTM D 1557 Method C. Filter material placed on slopes may be accepted if the surface density is less than 90%, at the discretion of the Engineer.

Where common fill or filter material that conforms to specified gradations is too coarse to permit testing with ASTM D 1557 Method C, the Excavation Subcontractor shall develop a compaction method that achieves a uniformly dense, non-yielding condition acceptable to the Engineer. Compaction acceptance shall be based on visual approval of the completed lift.

Backfill shall not be placed behind walls until authorized by the Engineer. Backfill behind walls and on slopes shall be placed in horizontal lifts not exceeding 6 inches in loose thickness and uniformly compacted. Failure to place materials in horizontal lifts shall be justification for the Engineer to require the Excavation Subcontractor to remove and replace said materials. Backfill adjacent to walls and on slopes supported by walls shall be compacted with hand-operated equipment to prevent eccentric loading upon or against the wall. Backfill shall be compacted to at least 95% of maximum dry density according to ASTM D 1557 Method C.

FINAL

Riprap shall be spread in uniform layers conforming to the limits shown on the plans. Placing and spreading equipment shall be used to eliminate voids, but no specific minimum compaction is required.

Topsoil shall be placed in one uniform loose lift and lightly compacted. No compaction testing is required.

The surface of each completed lift shall be scarified to a depth of approximately 3 inches prior to the placement of a subsequent lift.

3.7 GEOTEXTILES

Geotextile shall be handled, stored, and installed in accordance with the manufacturer's recommendations.

3.8 TESTING

In-place compaction testing shall be performed by the Excavation Subcontractor. Inspections and test results shall be certified by a Registered Professional Civil Engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the Excavation Subcontractor and that the results are representative of the materials or conditions being certified by the tests. The Excavation Subcontractor shall perform proctor test results on the backfill materials as needed.

Field in-place density shall be determined in accordance with ASTM D 2922. ASTM D 1556 or ASTM D 2167 shall be used to check ASTM D 2922 calibration curves and may govern in the case of a discrepancy depending on test conditions and as directed by the Engineer. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using Annex A1 of Method D 2922. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of the job and at intervals as directed by the Engineer.

When test results indicate, as determined by the Engineer, that compaction is not as specified, the material shall be reworked or removed, replaced, and recompacted to meet specification requirements. Tests on recompacted areas shall be performed to determine conformance with specification requirements.

3.8.1 Optimum Moisture and Laboratory Maximum Density

The Excavation Subcontractor shall transport the fill material to the work area for installation. The Excavation Subcontractor shall install the fill material such that the specified in situ densities are achieved. The Excavation Subcontractor shall condition the backfill materials to the approximate optimum moisture contents as necessary to achieve specified in situ densities.

FINAL

3.8.2 In-Place Density

- a. One test per 5,000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines, but not less than two tests per day when less than 5,000 square feet per day or lift is placed.
- b. One test per 1,000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

3.8.3 Riprap Testing and Approval

The samples shall be subjected to such tests as are necessary to determine the quality of the material unless suitable test reports or service records are available that are satisfactory to the Engineer. Tests to determine the suitability of the rock and gravel materials may include, as applicable, petrographic analysis, specific gravity, abrasion, absorption, sulfate soundness, wetting and drying, and freezing and thawing. All testing of the initially proposed source of material will be made by or under supervision of the Engineer. The approval of a material by the Engineer, based on test results, examination of the material exposed at the source and service records, shall not relieve the Excavation Subcontractor, in any way, of the responsibility of placing a material which meets the requirements specified herein. Approval of a sample of material for soundness and durability from a source shall not be construed as approval of all material from that source. The right is reserved to reject, at any time, any or all portions of the materials in a source or products using the materials from that source when such materials are unsuitable in the opinion of the Engineer.

3.9 FINISHING

The surface of excavations, backfilled slopes, and subgrades shall be finished to a smooth and compact surface in accordance with the specified tolerances and the lines and grades shown on the plans.

3.10 PLACING TOPSOIL

On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 3-inch depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly and graded to a depth sufficiently greater than that shown on the plans so that after natural settlement the completed work will conform to elevations shown on the plans.

Topsoil shall not be spread when frozen or excessively wet or dry. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained from approved off-site areas.

FINAL

3.11 PLACING

3.11.1 General

Structural fill, common fill, filter material, and riprap shall be placed and compacted on the riverbed prior to placing restoration materials on banks. Restoration activities must progress from the riverbed to the bank. Bank restoration must proceed from the toe to the top of bank. In areas where retaining walls are to be installed, walls shall be installed prior to initiating restoration of the bank at that location.

3.11.2 Base Preparation

Areas on which filter material and riprap are to be placed shall be graded and/or dressed to conform to cross sections shown on the Drawings within the specified tolerance from the theoretical slope lines and grades. The Engineer shall approve the prepared base. Where such areas are below the allowable minus tolerance limit, they shall be brought to grade by fill with earth similar to the adjacent material and then compacted to a density equal to the adjacent in place material. Immediately prior to placing the filter material, the Engineer will inspect the prepared base and no material shall be placed thereon until that area has been approved.

3.11.3 Placement of Filter Material

3.11.3.1 Placement of Filter Material on Prepared Base

Filter material shall be spread uniformly on the prepared base to the slope lines and grades as indicated on the Drawings and in such manner as to avoid damage to the prepared base. Placement shall begin at the bottom of the area to be covered and continue up slope. Subsequent loads of material shall be placed against previously placed material in such a manner as to ensure a relatively homogenous mass. Placing of sand, gravel, and crushed stone by methods that tend to segregate the particle sizes within the filter material or cause mixing of adjacent materials will not be permitted. The filter material shall be finished to present an adequately even surface, free from mounds or windrows. Any damage to the surface of the prepared base during placement of the material shall be repaired before proceeding with the work. Compaction of the filter material shall be as described previously.

3.11.4 Placement of Riprap

3.11.4.1 General

Riprap shall be placed on the filter material within the limits shown on the Drawings.

FINAL

3.11.4.2 Placement

Riprap shall be placed in a manner that will produce a well-graded mass of rock with the minimum practicable percentage of voids, and shall be constructed, within the specified tolerances, to the lines and grades shown on the Drawings or staked in the field.

Riprap shall be placed by means of truck, crane-operated skip-pan (box), dragline bucket, clamshell, rock-bucket, hydraulic excavator ("Gradall"), trackhoe, or other approved equipment. Pneumatic-tired front-end loaders also may be used provided that, in the opinion of the Engineer, no degradation of the rock occurs.

Riprap shall be placed to its full course thickness in one operation and in such manner as to avoid displacing the filter material. The large stones shall be well distributed and the entire mass of stones in their final position shall be graded to conform to the gradation specified.

Placement shall begin at the bottom of the area to be covered and continue up slope. Subsequent loads of material shall be placed against previously placed material in such a manner as to ensure a relatively homogenous mass. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones.

Placing riprap in layers will not be permitted. Placing riprap by dumping it into chutes, or by similar methods likely to cause segregation of the various sizes, shall not be permitted. Placing riprap by dumping it at the top of the slope and pushing it down the slope shall not be permitted. Care shall be used if equipment is operated on the completed stone protection system.

The desired distribution of the various sizes of stones throughout the mass shall be obtained by selective loading of the material at the quarry or other source, by controlled dumping of successive loads during final placing, or by other methods of placement that will produce the specified results. Each truckload shall be representative of the gradation requirements.

Rearranging of individual stones shall be required to the extent necessary to obtain a well-graded distribution of stone sizes as specified above. Manipulating stone by means of dozers or other blade equipment may be permitted, if in the opinion of the Engineer, the underlying filter materials are not disturbed.

The Excavation Subcontractor shall maintain the stone protection until accepted by the Engineer, and any material displaced prior to acceptance shall be replaced at the Excavation Subcontractor's expense to the lines and grades shown on the Drawings.

3.12 EQUIPMENT

No heavy-duty equipment, i.e., dozers, excavators, heavy-duty rollers, shall be operated on slopes. All backfill materials placed behind walls and on slopes behind walls shall be compacted using hand-operated compaction equipment, unless otherwise permitted in specifications.

END OF SECTION

FINAL

SECTION 02930

BANK REVEGETATION PHASE 2

PART 1 GENERAL

1.1 INTRODUCTION

This Section includes specifications for restoring the riverbank vegetation at the project site subsequent to excavation, including those portions of the bank extending from the upper limit of the riverbank rock armor to the limit of remediation. Riverbank restoration methods consist of constructing a hard structure riverbank toe (e.g., rock armor, concrete blocks) and applying revegetation treatments upslope to the limit of remediation. Revegetation treatments shall follow the completion of topsoiling and final bank grading and shall include seeding, installation of erosion control blankets, and planting of trees and shrubs. Specific areas to receive revegetation treatments are indicated on the Drawings. This work shall include furnishing all necessary submittals for plants, seeds, erosion control blankets, materials, equipment, and labor, as well as the care and replacement of plants and seeded areas during the Plant Establishment Period, in accordance with the plans and specifications and as implemented under the direction of the Engineer.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Pre-Construction Submittals; G

Statement of qualifications (resume) of the restoration specialist overseeing the riverbank planting work. The restoration specialist's qualifications must include at least 5 years of experience in the design and implementation of similar revegetation projects and an undergraduate degree in a science pertinent to the proposed restoration work (e.g., hydrology, botany, biology, civil engineering).

SD-03 Product Data

Equipment

A listing of equipment to be used for the revegetation operations.

FINAL

Delivery

Delivery schedules.

Plant Establishment Period

Calendar time period for the plant establishment periods. When there is more than one establishment period, the boundaries of the planted areas covered for each period shall be described.

Maintenance Record

Maintenance work performed, locations and quantities of plant losses and replacements, and diagnosis of unhealthy plant material.

Invasive Plant Control; G

The Invasive Plant Control Plan shall describe the sequence of treatment work, species to be treated, and estimated date of implementation during the plant establishment period. If a herbicide is to be used, the plan shall include the herbicide trade name, U.S. Environmental Protection Agency (EPA) registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied, the name and state license number of the state-certified applicator, Spill Prevention Control and Countermeasures Plan, and proposed weather conditions needed for application.

Invasive plants are plants that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems. Invasive plants referred to in this document are those plants listed in *A Guide to Invasive Plants in Massachusetts*¹.

SD-07 Certificates; G

Plant Material
Seed Mix
Erosion Control Blankets
Mulch Mats
Fertilizer
Compost
Herbicide

Prior to delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include:

¹ Weatherbee, P.B., P. Somers, and T. Simmons. 1998. *A Guide to Invasive Plants in Massachusetts*. Massachusetts Division of Fisheries and Wildlife.

FINAL

- a. Plant Material—Classification, botanical name, common name, stock type, size, quantity by species, date harvested, and location where grown.
- b. Seed Mix—Species list with botanical name, common name, and percent by weight of each species in the mix.
- c. Erosion Control Blankets and Mulch Mats—Technical specifications and product performance data.
- d. Fertilizer—Chemical analysis and composition percent.
- e. Compost—Specifications on source of compost, maximum particle size, pH, percent organic matter, conductivity, and total nitrogen content. Document compost compliance with EPA Chapter 40 CFR Part 503.
- f. Herbicide—EPA registration number and registered uses.

SD-10 Operation and Maintenance Data

Maintenance Instructions

Instruction for year-round care of installed plant material.

SD-11 Closeout Submittals

Planting Record Drawings; G

Scale drawings indicating the recorded number and locations of each plant installed and the areas seeded. Also, in red line on a print of the Drawings, record any changes made to the planting layout during installation.

1.3 SOURCE INSPECTIONS

The nursery or source of plant materials and the source of delivered topsoil and compost shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery of plants, seed, and erosion control blankets. A delivery schedule shall be provided for each batch of materials if phased construction and planting occur.

FINAL

1.4.1.1 Plant and Seed Identification

Plant material shall be identified with attached, durable, waterproof labels and weather-resistant ink, stating the botanical (i.e., Latin) plant name and size. Seed mixes shall be clearly marked to identify the contents of the mix in regard to species (botanical names), percent by weight of each species in the mix, and place (i.e., state) of origin of each species.

1.4.1.2 Protection During Delivery

Plant material shall be protected during delivery to prevent desiccation, heat stress, and damage to the branches, trunk, bark, root system, or earth ball. Branches shall be protected by tying-in. Exposed branches shall be covered during transport. Seed shall be protected during delivery to prevent wetting, water damage, or exposure to high temperatures (> 90°F).

1.4.1.3 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical, physical, and/or biological analyses. In lieu of containers, soil amendments may be furnished in bulk. The specifications listed in Subsection 1.2 SUBMITTALS shall be provided for bulk deliveries. For the purpose of this specification, soil amendments shall include fertilizer, lime, microbial inoculants, and compost. Natural peat products will not be accepted as a soil amendment.

1.4.1.4 Herbicide Material

Herbicide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

1.4.2 Inspection

Plant materials shall be inspected upon delivery and checked for species, size, quantities, and unauthorized substitution and to establish nursery-grown status or harvesting location. Plant material showing desiccation, abrasion, sun-scald injury, disease, disfigurement, or unauthorized substitution shall be rejected.

Plant material shall be well-shaped; vigorous and healthy with a well-branched root system; and free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement, or abrasion. Plant material shall exhibit typical form of branch-to-height ratio and shall meet the caliper or height measurements specified. Plant material that measures less than specified, or has been poled, topped off, or headed back, shall be rejected. Plant material shall show new fibrous roots, and the root mass shall retain its shape when removed from the container. Plant material with broken or cracked balls, or broken containers, shall be rejected.

FINAL

1.4.3 Storage

1.4.3.1 Plant Material Storage

Plant material not installed on the day of arrival at the site shall be stored and protected in designated areas. Plant material shall not be stored longer than 30 days and shall be watered as necessary to promote survival during the storage period. All plant material shall be protected from direct exposure to wind and sun.

1.4.3.2 Herbicide Storage

Herbicide solutions shall be prepared off-site prior to application. During application periods, herbicides shall be stored according to manufacturer's instructions by the Planting Subcontractor and shall be stored away from planting stock and other planting operation material. Herbicides shall not be stored within the project area during the Plant Establishment Period.

1.4.3.3 Other Material Storage

Storage of other material shall be in designated areas. Seed, soil amendments, erosion control blankets, and mulch mats shall be stored in dry locations, out of the sun and away from contaminants.

1.4.4 Handling

Plant material shall not be injured in handling. Containerized plants shall not be handled by the trunk or stems. Materials shall not be dropped from vehicles or otherwise mishandled.

1.4.5 Replacements

In the event of damage or rejection, repairs or replacements shall be made.

1.4.6 Time Limitations

The time limitation between shipping and installing of plants shall not be more than 30 days.

1.5 WARRANTY

Each responsible Planting Subcontractor shall warrantee installed plant materials and seeded areas against defects, including death, disease, unsatisfactory growth or coverage; herbivory damage; settling of soils that adversely affects grading and site stability; and dislodgement or failure of erosion control blankets, except for defects resulting from abuse or damage by others or unusual phenomenon such as floods greater than a 50-year event.

Plants and seeded areas shall be warranted to be in a healthy and vigorously growing condition for the calendar time period specified in Subsection 3.6 PLANT

FINAL

ESTABLISHMENT PERIOD. The warranty period shall coincide with the Plant Establishment Period, and shall commence at the completion of each planting phase, seeding phase, or bank restoration section. During the warranty period, the Planting Subcontractor shall replace dead, dying, or unhealthy installed plant material as directed by the Engineer. When such plant material is determined to be dead or unhealthy in accordance with Subsection 2.1 PLANT MATERIAL and Subsection 3.6 PLANT ESTABLISHMENT PERIOD, it shall be replaced one or more times under this warranty.

PART 2 PRODUCTS

2.1 PLANT MATERIAL

2.1.1 Plant Material Classification

All tree and shrub plants shall be derived from stock native to the Northeast (i.e., New England and New York) and shall consist of nursery-grown stock obtained from Northeast nurseries. Seed mixes shall be derived from stock native to New England, New York, New Jersey, or Pennsylvania.

All plant material shall be the species specified. Botanical and common names of supplied plants shall conform to *The Vascular Plants of Massachusetts: A County Checklist*².

2.1.2 Plant Species

Table 02930-1 contains a list of the tree and shrub species to be installed where plant material is specified. Each of the indicated species is native to the Project Area/region and has demonstrated high survivorship rates based on revegetation results upstream of the project area. The species listed shall be installed in two planting zones along the riverbank (i.e., Upper and Lower Planting Zones).

The Lower Planting Zone is defined as the riverbank area between the top-of-riverbank armor to the 5-year flood stage elevation. The Upper Planting Zone is defined as the riverbank area above the 5-year flood stage elevation to the limit of remediation. The 5-year flood stage elevation varies by station and shall be provided by the Engineer to the Planting Subcontractor prior to plant installation.

Within each of these planting zones, approximately 75% of the tree species planted shall be primary species and 25% shall be associate species as described in Table 02930-1. Shrub species shall be equally distributed and planted in clumps, except for red-osier dogwood (*Comus sericea*), which shall be planted in a band just upslope of the riverbank armor as shown on the Drawings.

² Sorrie, B. and P. Somers. 1999. *The Vascular Plants of Massachusetts: A County Checklist*. Massachusetts Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program, Westborough, MA 01581.

FINAL

Table 02930-1

Tree and Shrub, Species To Be Used for Plantings

Planting Zones	Trees	Shrubs
Bank Armor	No Tree Plantings	No Shrub Plantings
Lower Bank	<u>Primary:</u> Black willow (<i>Salix nigra</i>) and silver maple (<i>Acer saccharinum</i>). <u>Associates:</u> Eastern cottonwood (<i>Populus deltoids</i>) and box elder (<i>Acer negundo</i>).	<u>Band:</u> Red-osier dogwood (<i>Cornus sericea</i>). <u>Clumps:</u> Silky dogwood (<i>Cornus amomum</i>), northern arrowwood (<i>Viburnum recognitum</i>), choke cherry (<i>Prunus virginiana</i>), and winterberry holly (<i>Ilex verticillata</i>).
Upper Bank	<u>Primary:</u> Eastern cottonwood and box elder. <u>Associates:</u> Black willow and silver maple.	<u>Clumps:</u> Northern arrowwood, winterberry holly, silky dogwood, and choke cherry

2.1.3 Types, Sizes, and Planting Distribution

As shown on the Drawings, there are two types of riverbank revegetation methods: Straight Revegetation (plantings and topsoil) and Geoweb Revegetation (plantings, topsoil, and Geoweb). Table 02930-2 provides details on the plant sizes and installation densities and distribution for the Straight Revegetation areas. Geoweb Revegetation uses these same specifications except the overall planting density for trees shall be 500 plants per acre.

Table 02930-2

Types, Sizes, Installation Densities, and Distribution for Plantings Installed in Bank Revegetation Areas

Specification	Trees	Shrubs
Plant Type	Container-Grown (1-gal pot minimum)	Container-Grown (1-gal pot minimum)
Size at Planting	4 to 6 feet in height	2 to 3 feet in height
Planting Distribution	Unevenly-spaced rows parallel to river, with plants placed approximately 8 feet on center.	All shrubs except red-osier dogwood shall be installed in unevenly-spaced rows within 15-ft x 60-ft oblong clumps. Shrubs within clumps are to be spaced on 4-ft centers. Clumps spaced 40 feet apart (minimum). Red-osier dogwoods shall be installed in the lower bank area near the top of the rock armor. Dogwoods shall be spaced 6 feet on center.
Overall Planting Density	700 plants per acre	730 plants per acre

2.1.4 Plant Schedule

The plant schedule shall provide botanical names, common names (if available), classification, height/size, method of handling or shipping, and special characteristics as

FINAL

applicable. Botanical and common names shall conform to *The Vascular Plants of Massachusetts: A County Checklist*.

2.1.5 Substitutions

Substitutions will not be permitted without prior written request and approval from the Engineer.

2.1.6 Quality

Well-shaped, well-grown, vigorous plant material having healthy and well-branched root systems shall be provided. Plant material shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement, and abrasion. Plant material shall be free of shock or damage to branches, trunk, or root systems, which may occur from the digging and preparation for shipment, method of shipment, or shipment. Rejected plants may not be used on the project, will not be paid for, and shall be replaced with approved plants. Plants with communicable diseases shall be removed from the project area immediately upon discovery of disease. Plants in contact with diseased plants will also be rejected.

2.1.7 Growing Conditions

Plant material shall be well-adapted to the growing conditions of the project area. Plant material shall be grown under climatic conditions similar to those at the project area.

2.1.8 Shipment and Handling

Plant material shall be grown in a container over a duration sufficient for new fibrous roots to have developed, and for the root mass to retain its shape and hold together when removed from the container. The container shall be sufficiently rigid to protect root mass during shipping. Plants shall be handled carefully to protect leaves, stems, branches, bark, and roots, and shall be protected from wind and sunlight during shipment.

2.1.9 Growth Form

2.1.9.1 Deciduous Trees

Height of branching shall bear a relationship to the size and species of tree specified, with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

- a. Single stem—The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.
- b. Multi-stem—All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk that branches more than 6 inches from ground level.

FINAL

- c. Specimen—The tree provided shall be well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

2.1.9.2 Deciduous Shrubs

Acceptable plant material shall be well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project.

2.1.10 Plant Material Size

Plant material shall be furnished in sizes indicated. Plant material larger in size than specified may be substituted with approval from the Engineer.

2.2 TREE PROTECTORS

Tree protectors shall be installed on each tree to reduce or eliminate damage from herbivores and other physical damage. Tree protectors shall be galvanized welded wire (19-gauge minimum) that can be wrapped around the tree stem and last for at least 5 years. Protectors shall be 36 inches tall to offer adequate protection for the size of the tree being planted and have a mesh size of ½ to 1 inch. The tree protector shall be installed 6 inches from the stem to prevent constriction and bark damage and to allow for proper air circulation. As shown on the Drawings, a stem protector shall be used with each installed tree protector to prevent scraping of bark against the tree protector during wind-caused movement.

2.3 SEED

2.3.1 Seed Classification

Seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Weed content shall be less than 0.40% by weight and shall be free of all invasive plant seeds as listed by the State of Massachusetts³.

2.3.2 Seed Mixture

The seed mixture for permanent seeding of the bank revegetation areas shall be proportioned by weight as follows:

³ Invasive plant seeds are those plants listed in Weatherbee, P.B., P. Somers, and T. Simmons. 1998. *A Guide to Invasive Plants in Massachusetts*. Massachusetts Division of Fisheries and Wildlife.

FINAL

Botanical Name	Common Name	Percent by Weight
<i>Elymus riparius</i>	stream bank wild rye	25
<i>Elymus canadensis</i>	Canada wild rye	15
<i>Panicum clandestinum</i>	deer-tongue	15
<i>Poa palustris</i>	fowl bluegrass	10
<i>Agrostis stolonifera</i>	creeping bentgrass	10
<i>Desmodium canadense</i>	showy tick-trefoil	6
<i>Polygonum pennsylvanicum</i>	Pennsylvania smartweed	6
<i>Asclepias syriaca</i>	common milkweed	2
<i>Solidago canadensis</i>	Canada goldenrod	2
<i>Solidago gigantea</i>	smooth goldenrod	2
<i>Solidago rugosa</i> var. <i>rugosa</i>	wrinkled goldenrod	2
<i>Aster puniceus</i>	bristly aster	2
<i>Aster lateriflorus</i>	calico or golden aster	1
<i>Aster macrophyllus</i>	big-leaved aster	1
<i>Verbena hastata</i>	blue vervain	1
		<hr/> 100

If needed for temporary erosion control, a nurse crop of annual rye-grass (*Lolium temulentum*), or equivalent as approved by the Engineer, can be added to the seed mixture. The annual rye-grass shall be added as a separate item to the seed mixture and shall not exceed 10% by weight of the seed mixture applied (0.1 lb/1,000 ft²).

2.4 SOIL AMENDMENTS

2.4.1 Fertilizer

The nutrient ratio of fertilizer applied to the installed plants shall be as recommended by a soil test at the time of planting. Fertilizer shall be commercial-grade 12-month minimum slow-release, tablet form, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio suitable for the plant material being installed.

The nutrient ratio of fertilizer applied to the seeded areas shall be determined based upon results of a soil test at the time of seeding. The soil test will be performed as part of this task. Fertilizer shall be a slow-release commercial grade, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio. The use, type, amount, and application of fertilizer shall be carefully considered due to the proximity to the river. It should be used only if the topsoil's nutrient content is clearly deficient, as determined from the previously specified soil test prior to the topsoil being spread.

2.4.2 Compost

Compost shall be free of weed seeds and comply with EPA Chapter 40 CFR Part 503 (e.g., pathogens, metals). The compost shall have a loose and granular texture with the following

FINAL

characteristics or properties: 30 to 60% organic matter content, 0.5 to 2.0% total Kjeldahl nitrogen content, 6.5 to 7.5 pH, maximum particle size less than 1 inch, and a conductivity of less than 5 mhos/cm.

2.5 MULCH MAT

A mulch mat shall be placed around all installed plants at the time of installation. The intent is to allow the mulch mat to provide weed and soil moisture control to benefit the installed plant. The mulch mat shall be made of 100% biodegradable material such as coir, wood fiber, or wool and have a functional longevity of 2 to 3 years. The mulch mat size shall be 20-inch x 20-inch and conform to the following minimum specifications:

ASTM Standards	Specification
D 3776 Mass/Unit Area Minimum	1.1 lbs/yd ²
D 1777 Minimum Thickness	0.25 inches

2.6 WATER

Unless otherwise directed, watering of planted stock and seed shall be the responsibility of the General Contractor. The source of water shall be the Housatonic River adjacent to the specific planting area(s) being watered.

2.7 EROSION CONTROL BLANKETS

2.7.1 Erosion Control Blanket Material

Following final grading and seeding, extended-use erosion control blankets shall be installed in the bank revegetation areas to protect the soil surface from erosion and scour. The purpose of the erosion control blanket specified herein is to provide long-term (as opposed to temporary) soil stabilization.

The product specifications shall be as follows:

FINAL

Product	Specification
Fiber Type	High quality mattress-grade coir
Functional Longevity	2 – 3 years in place
Blanket Type	Stitched and netted
Stitching	Stitched at 2.0-inch centers
Stitching Material	Strong, biodegradable filament
Width of Roll	Minimum 7.5 feet
Length of Roll	Minimum 60 feet
Top Netting Type	Natural, biodegradable, 0.5 x 0.5-inch mesh
Bottom Netting Type	Natural, biodegradable, 0.5 x 0.5-inch mesh
Recommended Slope	1H:1V or steeper

ASTM Standards	Specification
D 3776 Mass/Unit Area Minimum	10.0 oz/yd ²
D 1777 Minimum Thickness	0.35 inches
D 4595 Minimum Tensile Strength	220 x 140 lb/ft
D 4595 Maximum Elongation	34% x 20%
D 4491 Flow Velocities, Short Term	10 ft./sec (minimum)
Maximum Permissible Shear Stress	2.0 lb/ ft ² (minimum)

2.7.2 Blanket Anchors

Ground anchors used to secure extended-use erosion control blankets shall consist of biodegradable stakes with a minimum length of 6 inches (152 mm). Stakes shall be made of starch- or corn-based material with added polymers for strength and shall be designed to last a minimum of 9 months before degrading. The shaft of the stake shall have a minimum diameter of $\frac{3}{4}$ inches and shall have serrations for holding it securely in the soil, and the top of the stake shall have a hook or a head large enough to effectively secure the blanket's netting to the soil surface.

2.8 HERBICIDE

The use of herbicides shall be allowed during the Construction and Plant Establishment Periods covered under this specification to control invasive plants within planting areas or within 25 ft of planting areas. The herbicide material shall be EPA-registered and approved.

PART 3 EXECUTION

3.1 GENERAL

Planting operations shall be performed in accordance with the specifications and Drawings and as directed by the Engineer. The Planting Subcontractor shall be responsible for the performance and completion of the work and shall retain a foreman experienced in the specified work at the site at all times when the work is in progress. In addition to the foreman, the Planting Subcontractor shall have on the job a sufficient number of persons experienced in plant identification, handling and installation of plants, and other tasks required to perform the required work.

3.2 BANK REVEGETATION

Bank revegetation measures shall take place in areas where the bank stabilization type is designated as Revegetation on the Drawings. The revegetation measures specified herein are to commence after finish grading of the topsoil and shall include seeding, installing erosion control blankets, planting trees and shrubs, installing mulch mats, and maintaining herbaceous cover and plantings during the Plant Establishment Period.

3.2.1 Site Conditions

Prior to planting, the Planting Subcontractor shall examine the subgrade and topsoil, observe the conditions under which the work is to be performed, and notify the Engineer of any unsatisfactory conditions. Planting work shall not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer. Commencement of work shall signify the Planting Subcontractor's acceptance of site conditions as satisfactory.

3.2.2 Seeding and Planting Time Periods

Seeding of revegetation areas within completed bank sections shall take place directly after finish grading and prior to installation of erosion control blankets. Actual seeding time will, therefore, be dependent on the construction schedule, and seed may be spread during any time of the year.

Planting associated with bank revegetation shall be performed only during periods when beneficial results can be obtained, based on seasonal and climatic factors and plant species. When drought, excessive moisture, frozen ground, or other unsatisfactory conditions prevail, the planting work shall be stopped as directed by the Engineer. When special conditions warrant a variance to the planting or seeding operations, proposed revised planting/seeding times shall be submitted in writing to the Engineer for approval prior to implementation.

Seasons for planting, unless otherwise directed, shall be within the following dates:

- a. Spring—April 1 to June 1

FINAL

b. Fall—September 1 to November 15

3.2.3 Seeding

Prior to installing seed, any previously-prepared surface shall be reworked to meet the finish grade, topsoil, and fertilizer requirements. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution. To prevent excessive runoff of fertilizer into the river, fertilizer shall not be spread during late fall or winter when the ground is frozen.

3.2.3.1 Seeding Method

The seeding method shall be broadcast seeding. Seed shall be uniformly broadcast at a rate of 1-lb/1,000 ft² of surface area, or as directed by the Engineer at the time of seeding⁴. Half the total rate of seed application shall be broadcast in one direction, with the remainder of the seed rate broadcast at 90 degrees from the first direction. Broadcast seed shall be raked lightly to provide proper contact with the soil.

If needed for temporary erosion control, a nurse crop of annual rye-grass, or equivalent as approved by the Engineer, may be added to the seed mixture. The annual rye-grass shall be added as a separate item to the seed mixture and shall not exceed 10% by weight of the seed mixture applied (0.1 lb/1,000 ft²).

After seed is broadcast, the seeded area shall be covered with an erosion control blanket as specified in the Drawings and outlined in Subsection 3.2.4 Installation of Erosion Control Blankets.

3.2.3.2 Watering

When seed is applied during the growing season, watering shall start immediately after the seeded areas are covered with erosion control blankets. Then, for the remainder of the growing season, water shall be applied to supplement natural rainfall at a rate sufficient to ensure moist soil conditions and vigorous root growth and development (approximately 1 inch of water per week). Erosion, excessive runoff, and puddling shall be prevented during supplemental watering.

When seed is applied during the winter or dormant seasons, the seeded areas shall not be watered until the growing season starts, at which time water shall be applied to supplement natural rainfall as described above.

3.2.4 Installation of Erosion Control Blankets

Extended-use erosion control blankets shall be installed on the bank revegetation areas immediately following finish grading and seeding, but before planting. The type of erosion

⁴ If a nurse crop of annual rye-grass or equivalent is used, it shall be added in addition to the 1 lb/1000 sf seed mixture that is applied.

FINAL

control blanket shall be as specified in Subsection 2.7 EROSION CONTROL BLANKETS, and it shall be installed as indicated on the Drawings. All seed shall be sown prior to installation of erosion control blankets.

3.2.5 Installation of Plants

3.2.5.1 Underground Utilities

The Planting Subcontractor shall verify the location of underground utilities and facilities in the area of the planting operation with the Engineer. Damage to underground utilities and facilities caused by the Planting Subcontractor shall be repaired by the Planting Subcontractor.

3.2.5.2 Layout

Plant material locations shall be marked with stakes or pin flags before any plant pits are excavated. Plant locations may be adjusted to meet field conditions at the direction or approval of the Engineer.

3.2.5.3 Protecting Existing Vegetation

When there are established lawns adjacent to the planting area, the turf shall be covered and/or protected during planting operations. Existing trees, shrubs, and plant beds that are to be preserved shall be barricaded along the dripline to protect them during planting operations.

3.2.5.4 Obstructions Below Ground

When obstructions below ground affect the work, shop drawings showing proposed adjustments to plant material location, type of plant, and planting method shall be submitted for approval.

3.2.5.5 Plant Pits

Excavate plant pits as shown on the Drawings. Prior to excavating the pit, the erosion control blanket shall be carefully and cleanly cut in an "X" pattern and the flaps laid back in a manner to allow excavation of the pit and placement of the plant.

Plants installed in the Geoweb Revegetation area shall follow a similar process, except that portions of the Geoweb will need to be cut prior to plant installation. As shown on the Drawings, four adjacent cells shall be cut and a Geoweb node removed to accommodate the plant root mass and to reduce local soil compaction near the plant. An additional 8 to 10 inches of soil shall be lightly loosened below the planting pit prior to planting. Geoweb cells surrounding individual planting areas shall not be cut or damaged during plant installation.

FINAL

3.2.5.6 Setting Plant Material

Plant material shall be set plumb and straight and held in position until sufficient backfill has been firmly placed around the root system or ball.

3.2.5.7 Fertilizing

Plants shall be fertilized at the time of planting, if necessary, based on the results of a soil test. Fertilizer tablets shall be added to the planting pit between the bottom of the rootball to no higher than 1/3 of the way up the rootball. The tablets shall be spaced equally around the perimeter of the rootball. The number of tablets used for each plant shall correspond to the manufacturer's specified quantity for the plant size and soil requirements as determined at the time of planting.

3.2.5.8 Backfill Soil Mixture

The backfill soil mixture may be topsoil or a mix of topsoil and compost suitable for the plant material specified. The backfill shall generally consist of the excavated soil from the plant pit, with amendments added as needed based on soil test results. If compost is utilized, the backfill material shall contain 25 to 30% compost and shall be well mixed with the existing topsoil prior to backfilling.

3.2.5.9 Backfill Procedure

Prior to backfilling, plastic pots or containers shall be removed from the root system, avoiding damage to the root system. For plant material in biodegradable containers, the container shall be split prior to setting the plant with container in the pit. Prior to setting the plant in the pit, a maximum 1/4-depth of the root mass, measured from the bottom, shall be spread apart to promote new root growth. Backfill mixture shall be added to the plant pit in 4 to 6-inch layers, with each layer tamped. The backfill soil mixture shall be carefully worked in among the roots. Air pockets shall be removed from around the root system, and root-to-soil contact shall be provided. As shown on the Project Drawings, a soil berm shall be constructed on the downslope side of the installed plant to help retain moisture. The erosion blanket shall be folded back over the soil berm in a position similar to its placement prior to plant installation.

Unless saturated soil conditions exist, the General Contractor shall water plants within 24 hrs of backfilling until completely saturated to provide needed moisture and to remove air pockets.

3.2.5.10 Mulch Mat

After backfilling and watering have been completed, mulch mats shall be placed around the base of each installed plant as shown on Drawings. A gap of 1 to 2 inches shall be present between the mulch mat and the plant trunk or stem. Metal staples (minimum length of 8 inches) shall be used to secure the mulch mat to the riverbank while maintaining the structural integrity of the soil berm around the plant.

FINAL

3.2.5.11 Herbivore Control

To protect trees from potential herbivore damage, tree tubes or similar protectors shall be installed on all trees after planting. The protectors shall extend from the base of the tree (i.e., at or just below the soil surface) up the stem to a minimum height of 36 inches. The protector shall be wrapped around the tree and be spaced 6 inches (minimum) from the stem to provide sufficient space for stem growth and allow for air circulation along the stem. As shown on the Drawings, stem protectors shall be installed on each tree protector to prevent scraping of bark against the tree protector. A minimum of three metal staples (minimum length of 8 inches) shall be used to secure the tree protector to the riverbank.

Tree protectors shall remain on the trees during the Plant Establishment Period and shall be left securely in place at the end of the Plant Establishment Period.

3.2.5.12 Pruning

Pruning shall be conducted only if directed by the Engineer and shall be accomplished by trained and experienced personnel. Only dead or broken material shall be pruned from installed plants. The typical growth habit of individual plant material shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, and dead or broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off." Wound dressing or pruning paint shall not be applied.

3.3 MAINTENANCE DURING PLANTING OPERATION

Installed plant material shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed to prevent desiccation and shall continue until the Plant Establishment Period commences. The maintenance shall include watering, adjusting settled plants, pruning dead or broken branches, and adjusting tree protectors. Areas at the base of the installed plants shall be kept free of weeds, grass, and other undesired vegetation.

3.4 INVASIVE PLANT CONTROL

Assessments of invasive plants will be conducted to determine the extent of any invasive plants within the Project Area. These assessments will be conducted in the spring of the initial planting year and in the following years during the specified Plant Establishment Period. If invasive plants are identified within the project area, an invasive plant control plan shall be developed and furnished to the Engineer for approval 2 weeks prior to beginning control treatments. The control plan shall include those items listed in Subsection 1.2 SUBMITTALS. Depending on the time of plant installation, and the invasive species present and their extent, control work could begin prior to plant installation work. Implementation of invasive plant control measures shall be as specified in the specifications or as otherwise deemed necessary to achieve the project goals.

FINAL

3.4.1 Technical Representative

A technical representative experienced in invasive plant identification and control shall be present at all meetings and control treatment activities to monitor and assess control efforts. This representative must be experienced in the identification of invasive plants typically encountered in New England and in the proper application of appropriate herbicides.

3.4.2 Implementation

Physical, biological, and chemical methods may be employed as part of the invasive plant control plan. If herbicides are used, topical application of herbicide is preferred over foliar application. For the topical application of herbicide, wicks, brushes, protective cones, or other contact devices shall be utilized to apply herbicide directly to the cut stems and plant material. Where appropriate, foliar application shall utilize low-pressure sprayers with a concentrated distribution pattern or protective cones to apply the herbicides directly to the target invasive plant.

A state-certified applicator shall apply required herbicides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the herbicide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer that meets local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying herbicide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

Throughout the herbicide application activities, care shall be exercised near planted trees and shrubs, as well as non-invasive volunteer to avoid contact and subsequent plant damage. For example, if invasive plants are tall with a large leaf area then these plants shall be cut to reduce the areal extent spraying so that drift effects are minimized.

All biomass that results from any invasive plant cutting and trimming shall be removed and disposed of appropriately following such activities. If herbicide is applied, the biomass shall also be appropriately removed based on the effectiveness of the herbicide application.

A 48-hour advance notification to the Engineer shall be provided prior to all invasive plant control work.

FINAL

3.5 RESTORATION AND CLEAN UP

3.5.1 Restoration

Turf areas, pavements, and facilities that have been damaged due to the planting operation shall be restored to original condition.

3.5.2 Clean Up

Excess and waste material, including empty plant containers and other unused items, shall be removed from the bank restoration and material storage areas and shall be disposed or recycled off-site. Adjacent paved areas shall be cleared.

3.6 PLANT ESTABLISHMENT PERIOD

3.6.1 Commencement

Upon completion of the last day of the planting operation for that planting or seeding phase, the Plant Establishment Period for maintaining installed plant material and seeded areas in a healthy growing condition shall commence and shall be in effect for at least one full growing season (Spring planting shall last 16 months and fall planting shall last 12 months).

Immediately following the Plant Establishment Period, the growth and survival of the plants and seed will be monitored under a Long-term Maintenance Period specification (not defined or included herein). Written calendar time period(s) shall be furnished for the Plant Establishment Period(s). In the event that there is more than one Plant Establishment Period (due to a phased planting schedule), the boundaries of the planted and seeded area covered for each period shall be described and marked on a print of the Drawings and provided to the Engineer. The Plant Establishment Period shall be modified for inclement weather shut down periods or for separate completion dates for the individual planting areas or planting phases.

3.6.2 Maintenance During Plant Establishment Period

Maintenance of plant material shall include straightening plant material; protecting from girdling; adjusting erosion control blanket coverage at the base of plants; pruning dead or broken branches; maintaining plant material labels; watering; reseeding bare or sparsely-seeded areas; controlling invasive plants; and removing and replacing unhealthy, diseased, or dead plants.

Seeded areas will be accepted only upon attainment of 100% coverage of a reasonably thick, uniform stand of the grasses and herbaceous plants from the specified seed mix and from natural regeneration of non-invasive plant growth. Coverage does not include the areas under trees and shrubs covered by mulch or those areas where hard structures are present (e.g., rock swales, outfalls).

FINAL

3.6.2.1 Watering Plant Material

The plant material and seeded areas shall be watered as necessary to prevent desiccation and to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent to 1 inch of absorbed water per week, delivered by natural precipitation and augmented by irrigation, as required. Runoff, erosion, puddling, and wilting shall be prevented. The General Contractor will maintain a rain gage at the project site and will record precipitation data during the Plant Establishment Period.

3.6.2.2 Weeding

The areas at the base of the installed plants shall be kept substantially free of weeds and grass during the Plant Establishment Period to reduce competition for nutrients and water. Weeds and grass shall be completely removed, including the root systems.

3.6.2.3 Plant Pit Settling

When settling occurs to the backfill soil mixture, additional backfill soil shall be added to the plant pit until the backfill level is equal to the surrounding grade, while keeping the base of the plant stem at the proper height above the ground surface. Settling that affects the setting of the plant in relation to the maximum depth at which it was grown shall require replanting in accordance with Subsection 3.2.5 Installation of Plants.

3.6.2.4 Maintenance Record

A record shall be furnished describing the maintenance work performed, locations of maintenance activity, the quantity of plant losses, diagnosis of individual plant losses, and the quantity of replacements made during each site visit.

3.6.2.5 Unhealthy Plant Material

A tree or shrub shall be considered unhealthy or dead when the main leader has died back or more than 50% of the crown has died. This condition shall be determined by scraping an area 1/16-inch square (maximum) on a branch to determine if there is a green cambium layer below the bark. The Planting Subcontractor shall determine the cause for unhealthy or dead plant material and shall provide recommendations for replacement. Unhealthy or dead plant material shall be removed immediately and shall be replaced as soon as seasonal conditions permit.

3.6.3.6 Replacement Plant Material

Unless otherwise directed, new plant material shall be provided for replacement of unhealthy or dead plants in accordance with Subsection 1.5 WARRANTY. Replacement plant material in the revegetation areas shall be installed in accordance with Subsection 3.2.5 Installation of Plants. An extended Plant Establishment Period shall not be required for replacement plant

FINAL

material unless the Engineer determines that more than 50% of the replacement plants have failed.

3.6.3.7 Invasive Plant Control

Treatment for invasive plants shall be in accordance with Subsection 3.4.2 Implementation and the Invasive Species Control Plan.

3.6.3.8 Maintenance Instructions

Written instructions shall be furnished to the Engineer, including drawings and other necessary information for year-round care of the installed plant material. Instructions shall include when and where maintenance should occur and the procedures for plant material replacement.

END OF SECTION

DIVISION 10—SPECIALTIES

FINAL

SECTION 10100

TRAFFIC CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

**COMMONWEALTH OF MASSACHUSETTS,
DEPARTMENT OF HIGHWAYS**

State Specifications (1988, R 1998) Standard Specifications for Highways and Bridges, as amended. The publication will be referred to as the "State Specifications."

U.S. DEPARTMENT OF TRANSPORTATION

MUTCD (2000) Manual of Uniform Traffic Control Devices, as amended, including Part 6. The publication will be referred to as the "MUTCD."

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES AND REGISTER:

SD-03 Product Data

Sign Material.

Sign Supports.

Provide printed copies of the manufacturer's literature of the products proposed for use, prior to installation.

SD-11 Closeout Submittals

Traffic Control Police Detail Invoices; G.

FINAL

Submit copies of invoices from police agencies for traffic control police officers. Invoices must include officer's name, date and time of duty, unit rates and application of overtime rates.

PART 2 PRODUCTS

2.1 SAFETY SIGNING

Materials shall conform to Paragraph 850.42 of the State Specifications. Sign legends shall conform to standard legends specified in the MUTCD and as indicated on the drawings.

2.2 UNIFORMED POLICE OFFICERS

Uniformed police officers from the City of Pittsfield Police Department shall be used to the extent they are available, when necessary. To arrange for traffic details, the Excavation Subcontractor shall contact the Detail Officer at (413) 448-9723 with sufficient lead-time. The General Contractor shall be responsible for payment of police details for traffic control.

2.1.1 Uniform

Officers shall be clothed in a suitable and characteristic uniform that will readily distinguish them from all other employees. Officers shall be attired with regulation caps and blaze orange vests with or without white stripes. Extra reflectorization and lighting may be necessary at night.

2.1.2 Police Powers

Officers shall have police powers granted by the proper authorities and shall wear an exposed badge.

2.1.3 Qualifications and Responsibilities

Officers for traffic control shall have had previous experience directing traffic for construction operations. Officers shall have been given specific instructions from the Excavation Subcontractor as to their duties and responsibilities, both to the public and to their fellow workers on the job. They shall handle the movement of the traveling public and shall do all that is reasonable to expedite that movement in a safe manner. They shall have authority to direct the actions of the construction vehicles as well as vehicles of the traveling public.

FINAL

2.1.4 Other Personnel

The Excavation Subcontractor shall arrange for a Sheriff or other approved personnel to be used for flagging construction traffic when uniform police officers are not available upon approval of the Engineer.

PART 3 EXECUTION

3.1 ALLOWABLE TRAFFIC ROUTES

For materials being staged at the contaminated materials staging areas on GE Property and materials being disposed of at the OPCA, the primary disposal route from areas of excavation off High Street shall be north along Elm Street across the Elm Street Bridge into parcel I8-24-1, along access roads constructed adjacent to parcels on the north (or west) side of the river between Lyman Street and Elm Street, to Lyman Street from parcel I9-4-201, to the GE- owned Lyman Street parking lot and through the GE facility.

A secondary disposal route from areas of excavation shall include traveling east along Elm Street to Newell Street, north (or east) on Newell Street to Lyman Street, and north (or west) on Lyman Street into the GE-owned Lyman Street parking lot.

Additional construction traffic routes shall include Caledonia Street, the portion of Dawes Avenue between Caledonia Street and Deming Street (Dawes Avenue Bridge), and Deming Street.

All applicable permitting exemptions from manifesting and licensing are outlined in the memorandum entitled *On-Site Permit Requirements for Phase II Work from Elm Street to Dawes Avenue* (EPA, December 4, 2003).

Trucks delivering equipment, supplies, and materials to the site shall use appropriate public roads as indicated in the following:

- On the south (or east) side of the river, under no circumstances should Ashley Street be used. Day Street can be used for access by personal vehicles of construction personnel. Any other use of Day Street shall require Government approval.
- Use of Hathaway Street is permitted.
- The preferred route on the north (or west) side of the river shall be via Cove Street. However, as necessary, deliveries are permitted to enter the site through Root Place or Lyman Street via parcel I9-4-201.

END OF SECTION

DIVISION 11—EQUIPMENT

FINAL

SECTION 11000

HOUSATONIC RIVER BYPASS GRAVITY FLOW SYSTEM

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

SLIDE GATES – Section 11160

PLASTIC PIPE – Section 15064

1.2 DESCRIPTION OF WORK

a. General Description of Phase 2

A 4,000-foot length of the Housatonic River, starting at Station 514+00 and extending downstream, is to be the subject of Phase 2 of the 1.5-Mile Reach Removal Action in Pittsfield, Massachusetts. This stretch of river shall be progressively diverted by damming the river at Station 514+00, and installing additional lengths of pipe to the end of the existing, two 1,400-foot long (2,800 linear feet), 54-inch outside diameter (O.D.) pipes for gravity flow bypass. Bypass gravity flow will allow “dry” excavation and removal of contaminated sediment and soil, followed by restoration. The remediation work is expected to be completed in sequential lengths of approximately 300 to 500 feet in the river, with the gravity pipe being moved in each particular section to allow both sides of the river to be remediated. The two 54-inch O.D. pipes are capable of approximately 90 cubic feet per second (cfs) of flow each under gravity flow conditions. Based on historical hydrologic records, covering the period of 10 May through 12 March of the following year, it is estimated that the gravity system would be operated approximately 80% of the time. During the remaining 20% of the time (between 10 May to 12 March), flows historically exceed the expected capacity of the gravity piping system. The total duration of the operation of the water diversion system is expected to be on the order of 2 to 3 years.

It is anticipated that the two 54-inch O.D. gravity pipes will be installed in lengths as needed to divert the river around the farthest downstream work area.

b. The Phase 2 bypass gravity flow system, in general, consists of installing, and making operational as a complete integral system, the following:

1. Two 54-inch O.D. existing high-density polyethylene (HDPE) mains approximately 1,400 linear feet each in length (downstream of dam location) to be extended an additional 2,000 ft.
2. An engineered pipe restraint and anchoring system for each pipe.

FINAL

3. Two 66-inch diameter slide gates with manual operators, one for each gravity pipe intake.
4. Project support facilities, including office trailer.

1.3 SUBMITTALS

Government approval is required for submittals with a “G” designation; submittals not having a “G” designation are for information only. When used, a designation following the “G” designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

A Downriver Pipe Arrangement Plan submitted as part of the Excavation Plan, showing the intended 54-inch pipe layout downriver of the dam, and the pipe restraint and anchoring system, including any pipe fittings, shall be submitted. The Downriver Pipe Arrangement Plan shall also include the intended method of arranging both 54-inch mains around each anticipated work area, providing for the flows mentioned in Subsection 1.2 and addressing in detail potential pipe-anchoring requirements and pipe-bending restrictions. The Plan shall also include the design of the outlet structure, including anchoring of the pipe at the discharge point (if required) and erosion protection.

SD-02 Shop Drawings

Shop Drawings shall be submitted. At a minimum, the following shall be included with the Shop Drawings: literature, drawings, materials of construction, list of manufacturer’s recommended spare parts for each item and a detailed sketch of the pipe anchoring system.

PART 2 SCOPE ITEMS/MATERIALS

2.1 54-INCH DIAMETER HDPE PIPE

- a. The Excavation Subcontractor shall install two 54-inch O.D., DR 26 HDPE gravity pipes of approximately 2,000 linear feet in length each (total of 4,000 linear feet) which are to be furnished by the General Contractor. Pipe shall be furnished in 50-foot lengths for assembly. Fittings shall be provided, as necessary, based on the Downriver Pipe Arrangement Plan. Pipe shall be CP CHEM Performance Pipe Driscoplex 4100 or equivalent, constructed of PE 3408 black polyethylene. Pipe will be required to operate in gravity flow conditions. The supplier will furnish the pipe and fittings to the site in 50-foot lengths and he shall fusion weld the pipe into approved lengths with flanges at each end. The Excavation Subcontractor shall install

FINAL

the pipe by connecting it to the end of the existing 54-inch HDPE pipe which terminates at approximately Station 528+00.

- b. Pipe and fittings shall be manufactured in accordance with the Plastics Pipe Institutes, Inc. (PPI) Polyethylene Pipe and Fittings Manufacturing.
- c. The Excavation Subcontractor shall furnish and install an outlet structure designed to reduce outlet flow losses, thereby maximizing flow, at the discharge end of each of the flanged 54-inch O.D. HDPE pipes. The outlet structure shall be installed in such a manner as to allow relocation or re-connection as the gravity lines are extended downriver through Phase 2. This structure must be designed to prevent erosion at the discharge point.
- d. A pipe restraint and anchor system shall be engineered, designed, furnished, and installed by the Excavation Subcontractor. The design of the pipe restraint and anchor system shall be submitted in the Downriver Pipe Arrangement Plan and shall be designed and stamped by a Professional Engineer registered by the Commonwealth of Massachusetts for the appropriate discipline(s). The pipe restraint and anchor system shall be designed to provide pipe restraint under any of the following conditions:
 - Water dammed and being conveyed via gravity flow.
 - Dam removed and river free-flowing unimpeded through the Phase 2 design section. The 10-year storm output from the existing HEC-RAS model shall be the basis for parameters used under this condition.
- e. The pipe restraint and anchor system shall be engineered and designed in accordance with the pipe manufacturer's published recommendations and the PPI's Above Ground Applications for Polyethylene Pipe.
- f. The pipe restraint and anchor system design shall consider both existing and restored riverbed conditions.
- g. To aid in the design of the pipe restraint and anchor system, the Excavation Subcontractor shall utilize the information provided in the Pre-Design Document for Phase 2, the Basis of Design Document for Phase 2, and experience gained through operation of the gravity system.
- h. The pipe restraint and anchor system may utilize rock anchors, soil or screw anchors, piles, straps, or other approved pipe restraint techniques.
- i. The following design criteria shall be considered for the design of the pipe restraint and anchor system to be approved:
 - Minimum pipe bending radius.
 - Point-load stresses.

FINAL

- Shear, flexing, and bending strain and stresses.
 - Thermal expansion and contraction.
 - Deflection due to thermal expansion and contraction.
 - Buoyancy.
 - Frictional forces due to internal fluid flow.
 - External forces on pipe due to river flow.
 - Thrust forces at bends (change in direction of fluid flow) due to internal fluid flow.
 - Net force of zero applied to connection with conveyance piping at dam and at other points downstream as appropriate.
- j. The pipe supplier shall install gasketed 125/150# American National Institute (ANSI) flanges where required to make connections to valves, and pipe spool sections. The flanges shall be provided with gaskets and bolts.
- k. The Excavation Subcontractor shall furnish and install an inlet structure on each of the two gravity intakes or one inlet structure covering both gravity intakes. In either case, each inlet structure must allow for raising and lowering of the slide gates individually or must be easily removed for lowering of the slide gates. The inlet structure shall have a minimum 10-inch by 10-inch steel grate covering the inlet designed to keep out large debris that could become lodged in the pipe. The inlet structure shall, at a minimum, have two times the cross-sectional area of the 54-inch pipe at its inlet and shall be designed to minimize pipe entrance losses, thereby maximizing the gravity flow component of the river bypass system.

2.2 SLIDE GATES WITH ELECTRIC OPERATORS

- a. The Excavation Subcontractor shall install two 66-inch diameter slide gates, one on each of the gravity flow pipes. The slide gates shall be furnished by the General Contractor (see Specification Section 11160, SLIDE GATES).

PART 3 EXECUTION

3.1 GENERAL

- a. All equipment shall be installed as shown in the Drawings and in conformance with manufacturer's recommendations and instructions and in accordance with generally accepted practices.

FINAL

3.2 INSTALLATION

a. 54-Inch HDPE Gravity Flow Pipes

1. 54-inch HDPE pipe and fittings shall be handled in accordance with the manufacturer's handling instructions and in accordance with the PPI Material Handling Guide.
2. The installation shall conform with the manufacturer's instructions, an approved Pipe Restraint and Anchor System Plan, and the following current standards:
 - PPI TR-33
 - PPI TR-41
 - PPI Inspections, Test and Safety Considerations
 - PPI Polyethylene Joining Procedures
 - PPI Material Handling Guide

In addition, installation shall conform with appropriate ASTM standards as referenced by the above PPI standards (see also Specification Section 15064, PLASTIC PIPE, Paragraph 2.2.).

3. All butt and saddle fusion welds must be made per the pipe manufacturer's instructions. Welds are to be made by fusion machine operators qualified by the fusion machine manufacturer's approved program. Current training certificates shall be provided.
4. Pertinent information pertaining to making welds shall be recorded for each weld made. At a minimum, the following shall be recorded:
 - Ambient weather conditions, including temperature, wind speed, cloud cover, and precipitation.
 - Operator's name and current certificate qualifying the operator to operate the equipment used.
 - Pressure applied, time of applied pressure, and temperature of joint.
5. Each weld shall have a unique weld number assigned and clearly marked with a weather-proof material that is compatible with the HDPE pipe material, on each side of the weld.
6. Pipe anchors and restraints shall be installed per anchor and pipe manufacturer's instructions and as indicated in the Downriver Pipe Arrangement Plan.
7. Flanged connections must be installed per the manufacturers instructions. The two pipes being joined via flanges shall be in full contact at the joining edge prior

FINAL

to tightening of the flange bolts. In no instances shall the flanged fittings and bolts be used to pull two pieces of pipe together.

3.3 STARTUP AND TESTING

- a. Startup and testing procedures shall be included in the River Bypass System Operation and Maintenance Manual.

END OF SECTION

FINAL

SECTION 11800

WATER TREATMENT SYSTEM

PART 1 GENERAL

1.1 SYSTEM OVERVIEW

This specification for the temporary water treatment system is performance based. The system will be required to treat wastewater generated from the following activities: initial dewatering of excavations, ongoing dewatering of excavations, dewatering of saturated sediments and soils conducted at the contaminated materials staging area, contaminated run-on collected at the contaminated materials staging area, and decontamination of trucks and other equipment conducted at various staging areas. The Excavation Subcontractor shall use the existing on-site treatment plant for treatment of all wastewater generated as part of the remediation work to be conducted in Phase 2 from Station 527+60 to Station 543+50.

Currently, electrical power service (3-phase, 440-volt, 600-amp) is provided by the Western Massachusetts Electric Co. by underground conduit to the treatment system. An emergency power supply will not be provided for operation of the treatment system. However, the General Contractor shall be responsible for coordinating with the Excavation Subcontractor to curtail the excavation dewatering operations in the event that the storage capacity of the treatment system will be exceeded or if there is an interruption in electrical service.

The work covered by this specification includes the handling and treatment of water from the point where it enters the storage tank to the discharge point in the river. It does not include conveyance piping from the discharge of the excavation dewatering system to the treatment system and other components of the dewatering system as required by Specification Section 02300, EARTHWORK.

1.2 SYSTEM DESCRIPTION

The existing temporary water treatment system shall be operated and maintained to comply with the design conditions described below. The Excavation Subcontractor shall supply auxiliary systems and equipment required to maintain a complete and workable treatment system including, but not limited to, required piping between units, auxiliary equipment for plumbing, and controls and interfaces between auxiliary equipment and the treatment system. Chemical additives will be allowed to enhance the treatment system. The installation shall be constructed to prevent freezing of system components.

The system shall include a 300,000-gallon minimum storage tank, Modutank or equivalent, to be located within the general area available as shown on the Drawings. The system shall include processes for particulate settling, oil/water separation (light nonaqueous phase liquid [LNAPL] and [dense nonaqueous phase liquid [DNAPL], if encountered), filtration, granular activated carbon treatment, and discharge into the Housatonic River. Periodic shutdown

FINAL

and/or modification of the treatment system will be necessary to remove accumulated sediment from the large storage/equalization tank. The system shall include discharge piping. The system discharge shall be limited to 500 gallons per minute as stated in the National Pollutant Discharge Elimination System (NPDES) Permit Exclusion issued by the EPA to the General Contractor under Phase 1 of the 1.5-Mile Removal Action (EPA, September 2002, 07-0095). Increases in the effluent discharge flow rate shall need Government approval. Effluent shall be discharged at an approved location upstream of the temporary dam at Station 514+00 at a point as close as possible to the inlet of the gravity bypass system to minimize the recontamination of restored areas above the dam. Discharge shall be such that it does not result in scouring of the riverbed or riverbank. The 12-inch-diameter steel pipe sleeve previously installed by the General Contractor under the haul road for the treatment system discharge line shall continue to be used by the Excavation Subcontractor. Alternatively, a new location can be proposed by the Excavation Subcontractor for approval by the General Contractor. The Excavation Subcontractor shall relocate the discharge pipe if a new location is approved.

The Excavation Subcontractor shall man the temporary water treatment system with competent personnel while all dewatering and/or treatment processes are in progress. Therefore, the temporary water treatment system shall be manned 24 hours a day or as necessary if water treatment and/or dewatering processes are completed outside the hours of the normal work day. Security provisions shall be provided as applicable by the Excavation Subcontractor to ensure that any incidents concerning the temporary water treatment system will be addressed in a timely fashion according to the NPDES Permit Exclusion (EPA, September 2002, 07-0095) granted for the project.

1.2.1 Influent Characteristics

Treatment plant influent will be generated from dewatering of the excavation located within the river, decontamination of site materials and equipment, contaminated run-on collected at the contaminated materials staging area, and dewatering of soil and sediments in the contaminated materials staging area. The most significant volume of water is anticipated to be generated from excavation dewatering. Initially, the Excavation Subcontractor will pump down river water within the excavation before the start of excavation until 6 inches of water remain in the area. During this initial dewatering, water will be discharged directly back to the river. The final 6 inches of water and all subsequent water pumped from the excavation will then be pumped to the treatment system. Water that must be pumped by the Excavation Subcontractor from an active excavation following a flooding event will either be pumped directly back to the river until 6 inches of water remains or it will be pumped to the treatment system based on the conditions present following consultation with the Government. Once the excavation is dewatered, the Excavation Subcontractor will be required to maintain the excavation in a generally dry condition to facilitate excavation and restoration. It is anticipated that pumping will be required 24 hours per day while excavation and restoration of the Transition Area of Phase 2 is occurring. Under certain conditions, pumping of the active work areas may be temporarily discontinued following review and approval by the General Contractor.

FINAL

Other sources of water to be generated during the Removal Action such as water draining from saturated soils and sediments, contaminated run-on, and decontamination wash water will be delivered to the treatment system periodically as necessary by truck in batches.

The existing treatment system was designed to accommodate a design flow of 400 gallons per minute, minimum available head of 0 feet, and intermittent flow conditions. These parameters are also applicable to work to be conducted in the remainder of Phase 2 (Stations 527+60 to 543+50).

Additional influent characteristics describing the potential concentrations of contaminants in the groundwater at the areas of excavation are included in Table 11800-1. The influent data provided in this table are based on three pore water samples collected where groundwater discharges to the riverbed in the first reach. Additional data generated during operation of the treatment plant during Phase 1 construction are available and can be provided to the Excavation Subcontractor upon request. The quality of the water removed by the dewatering system is expected to vary depending on the location of the work being performed in the Housatonic River. The influent data included in Table 11800-1 represent the highest result of three pore water samples collected from the reach of the river in Phase 1.

1.2.2 Design Criteria

Water treatment system effluent shall meet the discharge limits included in Table 11800-1. These discharge criteria have been approved by the EPA in the NPDES Permit Exclusion (EPA, September 2002, 07-0095) granted for this project. All criteria established under the NPDES Permit Exclusion shall be followed accordingly.

1.2.3 System Location

The location of the water treatment system, including the discharge piping and the Modutanks, shall not change for the work to be conducted in Phase 2 from Station 527+60 to Station 543+50.

1.3 SUBMITTALS

Government approval is required for submittals with a “G” designation; submittals not having a “G” designation are for information only. When used, a designation following the “G” designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES AND REGISTER:

SD-10 Operations and Maintenance Data

Operations and Maintenance Manual Addenda; G.

FINAL

Excavation Subcontractor shall submit for government approval addenda to the Operations and Maintenance Plan as appropriate to cover any new equipment installed or any proposed changes in operation or maintenance procedures. A draft of an addenda shall be submitted before delivery of any new equipment to the site.

1.4 QUALIFICATIONS

A Licensed Professional Engineer shall review all system design submittals, including but not limited to, the temporary water treatment plant processes and layout design, the electrical line drawing, the piping layout, and the foundation/support system design.

1.5 FIELD MEASUREMENTS

The Excavation Subcontractor shall verify all dimensions in the field and shall advise the General Contractor of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use. Equipment shall be supported by a service organization that is, in the opinion of the Government, reasonably convenient to the site.

For the purposes of this specification, it is assumed that the treatment system shall include processes for particulate settling, oil/water separation (LNAPL and DNAPL), filtration, and granular-activated carbon treatment. However, this is a performance specification and the Excavation Subcontractor shall select unit processes, as appropriate, to meet the discharge criteria. The Excavation Subcontractor shall not be bound to the particular processes identified in this specification.

2.2 GENERAL REQUIREMENTS

2.2.1 Electrical Work

Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices shall be provided.

FINAL

Electrical wiring for the treatment system shall meet the electrical requirements for wet environments, including GFI protection.

2.2.2 Access Walkways, Platforms, Ladders, and Handrails

Walkways, platforms, and ladders shall be provided for access to equipment for operation and maintenance. They shall be designed and constructed in accordance with 29 CFR 1926 and 29 CFR 1910.

2.2.3 Utilities

All utilities have previously been brought to the site by the General Contractor, and no additional work is anticipated.

2.2.4 Secondary Containment

Secondary containment (previously constructed by the General Contractor) is required for the entire treatment system. This includes but is not limited to the two 150,000-gallon Modutanks, sand filters, activated carbon units, storage tanks or equalization basins, pumps, and piping. Sump(s) and pumps shall be provided by the Excavation Subcontractor as needed to transfer water out of the secondary containment areas to the head of the temporary water treatment system.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

Equipment delivered and placed in storage shall be protected from the weather; excessive humidity; excessive temperature variation; and dirt, dust, or other contaminants.

3.2 SAMPLING AND ANALYSIS

The General Contractor will perform sampling and analysis for all compounds listed in Table 11800-1 on a monthly basis. The General Contractor shall perform sampling and analysis of the water between carbon units in series (if applicable) at the same frequency; however, these samples will be analyzed for only the organic compounds in Table 11800-1. Monthly analytical reports, with quality control information, will be developed by the General Contractor and submitted to the Government by the 28th of each month. The Government shall be notified immediately of any exceedances. Appropriate corrective actions as determined in consultation with the Government and the General Contractor shall be implemented by the Excavation Subcontractor.

FINAL

All sampling, analysis, and quality control procedures shall follow the project QAPP as referenced in the specifications.

3.3 SYSTEM STARTUP

Although continuous operation of the treatment system from the portion of Phase 2 from Stations 522+29 to 527+60 to the remainder of Phase 2 is anticipated, if the treatment system is shut down for an extended period following the completion of the upstream Phase, the Excavation Subcontractor shall restart the treatment system. The Excavation Subcontractor shall make any necessary modifications to ensure that the plant is fully operable and meets the requirements of the performance specifications prior to initiation of normal plant operations. Criteria for completion of startup include steady-state operation of the facility with all system components and effluent quality meeting the performance criteria for a 2-week period. The Excavation Subcontractor shall provide 48-hour notice of system startup to the Government.

3.4 PROCESS RESIDUALS

Residuals generated from the operation of the temporary water treatment system shall be collected, contained, segregated, sampled, and disposed of by the Excavation Subcontractor in accordance with project ARARs. All residuals, except for spent activated carbon and NAPL-saturated residuals, can be disposed of in the appropriate OPCA cell. Spent activated carbon shall be sent off-site for regeneration or disposal, and shall be sampled, if necessary, to verify whether or not the material is regulated under TSCA. NAPL-saturated residuals will also be disposed of off-site in accordance with ARARs and applicable regulations.

3.5 SPILL RESPONSE AND DISCHARGE CONTROL

The Excavation Subcontractor shall provide on-site equipment and materials for spill response for any spills that are generated in the temporary water treatment system or generated as a result of water treatment system construction, operation, or maintenance activities. The Excavation Subcontractor shall follow the Spill and Discharge Control Plan developed for Phase 1 construction activities.

The Excavation Subcontractor shall comply with all federal, state, and local oil and hazardous waste regulations, including but not limited to 40 CFR 264 Subpart D; 40 CFR 280 Subpart E; 40 CFR 110, 112, 310 CMR 40 Subpart C; 314 CMR 15.00; 310 CMR 30.000; and 310 CMR 30.520, or as indicated in the ARARs table provided as Attachment 1 to the April 2003 Specifications. The Excavation Subcontractor shall provide methods, means, and facilities required to prevent contamination of soil, water, atmosphere, uncontaminated structures, equipment, or material by the discharge of wastes from spills due to the Excavation Subcontractor's operations. The Excavation Subcontractor shall provide equipment and personnel to perform emergency measures required to contain any spillages and to remove spilled materials and soils or liquids that become contaminated due to spillage. The Excavation Subcontractor shall provide equipment and personnel to perform

FINAL

decontamination measures that may be required to remove spillage from previously uncontaminated structures, equipment, or material. All spilled material; all decontamination residues; and all contaminated soils, absorbent materials, solvents, and other materials resulting from the cleanup of spilled or discharged substances shall be properly stored, labeled, and disposed of by the Excavation Subcontractor.

No discharge of oil, sufficient to cause a sheen (as defined in 40 CFR 112) shall occur to the Housatonic River. The discharge of a sheen of oil shall constitute an oil spill and must be reported immediately to EPA, the MDEP Emergency Response Section, and the National Response Center [(800) 424-8802].

FINAL

Table 11800-1

Performance Specification For Treatment System Discharge Criteria And Porewater Quality

Compound	CAS Registry No.	Discharge Criterion (ppb)	Pore Water (Influent) Quality ^a (ppb)
<i>Organics</i>			
1,2,4,5-Tetrachlorobenzene	95-94-3	100	11 U
1,2,4-Trichlorobenzene	120-82-1	70	11 U, 0.78 J
1,2-Dichlorobenzene	95-50-1	75	11 U
1,3-Dichlorobenzene	541-73-1	100	11 U
1,4-Dichlorobenzene	106-46-7	100	11 U
2-Butanone	78-93-3	100	2.5 R
Acetone	67-64-1	100	21 J
Benzene	71-43-2	5	3.9 J
Bis(2-ethylhexyl) phthalate	117-81-7	100	11 U
Chlorobenzene	108-90-7	100	1.6
Chloroform	67-66-3	100	0.5 U
Cis-1, 2-Dichloroethylene	156-59-2	70	Not available
Diethyl phthalate	84-66-2	100	11 U
Ethylbenzene	100-41-4	*	0.5 U
Polychlorinated biphenyls	1336-36-3	0.5	2.4
Polynuclear Aromatic Hydrocarbons (PAHs)	Various	100	1 J, 11 U ^b
Pentachlorobenzene	608-93-5	100	11 U
Phenol	108-95-2	100	11 U
Tert-butyl methyl ether (MTBE)	1634-04-4	70	Not available
Toluene	108-88-3	*	0.5 U
Trichloroethylene	79-01-6	5	0.5 U
Xylene(s)	1330-20-7	*	0.5 U
<i>Inorganics</i>			
Arsenic	7440-38-2	50	4.6 U
Barium	7440-39-3	100	55.9
Beryllium	7440-41-7	4	0.56
Chromium (total)	7440-47-3	100	2.2 U
Cobalt	7440-48-4	100	3 U
Copper	7440-50-8	100	5.8 J
Lead	7439-92-1	50	3.7 U
Nickel	7440-02-0	100	2.9 U

FINAL

Table 11800-1

**Performance Specification For Treatment System
Discharge Criteria And Porewater Quality
(Continued)**

Compound	CAS Registry No.	Discharge Criterion (ppb)	Pore Water (Influent) Quality^a (ppb)
Thallium	7440-28-0	2	3.9 U
Tin	7440-31-5	100	3.8 UJ
Vanadium	7440-62-2	100	2.9 U
Zinc	7440-66-6	500	656

* Total BTEX cannot exceed 100 ppb.

U - Compound was not detected in the sample above the reported detection limit.

J - Concentration stated represents an estimated value.

R - Result was rejected during data validation.

Not Available – Data not available.

Bold - Indicates result exceeds one of the stated criteria.

^a Highest results of three pore water samples collected from the reach of the river to be excavated in Phase 1.

^b Based on highest results for individual PAH compounds.

END OF SECTION

DIVISION 15—MECHANICAL

FINAL

SECTION 15064

PLASTIC PIPE

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

HOUSATONIC RIVER BYPASS GRAVITY FLOW SYSTEM - Section 11000.

1.2 SCOPE

- a. The supplier shall furnish to the construction site all pipe, labor, materials, tools, and equipment necessary for the satisfactory fabrication and fusion welding of plastic pipe and fittings as shown on the Drawings and as specified.
- b. Two complete 2,000-foot lengths (4,000 linear feet) of high-density polyethylene pipe (HDPE), 54-inch outside diameter (OD). Dimensional ratio (DR) 26 approximately 2.08-inch wall.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Submit manufacturer's product data for pipe and fittings including materials of construction, dimensions, and physical characteristics.

SD-06 Test Reports

Submit information pertaining to making each fusion weld, including ambient weather conditions (temperature, wind speed, cloud cover, and precipitation); operator's name; current certificate qualifying the operator to operate the fusion equipment used; pressure applied; time of applied pressure; and temperature of joint during the fusion process.

SD-07 Certificates

Training certificates of personnel performing fusion welding shall be submitted prior to any fusion welding. Certificates shall qualify each operator to operate the fusion equipment used.

FINAL

SD-08 Manufacturer's Instructions

Submit manufacturer's design, installation, handling, joining, and maintenance instructions.

1.4 INSPECTION AND TESTING

- a. The quality of all materials, the process of manufacture, and piping in place shall be subject to inspection and approval of the Government or Authorized Representative. Pipe may be inspected at the place of manufacture and on the Work. Pipe shall be subject to rejection at any time even though submitted samples may have been approved. In addition, the Government reserves the right to have any or all pipe or fittings inspected or tested, or both, by an independent inspection service at either the manufacturer's plant or elsewhere. Such inspection and/or tests shall be at the Government's expense.
- b. All pipe, fittings, and appurtenances shall be carefully inspected in the field before installation. All pieces found to be defective, as determined by the Government or Authorized Representative, shall be pulled out and not installed. Such rejected pipe shall be clearly tagged in such a manner as not to deface or damage it, and the pipe shall then be removed from the job site by the Excavation Subcontractor at his own expense. Results of shop tests which are required in the Specifications shall be submitted to the Government prior to installation of the pipe for which such tests were ordered.

1.5 HANDLING OF PIPE AND FITTINGS

- a. All pipe and fittings shall be carefully shipped and handled by equipment of sufficient capacity and proper design to avoid damage to the pipe and fittings. Under no circumstances shall materials be dropped or dumped. Pipe and fittings shall be stored in such a manner as to be protected and kept clean and dry.

1.6 QUALITY ASSURANCE

- a. Each length of pipe shall be marked by manufacturer with the trade name, nominal size, material designation, and class.
- b. Couplings and fittings shall be marked by the manufacturer with the trade name, nominal size, material designation, and class.
- c. The manufacturer shall have manufacturing and quality assurance facilities capable of producing and assuring the quality of the pipe and fittings required by these Specifications. The manufacturer's production facilities shall be open for inspection by the Government or his Authorized Representative. The Project Engineer shall approve qualified manufacturers.

FINAL

PART 2 PRODUCTS

2.1 GENERAL

- a. Plastic pipe shall meet the minimum strength requirements for the type and/or class specified. Pipe and fittings shall conform to the specifications of the latest ASTM and PPI standards.

2.2 HIGH DENSITY POLYETHYLENE PIPE, FITTINGS AND JOINTS

- a. Pipe shall be equivalent to Driscoplex 4100 PE 3408, ASTM D 3350 cell classification 345464c with standard HDB rating of 1600 PSI at 73°F.
- b. Pipe shall be delivered to the site in 50-foot lengths and fusion welded. Flanged fittings shall be provided, as necessary, based on the approved Downriver Pipe Arrangement Plan.
- c. Polyethylene Fittings & Custom Fabrications—Polyethylene fittings and custom fabrications shall be molded or fabricated by the approved pipe manufacturer. All fittings and custom fabrications shall be pressure rated for the same internal pressure rating as the mating pipe.
- d. Molded Fittings—Molded fittings shall be manufactured and tested in accordance with ASTM D 3261 and shall be so marked. Molded fittings shall be tested in accordance with American Water Works Association (AWWA) C906.
- e. Fabricated Fittings—Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full-service pressure rating of the mating pipe. Fabricated fittings shall be tested in accordance with AWWA C906.
- f. Polyethylene Flange Adapters—Flange adapters shall be made with sufficient through-bore length to be clamped in a butt fusion-joining machine without the use of a stub-end holder. The sealing surface of the flange adapter shall be machined with a series of small V-shaped grooves (serrations) to promote gasketless sealing, or restrain the gasket against blowout.
- g. Back-up Rings & Flange Bolts—Flange adapters shall be fitted with back-up rings that are pressure rated equal to or greater than the mating pipe. The back-up ring bore shall be chamfered or radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 3 or higher.

FINAL

PART 3 EXECUTION

3.1 GENERAL

- a. Pipe and fittings shall be jointed in accordance with the recommendations of the latest ASTM standards and the manufacturer's requirements.

3.2 JOINING

- a. Pipe and fittings shall be thoroughly cleaned before they are placed. Ends of pipe, the inside of sleeve, and any rubber rings shall be wiped clean and any burrs removed immediately before jointing the pipes.
- b. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. The entrance of earth into pipe will not be permitted, and the Government may require the placing of a heavy canvas bag of suitable size over each end of the pipe before it is lowered into the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.
- c. Heat Fusion Joining—Joints between plain end pipes and fittings shall be made by butt fusion. Joints between the main and saddle branch fittings shall be made using saddle fusion. The butt fusion and saddle fusion procedures used shall be procedures that are recommended by the pipe and fitting manufacturer. The supplier shall ensure that persons making heat fusion joints have received training in the manufacturer's recommended procedure. The supplier shall maintain records of trained personnel, and shall certify that training was received not more than 12 months before commencing construction. External and internal beads shall be not removed.
- d. Heat Fusion Training Assistance—Upon request and at the requestor's expense, training personnel from the manufacturer or his representative shall be made available.
- e. Joining by Other Means—Polyethylene pipe and fittings may be joined together or to other materials by means of (a) flanged connections (flange adapters and back-up rings), (b) mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material, or (c) electrofusion. When joining by other means, the installation instructions of the joining device manufacturer shall be observed.
- f. ID Stiffener and Restraint—A stiffener shall be installed in the bore of the polyethylene pipe when an OD compression mechanical coupling is used and when connecting plain end PE pipe to a mechanical joint pipe, fitting or appurtenance. External clamp and tie rod restraint shall be installed where PE

FINAL

pipe is connected to the socket of a mechanical joint pipe, fitting, or appurtenance except where an MJ Adapter is used.

- g. Branch Connections—Branch connections to the main shall be made with saddle fittings or tees. Polyethylene saddle fittings shall be saddle fused to the main pipe per Item c.

PART 4 TESTING

- a. Fusion Quality—The supplier shall ensure the field set-up and operation of the fusion equipment, and the fusion procedure used by the supplier fusion operator while on-site. Upon request by the Engineer, the supplier shall verify field fusion quality by making and testing a trial fusion. The trial fusion shall be allowed to cool completely, then test straps shall be cut out and bent strap tested in accordance with ASTM D 2657. If the bent strap test of the trial fusion fails at the joint, the field fusions represented by the trial fusion shall be rejected. The supplier at his expense shall make all necessary corrections to equipment, set-up, operation, and fusion procedure, and shall re-make the rejected fusions.

END OF SECTION