United States et al. v. General Electric Company (D. Mass.)

Appendix F to Consent Decree

Removal Action Work Plan for Upper ½ Mile Reach of Housatonic River, dated August 1999, and EPA approval letter dated August 5, 1999

Pittsfield/Housatonic River Site
General Electric Company
Pittsfield, Massachusetts

October 1999

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

6723 Towpath Road, P.O. Box 66
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EPA Approval Letter Dated August 5, 1999 for GE's Removal Action Work Plan - Upper ½-Mile Reach of Housatonic River, August 1999

United States Environmental Protection Agency
Region I
One Congress Street, Suite 1100
Boston, MA 02114-2023

August 5, 1999

Mr. Andrew T. Silfer, P.E.
General Electric Company
100 Woodlawn Avenue (Building 11-250)
Pittsfield, Massachusetts 01201

RE: Approval of GE's *Removal Action Work Plan - Upper ½-Mile Reach of Housatonic River*, submitted in June and Revised in August 1999

On June 25, 1999, General Electric ("GE") submitted the above-referenced Work Plan to EPA, the Massachusetts Department of Environmental Protection ("MA DEP") and the Federal and Massachusetts Natural Resource Trustees (the "Trustees"). Subsequent to this submittal, additional discussions were held between EPA, MA DEP, the Trustees and GE regarding the Work Plan. As a result of these discussions, GE submitted revisions to the Work Plan dated August 2, 1999 and August 5, 1999.

By this letter, EPA and the Trustees, after consulting with MA DEP, hereby approve GE's June 1999 *Removal Action Work Plan - Upper ½-Mile Reach of Housatonic River* as modified by GE's August 2, 1999 and August 5, 1999 revisions.

If you have any questions, please contact Dean Tagliaferro at (617) 918-1282.

Sincerely,

Dean Tagliaferro
Dean Tagliaferro
On-Scene Coordinator
EPA

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Public Information Repositories
Site File

Removal Action Work Plan -
Upper ½-Mile Reach of Housatonic River,
August 1999

[Note: This Work Plan includes the revisions submitted by GE to EPA dated August 2, 1999 and August 5, 1999.]

TECHNICAL REPORT

Removal Action Work Plan - Upper ½-Mile Reach of Housatonic River

General Electric Company
Pittsfield, Massachusetts

August 1999

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

6723 Towpath Road, P.O. Box 66
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1. Introduction

1.1 General

In September 1998, the General Electric Company (GE), the United States Environmental Protection Agency (USEPA), the Massachusetts Department of Environmental Protection (MDEP), and other federal and state agencies reached a settlement agreement in principle relating to response actions to address polychlorinated biphenyls (PCBs) and other chemicals at or deriving from GE's facility in Pittsfield, Massachusetts. Under this agreement in principle, GE agreed to remove select river sediments and river bank soils in a ½-Mile Reach of the Housatonic River adjacent to the GE facility (from Newell Street Bridge to Lyman Street Bridge) (the "upper ½-Mile Reach" or "½-Mile Reach"). Since the time that the agreement in principle was reached, GE and the governmental agencies involved have been negotiating the terms of a Consent Decree to embody the contents of that agreement. At the present time, several remaining issues must be resolved before final agreement is reached on the Consent Decree. Subsequently, the Consent Decree will be lodged in the United States District Court and will be subject to public comment and court review before it is entered by the Court and becomes legally binding on the parties. Nevertheless, GE has agreed with USEPA, MDEP, and the other agencies involved that it will perform certain response actions after lodging but prior to entry of the Consent Decree. These actions include the performance of the Removal Action for the Upper ½-Mile Reach, involving the removal, replacement, and restoration of certain sediments and bank soils in that reach. To expedite this process, and in accordance with correspondence from the USEPA (described below), GE is submitting this Removal Action Work Plan (Work Plan) to describe the approach developed by GE for removal of select sediments and bank soils in the ½-Mile Reach, as well as site restoration, once the Consent Decree has been lodged with the Court.

In July 1998, in connection with settlement discussions among the parties, GE submitted to the USEPA and MDEP a *Conceptual Work Plan - Upper Reach of Housatonic River (First ½-Mile)* (Conceptual Work Plan) (Blasland, Bouck & Lee, Inc., July 1998), which described the general approach proposed by GE to address PCB-containing sediments and bank soils in the ½-Mile Reach. The USEPA (with the concurrence of the MDEP) provided conditional approval of the Conceptual Work Plan in a letter to GE dated August 14, 1998, which required GE's subsequent submittal of a detailed bank soil/sediment removal work plan and established certain requirements for that work plan. The USEPA subsequently provided GE with additional sampling data collected by the USEPA from the ½-Mile Reach. In a letter to GE dated December 1, 1998, the USEPA provided modified and additional requirements for the work plan and established a deadline of January 15, 1999, for submittal of that work plan. A Draft Work Plan was developed in response to those USEPA letters, and submitted to the Agencies on January 15, 1999. Modifications have been made to the draft Work Plan based on subsequent discussions between GE and the Agencies. This Work Plan incorporates those modifications. However, GE's performance of the on-site removal work described herein is contingent upon lodging of the Consent Decree embodying the parties' settlement agreement.

This Work Plan presents the details of GE's proposed approach for sediment and bank soil removal and restoration actions in the first ½-Mile Reach. It contains some modifications from the July 1998 Conceptual Work Plan and the January 1999 draft Work Plan based on: (1) the parties' settlement agreement in principle; (2) the USEPA's letters of August 14 and December 1, 1998; (3) additional sediment and bank soil data provided by the USEPA after its conditional approval of the Conceptual Work Plan; and (4) subsequent discussions between GE and the Agencies. The Removal Action described herein will be conducted under the direct oversight of the USEPA, in consultation with the MDEP, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Consent Decree. In addition, this Work Plan provides details of certain habitat enhancement activities, for both the aquatic and the riparian habitat, to which GE has agreed as part of settlement of claims by federal and state natural resource trustees for natural resource damages (NRD) under CERCLA and state law.

1.2 Background

GE has owned and operated a manufacturing plant in Pittsfield, Massachusetts since the early 1900s. The primary industrial activities at this plant included the manufacturing and servicing of power transformers, defense and aerospace operations, and the manufacture of plastics. Currently, GE's world headquarters for plastics is located at the site, and the Transformer Division is closed. The Transformer Division's activities included the construction and repair of electrical transformers utilizing dielectric fluid, some of which contained PCBs. As illustrated on Figure 1-1, GE's Pittsfield, MA facility is located along the bank of the Housatonic River.

GE manufactured and serviced electrical transformers containing PCBs at this facility from approximately 1932 through 1977. According to GE reports, from 1932 to 1977, releases of PCBs reached the wastewater and storm systems associated with the facility and were subsequently conveyed to the East Branch of the Housatonic River and Silver Lake. In the late 1930s or early 1940s, approximately one mile of the river from Newell Street to Elm Street was straightened and rechannelized to reduce flooding. This resulted in the creation of eleven former oxbows being isolated from the river channel. Some of these oxbows were filled with material from GE and others that was later found to contain PCBs.

As part of ongoing investigations at the GE facility and Housatonic River, GE performed PCB sampling of river sediments and bank soils along the ½-Mile Reach of the Housatonic River between 1981 and 1998. In addition, in March 1998, bank soil samples were collected by the USEPA at select locations in the ½-Mile Reach and analyzed for PCBs. The analytical results of these sampling efforts identified locations with elevated levels of PCBs. Based on these results, together with other analyses, the USEPA determined in May 1998 that the PCB concentrations in the sediments and bank soils in the upper two-mile reach of the Housatonic River (Newell Street Bridge to confluence with the West Branch), including the ½-Mile Reach involved here, may present an "imminent and substantial endangerment" to human health and the environment under CERCLA. The USEPA also conducted additional investigations within the ½-Mile Reach, the most recent being performed between August and October 1998. [The USEPA intends to address the remaining 1½-mile portion of the upper two-mile reach through a separate Engineering Evaluation/Cost Analysis (EE/CA) under CERCLA.]

GE does not believe that the sediments and bank soils in the upper two-mile river reach, including the ½-mile reach between Newell Street and Lyman Street Bridges, present an imminent and substantial endangerment to human health or the environment. Nevertheless, GE agreed for settlement purposes to prepare the Conceptual Work Plan for remediation of sediments and bank soils in the ½-Mile Reach [excluding the previously-remediated (1997-1998) Building 68 Area]. To assist GE in preparing this Plan and coordinating required removal actions, Blasland, Bouck & Lee, Inc. (BBL) of Syracuse, New York, was retained by GE to serve as GE's Supervising Contractor. The USEPA provided conditional approval of the Conceptual Work Plan in its August 14, 1998 letter. Additional and modified requirements for the subsequent detailed work plan were provided in the USEPA's December 1, 1998 letter.

One of the conditions provided in the August 14, 1998 conditional approval letter was that GE identify and address non-aqueous phase liquids (NAPL) present in the ½-Mile Reach that could result in recontamination of the bank soils and river sediment during or after completion of the removal action. GE has over the years conducted numerous detailed investigations of the areas at and adjacent to the first ½-mile of the River, and has installed and continues to operate numerous source control measures in those areas. These source control measures include:

- The installation, operation, and maintenance of seven active light NAPL (LNAPL) recovery systems, a slurry wall, and absorbent oil booms in the River at East Street Area 2;
- The installation, operation, and maintenance of three active LNAPL and dense NAPL (DNAPL) recovery systems and absorbent oil booms in the River at the Lyman Street Parking Lot; and

C The performance of manual LNAPL and DNAPL recovery at the Newell Street Parking Lot (which is being upgraded to two automated systems).

GE believes that these measures are effectively controlling any significant migration of NAPL or hazardous constituents into the River. Nevertheless, in response to the conditions in the USEPA's August 14, 1998 letter, and in accordance with a commitment that GE made in settlement discussions among the parties involved at this site, a *Source Control Work Plan* (BBL, September 1998) was prepared on GE's behalf and approved by USEPA. This plan presented a proposal and schedule for further assessing, evaluating and addressing NAPL along the ½-Mile Reach of the river and was conditionally approved by the USEPA in a letter dated October 6, 1998.

The *Source Control Work Plan* proposed a number of additional investigations to further assess subsurface conditions along the ½-Mile Reach of the River with respect to the presence of NAPL. It focused initially on the known or suspected NAPL areas at the East Street Area 2, Lyman Street Parking Lot, and Newell Street Area II sites, but also provided for more general investigations of subsurface conditions in the first ½-mile. GE also agreed to install containment barriers along portions of the north river bank at East Street Area 2 and the Lyman Street Parking Lot. As described below, certain source control measures have been proposed, approved by USEPA and constructed, while others are in the design phase.

East Street Area 2

GE submitted a *Proposal for Supplemental Source Control Containment/Recovery Measures* on January 12, 1999. That proposal included installation of approximately 450 linear feet of sheetpile along the riverbank (up to 25 to 28 feet below the ground surface) to supplement the existing LNAPL control measures already in place. In a conditional approval letter dated February 11, 1999, the USEPA provided several comments, questions, and requests regarding GE's January 12, 1999 proposal. GE responded to the USEPA's February 11, 1999 conditional approval letter with a letter dated March 1, 1999, and the USEPA provided final approval to proceed with construction via letter dated May 7, 1999. Construction activities were completed during the week of June 7, 1999. With respect to the detection of DNAPLs at certain locations in this area, manual DNAPL gauging and bailing is being performed in two wells located along the riverbank, and GE recently performed a pumping test to further evaluate the feasibility of an active DNAPL recovery system. The results of those activities were presented to the USEPA in a document entitled *DNAPL Assessment, East Street Area 2 Site, Pittsfield, Massachusetts,* dated April 28, 1999 and prepared by HSI GeoTrans, Inc. As described in the Report, GE has proposed the installation of a 4- to 6-inch diameter recovery well to further assess the feasibility of automated DNAPL recovery from this portion of East Street Area 2.

Lyman Street Parking Lot

GE submitted a Proposal for Supplemental Source Control Containment/Recovery Measures on July 13, 1999, summarizing design parameters associated with a proposed NAPL containment barrier along the riverbank in this area which will include the installation of approximately 400 linear feet of sheetpile along the riverbank in this area. It is expected that the construction of the containment barrier proposed for this area will be performed in 2000, in conjunction with the ½-Mile Reach removal action.

At the 10 Lyman Street parcel (adjacent to the Lyman Street Parking Lot), GE is still evaluating the lateral extent of DNAPL. In a June 15, 1999 Report submitted by HSI GeoTrans on behalf of GE, two additional wells were proposed.

Newell Street Parking Lot

Based on the results of DNAPL recovery tests performed between September 22 and September 30, 1998 in three wells (NS-15, NS-30, and NS-32), GE proposed the installation of an automated DNAPL recovery system for these wells in a proposal dated November 24, 1998. That proposal was conditionally approved by the USEPA in a letter dated December 15, 1998. As requested by the USEPA's letter (December 1998), GE initiated recovery tests on four additional wells (N2SC-1I, -2, -3S, and I) and reported these results to the USEPA in a letter dated January 8, 1998. The January 8, 1998 letter proposed to further evaluate the potential recovery volumes from well N2SC-1I with additional recovery testing. Subsequently, between January 15 and February 1, 1999, GE in conjunction with BBL, performed DNAPL recovery testing. The results of these tests were presented in a document entitled *Source Control Investigation Report Upper Reach of Housatonic River (First ½-Mile)* (HSI GeoTrans, February 1999). Based on the DNAPL recovery test results, GE proposed installation of an automated DNAPL collection system for well N2SC-1I in a letter dated March 10, 1999. This proposed automated DNAPL collection system was in addition to the USEPA-approved automated DNAPL collection system for wells NS-15, NS-30, and NS-32 (which became operational on March 1, 1999). That proposal was conditionally approved by the USEPA in a letter dated March 17, 1999. As requested by the USEPA's letter (March 17, 1999), GE will evaluate extending to automated recovery system to wells N2SC-2, N2SC-3S, and N2SCI within six months of the on-line date for the DNAPL recovery system for well N2SC-1I (which will become operational in July 1999). In addition, as requested in the USEPA's March 17, 1999 letter, GE will submit a report summarizing and evaluating all of the NAPL monitoring and recovery systems at the Newell Street II site every six months. The initial report is due to the USEPA within six months of the on-line date for the DNAPL recovery system for well N2SC-1I.

Additional wells may also be added to the automated recovery system after further evaluation of the source control investigation results.

Source control activities have also been performed related to DNAPL detected in the Building 68 area. GE separately submitted a proposal to the USEPA to address DNAPL at Building 68, which the USEPA conditionally approved by a letter dated July 17, 1998. Pursuant to that approval, approximately 180 linear feet of sheetpile was installed near the base of the riverbank, east of the footbridge, during November and December 1998. GE performed a DNAPL recovery test in two of the wells located in this area over a two-week period between December 28, 1998 and January 11, 1999, to determine an appropriate DNAPL recovery method. The results indicated that there were not significant amounts of DNAPL in the river bank area west of Building 68, and that removal rates for DNAPL (if any) in these wells would be slow. Based on these results, GE proposed to monitor the wells and pump and properly dispose of any recovered DNAPL. The plan was approved by the USEPA in a letter dated February 2, 1999, and GE currently is implementing the plan.

1.3 Summary of Proposed Plan

The Removal Action described in this Work Plan will involve removal and restoration of select sediments and bank soils from portions of the first ½-Mile Reach. Descriptions of these activities are provided below.

1.3.1 Sediment-Related Activities

GE proposes to remove and restore (i.e., replace with cap and armor) certain river sediments in the ½-Mile Reach. Within this reach, the vertical extent of removal in the majority of those areas where removal will occur will be up to 2 feet, with removal to a depth of 2.5 feet proposed for one area. In areas of low PCB concentrations, no action is planned. For example, a stretch of the River downstream of Newell Street contains sediment with little to no detectable levels of PCBs; thus, no action is required in this section.

The sediment removal areas were developed in conjunction with USEPA and MDEP, based on a detailed review of the relative concentration of PCBs present in both the River sediments and adjacent bank soils. The locations and volumes of sediment to be removed are discussed in Sections 4 and 7 of this Work Plan. It is anticipated that approximately 8,100 cubic yards (cy) of sediment will be removed. The general sediment removal and restoration approach involves diverting the River around established work areas in a phased, area-by-area approach primarily using a water diversion/containment structure such as steel sheetpiling or other appropriate means, dewatering the work cell in which work will be performed, treating the water as required, and performing sediment removal, replacement, and restoration activities. The removed sediment will be permanently consolidated with other GE site-related materials at USEPA-approved locations at the GE facility. Following removal, the sediment removal areas will be capped and armored using a multi-layer cap system. Aquatic enhancement structures will subsequently be installed as part of the ½-Mile Reach restoration activities.

The current spatial average PCB concentration for the top foot of sediment in the ½-Mile Reach is approximately 55 ppm. Following implementation of the sediment removal and replacement activities, the sediment with the highest PCB concentrations will have been removed and the spatial average PCB concentration in the surficial sediment (top foot) will be reduced to less than 1 ppm. Further, the proposed sediment replacement activities will effectively isolate any remaining PCB-containing sediment and minimize the potential for resuspension of sediments, desorption of PCB from the sediments into the water column, and direct contact of humans and biological receptors with PCB-containing sediment.

1.3.2 Bank Soil-Related Activities

To the extent practical, the bank soil removal activities will be conducted in coordination with the sediment removal and restoration activities. For the river bank soils, this will involve the removal of bank soils, to a maximum depth of three feet, as necessary to achieve spatial average PCB concentrations less than 10 ppm in the top foot and less than 15 ppm in the 1- to 3-foot depth increment. In accordance with the USEPA's letter of December 1, 1998, the bank soil removal actions will achieve these average PCB concentrations in each of seven river bank averaging areas specified by the USEPA. In addition, GE will remove and/or stabilize bank soil along portions of the bottom or the "toe of banks," as agreed to by GE, USEPA, and MDEP. The locations and volumes to be removed to achieve the specified cleanup levels are discussed in Sections 4 and 8 of this Work Plan. Following removal, the soil removal areas will be backfilled and the bank habitat will be restored using an engineered soil and vegetative cover, except along the lower banks at the toe of the slope, where armor stone will be placed on the bank surface for erosion protection. As with the sediments, the removed soil will be permanently consolidated with other GE site-related materials at USEPA-approved locations at the GE facility.

It is estimated that the bank soil removal activities involve the removal of approximately 4,300 cy of bank soils and the replacement and restoration of approximately 52,000 square feet of bank area. An additional 340 cubic yards of bank soil will be removed between the sheetpiling and the River at East Street Area 2 to help complete source control activities in that area. The current spatial average PCB concentrations for the top foot and 1-to 3-foot depth increment in the ½-Mile Reach are approximately 198 ppm and 87 ppm, respectively. Following implementation of the bank soil removal and restoration activities, the bank soils with the highest PCB concentrations will have been removed and the spatial average PCB concentrations will be reduced to less than 10 ppm in the top foot and less than 15 ppm in the 1- to 3-foot depth increment, both in the overall ½-Mile Reach and in each of the averaging areas specified by the USEPA. Further, any PCBs contained in the subsurface soil underlying the areas subject to these removal/restoration measures will be effectively isolated, thus preventing erosion from these subsurface soils and direct contact of human or biological receptors with these soils.

During the above sediment and soil removal activities, visual observations will also be made for the potential occurrence of NAPL, drums, capacitors, or related equipment within the excavations. If these materials are encountered, appropriate actions, as discussed in Sections 7 and 8, will be taken to address their presence.

1.3.3 Habitat Restoration/Enhancement

Certain habitat restoration measures will also be conducted along the ½-Mile Reach, as part of the NRD settlement, to restore and enhance the existing habitat. The habitat restoration will include both aquatic habitat and riparian habitat. The focus of the aquatic habitat restoration/enhancement activities will be to increase the variability in water flow and depth, and provide additional in-stream cover. These objectives will be met through the placement of engineering devices such as low stage dams, current deflectors, and boulders to improve the aquatic habitat. Placement of the aquatic habitat structures will be designed so as not to significantly affect flood elevations or the flood storage capacity of the River. The objective of the riparian habitat restoration is to restore and enhance the riparian corridor in terms of vegetation and potential wildlife use. Specific tasks will include regrading the disturbed banks as necessary and planting the site with a variety of native plant species of better habitat value than those currently present. The specific habitat restoration/enhancement activities are described in Section 9 of this Work Plan.

1.4 Format of Work Plan

This Work Plan is divided into 13 sections. Section 1 has provided a general introduction to the Plan. Section 2 identifies the remedial action objectives, performance standards, and applicable or relevant and appropriate requirements (ARARs) for this removal action. Section 3 provides information regarding the anticipated organization and roles of the parties involved in this project. Section 4 presents the sediment and bank soil data collected from the first ½-mile, along with the estimated removal areas. Section 5 provides the baseline habitat assessment. Section 6 provides information related to removal preparation activities. Sections 7 and 8 provide details regarding the design and implementation of the removal actions. Section 9 provides details regarding site restoration and habitat enhancement activities. Section 10 provides details regarding the handling, transportation, and disposition of materials. Section 11 presents a description of project monitoring activities. Section 12 focuses on some of the remediation management and support activities associated with the removal actions. Finally, Section 13 describes the anticipated implementation schedule and remaining submittal/reporting requirements.

2. Removal Action Objectives, Performance Standards, and Applicable or Relevant and Appropriate Requirements

2.1 Removal Action Objectives

USEPA's removal action objectives (RAOs) for the ½-Mile Reach of the Housatonic River have been provided to GE. While GE does not necessarily agree that these are the appropriate RAOs for the Removal Action, USEPA's RAOs are as follows:

- Mitigate the potential human health and environmental threat posed by the existing levels of PCBs in river sediments, and bank and floodplain soils;
- Minimize the potential for recontamination of previously remediated floodplain properties and further contamination of other floodplain areas;
- Minimize the potential for the downstream migration of contaminated sediments and banks soils; and
- Eliminate or mitigate existing sources of contamination to the upper ½-Mile Reach of the Housatonic River (this objective also applies to various other source control measures being undertaken by GE separately from this Removal Action).

Although GE does not necessarily accept these objectives, the "Trustees" objectives are as follows:

1. Implement the Removal Action for this reach as conditionally approved by USEPA;

2. Perform the restoration, including the enhancement of the river sediment and bank habitat as agreed to between GE, the Trustees, USEPA, the Commonwealth of Massachusetts, and the State of Connecticut, to increase the diversity and productivity of the biological community in this reach;.

3. Restore the river bank to provide overlying cover as agreed to by GE, the Trustees, USEPA, the Commonwealth of Massachusetts, and the State of Connecticut and to enhance the bank vegetation by reestablishing plantings using native species; and

4. Minimize the potential for erosion of residual PCB-containing bank soils and river sediments which would result in recontamination of river sediments or transport of PCBs, and which could impair the river restoration by adversely impacting the ecological receptors.

As discussed previously in Section 1, the work described herein will result in a substantial reduction in PCB levels in the sediments and bank soils for this reach of the River. Following implementation of the sediment removal, replacement, and restoration activities, the sediment with the highest PCB concentrations will be removed and the PCB concentrations in the top foot will be reduced to less than 1 ppm. Further, the proposed sediment-related activities will effectively isolate the remaining PCB-containing sediment and minimize the potential for resuspension of sediments into the water column and for direct contact of humans and biological receptors to the sediment.

For the bank soils, following implementation of the bank soil removal and restoration activities, the bank soils with the highest PCB concentrations will be removed. As agreed, the spatial average PCB concentrations will be reduced to under 10 ppm and under 15 ppm in the top foot and 1- to 3-foot depth intervals, respectively, both in the overall ½-Mile Reach and in the specific averaging areas identified in the USEPA's letter of December 1, 1998. Further, the PCBs contained in the subsurface soil underlying the areas subject to these removal/restoration measures will be effectively isolated, thus preventing potential erosion from these subsurface soils and direct contact of human or biological receptors with these soils.

Given the topography and vegetated nature of these banks, their location in an industrial/commercial area, and the consequent limited use of the river and banks, the removal and restoration activities described in this Work Plan will be more than adequate for human health and environmental protection in this reach. Additionally, restoration measures will be implemented for the ½-Mile Reach, which will restore -- and, where practicable, enhance -- the aquatic and riparian habitat, without significantly affecting flood elevations or the flood storage capacity of the River.

2.2 Performance Standards

The Performance Standards for the ½-Mile Reach Removal Action are as follows:

Performance Standards for Sediments

1. GE shall remove and replace an estimated in-situ volume of 8,100 cubic yards of sediments from the ½-Mile Reach at the locations and depths specified on Figures 4-1 through 4-4 and Figures 7-1A through 7-1C of this Work Plan.

2. GE shall replace the removed sediments with a cap and armor system that will consist of geotextile bottom layer, a silty sand isolation layer, a geotextile filter layer, a filter protection layer (i.e., GeoGrid), and an erosion protection stone armor layer. This cap and armor system shall be installed using the materials and approaches described in Section 7.4.2 of this Work Plan.

3. To restore and enhance the aquatic habitat of the ½-Mile Reach, GE shall construct habitat enhancement structures in this reach, consisting of current deflectors, low-profile dams, and boulder clusters, as described in Section 9.1 of this Work Plan.

4. GE shall conduct periodic sampling of the sediment cap isolation layer at six locations, in accordance with the specifications in Section 11.5.1 of this Work Plan, to monitor the long-term effectiveness of the cap in controlling PCB migration from the underlying sediments. If this or other sampling indicates that the isolation layer is not performing in general accordance with the predictions on which the isolation layer design was based in terms of controlling PCB migration from the underlying sediments into the surface water of the River, GE shall evaluate and propose to USEPA appropriate corrective actions, and shall implement such corrective actions upon USEPA approval. If such sampling indicates that the isolation layer is performing as generally predicted in terms of controlling PCB migration from the underlying sediments, no further response actions shall be required for the isolation layer, except as otherwise required pursuant to Performance Standards #5 and #12 of this section and/or the provisions of the Consent Decree on Emergency Response and Pre- and Post-Certification Reservations of Rights (Re-openers).

5. GE shall conduct periodic inspections of the stone armoring layer, in accordance with the specifications in Section 11.5.2 of this Work Plan, to ensure that it is effectively preventing erosion of the sediment cap isolation layer. If these inspections indicate that the stone armoring layer is not protecting the cap isolation layer from erosion, GE shall evaluate and propose to USEPA appropriate corrective action and shall implement such corrective action upon approval by USEPA.

6. GE shall conduct periodic inspections of the habitat enhancement structures in the ½-Mile Reach, in accordance with the specifications in Section 11.5.3 of this Work Plan, to ensure that they are structurally stable and have not

increased the potential for bank-side erosion. If these inspections indicate that the structural stability of the enhancement structures has been compromised or that increased bank-side erosion has occurred as a result of the presence of those structures, GE shall evaluate and propose to USEPA appropriate corrective actions and shall implement such corrective action upon approval by USEPA.

7. GE shall conduct sampling of the surface of the sediments in the ½-Mile Reach for PCBs at three five-year intervals, beginning five years after completion of construction on the sediment removal/replacement/ restoration activities. Such sampling shall be conducted in accordance with the procedures specified in Section 11.5.4 of this Work Plan. If this sampling indicates the deposition of PCBs on the surface of the covered/restored sediments (as opposed to migration of PCBs through the isolation layer from the underlying sediments), GE shall evaluate, to the extent feasible, the source of such PCBs. If that evaluation indicates that such surface PCBs are attributable to sources other than those that have been or are being addressed by GE at the Pittsfield/ Housatonic River Site (as defined in the Consent Decree), then GE shall evaluate potential source control measures for such sources, shall submit a report on such evaluation to USEPA, along with a proposal for any appropriate source control measures, and shall implement such measures as are approved by USEPA. If the above conditions are not met, no further response actions shall be required to address such PCBs deposited on the surface of the covered/restored sediments, except as otherwise required by Performance Standard #12 of this section and/or pursuant to the provisions of the Consent Decree on Emergency Response and Pre- and Post-Certification Reservations of Rights (Re-openers).

Performance Standards for Bank Soils

8. GE shall remove and replace bank soils in the ½-Mile Reach as necessary to achieve spatial average PCB concentrations less than 10 ppm in the top foot and less than 15 ppm in the 1 to 3 foot depth increment in each of the averaging areas identified on Figure 4-7 of this Work Plan. GE shall also remove and/or stabilize bank soil along portions of the "toe of the banks" as described in Section 8.4.5 of this Work Plan. These actions shall involve bank soil removal at the locations and depths specified on Figures 4-1 through 4-4, Figures 7-1A through 7-1C, and Figure 8-2 of this Work Plan.

9. GE shall remove and replace additional bank soils in the ½-Mile Reach as necessary to achieve the following conditions for Appendix IX+3 constituents other than PCBs in each averaging area following performance of the soil removal/replacement activities to address PCBs:

   a. For polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (dioxins/furans), no individual sample with a Toxic Equivalent (TEQ) concentration (calculated using the Toxicity Equivalency Factors (TEFs) published by the World Health Organization) in excess of the following Preliminary Remediation Goals (PRGs) established by USEPA for dioxin/furan TEQs in this area: 1 ppb for soil in the top foot and 1.5 ppb for soil at 1-3 feet; and

   b. For other constituents, any combination of the following: (I) maximum constituent concentrations in any sample that do not exceed the USEPA Region 9 PRGs for residential areas (or other screening PRGs based on the Region 9 PRGs, as approved by USEPA); (ii) constituent concentrations that are consistent with upstream background levels, based on summary statistics; or (iii) average concentrations that do not exceed the Method 1 S-2 soil standards set forth in the Massachusetts Contingency Plan (MCP).

10. GE shall replace removed bank soils with an engineered cover consisting of a soil layer, topsoil, and appropriate vegetation, as described in Sections 8.4.4 and 9.2 of this Work Plan, except along portions of the lower three feet

at the toe of the slope, where GE shall install armor stone, as described in Section 8.4.4 and 8.4.5 of this Work Plan, to control erosion and undermining at the water's edge.

11. GE shall restore and enhance the vegetation on the river banks through the planting of a floodplain forest community in accordance with the specifications set forth in Section 9.2 of this Work Plan. Trees shall be planted in varying densities, clumps, or if necessary, sinuous lines (using existing trees/stumps as applicable), using a planting density of 700 trees per acre. Understory species shall be planted at an approximate planting density of 730 shrubs per acre. Understory species shall be planted (to the extent possible) in oblong patches 30 feet wide by 50 feet long (or similar configuration approved by the Trustees such that no more than 730 shrubs per acre are planted), scattered such that there is a minimum distance of 40 feet between patches, with plantings within each patch on four-foot centers. Woody vines shall be planted at an approximate planting density of 40 vines per acre. The vines will be planted in small, oblong patches measuring 15 feet wide by 30 feet long, scattered such that there is a minimum distance of 150 feet between patches, with plantings within each patch on four-foot centers. Open ground throughout the planted forest community area shall be sown with a herbaceous seed mixture of native grass and wildflower species to provide immediate erosion control and create a herbaceous community.

12. GE shall conduct periodic inspections of the cleared and restored areas of the bank of the Upper ½-Mile Reach, excluding the approximately 170 foot long section excavated and restored as part of the Building 68 Removal Action, and including the armoring at the toe of the slope, in accordance with the specifications in Section 11.6.1 of this Work Plan. If these or other inspections indicate significant erosion (e.g., ruts, gullies, washouts, or sloughing) of the cleared or restored areas or armor stone, GE shall propose to USEPA appropriate measures to replace or restore the eroded soil in the cleared and/or restored areas or the armor stone to its original condition, and shall implement such measures upon approval by USEPA. In addition, GE shall evaluate the source, dispersal and quantity of the eroded soil in the River, and shall propose to USEPA appropriate measures to remove any significant quantity of contaminated eroded soils to the extent practicable, and shall implement such measures upon approval from USEPA.

13 GE shall conduct periodic monitoring of the restored/enhanced vegetation on the river banks in accordance with the specifications in Section 11.6.2 of this Work Plan. GE shall monitor and inspect this vegetation for a minimum of seven years after the year in which the plantings occur. Monitoring will be conducted two times a year for the first three years after planting. One monitoring visit will be made each during the fifth year and seventh year after planting. In each of the first three years after plantings, GE shall inspect each of the planting areas in the late spring after the first leaf flush (May/June) and in the summer (July/August) to assess plant survival. During the fifth and seventh year after planting, GE shall inspect each of the planting areas in the summer. During these events, based on stem counts, any dead trees or shrubs in excess of 20% of the original planting shall be replaced to ensure an 80% survival rate. GE shall have no further obligation to replant to the extent that plant loss is caused solely by a third party not related to GE. A 100% coverage of bare ground (outside of the foliar coverage of the trees) shall be maintained.

2.3 Applicable or Relevant and Appropriate Requirements

This section describes, for this Removal Action, the applicable or relevant and appropriate requirements (ARARs) under federal and state environmental laws. Under the National Contingency Plan (NCP) under CERCLA, removal actions must attain ARARs only to the extent practicable considering the exigencies of the situation (40 CFR 300.415(j)). A requirement under federal and state environmental laws may be either "applicable" or "relevant and appropriate" to a removal action. "Applicable requirements" are those cleanup standards, standards of control and other substantive requirements, criteria, or limitations that are promulgated under federal or state environmental laws and that specifically addresses a hazardous substance, pollutant, contaminant, response action, location, or other circumstance found at the site (40 CFR 300.5). "Relevant and appropriate requirements" are those promulgated cleanup standards, standards of control, and other substantive requirements, criteria, or limitations that, while not applicable to a hazardous substance, pollutant, contaminant, response action, or other circumstance at the site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site *(ibid.)*. Only those state substantive standards that are identified in a timely manner and that are more stringent than federal requirements are ARARs *(ibid.)*.

To constitute an ARAR, a federal or state standard or requirement must be substantive in nature. Administrative requirements, such as those relating to permitting, documentation, reporting, and record keeping, are not ARARs. In addition, to constitute an ARAR, the standard or requirement must have been formally promulgated by a federal or state agency. Federal and state advisories and guidance documents that have not been formally promulgated as binding laws or regulations do not constitute ARARs. Such items need not be complied with, although they may be considered in formulating a removal action (these items are referred to as "TBC" for "to be considered").

The USEPA recognizes three types of ARARs:

- **Chemical-Specific ARARs:** Health or risk-based numeric values or methodologies that establish the acceptable amount or concentration of a chemical that may be found in or discharged to the ambient environment;

- **Action-Specific ARARs:** Technology- or activity-based requirements or limitations on actions involving the management of hazardous substances, pollutants, or contaminants; and

- **Location-Specific ARARs:** Restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in specific locations.

In determining whether compliance with an ARAR is practicable, the lead agency may consider all appropriate factors including: 1) the urgency of the situation; and 2) the scope of the removal action (40 CFR 300.415(j))). In addition, even if compliance with an ARAR is deemed practicable based on consideration of the above factors, compliance may nonetheless be waived under any of the circumstances for which CERCLA allows a waiver for remedial actions (see section 121(d)(4) of CERCLA; 40 CFR 300.430(f)(2)(C)).

Tables 2-1, 2-2, and 2-3 list, respectively, the chemical-specific, action-specific, and location-specific ARARs that pertain to the Removal Action described in this Work Plan. The tables identify each ARAR, outline its requirements, define its applicability or appropriateness, and include a proposal as to whether it will be attained by the Removal Action for the Upper ½-Mile Reach and, if not, the basis for a USEPA determination to that effect (e.g., impracticability or other reason for a waiver).

These tables do not include the ARARs for the permanent consolidation of the excavated sediments and bank soils at the GE facility . The ARARs applicable to such on-plant consolidation are identified in the Detailed Work Plan for the On-Plant Consolidation Area, which was submitted to USEPA on June 11, 1999. However, the tables included in this Work Plan do include the temporary on-site storage/ accumulation of the excavated sediments and bank soils prior to their transfer to the permanent on-site consolidation areas or off-site shipment/disposal.

3. Project Organization and Roles

This section presents the anticipated project organization and associated roles, including key personnel, descriptions of duties, and lines of authority in the management of the removal of soil and sediment actions in the ½-Mile Reach of the Housatonic River. Figure 3-1 provides a project organization chart. Additional information regarding the organizations/ personnel and their associated responsibilities is provided below.

3.1 USEPA

The USEPA will serve as the lead regulatory agency for this project. The USEPA will provide an On-Scene Coordinator (OSC) to administer USEPA's responsibilities and receive all required written notices, reports, plans, and other documents. The identified OSC for this project is:

Dean Tagliaferro
U.S. Environmental Protection Agency
Site Evaluation and Response Section I (HBR)
One Congress Street
Boston, MA 02203
(617) 918-1282
Fax (617) 918-1291

Absence of the OSC from the site will not be cause for delay or stoppage of work, unless specifically directed by the OSC. Where necessary, the USEPA will be responsible for coordinating efforts of other regulatory agencies (e.g., document review with the MDEP).

3.2 MDEP

The MDEP will serve as a consulting regulatory agency for this project. The MDEP will provide a Project Manager to administer MDEP's responsibilities and also receive all required written notices, reports, plans, and other documents. The identified MDEP Project Manager for this project is:

Susan Steenstrup
Bureau of Waste Site Cleanup
Department of Environmental Protection
436 Dwight Street
Springfield, MA 01103
(413) 755-2264
Fax (413) 784-1333

3.3 Trustees

The Trustees (to be defined in the Consent Decree) will provide review, comment, and approval, in consultation with the USEPA, on those portions of this Work Plan that relate to the habitat restoration/enhancement measures described in this Work Plan.

3.4 GE

GE will be responsible for the overall management of removal and post-removal site control actions. GE also will serve as the primary intermediary between the USEPA and the GE-contracted organizations involved in the project.
GE will provide a Project Coordinator to be responsible for administration of GE's actions. The identified GE Project Coordinator for this project is:

Andrew T. Silfer, P.E.
General Electric Company
100 Woodlawn Avenue
Building 11-250
Pittsfield, MA 01201
(413) 494-3561
Fax (413) 494-5024

General responsibilities of Mr. Silfer, include, but are not limited to, the following:

- Serve as primary point of contact with the USEPA and MDEP;
- Direct activities of the Supervising Contractor, Remediation Contractor, analytical laboratory, and disposal facility;
- Review all written notices, reports, plans, and other documents prior to submittal to the Agencies;
- Notify the Agencies of contractor or subcontractor selections;
- Ensure that all GE-hired contractors, subcontractors, laboratories, and consultants work in conformity with and the terms and conditions of the Work Plan and associated submittals;
- Review Contractor submittals;
- Conduct construction progress meetings as needed;
- Monitor quality assurance/quality control (QA/QC) during construction;
- Provide updates of project activities and schedule;
- Review all sampling results obtained as part of implementation of the ½-Mile Reach Work Plan activities; and
- Certify the completion of Work Report for the ½-Mile Reach.

3.5 Supervising Contractor

BBL, an environmental consulting firm headquartered in Syracuse, New York, will serve as the Supervising Contractor. BBL's primary contact is:

Robert K. Goldman, P.E.

Blasland, Bouck & Lee, Inc.
6723 Towpath Road, P.O. Box 66
Syracuse, NY 13214-0066
(315) 446-9120
Fax (315) 449-0023

BBL will assist GE to ensure that the project is performed in accordance with the USEPA-approved Work Plan. BBL will also assist GE in monitoring the status of the project, including sampling activities, monitoring of Contractor activities, and review/evaluation of project status. More specifically, BBL's responsibilities will include, but not be limited to, the following:

- Prepare the submittals required by the Work Plan;
- Review various submittals provided by the Remediation Contractor for adequacy relative to submittal requirements presented in the Contract Documents;
- Conduct periodic on-site visits to observe the implementation of the Work Plan activities;
- Provide documentation of Work Plan activities;
- Provide technical assistance/issue resolution related to the implementation of the Work Plan;
- Implement monitoring activities, prior to, during, and following removal/restoration activities;
- Assist GE and the Agencies in verifying that removal actions are complete and performed in accordance with the Work Plan; and
- Prepare, and submit the Completion of Work Report (including record drawings) summarizing removal/restoration activities.

3.6 Remediation Contractor

GE will select a Remediation Contractor for this project. The primary role of the Remediation Contractor will be to implement the activities outlined in this Work Plan. Those activities will include, but not be limited to, implementing soil/sediment removal, replacement and restoration activities, providing emergency spill response services (if necessary), and managing waste transport and disposal. Additionally, the Remediation Contractor will participate in construction progress meetings to address the status of project construction, schedule changes, test results, observations and findings, technical issues, design changes, and upcoming activities. Other duties of the Remediation Contractor include, but are not limited to, the following:

- Provide all labor, materials, equipment, and services necessary to complete the removal activities in accordance with the Work Plan;
- Prepare any additional submittals to the extent required;
- Coordinate transport and disposal of soil, sediment, liquid, and residual wastes, using the on-site consolidation areas and treatment facilities; and

- Provide site health and safety monitoring activities for the Remediation Contractor's workers and subcontractors (if any).

The Remediation Contractor may retain various subcontractors for the purposes of completing the project, if necessary and upon approval by GE and the USEPA. GE will notify the USEPA of the identity and qualifications of any other contractor(s) or subcontractor(s) to be used for the ½-Mile Reach within at least five days in advance of performing any work.

3.7 Analytical Laboratory

GE will select and contract with an analytical laboratory(ies) to be used for this project. Each laboratory will be provided with the necessary information regarding the project, including a copy of the *Sampling and Analysis Plan/Data Collection and Quality Assurance Plan*, *General Electric Company*, *Pittsfield, Massachusetts*, BBL, May 1994 (and several subsequent revisions) (SAP/DCAQAP).

4. Data Summary and Designated Removal Areas

GE has over the years collected numerous samples of sediment and bank soil from the ½-Mile Reach of the Housatonic River. To supplement the data collected by GE, the USEPA completed additional sediment and soil sampling, with the majority of activities occurring between August 1998 and October 1998. More recently, GE collected soil and sediment samples at East Street Area 2 (February 1999), and soil samples at Lyman Street parking Lot (April 1999). Based on the results of all sampling activities performed in the ½-Mile Reach [except for the recent source control-related soil sampling, which, consistent with USEPA's interpretation, was performed under a program with a different set of goals and protocol (i.e., potential NAPL investigation)], areas of sediment and bank soil were designated for removal. This section summarizes the data collected at the ½-Mile Reach and outlines the approach to designate areas for removal, as well as the results of that process. Information also is provided regarding recent survey and topographic map development for the ½-Mile Reach.

4.1 Base Map Preparation

A topographic map of the site was prepared using conventional ground survey methods. The field survey was performed between October 12, 1998 and October 23, 1998. The mapping was based on existing horizontal (NAD 1927) and vertical (NGVD 1929) datums that have been used to generate previous maps of the area. Mapping limits were from the top of river bank on the north side to the top of river bank on the south side, along the project area. The river bottom was included in the topographic mapping. A contour interval of one foot was used to show topographic detail. The base map was later combined with existing photogrammetric mapping prepared in 1990, to provide an overall comprehensive map of the site. Bank and sediment samples were located by conventional survey methods (i.e., angle and distance from a known point) or by physical ties taken at the time of sampling. USEPA samples are shown on the map based on coordinates provided by USEPA.

4.2 Upper ½-Mile Reach Sediment Data and Removal Areas

This section of the Work Plan describes the sediment data collected by GE and the USEPA, being used to characterize the sediments and determine the sediment removal areas in the ½-Mile Reach.

4.2.1 Sediment Data

River sediment sampling for PCB analysis has been conducted in the ½-Mile Reach during several rounds between 1981 and 1998, and has included the collection of over 640 sediment samples from 228 locations, excluding the previously remediated Building 68 area. Samples were collected by GE as well as the USEPA. Recent sampling performed by the USEPA (August - October 1998) involved establishing 63 transects, approximately 50 feet apart, along the River in the ½-Mile Reach, and generally obtaining samples (when retrievable) from three locations along each transect at 6-inch depth intervals, to a maximum depth of 2.5 feet. Samples collected from this reach between 1981 and 1998 indicate the presence of PCBs in sediments ranging from less than 1 part per million (ppm) to 9,411 ppm. Figures 4-1 through 4-4 show sampling locations and results.

As part of the sampling performed by the USEPA in 1998, approximately one sample per transect was also analyzed for those constituents listed in Appendix IX of 40 CFR Part 264 plus three additional constituents -- benzidine, 2-chloroethylvinyl ether, and 1,2-diphenylhydrazine (Appendix IX+3). Several Appendix IX+3 constituents were detected at low concentrations in the river sediments within the ½-Mile Reach. A summary of Appendix IX + 3 sediment data is provided in Table 4-1.

During the 1998 USEPA sampling effort, GE collected 56 sediment split samples for PCB analysis and 13 split samples for Appendix IX + 3 analysis. The PCB data for the split samples are provided on Figures 4-1 through 4-4 of this Work Plan, while the Appendix IX+3 split sample data are presented in Table 4-1. A comparative analysis of the USEPA's data and GE's split sample data was performed, the results of which are contained in Appendix B. In general, the two data sets are similar, with some outliers noted. For purposes of this Work Plan, the GE/USEPA split data were averaged for use in representing concentrations at split sample locations and calculating spatial averages for PCBs and arithmetic averages for other Appendix IX+3 constituents. The USEPA results for dieldrin, DDT and ketone has reportedly been rejected, and were not used to determine averages.

Sediment sampling was performed in February 1999 as part of source control activities at East Street Area 2. In total, 13 sediment samples were collected from nine locations. Samples were collected in the top foot at all locations, and in 1-foot intervals to a depth of 4 feet at one location. Results from this sampling indicate the presence of PCBs ranging from non-detect to 165 ppm. The PCB results are depicted on Figure 4-1.

4.2.2 Designation of Sediment Removal Areas to Address PCBs

In general, the approximate removal and replacement limits for sediment were developed in conjunction with USEPA and MDEP, based on a detailed review of the relative concentration of PCBs present in both the River sediments and adjacent bank soils.

The initial step in designating sediment removal areas involved generating Thiessen polygons for all locations from which sediment samples were collected in the ½-Mile Reach. Thiessen polygon mapping involves the use of computer software to draw perpendicular bisector lines between adjacent sample locations to create two-dimensional, sample-specific polygon areas. Polygons for the river sediments are provided in Figures 4-1 through 4-4.

To determine the extent and depth of sediment proposed for removal, the analytical data were plotted on a map to better understand the distribution of PCBs in the sediment. During several meetings with USEPA, MDEP and GE representatives, the sediment removal extent and depth were agreed upon for each polygon, based on an evaluation of spatial and vertical trends in PCB concentration. The sediment removal areas and depths proposed to reduce PCB concentrations in the ½-Mile Reach are depicted on Figures 4-1 through 4-4.

As part of the sediment removal determination process, spatial averaging was performed to determine the overall effectiveness of the removal scenario in reducing the concentration of surficial (0-1 foot) PCBs in the ½-Mile Reach. The spatial averaging approach used by GE supports an averaging technique that is area weighted. The basis for the spatial averaging approach is the initial characterization of a given area using Thiessen polygons. This approach has been used by GE to identify removal areas at other PCB sites in Pittsfield requiring response actions, and has been approved by the USEPA and MDEP for use at those sites.

The current calculated spatial average for the surficial river sediments (0- to 1-foot) in the ½-Mile Reach of the Housatonic River is 54.8 ppm (excluding data collected as part of the Source Control activities at East Street Area 2). The surficial sediment PCB concentrations were then assessed following implementation of the sediment removal and replacement activities to determine the post-removal spatial average PCB concentration in the surficial sediments of the ½-Mile Reach. This post-removal surficial spatial average PCB concentration was calculated as less than 1 ppm. Refer to Appendix C for spatial average calculations and assumptions.

4.2.3 Evaluation of Appendix IX + 3 Data

A total of 53 sediment samples collected by the USEPA within the ½-Mile Reach have been analyzed for Appendix IX+3 constituents. The results of these analyses are presented in Table 4-1. As also indicated in Table 4-1, many of the locations from which these samples were collected will be removed as part of the PCB-related sediment removal activities, depicted on Figures 4-1 through 4-4.

To evaluate the adequacy of the proposed sediment removal for addressing non-PCB Appendix IX+3 constituents, post-removal average concentrations were calculated for each such constituent detected in the sediments of the ½-Mile Reach taking into account the removal and replacement activities related to PCBs. These average concentrations were calculated as arithmetic averages over the entire ½-Mile Reach. The resulting average concentrations, as well as the ranges, are presented in Table 4-2. These post-removal average concentrations were then compared to the range of background levels of these constituents in sediments, based on the analytical results of sediment samples collected from the Housatonic River upstream of any releases from the GE facility as presented in GE's report entitled *Evaluation of Housatonic River Sediment and Floodplain Soil Data on Hazardous Constituents To Assess Need for Further Sampling* (BBL, September 1996). The background data are also presented in Table 4-2.

Inspection of Table 4-2 indicates that, for most constituents for which background data exist, the average post-removal concentrations are within or generally comparable to the background range (using the detection limit to represent the maximum value for constituents that were not detected upstream). For those constituents for which background data do not exist, the average post-removal concentrations are low and comparable to the concentrations of similar constituents for which background data do exist. There are a couple of exceptions to these conclusions. Most notably, during an initial comparison of the data sets, the average post-removal concentrations of lead and thallium seemed relatively elevated. However, these averages were driven by high lead and thallium values for a single sample (T013-SD010133) in the USEPA data set. A comparative evaluation of the USEPA and GE split sample data showed a very large inconsistency in the lead and thallium results for that sample (see Table 4-1, page 4) and suggested that the USEPA results for those constituents in that sample may have been anomalies. With concurrence from USEPA, GE resampled the sediments at location T013-SD10133, and analyzed the sample for lead and thallium. The resampled lead and thallium results for this location were 7.1 ppm and 0.57 ppm respectively, which are consistent with GE's original results. Therefore, the original USEPA results were not used in the final evaluation. With these modifications made, the sediment Appendix IX+3 constituent concentrations following the removal/replacement of sediment polygons to address PCBs are considered generally consistent with the upstream background data, and therefore, no Appendix IX+3-related sediment removal/replacement is proposed.

4.3 Upper ½-Mile Reach Bank Soil Data and Removal Areas

This section of the Work Plan describes the soil data, collected by GE and the USEPA, being used to characterize the banks and determine the bank soil removal areas in the ½-Mile Reach.

4.3.1 Soil Data

Bank soil sampling for PCB analysis has been conducted in the ½-Mile Reach during several rounds between 1991 and 1998, and has included the collection of approximately 1200 bank soil samples from 429 locations, excluding the Building 68 area. Samples were collected by GE as well as the USEPA. Recent sampling performed by the USEPA (August - September 1998) involved the delineation of 63 transects, approximately 50 feet apart, along the river banks in the ½-Mile Reach, and generally obtaining samples at three different locations (lower, middle, top of bank) on each bank (north and south bank) along the 63 transects. Soil samples from 0-6 inches, 12-18 inches, and 24-30 inches were obtained (when recoverable) from each location. Samples collected from this reach between 1991 and 1998 indicate the presence of PCBs in bank soils ranging from less than 1 ppm to 35,900 ppm. Figures 4-1 through 4-4 show sampling locations and results (as shown on those figures, this area is fenced on the top and on the sides and access from the River is limited by the River).

As part of the sampling performed by the USEPA in 1998, approximately one sample per transect on each bank of the River was also analyzed for the Appendix IX + 3 constituents. Several Appendix IX +3 constituents were detected at low concentrations in the bank soils within the ½-Mile Reach. A summary of the Appendix IX + 3 bank soil data is provided in Table 4-3.

During the 1998 USEPA sampling effort, GE collected 118 bank soil split samples for PCB analysis and 23 split samples for Appendix IX + 3 analysis. The PCB data for the split samples are included on Figures 4-1 through 4-4, while the Appendix IX + 3 split sample data are presented in Table 4-3. A comparative analysis of the USEPA's data and GE's split sample data was performed, the results of which are in Appendix B. In general, the two data sets are similar, with some outliers noted. For purposes of this Work Plan, the GE/USEPA split sample data were averaged for use in representing concentrations at split sample locations and calculating spatial averages for PCBs and arithmetic averages for other Appendix IX + 3 constituents. As noted in Section 4.2.1, the USEPA results for dieldrin, DDT and ketone were rejected, and have therefore not been used.

More recently, soil sampling was performed as part of source control activities at East Street Area 2 and Lyman Street. The primary objective of the source control activities was to determine whether any NAPL was present in the vertical soil profile. In total, 56 bank soil samples were collected in February 1999 from eight locations at East Street Area 2 and analyzed for PCBs. These locations were sampled at 1-foot intervals to a depth of 8 feet. Results from this sampling indicate the presence of PCBs in concentrations ranging from non-detect to 725 ppm. In April, 1999, 114 bank soil samples were collected for PCB analysis from 10 locations at Lyman Street. These locations were sampled at 1-foot intervals to a depth of 10 feet at eight locations, to a depth of 18 feet at one location, and to a depth of 16 feet at one location. Results from this sampling indicate the presence of PCBs in concentrations ranging from non-detect to 5,600 ppm. These data are presented on Figures 4-5 (East Street Area 2) and 4-6 (Lyman Street).

4.3.2 Designation of Soil Removal Areas to Address PCBs

In accordance with the parties' settlement agreement in principle and as specified in the USEPA's December 1, 1998 letter to GE, the Performance Standards for the river bank soils in the ½-Mile Reach are to achieve spatial average PCB concentrations of 10 ppm in the top foot of soil and 15 ppm in the soil in the 1- to 3- foot depth increment. The spatial averaging to achieve these standards was performed separately on seven discrete bank areas identified by the USEPA in its December 1, 1998 letter. Those seven areas are:

<u>Northern River Bank</u>

1. The GE facility;
2. The Western Massachusetts Electric Company property; and,
3. GE's Lyman Street Parking Lot.

<u>Southern River Bank</u>

4. The riverbank extending from the western edge of the Western Massachusetts Electric Company property to the Lyman Street bridge;
5. The Western Massachusetts Electric Company property;
6. The GE-owned Newell Street parking lot and the strip of GE owned land behind the Newell Street commercial properties; and,
7. The City-owned property adjacent to Hibbard playground.

These seven averaging areas are shown on Figure 4-7.

To determine the spatial average PCB concentrations for each averaging area, Thiessen polygons were generally drawn around each sample location at 0- to 1-foot and 1- to 3-foot depths. Different polygons were drawn for these two depth intervals because at some locations only surficial soil analytical results were available. The surface areas of the polygons were calculated consistent with and parallel to the slope of the bank. The area of each polygon was represented by the PCB data obtained with each polygon. The data used in the spatial averaging included all existing PCB data for the bank soil in the ½-Mile Reach, except for the most recent source control-related sampling (at the request of USEPA, the PCB data collected as part of the source control activities at East Street Area 2 and Lyman Street were not included in the bank soil spatial averaging calculations, as these data represent vertical profiles, and the bank soil characterization data were collected at an angle perpendicular to the banks). With the concurrence of the USEPA, in instances where samples were only collected/analyzed from every other 0.5-foot interval, the 0- to 0.5-foot depth interval value was used to represent the top foot of bank soil, and the arithmetic average of the 1- to 1.5-foot and 2- to 2.5-foot depth increment values was used for the 1- to 3-foot concentration. Using the polygon areas and associated data, a spatial-average PCB concentration was calculated for each depth increment at each of the seven averaging areas of the ½-Mile Reach. Existing spatial-average PCB concentrations range from 1.7 ppm to 634 ppm in the top foot of soil and from 2.4 ppm to 146 ppm in the next 2-foot depth interval. Supporting calculations and assumptions are provided in Appendix D.

The polygons described above and associated data were used to determine removal areas to achieve compliance with the spatial-average performance standards. Polygons with the highest PCB concentrations were initially "removed" and a post-removal backfill concentration of 0.0375 ppm (one-half the analytical detection limit) was assumed. Additional polygons were "removed" as necessary to achieve the Performance Standards. Six of the seven averaging areas will be subject to soil removal. The existing spatial-average PCB concentrations in the bank soils of Area 7, the City-owned property adjacent to Hibbard playground, already met the Performance Standards (with a spatial average in the top foot of 1.7 ppm and in the 1- to 3-foot depth range of 2.4 ppm). Thus, no bank soil removal is necessary in this area to achieve the 10 and 15 ppm Performance Standards. The removal areas are shown on Figures 4-1 through 4-4, and supporting calculations and assumptions are provided in Appendix D.

Using the averaging methods described above, following implementation of the bank soil removal program, the spatial-average PCB concentrations for the entire ½-Mile Reach of the Housatonic River will be 7.6 ppm in the top foot and 11 ppm in the 1- to 3-foot depth interval. For each of the seven bank areas defined by the USEPA, the individual area spatial averages will be less than 10 ppm in the top foot of soil and less than 15 ppm in the 1- to 3-foot depth interval. The table below presents the resulting spatial averages for the two depth intervals for each area, based on the bank soil removal activities specified in this Work Plan.

Area	0- to 1-Foot Depth Post-Removal Spatial-Average PCB Concentration (ppm)	1- to 3-Foot Depth Post-Removal Spatial-Average PCB Concentration (ppm)
1*	9.6	11.9
2	8.3	14.3
3	9.7	14.8
4	8.4	13.6
5	8.9	14.3
6	8.5	14.6
7**	1.7	2.4

Notes:

* The 0-1 and 1-3 foot depth post-removal spatial-average PCB concentrations will also be less than 10 and 15 ppm, respectively, in the north bank soils adjacent to the area of a proposed ball field (the approximately 320-foot stretch of bank west of and adjacent to the Newell Street Bridge).

** Removal is not necessary to meet the Performance Standards (i.e., concentrations provided are existing spatial-average PCB concentrations).

4.3.3 Evaluation of Appendix IX + 3 Data

A total of 113 bank soil samples collected by the USEPA from the ½-Mile Reach have been analyzed for Appendix IX+3 constituents. The results of these analyses are presented, for each averaging area, in Table 4-3. As also indicated in Table 4-3, a number of the bank soil locations from which these samples were collected will be removed to achieve the 10 and 15 ppm PCB Performance Standards, as described in Section 4.3.2 and depicted on Figures 4-1 through 4-4.

To evaluate the adequacy of the proposed bank soil removal for addressing non-PCB Appendix IX + 3 constituents, an evaluation was made of the concentrations of such constituents in the bank soils after taking into account the removal and replacement activities related to PCBs. This evaluation followed an approach that was conceptually approved by USEPA. Under this approach, the post-PCB removal data for each bank soil averaging area (as defined above) were first divided into surface (top foot) and subsurface data sets. For all constituents except for dioxins and furans (which were evaluated separately as discussed below), the maximum post-PCB removal concentrations were initially compared to the USEPA Region 9 Preliminary Remediation Goals (PRGs) for such constituents in residential areas. For polycyclic aromatic hydrocarbons (PAHs) for which Region 9 PRGs do not exist, GE used the Region 9 PRG for benzo(a)pyrene for carcinogenic PAHs and the Region 9 PRG for naphthalene for noncarcinogenic PAHs (e.g., acenapthylene, benzo(g,h,i)perylene , 2-methyl-napthalene, and phenanthrene). In addition, for the other detected constituents for which there are no Region 9 PRGs -- endrin aldehyde and pentachloroethane -- GE used the Region 9 PRGs for endrin and 1,1,2,2-tetrachloroethane respectively. If the maximum concentration did not exceed the PRG for a constituent, the constituent was no longer considered in the evaluation. If the maximum concentration did exceed the PRG, the maximum and median concentrations of the constituent were then compared to the maximum and median concentrations of the constituent in a background data set derived from GE's sampling of surface soil in the Housatonic River floodplain upstream of releases from the GE facility. These comparisons were made using the summary statistics approach set forth in MDEP's *Guidance for Disposal Site Risk Characterization* under the MCP for comparing site-related data to background data. Under this approach, if either the maximum or the median concentration was greater than 150% of the background value, or if both the maximum and median concentrations exceeded the background concentrations, the constituent was retained for further evaluation. The final step involved comparing the average post-PCB removal concentrations of the remaining constituents to the MCP Method 1 Category S-2 standards for soil to determine if further response actions are required to address the constituents. The more conservative of the GW-2 / S-2 and GW-3 / S-2 standards were used for this comparison.

Dioxins and furans were evaluated separately. To evaluate the dioxins and furans, a total Toxic Equivalent (TEQ) concentration was calculated for each sample using the consensus Toxic Equivalency Factors (TEFs) published by the World Health Organization. The maximum TEQ concentrations (calculated on post-PCB removal basis) for each averaging area were then compared to USEPA-approved PRGs for dioxin/furan TEQs in recreational areas. These PRGs, which were based on the dioxin PRG established by USEPA for residential areas in USEPA OSWER Directive 9200.4-26 (April 13, 1998), are 1.0 ppb for the top foot of soil and 1.5 ppb for the 1- to 3-foot depth increment. If the maximum TEQ concentration from the pertinent averaging area and depth interval was below the applicable PRG, dioxins/furans were eliminated from further consideration. If the maximum TEQ concentration exceeded the applicable PRG, it was determined that response actions are necessary to address the dioxins/furans represented by that sample.

The results of this evaluation are summarized in Table 4-4. As shown in that table, four of the seven bank soil averaging areas contain constituents that were not excluded after application of the above criteria: Area 1, Area 2, Area 3, and Area 6. To address these constituents in the context of the present Removal Action, additional polygons in these areas were selected for removal, with such removal to be conducted to a depth corresponding to the depth at which the sample causing the exceedance was taken. The polygons to be removed based on the Appendix IX+3 evaluation are listed in Table D-15, located in Appendix D. Following these removals, the non-PCB Appendix IX+3 constituents in each of the seven bank soil averaging areas will meet the Performance Standard for such constituents (Performance Standard #9 in Section 2.2 above). The post-excavation conditions are depicted in Tables 4-5 and 4-6.

4.3.4 Soil Removal/Stabilization at the Toe of the Bank for Erosion Protection

The USEPA requested that GE remove and/or stabilize the toe of the bank as an erosion protection measure, at certain locations where sediment removal will occur adjacent to the bank, and where no bank removal would otherwise be performed to achieve the PCB and Appendix IX bank soil Performance Standards. During several meetings with USEPA, MDEP and GE representatives, the toe of bank locations where additional soil removal and/or stabilization will occur were agreed upon, and are depicted on Figures 4-1 through 4-4. The limits of excavation at the toe of bank locations where bank soil removal is proposed to help stabilize the bank, are depicted in Figures 7-1A through 7-1C and Figure 8-2.

5. Baseline Habitat Assessment

This section presents the results of the baseline habitat assessment for the ½-Mile Reach of the Housatonic River, including a description of the existing conditions of the in-stream (aquatic) and riparian (bank) zones. The descriptions presented below also include a characterization of the function and value of the aquatic and riparian habitats as they currently exist, before implementation of the Removal Action.

5.1 Aquatic Habitat Assessment

The aquatic habitat assessment documents the current morphology, substrate, channel stability, and habitat features within the ½-Mile Reach. The initial assessment of aquatic habitat is important because post-remedial habitat restoration schemes that utilize physical features similar to those found naturally within the river system have the greatest probability for long-term success.

This assessment is based primarily on site visits conducted by personnel from BBL and McLaren Hart on September 25 and November 5 and 6, 1998, supplemented by information collected during other studies. During the November 5 and 6, 1998 site visits, an USEPA oversight contractor was additionally present. The site visits involved photographing and recording aquatic habitat features along the length of the River from Newell Street to Lyman Street. Observations included stream dimensions and flow characteristics, sediment type, availability of in-water cover (i.e., the presence of boulders, snags, and aquatic vegetation), channel/lower bank stability, and qualitative observations of the existing benthic community. Information gained from the site visits was used to develop an aquatic habitat base map (Figure 5-1).

5.1.1 Morphology

River morphology is described by the form and structure of a river, and includes characteristics of entrenchment, width, depth, slope, and sinuosity. The morphology of the Housatonic River is altered from its natural condition, as the river has historically been straightened and channelized within this reach. In general, the ½-Mile Reach has low gradient slope (0.0003 ft/ft at baseflow to 0.001 ft/ft at high flows). The channel and lateral deposits indicate a fairly high sediment load with mixed suspended and bed loads. The channel is moderately entrenched (as discussed below), and both banks consist of well-vegetated silty sand banks rising approximately 12 to 15 feet above the stream bed. The vegetated cover starts at a well-defined elevation about 2 feet above the low flow water elevation.

The channel width generally ranges from 60 feet at Newell Street to 70 feet near Lyman Street. Based on several visual and physical indicators, the "bankfull" elevation was estimated at 975 feet at Newell Street and 973.5 at Lyman Street. In this context, "bankfull" should not be confused with the river water leaving the entrenched limits of the channel. Rather, the "bankfull" stage corresponds to the discharge or flow rate necessary to adequately maintain the average morphological characteristics of the stream channel. This bankfull stage represents the conditions under which long-term channel morphology will be in dynamic equilibrium and thus is very important in assessing the morphologic features of a stream and in comparing stream patterns and bed features among river systems. Various indicators may be used to represent the approximate bankfull stage, including changes in bank slope, change in vegetation, highest elevation, and/or depositional features (USDA, 1995; Hanson et al., 1994). Based on flow modeling using a HEC-2 water surface profile model, the bankfull elevation for the ½-Mile Reach corresponds to a discharge (flow rate) of approximately 850 to 1,000 cfs. Given the existing flow data for the Housatonic River (1-year peak 460 cfs; 2-year peak 1820 cfs for Lyman Street), this range is consistent with analyses (e.g., Andrews, 1980; Annable, 1994; Dunne and Leopold, 1978; Wolman and Miller, 1960) that indicate, for many streams, bankfull discharge frequently corresponds to a flow recurrence interval of approximately 1.5 years.

For the ½-Mile Reach, the average width to depth ratio for non-bridge affected cross-sections at bankfull flow is 16. The term "entrenchment ratio" -- i.e., the ratio between flood-prone width (depth = 2 x bankfull depth) and bankfull width (Rosgen, 1996) -- is used to describe the vertical containment of the River. The entrenchment ratio for this reach is generally between 1.5 and 2.0. Streams with entrenchment ratios in this range are considered "moderately" entrenched (Rosgen, 1996).

Rosgen's classification scheme (shown on Figure 5-2) is a useful tool used to characterize overall stream morphology. Based on the field observations, the channel within the ½-Mile Reach is best classified as a B5c stream, with some tendency towards a more entrenched F5 stream. The F5 characteristics may be the residual result of past channelization. A description of a B5 stream is presented on Figure 5-3.

As shown on the aquatic habitat base map (Figure 5-1), the depth variations within the channel appear to be the result of a subtle pool and riffle system, with a meander wavelength of approximately 600 feet. Pool-riffle channels have an undulating bed that is defined by a sequence of bars, pools, and riffles (Leopold, 1964). Pools are topographic low points within the channel and bars are the corresponding high points. Pools can either be free-formed (unrelated to obstruction) or forced (caused by flow deflection by non-alluvial obstruction). Riffles are the higher velocity, shallow depth transition areas between pools. Runs (or glides) are moderately shallow water with an even flow lacking the pronounced turbulence noted in riffles. In low gradient streams, runs may be the dominant flow type, and with increasing higher flows, riffles may become runs. Slack water is slow moving, but lacking the topographic depression associated with pools.

Pool-riffle bed forms are relatively stable morphologic features even though some degree of bed-load transport may occur frequently. In self-forming pool-riffle channels without significant wood debris and gradients less than 0.02, pools and alternate bar formations are rhythmically spaced at about every 5 to 7 channel widths (Montgomery and Buffington 1993). Flow modeling for the ½-Mile Reach indicates the relative velocity reversal proposed by Keller (1971) or reversal of bed shear stress measured by Lisle (1979) between pool and riffle areas.

In summary, the general morphologic condition in the ½-Mile Reach is that of a low gradient B5c stream, which appears to be the best stream habitat condition given past channelization and other physical restrictions of the landform. The bankfull flow appears to be approximately 1,000 cfs, representing the best balance among bed sediment, suspended sediment loads, and bank material. A pool and riffle pattern is developing at approximately 10 channel width wavelength, although the development is somewhat retarded by past channelization and the low, existing gradient.

5.1.2 Substrate

Substrate data are important for evaluating the quality of fisheries habitat, as well as designing an effective restoration plan, since channel bed and bank materials influence the cross-sectional plan-view and longitudinal profile of rivers. Substrate conditions also influence sediment transport and provide the means of resistance to hydraulic stress (Rosgen, 1996).

This evaluation of the channel substrate is based on observations made during site visits and preliminary evaluation of particle size analyses conducted on approximately 318 samples from 120 cores by the USEPA in 1998. Channel substrate material within the ½-Mile Reach is naturally sorted, varying in size as a result of localized hydraulic conditions. This observation is typical for pool-riffle channels of this type, which have heterogeneous beds that exhibit a variety of sorting and packing, commonly with a coarse surface layer and a finer subsurface (Leopold, 1964). This heterogeneity is important in determining the viability of the substrate.

The surface material (0- to 6-inch) in the ½-Mile Reach was generally coarse to medium sand (Figure 5-4). Within the same transect, the mid-channel samples were usually coarser than the lateral samples, and the north side tended to have coarser surface material than the south side, as indicated by the median particle size (D_{50}). The D_{50} particle size represents the size for which larger particles comprise half the mass; 50 percent of the particles in the ½-Mile Reach are smaller than D_{50}, and 50 percent are greater than D_{50}.

Some gravel was present in riffles, and some fine sand to silt present in pools; however, in general, there were few silts and clays present in the upper 6 inches (Figure 5-5). The material in the pools was more homogeneous than in the riffles. As noted, substrate size varied with localized stream depth and velocity. Riffle areas, with shallower depth and faster velocities, contained gravel embedded with the sands. At the surface, riffles were typically up to 10 percent coarse gravel, with up to 45 percent fine gravel. The deeper pool areas contained increasing amounts of fine sands and some silts. Near the surface, pools typically had under 3 percent coarse sand and up to 10 percent fines. Overall, there was not an abundance of fines present in the sediments of the ½-Mile Reach.

For most sediment cores from the ½-Mile Reach, especially in riffle areas, the surface sediment was coarser than sediment from deeper in the bed. A typical example is shown on Figure 5-6. This difference in sediment size distribution is the result of natural armoring, a process in which finer sediments are selectively scoured from the surface leaving behind a layer of coarse erosion-resistant sediments that overlay the fines sequestered below. To illustrate the overall degree of the armoring process in the ½-Mile Reach, the ratio of the D_{50}'s for the 0.5- to 1-foot layer and surface layer was computed. For the majority of the transects, the ratio was computed as less than 1, which indicates that armoring is occurring. The frequency and distribution of natural armoring within the ½-Mile Reach is presented on Figure 5-7.

The threshold for general mobility of the bed surface layer is associated with the approximate bankfull flow. At flow rates below the bankfull threshold, sediment transport in pool-riffle streams is generally supply limited. During events exceeding bankfull, when the finer materials below the naturally armored surface area are exposed, sediment transport is limited by transport capacity rather than supply (Montgomery and Buffington, 1993).

5.1.3 Channel Stability

Knowledge of the relative stability of a stream reach is important to the success of a restoration program (Wesche, 1985).

The evaluation of the channel stability in the ½-Mile Reach is based on Pfankuch's (1975) procedure, which provides for the systematic evaluation of the resistive capacity of the stream to erosion of bank and bed materials, and provides insight into the capacity of streams to adjust and recover from alterations. This procedure uses a total of 15 categories to describe the conditions of the upper bank, lower bank, and stream bed. The distinction between the upper and lower bank is based on channel geometry and vegetation. Eifert and Wesche (1982) field tested Pfankuch's procedure and found it a reliable indicator for evaluating channel stability as well as fish habitat quality.

For assessing the channel stability of the ½-Mile Reach, the division between the upper and lower bank was made at approximately 974' to 975' elevation. Using Pfankuch's procedure, the following observations were made regarding conditions of the upper bank, lower bank, and stream bed:

- The stability of the upper banks is generally classified as good, with the moderate bank slope (averaging 3H:IV) offset by dense vegetative bank cover, indicating a deep and dense soil binding root mass. There is little evidence of mass wasting or debris jam potential along the upper banks, other than twigs and smaller limbs.

- The lower banks are generally rated fair, with adequate channel capacity for all but peak flows. Few obstructions to flow exist along the bank, with some evidence of infrequent sand bar formation. In the absence of vegetation, some undercutting is observed with exposure of bank soils for 6 inches to 1 foot above the low-water level.

- The stream bed stability is also classified as fair. The bed material is generally a loose unconsolidated mixture of sands and small gravel. The gravel-size material is generally dull with rounded corners and edges. In mid channel, an armored layer of coarse material frequently overlays a finer substrate.

Based on these evaluations, an overall Pfankuch numerical score of 83 is given to the channel, which classifies it as fair for a B5c stream.

Using a bank erodability hazard rating guide developed by Rosgen (1996), the current bank conditions are rated as having a moderate erosion potential. The factor contributing most to the erosion potential is the slope and texture of the banks, while the vegetation density and root depth mitigate some of the erosion potential. The erodability based on stresses in the channel compares the mid-channel physical forces to forces adjacent to the bank. According to the evaluation, stresses (i.e., velocity gradient, area ratios, and near bank shear stress ratios) in the channel and along the bank indicate a moderate potential for erosion. The bank stability of the ½-Mile Reach is dependent on a well-developed riparian vegetation and sediment bed armor layer development typical of a B5c stream.

5.1.4 Physical Habitat-Related Structures

As documented during the site visits, current conditions within the ½-Mile Reach allow for only a limited amount of fish habitat. While some fish (mostly minnows) were expected to be present in the ½-Mile Reach, no fish were observed during the site visits. According to recent studies, the fish community in this region of the Housatonic River is dominated by minnows (e.g., bluntnose minnow, common shiner, fallfish, blacknose dace), white suckers, and sunfish (i.e., rock bass) (Chadwick & Associates, 1994).

To assess the physical habitat-related structures of the ½-Mile Reach, evaluations of the water depth and flow, in-stream cover, and substrate were completed, as presented below.

- Water Depth and Flow: As shown on the aquatic habitat base map (Figure 5-1), variations in the sediment bed topography are evident, and result from a variety of submerged and emergent gravel bars and terraces, including point, central, and transverse bars. In general, the highest degree of variation is noted in the upper ¼-Mile Reach. Although most of the ½-mile stretch is characterized as relatively shallow (i.e., less than 3 feet deep) with slow-moving pools and slack water, these features do provide a limited mix of depths and velocities, and create several riffle areas. The riffle areas provide increased current velocities, and are favored by mayflies and other aquatic invertebrates. In the slower-moving pools, the benthic community is dominated by more tolerant organisms, including midges and oligochaete worms.

- In-Stream Cover: Cover such as snags, undercut banks, large rocks, and submerged macrophytes do exist, but are sparse. Some downed trees and large rocks may provide refuge, but are generally limited to shallow water areas. The photos on Figure 5-1 show occasional large organic debris (i.e., downed trees), which provide some degree of cover and flow deflection. The debris are both submerged and anchored to the bank. At some of the submerged logs, a plunge pool exists with a 1½- to 2-foot bed change. Three hundred feet downstream of Newell Street, a mid-channel island is present, measuring approximately 50 feet long, 15 feet wide, and 2½ feet above the water line. The island is well vegetated starting at 1 foot above the water line. Occasional undercutting of the bank at the water line also provides potential cover areas. The bank is stabilized above these cuts by the dense root system.

- Substrate: Based on the description of the substrate provided by the particle analysis, this substrate yields an estimated 0.1 to 0.93 g/ft^2 of food for fish (USDA, 1977). The areas with coarser particles (gravel, pebbles, and cobbles) likely yield more food because many benthic species (e.g., Ephemeroptera, Plecoptera, and Trichoptera), which are the principal taxa available to fish, prefer coarser sediment types. The finer particle substrate (sand and silt) is preferred by chironomid larvae and other burrowing organisms that are not readily available to the fish (Waters, 1995). Therefore, the riffle areas are expected to yield more food than the pool areas.

5.1.5 Aquatic Habitat Assessment Summary

The ½-Mile Reach of the Housatonic River is classified as a B5c stream; it is characterized by a relatively low gradient slope, moderate entrenchment, and a fairly high sediment load. Some definition of pools and riffles exists within the reach. The substrate consists of course to medium sand, and some gravel is present in the riffles. The stability of the stream banks are fair to good, with moderate erosion potential. The fish habitat within the ½-Mile Reach is fair, but is limited by the sparse amount of in-stream cover and the presence of shallow slow-moving pools and slack water. The aquatic habitat will be improved through the construction of the habitat enhancement structures described in Section 9.1. Specifically, the in-stream structures will benefit the aquatic habitat of the reach by improving riffle/pool characteristics, providing in-stream and bank-side cover, and increasing the variability in water flow and depth.

5.2 Riparian Habitat Assessment

The primary purpose of the riparian (bank) habitat assessment is to document the current vegetative community and potential wildlife usage along the ½-Mile Reach. This information is important in determining the existing functions and values of the riparian corridor prior to the removal action. As such, information from this assessment is important to identifying habitat features to be restored or enhanced, as presented in Section 9 of this report.

During a site visit on November 4 and 5, 1998, observations of the riparian habitat were documented and then used to prepare the riparian habitat base map presented on Figure 5-8. For this assessment, the riparian habitat of the ½-Mile Reach is the vegetative community covering the river bank slope from the edge of the water to the crest of the slope. A general description of the riparian area along the ½-Mile Reach is provided below.

Five sampling plots on each bank were used to quantitatively and qualitatively characterize the vegetative community of the ½-Mile Reach. As depicted on Figure 5-8, each plot measured 50 feet in length and encompassed the width of the riparian area (generally 30 to 50 feet). At each sampling plot, the canopy strata were quantitatively characterized by identifying the species of each canopy specimen within the plot, and then measuring its diameter-at-breast height (DBH). A smaller, 30-foot subarea in the center of each sampling plot was utilized to characterize the remaining strata. These strata were characterized by qualitatively noting cover classes (the percentage of the subplot covered by the species) for each species within the sub-canopy (tall shrub/sapling and shrub), vine, and herbaceous strata.

In addition to analyzing the vegetative community, the riparian habitat assessment also includes the documentation of potential wildlife usage. Potential wildlife usage was evaluated through direct observations of wildlife and wildlife signs (i.e., tracks, dens, nests, scat), and knowledge of the habitat requirements for species along the ½-Mile Reach.

5.2.1 General Description

The ½-Mile Reach is located within a highly developed/urbanized area containing numerous industrial facilities. In general, the outside border of the riparian habitat is bounded by roads, parking areas, buildings, and old fields. The terrestrial habitat within the ½-Mile Reach consists of undeveloped areas immediately adjacent to the River, as well as unpaved areas adjacent to buildings and parking lots.

Undisturbed habitat in this area is severely limited and fragmented by historic development. The existing habitat supports only wildlife amenable to urbanized settings and provides little support for wildlife that require large territories.

The habitat along the ½-Mile Reach appears to be early successional in nature and is relatively uniform in composition. While there is no indication of recent clearing, the size of the trees and understory vegetation suggests that the banks were cleared at some point in the past. Although no indication of fire damage was present, several trees have fallen due to wind, creating small microhabitats within each of the sampling plots, and numerous downed logs appear to have been deposited by recent floodwaters. Some snags (mostly dead eastern cottonwoods, American elms and black cherries) were noted in some of the plots, numbering approximately 25 per acre.

The riparian corridor of the ½-Mile Reach has an average width of 34 feet along the north bank, and an average width of 40 feet along the south bank. Given the total length (south and north bank combined) of 6,600 feet, the total amount of riparian habitat through the study area is approximately 225,000 square feet (5.2 acres).

5.2.2 Vegetative Community

A detailed characterization of the existing vegetation is important in determining types and amounts of plant species to be replaced during restoration and enhancement activities. To characterize the riparian vegetation on the banks of the ½ -Mile Reach more fully, 10 plots along the banks were intensively inventoried for vegetation, as noted above. These plots, shown on Figure 5-8, comprise a total of 8,550 square feet on the north bank and 10,000 square feet on the south bank, and together represent about 8% of the total riparian habitat in this reach. The results of these inventories are shown on Figure 5-8. A list of species identified within the study area is presented in Table 5-1, and the detailed results from each plot are summarized in Table 5-2.

The riparian habitat within the study area is a relatively narrow band of mixed, broad-leaf deciduous forest. The community is well stratified, but not very diverse, with only a limited number of species found within each of the strata. In general, canopy and subcanopy species are distributed randomly throughout the plots. Exceptions include red-osier dogwood (*Cornus stolonifera*), which is only found immediately adjacent to the River. There is one small area in the vicinity of Plot 9, where historic clearing of the forest community for a transmission line right-of-way has resulted in a community dominated by shrubs and coppice hardwood shoots.

Overall canopy coverage of the plots was generally observed to be 75 to 100 percent. The canopy stratum is dominated by eastern cottonwood (*Populus deltoides*), American elm (*Ulmus americana*), boxelder (*Acer negundo*), and Norway maple (*Acer platanoides*). Other species such as black willow (*Salix nigra*), black cherry (*Prunus serotina*), red oak (*Quercus rubra*), staghorn sumac (*Rhus typhina*), and paper birch (*Betula papyrifera*) were also observed on a limited basis within some of the plots.

Based on size, the eastern cottonwood is the dominant species throughout the study area. The cottonwoods are generally of the same age class, are approximately 75 feet in height, and have an average DBH of 22.4 inches. Based on abundance, the boxelder, American elm, and eastern cottonwood are the species with the highest average number of specimens per plot. The Norway maple is found in almost every plot, but is not as abundant as the other three species. The average number of stems per plot (14 stems/plot) is the same for both the north and south side of the River. Plots 1 and 7 have the greatest density (20+ stems/plot), while plot 9, where clearing had occurred, has the least (7 stems).

The estimated number of the dominant canopy specimens throughout the study area is:

Species	**Quantity**
American Elm (*Ulmus americana*)	420
Black Cherry (*Prunus serotina*)	50
Black Willow (*Salix nigra*)	60
Boxelder (*Acer negundo*)	450
Eastern cottonwood (*Populus deltoides*)	390
Northern red oak (*Quercus rubra*)	60
Norway Maple (*Acer platanoides*)	190

Black oak (*Quercus velutina*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), staghorn sumac (*Rhus typhina*), and domestic apple (*Pyrus malus*) are found in very small numbers or exist in only one plot.

The overall foliar coverage of the tall shrub/sapling and shrub strata in each of the sampling plots was generally between 50 and 80 percent. The tall shrub/sapling and shrub strata are generally dominated by invasives. Those species include Morrow's honeysuckle (*Lonicera morrowii*), an invasive Eurasian transplant that has escaped from thickets (Petrides, 1986), and winged eunonymus (*Eunonymus alata*), an Asian species that has escaped from cultivation (Symonds, 1963). Morrow's honeysuckle was found in all but one subplot and was generally one of the most dominant species based on foliar coverage within each subplot. Ninebark (*Physocarpus opulifolius*), an escaped ornamental, and Japanese barberry (*Berberis thunbergii*), an oriental invasive, were also noted in some of the plots. There is little available information regarding the wildlife value of these species. Other species identified in the tall shrub/sapling stratum included red oak, American elm, black cherry, and Norway maple saplings. Other species identified in the shrub stratum included American yew (*Taxus canadensis*), Carolina buckthorn (*Rhamnus caroliniana*), red-osier dogwood, and silky dogwood (*Cornus amomum*). Vines, in particular American bittersweet (*Celastrus scandens*) and wild grape (*Vitis sp.*), also provided a substantial foliar coverage (18 to 35 percent) for most of the plots.

The herbaceous stratum was generally sparse in each of the subplots. The foliar coverage by herbaceous species was usually no more than 12 percent of each subplot. However, the largest foliar coverage of a subplot by an individual species was 13 to 24 percent within Plot 7 by New York fern (*Thelypteris noveboracensis*). There are indications that substantial portions of the south bank of the River through the study area are covered by this species during the summer months. The more common species seen in the herbaceous stratum were field horsetail (*Equisetum arvense*), white snakeroot (*Eupatorium rugosum*), giant goldenrod (*Solidago giganteum*), rough avens (*Geum laciniatum*), and wild madder (*Galium mollugo*).

An observation noted during the riparian habitat evaluation is that the lower banks (i.e., from water level at low flow to height of approximately 2 to 4 feet) are generally devoid of vegetation, consistent with the bankfull flow elevation. This observation is apparent in the photos on Figure 5-1.

5.2.3 Wildlife Community

The riparian corridor along the ½-Mile Reach is relatively narrow, yet the area is apparently used by a number of wildlife species for both foraging and nesting. As shown on Figure 5-8, raccoon (*Procyon lotor*) and muskrat (*Ondatra zibethica*) tracks were observed sat numerous locations along the River, and fresh beaver (*Castor canadensis*) marks were observed at the base of several trees. Woodchuck (*Marmota monax*) holes and eastern gray squirrel (*Sciurus* *carolinensis*) nests were noted in some of the vegetative sampling plots. Eastern chipmunks (*Tamias striatus*) have been historically observed in the riparian habitat. The plant community is expected to be used by song birds, including black-capped chickadee (*Parus atricapillus*), tufted titmouse (*Parus bicolor*), gray catbird (*Dumetella carolinensis*), American tree sparrow (*Spizella arborea*), and northern junco (*Junco hyemalis*). American black ducks (*Anas rubripes*) were also observed in the River during the site visit.

The vegetative species present in the ½-Mile Reach provide mixed values to wildlife. For instance, the wildlife value of a cottonwood is generally limited to perching, roosting, and nesting areas for arboreal (i.e., tree dwelling) mammals and birds (USDA, undated), although cottonwood buds are eaten by some birds and the bark can be eaten by beaver. The American elm serves as a source of food for birds and mammals (Thunhorst, 1993), though it offers limited cover (Redington, 1994). Boxelder fruits, seeds and buds are eaten by birds, and its twigs are eaten by squirrels (Martin et al., 1961, Petrides, 1986). Boxelders are used for cover and nesting by songbirds (Thunhorst, 1993). Norway maples are used by many bird species, as well as small mammals, for food and shelter (Martin et al., 1961). Black cherries provide food for birds, squirrels, cottontail rabbits, and other mammals (Petrides, 1986). American bittersweet provides wildlife value in that various bird and mammal species consume the fruit and cottontail rabbits have been known to consume the bark (Petrides, 1986).

5.2.4 Riparian Habitat Assessment Summary

The riparian habitat within the ½-Mile Reach consists of a relatively narrow band of mixed, broad-leaf deciduous forest, and reflects historic disruption by anthropogenic activities. The existing canopy stratum is dominated by eastern cottonwood, American elm, boxelder, and Norway maple. The tall shrub/sapling and shrub strata are dominated by Morrow’s honeysuckle and winged eunonymus. The herbaceous stratum is dominated by New York fern. The vegetative cover provides mixed values to wildlife. Existing wildlife is limited by disturbance and fragmentation by the existing land use. Typical species currently utilizing the area include song birds, squirrels, cottontail rabbits, muskrat and raccoon.

The existing riparian habitat features will be reconstructed and enhanced with the planned habitat projects described in Section 9.2. Specifically, following restoration activities, the riparian habitat will be restored/enhanced by replanting disturbed areas with species which are typical of a floodplain forest community. In addition, efforts will be made to leave existing supercanopy specimens (especially eastern cottonwood and black willow) in place, if possible from an engineering standpoint. These techniques, which are described in more detail in Section 9.2, will serve to establish a functioning riparian system which will provide suitable habitat for a variety of plant and animal species.

5.3 Threatened/Endangered Species

Threatened or endangered plant or animal species were not observed within the ½-Mile Reach during the field visits conducted by BBL and McLaren Hart personnel as part of the baseline habitat assessment. However, information from the USEPA (1997) indicates that two state-protected species (American bittern and wood turtle) may reside in the vicinity of this site. Additional species have been identified by the USEPA (1995) as residing within the downstream section of the Housatonic River stretching to the Connecticut border. Although it is not possible to rule out the potential for threatened or endangered species to occur within the work area, it is highly unlikely that the habitat available is sufficient to support individuals of these species. In comparison to adjacent areas, the ½-Mile Reach does not provide any unique features that would make the area preferable for protected species. As previously described, both the aquatic and terrestrial habitats of the ½-Mile Reach are limited by a number of factors, including relative lack of cover and sand/silt substrate of the River, the surrounding land use, and relatively narrow width of the riparian corridor. As such, it is unlikely that the Removal Action will impact any threatened or endangered species.

6. Removal Preparation Activities

6.1 General

Prior to the initiation of soil and sediment removal actions, several site preparation activities will be performed. These activities will include provisions for site security, installation of erosion/sedimentation control measures, removal and disposal of vegetation, and relocation of site utilities and other facilities. Each of these activities is further described below.

6.2 Site Controls and Access

Site controls are currently in place which restrict public access to the ½-mile stretch of River where remedial work will be performed. Fencing is located along the top of the river bank on both sides of the River and warning signs have been posted in the river bank area as directed by the USEPA and MDEP. GE has installed additional fencing at the Newell Street and Lyman Street Bridges to further restrict access to the river bank. In addition, the physical features of this particular area (e.g., steep river bank, dense vegetative cover, etc.) discourage access.

To restrict access during remedial activities, warning tape may be installed at certain locations such as open excavations, cleaning areas, stockpile areas, etc. As indicated above, warning signs are currently posted along the river bank. For the duration of removal activities, a sign-in/sign-out sheet will be maintained for the site. All on-site personnel and site visitors will be required to sign in upon entering the site and sign out upon leaving.

Implementation of safe work practices will provide for additional site security during remediation. Safe work practices that will contribute to overall site security include the following:

- Maintaining temporary construction fencing around all open excavations and other potentially dangerous areas;
- Parking heavy equipment in a designated area each night and removing keys;
- Maintaining an organized work area, including proper storage of all tools and equipment; and
- Conducting a daily security review.

Current plans call for primary work areas to be set up on GE property along the north side of the River and at the Newell and Lyman Street parking lots, which will provide access to perform the sediment and bank soil removal and restoration activities (Figure 6-1). These work areas will be used for staging of equipment and materials, stockpiling of soil and sediment, cleaning activities, and water treatment. Additional information regarding these activities is presented in Section 10.

Access will also be necessary from both sides of the River, on property not owned by GE. Appropriate access agreements will be sought for access to these properties. Property owned by GE in this stretch of the River is identified on Figure 1-1. To provide equipment access to the sediment removal, replacement, and restoration areas, access roads and temporary abutments will be constructed, as required. The access roads will be constructed by first performing some limited grading (if necessary), then placing geotextile followed by gravel. Figure 6-1 indicates the anticipated locations of access roads. The actual location of the access roads will be selected in the field based upon equipment limitations and requirements. Extending out from the access road and toward the edge of the River, temporary abutments will be constructed as needed at regular intervals along the bank to provide a location from which the equipment can be positioned. The spacing of the temporary abutments will be dictated by the physical capabilities of the equipment. The construction of the temporary abutments will utilize a geotextile layer installed on top of the existing bank, followed by the placement of a suitable earthen material to provide a relatively level working platform extending toward the River. Since the spacing/specific locations of the temporary abutments will be dependent on the physical capabilities of the equipment, abutment locations will be selected in the field, as necessary. To the extent practical, the temporary abutments will be located in bank areas that will also be subject to excavation, in an attempt to limit vegetation removal.

Following completion of sediment-related activities, the access roads and abutments will be removed. The gravel and earthen materials used for their construction will be stockpiled and approximately 1 sample per 20 cubic yards will be collected and analyzed for PCBs to determine if the materials can be re-used (i.e., PCBs < 2 ppm) or whether they will be disposed of.

6.3 Erosion and Sedimentation Control

The selection of specific erosion and sedimentation control measures for the removal and restoration activities will depend on a number of considerations, including the scope of activities, site topography, type of ground cover, whether the controls are land- or water-based, and operational/maintenance considerations. In addition to the various physical types of control measures that can be installed, certain operational and management practices will be implemented throughout the project to provide an additional measure of erosion and sedimentation control. This section describes some of the fixed controls that will be installed before initiating intrusive sediment and soil activities. The specific locations of these controls will be determined and adjusted in the field based on site-specific considerations related to drainage, topography, work activities, etc.

Before initiating bank soil or sediment removal and restoration activities, appropriate erosion control measures will be installed to minimize the potential for rainfall- or flood-induced migration of soils into or out of the areas subject to disturbance. These measures may include the placement of geotextile fencing and/or hay bales along the edge of the River and the sides of the bank. Geotextile fences typically consist of a geotextile fabric material suspended between support posts and trenched into the ground (refer to detail on Figure 7-2). As rainfall runoff approaches the geotextile fence, it is either diverted around downgradient areas or filtered through the fabric material, depending upon the orientation and configuration of the geotextile fence. When utilized as a diversion method, geotextile fence limits the amount of runoff that contacts downstream areas. When utilized as a filter, the geotextile fence limits the velocity and the amount of suspended materials in the runoff water, thus limiting the downstream transport of soils.

Similar to geotextile fences, staked hay bales minimize velocities associated with overland flow, and provide filtration to minimize the downgradient migration of suspended soils. Hay bales may be installed around the perimeter(s) of work areas as required and secured to the existing ground surface by wooden stakes. Hay bales may be used alone or in combination with geotextile fences. Hay bales will only be trenched into the ground, if used in the absence of geotextile fence.

Additionally, as a precautionary measure, an absorbent boom will be deployed prior to installation of the water diversion/containment structure, 50 to 100 feet downstream of each “cell”. A silt curtain also will be installed at this location. (Specific measures relating to the control of potential migration from the former bank seep areas at East Street Area 2 and the Lyman Street parking lot during the conduct of remedial activities are discussed in Section 7.)

After the erosion and sedimentation control measures have been installed, remaining site preparation activities will be performed. The erosion and sedimentation control devices will be maintained for the duration of the project until such time that site restoration activities have provided a final surface cover (as appropriate) in all areas. During this time, erosion and sedimentation control devices will be inspected each work day and maintained and/or adjusted as necessary, based on site conditions and site activities.

6.4 Removal and Disposal of Vegetation

After the erosion controls are in place, and before soil and sediment removal and restoration activities begin within a given area, brush and trees will be removed to allow project activities to occur without significant obstructions. Vegetation clearing will only be performed as necessary to provide access to the soil/sediment removal areas. The timing of the removal of vegetation will be linked to the bank soil/sediment excavation (i.e., the entire riverbank will not be cleared of vegetation during the initial phase of the project, but, instead, vegetation removal will precede bank/sediment removal to the extent necessary to allow for continued operations). To the extent practical, efforts will be made to minimize vegetation and tree removal, particularly adjacent to Hibbard Playground and that involving the removal of large trees located on the banks. Figure 6-1 indicates anticipated vegetated areas to be cleared; however, the actual extent of vegetation removal will be determined in the field. Above-grade materials that are cleared from the bank areas will be chipped and/or cut up as necessary and removed from the site. These materials will be handled as non-regulated wastes. Below-grade materials (i.e., tree stumps and roots) that are cleared as part of soil removal activities will be handled in the same manner as the soil from which the material was removed. These materials will be cut into appropriately sized pieces (if necessary) so they can be easily managed during subsequent disposition activities.

During site clearing activities, contact between any felled trees and any PCB-containing soils, regardless of whether or not the soil is to be removed, will be minimized. If any felled trees or other vegetation comes into contact with PCB-containing soil and there is visual evidence of soil adhering to the materials, the vegetation/felled trees will be decontaminated prior to leaving the site, or will be appropriately disposed of as PCB-containing material. Equipment used in these clearing activities that contacts PCB-containing soil will be cleaned prior to leaving the site using appropriate equipment cleaning procedures.

6.5 Identification and Relocation of Utilities

GE-owned utilities within the work area that may impede performance of the removal and restoration activities will be temporarily removed or relocated. Based on a preliminary review of utilities in this area, it appears that an overhead steam line, an overhead electric line (480 volt), and a number of below-grade pipelines are present along the north and south banks of the river in the facility area. Each of the above-grade utilities will be removed or re-routed by GE prior to the initiation of the removal and restoration activities. The extent to which the known below-grade pipelines will affect the work activities will be evaluated and appropriate measures will be taken to protect these utilities.

In addition, the appropriate utility locating services will be contacted, prior to performance of the work, to identify any other utilities that may be present in the work area. Appropriate measures will be taken to protect these utilities. Western Massachusetts Electric Company will be contacted directly to discuss protection of the high voltage transmission lines present in this area.

7. Removal and Replacement of River Sediments

7.1 General

GE proposes to remove and replace with cap and armor certain river sediments in the ½-Mile Reach of the Housatonic River. Within this reach, the vertical extent of removal in the majority of those areas where removal will occur will be up to 2 feet, with removal to a depth of 2.5 feet proposed for one area.

The general sediment removal and replacement approach will involve the following:

- Designating the work areas at the site, as determined in Section 4.2 of this Work Plan;
- Preparing the site for project activities, as discussed in Section 6;
- Diverting the River around the work areas in a phased, area-by-area approach by constructing a water diversion/containment structure using sheetpiling or other appropriate means (e.g., sand bags, jersey barriers, portable dams, etc.), designed considering the possible hydraulic effects associated with diverting the River through a reduced cross-sectional flow area;
- Segregating the removal and replacement areas into manageable work cells by installing additional water diversion/containment structures generally perpendicular to the river flow, at the upstream and downstream ends;
- Dewatering the work cell in which work will be performed and treating the water as required; and
- Performing sediment removal and replacement activities on an area-by-area basis.

To the extent practical and as discussed in Section 8, the bank soil removal activities will be conducted in coordination with the sediment removal and replacement activities. To maintain each area in as dewatered a state as possible, the incoming water will be continuously extracted with pumps. For areas subject to sediment removal, it is anticipated that sediments will be excavated using equipment stationed on the bank/abutments as well as in the dewatered area of the River itself. Visual observations will be made for the potential occurrence of DNAPL in the bottom of the excavations. If DNAPL is encountered at the bottom of the excavation in any area, appropriate actions, as discussed in Section 7.4.4, will be taken to address that condition. If drums, capacitors, or related equipment are encountered within the excavation area, appropriate actions, as described in Section 7.4.5 will be taken to address their presence.

This section of the Work Plan provides details regarding the proposed design and implementation of the sediment removal and replacement activities, including: a discussion of sediment removal and replacement limits; excavation stability and water diversion techniques; excavation dewatering techniques; sediment removal and replacement methods and approach; and contingency plans to address overtopping of the surface water diversion/containment structures, DNAPL or drums, capacitors, or related equipment, if encountered.

7.2 Removal and Replacement Limits and Quantities

As discussed in Section 4.2 of this Work Plan, the removal and replacement limits for sediment have been developed in consideration of the relative concentration of PCBs present in both the River sediments and adjacent bank soils through discussions/meetings with the Agencies.

In addition, the selection of removal and replacement limits, in conjunction with planned restoration measures, has taken into account the effects on the flood storage capacity of the River and the ability to create in-stream conditions (e.g., variable water depths and velocity, in-stream cover) that would improve certain aspects of the aquatic habitat. (See Section 9 for final restoration design.)

Based on these considerations, a sediment removal and replacement configuration was developed that involves general removal of up to 2 feet, with removal of 2.5 feet in one select area, followed by replacement. Along the upstream, downstream and side edges of the polygons which border non-removal sediment areas (with the exception of the edge which borders the Building 68 Removal Action Area), additional removal will occur vertically and/or laterally, as requested by the Agencies, to accommodate construction of an armor stone protection buffer zone (i.e., tie-in buffer). Sediment removal will generally take place within four sections of the River: a 440-foot section just downstream of the Newell Street bridge; an 800-foot section just upstream of the Building 68 Area; a 500-foot section between the south bank of the River and the area remediated as part of the Building 68 Area removal; and the 900-foot stretch between the GE footbridge and Lyman Street Bridge.

Additional sediment removal will occur in conjunction with East Street Area 2 source control activities, as part of this Removal Action. Sediments within a 5-foot wide strip located along the bank, adjacent to the East Street Area 2 sheetpiling, will be removed to an elevation generally corresponding to that of adjacent bank soil removal. As identified on Figure 4-1, on the River side of the Source Control sheeting, excavation of sediments shall be completed to a depth of 1.5 feet below existing grade, or to the specified elevation (ranging from 967.5 to 969.5), which ever is greater.

The proposed sediment removal configuration is presented on Figures 4-1 through 4-4. The total volume of in-situ sediment corresponding to this configuration is estimated to be approximately 8,100 cubic yards.

Following the implementation of the removal and replacement/cover activities outlined above, the spatial average PCB concentration in the top 1 foot of sediments in the ½-Mile Reach will be less than 1 ppm. In addition, the replacement system will provide an effective barrier over the subsurface sediments, minimizing both the potential upward migration of PCBs from the underlying residual sediments and the potential scour/transport of the underlying PCB-containing sediments. The effectiveness of this system in minimizing migration and scour from the underlying sediments is discussed further in Section 7.4.2 below.

7.3 Excavation Stability/Water Diversion

To accomplish sediment removal and replacement activities, it is anticipated the active river flow will be diverted around the work areas by constructing a water diversion/containment structure using steel sheetpiling or other appropriate means (e.g., placement of sand bags, jersey barriers, portable dams, etc.). The selected water diversion/containment structure will be designed to:

- withstand the hydrostatic and hydrodynamic forces associated with diverting the River;
- provide sufficient cross sectional river area for the surface water to bypass the structure without significantly increasing surface water velocity (i.e., scour potential) or elevation (i.e., flood potential);
- provide a sufficient surface water/groundwater infiltration barrier to allow dewatering of the work area prior to and during excavation with excavation performed under “dry” conditions (i.e., not through a standing column of water); and

C be structurally stable during removal of sediment to the designated depths, while minimizing the potential for adjacent sediments to migrate or slough into the removal area.

The use of sheetpiling for the Building 68 Area removal action proved to be an effective means of diverting the River's flow around the work areas. The river flow was diverted (via open-channel flow) through the remaining section of the River by installing sheetpiling down the River and around each removal area as appropriate. The exact types and locations of water diversion/containment structures will be determined by the Remedial Contractor and described in the Operations Plan.

7.3.1 Water Diversion

The Contractor will be given the responsibility of selecting the water diversion/containment structure location and elevation necessary to protect the removal area. The elevation of the water diversion/containment structures will be presented in the Operations Plan for approval by EPA. The elevation of the water diversion/containment structure for a given removal area will be selected based on the time of the year the water diversion/containment structure will be in place and the hydraulic effects associated with diverting the River through a reduced cross-sectional flow area (i.e., the restricted channel/width). An assessment of average daily flows in the Housatonic River, based on the period of record for the USGS gage at Coltsville approximately 3.7 river miles upstream (March 8, 1936 to September 30, 1997) is shown below.

Daily Average Flow Characteristics
Period of Record - 3/8/36 to 9/30/97
Daily Average Flows in the Housatonic River by Month (cfs).

	Average (cfs)	90 Percentile (cfs)	Average High Flow	99 Percentile (cfs)	Maximum (cfs)
January	69	177	220	736	1820
February	73	191	212	503	1190
March	124	366	544	1060	4460
April	204	522	685	1220	2860
May	106	281	351	632	2750
June	56	159	204	609	1600
July	37	93	130	400	1500
August	33	84	111	337	2010
September	36	851	142	418	3110
October	50	133	161	526	1800
November	70	196	296	577	1900
December	75	191	290	567	4350

To provide an indication of flow variability, the above table includes the average daily flow, the 90th percentile, average high flow, 99th percentile, and maximum observed daily average flows. The 90th (99th) percentile flow represents the daily average flow which has been exceeded 10% (1%) of the time for a particular month, based on the 61-year period of record. For example, in the month of June, the long-term daily average flow is 56 cfs. However on 10% of days in June, the daily average flow is expected to exceed 159 cfs, and 1% of the time will exceed 609 cfs. The average high flow represents the mean of the 61 highest yearly recorded daily flows (by month). The maximum daily average flow provides the upper bound of flow conditions for that month observed over the 61-year period of record.

The design of the water diversion/containment structure, as discussed above, will consider the possible hydraulic effects associated with diverting the River through a reduced cross-sectional flow area. With respect to changes in the elevation and velocity of the River resulting from its diversion around the removal area, an analysis of this specific section of the River was performed using a previously-developed Hydrologic Engineering Center-2 (HEC-2) model of the Housatonic River from the Woods Pond Dam upstream to Hubbard Avenue, a distance of approximately 12 miles. This HEC-2 model includes the area of interest between Lyman Street and Newell Street.

As an example of the effects of water diversion on water surface elevation, results of a similar evaluation for the Building 68 Removal Action performed by GE in 1998 is provided. In that evaluation, appropriate modifications were made to the channel geometry in the model for the area of the proposed removal and replacement activities to simulate river diversion conditions. To simulate the water diversion/containment structure, the channel bottom cross section in this reach was modified to include a vertical barrier located approximately two-thirds (considered for Building 68 to be the maximum necessary restrictive condition) of the distance across the river channel. The model was then run using various flow rates to determine the change in elevation and velocity in the channelized portions of the River. Flow rates including average annual flow, the one-year flood, and the 2-year flood were used in this evaluation. These flows were determined from USGS 15-minute peak flow statistics for data at the Coltsville gaging station from 1939 to 1990. Appendix A provides the input and output files for the HEC-2 model. Table 7-1 summarizes the results of this analysis and an evaluation of these results is presented below.

For the evaluation of the Building 68 Area sheetpile analysis, the 1-year flood elevation was selected as the general design criterion for the top of the sheetpiling. This design elevation provided a reasonable balance between reducing the potential for, or frequency of, overtopping the sheetpiling and reducing the potential for scour and erosion due to increased velocities in the channelized (restricted) portion of the River. As can be seen from Table 7-1, the occurrence of a one-year flood, while the river channel is restricted, was predicted to produce an increase in the river elevation and velocity in comparison to its current, unrestricted flow conditions. Comparison of water surface elevations between unrestricted mean flow and restricted 1-year recurrence flow indicated that, in order to design the sheetpiling for the 1-year flood conditions, the top of the sheetpiling would have to be approximately 2.5 to 3 feet above the elevation of the average annual unrestricted flow event. Although several flow events above the average flow event for the residential channel occurred during the Building 68 remedial activities, this evaluation provided for adequate protection against overtopping of the installed sheetpile.

Selection of an appropriate design elevation for the top of the water diversion/containment structure to provide a reasonable protection against overtopping during the construction period will depend, in part, on the acceptable risk of flood occurrence. For example, during the months of April through December, the river flows would be expected to be typically less than a 1-year flood. Based on daily average flows, 61 years of records (1936 to 1997) indicate that average daily flows less than the 1-year flood (440 cfs) have been recorded more than 97 percent of the time for the period of April through December. Although this frequency represents the occurrence of daily average flows, it is expected that the frequency of peak flows during this time interval would exhibit a similar pattern.

The Contractor will also have flexibility in the location and elevation of water diversion/containment structures based on the size of the area contained within the ½-Mile Reach. In some sections of the River, small areas may be isolated with diversion techniques and sediment removal can be completed in a relatively short period of time. In those instances, a flood recurrence interval closer to the monthly average historic flow may be used to determine the height and placement of the diversion structure. Also, it is expected that the degree of intrusion into the river channel will be less than two-thirds of the river width used in the Building 68 example. In some localized situations, water diversion may only be required to be placed a few feet into the River, subsequently reducing cross-sectional flow area by a relatively insignificant amount and requiring overtopping protection at a much lower elevation. The Contractor will assess adequate protection based on area-specific activities, short-term flow and weather conditions, and the risks acceptable based on those factors.

In the event that overtopping of the water diversion/containment structure occurs, appropriate actions will be taken to stabilize the work area prior to overtopping. Such actions are described in Section 7.4.3.

With respect to scour and erosion, modeling of the river hydraulics during the proposed water diversion does not appear to indicate increases of the river velocities above those typically observed in the affected areas. A river flow of 440 cfs (i.e., a 1-year flood event) has been reviewed in terms of potential scour and erosion impacts associated with the restricted river flow. Specifically, as described above, there is an increase in the elevation and velocity during a flow of 440 cfs (even with unrestricted flow), and if such an event were to occur while the removal actions were underway, the increases would be further exaggerated. However, the HEC-2 model results, as well as the results of recent water column monitoring performed by GE at several locations within the Housatonic River, suggest that these increases in elevation and velocity would not significantly increase scour and erosion, as discussed further below.

Using the Building 68 Removal Action as an example, for one-third of the river bottom (i.e., the area through which the river flow was assumed to be diverted in the HEC-2 calculations), the average water velocity (under average annual flow conditions of approximately 105 cfs) during river diversion would be approximately 2.6 feet per second (fps). This velocity would correspond to an overall unrestricted river flow of approximately 440 cfs, or approximately the flow associated with the 1-year flood event. This evaluation indicates that, under normal river flow conditions, the increase in water velocity caused by the diversion of the river around the removal area would be well within the velocity that the river bottom and bank routinely experience. Therefore, it is not expected that any significant increase in the scouring or erosion of sediments and bank soils would occur during average flow conditions.

Regarding the 1-year flood event and its potential to increase scour/erosion within the river bottom or bank, a similar evaluation to that summarized above was performed. The average velocity of the river through the southernmost one-third of the river in a 1-year flood event during diversion (5 fps) is roughly equivalent to an unrestricted flow of 2,270 cfs. This flow corresponds to the approximate 10-year flood event. Flows at or greater than the 10-year flood have been recorded on five occasions since the mid 1930s (4,460 cfs on March 18-19, 1936; 3,110 cfs on September 21-22, 1938; 4,350 cfs on December 31, 1948; 2,749 cfs on May 30, 1984; and 2,860 cfs on April 5, 1987). If a flood greater than the 10-year flood were to occur, the water diversion/containment structure would overtop and the effects of the restriction would be reduced since the flow would no longer be entirely contained within the diverted channel. In effect, placement of diversion structures in the River is not expected to result in River flows that exceed those that have been historically documented, or might be anticipated in the future without the presence of diversion structures. In addition, it has been noted by the USEPA that, due to the uneven topography and the undercutting of the banks in some areas, scour/erosion protection on the banks will be ineffective, if not counterproductive.

In summary, scour/erosion protection activities do not appear warranted on the river bottom or banks adjacent to the water diversion structures, based on a review of the proposed diversion structures and their potential effect on river hydraulics.

7.3.2 Excavation Stability

As noted in Section 7.3, the selected water diversion/containment structure must be designed to withstand the hydrostatic and hydrodynamic forces of the river and be structurally stable during removal of sediments to the designated depths. The final design of the water diversion/containment structure will depend on the type of structure used, which will be developed in consultation with the Remediation Contractor. For illustration purposes, a preliminary assessment has been performed using sheetpiling as the water diversion/containment structure. Preliminary design calculations have been done for the three different removal depths assuming a water surface elevation increase of approximately 3 feet above average (in response to the one-year flood event with a two-thirds River constriction). The depths of sediment removal agreed upon by GE, USEPA, and MDEP for the ½-Mile Reach are 1.5, 2, and 2.5 feet. Details are provided in Appendix E. The potential depth of sheetpile, where the full embedment depth is in medium-dense sands, is presented in the table below.

Removal Depth (feet)	Depth of Sheetpile* (feet below top of existing sediment layer)
1.5	11.5
2.0	13.0
2.5	14.5

Notes: * A factor of safety of 1.0 and a friction angle of 35 degrees (medium-dense sands) are included in the calculations. This has only been presented for illustration purposes.

7.4 Sediment Removal and Replacement Method and Approach

7.4.1 Sediment Removal and Dewatering

To facilitate the removal and replacement of sediment in the river target areas, a number of site preparation activities will first be performed and will, to varying degrees, involve both sides of the River. Following the installation of appropriate erosion and sedimentation controls, trees and large vegetation will be removed from certain bank areas, including some that are not subject to the removal activities. This removal of vegetation will allow the mechanical equipment that will be used for the sediment removal and replacement activities to be positioned on or adjacent to the bank to improve access to the sediments subject to removal and replacement. Additional bank vegetation removal is also necessary to provide clearance for the equipment to transfer the removed materials to the staging areas. Section 6.4 of this Work Plan further describes the removal and disposition of the removed vegetation. Additionally, as described in Section 6.2, several temporary access roads and abutments will be constructed to provide a location from which the removal equipment can be positioned. Although the exact areas will be determined in conjunction with the Remediation Contractor, anticipated areas of vegetation removal, access road locations, and staging/stockpile area locations are shown on Figure 6-1.

The diversion of the River around the removal and replacement areas will involve the construction of a water diversion/containment structure positioned in the River, parallel to flow. The removal and replacement areas will then be segregated into manageable work cells by extending the water diversion/containment structure generally perpendicular to the river flow, at the upstream and downstream ends. This approach will allow the River to continue to flow in a gravity-based, open-channel flow, around the work cell.

Following installation of the water diversion/containment structure, the work cell will be dewatered. Issues relating to dewatering that will need to be addressed to facilitate the removal and replacement of sediment include determining water treatment capacity, identifying appropriate treatment process units that will effectively meet any applicable discharge requirements, and designing a functional water collection/transfer system. Initially, consistent with the plan approved by the USEPA for the Building 68 Area removal action, the impounded river water within the work area will be pumped over the water diversion/containment structure back into the flowing portion of the River. Initial dewatering of work areas and discharge of the untreated water to the flowing portion of the river, will be performed via a pump suspended a minimum of 6 inches above the bottom of the River. When the depth of water in a work area approaches the sediment, it will be subject to handling, treatment, and discharge as discussed in Section 10.6.

For illustration purposes, groundwater modeling using Visual MODFLOW™, a well-documented and publicly available groundwater modeling code, was performed to assess dewatering pumpage rates within a sheetpile containment cell. Modeling results indicated that simulated steady-state dewatering rates range from approximately 55 to more than 350 gallons per minute (gpm) utilizing various assumptions for the layout of the containment cells. As would be expected, the larger the containment cell, the higher the required pumping rates. It is appropriate to emphasize that these projections are for steady-state conditions, and assume a certain hydraulic conductivity (10^{-5} cm/sec). There will likely be higher short-term pumpage requirements during the initial stages (1 to 3 days) of the dewatering activities, and a higher pumping rate will be required in an area if subsurface soil materials exhibit a higher hydraulic conductivity. A description of the model development, data input, and results is provided in Appendix F.

Based on the dewatering estimates that have been modeled for various portions of the ½-Mile Reach as well as experience from the Building 68 Area removal action (which required a maximum treatment capacity of 400 gpm), GE is currently awaiting approval from MDEP on the design to expand the capacity of the 64G groundwater treatment facility. The 64G facility was designed with the consideration that it may be necessary, at some future time, to increase the treatment capacity. The proposed modifications would allow the 64G facility treatment capacity to be increased from 350 gpm to 700 gpm (the full design capacity). Considering that a treatment capacity of 250 gpm needs to be reserved for ongoing groundwater recovery operations and 100 gpm is required for operation of the continuously backwashing sand filters, a treatment capacity of 350 gpm is anticipated to be available for the sediment removal project. In the event that groundwater infiltration rates exceeding 350 gpm are encountered, either smaller working cells may need to be created for dewatering, or additional on-site treatment systems will be obtained and utilized.

An important additional consideration with respect to excavation dewatering associated with the removal activities is the effect of dewatering on the former seep areas. At the East Street Area 2 and Lyman Street former seep areas, sheetpiling installed prior to commencement of the ½-Mile Reach removal activities will provide rigid containment barriers in these areas during construction activities. An assessment of vertical gradients within the saturated overburden materials below and adjacent to the Housatonic River ½-Mile Reach was performed using groundwater modeling (Visual MODFLOW™). The use of sheetpiling as the water diversion/containment structure was conservatively modeled in the River to assess the effect of dewatering on the former seep areas. Results indicate that the increase in hydraulic gradients due to the dewatering activities necessary to perform the sediment removals does not appear to be significant enough to mobilize DNAPL, unless the depth to the top of till is relatively shallow. Since the coal tar DNAPLs in East Street Area 2 adjacent to the river are deep (the till surface is as low as elevation 936 feet) and sediment excavations are shallow in this area (less than 3 feet), upward mobilization of the coal tar DNAPLs is not expected due to dewatering and excavation activities. In the remaining areas, the DNAPLs would be heavy (specific gravity of 1.5), if they are present, and are not expected to be remobilized upward due to dewatering and excavation activities. A description of the model development, data input, and results is provided in Appendix F.

With respect to LNAPL, the containment barriers that have been or are being installed at East Street Area 2 and the Lyman Street area have been or are being designed and installed with the assumption that dewatering due to sediment removal will occur adjacent to them. Therefore, they are designed to penetrate sufficiently to preclude LNAPL (if it is present) from migrating below these barriers into the excavations.

Following completion of the activities noted above, sediment removal and replacement activities will be performed in a phased, area-by-area approach. To the extent practical and as discussed in Section 8, the bank soil removal activities will be conducted in coordination with the sediment removal and replacement activities. To maintain each area in as dewatered a state as possible, the incoming water will be continuously extracted with pumps. One or more sumps will be constructed in the corners of the cells using large diameter perforated pipe (or equivalent), and trenches will be constructed along the sides of the sheeting as needed to direct the water to the sumps. Sediment removal activities will be required under “dry” conditions (i.e., not through a standing water column).

For areas subject to sediment removal, it is anticipated that sediments will be excavated using equipment stationed on the bank/abutments (e.g., long-reach excavator) as well as in the work area of the River itself. As discussed in further detail in Section 10.2, upon removal from the River, the sediment will be placed in a lined truck and either transferred directly to the on-plant consolidation areas, or to a stockpile area in close proximity to the removal area to allow remaining free liquids to gravity drain from the materials and be collected for treatment. The ultimate disposal of the sediments will be determined based on the average PCB concentration and RCRA disposal classification of the materials removed from each polygon. Non-RCRA sediment with an average in-situ PCB concentration less than 50 ppm will be disposed in the Hill 78 On-Plant Consolidation Area. Sediment removed from polygons with an average in-situ PCB concentration equal to or greater than 50 ppm and sediments classified as a RCRA waste will be disposed in the Building 71 On-Plant Consolidation Area (see Section 10.4 for more details). Appropriate precautions will be taken (e.g., installation of an impermeable geomembrane material, additional erosion and sedimentation controls, etc.) to minimize the potential for the removed materials to contact a “clean” area. In addition, free liquids released from the staged materials will also be kept from contacting “clean” areas.

The extent and depth of removal within a given area will be closely monitored through the use of survey equipment. Once the survey information confirms that the sediment removal limits have been achieved, replacement activities will be performed through installation of a cap and armor system. As discussed in Section 7.4.2, the cap and armor system is designed to provide both adequate erosion protection and, an effective isolation barrier for PCBs in the underlying sediments. Since the cap and armor system will be installed wherever sediment removal occurs, post-removal confirmation sediment sampling will not be necessary. However, during sediment removal, GE will conduct post-excavation sampling for PCBs at six locations prior to cap placement to confirm that detectable PCBs are present in the remaining sediments to provide data for use in the subsequent evaluations of the long-term effectiveness of the sediment cap isolation layer. This post-excavation sampling, described in Section 11.5.1, will be conducted only at these six locations and solely for the foregoing purposes.

Visual observations will be made for the potential occurrence of DNAPL in the bottom of the excavations. If DNAPL is encountered at the bottom of the excavation in any area, appropriate actions, as discussed in Section 7.4.4 , will be taken to address that condition. In the event that drums, capacitors, or related equipment are found within the limits of a removal area, various procedures will be followed to handle such items, as described in Section 7.4.5 . Removal and replacement activities will be completed in their entirety for a given cell before any removal of the water diversion/containment structure occurs.

7.4.2 Sediment Replacement Configuration

Following removal, a sediment replacement program will be implemented, which will involve capping and armoring removal areas throughout the ½-Mile Reach.

The purpose of capping and armoring is to provide a chemical and physical barrier between the residual sediment PCBs and the overlying water. The cap and armor system will consist of a multi-layer cap system that will include a geotextile liner, an isolation layer (the cap), a filter layer (geotextile), a filter protection layer (GeoGrid), and an erosion protection layer (the armor). Specifications for these materials are provided on Figure 7-2.

Installation of a cap and armor system will involve the initial placement of a geotextile directly over the sediments to serve as a barrier between the underlying sediments and the cap material, thus limiting the potential for mixing of the underlying sediments with the cap materials. A geotextile liner is currently proposed both as a secondary long-term erosion protection layer and as a recontamination barrier during placement of the cap material.

Following placement of the geotextile liner, a layer of silty sand containing at least 0.5% total organic carbon (TOC) will be installed to act as an isolation layer, effectively isolating the underlying materials from the surrounding environment. The presence of this cap provides a long-term reduction in potential PCB flux (i.e., migration) from the sediment into the water column and addresses the following physicochemical processes that can contribute to the migration/transfer of PCBs: 1) molecular diffusion (in the absence of groundwater flow); and 2) advection/dispersion (in response to groundwater flow through the sediment). The isolation layer addresses these processes by increasing the transport length necessary for PCBs to reach the armor-water interface, and by increasing the availability of materials for sorptive processes to occur during this transport process. The ability to isolate the PCBs increases with both thickness and organic carbon content of the cap.

A geotextile liner will then be placed to act as a filter layer, inhibiting the potential for erosion of the silty sand isolation layer up through the armor layer. Tear resistance of the geotextile during subsequent placement of the armor protection layer will be provided through placement of GeoGrid on the geotextile.

A stone armor protection layer will then be placed on the GeoGrid to dissipate the energy of high velocity flood flows to a point where the isolation layer would not be subject to scour or erosion. In addition, the erosion protection layer, in conjunction with the isolation layer, provides a physical barrier which effectively prevents the scour and resuspension of PCB-containing sediment into the water column and reduces the potential for direct contact by humans and biological receptors to the underlying sediment.

To assess the effectiveness of various types and thicknesses of isolation and armor layers in minimizing the potential for migration of PCBs from underlying sediments into the water column in the ½-Mile Reach, mathematical modeling was employed. Modeling has the ability to evaluate the comparative effectiveness of potential capping and armor layer configurations, and thus is useful in understanding the potential applications and performance of the isolation and scour protection layers for the underlying PCB-containing sediments. To conduct these evaluations, several parameters were initially established, including conservative "baseline" sediment conditions for the ½-Mile Reach, water velocity and depth profiles for various flow events, and the potential isolation layer configurations. The results of this modeling, together with the basis for design of a sediment cap and armor system, are presented in Appendix G.

Based on the conservative cap and armor system design calculations presented in Appendix G, a 12-inch thick silty sand layer with a 0.5 percent TOC concentration is proposed for the majority of removal areas in the ½-Mile Reach, with a minimum twelve-inch thick armor layer of stone ranging in size up to 9 to 12 inches in diameter. As shown in Appendix G, the isolation layer in this system is estimated to preclude "breakthrough" of underlying PCBs for at least 125-145 years, while the armor layer is sufficient to prevent erosion or scour of the isolation layer. As agreed to by USEPA, in certain areas, a 6-inch thick silty sand layer will be installed where 1 ½-foot sediment removal is proposed. Additionally, an 18-inch thick silty sand layer with a twelve-inch thick armor layer of stone will be installed at one location in the ½-Mile Reach, where deeper excavation is proposed.

In total, the multi-layer system will range from 18 inches to 30 inches thick with slightly greater thicknesses possible if NAPL is encountered. Installation of the cap and armor system in sediment-removal areas will bring each area back to original grade. Cross-sections showing capping and tie-in buffer details are provided on Figures 7-1A, B, and C. General notes and details are provided on Figure 7-2.

Replacement activities will be performed primarily by using conventional land-based mechanical equipment (e.g., bucket loaders, backhoes, cranes, etc.) located adjacent to the area involved. Materials will be carefully installed using this equipment to provide a uniform layer of the appropriate thickness. The water diversion/containment structure installed during removal activities will remain in place until sediment restoration is complete within the appropriate work area.

If data are not already available, the sandy materials to be used for sediment replacement will be subject to laboratory testing and analysis prior to their use. Samples for PCBs, total organic carbon (TOC), and sieve analysis (as per ASTM-D422-63) will be collected at a frequency of one sample for every 500 cubic yards of material. Samples for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), and metals will be collected at a frequency of one sample for every 2,000 cubic yards of material. All samples will be analyzed consistent with the procedures in the SAP/DCAQAP. The sampling results from replacement material proposed to be used in this project will be presented to the USEPA. If analytical results indicate unacceptable chemical concentrations, the replacement material from the proposed source will be rejected. Subsequently, another source will be identified and tested. This process will continue until samples from a particular source are determined to be acceptable. Due to the nature of the materials, it is not practicable to sample the stone in a similar manner.

7.4.3 Contingency Plan for Potential Overtopping of Surface Water Diversion Structures

As stated in Section 7.3.1, the Contractor will select the water diversion/containment structure configuration and elevation necessary to protect the work area. In the event that overtopping of the water diversion/containment structure is anticipated due to rising water levels or forecasted rainfall, the following actions will be taken:

1. Remove all excavation equipment from the work cell;

2. Place a layer of geotextile (and adequately anchor using sand bags) over the areas where:

   (1) sediment removal or capping/armoring is in progress and/or has been completed; and

   (2) areas where sediment removal is not proposed.

   If removal and replacement activities have not yet commenced, it will not be necessary to place the geotextile over the proposed removal areas.

3. After the water has receded, the impounded river water within the water diversion/containment structure area will be pumped over the structure, back into the flowing portion of the River, using a pump suspended a minimum of 6 inches above the bottom of the River. When the depth of water in the work area approaches the sediment, the water will be subject to handling, treatment, and discharge as discussed in Section 10.6; and

4. Remove the geotextile and recommence removal activities.

5. In the event that overtopping of the water diversion/containment structure occurs prior to implementation of the Contingency Plan, an inspection of the work area will be conducted and the appropriate actions identified by GE and implemented in conjunction with USEPA approval.

7.4.4 Contingency Plan for Potential Observation of DNAPL

Visual observations will be made for the presence of DNAPL, in the form of free product, in the sediments and/or underlying native soils during the sediment removal program. Should DNAPL in the form of free product in the sediment or underlying native materials be visually observed following removal of the sediments to their designated depths, the following steps will be followed:

1. Up to 10 additional cubic yards of sediment or underlying native soil will be removed from around and below the observed DNAPL to evaluate if the DNAPL is localized and can be easily addressed through removal.

2. If, following removal of up to 10 additional cubic yards of sediment or native soil, the DNAPL appears to extend beyond the bounds of the excavation, then a DNAPL investigation will be implemented to define the extent of free product at that location.

3. Once the depth and areal extent of DNAPL are adequately defined, the DNAPL present in the sediment or underlying native soil will be addressed through DNAPL removal and/or sediment isolation. The extent of sediment removal and/or isolation will be determined by the GE Project Coordinator, with approval from the USEPA OSC.

   (a) DNAPL Removal
   The primary mechanism for removal of DNAPL from the sediment or underlying native soil will be excavation. Where DNAPL excavation occurs, removal and replacement will occur vertically to a maximum depth of four feet, with four foot removal being potentially performed only if it is expected to result in collection of a significant volume of the DNAPL at that location. GE shall take all practicable actions to ensure that if necessary, excavation can be performed to sediment depths of 4 feet. This may include the use of bracing, tie-backs, or driving the water diversion/containment structures deeper into the sediments. If the free product is amenable to collection as a liquid in the excavation, pumps or other liquid collection methods may be employed during excavation.

   (b) Sediment Capping
   In areas of the River where DNAPL is still present following implementation of any DNAPL removal activities, a cap and armoring system will be installed which adequately isolates the DNAPL from transport upwards to the water column. The design of the DNAPL cap and armor system is presented in Appendix G. Similar to the cap and armor system proposed for isolation of non-DNAPL sediments containing residual PCBs, the DNAPL cap and armoring system will consist of a geotextile liner, silty sand isolation layer with a minimum TOC of 0.5 percent, a geotextile filter layer, a tear resistance layer (GeoGrid), and a scour protective armor/stone layer. The thickness of the isolation layer will range from one to three feet depending upon the depth of excavation where the cap and armor system is being installed, coupled with the final restoration plan. The cap will be overlain with a minimum twelve-inch thick armor layer of up to 9- to 12-inch diameter scour protective stone. As shown in Appendix G, the cap and armor design calculations indicate that this system will be sufficient to prevent “breakthrough” of dissolved-phase constituents associated with the DNAPL for at least 125-145 years (for a 1-foot cap) to approximately 400 years (for a 3-foot cap). If DNAPL remains at the 4-foot depth, GE shall add a monitoring location to monitor the effectiveness of the DNAPL cap in the areas where residual DNAPL remains. A maximum of two additional locations to monitor cap effectiveness in DNAPL areas will be added in the entire ½-Mile Reach.

4. If the DNAPL extends into the bank soils, then they will be addressed following the procedures in 8.4.2.

7.4.5 Contingency Plan for Potential Excavation of Drums, Capacitors, or Related Equipment

In the event that drums, capacitors, or related equipment are found within the limits of a removal area, various procedures will be followed to handle such items. The procedures are as follows:

Drums

If drums are encountered during excavation, GE will evaluate the integrity of the drums via visual inspection prior to attempting removal. If it is determined that a drum is intact and full or partially full, then the area around the drum will be excavated manually and the drum will be extracted with the excavator using a drum sling (or similar device), minimizing potential sediment/soil disturbance. Additionally, absorbent material will be placed around the drum and in the swing area of the excavator bucket (if necessary). Following removal, the drum will be carefully placed into a salvage drum (overpack) for characterization prior to disposal. Such drums will ultimately be disposed of off-site, as described in Section 10.5. If it is determined that a drum is not intact and/or is empty, then the excavator will be used to extract the drum along with the sediment or soil for placement in the permanent on-plant consolidation areas described in Section 10.4.

Capacitors or Related Equipment

In the event that intact capacitors or related equipment are found during excavation, it is anticipated that these items, due to their potentially small size, will be manually removed from the excavation area with minimal disturbance of the sediment/soil. If the item is small enough, it will be placed into a five-gallon pail with absorbent materials, and hand-carried to a drum staging area located adjacent to the excavation area and placed into a drum. If the item is too large to be hand carried, it will be extracted using the excavator and placed into a drum, as appropriate GE has established waste profiles for disposal of several types of capacitors and related equipment; therefore, such items will be segregated into separate drums for disposal off-site. If the item does not have an established waste profile, it will be subject to characterization prior to disposal. If small capacitor parts are encountered, these materials will be excavated along with the sediments/soils for placement in the permanent on-plant consolidation areas described in Section 10.4.

7.5 Hydraulic Analysis of ½-Mile Reach Following Restoration

Hydraulic modeling, using the previously described HEC-2 model, has been performed for the ½-Mile Reach to represent the river conditions following performance of the sediment removal and replacement activities described above, as well as the bank soil removal and restoration activities described in Section 8 and the habitat restoration activities described in Section 9. The input and output files of this modeling effort are presented in Appendix A. In general, the modeling results indicate that the sediment removal, replacement, and restoration activities will not result in a significant alteration of the flood storage capacity and flood elevations of the ½-Mile Reach. The existing conditions and post-remedial/restoration were first modeled for a bankfull flow of 1,000 cfs. This flow represents a natural equilibrium condition for the channel. Shown in Figure 7-3A, B, and C are the comparative water surface elevations, cumulative water storage, and velocity. Profiles shown include the existing and post-remedial conditions (i.e., with re-sedimentation over the placed armor layer). Given the extent of the armor layers on the channel bottom, model predictions are extremely sensitive to the affect of channel roughness on hydraulic parameters. The post-remedial, (i.e., after sediment deposition) condition represents conditions after sedimentation has occurred and returned the channel roughness to its pre-remedial conditions. This scenario, then, represents the change solely to the channel geometry modifications. The results of the analyses indicate that the proposed activities should not result in destabilization of the channel.

To assist in evaluating the beneficial effect on habitat water velocity , an evaluation was also performed of normal flow conditions (100 cfs). Figure 7-4 indicates that water velocity will generally be decreased and more variable as a result of the removal, replacement, and restoration activities.

The HEC-2 model was also run to assess the effects of the removal, replacement, and restoration activities on the 100-year (7,280 cfs) recurrence interval flood, in order to evaluate whether these activities would significantly increase flood elevation or flood water velocities or reduce flood storage capacity during such events. As shown on Figures 7-5A, B, and C, based on a comparison to post-remedial conditions, the proposed activities are predicted to have minimal or no adverse impact on these parameters even during extreme flood events. The model results indicate that after the armor layer is covered with sediment, during a 100-year flood occurring after such activities, the maximum change in water surface elevation at any cross-section would be 0.17 feet (2 inches) just downstream of Newell Street Bridge (Figure 7-5A), water velocities would generally not be higher at any location (Figure 7-5B), and cumulative water storage capacity would actually be increased slightly (Figure 7-5C).

8. Removal of Bank Soils

8.1 General

GE will remove certain bank soils in the ½-Mile Reach of the Housatonic River. Discrete removal areas have been identified within this stretch, extending from the top of the river bank to the edge of the River. Within these areas, the vertical extent of soil removal will range from one to three feet. Following removal, the bank areas will be subject to restoration using an engineered soil and vegetative cover, and erosion-control armor stone, as appropriate.

The USEPA's letter to GE of August 14, 1998, stated that GE should "propose a plan to minimize the potential for recontamination of river sediments and bank soils due to erosion of residual contaminated bank soils, including specific methods to prevent erosion." Since that time, the USEPA and GE have reached agreement on specific erosion protection measures including lower bank stabilization, erosion protection for various swales and outfalls, as well as a monitoring and maintenance program, which is described in Section 11. For the bank areas subject to removal, future erosion concerns will be addressed through the engineered soil and vegetative cover described herein.

The text which follows describes the various components involved in the removal process (including the removal limits/quantities), the excavation dewatering methods (if necessary), the anticipated method and sequence of bank soil removal, coordination with Source Control Activities, installation of the engineered and vegetative cover, and erosion protection measures.

8.2 Removal Limits/Quantities

Bank soil areas subject to removal, as presented in this Work Plan, were selected based on the relative concentration of PCBs present. Removal will be performed to achieve post-removal spatial average PCB concentrations of less than 10 ppm in the upper one foot and less than 15 ppm in the 1- to 3-foot depth interval in each of the seven discrete bank areas defined by USEPA in its letter to GE dated December 1, 1998. Additional removal will be performed based on post-PCB removal concentrations of select Appendix IX constituents (see Section 4.3.3), and as part of measures to enhance erosion protection (as described in Section 8.4.5). Consistent with the protocol described herein, bank soil removal and backfill activities were performed in late 1998 in the vicinity of Building 68 adjacent to the sediment removal area. With concurrence from USEPA, these activities were completed in conjunction with the Building 68 Area river bank (wedge) excavation/backfill and sealed sheetpile installation activities. Related correspondence and figures depicting the work are presented in Appendix H.

Additionally, bank soil removal activities were recently performed for the East Street Area 2 former bank seep area as part of the source control activities. Bank soil removal is also anticipated in the vicinity of the Lyman Street former bank seep areas as part of the source control activities proposed for that area. A portion of these bank soils fall outside the boundaries of the polygons targeted for removal in this Work Plan, further lowering the spatial average PCB concentrations in bank soil below the cleanup goals and increasing the volume to be removed. Bank soil removal as part of the source control activities for the East Street Area 2 site is described in the *Proposal for Supplemental Source Control Containment/Recovery Measures* (BBL, January 1999) including revisions dated March 1, 1999. Source control and sediment/bank soil removal activities along the ½-Mile Reach are being coordinated to ensure the goals and objectives of each program are met.

For the East Street Area 2 site, this coordination involves sediment and additional bank soil removal, as identified on Figure 4-1, as well as the implementation of stabilization measures at the East and West Headwalls, both located adjacent to the 64X oil-water separator. In addition to the above-mentioned activities, flushing and grouting of the sheeting joints will be performed, following excavation/replacement in the adjacent section of River as a separate job/contractor. Bank soil excavation on the River side of the Source Control sheeting will be completed to elevations ranging from 967.5 to 969.5 AMSL, as depicted on Figure 4-1. In addition, some bank soils on the bank side of the Source Control sheeting have been excavated to provide a stable working platform for installation of the sheeting. The area north of the sheeting will be restored in accordance with Section 9 (Habitat Restoration/Enhancement). The area between the sheeting and the River will be restored by placing geotextile over the soils and then isolation layer materials and rip rap backfill will be placed to provide a 1:1 slope from the River to the sheetpiling (See Figure 7-1A).

In addition to the sediment and bank soil excavation and backfill activities described above, stabilization measures will be performed on the East and West Headwalls adjacent to the 64X oil-water separator. For the East Headwall, this area shall be restored by backfilling the area with soils and constructing a rip rap swale to allow for gravity flow of stormwater over the top of the sheetpile wall (elevation 977 ft. MSL) in accordance with the Source Control Work Plan. For the West Headwall (see Figure 8-1), as part of the ½-mile restoration activities, the existing headwall will be extended by pouring concrete to encase the sheetpile barrier, as depicted on Figure 8-1.

The proposed configuration of removal limits required to meet the spatial average PCB Performance Standards and the Appendix IX+3 Performance Standards for bank soils is presented on Figures 4-1 through 4-4. In general, the areas of the bank with the highest PCB concentrations will be removed. Based on the limits presented on Figures 4-1 through 4-4, the volume of in-situ soil subject to removal is estimated to be approximately 4,300 cy. In addition, approximately 340 cy will be removed as part of the East Street Area 2 source control activities, as shown on Figure 4-1. Plans for the Lyman Street area are not currently finalized; however, it is anticipated that there will be additional excavation between the sheeting and the River in this area that will be proposed as part of that project.

Based on existing data, removal of the estimated 4,300 cy of bank soil will reduce the spatial average PCB concentration of soil on the banks in this ½-Mile Reach, including each of the averaging areas specified by USEPA, to less than 10 ppm in the upper one foot and to less than 15 ppm in the 1- to 3-foot depth interval. In addition, the other Appendix IX+3 constituents in the seven bank soil areas will meet the Performance Standards for such constituents. Section 4 of this Work Plan details the selection process and locations of the bank soil removal areas. Supporting data and calculations are provided in Appendix D.

8.3 Dewatering

The proposed depths of soil removal range from 1 to 3 feet; therefore, excavation dewatering is not anticipated except at the toe of the bank where saturated soils will be encountered. As discussed previously in Section 7, the bank soil removal will be conducted in coordination with sediment removal and replacement activities to the extent practical. As a result, it is anticipated that, when the bank soil removal is conducted in conjunction with sediment removal, the dewatering performed for the sediment-related activities will be sufficient to allow excavation of the necessary saturated soils at the toe of the bank. Additional discussion regarding excavation dewatering is included in Section 7.4.1 and discussion regarding handling of the accumulated water is presented in Section 10.6.

8.4 Soil Removal and Installation of Engineered Cover

8.4.1 Soil Removal

As discussed elsewhere within this Work Plan, a number of on-site activities will be performed prior to initiating bank soil removal activities. Such activities include the installation of erosion and sedimentation controls, removal of trees and other vegetation from the areas to be affected by the removal activities, implementation of engineering controls for the former bank seep areas (e.g., sheeting), and installation of the appropriate material handling and staging facilities.

Figure 6-1 shows the anticipated stockpile/staging areas, access roads, and vegetation removal areas. Once these activities have been completed, removal activities will commence.

In general, sediment removal and replacement activities will be performed before the required bank soil removal activities are initiated. One factor contributing to the selection of this sequence was the anticipated use of the bank as a support area during sediment removal and replacement activities. Specifically, it is expected that bank areas subject to removal, and other discrete bank areas adjacent to the sediment removal areas, will function as a staging location for (1) the equipment to be used for the sediment removal and replacement, (2) the transfer of sediments away from the River, and (3) the transfer of clean replacement and restoration-related materials into the River. While some disruption to the existing bank configuration and removal of soil may be necessary to provide a suitable support area (e.g., excavation and benching of the existing materials or construction of access ramps to provide a level working area), it is expected that the majority of bank soil removal will occur following the completion of sediment-related activities.

Similar to the sediment removal and replacement activities discussed in Section 7, bank soil removal will utilize typical excavation and construction equipment, such as excavators, backhoes, front-end loaders, etc. In general, the procedures to be used for the excavation of the bank soils will involve the removal of bank soils using an excavator or backhoe, followed by the transfer of the excavated materials either directly to the on-plant consolidation areas or to an adjacent temporary staging area (see Section 10.3). It is expected that this process will involve the use of additional equipment (e.g., dump truck) to transfer the materials from their point of excavation. The day-to-day excavation procedures (and therefore the production rate) will vary based on the specific areas targeted for removal. Dewatering of excavated materials, if needed, will be performed in a manner consistent with that described in Section 7 regarding river sediments. Following removal, material will be either transferred directly, or stockpiled and adequately dewatered (if necessary), prior to placement in the on-plant consolidation areas (discussed in Section 10.4 below). Bank soil excavation will proceed until the limits of removal have been reached. These limits will be field determined and verified through the use of survey control.

8.4.2 Contingency Plan for Potential Observation of NAPL

During the course of implementation of the soil removal activities, visual observations will be made regarding the potential presence of NAPL (visual observation of free product). In the event NAPL is encountered in the bank soils outside of areas addressed under the source control program following removal of the soils to their designated depths, the following procedures will be initiated:

1. Up to 10 additional cubic yards of bank soil will be removed from around and beneath the observed NAPL, to evaluate whether the NAPL is localized and can be easily addressed through removal.

2. If, following removal of up to 10 additional cubic yards of soil, the NAPL appears to extend beyond the bounds of the extended excavation, a test pit and/or boring investigation program will be implemented to define the extent of NAPL at that location.

3. Once the investigation program is complete, the need for and extent of NAPL removal or containment measures will be determined for the riverbank by the GE Project Coordinator, in coordination with the USEPA OSC. Potential NAPL removal/containment measures to be considered will include NAPL collection/disposal, additional soil excavation, and placement of NAPL containment structures (e.g., sheetpiling, absorbent booms, etc.).

4. If the NAPL extends laterally beyond the top of the river bank, then this area will be added to the source control program for more extensive evaluation and appropriate removal or containment measures, as needed.

8.4.3 Contingency Plan for Potential Excavation of Drums, Capacitors, or Related Equipment

In the event that drums, capacitors, or related equipment are encountered during implementation of the bank soil removal program, they will be handled using the same procedures described in Section 7.4.5.

8.4.4 Installation of Engineered Cover

Following completion of soil removal activities, the removal area will be restored. Bank restoration material will be appropriately designed/selected to withstand erosion and to isolate subsurface materials that remain in place. Bank restoration will consist of placement of backfill to return the bank to original grade, as deemed practicable, in all portions of the removal area, except at the toe of the slope. The lower 3 feet of the toe of the slope will be backfilled to within 2 feet of original grade to allow installation of a 24-inch thick cap and armor system, as described below. Similar to the sediment replacement, the backfill will be subject to laboratory testing prior to its use as "clean" backfill, with the results presented to the USEPA. Samples for PCBs will be collected at a frequency of one sample for every 500 cubic yards of material. Topsoil to be placed as part of the restoration (as described below and in Section 9.2) will be analyzed for PCBs, organic content, and pH at a frequency of 1 sample for every 500 yards (since backfill and topsoil will not be used as a structural fill, sieve analysis will not be required). For both topsoil and backfill, samples for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), and metals will be collected at a frequency of one sample for every 2,000 cubic yards of material. All samples will be analyzed consistent with the procedures in the SAP/DCAQAP.

An engineered soil and vegetative cover system will then be installed. This system will involve the placement of a soil isolation layer on all areas of the bank, except at the toe of the slope. A cap and armor-type system will be installed at the lower 3 feet of the toe of the slope where appropriate (i.e., when excavation occurs at the water's edge) to minimize erosion and undermining at the water's edge. It will consist of geotextile, a 6-inch thick silty sand isolation layer, geotextile, GeoGrid, and an 18-inch thick layer of D_{100} 12-inch stone, as shown on Figures 7-1A through 7-1C. General notes and details are provided on Figure 7-2. After placement of the soil isolation layer on all other areas of the bank, a vegetative layer will be placed to restore the banks, including topsoil and appropriate revegetation. A discussion of the bank habitat restoration activities can be found in Section 9.2.

8.4.5 Erosion Protection Measures

As previously discussed, erosion protection measures will be implemented to alleviate future erosion concerns related to lower banks and various swales and outfalls located along the ½-Mile Reach. Two types of bank stabilization measures will be installed, as appropriate, throughout the ½-Mile Reach at the toe of the banks, at locations agreed to by GE, USEPA, and MDEP, as depicted on Figures 4-1 through 4-4 and 8-2. The first type of lower bank stabilization (Type I - Undercut Lower Bank) will involve placing geotextile and D_{100} 12-inch stone along the undercut lower bank soils. This Type I stabilization will be placed on banks that have significant lower bank undercutting (see typical cross-section on Figure 7-1B). The second type of lower bank stabilization (Type II - Sloped Bank) will involve placing geotextile, a 6-inch gravel layer, and 18-inch layer of D_{100} 12-inch stone, following lower bank excavation of sloped areas. The lower bank, approximately 3 feet up the bank, will be excavated to a depth of approximately 2 feet, then backfilled with the geotextile, gravel, and stone to provide a maximum 1:1 slope from the lower bank to the River (see typical cross-sections on Figure 7-1A and 7-1B).

In addition to erosion protection measures for select areas of the lower bank, various swales and outfalls will be addressed as part of the ½-mile Work Plan. In general, these swales and outfalls will be addressed through excavation and subsequent placement of geotextile overlain by rip rap within the swale area. In some cases, it may be necessary to excavate soils to reshape the sides of the swale, or create a settling basin at the top of the swale (at the top of the riverbank), as appropriate. The location of these swales/outfalls and the measures to be performed to address these swale/outfalls are identified in Figure 8-2.

Additional swales located along the ½-Mile Reach, that have already been submitted and conditionally approved by the Agencies as Immediate Response Action (IRA) Plans, will be addressed as part of the ½-Mile Removal Action. On July 24, 1998 and September 30, 1998, BBL, on behalf of GE, submitted IRA Plans to address swales located adjacent to the 191 Newell Street property and at the 247-249 and 261 Newell Street properties, respectively. Based on review of the IRA Plans and upon inspections of the swales conducted by the Agencies on May 10, 1999, the Agencies conditionally approved the IRA Plans with a letter dated June 1, 1999. The erosion control measures to be implemented for the Newell Street properties are as follows:

<u>191 Newell Street:</u> For the 191 Newell Street property (the former Quality Printing property, currently owned by GE), grass seed and an erosion control blanket will be placed within a swale located along the northern side of the property. Also, hay bales will be placed along the top of the slope on the uphill side of the riverbank, within the swale.

<u>247-249 Newell Street:</u> For the 247-249 Newell Street property, following implementation of the bank soil removal activities proposed for this area, the swale will be straightened, and geotextile overlaid by rip rap will be placed within the base of the swale starting at the top of the riverbank to a steep overhang adjacent to the River's edge. In addition, a settling basin will be constructed of rip rap within the swale at the top of the riverbank, and installation of rip rap in the undercut bank area will also be performed.

<u>261 Newell Street:</u> For the 261 Newell Street property (the former F.W. Webb property, currently owned by GE), following implementation of the bank soil removal activities proposed for this area, a settling basin will be constructed of rip rap immediately adjacent to the inlet or upstream side of the 12-inch drainage pipe. A layer of rip rap at the discharge end of the 12-inch pipe will also be placed. In addition, rip rap will be placed in the area of the pipe outfall to minimize erosion from water flow from the 12-inch drainage pipe.

In addition, during the May 10, 1999 inspection performed by the Agencies, another small swale was observed located adjacent to the northern side of the property boundary between 203 and 217 Newell Street (slightly downstream of the city storm water outfall adjacent to the northern side of the property at 217 Newell Street). Based on results of soil sampling recently performed, GE will propose to install erosion control measures, as appropriate, as part of the ½-Mile Removal Action.

8.4.6 Monitoring During Bank Soil Removal Activities

The integrity of the engineered bank cover system and erosion protection measures will be monitored during construction. During the period of on-site construction activities, visual observation of bank cover/erosion protection measures that have been installed will be performed following high water conditions and/or high precipitation events. The inspections will evaluate the cover/erosion protection measures for evidence of erosion due to flow currents, storm-related surges, and ice movement, as appropriate. In areas where visual observations indicate a significant loss of the soil cover/erosion protection, steps will be taken to replace/restore the soil cover/erosion protection to the original design conditions. If significant erosion within the Upper ½-Mile Reach of the Housatonic River is observed during construction in areas not currently proposed for erosion control measures, GE will identify the cause of the erosion, and to the extent practicable, if the area is within GE's control, implement appropriate stabilization measures.

8.4.7 Summary

In combination, the bank soil removal actions described above, together with the installation of the engineered and vegetative cap, the implementation of appropriate measures to address NAPL if encountered (as described in Section 8.4.2), erosion protection measures, and a monitoring and maintenance program for the cap (as described in Section 11.5.2), will effectively address potential direct contact and erosion concerns, as previously discussed. These measures will also effectively isolate the underlying subsurface soils (i.e., soils greater than three feet in depth) and thus control any potential migration of residual constituents from such soils to the remediated bank soils and sediments. These banks are located adjacent to portions of the GE facility and a number of former oxbows. To the extent that additional measures are necessary to address soils in such areas where elevated PCB levels are or may be present, such measures will be implemented as part of the response actions for those areas, in accordance with the Consent Decree and accompanying Statement of Work. Such measures will be designed to complement the bank soil response actions implemented under this Work Plan.

9. Habitat Restoration/Enhancement Measures

Aquatic and riparian habitat restoration activities will be conducted along the ½-Mile Reach to mitigate potential impacts from physical disturbance associated with removal activities and enhance certain aspects of the habitats. Collectively, the proposed restoration activities for the aquatic habitat in the River and riparian habitat along the banks will help to restore the biodiversity and aesthetic quality of the ½-Mile Reach. This section describes the types of habitat restoration/ enhancement measures that will be implemented in the River and along the river banks.

9.1 Aquatic Habitat Restoration

According to the baseline habitat assessment presented in Section 5 of this report and information from previous reports (i.e., ENVIRON, 1996; Chadwick & Associates, 1994), the aquatic habitat of the ½-Mile Reach is currently limited by poor substrate (i.e., predominantly sand and silt) and relative lack of in-stream cover. Given these limitations, the proposed aquatic habitat restoration activities are intended to mitigate the potential disruption caused by removal activities, as well as to improve existing conditions for the aquatic habitat.

The primary objective of the aquatic habitat restoration is to improve the aquatic habitat, particularly for fish, by:

- Increasing variability in water flow and depth; and
- Providing in-stream cover.

This objective will be achieved by applying various restoration techniques (i.e., placement of structures in the River) proven successful at other rivers, as described in *Stream Habitat Improvement Handbook* (USDA, 1992), *The Restoration of Rivers and Streams* (Gore, 1985), and *Applied River Morphology* (Rosgen, 1994). The structures involved for each of these techniques are described below, with the proposed locations of the structures presented on Figure 9-1.

9.1.1 Increasing Variability for Water Flow and Depth

The natural diversity of flow conditions in a stream is an essential habitat feature (Swales, 1989; Keller, 1978), and the survival and growth of many species are directly correlated with the amount of pool habitat, water depth, and streambed complexity (Mesick, 1995). A number of aquatic structures will be constructed, following sediment removal and replacement activities, to increase variability in surface water flow and depth, and improve the riffle/pool characteristics in the ½-Mile Reach.

- Current Deflectors: Current deflectors function to direct flow and reduce the accumulation of sediments, or to narrow a channel and increase surface water velocity (Brookes, 1989). Single-wing current deflectors (depicted on Figure 9-2) are placed along one bank, and deflect the water downstream towards the opposite bank. The ability of current deflectors to manipulate stream flow makes them one of the most effective of all improvement devices (Swales, 1989).

  Typically the deflector is angled downstream from 30 to 45° to the streamflow, extending from 35 to 80 percent across the channel. The top elevation of the deflector can vary from 6 to 18 inches above the normal low flow water surface. When overtopped, the downstream side of the deflector should angle water towards the center of the channel rather than the bank.

  Applicable to a wide range of stream sizes, current deflectors are relatively easy to construct, can be built from a variety of materials, and can be readily modified to suit on-site conditions. Given these advantages, current deflectors have been very successful in improving habitat (Wesche, 1985). The most suitable locations for current deflectors are in wide shallow riffles or flats. For a single-wing deflector, it is best to divert the water into a relatively stable section of stream bank. Single-wing deflectors are proposed for installation at several locations along the ½-Mile Reach (see Figure 9-1). These locations are across from areas with existing or proposed bank stabilization measures. In this manner, the structures will constrict flow, thereby creating riffles to provide suitable habitat for a variety of fish and macroinvertebrate species.

C Low-Profile Wedge Dams: Low-profile wedge dams (depicted on Figure 9-2) are also known as check dams, weirs, plunge, and overpour dams. Low-profile dams are typically placed low in the channel profile (generally less than 1/3 of the bankfull stage) (Rosgen, 1996). Low-profile dams deepen existing pools, create new pools, collect and hold spawning gravels, encourage gravel bar formation, trap fine sediments, aerate water, and slow the current, thereby allowing organic debris to settle out (Wesche, 1985). These low profile structures also function to establish a stable grade control to prevent down cutting. By controlling the angle of the dam relative to the flow (for example in a "V" or "W" weir), the dam can be used to take shear stress away from "near bank" areas and concentrate flow in the middle of the stream to maintain lateral stability.

Low-profile dams are easy to construct, and can be built from a variety of materials such as boulders or logs. Different types of low-profile dams are proposed for the ½-Mile Reach, including vortex rock weirs and "W" weirs, as described below. Where possible, naturally formed boulders will be used to construct weirs. The proposed locations of these structures, described below, are shown on Figure 9-1.

- Vortex Rock Weir: An example of a vortex rock weir is shown on Figure 9-2. This variation of a low profile dam is designed to offset secondary effects of straight weirs or dams, usually associated with backwater formation at low flows. Large rocks provide the usual benefits of the low profile dams, while the loose packing allows turbulent flow even at low flow. Vortex rock weirs are proposed for the ½-mile stretch, and will be located at various intervals along the River as shown on Figure 9-1. Given the right stream conditions, vortex rock weirs create riffle/pool characteristics, provide in-stream cover, and increase variability in water flow and depth.

- "W" Rock Weir: An example of a "W" rock weir is shown on Figure 9-2. This structure is useful for channel widths greater than 40 feet. This variation on the vortex rock weir uses the W-shape placement of rock and boulders to create a diversity in depth and velocity and provide in-stream cover, while maintaining a more natural appearance than regular weirs over a greater distance. As shown on Figure 9-1, a "W" weir is proposed for the ½-Mile Reach, approximately 800 feet downstream of the Newell Street Bridge.

9.1.2 In-Stream Cover

In-stream cover is important to a river's aquatic habitat since it provides fish with foraging areas and protection from predators and provides attachment sites for aquatic macroinvertebrates. Since little in-stream cover currently exists in the ½-Mile Reach, the placement of more cover will improve the reach's habitat potential.

Specific activities to increase the in-stream cover of the ½-Mile Reach include boulder and rip-rap placement, as described below.

C Boulder Placement: Placing boulders and boulder clusters (Figure 9-2) is a simple and commonly applied in-channel treatment to improve in-stream habitats (Wesche, 1985). Used in runs, riffles, slack water, and pools, boulders present a more natural appearance than other structures, provide rearing habitat and fish cover, improve pool-riffle ratios, restore meanders and pools, and protect eroded banks. While the minimum rock size used for boulder placement depends upon the maximum velocities of the River, 2- to 3-foot diameter rocks typically are used (Rosgen, 1996). Boulders of this size should remain stable under channelfull conditions. Where possible, naturally formed boulders will be used. Best results are obtained by placing the boulders in groups.

As shown on Figure 9-1, boulders will be placed at various locations along the ½-Mile Reach; this task can be accomplished relatively quickly with the types of equipment expected on-site. For maximum effectiveness, boulders will be placed within riffles or in the tails of pools. In addition, boulders will not be placed in sections of stream bed that lack an armor layer.

C Rip-Rap: Rip-Rap will be placed to promote bank stabilization. For the ½-Mile Reach, the rip-rap will be placed at various locations along the toe of the banks as described in Section 8, and will also be integrated with the proposed aquatic structures.

9.1.3 Aquatic Habitat Restoration Summary

The aquatic habitat restoration/enhancement techniques will mitigate potential impacts associated with removal activities, and enhance certain aspects of the existing aquatic habitat within the ½-Mile Reach. As described in Section 5.1, the existing aquatic habitat of the ½-Mile Reach is limited by poor substrate (predominantly sand and silt), the relative lack of suitable cover, and the presence of shallow pools and slack water. The construction of the above-described habitat enhancement structures will improve several aspects of the aquatic habitat. These activities will improve the riffle/pool characteristics of the reach, and will increase the variability of water flow and depth, thereby potentially increasing the dissolved oxygen in the stream and providing habitat for organisms that favor swifter moving water. Further, the addition of in-stream cover (e.g., boulders and riprap) will provide refuge and cover for fish and attachment sites for macroinvertebrates.

9.2 Bank Restoration Activities/Vegetative Cover

The riparian habitat along both banks of the first ½-Mile Reach (except the previously addressed Building 68 area) will be impacted during the removal action as a result of sediment and bank excavation, resulting in the removal of the existing vegetative community. This section describes the various techniques proposed to restore the vegetative community in those disturbed areas to a functional value that exceeds that of the current riparian habitat. While it is the objective of this restoration program to improve the conditions of the riparian habitat, it is recognized that it will take a minimum of 20 to 30 years to reach a mature habitat affording that full increase in value and that a short-term loss in habitat during the developmental period will occur.

As noted in Section 5.2 of this report, both banks of the ½-Mile Reach contain a riparian habitat characterized by a relatively narrow band of mixed, broad-leaf deciduous forest. The habitat is uniform in composition and dominated in both the canopy and understory strata by woody species that are considered to be either early successional or invasive in nature. These species include boxelder, staghorn sumac, Norway maple, and Morrow's honeysuckle. While there is no indication of recent clearing, the size of the trees and understory vegetation reflect historic disruption by anthropogenic activities (i.e., rechannelization).

To increase the habitat value of the restored riparian community, vegetation that is characteristic of a floodplain forest community, as described in *Flora of Berkshire County Massachusetts* (P.B. Weatherbee, 1996) and *Natural Plant Communities of Berkshire County, Massachusetts* (P.B. Weatherbee and G.E. Crow, *in* Rhodora, 1992), will be utilized as replacement species. The following sections describe the specific methodologies proposed to restore the vegetative community that will be disturbed through excavation or clearing.

9.2.1 Restoration in Areas to be Excavated

Before initiating removal activities, bank areas to be excavated will be cleared of existing vegetation. Where it is possible from an engineering standpoint, the existing supercanopy specimens (predominantly eastern cottonwood and black willow) will be allowed to remain. After soil removal activities are completed, habitat restoration activities on both banks of the ½-Mile Reach will be initiated.

In general, restoration will involve placement of backfill and topsoil in the excavation areas to return the banks to their original grade. Certain stretches of the bank will be restored at a reduced slope, which will lessen future erosion potential and enhance bank stability. During restoration, backfill will be placed in the excavation to within 6 inches of the final grade. A minimum 6-inch layer of topsoil will be placed over the backfill to serve as the medium for plant establishment and restore the final grade along the bank. Topsoil material to be used in the restoration of the final grade will be a sandy loam and contain approximately three to five percent organic matter. The target pH for the soil is 6 (± 1 standard unit).

Bank areas that are excavated immediately adjacent to the River will have an armor stone installed at the toe of the slope to enhance bank stability. As described in Section 8.4.4, this configuration will extend 3 feet up the bank, and will consist of geotextile, and either a 6-inch layer of bedding gravel and an 18-inch thick layer of D_{100} 12-inch stone, or a 6-inch thick silty sand isolation layer, geotextile GeoGrid, and an 18-inch thick layer of D_{100} 12-inch stone. Disturbed bank areas will be stabilized by installing North American Green SC150 fiber mat, or equivalent, over the bare soil surface. In excavated areas adjacent to the River, the matting will be tied in to the armor stone system installed at the toe of the bank. The prescribed fiber matting is 70 percent agricultural straw and 30 percent coconut fiber encased in a heavyweight top net and a photodegradable bottom net. Matting will be installed as per the manufacturers specifications.

Upon restoration of the banks to their planned grade, the vegetative community will be restored along each bank in order to enhance the available riparian habitat.

The riparian community will be reestablished by planting a vegetative community referred to as a floodplain forest community, based on Weatherbee (1996) (Figure 9-3). The streambank replanting plan is provided on Figure 9-4. Common floodplain forest community species that will be utilized in the replantings include:

Canopy	**Understory/Shrub**
boxelder (*Acer negundo*)	serviceberry (*Amelanchier canadensis*)
eastern cottonwood (*Populus deltoides*)	northern arrowwood (*Viburnum dentatum*)
black willow (*Salix nigra*)	silky dogwood (*Cornus amomum*)
silver maple (*Acer saccharinum*)	red-osier dogwood (*Cornus sericea*) winterberry holly *(Ilex verticillata)*

Trees shall be planted in varying densities, clumps, or if necessary, sinuous lines (using existing trees/stumps as applicable) across the area using a planting density of 700 trees per acre, incorporating growth from stumps into the 700 trees per acre, in areas where grubbing does not occur. This will allow for the development of structural diversity within the habitat and integration of understory habitats within the area covered by the canopy species. Approximately 75% of the planted trees will be made up of equal numbers of boxelder andcottonwood. The balance will be evenly divided between the silver maple and black willow. The silver maple and black willow specimens will be planted in the lower portion of each bank. Canopy specimens will be container-grown, with species obtained for planting being four feet to six feet in height, unless otherwise approved by the Trustees.

To further allow for good structural distribution and juxtaposition of habitats, understory vegetation (except red-osier dogwood) and woody vines will be planted on a patchy basis along both banks. Understory species will be planted at an approximate planting density of 730 shrubs per acre. Understory species, as described above, will be planted (to the extent possible) in oblong patches 30 feet wide by 50 feet long, or similar configuration approved by the Trustees such that no more than 730 shrubs per acre are planted. The patches will be scattered such that a minimum distance of 40 feet is maintained between patches. Understory plantings within each patch will be on four-foot centers. Each planted shrub will be 2 to 3 feet in height unless otherwise approved by the Trustees. Shrubs will be container-grown, unless not commercially available. Understory specimens will be planted on a random-mixed basis so as to ensure a heterogeneous distribution of species.

Woody vines will be planted at an approximate planting density of 40 vines per acre. Woody vines will be planted in small, oblong patches measuring 15 feet wide by 30 feet long, scattered such that there is a minimum distance of 150 feet between patches, with plantings within each patch on four-foot centers. The form of grape vine (*Vitis riparia*) will be used for the woody vine plantings if availability permits. The grape vine *Vitis sp.* will be substituted as necessary, with Trustee approval.

Observations made during the baseline habitat assessment indicated that red-osier dogwood is restricted to an area within the first 5 to 10 feet of the bank. Therefore, the red-osier dogwood will not be planted in the oblong patches described above, but instead will be planted immediately above the toe of the slope, adjacent to the river, or above the rip rap, when installed at the toe of the slope. The red-osier dogwood band will be kept approximately 10 feet wide, with the shrubs within the band on four foot centers.

All plants will be delivered and staged onsite prior to planting. Planting pits for both trees and shrubs will be dug 1 foot wider than the plant container, with the pit depth equal to the depth of the plant container. When the trees and shrubs have been properly set, the pit will be thoroughly watered during and after backfilling. The existing soil will be used as backfill and placed to bring the surface, when settled, to the required grade.

At the time of planting, watering will be conducted in a manner such that the newly installed plant is not injured, nor is the surrounding soil eroded away. Subsequent watering of the installed plants will occur, as appropriate, based on future monitoring visits, which is described in Section 11.6.2. Supplemental watering may be required during drought conditions, as indicated by substantial leaf wilting (greater than 20% of the installed plants) or loss of vigor (as determined during the monitoring visits).

Plants will not be removed from containers until immediately before planting. Roots will be examined to determine if they are pot bound. Roots that are pot bound will be separated prior to planting. Plants will be placed in the pit so as to allow for further growth without additional constriction of the root ball. After planting and watering, each plant will be mulched with wood chips from on-site cleared vegetation, loose straw, or hay, and fertilized with a 10-10-10 slow release fertilizer, applied at the product-recommended application rate.

The herbaceous community will be established using a mixture of native warm-season grasses and wildflowers such as little bluestem (*Andropogon scoparius*), big bluestem (*Andropogon gerardi*), switchgrass (*Panicum virgatum*), deertongue (*Panicum clandestinum*), fox sedge (*Carex vulpinoidea*), Pennsylvania smartweed (*Polygonum pensylvanicum*), Canada wild-rye (*Elymus canadensis*), cup-plant (*Silphium perfoliatum*), nodding bur-marigold (*Bidens cernua*), showy tick-trefoil (*Desmodium canadense*), butterfly milkweed (*Ascelpias tuberosa*), Canada goldenrod (*Solidago canadenis*), giant goldenrod (*Solidago gigantea*), and white snakeroot (*Eupatorium altissima*). To ensure soil stability and minimize erosion, a nurse crop of annual rye-grass (*Lolium temulentum*) (not to exceed 10% of the seed mixture) will be added to the seed mixture. The herbaceous plant mixture will be seeded at a rate of 25 pounds per acre.

Trees and shrubs will be planted during the months of April or May, or in October or November. To help provide erosion control, herbaceous species will be planted in the cleared and restored areas, as soon as possible following completion of work in those areas. The seeded areas will be watered appropriately. A summary of the plantings is as follows:

	Canopy	**Understory**
Plant Condition	Container grown	Container grown
Plant Height	4 to 6 feet (unless otherwise approved by the Trustees)	2 to 3 feet (unless otherwise approved by the Trustees)
Distribution	Variable	Patchy
Planting Density	700/acre, varying densities	730/acre, 4 feet between species

9.2.2 Restoration in Cleared Areas

In certain bank areas, clearing of the existing riparian habitat will be necessary to allow for access to soil/sediment excavation areas. Where possible from an engineering standpoint, the existing supercanopy specimens in the riparian habitat will be allowed to remain in place and the appropriate canopy species will be considered as part of the restoration (i.e., 700 trees/acre). In these cleared areas, bank restoration activities similar to those described in Section 9.2.1 will be followed. Following clearing, all remaining brush and debris will be removed from any area cleared for construction access. These areas will not be grubbed, and stumps will be cut flush with the ground surface to the extent practical, and growth from stumps of appropriate species will be considered as part of the restoration (i.e., 700 trees per acre). GE will utilize appropriate safeguards such as mats, where practicable, to minimize root damage to the remaining stumps. The planting schemes, schedules and material described in Section 9.2.1, and shown on Figure 9-3 and 9-4, will be utilized to restore the canopy and understory strata. The herbaceous community will be restored through the seeding as described in Section 9.2.1.

9.2.3 Restoration in Other Areas Disturbed During Removal Activities

Certain sections of the ½-Mile Reach that are adjacent to the excavation areas, but that will not be cleared for access, may be impacted during removal activities through incidental actions. To the extent that any restoration is necessary, these areas will be restored in the following manner. First, any soil that was disturbed during the remediation will be restored to grade and smoothed. Destroyed or damaged vegetation will be removed at the ground surface, with all debris taken off-site. Any stumps will be flush cut at ground surface, to the extent practical. Restoration of these areas will depend on the existing conditions present in the areas prior to disturbance. These areas will be restored to approximate the pre-disturbance conditions (e.g., open field or tree canopy). The planting schemes, schedules, and material described in Section 9.2.1 will be used to restore the canopy and understory status. The herbaceous community will be restored through the seeding of the same commercial plant mix described in Section 9.2.1.

9.2.4 Bank Restoration Summary

Following construction activities, the riparian vegetation along both banks of the ½-Mile Reach will be restored to a functional value that exceeds that of the current riparian habitat. Many of the existing plant species provide little habitat value, and will be replaced by vegetation characteristic of a floodplain forest community. The species of plants have been selected because they are native to the area, and provide food and shelter for a variety of wildlife species. During construction activities, existing supercanopy specimens will, where practical, remain intact. These trees will serve as established perching and nesting areas for wildlife, and will provide shade and bank stabilization. The anticipated habitat following restoration/enhancement activities will provide suitable habitat for a variety of plant and animal species.

10. Material Handling and Disposition

10.1 General

This section describes the various handling and disposition activities associated with the soil and sediment removal for the upper ½-Mile Reach of the Housatonic River. As bank soils and river sediments are removed from the area, and prior to their ultimate disposition, a number of intermediate on-site handling activities must be performed. To ensure that such activities are performed in a manner that minimizes the potential for inadvertent releases to the environment, unsafe conditions for on-site and off-site personnel, and delays or complications in project implementation, several on-site material handling procedures have been identified for those materials (soils, sediments, liquids, and residual wastes) that are expected to be generated during the removal actions. Ultimately, the bank soils and sediments removed during this project will be moved to on-site facilities for appropriate disposition in accordance with applicable regulations.

10.2 On-Site Handling of Soils and Sediments

The specific method(s) of handling the removed bank soils and sediments will be based on, but not limited to, the following considerations:

- The nature of the removed materials and any on-site processes needed to prepare the materials for subsequent disposition (e.g., dewatering of materials containing excessive water);
- The locations from where the materials are removed and their proximity to temporary staging and loading area(s); and
- The overall sequence and schedule of the removal actions.

Based on the above, several handling-related activities will be performed between the time that the bank soils and sediments are removed and the time they are subject to final disposition. In addition, independent of different handling requirements, bank soils and sediments will be moved to on-plant facilities for appropriate disposition in accordance with the *Statement of Work for Removal Actions Outside the River*, which will be attached to the Consent Decree embodying the parties' settlement agreement. These on-plant consolidation areas are shown on Figure 10-1.

10.3 Temporary Dewatering/Staging Area(s)

To minimize the potential for the release of PCBs to the environment during removal and handling activities, it is desirable to minimize the number of times that the material is handled. Therefore, the soils and sediment will be transported directly to the on-plant consolidation areas for disposal if it is capable of passing the paint filter test, or placed in a temporary dewatering/staging area(s) in the vicinity of the work area if further dewatering is required. In addition to facilitating removal, handling, and dewatering, the temporary dewatering/staging areas will function as the sediment/soil loadout area for transport vehicles upon their arrival at the site. The temporary dewatering/staging area will be designed to accommodate a backhoe or front-end loader which will be used to load materials from the temporary dewatering/staging area into the transport vehicles.

The number and relative size of the dewatering/staging areas will depend on their proximity to the work areas, and the logistics and rate of the excavation, handling, loading, and transport operations. Based on current information, it is anticipated that temporary dewatering/staging areas will be located in the areas designated on Figure 6-1. Since the materials subject to removal may, upon their initial removal, contain excess water, the temporary dewatering/staging areas will be constructed to facilitate gravity drainage of these materials. Construction of the dewatering/staging areas will involve, at a minimum, the use of a plastic liner placed over a perimeter berm, constructed of haybales. The existing surface topography will be taken into consideration when constructing the temporary dewatering/staging areas (i.e., the temporary dewatering/staging areas will be constructed to allow the excess water to drain to natural low points). Water that accumulates in the low points will be collected using a small submersible pump and handled in accordance with Section 10.6. The resulting configuration will allow placement of materials into the temporary dewatering/staging area while minimizing the potential for contact with the underlying surface and the migration of any water released from the materials while present in the dewatering/staging area.

Additional information regarding the use of temporary dewatering/staging areas is as follows:

- Bank soil and sediment transported from the work site to the temporary stockpile areas will be unloaded into the appropriate stockpile based on its TSCA/RCRA or non-TSCA/non-RCRA designation. The TSCA/RCRA and non-TSCA/non-RCRA designation of the sediment and soil to be removed is depicted on Figures 4-1 to 4-4.

- To minimize the potential for PCB migration due to wind- and rainfall-related factors, staged materials will be covered by an impermeable cover (e.g., polyethylene) and anchored when the area is not actively being used.

- Additional dewatering/staging areas shall, to the extent practical, not be placed in locations which may interfere with facility operations, removal actions, normal traffic flow, or areas not subject to the Consent Decree (i.e., Hibbard Playground, adjacent to bank averaging area 4). If dewatering/staging areas are required in these areas, samples will be collected in the soils located beneath the dewatering/staging area to ensure that the stockpiling operations do not impact the existing soil. In addition, the location of a dewatering/staging area will consider site topography and avoid (to the extent possible) possible rainfall drainage areas.

- To minimize potential erosion and migration issues, the volume of soil/sediment present in a dewatering/staging area will be kept at manageable levels.

- Erosion and sedimentation control measures (e.g., hay bales, geotextile fencing, etc.) will be utilized as necessary.

- Dewatering/staging areas will be inspected daily and any noted deficiencies will be promptly addressed.

- Additional staging areas other than those on Figure 6-1 will be subject to EPA approval.

10.4 Disposition of Soils and Sediments

Final disposition of the removed soils and sediments will involve permanent consolidation in designated consolidation areas at the GE facility (Figure 10-1). Specifically, removed material that, based on in-situ sampling results or appropriate composite sampling, is not subject to regulation under the Toxic Substances Control Act (TSCA) and does not constitute hazardous waste under the Resource Conservation and Recovery Act (RCRA) may be permanently consolidated at the former Hill 78 On-Plant Consolidation Area.

Other removed materials will be placed in the Building 71 On-Plant Consolidation Area at the GE facility. However, materials placed in any of the on-plant consolidation areas will not include full or partially full drums, intact capacitors, related equipment that could potentially contain PCBs, free product, or other liquids -- all of which (if encountered) will be appropriately disposed of off-site (see Section 10.5). The locations, configuration of the permanent consolidation areas at the GE facility and the standards and restrictions governing permanent consolidation of excavated materials at those areas, including the preparation, operation, and capping/restoration of the on-plant consolidation areas, will be set forth in the *Statement of Work for Removal Actions Outside the River*, which will be attached to the Consent Decree embodying the parties' settlement agreement.

To the extent that off-site shipment and disposal of materials excavated from the ½-Mile Reach are necessary, GE will develop and submit a separate plan, as needed, for USEPA approval for such off-site transport and disposal. All off-site transport and disposal will be in accordance with applicable federal and state regulations.

All aspects of the handling, loading, transport, and disposition of materials will be performed under GE's supervision and will only use GE-approved organizations. Any and all transport of materials will be performed by licensed haulers in accordance with appropriate local, state, and federal regulations. Loaded vehicles transporting materials over public roads will be appropriately tarped, manifested, and placarded in accordance with appropriate federal RCRA, TSCA, and Department of Transportation (DOT) requirements, as well as any equivalent state requirements. Trucks transported over public roads will be inspected prior to leaving the site to ensure there are no free liquids in the sediment/soil.

10.5 Disposition of Drums, Capacitors, Related Equipment, or Free Product (if encountered)

In the event that free liquids, free product, intact drums or capacitors, or other equipment that contains PCBs within its internal components are encountered, these materials will be disposed off-site in accordance with GE's standard procedures, as well as applicable federal, state, and local regulations. In general, prior to off-site disposal, these materials will be stored at GE's permitted storage facilities located at Building 78 and Building 12. The Building 78 drum storage facility is a RCRA Part B permitted treatment storage and disposal facility (TSDF) that can be used for drum storage up to 1 year. Additionally, this facility can receive drums generated by GE that are transported over public roadways (i.e., manifested). The Building 12 temporary drum storage facility is permitted for 90-day storage of drums that are generated and transported only within the GE facility.

Drums will be placed into a salvage drum (overpack), transported to the appropriate storage facility to be sampled, and subsequently transported to an appropriate off-site facility for disposal. Intact capacitors will be placed into 55-gallon drums along with absorbent materials, transported to the appropriate storage facility, and subsequently transported to an appropriate off-site facility for disposal. Empty drums, pieces of drums, and small capacitor parts will simply be included with the excavated sediments or soils placed in the permanent on-plant consolidation areas. The handling of any related equipment will be similar. Free product/NAPL that has been collected will be containerized as appropriate by the volume of material, transported to the appropriate storage facility, placed into a 55-gallon drum, sampled, and subsequently disposed of off-site.

10.6 On-Site Handling of Water

This section describes the handling and treatment of water extracted from the sediment removal area in the dewatering process. It also describes the handling and treatment of water released from the removed materials as part of gravity dewatering processes, as well as water resulting from equipment cleaning activities.

10.6.1 Excavation Dewatering

Water handling and treatment will be an ongoing and time-critical component of the sediment and bank soil removal and replacement/cover operations. To this end, there are several important factors that must be considered for implementation. These include the following:

- Treatment Capacity - Due to the proximity of the water table and the fact that removal will be conducted within the River, the treatment capacity is an important consideration. As previously discussed, a hydrogeologic model has been used to estimate the potential amount of water to be handled if sheetpiling is selected as the water diversion/containment structure. Various assumptions were made in support of the modeling effort; however, if unanticipated site conditions are encountered, water handling requirements may change significantly. As a result, the size of the work areas was considered in the modeling effort, and will be controlled, in part, by the rate of water infiltration into the work area.

- Logistics - Adequate pumps and piping must be available to keep the excavation areas dry and to route the water to the treatment unit. For the downstream stretch, this could involve pumping water through more than 2,000 feet of piping, which may need to cross the River, and could potentially interfere with ongoing removal operations.

- Treatment Effectiveness - Timely sediment removal also requires that the water treatment plant effectively treat the water encountered. If the collected water cannot be adequately treated and discharged, the sediment removal activities may need to be temporarily shut down. The primary method for water treatment will involve the use of GE’s 64G Groundwater Treatment Facility (GWTF). The treatment processes within the 64G GWTF include oil separation, chemical addition and clarification, sand filtration, and carbon adsorption. The current capacity of the 64G GWTF is 350 gpm. GE is currently expanding the treatment capacity of this system to 700 gpm, which would make available approximately 350 gpm for treatment of water from removal activities (250 gpm is needed for current groundwater recovery operations and 100 gpm is required for operation of the continuously backwashing sand filters). If additional treatment capacity is required, it is anticipated that water will be routed to a portable water treatment system with components similar to the 64G GWTF system.

- Discharge - It is anticipated that water routed to the 64G GWTF will be discharged through one of GE’s existing NPDES permitted outfalls. Water that is treated by the portable treatment system will be discharged to the River via a temporary discharge point in the vicinity of the work area. If a portable treatment system is used, an exclusion from the NPDES Permit requirement pursuant to 40 CFR 122.3 (d) will be required. In general, it is anticipated that the effluent limitations will be the same as those in GE’s existing NPDES permit.

10.6.2 Materials Dewatering/Equipment Cleaning

The handling and treatment of water from dewatering of the stockpile and from equipment cleaning will be dependent upon the procedures and locations used for these activities. It is anticipated that the water accumulated from those activities will be pumped into a storage tank and will be treated along with the water generated during excavation dewatering. However, if equipment cleaning water contains cleansing agents or surfactants, the water will be collected, characterized, and appropriately disposed off site.

10.7 On-Site Handling of Residual Wastes

Residual wastes likely to be generated during removal activities include used disposable equipment, personal protective equipment, sampling equipment, cleaning residuals, etc. Any residual wastes generated will be placed in stockpiles and will be disposed of with the soils and sediments.

11. Project Monitoring and Maintenance Plan

11.1 General

This section presents the water column, biota, and air monitoring program that will be performed before, during and after implementation of the removal and restoration/capping activities, as well as post-restoration river and bank cover monitoring. The water column monitoring program to be performed during and following construction is discussed in Section 11.2, along with the actions that may be taken if the monitoring identifies construction-related impacts to the water column. The biota monitoring program to be performed during and following construction is discussed in Section 11.3, and includes a discussion of the potential uses of the data collected from this program. Figure 11-1 provides the water column and biota monitoring locations. The air monitoring program to be performed during construction is discussed in Section 11.4, while the post-restoration monitoring and maintenance of the river and the bank soil cover are discussed in Section 11.5 and 11.6.

11.2 Water Column Monitoring

The objective of the proposed water column monitoring activities is to identify, evaluate, and respond to potential water column impacts that may be the result of the ongoing soil and sediment removal and replacement/cover activities. The monitoring activities performed during the removal and replacement/cover activities will use procedures consistent with the monitoring program previously performed for the Building 68 Area removal action in 1997.

Specifically, water column monitoring will be performed at two locations associated with the ½-Mile Reach: immediately upstream of the Newell Street Bridge and immediately downstream of the Lyman Street Bridge. Water column monitoring will be initiated once the first intrusive sediment activities (i.e., the installation of the water diversion/containment structure) are initiated and will continue for the duration of the removal and replacement activities within the River. Water column monitoring will be conducted using automated sampling equipment. Collection and analysis procedures will be consistent with the procedures specified in the SAP/DCAQAP. Samples will be collected hourly and composited (volume-weighted basis). Each hourly sample and the single daily composite sample will be analyzed for turbidity. In addition, measurements of water velocity and water depth will be obtained at each sample location. All sample results obtained on a given day will be evaluated collectively at the end of each day. Periodic sampling for PCBs in the water column will also be conducted, regardless of turbidity levels at the upstream and downstream sampling location. PCB sampling will be performed once every two weeks when in-river activities are being conducted. The samples will be analyzed for total and dissolved PCBs. Sampling may be suspended during winter months if weather conditions render sampling equipment inoperative.

The evaluation of potential water column impacts during the ongoing removal and restoration/cover activities will be primarily based on the daily turbidity result. A downstream turbidity action level was developed for the Building 68 Area removal action based on the correlation between "baseline" turbidity readings and corresponding PCB and TSS data. This action level is presented as follows:

$$\text{Turbidity}_{\text{Downstream}} \; \# \; \text{Turbidity}_{\text{Upstream}} + 50 \text{ ntu.}$$

This action level is the same as that which was developed, approved by USEPA, and used for the Building 68 area removal action. This action level was based on the evaluation of a database of "baseline" water column sampling results from which an assessment of the water quality conditions (and variations under natural conditions) was performed. Accordingly, this action level is also proposed for use as part of the removal action for the upper ½ - Mile Reach.

In addition, the following action level is proposed for total PCBs.

$$PCBs_{Downstream} \# PCBs_{Upstream} + 5 \text{ ug/l.}$$

This action level has been developed based on a review of the data collected during the Building 68 area removal action.

In the event that either the downstream turbidity or downstream PCB action levels are exceeded, a daily sample from the Newell and Lyman Street monitoring stations will be submitted for PCB (if not already analyzed) and TSS analysis on a 24 hour turn-around basis. Additionally, a sample will be collected near the Dawes Avenue Bridge and analyzed on a rush turn-around basis for PCBs and TSS. Further, a number of site assessment activities will be initiated including, but not limited to, the following:

- Review of the ongoing removal and replacement activities and modification of the condition/performance of the existing erosion and sedimentation control measures;
- Comparison of the upstream/downstream results from a similar "baseline" monitoring effort and/or a monthly water column sampling event;

- Re-sampling at the downstream location to determine if the prior sampling result was an anomaly or if the elevated reading was possibly a short duration event; and

- Collection of additional samples from various locations within or adjacent to the removal area to possibly identify the potential source(s) of the elevated reading.

If the elevated downstream turbidity or PCB reading is determined to be related to specific removal and replacement/cover activities or site controls, the pertinent activities will be modified to the extent feasible or additional controls will be implemented.

In addition to these monitoring efforts conducted during the removal and replacement activities, a post-removal water column monitoring program will be performed after completion of restoration activities. This post-removal monitoring program will consist of water column sampling performed three times annually (high flow, storm flow, and low flow) for the first five years at the Newell and Lyman Street sampling locations, following completion of restoration activities. Samples will be analyzed for total/dissolved PCBs and TSS, and during each sampling event measurements will be made of turbidity, temperature, water velocity, and water depth. After five years, the data will be evaluated and, if appropriate, modification or the elimination of the water column monitoring program will be proposed to the USEPA for approval.

11.3 Biota Monitoring

The overall objective of the proposed biota monitoring program is to assess the effects of the removal and replacement activities on the bioavailability of PCBs in the vicinity of the ½-Mile Reach. As suggested in the USEPA August 1998 comments on the Conceptual Work Plan, the biota monitoring will consist of *in situ* exposure of caged mussels. The specific protocols to be used for the caged mussel study is presented in Appendix I.

The caged biota program will be performed before and during implementation of the removal and replacement activities and after completion of restoration activities. The pre-removal data will be used as a baseline with which to evaluate the data obtained during removal and replacement activities, as well as the post-restoration data. The first phase (i.e., the pre-removal phase) will be conducted during the late spring/early summer of 1999, prior to intrusive activities. Subsequent phases (i.e., during-removal and post-restoration phases) will be conducted in subsequent years. Completing each caged biota study during the same time of year under similar conditions (to the extent practical) potentially reduces seasonal and temperature-related effects on PCB uptake. The caged biota sampling events to be conducted during the active on-site activities will (to the extent possible) be performed during active sediment removal.

Sample locations for the caged mussel study will include the sample locations used in the water column study. In summary, two mussel cage arrays will be placed upstream of the Newell Street Bridge (to serve as an indication of background bioavailability), two cage arrays will be placed downstream of the Lyman Street Bridge, and two additional cage arrays will be placed further downstream of Lyman Street at the Dawes Avenue Bridge. Specimens will be collected from the cages following an appropriate exposure period. The samples will consist of one approximately 10-mussel composite sample from each mussel cage array. The mussel samples will be analyzed as whole body composite samples for PCBs and percent lipids.

11.4 Air Monitoring

Ambient air monitoring will be conducted during removal and replacement activities to assess ambient particulate matter and PCB levels. Monitoring plans are summarized below, and the Scope of Work for ambient air PCB and particulate monitoring is provided in Appendix J.

Particulate Monitoring

Real-time particulate monitoring will be performed during all construction-related activities, beginning with the initial phase of construction (water diversion/containment structure installation). Such monitoring will be conducted at two stations -- one at an appropriate location downwind of the construction-related activities (which may vary as construction-related activities progress along the ½-Mile Reach) and another at an appropriate location in Pittsfield that is representative of background particulate concentrations. The specific locations for these stations will be selected and proposed to USEPA, based on the location and nature of the construction activities, predominant wind direction, location of potential receptors, availability of power, site accessibility, site security, and existing ambient air monitoring data.

At each station, real-time particulate monitoring will be performed using a MIE dataRAM Model DR-2000 real-time particulate monitor. Each monitor will be equipped with a temperature conditioning heater and in-line impactor head to monitor and record concentrations of particulate matter with a mean diameter less than 10 micrometers (PM_{10}). Monitoring will be conducted for approximately 10 hours daily, from 7 am to 5 pm, during construction-related activities. Particulate data will be recorded and averaged by the instruments' datalogger for each hour of the day (approximately 10 hours).

For each day of monitoring, the particulate data from the downwind monitor will initially be compared with the data from the background monitor. If the average 10-hour PM_{10} concentration at the downwind monitor exceeds the average concentration at the background monitor, the downwind concentrations will then be compared with a notification level of 120 $\mu g/m^3$ (micrograms per cubic meter) -- which represents 80 percent of the current 24-hour National Ambient Air Quality Standard (NAAQS) for PM_{10} (150 $\mu g/m^3$). This level has been selected to allow notice to GE before concentrations reach the level of the 24-hour NAAQS. Any exceedances of the notification level or the NAAQS will be immediately reported to the OSC, and GE's Project Coordinator will discuss with the OSC the need for and type of response actions.

PCB Monitoring

Ambient air monitoring for PCBs will be conducted during removal activities to assess ambient PCB levels. The objective of the PCB sampling program is to obtain valid and representative data on ambient levels of PCBs downwind of removal areas during significant removal activities to insure that the removal activities are not causing an unacceptable increase in ambient air concentrations of PCBs.

Monitoring will be conducted at four locations along the River. The sampling locations may vary as construction-related activities progress along the ½-Mile Reach. An additional monitor will be operated at an appropriate location in Pittsfield that is representative of background PCB concentration.

Ambient air monitoring for PCBs will be conducted during removal activities along the River. Sampling will be conducted during two 24 hour periods prior to remediation and one day per month during actual removal actions. Sampling will not be conducted during mobilization, site preparation work, restoration, or demobilization activities.

The ambient air monitoring frequency for PCB will be increased to bi-weekly in the event that ambient particulate concentrations at any one location consistently exceed the proposed particulate notification level (i.e., 120 Fg/m^3). Consistently exceeding will be defined as greater than 120 Fg/m^3 on three consecutive 10 hour days or 5 days in any two week period. If PCB concentrations are below PCB action levels for two consecutive bi-weekly events, then sampling frequency will revert to monthly.

11.5 Post-Construction Monitoring of the River Cap and Armor System, Enhancement Structures and the Restored Sediment

This section describes the proposed protocol for monitoring, reporting and corrective action of the cap and armor system, restoration enhancement structures and the restored sediments in the ½-Mile Reach, after construction is complete, to ensure that the Performance Standards are achieved and maintained.

11.5.1 Monitoring the Sediment Cap Isolation Layer

GE will conduct periodic sampling of the sediment cap isolation layer to monitor its long-term effectiveness in controlling PCB migration from the underlying sediment. Such sampling will be conducted at six locations where the sediment cap isolation layer is 12 or more inches thick and detectable levels of PCBs are present in the underlying sediment. The six proposed sampling locations are depicted on Figure 11-2. During the sediment removal activities described in Section 7.4.1, GE will conduct post-excavation sampling for PCBs at those six locations prior to cap placement, to confirm that detectable PCBs are present in the remaining sediments and to provide data for use in the subsequent evaluations of the long-term effectiveness of the sediment cap isolation layer. If levels at these six locations are found to have non-detectable or very low PCB concentrations, substitute location(s) will be selected. If residual DNAPL remains in the sediments, a maximum of two additional sediment cap isolation layer sample locations will be added in the entire ½-Mile Reach. (This post-excavation sampling will be conducted only at these locations and solely for the foregoing purposes.)

The periodic sampling of the isolation layer at these locations to assess the isolation layer's effectiveness in controlling PCB migration from the underlying sediments will be conducted immediately after cap placement (to provide baseline data), one year after cap placement, and at the end of the initial five-year period after cap placement. At each event, an undisturbed core of the sediment isolation layer will be collected at each sampling location. At the time of sample collection, each core will be sectioned into 2-inch increments. The core segments which measure 2-4, 4-6, and 6-8 inches above the bottom geotextile layer will be analyzed for PCBs and TOC in sediment. The following assumptions were used in the calculation of PCB migration from residual sediments through the isolation layer to the overlying water column.

C_{SED} = 20 (mg/kg)
f_{OC} = 0.005 (gm/gm)
and V = 3.3 (cm/day)

Based on these site-specific parameter values Figure G-1 was developed. If post-excavation sampling for PCBs and TOC indicates that these values need to be revised, such revisions will be made. The equations used in Section 1.5 of Appendix G calculate the concentration as a function of x (the distance above the sediment/isolation layer interface) and t (time from placement). Specific concentration values can be calculated for specific time durations and locations within the layer as necessary.

If the sampling of the isolation indicates that the layer is not performing in general accordance with the predictions on which the isolation layer design was based (as set forth in Section 7.4.2 and Attachment G to this Work Plan) in terms of controlling PCB migration from the underlying sediment into the surface of the River, GE will evaluate and propose to the USEPA appropriate corrective actions, and will implement such corrective actions upon USEPA approval. At the end of this initial five-year period, GE will propose to USEPA an appropriate long-term monitoring frequency, as well as any other modifications to the monitoring program, and will implement that long-term monitoring program upon approval by USEPA.

11.5.2 Monitoring the Armor Stone Layer

GE will conduct periodic monitoring of the armoring layer of stone to ensure that it is effectively preventing erosion of the underlying sediment cap isolation layer. The monitoring program will consist of a visual inspection and photographs of the ½-Mile Reach following the first ice-out and high water condition (i.e., a flow of 440 cfs or greater reported at the Coltsville gaging station) one time per year for 5 years during low flow conditions, to observe whether significant movement of armor stone or reduction in armor stone thickness has occurred. The inspection during low- flow periods will also include an inspection of the rip rap along the toe of slope. If locations are noted where significant reductions in the armor stone thickness has occurred, the actual thickness of the armor stone layer at those locations will be measured. The results of each annual inspection will be documented in a report and submitted to USEPA. If the annual inspection of the armor stone layer indicates a significant loss of the armor stone in areas of the ½-Mile Reach, GE will evaluate and propose to USEPA appropriate corrective actions to achieve protection, and will implement such corrective actions upon approval by USEPA. At the end of this initial five-year period, GE will propose to USEPA an appropriate long-term monitoring frequency, as well as any other modifications to the monitoring program, and will implement that long-term monitoring program upon approval by USEPA.

11.5.3 Monitoring Aquatic Habitat Enhancement Structures

It has been recommended that monitoring of the hydraulic changes and stability of aquatic habitat structures should be conducted at two critical times: (1) following the first ice-out and high water condition (i.e., a flow of 440 cfs or greater, reported at the Coltsville gaging station), and (2) following a prolonged period of low flow (Wesche, 1985). Consistent with this recommendation, the aquatic habitat restoration/ enhancement structures to be installed in the ½-Mile Reach will be inspected following the first high flow event and following the first prolonged low-flow situation on an annual basis for 5 years. At each inspection, observations will be made of the structural stability of the habitat enhancement structures, the effects of those structures on aquatic habitat, and the potential for increased bank-side erosion. The results of each annual inspection will be documented in a report and submitted to USEPA. If the annual inspection indicates that the structural stability of the enhancement structures has been compromised or that increased bank-side erosion has occurred resulting from the presence of the enhancement structures, GE will evaluate and propose to USEPA appropriate corrective actions, and will implement such corrective actions upon approval by USEPA.

11.5.4 Monitoring of the Restored Sediments

GE will conduct three rounds of periodic sampling of the restored sediments in the ½-Mile Reach at five-year intervals, beginning five years after completion of construction on the sediment removal/replacement activities. Sampling will consist of 39 sediment grab samples, collected at the locations depicted on Figure 11-2. Each of the 39 sediment samples will be analyzed for PCBs. If this sampling indicates the deposition of PCBs on the surface of the covered/restored sediments (as opposed to migration of PCBs through the isolation layer from the underlying sediments), GE will evaluate, to the extent feasible, the source of such PCBs. If that evaluation indicates that such surface PCBs are attributable to sources other than those that have been or are being addressed by GE at the Pittsfield/Housatonic River Site (as defined in the Consent Decree), then GE will evaluate potential source control measures for such sources, will submit a report on such evaluation to USEPA, along with a proposal for any appropriate source control measures, and will implement such measures as are approved by USEPA. If the above conditions are not met, no further response actions will be undertaken to address such PCBs deposited on the surface of the covered/restored sediments, except as otherwise required by Performance Standard #12 of this Work Plan and/or pursuant to the provisions of the Consent Decree on Emergency Response and Pre- and Post-Certification Reservations of Rights (Re-Openers).

11.6 Post-Construction Monitoring of the Bank Soil Cover, Armor Stone and Restored Bank Vegetation

This section describes the proposed protocol for monitoring, reporting and corrective action of the bank soil cover, erosion-control armor stone, and restored bank vegetation.

11.6.1 Monitoring Cleared and Restored Bank Soil Areas

The integrity of the cleared and restored areas of the bank of the Upper ½-Mile Reach, excluding the approximately 170-foot long section excavated and restored as part of the Building 68 Removal Action, will be monitored for five years after project completion. Visual inspections of the cleared and restored banks will be made after each storm and high water event (i.e., a flow of 440 cfs or greater, reported at the Coltsville gaging station) until the herbaceous cover is established, on a semi-annual basis during the first year after the cover is installed and on an annual basis in years two through five. The inspections will evaluate the cleared and restored areas for evidence of erosion due to flow currents, storm-related surges, and ice movement and will be documented in annual reports submitted to USEPA. In areas where visual observations indicate a significant erosion (e.g., ruts, gullies, washouts, or sloughing) of the cleared or restored areas or armor stone, GE will propose to USEPA steps to replace/restore the eroded soil or armor stone to the original restoration design conditions, and will take such steps upon USEPA approval. GE will also, to the extent practicable, identify the cause of the erosion and if it is in GE's control, take appropriate actions to reduce future erosion. In addition, GE will evaluate the source, dispersal, and quantity of the eroded soil in the River, and will propose to the USEPA appropriate measures to remove any significant quantity of contaminated eroded soils to the extent practicable, and will implement such measures upon approval from USEPA.

At the end of the 5-year period, GE will propose an appropriate long-term monitoring program, and will implement the program upon approval by USEPA.

11.6.2 Monitoring of Restored Bank Vegetation

To ensure the establishment of the restored vegetative community on the banks, a program to monitor the success of the planted specimens will be implemented. The monitoring program will consist of two visits during each of the first three years after planting, and an annual visit to be conducted during the fifth year and seventh year after planting. In each of the first three years after planting, visits will be conducted in the late spring after the first leaf flush (May/June) and in the summer (July/August) to assess plant survival. The single visit in the fifth year and seventh year after planting will be conducted in the summer (July/August). In the event of a significant loss of plantings (greater than 1/4 acre in size), the timing for monitoring will be restarted following actions to replant the lost trees or shrubs (except in the case where a third party is responsible for growth failure).

Survival will be determined based on a stem count of trees and shrubs and percent of herbaceous cover. The measure of survivability of the plants will be determined both by mortality and by apparent vigor, and any herbaceous planting areas with less than 100% cover (outside the foliar area) will be supplemented with additional planting/seeding. Any dead trees or shrubs in excess of 20% of the original planting (80% survival) will be replaced before the first of November of the years in which monitoring occurs. Monitoring will also assess whether supplemental activities, such as additional fertilizing or watering, are necessary.

A certified arborist will be selected (in consultation with the Agency) to assist in the completion of the monitoring program. The arborist will utilize best professional judgement to assess the apparent vigor of the planted specimens. If the apparent vigor is determined to be less than adequate, appropriate watering, fertilizers, or other reasonable measures will be taken to the extent practicable to correct the deficiencies. Tree/shrub replacement will not be required based on an evaluation of vigor. The arborist will observe the plantings and will be involved with each monitoring visit.

During each of the monitoring visits, the restoration areas will be inspected for the presence of invasive species. Invasive species of concern include Amur honeysuckle, Autumn olive, Black locust, Black swallow-wort, Common barberry, Common buckthorn, Garlic mustard, Glossy buckthorn, Goutweed or Bishop's weed, Japanese barberry, Japanese honeysuckle, Japanese knotweed, Morrow's honeysuckle, Morrow's X Tatarian honeysuckle (hybrid), Multiflora rose, Norway maple, Oriental bittersweet, Phragmites - Reed grass, Porcelain berry, Purple loosestrife, Russian olive, Tatarian honeysuckle, and Yellow iris. No greater than 5% of the restoration area of either bank will be allowed to be covered by invasive species. Any invasive species in excess of the 5% coverage limit will be removed by appropriate means.

Each monitoring visit will consist of a pedestrian survey of all areas on both banks in which restoration activities occurred. During the field visit, personnel conducting the inspection, supported by the certified arborist, will perform a stem count of planted trees and shrubs to determine survival rates. Estimates of groundcover by herbaceous species will be made to verify aerial coverage. Any indications of damage from trespassing or herbivory will be noted. Signs of erosion will also be noted and any actions to address invasive species will be initiated. The monitoring visit will be documented through field notes and photographs. Based on the results of each visit, recommendations for remedial actions such as replanting, watering, repair of erosional areas, and implementation of measures to reduce herbivory will be made.

An annual summary monitoring report will be prepared documenting the conditions of the ½-Mile Reach. The report will summarize the results of the monitoring visits, including photodocumentation, and document any remedial actions that were implemented. The annual report will be provided to the USEPA, MDEP, and the Trustees by December 15 of each year of monitoring.

12. Other Construction-Related Activities

This section identifies various construction-related activities that will be performed by the Remediation Contractor and other parties involved in the project. The specific topics discussed in this section include pre-construction activities, construction management activities, and construction support activities.

12.1 Pre-Construction Activities

Pre-construction activities are those performed before removal and replacement activities commence, such as preparing Contract Documents for implementation of the construction-related activities, procuring contractors, and preparing Contractor submittals.

12.1.1 Contract Documents

Contract Documents for implementation of the removal, replacement/cover, and restoration activities will be prepared to solicit bids for performance of the work. The primary functions of these documents are to: 1) identify to the Remediation Contractor the scope of work necessary to achieve the project objectives; 2) provide a basis by which the Remediation Contractor can develop a cost quotation; and 3) indicate the specific materials, equipment, and standards to be utilized in performing the construction activities.

12.1.2 Remediation Contractor Procurement

Remediation Contractor Procurement will be completed by GE, and the Contractor's qualifications will be submitted to the USEPA. GE will provide the Contractor with copies of the Work Plan.

The Remediation Contractor will be issued a notice to proceed with construction activities once all necessary approvals from the USEPA have been received.

12.1.3 Contractor Submittals

For most elements of this removal action, the Contract Documents will require the Remediation Contractor to prepare and submit detailed removal plans and other removal-related documents for review. The objective of this requirement is to monitor the Remediation Contractor's understanding of the Work Plan requirements and prevent any misinterpretation of the technical specifications that may otherwise impact the project objectives or removal schedule. As the Supervising Contractor, BBL will review all Remediation Contractor submittals for conformance with the Contract Documents. The required submittals are expected to include the following:

- Proposed substitutions for materials or modifications to procedures specified in the Contract Documents.

- Operations Plan which will further detail the sequencing of the Removal Action, including the following:

  - Excavation Stability/Water Diversion Methods;
  - Excavation, Replacement, and Restoration Approach;
  - Materials Handling and Staging Plan;
  - Equipment Cleaning Procedures;
  - List of Equipment to be used on-site; and
  - Work Schedule.

- Health and Safety Plan.

- Contingency Plan.

- Record Drawings.

- Manufacturer's technical data for restoration products.

- The name and location of each source and type of replacement material proposed by the Contractor. If not previously sampled, the Contractor must submit the appropriate number samples from each proposed source of replacement material to GE for analytical laboratory analysis.

- The name and location of each source and type of vegetation to be used for site restoration.

The above information will also be provided to the USEPA and MDEP for review and comment. The Operations Plan and material substitutions will be submitted for USEPA approval. GE will provide any material or design specifications, cross-sections, or other construction-related design documents upon Agency request.

12.2 Construction Management

This section presents a discussion of the activities to be performed as part of construction management, including site access, meetings, inspections, schedule maintenance, project modifications, and project documentation and records keeping.

12.2.1 Site Access

GE owns, occupies, and controls the majority of the property to which access is required to implement the project described in this Work Plan. GE will provide access to the USEPA, MDEP, and natural resource trustee agencies, and their employees, agents, contractors, consultants, and other authorized representatives, for the purposes of overseeing and monitoring work to be performed. GE will also provide access to all GE-retained contractors or subcontractors for the same purposes. GE will make best efforts (to be defined in the Consent Decree) to secure access to any non-GE-owned property also required for this project. In the event that GE is unsuccessful in securing access, the USEPA and MDEP have agreed to assist GE in obtaining access, including, but not limited to, use, as appropriate, of their legal authorities to secure access to such properties.

12.2.2 Project Start-Up Meeting

The project start-up meeting will be scheduled before the Remediation Contractor mobilizes to the site. Specifically, the objectives of this meeting will be to:

- Review contract requirements;
- Establish a detailed project schedule;
- Review the roles and responsibilities of all project participants; and
- Resolve any other issues raised by the parties.

GE will prepare a summary of the meeting discussions, noting in particular, any decisions made. A copy of the summary will be provided to each of the parties in attendance.

12.2.3 Schedule Maintenance and Progress Reporting

The status of the project schedule will be monitored and updated as part of project progress meetings and progress reporting. Progress meetings will be held periodically and will be attended by representatives of the USEPA, MDEP (at its option), GE, BBL, the Remediation Contractor, and other pertinent parties, as needed. The purpose of the meetings will be to discuss the status of day-to-day operations, schedule, health and safety items, outstanding issues, and overall project implementation issues. After each meeting, GE will issue meeting minutes to document the items discussed, project modifications, and issue resolution.

In addition, GE will prepare monthly progress reports to be submitted to the USEPA and MDEP, with copies to other pertinent parties. The monthly progress reports will include at a minimum, the following:

- Chronological description of the tasks performed;
- Number of samples collected;
- Diagrams (if any) associated with the tasks performed;
- Identification of any reports received and reports prepared;
- Photo-documentation and supporting documentation of activities performed; and
- Brief description of activities to be performed in the following month.

The monthly progress reports will be submitted to the USEPA and MDEP by the 10th day of each month.

12.2.4 Removal Oversight

Removal oversight during this project will be provided by the USEPA's On-Site Coordinator (OSC) and the Supervising Contractor. The roles and responsibilities of the USEPA and the Supervising Contractor are provided in Section 3. The USEPA has indicated that U.S. Army Corps of Engineers personnel will provide support to the USEPA, including an on-site construction representative, throughout the project.

12.2.5 Record Drawings

During construction, the Remediation Contractor will be required to maintain one set of Contract Drawings at the site, on which the Remediation Contractor will show all scope of work changes. These drawings will be kept current on a day-to-day basis in concert with the progress of the work. Where applicable, any changes marked on the drawings will include the notation "per Change Order No. ___", or similar reference that cites the reason for the change.

The following items are examples of some of the types of changes that could occur and must be recorded by the Remediation Contractor:

- Change in limits/extent of removal;
- Change in materials, such as fill materials;
- Change in topographical contours of finished grades;

- Additions to project activities;
- Elimination of a project component; and
- Unforeseen modifications made to existing underground utilities, fences, etc. made necessary by requirements of the work.

Upon completion of the project, the Remediation Contractor will provide the Record Drawings to GE for use in preparation of the Completion of Work Report. In addition, the Supervising Contractor will keep a set of Contract Drawings on site to record the location of samples collected, final excavation depths, changes to extent of removal, etc.

12.2.6 Project Modifications

During the course of implementation of this project, various project modifications may be identified by the USEPA, GE, the Supervising Contractor, or the Remediation Contractor. These modifications could include, but are not limited to, those that enhance performance, improve constructability, or respond to changing field conditions, weather-related developments, or sampling results. The procedures for accomplishing project modifications will depend on the significance and magnitude of the changes, as described below.

Modifications to the performance standards for this removal action, as set forth in Section 2.2 of this Work Plan, will not be made except by written agreement of GE, USEPA, and MDEP. If USEPA identifies other project modifications, such modifications will be governed by the provisions of the Consent Decree relating to USEPA-initiated modifications of work plans. If GE or its contractors identify the need for particular modifications to this project, GE will propose such modifications to USEPA for review and approval prior to implementation, except for “minor” modifications, which may be initiated without prior USEPA approval. Minor modifications will be limited to changes that facilitate ease of construction without jeopardizing the performance of the removal action. GE will notify EPA’s on-site representative of minor changes or modifications. These minor modifications include but are not limited to the following:

1) Erosion control layout;
2) Material handling procedures;
3) Increasing the limits of remedial excavations to combine adjacent areas;
4) Increasing or decreasing the limits of vegetation removal to facilitate access; and
5) Sequencing of removal activities for efficiency.

Such “minor” modifications will be identified to USEPA as part of general project communications during the periodic progress meetings and will be documented in the monthly progress reports. All other modifications, following USEPA approval, will be documented in the monthly progress reports and/or the Record Drawings. In any case, all project modifications will be identified in the Completion of Work Report.

12.3 Construction Support Activities

This section includes a discussion of various support activities to be performed during the construction-related activities, including surveying and site layout, health and safety, development of a contingency plan, equipment decontamination procedures, and sampling and analysis QA/QC.

12.3.1 Surveying and Site Layout

Initial surveying and site layout have been performed by BBL to generate a more detailed base map in support of this project. Figures presented in this Work Plan incorporate this additional survey information. During performance of the project, additional surveying may also be performed to verify existing conditions, and/or the limits of removal and/or restoration.

12.3.2 Health and Safety

All parties represented at the site must prepare a task-specific HASP (discussed further below), which would apply to their own workers. Each task-specific HASP must meet the minimum requirements established in the *General Facility Health and Safety Plan* (GE, June 1993) and 29 CFR 1910 and 1926.

Contractor HASP

As discussed above, each Contractor present at the site during construction-related activities will be responsible for developing, submitting, and implementing a task-specific HASP. The plan must address those activities scheduled to be undertaken by that particular Contractor and present required information including, but not limited to, training, identification of key personnel (including the Contractor's Health and Safety Officer), medical surveillance, site hazards, work zones, personal safety equipment and protective clothing, personal air monitoring, equipment cleaning, material safety data sheets, and contingency plan. Each contractor is to have a hazard communication plan in place.

12.3.3 Contingency Plan

A Contingency Plan will be developed and implemented as part of the above-identified HASP to be submitted by the Remediation Contractor. The Contingency Plan will set forth procedures for spill prevention and emergency response in accordance with the requirements established in the Work Plan and Contract Documents. In addition, the Contingency Plan will include a flood control plan that identifies the activities to be performed in the event of flooding to control the potential migration of PCB-containing materials off site and minimize flooding impacts from the Remediation Contractor's operations.

12.3.4 Equipment Decontamination

Equipment cleaning will be utilized to prevent the transport of PCBs or other potential site materials that may be present on any equipment used for removal activities. The Remediation Contractor will be responsible for establishing and implementing specific equipment cleaning procedures, which are anticipated to include the following.

- An equipment cleaning area will be constructed and will generally consist of an impermeable barrier that is sloped to a collection sump.

- Each transport vehicle will be visually inspected prior to leaving the loading area. Accumulations of soil or sediment on the vehicle tires or other exterior surfaces will be removed manually or, if necessary, by using a high-pressure water spray in the equipment cleaning area.

- Material handling equipment that has been used to remove PCB-containing soils or sediments will be cleaned in the equipment cleaning area before it handles non-TSCA/non-RCRA materials after having handled TSCA/RCRA materials, handles "clean" materials (e.g., backfill, etc.), or leaves the site. Equipment cleaning will likely be performed utilizing a high-pressure water spray.

C Liquid materials (and other residual material collected during equipment decontamination) will be collected, containerized, and treated/disposed of in accordance with Section 10.

C Wipe sampling of heavy equipment (e.g., excavators, loaders, etc.) and sheetpiling will be performed following final equipment cleaning in accordance with 40 CFR 761.79. If wipe sampling indicates PCB levels above 10 Fg/100 cm^2 at a 99% confidence limit, the equipment will be recleaned and resampled until a PCB level less than 10 Fg/100 cm^2 at a 99% confidence limit is achieved.

13. Schedule and Reporting

13.1 Schedule for Removal Activities

At this time, it is estimated that the Remediation Contractor will mobilize and begin on-site removal activities in September of 1999. However, achievement of this mobilization date is dependent on receiving timely USEPA approval of this Work Plan and any other approvals necessary to commence work, as well as upon lodging of the Consent Decree with the Court prior to the mobilization date.

Prior to the commencement of on-site activities, a number of additional tasks must be completed. First, USEPA must review this Work Plan. Such review should be expedited and facilitated by the fact that the scope of this plan incorporates comments previously provided by USEPA as well as agreed-upon strategies developed during recent meetings between GE, USEPA and MDEP. GE will need to receive USEPA's comments and approval on this Work Plan in August 1999. In July/August of 1999, GE will also prepare contract documents that will include bidding/job specifications, and will retain a qualified contractor. Contractor procurement is estimated to take approximately one month.

Once a qualified contractor has been selected and all necessary approvals have been obtained, on-site activities can begin. Completion of all on-site work as described in this Work Plan is estimated to take a minimum of 1.5-2 years. Hence, if construction work can begin in September 1999, it shall be completed by May 31, 2001 (excluding restoration activities). Thereafter, a Completion of Work Report will be prepared and submitted to USEPA (as described in Section 13.2), which is estimated to require approximately three months.

The project schedule outlined above is provided on Figure 13-1 and is contingent upon timely USEPA approvals and lodging of the Consent Decree prior to commencement of the on-site activities. Delays in those events will require modification to the project schedule.

13.2 Completion of Work Report

Upon completion of the removal activities, a Completion of Work Report will be prepared, providing a description of the removal activities, including the results of sampling, quantities of soil and sediment removed, disposal procedures, and documentation of any difficulties encountered (if applicable). Also, this report will document deviations from the approved Work Plan (if any). The Completion of Work Report will be certified by GE, after ensuring that all removal activities have been completed in accordance with the Work Plan.

As part of the Completion of Work Report, GE will provide record drawings depicting post-removal site conditions. Record drawings will be based on physical measurements and/or survey measurements obtained by BBL or the Remediation Contractor.

In addition, the Completion of Work Report will include records of all on-plant consolidation as well as copies of all hazardous waste manifests (copies signed by the ultimate disposal facilities) and the associated certificates of disposal if it is necessary to dispose of any materials offsite. If the certificates of disposal are not available at the time of report submission, they will be transmitted under separate cover at a later date.