REPORT

Immediate Response Action Plan for Building 68 Area

General Electric Company
Pittsfield, Massachusetts

October 1996

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

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Table of Contents

Executive Summary

Introduction

This document presents the plan proposed by the General Electric Company (GE) for conducting Immediate Response Actions (IRAs) for the soils and river sediments in the area adjacent to Building 68 at GE's Pittsfield, Massachusetts facility. Sampling conducted in this area has identified elevated levels of polychlorinated biphenyls (PCBs) in both the river bank soils and river sediments in this area, compared to nearby areas. These PCB concentrations appear to be attributable to the collapse of an Aroclor 1260 storage tank located at Building 68 in or around 1968, which released liquid Aroclor 1260 to the river bank and river bed. Although impacted surface trap rock and sediment were excavated at that time, the recent sampling in this area indicates that some elevated PCB levels remain in the soil and sediments.

Based on these findings, the Massachusetts Department of Environmental Protection (MDEP) and the U.S. Environmental Protection Agency (USEPA) (jointly referred to as "the Agencies") determined that the PCB concentrations found in the bank soils and sediments in this area pose an "imminent hazard" to human health and potentially to the environment and constitute an ongoing source of contamination to downstream reaches of the river. They directed GE to conduct additional sampling to define the extent of affected soils and sediments in the Building 68 area that may be related to the Aroclor 1260 tank collapse, and after having done so, to submit an Immediate Response Action Plan (IRAP) proposing specific IRAs for this area.

Based upon extensive additional sampling in this area over the last several months, the Agencies have agreed that the extent of affected soils and sediments in the Building 68 area has been sufficiently defined to develop an IRAP. Elevated levels of PCB Aroclor 1260 have been used to delineate the extent of the affected bank soils and sediments. The extent of the affected soil and sediment areas, together with the PCB sampling results, are illustrated on Figure 2-1 of this IRAP. As can be seen on that figure, many of the most elevated PCB levels in these areas are not on the surface, but at depth.

Objectives of IRAP

The objective of this IRAP, given the Agencies' findings, is to ensure that the PCBs and other constituents in the soils and sediments in the area adjacent to Building 68 do not pose an imminent hazard to human health or the environment and do not constitute a significant ongoing source of contamination to the Housatonic River. Although GE does not accept the Agencies' findings that this area currently constitutes such an imminent hazard and significant source, this IRAP has been designed to address the Agencies' concerns that such a potential imminent hazard and source may exist. As such, it will ensure the protection of the public health and the environment until an evaluation and determination can be made as to final remedies for these sites.

Proposed IRA Approach

GE's proposed IRA approach for the Building 68 area involves a combination of partial soil removal, containment, and continued institutional controls. In brief, this approach includes: (1) removal of the upper 2 feet of the affected bank soil related to the Building 68 release, appropriate disposal of such soil, and stabilization and covering of the excavated bank area with an engineered vegetative cover 12 inches thick; (2) containment of the affected sediment area by armoring the sediments in place with a minimum 14-inch thick cover system consisting of a geotextile, an isolation layer (6 inches of sandy silt), and an erosion protection layer (8 inches of stone); (3) regular monitoring of river water quality upstream and downstream of this area and of groundwater quality in the area; (4) regular inspection and maintenance (as needed) of the vegetated cover on the bank and the armoring system in the sediment area; and (5) continuation of the existing access controls (i.e., security fencing and warning signs) with regular inspections and maintenance (as needed).

Rationale for Proposed IRAs

The proposed IRAs will fully achieve the IRA objectives outlined above.

1. Prevention of Imminent Hazard to Human Health - The Agencies' assertion that the current levels of PCBs in the surface soils and sediments in the Building 68 area pose an imminent hazard to human health is based on an evaluation of a "youth trespasser" scenario, which relies on numerous assumptions that are unrealistic, unsupportable, and overly conservative. That evaluation assumes that a youth aged 9 to 18 would walk or play in this area while engaged in "exploratory" type activities two times per week for seven months per year for nine years. That assumption is grossly overstated. Both the affected bank area and the affected sediment area have very limited access to the public, since (a) both sides of the river in this area consist of GE-owned property and are fenced, (b) the bank is steep and densely vegetated, (c) there are no trails to or recreational locations within this area, and (d) signs have been posted in the area warning of the presence of PCBs. In addition, the Agencies' imminent hazard evaluation utilized a number of other overly conservative assumptions, including: (a) the maximum surficial soil or sediment concentration in the area to represent all exposures; (b) several specific exposure parameter values that are overstated (e.g., for the amount of exposed skin surface area, for dermal absorption and adherence factors, and for soil ingestion rate); and (c) the USEPA's former and outdated toxicity value for the carcinogenicity of PCBs, which has now been replaced by a lower cancer toxicity value.

   Nevertheless, even if it were assumed that the current levels of PCBs in the soil and sediment in this area present an imminent health hazard, the proposed IRAs are wholly sufficient to abate that imminent hazard. The asserted imminent hazard is based on the assumed contact by a youth trespasser with the concentrations of PCBs in the surface soil and/or sediments (i.e., the top 6 inches) in this area. By removing the top 2 feet of affected bank soil and covering that area with a 12-inch thick vegetative cover and by covering the affected sediments with a 14-inch thick armoring system, the IRAs will ensure that at least the top foot of soil and sediment in the affected area will consist of clean material, and thus the IRAs will prevent contact by human receptors with the PCB-containing soils and sediments that are asserted to pose an imminent hazard.

2. Prevention of Imminent Hazard to Ecological Receptors - The Agencies' assertion that the Building 68 area could pose an imminent hazard to the environment is based on the assumption that ecological receptors, namely birds and fish, would spend a significant amount of time foraging in the affected area, during which they would contact the surface soils or sediments. However, the potential for exposure of ecological receptors in this area is limited by the nature of the area. The affected bank area is very small and bounded by developed factory buildings, and is thus not an attractive area for ecological receptors. The affected sediment area is part of an unnatural engineered channel, has a substrate consisting principally of sand, has an extremely shallow water depth during low-flow periods, and thus provides a relatively undesirable aquatic habitat. Given these factors, even if some individual birds or fish may be present in these areas, the areas are unlikely to support an ecological population or community. As recognized in the Massachusetts Contingency Plan, the evaluation of significant ecological harm must be made at the population, subpopulation, community, or ecosystem-wide level. In this case, the available evidence does not support the conclusion that the PCBs in the Building 68 area would cause adverse impacts to a population or subpopulation of birds or fish, to an overall wildlife community, or to the overall ecosystem in this generally vicinity.

In any event, even if this area did pose an imminent hazard to certain individual ecological receptors, the proposed IRAs would abate that imminent hazard. As with the Agencies' human health evaluation, the asserted imminent hazard to birds and fish is driven by the PCB levels in the surface soil and sediments. By covering the affected bank soil area (after removal of the top 2 feet) with a 12-inch vegetative cover and by armoring the affected sediment area with a 14-inch cover, the IRAs will prevent the ecological receptors from contacting and being exposed to the PCB levels asserted to pose an imminent hazard.

3. Prevention of Significant Continuing Releases - The currently available water column data from the Housatonic River indicate that the Building 68 area is not a significant source of PCBs (or other hazardous constituents) to or transport within the Housatonic River. Specifically, the most recent water column PCB data from stations just upstream and just downstream of this area do not indicate any significant overall increase in PCB concentrations or loading to the river from this area. Moreover, the PCBs detected in the water column in this area consist of Aroclor 1254, whereas the PCBs present in the soils and sediments in this area consist predominantly of Aroclor 1260.

   Even if this area were a source, however, the proposed IRAs will prevent any significant continuing releases from this potential source area to or within the river. For the bank area, the top 2 feet of affected soils will be removed, and the excavated area will be restored and covered with an engineered vegetative layer that will be resistant to the erosional forces of the river and will prevent precipitation- or wind-induced erosion of affected bank soils to the river. For the affected sediment area, the armoring system has been designed to be resistant to the erosional effects of the river even in a 100-year flood and is predicted to prevent PCB migration through it (either from the underlying sediments or from groundwater) for an indefinite period (hundreds of years). As such, the armoring system will prevent the resuspension and transport of the sediments containing the PCB levels of concern.

   Experience from other sites also indicates that armoring, if properly applied, is an effective and reliable technique for the isolation of sediments containing PCBs. For example, at the Waukegan Harbor Superfund Site in Illinois, an armoring system was installed in 1992 to address a section of sandy soil in a drainage ditch containing PCB concentrations of 1,000 to 10,000 ppm, and has performed well since it was installed, compared to an unarmored section of the ditch where erosion has occurred. Similarly, at the Sheboygan River and Harbor Superfund Site in Wisconsin, armoring was installed in 1989-90 over approximately 26,000 square feet of PCB-containing sediments in the river, and remains in excellent physical condition, continuing to withstand the erosional forces of the river. Again, after the Fort Edward Dam on the Hudson River was removed in 1973 exposing large remnant deposits containing PCB concentrations up to 2,000 ppm, certain remnant deposits were armored in 1974 and the remainder were armored in 1991. This bank armoring system has been successful for over 20 years in preventing sediment erosion and transport from the remnant deposits.

As shown above, the proposed IRAs would fully achieve the IRA objectives of abating any imminent hazard and any significant continuing source. In these circumstances, it is unnecessary and would not make sense at this time to implement alternatives involving more soil removal or sediment removal, since an evaluation of the most appropriate long-term remedies for these sites has not yet been made. Moreover, in the event that further actions are determined to be necessary in this area as part of a final remedy, such actions can feasibly be accomplished by removing the engineered vegetative layer on the banks and/or the sediment armoring system, using the same techniques involved in their installation.

Proposed IRA for Bank Soils

The proposed IRA for the affected bank soils will involve several steps. These include:

- Site preparation (including establishment of appropriate erosion control measures, relocation of utilities and fencing, and clearing of vegetation);
- Removal of the top 2 feet of affected soil and disposal of that soil at an off-site facility permitted under the Toxic Substances Control Act;
- Placement of an engineered vegetative cover 12 inches in thickness over the excavated area; and
- Site restoration activities.

Proposed IRA for River Sediments

The proposed IRA for the affected sediment area will likewise involve several steps. These include:

- Site preparation (including placement of silt curtains around the affected sediments to isolate the work area and establishment of appropriate erosion control measures along the river edge);
- Covering the affected sediments in the northern portion of the river with a geotextile (by manual placement through the water column);
- Placement of a 6-inch isolation layer of sandy silt over the geotextile (using conventional land-based mechanical equipment) to isolate the affected sediments from the surrounding environment;
- Placement of an 8-inch erosion protection layer of stones over the isolation layer (using conventional land-based mechanical equipment) to prevent erosion; and
- Repeating the above steps to armor the small area of affected sediment in the southern portion of the river.

Monitoring and Maintenance Activities

During construction activities for the above steps, dust control measures will be implemented, and water column monitoring will be performed, involving turbidity and PCB measurements, to assess the effectiveness of the erosion control measures. In addition, following construction, GE will perform regular monitoring of the river water quality upstream and downstream of this area, as well as long-term monitoring of groundwater in this area. GE will also develop a specific plan to evaluate the performance and effectiveness of the IRAs in terms of reducing PCB releases to and impacts on the river system. This plan will include monitoring of various media before, during, and after implementation of the IRAs. Further, GE will conduct regular inspections of the vegetated cover on the banks, the bank stabilization materials, the armoring system for the sediments, and the existing access restrictions in the area (i.e., fences and signs), and will perform any necessary maintenance activities.

Evaluation of Potential Impacts on River Hydraulics and Flood Storage Capacity

An evaluation has been made, through modeling, of the potential impacts of the proposed IRAs on the hydraulics of the river and on its existing flood storage capacity. That evaluation indicates that implementation of the proposed IRAs will not significantly impact the existing river hydraulics due to their limited physical disturbance and ability to replicate the existing conditions that govern river hydraulics. It indicates further that the proposed IRAs, considered together, will result in only a minimal net decrease in flood storage capacity, including only a small and spatially limited increase in water elevation and velocity under 10-year flood conditions (where the increase would be confined within the river channel) and a wholly negligible impact under 100-year flood conditions.

Required Approvals and Schedule

Various approvals will be required for implementation of the proposed IRAs. These include MDEP approval and Pittsfield Conservation Commission approval under the Massachusetts Wetlands Protection Act, a Water Quality Certification from the MDEP, and possibly a Waterways License from the MDEP Division of Waterways and/or a permit from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. Once the necessary approvals are obtained, the IRAs will take approximately 6 to 8 weeks to complete, assuming no significant delays due to winter weather constraints.

1. Introduction

1.1 General

This document outlines a plan proposed by the General Electric Company (GE) for conducting Immediate Response Actions (IRAs) for soils and sediments in the area adjacent to Building 68 at GE's Pittsfield, Massachusetts facility. Within this area, the concentrations of polychlorinated biphenyls (PCBs) detected in the sediments of the Housatonic River and adjacent bank soils have been identified by the Massachusetts Department of Environmental Protection (MDEP) and the United States Environmental Protection Agency (USEPA) (jointly referred to as the "Agencies") as posing an "imminent hazard" to human health and potentially to the environment. Further, the Agencies have asserted that this area represents an "ongoing source of contamination to downstream reaches of the river." While GE did not (and still does not) concur with the Agencies' assertions, GE nevertheless agreed to conduct additional activities to better understand the nature and extent of the affected area, and, after the extent of the area had been defined, to submit an Immediate Response Action Plan (IRAP) proposing specific IRAs for this area. To begin examining potential IRAs for this area, GE identified several potential actions in the document entitled *Status Report and Identification of Immediate Response Action Options for Building 68 Area* (Status Report) [Blasland, Bouck & Lee, Inc. (BBL), September 1996], which was submitted to the Agencies on September 10, 1996.

Based upon the extensive sampling and analysis program conducted in this area over the last several months, the Agencies have agreed that the extent of affected materials in the Building 68 area has been adequately defined to address the asserted imminent hazards. Accordingly, this document outlines GE's proposed IRAP for this area.

It is <u>not</u> the intent or objective of this IRAP to fulfill the requirements of a final remedy for this area. In particular, it would be premature at this time to evaluate and/or select final remedial options for this area since such measures must be evaluated as part of the overall assessment of both the Housatonic River itself and the East Street Area 2/USEPA Area 4 Site. Rather, the objective of this IRAP is to ensure that the PCBs and other constituents in the soils and sediments in the area adjacent to Building 68 do not pose an imminent hazard to human health and the environment and do not constitute a significant ongoing source of contamination to the Housatonic River. By doing so, the IRAP will ensure the protection of the public health and the environment until an evaluation and determination can be made as to final remedies for these sites.

1.2 Background

As illustrated on Figures 1-1, 1-2, and 1-3, Building 68 is located along the bank of the Housatonic River on the south side of the East Street Area 2/USEPA Area 4 Site. Figure 1-1 depicts the general location of the Building 68 area, while Figure 1-2 provides a more detailed site plan, as well as the PCB data available for sediment samples collected in this general area from prior sampling programs. Figure 1-3 presents a more detailed site plan and identifies recent sampling locations. The original Building 68 structure was constructed in 1966. Figure 1-2 illustrates the original location and relative size of Building 68, and several associated storage tanks as depicted on engineering maps prepared by GE in 1969.

In 1969, as part of an expansion of Building 68, an area of concrete pavement was added immediately adjacent to the original building along its west and south sides. Subsequently, in approximately 1970, three drainage pits were constructed to contain storm water and surface runoff from the concrete pavement, as well as floor drainage from within Building 68. Appendix A of the Status Report includes an engineering drawing prepared by GE in 1969 depicting the layout and dimensions of these drainage pits. As previously presented in Section 3.3.6 of the *MCP Interim Phase II Report and Current Assessment Summary for East Street Area 2/USEPA Area 4* (BBL, August 1994), and as shown in Appendix A of the Status Report, the three Building 68 drainage pits were located to the south and northeast of the original Building 68 structure. These pits are referred to by GE as Pits "A", "B", and "C" and by the USEPA as Solid Waste Management Unit T-42 in its RCRA Corrective Action Permit. Figure 1-3 shows the approximate location of these pits. These pits were connected to a pipe which, at that time, apparently led to the Housatonic River. In approximately 1970, the drainage pits were connected to a stormwater interceptor pipe that conveyed overflow from these pits into the 64W oil/water separator.

In approximately 1973, a canopy was constructed over the paved areas to the south and west of the original Building 68 structure. Approximately five years later, in 1978, GE dismantled the tank farm and associated equipment in the original Building 68 structure. Subsequently, in the mid-1980s, GE installed sides on the canopy structure, which represents the current configuration of Building 68. For a short time during the 1980s, this building was used as a storage area for drummed waste materials. Prior to this use, the drainage pits were isolated from the stormwater interceptor system. Since that time, the building has been used for empty drum storage.

In or around 1968, an Aroclor 1260 storage tank located at Building 68 collapsed, releasing a portion of its content onto the bank soil and sediment adjacent to Building 68. According to a GE employee involved in the original cleanup of that release, approximately 1,000 gallons of liquid Aroclor 1260 (which was heated to facilitate pumping) was released onto the river bank and quickly solidified because of the temperature drop experienced upon its release from the tank; a portion of the material settled to the river bottom. To the extent possible (based on visual observation), impacted surface trap rock and sediment were excavated and placed in an on-site area. At a later date, this material was again removed and transferred to a secure landfill. This release and cleanup effort were described in a 1982 report to the Agencies on GE's past hazardous waste disposal practices at the Pittsfield facility, submitted pursuant to Consent Orders executed by GE and the Agencies in 1981. However, as part of ongoing investigations of GE's East Street Area 2/USEPA Area 4 Site and the adjacent Housatonic River, sampling and analysis of riverbank soils adjacent to Building 68 (March 1996) and of nearby sediments (May 1996) identified elevated levels of PCBs. In response to these findings, GE performed a series of activities under the direction of the Agencies, including: review of historical information; implementation of institutional controls to supplement controls already in place; and performance of additional field investigations. In the Status Report, submitted on September 10, 1996, GE presented a discussion of this information, the status of additional field activities performed through that date, and an identification of potential IRAs for this area.

Under the continued direction of the Agencies, GE continued the field program activities until October 9, 1996, when the Agencies agreed that the extent of the affected area had been defined. These activities were completed with the receipt of the final sampling data during the week of October 7, 1996. Sampling and analysis activities conducted as part of the additional field investigations are detailed in Section 2, while a summary of the results obtained as part of these efforts is presented in Section 3.

In addition, in a letter dated August 20, 1996, the Agencies requested the posting of warning signs in the Building 68 area within 10 days of the letter. As requested, these signs were posted within the 10-day limit.

2. Description of Sampling and Analysis Activities

2.1 General

This section summarizes the results of investigations conducted in the vicinity of Building 68 over the last several months. Included are a summary of investigations performed by GE as part of the ongoing MCP Supplemental Phase II/RCRA Facility Investigations (Supplemental Phase II/RFI) (Section 2.2), as well as a summary of more recent investigations related to the Building 68 IRAs (Section 2.3). The information presented in this section is supplemented by tabular and graphical summaries, which will be referenced as appropriate. A discussion of the analytical database resulting from all sampling and analysis activities is provided in Section 3.

2.2 Previous Phase II/RFI Investigations

Riverbank soil adjacent to Building 68 was first sampled in March 1996 as part of the ongoing Supplemental Phase II/RFI activities for the East Street Area 2/USEPA Area 4 Site. These activities included the collection of 16 shallow bank soil samples (plus one duplicate) at 6-inch depth intervals at four locations (68S-1 through 68S-4) to a total depth of 2 feet. These sampling locations are illustrated along with the corresponding PCB data on Figure 2-1. PCBs were detected at concentrations ranging from 150 to 37,000 parts per million (ppm). These results were reported to the Agencies in an *Addendum to the Supplemental Phase II/RFI Proposal for East Street Area 2/USEPA Area 4* (Golder Associates, May 1996), submitted on May 31, 1996. All of the data from this effort are also included in Table 2-1.

In May 1996, river sediment and additional riverbank soil samples were collected from this area and analyzed for PCBs as part of ongoing Supplemental Phase II/RFI activities for the Housatonic River. These samples included two bank soil samples collected from the 0- to 6-inch depth interval at two locations (3-6C-EB-1 and 3-6C-EB-2) and eight sediment samples collected from the 0- to 0.5-inch and 0.5- to 6-inch depth intervals at four locations (3-6C-1 through 3-6C-4). The results of these activities indicated PCB concentrations ranging from approximately 2 to 15,600 ppm. These data were submitted to the Agencies during June and July 1996 as part of GE's monthly reporting for the ongoing Supplemental Phase II/RFI activities. The sampling locations and corresponding PCB data associated with this effort, as well as prior sediment sampling data available for this area, are illustrated on Figure 2-1. The PCB data from these sampling activities also are included in Table 2-1.

2.3 Building 68 Area IRA Investigations

Upon review of the data described above in Section 2.2, the Agencies issued a letter to GE dated July 24, 1996 stating that the levels of PCBs detected in this area pose an imminent hazard to human health and the environment, and required GE to submit an IRAP to address these conditions by July 30, 1996. As such, GE submitted an IRAP via letter dated July 30, 1996, proposing to further characterize the extent of PCBs in the area. The Agencies conditionally approved these sampling activities via letter dated August 1, 1996. Based on this correspondence and subsequent conversations between GE and the Agencies, GE performed these sampling activities during the week of August 5, 1996. Specifically, as part of these activities, additional soil borings were installed along the riverbank at existing locations 68S-1 through 68S-4 and five new locations (3-6C-EB-3 through 3-6C-EB-7) using portable tripod-mounted split-spoon sampling equipment. These borings were installed to depths of 8 to 12 feet, with split-spoon samples being collected continuously at 2-foot depth intervals to the total depth of the borings. Borings 3-6C-EB-3 and 3-6C-EB-4 were converted to well-point piezometers. Boring log/well-point construction forms are included in Appendix A.

Sampling at the existing borings was initiated at a depth of 2 feet, since the top 2 feet of soil at these locations were previously characterized as indicated above. Each of the samples was screened in the field using a photoionization detector (PID) and analyzed for PCBs. The boring locations are shown on Figure 2-1 along with the corresponding PCB data. The PCB data also are presented in Table 2-1, while the PID readings are presented in Table 2-2. In addition to PCB analyses, the 0- to 2-foot depth sample from boring 68S-4 and the 8- to 10-foot depth sample from boring 68S-3 were analyzed for constituents listed in Appendix IX of 40 CFR Part 264 (excluding herbicides and pesticides) plus three additional constituents -- benzidine, 2-chloroethylvinyl ether, and 1,2-diphenylhydrazine (Appendix IX+3). These samples represented the soils in which the previously detected PCB concentration and PID reading were the highest, respectively. The results of these analyses are summarized in Tables 2-3 through 2-6. Additionally, eight other samples exhibited PID readings greater than 10 PID units, and therefore were analyzed for Appendix IX+3 volatile organic compounds (VOCs). The results of these analyses are summarized in Table 2-3.

Sediment samples collected during the week of August 5, 1996 included three cores collected at three existing locations (3-6C-2 through 3-6C-4) and eight cores at eight new locations (3-6C-5 through 3-6C-12). Sediment cores were collected to refusal at each of these locations, corresponding to total depths of sediments ranging from 2.3 to 5.3 feet. Six-inch depth interval samples from each core were analyzed for PCBs (except for the top 6 inches at the existing locations, since they were previously characterized in May 1996). Additionally, samples representative of the full depth of sediment at locations 3-6C-3 and 3-6C-4 were analyzed for Appendix IX+3 constituents (excluding herbicides and pesticides), since these locations previously showed the highest detected PCB concentrations. These sampling locations are shown on Figure 2-1 along with the corresponding PCB data. The PCB data also are included in Table 2-1, while the associated Appendix IX+3 data are included in Tables 2-3 through 2-6.

Based on the results of the sampling efforts discussed above and related conversations between GE and the Agencies, GE submitted a subsequent sampling plan on August 28, 1996, to continue characterizing the extent of affected materials in this area. The Agencies responded to that plan via letter dated that same day, and GE followed up with another response letter dated August 30, 1996. Pursuant to these letters and several conversations with the Agencies, GE initiated further characterization efforts for this area the following week (September 3, 1996). These efforts were conducted on an iterative basis, in accordance with discussions with the Agencies, and included the collection of 20 additional sediment cores (3-6C-13 through 3-6C-32) and the installation of five new bank soil borings (3-6C-EB-8 through 3-6C-EB-12). These locations are shown on Figure 2-1. [Note: Samples 3-6C-14 and 3-6C-16 were collected but not analyzed; therefore, they are not shown on Figure 2-1.] A total of 52 discrete 6-inch depth interval sediment samples were submitted for PCB analysis from these locations. As for the bank soils, a total of five surface soil (0- to 6-inch depth interval) and 21 subsurface soil (2-foot depth interval) samples were collected and submitted for PCB analysis. Each of these samples was screened in the field using a PID; based on these PID readings, four samples also were submitted for Appendix IX+3 VOC analysis. The PCB results of these analyses are presented in Table 2-1 and on Figure 2-1. The PID results are presented in Table 2-2, and the VOC data are presented in Table 2-3. Finally, boring log forms are included in Appendix A.

Additionally, on September 5, 1996, GE installed an angled boring/monitoring well (3-6C-EB-13) through the floor of Building 68 and into the riverbank, in the area of sampling locations 68S-1 through 68S-4 (see Figure 2-1). This boring/monitoring well was installed in accordance with a letter from the Agencies dated September 4, 1996, to define the vertical extent of PCBs and determine whether any non-aqueous-phase liquid (NAPL) is present in this area. Soil samples were collected from this boring continuously at 1.88-foot depth intervals beginning just below the floor of Building 68 and ending at a total depth of about 35.7 feet. Each of these samples was screened with a PID and submitted for PCB analysis. The 10 samples that exhibited PID readings greater than 10 PID units were also submitted for Appendix IX+3 VOC analysis. In addition, two samples were submitted for the remaining Appendix IX+3 constituents (excluding herbicides and pesticides). The PCB results for these samples are presented in Table 2-1 and on Figure 2-1, while the PID and Appendix IX+3 data are presented in Tables 2-2 and 2-3 through 2-6, respectively. Boring log/well construction forms are presented in Appendix A.

Also during the week of September 3, 1996, samples representative of full depth of sediment at existing locations 3-6C-2 and 3-6C-11 (see Figure 2-1) were collected and submitted for analysis of Appendix IX+3 semivolatile organic compounds (SVOCs). The results of these analyses are presented in Table 2-4.

Subsequently, on September 12, 1996, groundwater samples were collected from well 3-6C-EB-13 and submitted for analysis of PCBs (unfiltered and filtered) and Appendix IX+3 VOCs, SVOCs, polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and inorganics (filtered and unfiltered). The results of these analyses are presented in Table 2-8. NAPL was not detected in this well at the time groundwater samples were collected.

Since well 3-6C-EB-13 was installed with the bottom of its screen placed at the silt confining layer (approximately 33.8 feet below the ground surface) and a sheen was noted at a depth of 18.8 to 20.7 feet, concern was raised that NAPL could be present at a depth above the screened interval. Accordingly, with the Agencies' concurrence, GE decided to install a new well to check for NAPL, and set the bottom of its screen at a depth of 21.5 feet. This new well designated 3-6C-EB-14 was installed on September 12, 1996.

As part of the installation of well 3-6C-EB-14, soil samples were collected continuously at 2-foot depth intervals from the borehole for this well from depths of 12 to 22 feet. The characteristics of these samples were recorded, but no further chemical analyses were performed due to its proximity to well 3-6C-EB-13. Boring log/well construction forms are presented in Appendix A. To date, free-phase NAPL has not been detected in either well 3-6C-EB-13 or well 3-6C-EB-14.

After a review of the analytical data for samples collected through September 12, 1996, GE and the Agencies verbally agreed that there was no need to further sample bank soils in the area of Building 68; however, further characterization efforts were needed to define the downstream extent of PCBs in sediments related to the 1968 release. Hence, during September 26-28, 1996, 20 additional sediment samples were collected from 12 new core locations (3-6C-33 through 3-6C-44) and submitted for PCB analysis. The locations of these samples are illustrated on Figure 2-1 along with corresponding PCB data. [Note: Sample 3-6C-34 was collected but not analyzed, therefore, it is not shown on Figure 2-1]. The PCB data are also included in Table 2-1. Upon receipt of these data, the Agencies verbally indicated on October 9, 1996 that the downstream extent of the sediments affected by the 1968 release had been adequately delineated.

3. Evaluation of Extent of Release

3.1 General

This section summarizes the extent of soils and sediments affected by the 1968 tank rupture. The extent of affected soils (Section 3.2) and sediments (Section 3.3) has been determined based on the sampling and analysis efforts described in Section 2.

This evaluation is based on available information indicating that the 1968 tank rupture resulted in the release of PCB Aroclor 1260 into soils and sediments adjacent to Building 68. While certain of these materials were removed at the time of the release, other affected soils and sediments containing PCB Aroclor 1260 remain. These affected soils and sediment predominantly contain elevated levels of PCB Aroclor 1260, although the recent sampling efforts have also documented the presence of PCB Aroclor 1254 and other constituents, which were generally found at much lower levels than Aroclor 1260 and do not appear to be associated with the 1968 tank collapse. As described herein, the soils and sediments affected by the 1968 release are differentiated from other nearby soils and sediments on the basis of the elevated presence of Aroclor 1260.

Further, although chemical constituents other than PCBs were detected in this area, as further explained in this section, the relative concentrations of these constituents found in this area are significantly lower than the levels of PCBs present. Moreover, as discussed herein, these other constituents have not been shown to be released into the Housatonic River water column to any significant extent. This is illustrated by the fact that the Housatonic River surface water sampling data for Appendix IX+3 constituents do not show an appreciable increase in concentrations of these constituents immediately downstream of this area as compared to immediately upstream, as indicated in Tables 4-7 and 4-8 of the *Supplemental Phase II/RCRA Facility Investigation Report for Housatonic River and Silver Lake* (BBL, January 1996). As such, although summarized and presented herein, these constituents have not been considered in selecting or developing the IRAs proposed in Section 4. Rather, elevated levels of PCB Aroclor 1260 have been used for defining the extent of affected soils and sediments.

The currently available water column PCB data from the Housatonic River do not indicate that the Building 68 area is a significant source of PCB transport to or within the river. The water column PCB data collected during the five most recent monitoring events (May through August 1996) from the closest station upstream of this area (Newell Street Bridge) and the closest station downstream of this area (the footbridge to the Newell Street Parking Lot) are presented in Table 3-1. This table presents both total PCB concentrations and PCB mass flux at these stations. [Note: These data have been used for this comparison because they represent all the available water column PCB data from these two locations since the time that GE began using an analytical laboratory that is able to achieve a considerably lower detection limit for water column samples (0.000022 ppm) than was achieved in prior rounds (where many of the results were non-detect).] These data show some modest increases in PCB concentrations and loading across this area on two occasions and decreases on three occasions. Overall, they do not indicate a significant increase in PCB concentrations or loading to the river from this area. Moreover, it is important to note that the PCBs detected in the water column both upstream and downstream of the Building 68 area consist of Aroclor 1254, whereas the PCBs present in the soils and sediments in the Building 68 area consist predominantly of Aroclor 1260 (as would be expected since they are the result of the collapse of a tank containing Aroclor 1260). This fact further indicates that the PCBs in the soils and sediments in this area are not significant contributors to the PCBs in the water column.

3.2 Extent of Release to Bank Soil

3.2.1 Soil Quality

As described in Section 2 and illustrated on Figure 2-1, a total of 16 soil borings were installed along the riverbank adjacent to Building 68 to define the extent of the 1968 tank release (borings 68S-1 through 68S-4 and 3-6C-EB-1 through 3-6C-EB-13). Nearly 100 soil samples were collected as part of these boring installations. While most of these samples were analyzed for PCBs (Table 2-1), each sample also was screened for VOCs using a PID (Table 2-2). Twenty-two samples were submitted for Appendix IX+3 VOCs, based on PID readings (see Table 2-3), and four samples were submitted for full Appendix IX+3 analysis (excluding pesticides and herbicides) (see Tables 2-3 through 2-6).

As shown in Table 2-1 and on Figure 2-1, PCB concentrations in bank soils ranged from 8.6 to 5,500 ppm at the surface (0 to 6 inches) and from less than 1 to 102,000 ppm in subsurface soils. The arithmetic average surficial PCB concentrations is 720 ppm, while that for subsurface soils is 5,896 ppm. The relatively higher levels of PCBs (i.e., greater than 300 ppm) appear to be concentrated in the area immediately adjacent to and within approximately 65 feet downstream of the existing Building 68 structure (on the western or "downstream" side).

Various Appendix IX+3 constituents other than PCBs were also detected in this area, as shown in Tables 2-3 through 2-6. Notably, chlorobenzene was detected at concentrations up to 99 ppm (for boring 685-3 at 6 to 10 feet), with an arithmetic average of 5 ppm. With the exception of dichlorodifluoromethane, all other VOCs were either not detected or detected at estimated values below quantitation limits. Dichlorodifluoromethane was detected in two samples at very low levels (0.02 to 0.52 ppm). Several chlorinated benzenes were detected at concentration up to 62 ppm (for 1,2,4-trichlorobenzene at boring 3-6C-EB-13 at 18.8 to 20.7 feet). Several PAHs were detected at concentrations up to 10 ppm (for fluoranthene at boring 685-4 at 0 to 2 feet). All other SVOCs were either not detected or detected at estimated values less than quantitation limits.

Additionally, various metals were detected in this area (see Table 2-5), notably including copper up to 1,400 ppm (boring 68S-4 at 0 to 2 feet) with an arithmetic average of 423 ppm, lead up to 1,010 ppm (boring 68S-4 at 0 to 2 feet) with an arithmetic average of 307 ppm, and zinc up to 1,190 ppm (boring 68S-4 at 0 to 2 feet) with an arithmetic average of 350 ppm.

Finally, as shown in Table 2-6, of the four bank soils samples analyzed for PCDDs and PCDFs, only two samples indicated the presence of PCDDs [boring 68S-4 at 0 to 2 feet and 3-6C-EB-13 (7.5 to 9.4 feet)]. The total PCDD concentrations in these samples are 0.00402 and 0.000191 ppm, respectively. PCDFs were detected in all four samples, with total PCDF concentrations ranging from 0.00162 to 0.297 ppm, with an arithmetic average of 0.0758 ppm.

As previously noted in Section 3.2.1, the relative concentrations of these constituents are significantly lower than levels of PCBs present in this area. They also are not appreciably higher than corresponding concentrations found at other parts of the GE Plant Site, and do not appear to pose a significant impact to the Housatonic River surface water, based on water column Appendix IX+3 sampling and analysis performed immediately upstream and downstream of this area. Accordingly, these constituents are not considered in the IRAs discussed in Section 4.

3.2.2 Soil Lithology

This section provides a geologic description of the subsurface soils along the riverbank in the vicinity of Building 68. The description is based on field observations of 14 soil borings (borings 68S-1 through 68S-4 and 3-6C-EB-3 through 3-6C-EB-12) which were completed to 8 to 12 feet below the ground surface and two deeper borings (3-6C-EB-13 and 3-6C-EB-14) completed to depths of 35.7 and 22 feet, respectively. Boring log forms for these boring installation are included in Appendix A. Figure 3-1 illustrates a geologic cross-section developed along a north-south line from Building 68, across the Housatonic River, to soil boring NS-24 in the Newell Street Parking Lot. The general location of this cross-section is illustrated on Figure 1-3. Additional description of these materials is provided below.

Fill Materials

The fill unit does not appear to be continuous along the river bank adjacent to Building 68. Fill material was encountered at all soil boring locations except 3-6C-EB-4, 3-6C-EB-5, 3-6C-EB-8, 3-6C-EB-9, and 3-6C-EB-10, where no anthropogenic materials were observed in the subsurface to indicate the presence of fill. The thickness of the fill material ranged from 4 feet at soil borings 3-6C-EB-6, 3-6C-EB-7, 3-6C-EB-11, and 3-6C-EB-12 to greater than 12 feet at soil boring 68S-2. The fill is generally described as brown, fine sand with trace (less than 10 percent) amounts of silt and varying percentages of vegetative and anthropogenic materials. Vegetative materials consisted of roots, leaf litter and reeds. The anthropogenic material consisted of a black porous lightweight slag material, glass, red brick, and a resinous material. Varying percentages (less than 10 to 50 percent) of the slag were observed at the following locations: 3-6C-EB-3, 3-6C-EB-6, 3-6C-EB-7, 3-6C-EB-11, 3-6C-EB-12, 3-6C-EB-13, 68S-1, 68S-2, 68S-3, and 68S-4. The resinous material was observed only at soil borings 68S-2 and 68S-3. The presence of resinous materials corresponds to elevated PCB levels in these borings.

Upper Sand Units

A brown fine sand with varying percentages (less than 10 to 20 percent) of silt and vegetative materials (roots and reeds) was encountered below the fill unit at all soil boring locations except 3-6C-EB-4, 3-6C-EB-5, 3-6C-EB-8, 3-6C-EB-9, and 3-6C-EB-10 where this unit was encountered at ground surface. This unit coarsened downward and is described as to a fine to medium sand with 10 to 20 percent silt and trace amounts of coarse sand and fine to medium gravel. At some locations, this coarser sand unit was gray to dark gray in color. The bottom of this sand unit was reached only at soil borings 3-6C-EB-13 and 3-6C-EB-14 and had thicknesses of 9.7 and 11.3 feet, respectively. Peat layers were encountered at soil borings 3-6C-EB-8 (0.5-inch thick layers at 6.8 feet and 7.4 feet) and 3-6C-EB-10 (0.5-inch thick layers from 4.4 to 5.6 feet) within this upper sand unit.

Silt Unit

A gray-brown silt unit was encountered at soil borings 3-6C-EB-13 and 3-6C-EB-14. The thickness of the silt unit was 0.5 feet and 1.2 feet at 3-6C-EB-13 and 3-6C-EB-14, respectively.

Lower Sand Unit

A gray fine to coarse sand with varying percentages (less than 10 to 20 percent) of fine to medium gravel and trace amounts silt was encountered below the silt unit. This unit was approximately 15.3 feet in thickness at soil boring 3-6C-EB-13 and was not fully penetrated at soil boring 3-6C-EB-14.

Silt

A lower silt unit was encountered at approximately 33.0 feet at soil boring 3-6C-EB-13 and is described as olive brown, stiff silt with trace amounts of fine sand and fine to medium gravel.

3.2.3 Groundwater Quality

Since the initial sampling of soils in this area indicated the presence of affected soil below the water table, the Agencies requested GE to sample the groundwater in this area and check for NAPL presence. Accordingly, groundwater samples were collected from well 3-6C-EB-13 on September 12, 1996 and analyzed for PCBs and Appendix IX+3 constituents (excluding pesticides and herbicides). As presented in Table 2-7, the results of these analyses indicate the presence of constituents generally consistent with those found in bank soils of this area.

Specifically, several chlorinated benzenes such as mono-, di-, tri-, tetra-, and penta-chlorinated benzenes were detected at concentrations ranging from 0.015 to 1.2 ppm, with an arithmetic average of 0.22 ppm. All other VOCs and SVOCs were either not detected or detected at estimated values less than quantitation limits. Zinc and mercury were detected in the filtered sample at 0.0238 ppm and 0.00052 ppm, respectively. All other inorganics were either not detected or detected at concentrations less than quantitation limits. No PCDDs and PCDFs were detected, except for octachlorinated dibenzofuran which was detected at 0.000061 ppm. Aroclor 1260 was detected in the unfiltered sample at 0.021 ppm, but was not detected in the filtered sample. Aroclor 1254 was detected in the filtered sample at 0.0011 ppm, but was not detected in the unfiltered sample.

As indicated in Section 2.3, during the installation of well 3-6C-EB-13 a sheen was noted to be present at an approximate depth of 18.8 to 20.7 feet; however, NAPL was not detected in the well at the time of its sampling. Additionally, NAPL has not been detected to date in well 3-6C-EB-14.

It is important to note that in the Housatonic River surface water Appendix IX+3 sampling data, there is no appreciable increase in concentrations of these constituents (including PCBs) immediately downstream of this area as compared to immediately upstream. Specifically, high- and low-flow surface water Appendix IX+3 data were collected in March and June 1995, respectively at the Newell Street Bridge, the footbridge to the Newell Street Parking Lot, and approximately 1,000 feet downstream at the Lyman Street Bridge (among other locations upstream and downstream). Based on Tables 4-7 and 4-8 of the *Supplemental Phase II/RCRA Facility Investigation Report for the Housatonic River and Silver Lake* (BBL, January 1996), such constituents either were not detected or do not show any appreciable increase in concentration through this area. Moreover, as discussed above, the available water column PCB data collected from the Housatonic River upstream and downstream of this area during five recent sampling events in 1996 do not reveal any overall significant increase in PCB concentrations or loading in this area (see Table 3-1). Thus, it does not appear that groundwater in this area is significantly impacting the surface water quality of the Housatonic River, and therefore, groundwater is not specifically considered in selecting or developing the IRAs proposed in Section 4.

3.2.4 Evaluation of the Overall Extent of Release to Banks Soils

As indicated in Section 3.2.1, the relatively higher PCB concentrations in bank soils of this area (i.e., concentrations greater than 300 ppm) appear to be limited to the bank immediately adjacent to and within approximately 65 feet downstream of the existing Building 68 structure. This area also corresponds to the relatively higher proportion of Aroclor 1260 (approximately 70 to 100 percent of the total Aroclor contribution) in the samples. These sampling results allow a delineation to be made of the horizontal extent of PCBs in the bank soil that appear to be related to the Aroclor 1260 tank rupture and release in 1968. The extent of that affected bank soil area is depicted on Figure 2-1. This extent is consistent with the location of the former tanks in this area, as shown on Figure 1-3.

As shown on Figure 2-1, the vertical extent of the relatively higher concentration of Aroclor 1260 appears to extend to depths of about 4 to 6 feet below ground surface at either end of the affected area (defined by samples 3-6C-EB-11 and 3-6C-EB-3) and to extend at least to depths of 8 to 10 feet below ground surface in the vicinity of Building

68. As shown in soil samples collected from deep boring 3-6C-EB-13, PCBs were detected at a concentration of 3,510 ppm immediately adjacent to Building 68 at a depth of about 22 to 24 feet below ground surface.

3.3 Extent of Release to Sediment

3.3.1 Sediment Quality

As shown on Figure 2-1 and in Tables 2-1 and 2-3 through 2-6, more than 150 sediment sample have been collected recently from the river adjacent to and just downstream of the Building 68 area. These samples were collected from 44 locations, with nearly all being analyzed for PCBs and four samples being analyzed for other Appendix IX+3 constituents.

PCB concentrations in surface sediments of this area were detected up to 20,200 ppm with a spatially weighted average of 1,569 ppm. Overall the sediments range up to 54,000 ppm with a spatially weighted average of 1,534 ppm. While Aroclor 1260 generally predominates at most of the locations, Aroclors 1260 and 1254 are mixed at a number of locations. Additionally, several chlorinated benzenes such as moni-, di-, tri-, tetra-, penta-, and hexa-chlorinated benzenes were detected at concentrations up to 170 ppm with at an arithmetic average of 13 ppm. Various PAHs were also detected at concentrations up to 3 ppm with an arithmetic average less than 1 ppm. Except for acetone and methylene chloride which were also found in method blanks, no other VOCS and SVOCs were detected. In addition, various inorganics were detected, notably lead at 4.7 and 82.4 ppm and zinc at 32.3 and 116 ppm. Total PCDD concentrations measured 0.000089 and 0.00586 ppm, and total PCDF concentrations measured 0.00922 and 0.0218 ppm.

As in the case of the bank soils discussed in Section 3.2.1, the relative concentrations of these constituents are significantly lower than levels of PCBs present in this area. Except in the case of chlorinated benzenes, they are not appreciably higher than corresponding concentrations found at other locations sampled on the Housatonic River, and none (including chlorinated benzenes) appears to have a significant impact on the Housatonic River surface water quality, based on water column Appendix IX+3 sampling and analysis performed immediately upstream and downstream of this area. Accordingly, these constituents are not considered in the IRAs discussed in Section 4.

As for the physical characteristics of sediments in this area, these materials are found to consist of mostly brown fine sand with traces of medium to coarse sand and gravel, and range in depth from approximately 6 inches to 5 feet.

3.3.2 Evaluation of the Overall Extent of Release to Sediments

As indicated on Figure 2-1, the relatively higher concentrations of PCBs, notably Aroclor 1260, in sediments of this area generally encompass the northern approximately two-thirds of the river bed extending from the area immediately adjacent to Building 68 downstream for approximately 510 feet (from the upstream end of Building 68). These data appear to define the horizontal extent of the sediments that have been affected by the Aroclor 1260 release from Building 68. The extent of the affected sediment area is depicted on Figure 2-1. The spatially weighted average PCB concentrations in this affected area are 2,042 ppm overall and 2,041 ppm for surface (i.e., 0 to 6 inches) sediments only.

The vertical extent of PCBs in this area generally ranges from 2 to 4 feet. However, at several locations where core samples were collected to refusal and analyzed at depth, relatively high PCB levels were detected in the deepest sample collected. Since these cores were advanced to refusal (using manual sampling techniques), attempts to collect additional samples from such locations using similar sampling techniques would not likely be successful.

Moreover, it is not necessary to further define the vertical extent of elevated PCB levels in the sediments for purposes of implementing the IRAs proposed in this plan. As discussed in Section 4, the proposed IRAs are intended solely to abate the asserted imminent hazard and ongoing "source" determined by the Agencies, and as such involve installation of an armoring system over the top of the affected sediments.

4. Proposed Remedial Actions

This section presents the proposed IRAs for the affected bank soils and sediment in the Building 68 area. To do so, Section 4.1 first discusses the objectives of the IRAs and the criteria used in evaluating them. Section 4.2 then identifies the proposed IRAs for the Building 68 area and provides the rationale for their selection based on the criteria identified. Sections 4.3 and 4.4 describe how these IRAs will be implemented, Section 4.5 discusses monitoring activities to be performed during and after performance of the IRAs, and Section 4.6 discusses the inspection and maintenance activities that will be performed after completion of the IRAs. Additionally, Section 4.7 provides an evaluation of the potential impacts to the Housatonic River hydraulics resulting from implementation of the IRAs, and Section 4.8 presents and evaluation of the impacts of the proposed IRAs in preventing human and ecological receptors' exposure to the PCB levels of concern and in controlling transport of hazardous constituents to and within the river.

4.1 Overall Objective and Criteria

Since the Agencies have asserted that current levels of PCBs in the surface soil and sediments in the Building 68 area present an "imminent hazard to human health" and "may present an imminent and substantial endangerment to health or the environment," and since the Agencies have indicated that these materials are "an on-going source of contamination to downstream reaches of the river," they have required the submission of an IRAP proposing specific additional IRAs for this area. Although GE does not agree with the Agencies' assertions or basis for concluding that such an imminent hazard exists in the Building 68 area, or that this area is a significant source area, GE has prepared this IRAP to respond to those factors that the Agencies believe contribute to these determinations. As a result, the overall objective of this IRAP is to propose remedial actions to ensure that the Building 68 area does not pose an imminent hazard to human health or the environment, and to ensure that the area does not constitute a significant source of contamination to downstream reaches of the river. It is <u>not</u> the intent or objective of this IRAP to fulfill the requirements of a final remedy for this area. In particular, it would be premature at this time to evaluate and/or select final remedial options for this area since such measures must be evaluated as part of the overall assessment of both the Housatonic River itself and the East Street Area 2/USEPA Area 4 Site. While remedial measures performed as part of an IRA should not compromise or significantly impede future remedial actions, it is similarly clear that they need not accomplish final remedial objectives, especially since the scope of those possible future remedial measures will depend on a variety of factors that are not defined at this time.

The Status Report described the criteria to be were used in selecting proposed IRAs to meet the objectives. Those criteria included the following:

- Prevention of human exposure to the affected soils/sediments as necessary to prevent any potential imminent health hazard;
- Prevention of ecological receptors' exposure to the affected soils/sediments as necessary to eliminate any potential imminent ecological hazard;
- To the extent that this area is a significant continuing source of releases or transport of PCBs (or other constituents related to the Building 68 release) to or within the Housatonic River, prevention of such releases or transport;
- Prevention of significant impacts on river hydraulics and existing flood storage capacity associated with the IRAs;

- Avoidance, to the extent practicable, of measures that would significantly impede further remedial action (to the extent necessary);

- Cost-effectiveness of the measures to achieve the overall objective; and

- Timeliness with which the action could be implemented.

4.2 Selection of IRA Approach

The Status Report identified and briefly described a number of potential IRAs for the Building 68 area, all of which are included as possible IRAs in Section 40.041(3) of the MCP. These included:

- Continuation and expansion of institutional controls (i.e., security and site control measures), coupled with a showing that, with these controls in place, the affected soils and sediments do not pose an imminent hazard to human health or the environment;

- Containment of the affected soils and/or sediments through covering or armoring (or, for the sediments, an engineered channel);

- Removal of some or all of the affected soils and/or sediments; and

- Installation of recovery, control, and/or treatment systems for NAPL (if encountered).

Since the extent of the area affected by the 1968 release from Building 68 had not yet been defined, the Status Report did not provide detailed information as to how such IRAs would be implemented.

Now that additional data have defined the extent of the area apparently affected by the Building 68 release, GE has completed an evaluation of the available IRA options. Since, as noted above, NAPL has not been detected in the monitoring wells in this area, IRA measures for NAPL are not necessary. Hence, GE's evaluation has focused on the IRA options for affected soils and sediments (i.e., institutional controls, containment, removal). Based on the criteria listed in Section 4.1, GE has selected, and herein proposes, an IRA approach involving a combination of partial soil removal, containment, and continued institutional controls. In brief, this approach would involve: (1) removal of the upper two feet of the affected bank soil related to the Building 68 release, appropriate disposal of such soil, and covering the excavated area with an engineered vegetative cover 12 inches thick; (2) containment of the affected sediment area by armoring the sediments in place with a minimum 14-inch thick cover system consisting of a geotextile, an isolation layer (six inches of sandy silt), and an erosion protection layer (eight inches of stone); (3) regular monitoring of river water quality upstream and downstream of this area and of groundwater quality in the area; (4) regular inspection and maintenance (as needed) of the vegetated cover on the bank and the armoring system in the sediment area; and (5) continuation of the existing access controls (i.e., security fencing and warning signs) with regular inspections and maintenance (as needed).

These IRAs will fully satisfy the objectives and criteria outlined in Section 4.1, as discussed below.

1. <u>Prevention of Imminent Hazard to Human Health</u>

   The Agencies' assertion that the current levels of PCBs in the surface soil and sediments in the Building 68 area pose an imminent hazard to human health is based on an evaluation of a youth trespasser scenario, which in turn relies on numerous assumptions that are unrealistic, unsupportable, and overly conservative. Both the affected bank area and the affected sediment area have very limited access to the public. Both sides of the river in this area consist of GE-owned property, and both sides are fenced, thus substantially restricting access. Access to the GE-owned river bank area would be difficult since there are no trails to this area along the bank and access via the river would be inconvenient. Moreover, the steepness of the bank and dense vegetation on it discourage access, and signs have been placed in the area warning of the presence of PCBs, which would further deter individuals from trespassing there. Similarly, access to the affected sediment area is restricted by the fences and warning signs. Transit through this area by boaters is expected to be very limited since no boat launching areas are present and there are other, nearby boating areas which are more attractive for boating than this shallow, channelized section of the river. Further, even if boating in this area should occur, there is no reason for a boater to stop and come into contact with sediments or bank soils, since there are no recreational locations (e.g., picnic areas) in this industrialized section of the river, and stopping would be discouraged by the warning signs.

In these circumstances, the Agencies' exposure estimate, which assumes that a youth aged 9 to 18 would walk or play in this area while engaged in "exploratory" type activities two times per week for seven months per year every year for nine years, is grossly overstated. Even if it were assumed that a youth would climb the fences or access the area via the river to explore in this area, he or she would likely do so only once or at the most only a few times. This is not an attractive area to explore due to its proximity to an industrial facility as well as the presence of fences and warning signs. It does not present any interesting features, so that once a youth had explored this area on one or a couple of occasions, there would be nothing left to explore.

In addition, the Agencies' imminent hazard evaluation used the maximum surficial soil or sediment concentration in the area. This is not reasonable because, even if an exploring youth were in the area, he or she would not contact the soil/sediment with the highest concentration during the entire time he or she were in the area, but instead, all locations in the area are equally likely to be contacted during this hypothetical exploration.

Further, a number of the specific exposure parameter values used by the Agencies in their imminent hazard evaluation are overstated. For example, for the dermal contact pathway, the Agencies' evaluation assumes that the youth trespasser's hands, whole arms, feet, and lower legs would be in contact with the affected soil/sediment -- i.e., that the trespasser would not be wearing any shirt or shoes and would be wearing shorts -- for all seven months of exposure, whereas such a trespasser would likely wear at least a short-sleeve shirt and shoes and sometimes long pants, particularly in the cooler spring and fall months. The Agencies also used their default dermal absorption factor of 6 percent. However, the dermal absorption of PCBs in soil or sediment depends on the organic carbon content of the soil or sediment. Using the average of the available total organic carbon data for the soils and sediments in the Building 68 area, GE's risk assessment consultants at ChemRisk have calculated a site-specific dermal absorption factor of 1.9 percent for this area. Moreover, the Agencies used the highest dermal adherence factor (1 mg/cm^2) within the USEPA's default range, on the ground that the sediments and bank soils may be moist. However, to the extent that the trespasser would contact sediments under water, the water would likely wash those sediments off the skin before they could adhere. Thus, the dermal adherence factor used is too high. In fact, the MDEP's own default dermal adherence factor is 0.51 mg/cm^2.

For the soil ingestion pathway, the Agencies' evaluation used the USEPA's default soil ingestion rate of 100 mg/day for adults. Based on information provided by ChemRisk, it appears that this value was based on extrapolation from tracer element studies (Binder et al., 1986; Clausing et al., 1987) that had limited sample sizes and did not account for dietary contributions of the tracer elements. In fact, based on other data (LaGoy, 1987), the MDEP itself has established a default soil ingestion rate of 50 mg/day for older children and adults.

Finally, to evaluate potential carcinogenic risks, the Agencies' evaluation used USEPA's former and now outdated Cancer Slope Factor (CSF) of 7.7 $(mg/kg\text{-}day)^{-1}$. USEPA has now issued a reassessment of the toxicity of PCBs, which concludes that the appropriate CSF for such soil exposures should be 2.0 $(mg/kg\text{-}day)^{-1}$ or lower.

As these examples demonstrate, the Agencies' imminent health hazard evaluation is based on numerous unrealistic, unsupportable, and overly conservative assumptions.

In any event, even if it were assumed that the current levels of PCBs in the soil and sediment in this area present an imminent health hazard, the IRAs proposed herein are wholly sufficient to abate that imminent hazard. The asserted imminent hazard is based on the assumed contact by a youth trespasser with the concentrations of PCBs in the surface soil and/or sediments (i.e., the top six inches) in this area. Accordingly, any such potential imminent hazard can be abated by preventing contact by human receptors with the surface soil and sediments that are asserted to pose the imminent hazard. Such prevention will be accomplished by removing the top two feet of affected bank soil and covering that area with a 12-inch thick vegetative cover, and by covering the affected sediments with a 14-inch thick armoring layer. Such steps would ensure that, in the affected areas, at least the top foot of soil and sediment will consist of clean material, and would thus prevent exposure to a trespasser via incidental ingestion or dermal absorption of the PCB-containing soils and sediments found to constitute an imminent hazard. A further discussion of the extent to which the proposed IRAs would prevent an imminent hazard to human health is included in Section 4.8 below.

2. <u>Prevention of Imminent Hazard to Ecological Receptors</u>

The Agencies' assertion that the Building 68 area could pose an imminent hazard to the environment is based on the assumption that ecological receptors, namely birds and fish, would spend a significant amount of time in the affected area, during which they would contact the surface soils or sediments. It must be recognized, however, that such potential for exposure of ecological receptors to the PCBs in this area is limited by the nature of the area. The affected bank area is very small (4,400 square feet), is bounded by developed factory buildings and fencing, is part of an unnatural engineered channel created in the 1940s by the U.S. Army Corps of Engineers, and is thus not an attractive area for ecological receptors, particularly compared to nearby natural areas. The affected sediment area is likewise part of the unnatural engineered channel constructed by the Army Corps in the 1940s, has a substrate consisting principally of sand with limited areas of gravel or stone, has an extremely shallow water depth during low-flow periods, and thus provides a relatively undesirable aquatic habitat. Given these factors, even if some individual birds or fish may be present in these areas, the areas are unlikely to support an ecological population or community. As recognized in the MCP (310 CMR 40.0995(4)(d)2.), the evaluation of significant ecological harm must be made at the population, subpopulation, community, or ecosystem-wide level. In this case, the available evidence does not support the conclusion that the PCBs in the Building 68 area would cause adverse impacts to a population or subpopulation of birds or fish, to an overall wildlife community, or to the overall ecosystem in this general vicinity.

In any event, even for the individual receptors that may be present in these areas, the proposed IRAs would prevent any imminent hazard to them. The asserted imminent hazard to ecological receptors is driven by the PCB levels in the surface soils and sediment, since neither the birds nor the fish would forage in or otherwise contact soils or sediments deeper than six inches, and even the soil-dwelling or benthic invertebrates which they may consume would not generally be expected to inhabit soil or sediment at depths greater than 6-12 inches. Accordingly, covering the affected bank soil area (after removal of the top two feet) with a 12-inch vegetative cover and armoring the affected sediment area with a minimum 14-inch cover will abate any potential imminent hazard to these ecological receptors by preventing them from contacting and being exposed to the PCB levels asserted to pose an imminent hazard. A further discussion of the extent to which the proposed IRAs would prevent an imminent ecological hazard is included in Section 4.8 below.

3. Prevention of Significant Continuing Releases or Transport

As discussed above, the existing water column data from the Housatonic River upstream and downstream of the Building 68 area indicate that this area is not a significant overall source of PCBs or other hazardous constituents to or transport within the river. Even if it were a source, however, the proposed combination of soil removal and containment would prevent any significant continuing releases from this potential source area to or within the river. As discussed in more detail in Section 4.8 below, the proposed soil removal and engineered vegetative cover for the affected bank soil area will prevent the erosion of contaminated materials from this area to the river, and the proposed sediment armoring system will prevent the migration, resuspension, and transport of contaminants from the covered sediments to and within the river.

Moreover, the proposed IRAs would involve less potential for resuspension and transport of affected sediments during implementation than would an IRA involving sediment removal. Because a removal IRA would involve excavation of PCB-containing sediments, there would be an increased potential for sediment resuspension during the removal process, including the potential for significant transport of PCBs if a storm event should occur during that process (particularly if the removal process exposed higher levels of PCBs). Furthermore, as explained in GE's *Report on the Preliminary Investigation of Corrective Measures for Housatonic River and Silver Lake Sediment* (PICM Report) (Harrington Engineering and Construction, Inc., May 1996), removal techniques for river sediments are not entirely effective in removing all PCBs. Therefore, removal alone would leave some residual PCBs in the surficial sediments in the affected area, and these residual PCBs may be susceptible to resuspension. The sediment containment proposal avoids this potential problem.

In addition, experience from other sites indicates that armoring, if properly applied, is an effective and reliable technique for the remediation of sediments containing PCBs. The relevant information pertaining to the application of armoring at other sites is discussed in detail in Appendix B. That Appendix explains, for example, that armoring has been applied on a large-scale basis at several sites involving PCBs -- including Waukegan Harbor (Illinois), Sheboygan River (Wisconsin), and the Fort Edward Dam remnant deposits on the Hudson River (New York) -- and that the armoring systems at these sites have been performing effectively since they were installed.

Thus the implementation of the containment systems at the Building 68 area would provide a protective remedy that would effectively contain and isolate the affected soils and sediments until an overall evaluation is made as to the final remedies for the Housatonic River and the East Street Area 2/USEPA Area 4 Sites.

4. Prevention of Significant Impacts on River Hydraulics and Flood Storage Capacity

The potential impacts of the proposed IRAs on the hydraulics of the river and on its existing flood storage capacity are evaluated in detail in Section 4.7 below. As shown in that section, implementation of the proposed IRAs will not significantly impact the existing river hydraulics due to their limited physical disturbance and ability to replicate the existing conditions that govern river hydraulics. As also shown in Section 4.7, the proposed IRAs, considered together, will result in only a minimal net decrease in flood storage capacity, including only a small and spatially limited increase in water elevation and velocity under 10-year flood conditions (where the increase would be confined within the river channel) and a wholly negligible impact under 100-year flood conditions.

5. Impact on Future Remedial Action (If Necessary)

As noted above, the proposed IRAs are not necessarily intended to constitute the final remedy for the Building 68 area. Further evaluation will be performed, as part of the regular regulatory process, to assess the most appropriate final remediation for this area along with the rest of the Housatonic River and the East Street Area 2/USEPA Area 4 Sites. For example, additional information is needed before it can be determined whether or to what extent sediment removal from the river may be necessary or justified to achieve the ultimate remedial goals. In fact, evaluation of the actual effectiveness of the IRAs for the Building 68 area will provide useful information for that long-term assessment.

Moreover, implementation of the proposed IRAs would not significantly impede further remedial action in the event that such further action is determined to be necessary as part of a final remedy. To the extent that such further actions are required, they can feasibly be accomplished by removing the engineered vegetative layer on the banks and/or the sediment armoring system. Such removal activities, if required, could be implemented using similar techniques to those involved in their installation. In fact, use of a geotextile in the IRA for the sediments would provide a clear delineation between the affected sediments and the armoring layer and would thus allow the armoring layer to be simply "peeled back" from the affected area if sediment removal should be required. Furthermore, since, as discussed below, the IRA elements have an indefinite design life, there are no specific timing constraints on when further remedial measures (if any) would have to implemented.

6. Cost-Effectiveness

As discussed above, the proposed IRAs would fully achieve the IRA objectives of abating any imminent hazard and any significant continuing source. Given that they will achieve those objectives, they constitute a more cost-effective means of doing so than more extensive and costly alternatives involving more soil or sediment removal. Such alternatives are unnecessary to achieve the IRA objectives, and it would not make sense to implement them at this time inasmuch as an evaluation of the most appropriate long-term remedies has not yet been made.

7. Timeliness

The proposed IRAs can be accomplished through the application of standard construction practices and readily available materials and equipment. As such, they can be implemented in a relatively short time frame, assuming the receipt of timely approval from the pertinent federal, state, and local authorities (discussed in Section 5). The proposed IRAs could be implemented more expeditiously than activities involving more extensive soil or sediment removal.

Based on the foregoing criteria and evaluation, GE believes that the combination of partial soil removal, soil and sediment containment, and continued institutional controls, as described above, is the most appropriate IRA approach for the Building 68 area. Detailed descriptions of the proposed IRAs are provided in the following sections.

4.3 Proposed IRA for Bank Soils

This section summarizes the IRA proposed to address the presence of PCBs in the affected bank soils adjacent to Building 68 (Figure 2-1). This area, approximately 4,400 square feet in size, is adjacent to the Housatonic River within the river's 100-year floodplain, and includes undeveloped river bank. The bank soil area is relatively steep and heavily vegetated in this area, and is bordered by fencing and Building 68 itself on the northern side, by the Housatonic River on the southern side, and by other undeveloped bank areas and fencing on the east and west. As discussed above, public access to this area is strictly limited by the fencing, the river itself, the steep and vegetated nature of the area, and the presence of warning signs.

As described below, GE's IRA proposal for bank soils involves a combination of removal and off-site disposal of soil and stabilization of the riverbank in this area.

4.3.1 Site Preparation

Prior to the initiation of soil removal and bank stabilization activities, several site preparation activities will be performed. Initially, survey control will be re-established as necessary to delineate the soil removal limits. Next, 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 soil disturbance. These measures will include the placement of erosion control devices, including temporary geotextile fencing along the river edge and hay bales along the sides of the bank to enclose the work area. Figures 4-1 and 4-2 provide typical details for these erosion control measures. Once the erosion control measures have been installed, remaining site preparation activities will be performed. These activities will involve site clearing of brush and small trees (larger, mature trees that will remain to the extent possible to assist in bank stabilization), construction of access areas, and relocation of utilities, if necessary.

4.3.2 Soil Removal and Off-Site Disposal

Figure 2-1 illustrates the proposed limits of excavation for the bank soils. Excavation (to a depth of 2 feet) will be performed over an area of approximately 4,400 square feet, with an approximate excavation volume of 325 cubic yards. By designating a two-foot depth of removal as proposed herein, the IRA objectives will be fulfilled. A deeper excavation would require complex construction techniques (bracing or sheet piling on a steep bank adjacent to an intact building) and would result in a considerably longer construction duration. Furthermore, since PCBs are present to considerable depth, and their presence at depth does not compromise the IRA objectives, it is reasonable to allow the deeper depth soils to remain in place until an overall remedy for this area has been selected. In addition, based on a number of site conditions, including the proximity of the river and Building 68, depth to the water table, and nature of the subsurface materials, it may not be practicable to excavate soil below the water table and attempting to do so might even create potentially unsafe working conditions.

As part of the proposed IRA, soil removal will be performed for the area shown on Figure 2-1. Soil removal will primarily be achieved using conventional land-based mechanical excavation equipment (e.g., bucket loaders, backhoes, etc.). Mechanical removal will be supplemented by manual excavation (i.e., using hand tools and/or small machinery) in difficult access areas or around mature trees that are to remain. In either case, the equipment will be utilized to excavate the specified soils so they may be appropriately handled, transported, and disposed of.

It is estimated that up to approximately 325 cubic yards of soil will be removed from the site. Since these soils contain PCBs, they will be taken to an off-site facility permitted in accordance with the Toxic Substances Control Act (TSCA) for disposal. First, soils will be directly loaded (upon excavation) into transfer vehicles, transported across East Street to a location within the GE facility, and off-loaded onto a temporary stockpile area located outside the 100-year floodplain. While staged at this location, the stockpiled soils will be placed on and covered with a plastic liner to minimize potential contact with the environment. When a sufficient quantity of soil is ready for transport, the soils will be removed from the stockpile and transported to a TSCA-permitted disposal facility. Transport and disposal activities will be conducted in accordance with all applicable regulations. Copies of completed manifests will be provided to the MDEP, and the final soil volumes and quantities will be included in the final project completion report.

Survey controls will be utilized as necessary to define and verify the limits of soil removal. This effort will include horizontal control of the areal extent of excavation, as well as vertical control to verify and record the depth of removal.

It is anticipated that excavated soils will not require dewatering or other processing prior to transport and/or disposal. As a result, excavated soils will be directly loaded into transfer vehicles for transport to the stockpile and loading area. Further, the vehicles used for the transportation of the excavated soils will be equipped with plastic liners and the soils will be placed on and covered with a plastic liner at the stockpile and loading area.

4.3.3 Bank Stabilization/Site Restoration

To address the concern for potential erosion of the excavated area during high flow/flood events, as well as potential human or ecological exposure to PCBs remaining in the unexcavated soil, GE will stabilize and cover the remaining bank. The primary component of this activity involves the installation of an engineered vegetative cover. To further explore the potential application of an engineered vegetative cover to the site, a commercial vendor of this product was contacted. In general, it was recommended that the slope of the embankment subject to this type of application not exceed 1 (vertical) to 1 (horizontal) and that water velocities during flood events not exceed 12 feet per second. Both of these conditions are satisfied for this area as the maximum slope for this area is approximately 2 to 3 and, as discussed in Appendix C, a maximum channel bottom velocity for this reach of the river is estimated at 7.4 feet per second. [Note: Based on results of HEC-2 modeling discussed in Section 4.7 it was determined that the maximum velocity occurs for the 25-year storm (because the banks have not yet over-topped) and the use of channel bottom velocity is conservative since over-bank velocities are lower.] Therefore, an engineered vegetative cover has been selected for this application because it will more readily allow the establishment of vegetation to restore initial site conditions and is appropriate for the bank slope and estimated water velocity. Furthermore, the vegetative cover will preclude both human and ecological exposure to site soils (to the extent such exposure is possible in this access-restricted area).

The vegetated cover selected for this application consists of the use of several bioengineering materials including coir and rock fascines and a fiber mat. Coir fascines, also referred to in the bioengineering trade as Fiber rolls, Fiber-schines, Coconut logs, and Bio-logs, are geotextile natural mesh rolls that are often used along stream escarpments to deflect water current and serve as slope protection. Made from coconut fiber produced from coconut husks, they also can serve as a growth medium for plants. The fibers are enclosed in a woven rope mesh made either from a coconut fiber rope (coir) or polyethylene for greater durability. Coir fascines come in various diameters ranging from about 12 to 28 inches, are biodegradable, have high tensile strengths, absorb and retain moisture, and can be planted with various kinds of vegetation, including wetland herbaceous plants and even woody plants. Rock fascines are simply an adaptation of the coir facsine, which uses rock in place of fiber while the fiber mat is a mat of coconut fiber.

Prior to the placement of the engineered vegetative cover, the bank will be inspected to identify uneven slope areas, debris, roots, or other irregularities that may affect the placement of the cover. Such areas will be addressed to provide a smooth, uniform slope (to the extent necessary and possible) for subsequent placement of the cover.

Subsequently, rooting zone soils (free of sticks, roots, large rocks, etc.) brought from an off-site location will be used to create the base for the vegetative cover. The engineered vegetative cover will then be immediately placed. This will consist of the placement of rock fascines at the toe of the slope to prevent erosion and undermining at the water edge and to provide structural support for the overlying vegetative layer. The rock fascines will be held in place with appropriately spaced support stakes. Coir fascines will then be placed in succession up the slope. The coir fascines will be anchored using stakes at appropriate spacings. A fiber mat will be used to make the transition from the sloped portion of the bank to the top of bank. The vegetative cover will be 12 inches in thickness. A typical cross-section is provided on Figure 4-3.

Restoration activities will consist of planting vegetative species consistent with the region (e.g., soft rush, fox sedge, wool grass, black willow, etc.) within the coir fascines and fiber mat. The top of slope areas will be vegetated with grass.

4.4 Proposed IRA for River Sediment

This section summarizes the IRA proposed by GE to address the presence of PCBs in the affected Housatonic River sediments adjacent to the Building 68 area (Figure 2-1). This area, approximately 20,000 square feet in size, extends from the Building 68 area approximately 510 linear feet downstream. The area is bordered by GE-owned property along both sides of the river. The sediment area is in a portion of river rechannelized by the U.S. Army Corps of Engineers in the 1940s. As such, it is an engineered channel, relatively straight, with relatively steep banks. The river substrate is principally sand, with very limited areas of gravel or stone that could provide a more desirable variety of substrate for aquatic habitat. During very low-flow periods, the water depth in this channelized area is shallow, sometimes less than one foot. As described in Section 4.2, this area has very limited public access due to the fencing on both sides of the river. While some transit through this area by boaters is possible, it is expected to be limited, especially since there are other, nearby boating areas which offer more attractive boating opportunities.

As discussed below, GE's IRA proposal for river sediment involves placing of an engineered armor layer over the top of the affected sediments. This approach will fully achieve the IRA objectives outlined above and will thus be more than adequate until such time as a complete assessment can be made regarding final remedies for the river. Accordingly, for purposes of implementing this IRA, it is not necessary to further define the vertical extent of PCB contamination in the sediments or to include contingency plans to address possible contamination beneath the existing points of refusal.

4.4.1 Site Preparation

Prior to the initiation of armoring activities, several site preparation activities will be performed. Initially, survey control will be re-established as necessary to delineate the armoring limits. Next, a temporary protective liner will be installed over the sediments on the southern shore of the river (in the bypass area) to prevent any potential increased erosion of the sediment in this area due to the channelization of the river by the sediment control measures. The sediment control measures will be installed to minimize the potential for migration of sediment out of the work area during the armoring activities. These measures will include the placement of silt curtains (see Figure 4-2) to isolate the work area. Additionally, erosion control devices, including hay bales or geotextile fencing (see Figures 4-1 and 4-2), will be used along the river edge to limit the potential for bank soil erosion caused by the operation of any land-based equipment on the bank. Once the erosion control measures have been installed, remaining site preparation activities (involving removal of vegetation, construction of access areas, if needed, etc.) will be performed.

4.4.2 Installation of Armoring System

Figure 2-1 illustrates the proposed limits of armoring for the sediments. Installation of armoring materials will be performed over an area of approximately 20,000 square feet. The armoring activities will be performed in two stages. First, the sediment area adjacent to the northern shore of the river will be armored, and then the small portion of affected sediment on the southern shore of the river will be armored. The armoring system will be installed by isolating these portions of the river separately to maintain greater control over the installation procedure.

To install the armoring system, a geotextile will first be placed over the sediments (through the water column) to serve as a barrier between the sediments and the armoring system and thus to limit the potential for mixing of the sediment with the clean materials to be placed as part of the armoring system. The geotextile will be followed by a 6-inch layer of silty sand to act as an isolation layer, effectively isolating the sediments from the surrounding environment. An 8-inch stone protection layer will then be placed to dissipate the energy of high velocity flood flows to a point where the isolation layer would not be subject to scour or erosion. Appendix C provides a basis of design for the proposed armoring system. Figure 4-4 provides a typical cross-section of the armoring system.

The installation of armoring materials primarily will be achieved using conventional land-based mechanical equipment (e.g., bucket loaders, backhoes, cranes, etc.) within an area that has been isolated with silt curtains. Using this approach, the potential for downstream migration of sediment will be limited by the extent of area being armored.

In general, installation of the armoring system will be accomplished from a land-based materials and equipment staging area. To the extent practical, the installation activities will be coordinated such that they will be performed during low flow to allow for greater control over installation procedures. Following set-up of the staging area and work area, the geotextile will be placed. The geotextile will be placed primarily by hand (through the water column), overlapped at appropriate spacings, and weighted down with sand bags as required until the isolation layer materials can be placed.

The isolation layer materials will then be immediately placed on top of the geotextile followed by the protective layer materials. These layers will be carefully installed using standard construction equipment to provide a uniform layer of the appropriate thickness. The isolation layer and protection layer materials will be held back from the edges of the adjoining unarmored area on the southern shore of the river, to allow tie-in of the geotextile when the work area is moved to that location.

After the sediment area along the northern shore of the river has been armored, the silt curtains will be removed and operations will be remobilized to address the small portion of affected sediment on the southern shore of the river. The temporary liner installed in the bypass area will be removed, the work area will be isolated with silt curtains, and the remaining portion of affected sediment will be armored as discussed above.

GE anticipates obtaining the sand and stone materials from local sources. These materials (if not previously tested) will be subject to laboratory testing and analysis for PCBs, VOCs, SVOCs, and metals prior to their use.

Survey controls will be utilized as necessary to define and verify the limits of armoring. This effort will include horizontal control of the areal extent of armoring, as well as vertical control to verify and record the depth of armoring materials.

4.5 IRA Monitoring Activities

Construction Oversight

Prior to initiation of construction, GE will identify a Site Representative who will provide general construction oversight, monitoring of Contractor procedures, and field documentation of daily conditions/activities. The Site Representative will be responsible for approval of the locations of erosion control measures and routine inspection of their effectiveness. Furthermore, the Site Representative will be responsible for directing the Contractor in maintenance, repair, or modification of the erosion control measures, and will have the authority to request that the Contractor modify or discontinue work activities in the event that the effectiveness of the erosion control measures is diminished.

Dust Control During Construction

During soil excavation activities, dust control measures will be implemented as necessary to minimize the potential for airborne migration of site constituents. Dust control measures will include establishment and covering of stockpiles to minimize potential for wind erosion, limitations on equipment/vehicle operating speeds to minimize dust generation, and use of water spray (if necessary) to control visible dust generation. In the event that such measures do not effectively reduce airborne particulate levels, site operations will be modified or discontinued until the particulate source is identified and addressed.

Water Column Monitoring During Construction

To gauge the effectiveness of the erosion control measures, the following water column monitoring plan will be performed during implementation of this IRA:

- In general, monitoring of water column conditions during construction will involve turbidity and PCB measurements.

- Prior to the start of the project, GE will conduct a one-week (approximate) "baseline" water column sampling event to assess current turbidity conditions and possible turbidity variations in response to a rainfall event. These data will be forwarded to the Agencies.

- During armoring, excavation and restoration activities, samples will be collected for PCB analysis on a weekly basis from locations upstream, downstream, and adjacent to the work area. The PCB samples will be collected on a day in which excavation or other intrusive activities are being conducted.

- During armoring, excavation and restoration activities, samples will be collected for turbidity measurements on a daily basis from locations upstream, downstream, and adjacent to the work area. The daily turbidity results will be evaluated to determine if site activities may be impacting water conditions within the river. If it is determined that the site activities are potentially impacting surface water quality (e.g., if the turbidity data from the downstream location are significantly higher than the upstream and/or adjacent sample data), additional water samples will be collected from the upstream and downstream locations and analyzed for PCBs.

Sampling and analysis procedures for the above activities will be similar to those used by GE during other water column sampling within the Housatonic River. The results will be used to determine whether construction activities should be modified or discontinued until the source of any problem encountered has been identified and addressed.

Water Column Monitoring Post-Construction

Following construction activities, GE will perform regular monitoring of the river water quality upstream and downstream of this area, as part of the routine and on-going monitoring activities associated with the supplemental Phase II/RFI activities for the Housatonic River. The results of these monitoring activities will be reviewed as they relate to the potential for releases or migration of PCBs from the Building 68 area. Any follow-up monitoring or activities will be performed as appropriate and as directed by the Agencies.

Long-Term Groundwater Monitoring

GE will perform regular monitoring of the groundwater quality in this area, as part of the routine and on-going monitoring activities associated with the Phase II/RFI activities for East Street Area 2. The well installed in the Building 68 area (3-6C-EB-14) will be added to the East Street Area 2/USEPA Area 4 groundwater quality monitoring program and the results of monitoring activities for this well will be reviewed as they relate to the potential for releases or migration of PCBs (or other constituents) from the Building 68 Area. Any follow-up monitoring or activities will be performed as appropriate and as directed by the Agencies.

Evaluation of Performance/Effectiveness of IRAs

In addition to the regular monitoring activities described above, GE will develop a specific plan to evaluate the performance and effectiveness of the IRAs in terms of reducing PCB releases to and impacts on the river system. That plan will include monitoring of various media (e.g., water, caged fish, other biota, sediments, etc.) before, during, and after implementation of the IRAs, and may incorporate some of the monitoring activities described above. That evaluation plan will be submitted to the Agencies as soon as possible after approval of this IRAP.

4.6 IRA Inspection and Maintenance Activities

Periodic follow-up inspections will be performed to assess the post-IRA condition of the river bank and armoring system. This will include an inspection of the fencing and warning signs as well as the bank stabilization materials and completeness of the vegetative surface cover. The armoring materials themselves will also be inspected. Although not expected, follow-up actions will be performed to correct any deficiencies. These activities are described below.

Initially (within one month follow completion of the IRA) and semi-annually thereafter (until the Agencies agree that it is no longer needed), GE will perform a visual inspection to evaluate the condition of the vegetated cover on the bank and to ensure that the vegetation is growing as anticipated and providing the necessary erosion control. The semi-annual inspections will be performed during April and October of each year. If necessary, additional planting will be performed to replace dead or dying vegetation or to fill in any gaps resulting from less than adequate growth.

In addition, GE will perform a monitoring program consisting of quarterly visual inspections of the integrity of the fencing in this area, determination that warning signs remain in place, and a check of the condition of the sediment armoring materials. As necessary, follow-up activities will be performed to correct any deficiencies.

The results of the above inspections will be included in the appropriate reports submitted as part of GE's required monthly status reports to the Agencies. These reports will also note any follow-up activities performed by GE as a result of the inspections.

4.7 Evaluation of Potential Impacts of Proposed IRAs on River Hydraulics and Flood Storage Capacity

This section provides an evaluation of the potential for the proposed IRAs to result in adverse impacts to the existing Housatonic River hydraulics. As described below, several components of this assessment rely on basic hydraulic principles. To further support this evaluation, hydraulic modeling has also been performed to compare post-IRA conditions to existing conditions. The model utilized was the US Army Corps of Engineers' HEC-2 model which, given a specified flow rate, provides a means to determine a water surface elevation at any point along a stretch of river. The HEC-2 model has been previously developed and used for the hydraulic analysis of the Housatonic River as described in the report entitled *Addendum to MCP Interim Phase II Report/Current Assessment Summary for Housatonic River* (BBL, August 1992). The results of this hydraulic evaluation are further described below.

4.7.1 Evaluation Approach

During the identification and selection of potential IRAs, several evaluation criteria were identified, including the potential impacts to the existing hydraulics of the Housatonic River and the prevention of significant impacts on existing flood storage capacity. Once an alternative was selected, the potential impacts were further reviewed and addressed as discussed below.

From a design perspective, the approach taken to negate or minimize potential impacts was to provide a final installation that replicated, to the extent possible, the physical conditions of the river and riverbank area. Since the physical characteristics of these areas largely govern the river hydraulics, maintaining or providing similar conditions would result in similar river hydraulics.

The proposed bank IRA addresses only a relatively small area of the specific river reach. The geometry of the channel would change slightly because the bank would not be restored to original grade (to provide floodplain compensation as described herein). However, the area that would be impacted by the proposed measures would be restored to a slope and configuration similar to that currently present. The proposed sediment IRA addresses a larger area of the specific river reach, resulting in a change in the geometry of the channel because of an increase in the bed elevation. However, the armoring layer would be placed so as to conform to the existing channel slope and configuration.

An additional consideration would be the potential change in the frictional resistance of the bank or channel bottom due to the implementation of the IRAs. The frictional resistance for a river application is typically measured through the use of Manning's friction factor. As this factor increases, the flow capacity decreases. For a river application, an increased friction factor would lead to slower water velocities, a decrease in the flow capacity of a given river section, and possibly an increase in the elevation of the water profile. With respect to the river bank, the bank area would be restored with a vegetative cover that would closely match the existing conditions; therefore, changes to the physical configuration of the river reach with respect to changes in frictional resistance would not be significant. With respect to the channel bottom, published values for Manning's friction factor indicate values of 0.018 to 0.025 for natural channels and 0.023 for gravel channels (Lindeburg, 1989). Previous HEC-2 modeling efforts of existing river conditions have traditionally used a friction factor of 0.025 to represent the natural channel bottom. For this evaluation, it was assumed that the estimated friction factor of the channel bottom following implementation of the sediment IRA would be similar to that of a gravel channel; therefore, a value of 0.023 would be appropriate. Based on the above information, it appears that this estimated friction factor would be within the range of the values associated with the existing conditions.

In addition to potential impacts to the river hydraulics associated with the physical characteristics, it is possible that there could be changes to the available flood storage capacity. Implementation of the bank soil IRA will result in a positive impact on the flood storage capacity (i.e., increase) because materials would be excavated within the floodplain and would not be replaced to original grade. Implementation of the sediment IRA will result in a negative impact on the flood storage capacity (i.e., decrease) because the armor materials would be placed within the river without removal of sediments. However, this impact would be somewhat off-set by the increase in storage capacity resulting from implementation of the bank soil IRA.

To further evaluate the impacts on flood storage capacity, a hydraulic evaluation using the HEC-2 model was performed. To represent the range of possible effects, two flood scenarios were evaluated: a 10-year flood and a 100-year flood. The results of this evaluation for these two flood scenarios are presented below and on Figure 4-5.

4.7.2 Evaluation Results

A previously developed HEC-2 model of the Housatonic River was modified to represent the proposed IRAs. Specifically, 14 inches of elevation representing the armoring layer in the affected area was added to the river bottom in the model input, and the elevation of the north bank in the affected area was reduced 1 foot to simulate the net effects of bank excavation. The extent of the armor layer was from just upstream of Building 68 to just upstream of the footbridge (Figure 2-1), while the extent of the bank excavation was from the upstream end of Building 68 to approximately 165 feet downstream, in the immediate vicinity of Building 68 (Figure 2-1). To further refine the model in this river reach, additional cross-sections were introduced between existing cross-sections from the previous model and checked against surveyed elevations. Manning's friction factor, previously set at 0.025 in the channel, was not changed.

Two model runs were performed, each at various flow rates. For the first modified model run, the additional cross-sectional data were added, but the model was not adjusted to reflect the implementation of the IRAs. The intent of this first run was to reflect the change in hydraulics based solely on the input of additional cross-sectional data and thus to provide a baseline against which the effects of the IRA implementation could be evaluated. For the second modified model run, the appropriate cross-sections were modified to simulate the implementation of the IRAs.

The results of this modeling effort show very little impact on surface water elevations due to the proposed IRAs. For a 10-year flood event, the net effect of adding 14 inches of elevation to the river bottom was predicted to cause a maximum increase of surface water elevation of approximately 2.6 inches compared to approximately 11.7 feet of water depth under baseline 10-year flood conditions. This estimated 2.6-inch rise in water surface elevation is confined within the river channel, and represents a peak water surface elevation change located just upstream of the armored area. This water surface elevation change decreases rapidly downstream through the armored area, and decreases gradually upstream, for a distance of approximately 2 miles (Figure 4-5).

The relative increase of flood elevation becomes less with increasing flow. For the 100-year flow, when the banks have overflowed, the calculated increase in flood elevation as a result of the IRAs is negligible (e.g., less than 0.5 inch), compared to approximately 20 feet water depth under baseline 100-year flood conditions. In fact, this calculated difference is not statistically significant with the accuracy capabilities of the model (i.e., less than 0.5

inch changes in elevation may be due to the calculation procedures of the model rather than actual expected differences in the field).

The results of the HEC-2 model were also evaluated with respect to changes in river water velocities due to the implementation of the IRAs. Similar to the water surface profile, the effect was greater at a 10-year flood flow, in which it was predicted to cause a maximum increase of approximately 0.7 feet per second, compared to a river flow velocity of approximately 6.3 feet per second under baseline 10-year flood conditions. This estimated 0.7 feet per second increase in velocity occurs near the downstream edge of the armored area and then decreases rapidly to return to "normal" conditions once outside of the armored area. The relative increase in velocity and affected distance downstream also becomes less with increasing flow. For the 100-year flow, the calculated increase in velocity as a result of implementation of the IRAs is negligible (e.g., approximately 0.2 feet per second) compared to a velocity of approximately 5.4 feet per second under baseline 100-year flood conditions. Further, the effect on velocity in the 100-year event is essentially contained within the armored area. It is significant to note that even with the velocity increases, the modeled post-IRA velocities are within the range of the maximum velocity predicted by the model for this area under baseline conditions (i.e., 6.7 feet per second under baseline conditions for the 25-year flood).

4.7.3 Hydraulics and Flood Storage Capacity Summary

The results of the evaluation presented in this section indicate that implementation of the proposed IRAs will not significantly impact the existing hydraulics of the Housatonic River or the flood storage capacity. This conclusion is based on the limited physical disturbance related to the proposed IRAs (relative to the overall river reach), as well as the ability of the proposed measures to replicate the existing conditions that govern river hydraulics (i.e., physical configuration and frictional resistance). In addition, implementation of the proposed IRAs will result in only a minimal net decrease in flood storage capacity. HEC-2 modeling efforts have shown that under 10-year flood conditions, a maximum increase of surface water elevation of approximately 2.6 inches would occur (and would be confined within the channel), and that under 100-year flood flows, the elevation change becomes negligible (i.e., less than 0.5 inch increase compared to a predicted 20-foot water depth). The HEC-2 modeling efforts have also shown minimal effects on velocity (i.e., approximately 0.7 feet per second maximum increase under 10-year flood flows and a negligible increase (i.e., approximately 0.2 feet per second) under 100-year flood flows. Further, the modeling efforts have shown that these effects are within the range of flows expected for this area.

4.8 Evaluation of Impacts of Proposed IRAs on Human and Ecological Exposures and on Chemical Releases to River

This section considers the impacts of the proposed IRAs in terms of achieving the IRA objectives of: (a) preventing exposure of human and ecological receptors to the PCB-containing soils and sediments which the Agencies have found to pose an imminent health and environmental hazard; and (b) preventing the release or transport of PCBs (and other constituents) from the affected soil and sediment areas to and within the Housatonic River.

4.8.1 Impacts on Exposure of Human and Ecological Receptors

As discussed previously in Section 4.2, both the affected bank area and the affected sediment area have very limited public access due to the fences and other factors. Nevertheless, the Agencies have determined that they pose an imminent hazard to human health based on the premise that a trespasser would come into contact with the surface soils and sediments in these areas (i.e., the top six inches). As noted above, GE does not accept the assumptions on which that determination was based. However, even if there were such an imminent hazard, the IRAs proposed herein would abate that hazard. For the bank soils, two feet of affected materials will be removed and an engineered vegetative cover of 12-inch thickness will be installed. These activities will prevent exposure to humans via incidental ingestion of or dermal contact with the PCB-containing surface soils deemed to pose an imminent hazard. The affected sediments will be covered by an armoring layer of at least 14 inches thick on top of a geotextile. This will prevent trespassers from contacting and being exposed via the same routes to the PCB-containing sediments asserted to pose an imminent hazard. Any breach in these cover systems would be detected and remedied as part of the inspection and maintenance programs.

As also noted in Section 4.2, there is very limited potential for ecological receptors to be present for any significant period of time in the affected bank and sediment areas. Nevertheless, the Agencies have determined that those areas pose a potential imminent hazard to ecological receptors based on the premise that birds and fish would forage those areas and thereby be exposed to the elevated levels of PCBs in the surface soils or sediments. Again, although GE does not agree with the Agencies' conclusion, the proposed IRAs would abate any such imminent hazard by removing the top 2 feet of affected bank soils and covering the remainder with a 12-inch vegetative cover, and by covering the affected sediments with a 14-inch armoring system. These systems will prevent the ecological receptors from being exposed to the PCB-containing soils or sediments of concern via soil/sediment ingestion, dermal contact, or food chain routes (even for receptors that consume burrowing organisms).

4.8.2 Impacts on Contaminant Releases and Transport

As noted previously and shown in Table 3-1, the available water column PCB sampling data from the Housatonic River upstream and downstream of the Building 68 area do not indicate that this area is making a significant overall contribution of PCBs to the river water. However, even if this area were a continuing source of releases or transport of PCBs to or within the Housatonic River, the proposed IRAs would effectively control such continuing releases or transport. The excavated bank area will be restored and covered with an engineered vegetative layer. That layer will be resistant to the erosional forces of the river and will prevent precipitation- or wind-induced erosion of the affected bank soils to the river. For the affected sediment area, as discussed in Appendix C, an armoring system has been designed to include a 6-inch isolation layer of sandy silt and an 8-inch erosion protection layer of stones. As shown in Appendix C-1, the isolation layer has been designed to prevent PCB "breakthrough" (due to PCB transport via advection/dispersion) for over 700 years, and thus will prevent the migration of PCBs upward through it, either from the underlying sediments or from PCBs that may migrate from groundwater in East Street Area 2 into areas below the sediment armoring system. As shown in Appendix C-2, the 8-inch erosion protection layer has been designed to be resistant to the erosional effects of the river (i.e., designed for the 100-year flood) and thus will prevent the uncovering, resuspension, and transport of the underlying sediments containing the PCB levels of concern. Moreover, the regular inspections and maintenance of these systems will ensure that they are not compromised by unforeseen events.

With respect to other constituents, as discussed in Section 3.1, the existing Appendix IX+3 water column data from the river do not indicate any significant contribution of such constituents from this area to the river. As shown in Tables 4-7 and 4-8 of the Phase II/RFI Report on the river (BBL, January 1996), such constituents either were not detected downstream of this area or do not show any appreciable increase in concentration from upstream to downstream of this area. Nevertheless, to the extent that such other constituents are present in the bank and sediment areas to be addressed by the proposed IRAs, the removal and containment activities proposed herein will further reduce, if not prevent, the possibility of releases of such constituents from those areas to and within the river, for the same reasons given for PCBs.

5. Required Approvals

The stretch of the Housatonic River that will be disrupted as part of the IRA remediation program contains several types of resource areas that are subject to the jurisdiction of local, state, and federal authorities. As such, work in these areas requires approval prior to implementation of remedial activities. These resource areas, as defined in the Massachusetts Wetlands Protection Act, include "bank, land under waterway, and land subject to flooding." The IRA activities proposed in Section 4 would affect 165 linear feet of bank and approximately 20,000 square feet of land under waterway and land subject to flooding. Based on the proposed activities to be conducted within these resource areas, the following approvals would be required:

- **MDEP Approval** - A Notice of Intent (NOI) under the Massachusetts Wetlands Protection Act, G.L. c. 131, §40, will be required to be submitted to the MDEP. This application will require the preparation and submission of a work plan detailing the proposed remedial activities.

- **Pittsfield Conservation Commission (PCC) Approval** - Concurrently with the submission of the NOI to the MDEP, the Massachusetts Wetlands Protection Act, G.L. c. 131, §40, requires the submission of the NOI to the PCC. Within 21 days of the receipt of the NOI, the PCC will schedule a public hearing regarding the proposed activities presented in the NOI. Within 21 days of closing of the public hearing, the PCC will either issue an Order of Conditions regulating the proposed remedial activities or reject the application.

- **Waterways License** - Under MDEP Division of Waterways Chapter 91 License Requirements, a Waterways License will potentially be required for the placement of fill material into the land under waterway. The MDEP will notify the applicant as to whether a Chapter 91 license is required within 21 days of receipt of the NOI. If a waterways license is required, a separate waterways application with supporting documentation will be required by the MDEP.

- **Water Quality Certification** - Pursuant to Massachusetts G.L.c.21 and 314 CMR 9.00, a Section 401 Water Quality Certification for Fill and Excavation Projects in Waters and Wetlands also will be required by the MDEP for the placement of fill material into the land under waterway. This project will require a Minor Project (BRP WW 08) application because less than 5,000 cubic yards of fill material will be placed in the resource area.

- **US Army Corps of Engineers Approval** - The proposed remedial actions are characteristic of a Category II inland waters and wetlands project. A Category II project requires screening by the US Army Corps of Engineers for a case-by-case determination. The NOI application also serves as a US Army Corps of Engineers permit application. The US Army Corps of Engineers will notify the applicant within 15 days of the receipt of the NOI as to whether a permit is required under Section 404 of the Clean Water Act. If required, the Corps will utilize Part V of the NOI for the issuance of the permit.

The time required to obtain these approvals is undefined and dependent upon the respective approval authorities.

6. Schedule

Upon the Agencies' approval of this plan, GE will immediately initiate the acquisition of the required approvals outlined in Section 5. Immediately upon obtaining all such approvals, GE will initiate the IRAs as approved by the Agencies, subject to winter weather constraints. It is anticipated that, once initiated, the IRAs will take approximately 6 to 8 weeks to complete, again assuming no significant delays due to weather constraints. Within 60 days of completing the approved IRAs, GE will prepare and submit a summary report to the Agencies.

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Tables

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

TABLE 2-1

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF SOILS/SEDIMENT PCB DATA
(Results Presented in Dry-Weight Parts Per Million, ppm)

Location ID:	Depth	Date Sampled	Aroclor 1242	Aroclor 1254	Aroclor 1260	Total Aroclors
Riverbank Soil						
68S-1	0-0.5 ft	03/18/96	ND(2.1)	ND(2.1)	1,700	1,700
	0.5-1 ft	03/18/96	ND(1.9)	ND(1.9)	790	790
	1-1.5 ft	03/18/96	ND(0.76)	ND(0.76)	150	150
	1.5-2 ft	03/18/96	ND(0.78)	ND(0.78)	370	370
	2-4 ft	08/07/96	ND(14.8)	160	107	267
	4-6 ft	08/07/96	ND(1.24)	7.36	4.75	12.1
	6-8 ft	08/07/96	ND(1.26)	14.2	7.63	21.8
	8-10 ft	08/07/96	ND(224)	ND(224)	4,170	4,170
	10-12 ft	08/07/96	ND(22)	ND(22)	296	296
68S-2	0-0.5 ft	03/18/96	ND(2.2)	ND(2.2)	2,200	2,200
	0.5-1 ft	03/18/96	ND(4.4)	ND(4.4)	3,800	3,800
	1-1.5 ft	03/18/96	ND(3.7)	ND(3.7)	5,500	5,500
	1.5-2 ft	03/18/96	ND(3.7)	ND(3.7)	4,800 P	4,800
	2-4 ft	08/07/96	ND(2,650)	ND(2,650)	36,200	36,200
	4-6 ft	08/07/96	ND(49.9)	ND(49.9)	376	376
	6-8 ft	08/07/96	ND(124)	ND(124)	2,420	2,420
	8-10 ft	08/07/96	NR	NR	NR	NR
	10-12 ft	08/07/96	ND(132)	ND(132)	1,690	1,690
68S-3	0-0.5 ft	03/18/96	ND(2.0)	ND(2.0)	730	730
	0.5-1 ft	03/18/96	ND(3.9)	ND(3.9)	4,300	4,300
	1-1.5 ft	03/18/96	ND(2.0)	ND(2.0)	1,800	1,800
	1.5-2 ft	03/18/96	ND(4.0)	ND(4.0)	5,900	5,900
	2-4 ft	08/07/96	ND(6,290)[ND(11,400)]	ND(6,290)[ND(11,400)]	76600[127,000]	76600[127,000]
	4-6 ft	08/07/96	ND(479)	ND(479)	4,830	4,830
	6-8 ft	08/07/96	ND(988)	ND(988)	13,600	13,600
	8-10 ft	08/07/96	ND(5.55)	ND(5.55)	42.4	42.4
68S-4	0-0.5 ft	03/18/96	ND(37)	ND(37)	5,500	5,500
	0.5-1 ft	03/18/96	ND(38)	ND(38)	13,000	13,000
	1-1.5 ft	03/18/96	ND(19)[ND(38)]	ND(19)[ND(38)]	5,500[9,600]	5,500[9,600]
	1.5-2 ft	03/18/96	ND(38)	ND(38)	37,000	37,000
	2-4 ft	08/08/96	ND(1,190)	ND(1,190)	15,300	15,300
	4-6 ft	08/08/96	ND(2,410)	ND(2,410)	32,300	32,300
	6-8 ft	08/08/96	ND(10,900)	ND(10,900)	102,000	102,000
	8-10 ft	08/08/96	ND(607)	ND(607)	7,150	7,150
3-6C-EB-1	0-0.5 ft	05/17/96	ND(4.84)	44	34	77
3-6C-EB-2	0-0.5 ft	05/17/96	ND(7.85)	77	44	121
3-6C-EB-3	0-2 ft	08/07/96	ND(18.6)	174	152	326
	2-4 ft	08/07/96	ND(5.3)	61.5	35.5	97
	4-6 ft	08/07/96	ND(19)	198	128	326
	6-8 ft	08/07/96	ND(8.22)	63.9	59.4	123
	8-10 ft	08/07/96	ND(2.35)	9.76	15.2	25
3-6C-EB-4	0-2 ft	08/08/96	ND(19.9)	27.3	80.8	108
	2-4 ft	08/08/96	ND(1,670)	ND(1,670)	20,100	20,100
	4-6 ft	08/08/96	NR	NR	NR	NR
	6-8 ft	08/08/96	ND(74.6)	120	1,300	1,420
3-6C-EB-5	0-2 ft	08/08/96	ND(12.5)	33.9	89.4	123
	2-4 ft	08/08/96	ND(620)[ND(946)]	ND(620)[ND(946)]	6,940[11,700]	6,940[11,700]
	4-6 ft	08/08/96	NR	NR	NR	NR
	6-8 ft	08/08/96	ND(235)	ND(235)	2,680	2,680

(See Notes on Page 6 of 6)

TABLE 2-1

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF SOILS/SEDIMENT PCB DATA
(Results Presented in Dry-Weight Parts Per Million, ppm)

Location ID:	Depth	Date Sampled	Aroclor 1242	Aroclor 1254	Aroclor 1260	Total Aroclors
3-6C-EB-6	0-2 ft	08/08/96	ND(27.2)	63.4	473	536
	2-4 ft	08/08/96	ND(19.6)	46.3	260	306
	4-6 ft	08/08/96	ND(3.73)	6.13	ND(3.73)	6.13
	6-8 ft	08/08/96	ND(2.7)	ND(2.7)	16.8	16.8
3-6C-EB-7	0-2 ft	08/07/96	ND(5.03)	41.6	54.9	96.5
	2-4 ft	08/07/96	ND(6.26)	79.7	56.1	136
	4-6 ft	08/07/96	ND(4.76)	68	32.3	100
	6-8 ft	08/07/96	ND(2.89)	42.6	32.1	74.7
3-6C-EB-8	0-0.5 ft	09/04/96	ND(1.18)	2.56	6.69	9.25
	0.5-2 ft	09/04/96	ND(3.52)	8.59	40.9	49.5
	2-4 ft	09/04/96	ND(6.15)	47.2	37.2	84.4
	4-6 ft	09/04/96	ND(10)	103	64	167
	6-8 ft	09/04/96	ND(0.169)	0.184	0.549	0.733
3-6C-EB-9	0-0.5 ft	09/04/96	ND(0.486)	2.43	6.17	8.6
	0.5-2 ft	09/04/96	ND(3.65)	9.68	33.1	42.8
	2-4 ft	09/04/96	ND(14)	95.4	95.2	191
	4-6 ft	09/04/96	ND(1.98)	10.8	11.6	22.4
	6-8 ft	09/04/96	ND(0.708)	1.41	2.61	4.02
3-6C-EB-10	0-0.5 ft	09/04/96	ND(8.66)	23.8	122	146
	0.5-2 ft	09/04/96	ND(6.08)	14.3	56.4	70.7
	2-4 ft	09/04/96	ND(8.53)	66.6	66.9	134
	4-6 ft	09/04/96	ND(2.1)	4.74	18	22.7
	6-8 ft	09/04/96	ND(0.456)[ND(6.5)]	3.12[60.5]	5.44[55.1]	8.56[116]
3-6C-EB-11	0-0.5 ft	09/04/96	ND(5.86)	22.2	55.6	77.8
	0.5-2 ft	09/04/96	ND(11.6)	47.3	157	204
	2-4 ft	09/04/96	ND(19.4)	97	237	334
	4-6 ft	09/04/96	NR	NR	NR	NR
	6-8 ft	09/04/96	ND(6.42)	23.4	50.8	74.2
	8-10 ft	09/04/96	ND(7.26)	21.5	53.6	75.1
3-6C-EB-12	0-0.5 ft	09/04/96	ND(3.42)	10.2	35	45.2
	0.5-2 ft	09/04/96	ND(4.48)	18.5	63.1	81.6
	2-4 ft	09/04/96	ND(8.83)	76.4	91.8	168
	4-6 ft	09/04/96	ND(13.3)	161	126	287
	6-8 ft	09/04/96	ND(6.71)	56.4	55.6	112
3-6C-EB-13	0.7-1.9 ft**	09/05/96	ND(22.2)	339	90.7	430
	1.9-3.8 ft**	09/05/96	ND(37)	753	ND(37)	753
	3.8-5.6 ft**	09/05/96	ND(3.88)	21.9	17.9	39.8
	5.6-7.5 ft**	09/05/96	ND(5.36)[ND(1.83)]	73.6[24.9]	35.7[15.3]	109[40.2]
	7.5-9.4 ft**	09/05/96	ND(0.644)	4.4	1.62	6.02
	9.4-11.3 ft**	09/05/96	ND(0.128)	0.18	0.382	0.562
	11.3-13.2 ft**	09/05/96	ND(66.6)	ND(66.6)	1,130	1,130
	13.2-15.0 ft**	09/05/96	ND(40.7)	ND(40.7)	120	120
	15.0-16.9 ft**	09/05/96	ND(0.396)	2.04	3.5	5.54
	16.9-18.8 ft**	09/05/96	ND(251)	ND(251)	3,820	3,820
	18.8-20.7 ft**	09/05/96	ND(651)	ND(651)	8,480	8,480
	20.7-22.6 ft**	09/05/96	ND(1,120)	ND(1,120)	19,500	19,500
	22.6-24.4 ft**	09/05/96	ND(243)	ND(243)	3,510	3,510
	24.4-26.3 ft**	09/05/96	ND(12.4)	ND(12.4)	259	259
	26.3-28.2 ft**	09/05/96	ND(11.9)	ND(11.9)	183	183
	28.2-30.1 ft**	09/05/96	ND(3.56)	ND(3.56)	66.8	66.8
	30.1-32.0 ft**	09/05/96	ND(1.76)	ND(1.76)	30.4	30.4

(See Notes on Page 6 of 6)

TABLE 2-1

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF SOILS/SEDIMENT PCB DATA
(Results Presented in Dry-Weight Parts Per Million, ppm)

Location ID:	Depth	Date Sampled	Aroclor 1242	Aroclor 1254	Aroclor 1260	Total Aroclors
3-6C-EB-13 (cont'd)	32.0-33.8 ft**	09/05/96	ND(6.91)[1.19]	ND(6.91)[1.19]	107[25.6]	107[25.6]
	33.8-35.7 ft**	09/05/96	ND(0.587)	ND(0.587)	7.53	7.53
River Sediment						
3-6C-1	0-0.5 in	05/14/96	0.386*	0.456	1.15	1.99
	0.5-6 in	05/14/96	ND(0.816)	1.64	11	12.6
3-6C-2	0-0.5 in	05/17/96	ND(537)	1,040	7,750	8,790
	0.5-6 in	05/17/96	ND(224)	411	2,950	3,360
	6-12 in	08/09/96	ND(270)	ND(270)	3,720	3,720
	12-18 in	08/09/96	ND(2.6)	ND(2.6)	27.2	27.2
	18-24 in	08/09/96	ND(2.01)	ND(2.01)	22.7	22.7
	24-30 in	08/09/96	ND(31.6)	ND(31.6)	473	473
	30-38.4 in	08/09/96	ND(235)	ND(235)	2,620	2,620
3-6C-3	0-0.5 in	05/17/96	ND(639)	1,600	8,710	10,300
	0.5-6 in	05/17/96	ND(1,100)	1,930	13,700	15,600
	6-12 in	08/09/96	ND(122)[ND(245)]	ND(122)[ND(245)]	2,430[2,160]	2,430[2,160]
	12-18 in	08/09/96	ND(40.4)[ND(205)]	ND(40.4)[409]	576[2,850]	576[3,260]
	18-24 in	08/09/96	ND(104)	ND(104)	2,010	2,010
	24-30 in	08/09/96	ND(63.8)	ND(63.8)	1,030	1,030
	30-36 in	08/09/96	ND(304)	ND(304)	4,340	4,340
	36-40.8 in	08/09/96	ND(75)	ND(75)	1,170	1,170
3-6C-4	0-0.5 in	05/17/96	ND(222)	330	3,180	3,510
	0.5-6 in	05/17/96	ND(214)	275	2,540	2,820
	6-12 in	08/09/96	2.61*	4.1	9.04	15.8
	12-18 in	08/09/96	ND(0.654)	1.47	4.54	6.01
	18-24 in	08/09/96	ND(0.804)	1.36	5.31	6.67
	24-30 in	08/09/96	ND(255)	506	3,700	4,210
3-6C-5	0-6 in	08/09/96	ND(1.31)	ND(1.31)	ND(1.31)	ND(1.31)
	6-12 in	08/09/96	ND(1.31)	ND(1.31)	ND(1.31)	ND(1.31)
	12-18 in	08/09/96	ND(1.42)	2.02	ND(1.42)	2.02
	18-24 in	08/09/96	ND(1.34)	ND(1.34)	ND(1.34)	ND(1.34)
	24-30 in	08/09/96	ND(0.126)	ND(0.126)	0.476 B	0.476
	30-36 in	08/09/96	ND(0.133)	ND(0.133)	ND(0.133)	ND(0.133)
	36-42 in	08/09/96	ND(0.132)	ND(0.132)	0.256 B	0.256
	42-48 in	08/09/96	ND(0.129)	ND(0.129)	ND(0.129)	ND(0.129)
	48-54 in	08/09/96	ND(0.128)	ND(0.128)	0.212 B	0.212
	54-63.6 in	08/09/96	ND(0.133)	ND(0.133)	0.178 B	0.178
3-6C-6	0-6 in	08/09/96	ND(0.189)[ND(1.34)]	0.382[ND(1.34)]	2.19[ND(1.34)]	2.57[ND(1.34)]
	6-12 in	08/09/96	ND(0.549)	1.34	8.42	9.76
	12-18 in	08/09/96	ND(4.7)	ND(4.7)	75.5	75.5
	18-24 in	08/09/96	ND(177)	ND(177)	2,320	2,320
	24-30 in	08/09/96	ND(13.1)	ND(13.1)	147	147
	30-36 in	08/09/96	ND(2.61)	ND(2.61)	58.2	58.2
3-6C-7	0-6 in	08/09/96	ND(6.52)	ND(6.52)	101	101
	6-12 in	08/09/96	ND(260)	ND(260)	3,690	3,690
	12-18 in	08/09/96	ND(258)	ND(258)	2,880	2,880
	18-24 in	08/09/96	ND(542)	ND(542)	6,950	6,950
	24-30 in	08/09/96	ND(126)	ND(126)	1,570	1,570
	30-36 in	08/09/96	ND(50.3)	ND(50.3)	544	544
	36-42 in	08/09/96	ND(5,040)	ND(5,040)	54,000	54,000

(See Notes on Page 6 of 6)

TABLE 2-1

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF SOILS/SEDIMENT PCB DATA
(Results Presented in Dry-Weight Parts Per Million, ppm)

Location ID:	Depth	Date Sampled	Aroclor 1242	Aroclor 1254	Aroclor 1260	Total Aroclors
3-6C-7 (Cont'd)	42-45.6 in	08/09/96	ND(56.4)	ND(56.4)	839	839
3-6C-8	0-6 in	08/09/96	ND(5.71)	32	39	71
	6-12 in	08/09/96	ND(16)	44.4	151	195
	12-18 in	08/09/96	ND(17)	ND(17)	190	190
	18-24 in	08/09/96	ND(238)	ND(238)	3,910	3,910
	24-30 in	08/09/96	ND(240)	ND(240)	1,950	1,950
	30-36 in	08/09/96	ND(12.2)	ND(12.2)	105	105
	36-44.4 in	08/09/96	ND(1.24)	ND(1.24)	16.7	16.7
3-6C-9	0-6 in	08/09/96	ND(51.1)	138	514	652
	6-12 in	08/09/96	ND(41)	91.4	463	554
	12-18 in	08/09/96	1.77*	5.1	5.82	12.7
	18-24 in	08/09/96	2.01*	0.773	1.57	4.35
	24-30 in	08/09/96	ND(30.8)	40.6	395	436
	30-34.8 in	08/09/96	1.9*	1.93	1.2	5.03
3-6C-10	0-6 in	08/09/96	ND(364)	672	4,670	5,430
	6-12 in	08/09/96	ND(587)	ND(587)	6,590	6,590
	12-18 in	08/09/96	ND(321)	ND(321)	2,300	2,300
	18-24 in	08/09/96	ND(141)	ND(141)	1,640	1,640
	24-27.6 in	08/09/96	ND(1.2)	1.67	8.78	10.4
3-6C-11	0-6 in	08/09/96	ND(5.52)	89.4	44.4	134
	6-12 in	08/09/96	ND(5.46)	88	11.2	99.2
	12-18 in	08/09/96	ND(0.124)[ND(1.9)]	0.48[ND(1.9)]	0.939[ND(1.9)]	1.42[ND(1.9)]
	18-24 in	08/09/96	ND(1.23)	ND(1.23)	5.59	5.59
	24-27.6 in	08/09/96	ND(18.9)	40.1	245	285
3-6C-12	0-6 in	08/09/96	ND(0.196)	ND(0.196)	0.666 B	0.666
	6-12 in	08/09/96	6.94*	94	31.9 B	133
	12-18 in	08/09/96	53.5*	543	93.2 B	690
	18-24 in	08/09/96	9.03*	91.3	18.8 B	119
	24-30 in	08/09/96	0.273*	2.24	1.98 B	4.49
	30-36 in	08/09/96	ND(0.125)	ND(0.125)	ND(0.125)	ND(0.125)
	36-42 in	08/09/96	ND(0.123)	ND(0.123)	ND(0.123)	ND(0.123)
	42-48 in	08/09/96	ND(0.13)	ND(0.13)	ND(0.13)	ND(0.13)
	48-54 in	08/09/96	ND(0.124)	ND(0.124)	ND(0.124)	ND(0.124)
	54-62.4 in	08/09/96	ND(0.128)	ND(0.128)	0.25 B	0.25
3-6C-13	0-6 in	08/29/96	ND(0.114)	ND(0.114)	0.271	0.271
	6-12 in	08/29/96	ND((0.119)	ND(0.119)	0.12	0.12
	12-18 in	08/29/96	ND(0.12)	0.329	0.94	1.27
	18-24 in	08/29/96	ND(0.128)	ND(0.128)	ND(0.128)	ND(0.128)
	24-30 in	08/29/96	ND(0.129)	ND(0.129)	ND(0.129)	ND(0.129)
	30-36 in	08/29/96	ND(0.115)	ND(0.115)	ND(0.115)	ND(0.115)
	36-42 in	08/29/96	ND(0.124)	ND(0.124)	ND(0.124)	ND(0.124)
	42-48 in	08/29/96	ND(0.126)	ND(0.126)	ND(0.126)	ND(0.126)
	48-54 in	08/29/96	ND(0.126)	ND(0.126)	ND(0.126)	ND(0.126)
	54-58 in	08/29/96	ND(0.123)	ND(0.123)	ND(0.123)	ND(0.123)
3-6C-15	0-6 in	08/29/96	ND(1.3)	3.13	24.7	27.8
	6-12 in	08/29/96	103*	152	35.5	290
	12-18 in	08/29/96	ND(16.3)[ND(15.7)]	173[143]	49.4[37.8]	222[181]
	18-24 in	08/29/96	ND(2.67)	26.7	20.4	47.1
	24-30 in	08/29/96	ND(0.13)	ND(0.13)	ND(0.13)	ND(0.13)
	30-36 in	08/29/96	ND(0.132)	ND(0.132)	ND(0.132)	ND(0.132)
	36-39 in	08/29/96	ND(0.132)	ND(0.132)	ND(0.132)	ND(0.132)

(See Notes on Page 6 of 6)

TABLE 2-1

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF SOILS/SEDIMENT PCB DATA
(Results Presented in Dry-Weight Parts Per Million, ppm)

Location ID:	Depth	Date Sampled	Aroclor 1242	Aroclor 1254	Aroclor 1260	Total Aroclors
3-6C-17	0-6 in	08/29/96	ND(0.126)	ND(0.126)	ND(0.126)	ND(0.126)
	6-12 in	08/29/96	ND(0.667)	9.66	2.88	12.5
	12-18 in	08/29/96	ND(5.82)	53.5	22.1	75.6
	18-25 in	08/29/96	ND(1.92)	20.4	10.5	30.9
3-6C-18	0-6 in	08/30/96	ND(1.31)	13.4	13.6 B	27
	6-12 in	08/30/96	ND(1.49)	15.2	16.2 B	31.4
	12-18 in	08/30/96	ND(4.39)	69.1	25.5 B	94.6
	18-24 in	08/30/96	ND(0.664)	0.919	ND(0.664)	0.919
3-6C-19	0-6 in	08/29/96	ND(1,190)	2,830	17,400	20,200
	6-12 in	08/29/96	ND(26.2)	198	237	435
	12-18 in	08/29/96	ND(15.7)	113	56	169
	18-24 in	08/29/96	ND(12.6)	28.6	88.7	117
	24-30 in	08/29/96	ND(1.24)	2.25	11.5	13.8
3-6C-20	0-6 in	08/30/96	ND(6.97)	108	32.4 B	140
	6-12 in	08/30/96	21.3*	150	38.4 B	210
	12-19 in	08/30/96	ND(0.51)	0.736	ND(0.51)	0.736
3-6C-21	0-6 in	08/29/96	ND(26.5)	73.5	450	524
	6-12 in	08/29/96	ND(19.2)[ND(15.9)]	133[157]	38.4[49.6]	171[207]
	12-18 in	08/29/96	ND(5.66)	32.5	15.1	47.6
	18-22 in	08/29/96	ND(0.257)	0.849	1.61	2.46
3-6C-22	0-6 in	08/30/96	ND(1.26)	2.35	14.1 B	16.4
	6-12 in	08/30/96	2.97*	7.39	1.98 B	12.3
3-6C-23	0-6 in	08/29/96	ND(0.637)	1.03	7.22	8.25
3-6C-24	0-6 in	08/29/96	ND(996)	ND(996)	14,300	14,300
3-6C-25	0-5 in	09/03/96	ND(54.6)	127	874 B	1000
3-6C-26	0-6 in	09/03/96	ND(7.27)	ND(7.27)	100 B	100
3-6C-27	0-5 in	09/03/96	ND(1.24)	ND(1.24)	20.1	20.1
3-6C-28	0-6 in	09/03/96	ND(538)	1,170	9,300 B	10,500
3-6C-29	0-6 in	08/29/96	ND(36.2)	493	149	642
	6-12 in	08/29/96	ND(0.194)	0.975	0.406	1.38
	12-14 in	08/29/96	0.946*	2.2	3.04	6.19
3-6C-30	0-6 in	09/03/96	ND(2.21)	4.44	46.1 B	50.5
	6-8 in	09/03/96	3.65*	4.15	4.78*	12.6
3-6C-31	0-4 in	09/03/96	ND(212)	ND(212)	2,840 B	2,840
3-6C-32	0-6 in	09/04/96	ND(1.23)	8.28	12.8	21.1
3-6C-33	0-7.2 in	09/26/96	ND(1.62)	6.79	23.5	30.3
3-6C-35	0-8.4 in	09/26/96	ND(1.23)	ND(1.23)	4.54	4.54
3-6C-36	0-6 in	09/26/96	ND(350)	ND(350)	7,230	7,230
	6-12 in	09/26/96	ND(771)	ND(771)	15,300	15,300
3-6C-37	0-8.4 in	09/26/96	ND(124)	ND(124)	2,110	2,110
3-6C-38	0-8.4 in	09/26/96	ND(2.67)	ND(2.67)	ND(2.67)	ND(2.67)
3-6C-39	0-6 in	09/26/96	ND(2.84)	5.32	23	28.3
	6-13.2 in	09/26/96	ND(18.6)	57.7	358	416
3-6C-40	0-6 in	09/26/96	ND(3.01)	24.7	23.8	48.5
	6-13.2 in	09/26/96	ND(3.01)	24.4	13.7	38.1
3-6C-41	0-6 in	09/26/96	ND(0.133)	ND(0.133)	1.35	1.35
	6-13.2 in	09/26/96	ND(398)	ND(398)	7,720	7,720

(See Notes on Page 6 of 6)

TABLE 2-1

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF SOILS/SEDIMENT PCB DATA
(Results Presented in Dry-Weight Parts Per Million, ppm)

Location ID:	Depth	Date Sampled	Aroclor 1242	Aroclor 1254	Aroclor 1260	Total Aroclors
3-6C-42	0-6 in	09/28/96	ND(12.5)	17.8	129	147
	6-12 in	09/28/96	ND(12)	70.4	75.8	146
	12-18 in	09/28/96	1.56*	7.08	2.31	11
3-6C-43	0-6 in	09/28/96	ND(6.7)	25.6	36.1	61.7
	6-12 in	09/28/96	ND(10)	59.9	48.1	108
	12-16.8 in	09/28/96	ND(2.84)	26.8	12.1	38.9
3-6C-44	0-6 in	09/28/96	ND(0.128)	0.236	1.47	1.71

NOTES:

1. Samples were collected by Blasland, Bouck & Lee, Inc., and submitted to Northeast Analytical, Inc. , or CompuChem Environmental Corporation for PCB analysis. Only those Aroclors detected in at least one sample are presented.
2. ND(0.32) - Compound was analyzed for, but not detected. The number in parenthesis is the detection limit.
3. NR - No sample recovery.
4. NA - Not analyzed.
5. [ ] - Field duplicate analysis.
6. * - Aroclor 1242 is being used to report an altered PCB pattern exibited by the sample. Actual Aroclor 1242 is not present in the sample, but is reported to more accurately quantify PCB present in the sample that has undergone environmental alteration.
7. P - Indicates that the percent difference between the results from the two analytical columns is greater than 25%.
8. B - Indicates an estimated value. The analyte was detected in the associated blank at a level exceeding the Practical Quantitation Limit (PQL).
9. Held - Sample archived for potential future PCB analysis.
10. TBA - Data not yet available.
11. ** - Represents depth penetrated beneath floor of building 68, adjusted for 20 degree angle for boring installation.

TABLE 2-2

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF RIVERBANK SOIL PHOTOIONIZATION DETECTOR (PID) RESULTS

Location ID	Depth (ft)	Date Sampled	PID Reading
68S-1	0-2	08/07/96	NS
	2-4	08/07/96	0.7
	4-6	08/07/96	3.1
	6-8	08/07/96	2.7
	8-10	08/07/96	2.9
	10-12	08/07/96	31.4
68S-2	0-2	08/07/96	NS
	2-4	08/07/96	6.8
	4-6	08/07/96	3.4
	6-8	08/07/96	9.1
	8-10	08/07/96	NR
	10-12	08/07/96	7.8
68S-3	0-2	08/07/96	NS
	2-4	08/07/96	6.3
	4-6	08/07/96	5.9
	6-8	08/07/96	661
	8-10	08/07/96	1175
68S-4	0-2	08/08/96	4.2
	2-4	08/08/96	88.5
	4-6	08/08/96	168
	6-8	08/08/96	82
	8-10	08/08/96	1015
3-6C-EB-3	0-2	08/07/96	3.2
	2-4	08/07/96	3.6
	4-6	08/07/96	3.4
	6-8	08/07/96	3.3
	8-10	08/07/96	6.7
3-6C-EB-4	0-2	08/08/96	NS
	2-4	08/08/96	NS
	4-6	08/08/96	NS
	6-8	08/08/96	992
3-6C-EB-5	0-2	08/08/96	8.2
	2-4	08/08/96	2.4
	4-6	08/08/96	NR
	6-8	08/08/96	36.6
3-6C-EB-6	0-2	08/08/96	1.0
	2-4	08/08/96	2.3
	4-6	08/08/96	9.1
	6-8	08/08/96	8.9
3-6C-EB-7	0-2	08/07/96	0.0
	2-4	08/07/96	2.0
	4-6	08/07/96	4.1
	6-8	08/07/96	0.5
3-6C-EB-8	0-2	09/04/96	NS
	2-4	09/04/96	0.0
	4-6	09/04/96	0.0
	6-8	09/04/96	0.0

(See Notes on Page 2 of 2)

TABLE 2-2

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF RIVERBANK SOIL PHOTOIONIZATION DETECTOR (PID) RESULTS

Location ID	Depth (ft)	Date Sampled	PID Reading
3-6C-EB-9	0-2	09/04/96	NS
	2-4	09/04/96	5.3
	4-6	09/04/96	67.4
	6-8	09/04/96	89.0
3-6C-EB-10	0-2	09/04/96	NS
	2-4	09/04/96	0.0
	4-6	09/04/96	34.8
3-6C-EB-11	0-2	09/04/96	NS
	2-4	09/04/96	2.2
	4-6	09/04/96	NR
	6-8	09/04/96	4.9
	8-10	09/04/96	0.0
3-6C-EB-12	0-2	09/04/96	NS
	2-4	09/04/96	0.0
	4-6	09/04/96	NS
	6-8	09/04/96	0.4
3-6C-EB-13	0.7 - 1.9**	09/05/96	0.0
	1.9 - 3.8**	09/05/96	0.0
	3.8 - 5.6**	09/05/96	0.0
	5.6 - 7.5**	09/05/96	2.0
	7.5 - 9.4**	09/05/96	20.0
	9.4 - 11.3**	09/05/96	0.0
	11.3 - 13.2**	09/05/96	7.0
	13.2 - 15.0**	09/05/96	3.0
	15.0 - 16.9**	09/05/96	3.0
	16.9 - 18.8**	09/05/96	60.0
	18.8 - 20.7**	09/05/96	60.0
	20.7 - 22.6**	09/05/96	68.0
	22.6 - 24.4**	09/05/96	38.0
	24.4 - 26.3**	09/05/96	28.0
	26.3 - 28.2**	09/05/96	24.0
	28.2 - 30.1**	09/05/96	18.0
	30.1 - 32.0**	09/05/96	22.0
	32.0 - 33.8**	09/05/96	10.0
	33.8 - 35.7**	09/05/96	3.1
3-6C-EB-14	12-14	09/12/96	0.0
	14-16	09/12/96	0.0
	16-18	09/12/96	0.0
	18-20	09/12/96	31.3
	20-22	09/12/96	0.0

Notes:

1. All readings were obtained by Blasland, Bouck & Lee, Inc., as part of boring installation.
2. These results are qualitative only and do not represent the absolute concentrations of any volatile organic compound in soil or sediment, whether the compound is natural or man-made.
3. NS - Not Sampled.
4. NR - No Sample Recovery.
5. **Represents depth penetrated beneath floor of building 68, adjusted for 20 degree angle for boring installation.

TABLE 2-3

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF SOILS/SEDIMENT APPENDIX IX+3 VOLATILES DATA
(Results Presented in Dry-Weight Parts Per Million, ppm)

Sample Media:	River Sediment		Riverbank Soil											
Location ID: Date Sampled:	3-6C-3(0'-3.4') 08/09/96	3-6C-4(0'-2.5') 08/09/96	68S-1(10'-12') 08/07/96	68S-3(6'-8') 08/07/96	68S-3(8'-10') 08/07/96	68S-4(0'-2') 08/08/96	68S-4(2'-4') 08/08/96	68S-4(4'-6') 08/08/96	68S-4(6'-8') 08/08/96	68S-4(8'-10') 08/08/96	3-6C-EB-4(6'-8') 08/08/96	3-6C-EB-5(6'-8') 08/08/96	3-6C-EB-9(4'-6') 09/04/96
Volatile Organics													
Methylene Chloride	0.037 JB	0.005 JB	0.006 JB	ND(7.4)	0.068 JB	0.005 JB	0.003 JB	0.003 JB	0.008 JB	ND(1.9)[0.006 JB]	0.007 JB	0.009 JB	0.016 JB
Acetone	0.32 JB	0.006 JB	0.006 JB	ND(6.9)	0.1 JB	0.008 JB	0.007 JB	0.006 JB	0.021 JB	ND(1.8)[0.027 JB]	0.048 JB	0.01 JB	0.066 JB
2-Butanone	ND(0.26)	ND(0.045)	ND(0.045)	ND(4.8)	ND(0.22)	ND(0.038)	ND(0.04)	ND(0.041)	ND(0.044)	ND(1.2)[0.006 J]	0.01 J	ND(0.054)	ND(0.047)
1,1,1-Trichloroethane	ND(0.15)	ND(0.026)	ND(0.026)	ND(6.9)	ND(0.13)	ND(0.022)	ND(0.023)	ND(0.023)	0.009 J	ND(1.8)[ND(0.026)]	ND(0.027)	ND(0.031)	ND(0.027)
1,2-Dichloropropane	ND(0.15)	ND(0.026)	ND(0.026)	ND(0.85)	ND(0.13)	ND(0.022)	ND(0.023)	ND(0.023)	ND(0.025)	ND(0.22)[ND(0.026)]	ND(0.027)	ND(0.031)	ND(0.027)
Trichloroethene	ND(0.15)	ND(0.026)	ND(0.026)	ND(4.3)	ND(0.13)	ND(0.022)	ND(0.023)	ND(0.023)	ND(0.025)	ND(1.1)[ND(0.026)]	0.008 J	ND(0.031)	ND(0.027)
Tetrachloroethene	ND(0.11)	ND(0.019)	ND(0.019)	ND(4.2)	ND(0.095)	ND(0.016)	ND(0.017)	ND(0.017)	0.002 J	ND(1.1)[ND(0.019)]	ND(0.021)	ND(0.023)	ND(0.02)
Toluene	ND(0.11)	ND(0.019)	ND(0.019)	ND(7.4)	ND(0.095)	ND(0.016)	0.006 J	0.002 J	ND(0.019)	ND(1.9)[ND(0.019)]	0.004 J	ND(0.023)	ND(0.02)
Chlorobenzene	0.57	ND(0.019)	0.029	99	0.15	ND(0.016)	ND(0.017)	0.004 J	ND(0.019)	23[2.7 DE]	0.15	0.024	0.004 J
Ethylbenzene	ND(0.11)	ND(0.019)	ND(0.019)	0.68 J	ND(0.095)	ND(0.016)	0.002 J	ND(0.017)	ND(0.019)	ND(1.4)[ND(0.019)]	ND(0.021)	ND(0.023)	ND(0.02)
Xylene(total)	ND(0.15)	ND(0.026)	ND(0.026)	1.2J	ND(0.13)	ND(0.022)	0.004 J	0.002 J	ND(0.025)	ND(2.9)[ND(0.026)]	ND(0.027)	ND(0.031)	ND(0.027)
Trichlorofluormethane	ND(0.15)	ND(0.026)	ND(0.026)	ND(11)	ND(0.13)	ND(0.022)	ND(0.023)	ND(0.023)	ND(0.025)	ND(2.9)[ND(0.026)]	ND(0.027)	ND(0.031)	ND(0.027)
Acetonitrile	ND(1.5)	ND(0.26)	ND(0.26)	ND(110)	ND(1.3)	ND(0.22)	ND(0.23)	0.019 J	ND(0.25)	ND(27)[0.032 J]	0.01 JB	ND(0.31)	0.02 JB
1,2-Dibromo-3-Chloropropan	ND(0.37)	ND(0.065)	ND(0.064)	ND(15)	ND(0.32)	ND(0.054)	ND(0.057)	ND(0.058)	0.001 JB	ND(3.8)[ND(0.064)]	ND(0.068)	ND(0.077)	ND(0.068)
Dichlorodifluoromethane	ND(0.074)	ND(0.013)	ND(0.013)	ND(0.0)	ND(0.063)	ND(0.011)	ND(0.011)	ND(0.012)	ND(0.013)	ND(0.0)[ND(0.013)]	ND(0.014)	ND(0.015)	ND(0.014)

Sample Media:	Riverbank Soil												
Location ID: Date Sampled:	3-6C-EB-9(6'-8') 09/04/96	3-6C-EB-10(4'-6') 09/04/96	3-6C-EB-10(6'-8') 09/04/96	3-6C-EB-13(7.5'-9.4')** 09/05/96	3-6C-EB-13(16.9'-18.8')** 09/05/96	3-6C-EB-13(18.8'-20.7')** 09/05/96	3-6C-EB-13(20.7'-22.6')** 09/05/96	3-6C-EB-13(22.6'-24.4')** 09/05/96	3-6C-EB-13(24.4'-26.3')** 09/05/96	3-6C-EB-13(26.3'-28.2')** 09/05/96	3-6C-EB-13(28.2'-30.1')** 09/05/96	3-6C-EB-13(30.1'-32.0')** 09/05/96	3-6C-EB-13(32.0'-33.8')** 09/05/96
Volatile Organics													
Methylene Chloride	0.012 JB	0.024 B	0.022 B[0.019 B]	0.013 JB	0.012 JB[0.015 JB]	0.014 JB	0.43 JB	0.01 JB	0.012 JB	0.008 JB	0.01 JB	0.012 JB	0.016 B
Acetone	0.048 JB	0.057 JB	0.046 JB[0.032 JB]	0.029 JB	0.031 JB[0.027 JB]	0.038 JB	ND(1.6)	0.02 JB	0.024 JB	0.019 JB	0.028 JB	0.029 JB	0.015 JB
2-Butanone	0.009 J	ND(0.047)	ND(0.048)[ND(0.045)]	ND(0.044)	ND(0.039)[ND(0.04)]	ND(0.042)	ND(1.1)	ND(0.041)	ND(0.04)	ND(0.039)	ND(0.039)	ND(0.038)	ND(0.038)
1,1,1-Trichloroethane	ND(0.027)	ND(0.027)	ND(0.027)[ND(0.026)]	ND(0.025)	ND(0.022)[ND(0.023)]	ND(0.024)	0.31 J	ND(0.023)	ND(0.023)	ND(0.022)	ND(0.022)	ND(0.022)	ND(0.022)
1,2-Dichloropropane	ND(0.027)	ND(0.027)	ND(0.027)[ND(0.026)]	ND(0.025)	ND(0.022)[ND(0.023)]	ND(0.024)	ND(0.2)	ND(0.023)	ND(0.023)	ND(0.022)	0.001 J	0.001 J	ND(0.022)
Trichloroethene	ND(0.027)	ND(0.027)	ND(0.027)[ND(0.026)]	ND(0.025)	ND(0.022)[ND(0.023)]	ND(0.024)	ND(1.0)	ND(0.023)	ND(0.023)	ND(0.022)	ND(0.022)	ND(0.022)	ND(0.022)
Tetrachloroethene	ND(0.02)	ND(0.02)	ND(0.021)[ND(0.019)]	ND(0.019)	ND(0.017)[ND(0.017)]	ND(0.018)	ND(0.98)	ND(0.017)	ND(0.017)	ND(0.017)	ND(0.017)	ND(0.016)	ND(0.016)
Toluene	ND(0.02)	ND(0.02)	ND(0.021)[ND(0.019)]	ND(0.019)	ND(0.017)[ND(0.017)]	ND(0.018)	ND(1.7)	ND(0.017)	ND(0.017)	ND(0.017)	ND(0.017)	ND(0.016)	ND(0.016)
Chlorobenzene	0.07	0.079	0.018 J[0.024]	ND(0.019)	0.11[0.073]	0.11	17	0.078	0.002 J	ND(0.017)	ND(0.017)	ND(0.016)	ND(0.016)
Ethylbenzene	ND(0.02)	ND(0.02)	ND(0.021)[ND(0.019)]	ND(0.019)	0.002 J[ND(0.017)]	0.001 J	0.27 J	0.002 J	ND(0.017)	ND(0.017)	ND(0.017)	ND(0.016)	ND(0.016)
Xylene(total)	ND(0.027)	ND(0.027)	ND(0.027)[ND(0.026)]	ND(0.025)	ND(0.022)[ND(0.023)]	ND(0.024)	ND(2.6)	ND(0.023)	ND(0.023)	ND(0.022)	ND(0.022)	ND(0.022)	ND(0.022)
Trichlorofluormethane	0.001 J	0.001 J	ND(0.027)[0.001 J]	ND(0.025)	ND(0.022)[ND(0.023)]	0.001 J	ND(2.6)	0.001 JB	ND(0.023)	ND(0.022)	ND(0.022)	ND(0.022)	ND(0.022)
Acetonitrile	0.019 JB	0.02 JB	0.023 JB[0.024 JB]	0.021 JB	0.016 JB[0.016 JB]	0.019 JB	ND(24)	0.021 JB	0.021 JB	0.016 JB	ND(0.22)	0.02 JB	0.014 JB
1,2-Dibromo-3-Chloropropan	ND(0.067)	ND(0.068)	ND(0.068)[ND(0.064)]	ND(0.062)	ND(0.056)[ND(0.057)]	ND(0.06)	ND(3.4)	ND(0.058)	ND(0.057)	ND(0.056)	ND(0.056)	ND(0.055)	ND(0.055)
Dichlorodifluoromethane	ND(0.013)	ND(0.014)	ND(0.014)[0.052 E]	0.02 E	0.003 J[ND(0.011)]	0.008 J	ND(0.0)	ND(0.012)	ND(0.011)	ND(0.011)	ND(0.011)	ND(0.011)	ND(0.011)

Notes:

1. Samples were collected by Blasland, Bouck & Lee, Inc., and submitted to CompuChem Environmental Corporation for analysis of Appendix IX+3 volatile organic compounds. Only those compounds detected in at least one sample are presented.
2. ND(0.32) - Compound was analyzed for, but not detected. The number in parenthesis is the Practical Quantitation Limit(PQL).
3. [ ] - Field duplicate analysis.
4. J - Indicates an estimated value less than the CLP - required quantitation limit.
5. D - Analysis was performed at a secondary dilution factor.
6. B - Indicates the compound was found in the associated blank as well as in the sample.
7. E - Compound exceeded calibration range.
8. ** - Represents depth penetrated beneath floor of building 68, adjusted for 20 degree angle for boring installation.

TABLE 2-4

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF SOILS/SEDIMENT APPENDIX IX+3 SEMIVOLATILES DATA
(Results Presented in Dry-Weight Parts Per Million, ppm)

Sample Media:	River Sediment				Riverbank Soil			
Location ID: Date Sampled:	3-6C-2(0'-3.2') 09/04/96	3-6C-3(0'-3.4') 08/09/96	3-6C-4(0'-2.5') 08/09/96	3-6C-11(0'-2.3') 09/04/96	68S-3(8'-10') 08/07/96	68S-4(0'-2') 08/08/96	3-6C-EB-13(7.5'-9.4')** 09/05/96	3-6C-EB-13(18.8'-20.7')** 09/05/96
Semi-Volatile Organics								
Aniline	ND(0.74)	0.14 J	ND(0.72)	ND(0.76)	0.19 J	0.77 J	ND(0.7)	ND(0.66)
1,3-Dichlorobenzene	2.1	54 D	0.12 J	0.64 J	0.72	ND(2.8)	ND(0.64)	0.2 J
1,4-Dichlorobenzene	16 D	170 D	1.5	2.8	3.3	ND(2.8)	ND(0.65)	0.85
1,2-Dichlorobenzene	1.1	5.6	ND(0.76)	0.093 J	0.17 J	ND(3.2)	ND(0.74)	0.15 J
1,2,4-Trichlorobenzene	28 D	7.7 DJ	5.7	4.8	1.4	3.6	0.19 J	62 D
Naphthalene	ND(0.87)	0.18 J	ND(0.85)	ND(0.9)	0.076 J	0.25 J	ND(0.82)	ND(0.78)
1,2,3-Trichlorobenzene	--	--	--	--	--	--	0.053 J	--
N-Nitroso-di-n-butylamine	ND(1.8)	ND(2.1)	ND(1.8)	ND(1.9)	0.15 J	ND(7.6)	ND(1.8)	ND(1.7)
1,2,4,5-Tetrachlorobenzene	5.0	3.5	7.4 DJ	1.9	0.14 J	3.0 J	ND(1.6)	4.5
Acenaphthylene	0.045 J	ND(0.98)	ND(0.86)	ND(0.91)	ND(0.85)	ND(3.6)	ND(0.84)	ND(0.8)
Acenaphthene	0.76 J	3.0	0.74	ND(0.9)	0.26 J	0.36 J	ND(0.82)	ND(0.78)
Pentachlorobenzene	25 D	8.0 DJ	21 D	3.3	0.38 J	14	ND(0.82)	5.7
Dibenzofuran	ND(0.91)	0.33 J	ND(0.88)	ND(0.94)	0.16 J	0.24 J	ND(0.86)	ND(0.82)
Fluorene	0.34 J	1.3	0.48 J	ND(0.94)	0.25 J	0.38 J	ND(0.86)	ND(0.82)
Hexachlorobenzene	0.7 J	0.81 J	0.26 J	ND(1.1)	ND(0.97)	3.3 J	ND(0.96)	0.22 J
Phenanthrene	0.092 J	1.1	ND(0.79)	ND(0.85)	1.5	3.8	ND(0.78)	ND(0.74)
Anthracene	0.058 J	0.18 J	0.045 J	ND(1.0)	0.3 J	1.3 J	ND(0.92)	ND(0.88)
Di-n-butylphthalate	ND(1.0)	ND(1.1)	ND(0.99)	ND(1.1)	0.16 J	ND(4.2)	ND(0.96)	ND(0.91)
Fluoranthene	0.13 J	1.5	0.34 J	0.28 J	1.7	10	ND(1.2)	ND(1.1)
Pyrene	0.21 J	1.4	0.27 J	0.32 J	1.2	6.4	ND(0.91)	ND(0.87)
Bis(2-ethylhexyl)Phthalate	ND(0.99)	ND(1.1)	ND(0.96)	0.054 J	ND(0.95)	ND(4.0)	0.058 J	ND(0.89)
Benzo (a) Anthracene	0.052 J	ND(0.97)	ND(0.85)	0.15 J	0.56 J	ND(3.6)	ND(0.82)	ND(0.78)
Benzo (b) fluoranthene	0.13 XJ	1.1 X	ND(0.99)	0.26 XJ	1.0 X	ND(4.2) R	ND(0.96)	ND(0.91)
Benzo (k) fluoranthene	0.11 XJ	1.3 X	ND(0.79)	0.22 XJ	1.3 X	ND(3.3) R	ND(0.78)	ND(0.74)
Benzo (a) pyrene	0.052 J	0.33 J	ND(0.85)	0.14 J	0.59 J	ND(3.6) R	ND(0.82)	ND(0.78)
Indeno (1,2,3-c,d) pyrene	ND(0.61)	ND(0.67)	ND(0.59)	0.078 J	0.3 J	ND(2.5)R	ND(0.58)	ND(0.55)
Benzo (g,h,i) perylene	ND(0.82)	ND(0.91)	ND(0.79)	0.1 J	0.17 J	ND(3.3) R	ND(0.78)	ND(0.74)
Chrysene	0.062 J	ND(0.79)	ND(0.69)	0.16 J	0.89	ND(2.9) R	ND(0.68)	ND(0.64)

(See Notes on Page 2 of 2)

TABLE 2-4

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF SOILS/SEDIMENT APPENDIX IX+3 SEMIVOLATILES DATA
(Results Presented in Dry-Weight Parts Per Million, ppm)

Notes:

1. Samples were collected by Blasland, Bouck & Lee, Inc., and submitted to CompuChem Environmental Corporation for analysis of Appendix IX+3 semivolatile organic compounds. Only those compounds detected in at least one sample are presented.
2. ND(0.32) - Compound was analyzed for, but not detected. The number in parenthesis is the Practical Quantitation Limit(PQL).
3. [ ] - Field duplicate analysis.
4. J - Indicates an estimated value less than the CLP - required quantitation limit.
5. D - Analysis was performed at a secondary dilution factor.
6. X - data has been manually integrated.
7. R - Indicates that the previously reported detection limit or sample result has been rejected due to a major deficiency in the data generation procedure. The data should not be used for any qualitative or quantitative purposes.
8. -- = Analyte not reported by analytical laboratory.
9. **Represents depth penetrated beneath floor of building 68, adjusted for 20 dregree angle for boring installation.

TABLE 2-5

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF SOILS/SEDIMENT APPENDIX IX+3 INORGANICS DATA
(Results Presented in Dry-Weight Parts Per Million, ppm)

Sample Media:	River Sediment		Riverbank Soil			
Location ID: Date Sampled	3-6C-3(0'-3.2') 08/09/96	3-6C-4(0'-3.4') 08/09/96	68S-3(8'-10') 08/07/96	68S-4(0'-2') 08/08/96	3-6C-EB-13(7.5'-9.4')** 09/05/96	3-6C-EB-13(18.8'-20.7')** 09/05/96
Metals						
Antimony	0.74 J*N	ND(0.29) N	0.39 J*N	7.2 N	0.31 J*N	ND(0.26) N
Arsenic	3.0	1.1 J*	5.1	12	2.4	1.1 J*
Barium	50.4	26.2	35.4	169	41.5	19.7 J*
Beryllium	0.24 J*	0.16 J*	0.34 J*	0.39 J*	0.38 J*	0.16 J*
Cadmium	0.34 J*	ND(0.04)	0.18 J*	2.7	ND(0.04)	ND(0.04)
Chromium	20	6.0	11.2	47.7	12.6 S	9.2 S
Cobalt	6.2 J*	4.3 J*	6.9	7.8	7.8	5.7 J*
Copper	62.3 S	7.7 S	218 S	1400 S	61.6 S	13.7 S
Lead	82.4 NS	4.7 NS	193 NS	1010 NS	20.3 S	6.2 S
Nickel	14.7	9.2	14.4	69.4	18.9	10.5
Selenium	ND(0.44) N	ND(0.39) N	ND(0.38) N	ND(0.33) N	0.52 J*N	ND(0.36) N
Silver	0.33 J*	ND(0.08)	ND(0.08)	3.8	ND(0.08) N	ND(0.07) N
Thallium	ND(0.46)	ND(0.4)	0.47 J*	0.45 J*	ND(0.39)	ND(0.37)
Vanadium	8.9	5.6 J*	11.6	16.3	11.8	5.4 J*
Zinc	116	32.3	93.6	1190	80.9	35.6
Tin	9.1	3.0 J*	7.2	132	3.9 J*	2.1 J*
Mercury	0.19 N	ND(0.13) N	0.26 N	6.1 N	0.14	ND(0.12)

Notes:

1. Samples were collected by Blasland, Bouck & Lee, Inc., and submitted to CompuChem Environmental Corporation for analysis of Appendix IX+3 inorganic compounds. Only those compounds detected in at least one sample are presented.
2. NA - Not analyzed.
3. ND(0.32) - Compound was analyzed for, but not detected. The number in parenthesis is the detection limit.
4. [ ] - Field duplicate analysis.
5. N - Spiked sample recovery is not within control limits.
6. J* - The reported value is less than the Contract Required Detection limit(CRDL) but greater than the Instrument Detection Limit(IDL).
7. S - Duplicate analysis is not within control limits.
8. **Represents depth penetrated beneath floor of building 68, adjusted for 20 degree angle for boring installation.

TABLE 2-6

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF SOILS/SEDIMENT APPENDIX IX+3 DIOXINS/FURANS DATA
(Results Presented in Dry-Weight Parts Per Million, ppm)

Sample Media:	River Sediment		Riverbank Soil			
Location ID: Date Sampled:	3-6C-3(0'-3.2') 08/09/96	3-6C-4(0'-3.4') 08/09/96	68S-3(8'-10') 08/07/96	68S-4(0'-2') 08/08/96	3-6C-EB-13(7.5'-9.4')** 09/05/96	3-6C-EB-13(18.8'-20.7')** 09/05/96
Dioxins						
TCDDs(total)	0.00091	ND(0.0000083)	ND(0.00012)	0.00058	0.00005	ND(0.0005)
2,3,7,8-TCDD	0.000069	ND(0.0000037)	ND(0.00012)	0.000042	0.0000018 J	ND(0.0005)
PeCDDs(total)	0.000059	ND(0.00002)	ND(0.029)	0.00055	ND(0.000013)	ND(0.043)
HxCDDs(total)	0.00059	ND(0.0000069)	ND(0.0011)	0.00049	0.000021	ND(0.0017)
1,2,3,4,7,8-HxCDD	0.000033 J**	ND(0.0000014)	ND(0.000045)	0.00011	ND(0.0000015)	ND(0.000046)
1,2,3,6,7,8-HxCDD	0.000043 J**	ND(0.0000014)	ND(0.000037)	0.00016	ND(0.0000026)	ND(0.000047)
1,2,3,7,8,9-HxCDD	0.000078	ND(0.0000015)	ND(0.00004)	0.00022	ND(0.0000035)	ND(0.000043)
HpCDDs(total)	0.0014	ND(0.00001)	ND(0.000038)	0.0013	0.000024	ND(0.000092)
1,2,3,4,6,7,8-HpCDD	0.00053	ND(0.0000094)	ND(0.000017)	0.00056	0.000012 J	ND(0.000092)
OCDD	0.0029	0.000089 J**	ND(0.00004)	0.0011	0.000096	ND(0.000085)
Total PCDDs	0.00586	0.000089	ND	0.00402	0.000191	ND
Furans						
TCDFs(total)	0.002	0.0004	ND(0.00053)	0.038	0.0011	ND(0.0001)
2,3,7,8-TCDF	0.00021	0.000051	ND(0.000097)	0.0049	0.00027 J	ND(0.000046)
PeCDFs(total)	0.0022	0.00062	0.00077	0.037	0.00045	ND(0.00014)
1,2,3,7,8-PeCDF	0.00012	0.000042 J**	ND(0.000069)	0.0038	0.000054	ND(0.00014)
2,3,4,7,8-PeCDF	0.00022	0.000089 J**	ND(0.0001)	0.0048	0.000045	ND(0.00014)
HxCDFs(total)	0.0037	0.0011	0.00062	0.048	0.00024	0.00042
1,2,3,4,7,8-HxCDF	0.0016	0.00057	ND(0.00027)	0.023	0.000083	0.00036
1,2,3,6,7,8-HxCDF	ND(0.00064)	0.000054 J**	ND(0.000052)	0.0032	0.000025	ND(0.000069)
2,3,4,6,7,8-HxCDF	0.000094	ND(0.000027)	ND(0.000061)	0.0028	0.000011 J	ND(0.000072)
1,2,3,7,8,9-HxCDF	ND(0.0000098)	ND(0.0000051)	ND(0.000025)	0.00027	ND(0.0000031)	ND(0.000085)
HpCDFs(total)	0.005	0.0021	0.00069	0.054	0.00012	ND(0.00083)
1,2,3,4,6,7,8-HpCDF	0.0015	0.00043	0.00021	0.014	0.00006	ND(0.00023)
1,2,3,4,7,8,9-HpCDF	0.00077	0.00048	0.00013	0.01	0.000023	ND(0.00009)
OCDF	0.0089	0.005	0.00054	0.12	0.00011	0.0012
Total PCDFs	0.0218	0.00922	0.00262	0.297	0.00202	0.00162

Notes:

1. Samples were collected by Blasland, Bouck & Lee, Inc., and submitted to Quanterra Environmental Services for analysis of Appendix IX+3 dioxins/furans. Only those compounds detected in at least one sample are presented.
2. ND(0.32) - Compound was analyzed for, but not detected. The number in parenthesis is the detection limit.
3. J** - Indicates an estimated value below the lower calibration limit, but above the target detection limit.
4. TBA - Data not yet available.
5. Total PCDDs/PCDFs determined as sum of total homolog concentrations; non-detect values considered to be zero.
6. ** - Represents depth penetrated beneath floor of building 68, adjusted for 20 degree angle for boring installation.

TABLE 2-7

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF GROUNDWATER APPENDIX IX+3 DATA
(Results Presented in Parts Per Million, ppm)

Location ID: Date Sampled:	3-6C-EB-13(unfiltered) 09/09/96	3-6C-EB-13(filtered) 09/09/96
Volatile Organics		
Chlorobenzene	0.027	NA
Semi-Volatile Organics		
1,3-Dichlorobenzene	0.015	NA
1,4-Dichlorobenzene	0.054	NA
1,2-Dichlorobenzene	0.018	NA
1,2,4-Trichlorobenzene	1.2D	NA
N-Nitrosopiperdine	0.002J	NA
1,2,4,5-Tetrachlorobenzene	0.035	NA
Pentachlorobenzene	0.021	NA
Bis(2-Ethylhexyl)Phthalate	0.002BJ	NA
PCBs		
Aroclor 1254	ND(0.0062)	0.0011
Aroclor 1260	0.021	ND(0.00033)
Inorganics		
Barium	0.0133J*	0.0122J*
Cobalt	ND(0.0023)	0.0024J*
Copper	0.0024J*	0.0021J*
Thallium	0.0032J*	ND(0.0032)
Zinc	0.0122J*	0.0238
Mercury	ND(0.0002)	0.00052N
Dioxins/Furans		
OCDF	0.000061	NA

Notes:

1. Samples were collected by Blasland, Bouck & Lee, Inc., and submitted to Quanterra Environmental Services for Appendix IX+3 analysis(excluding pesticid and herbicides). Only those compounds detected in at least one sample are presented.
2. ND(0.32) - Compound was analyzed for, but not detected. The number in parenthesis is the detection limit.
3. NA - Not analyzed.
4. J - Indicates an estimated value less than the CLP - required quantitation limit.
5. J* - The reported value is less than the Contract Required Detection limit(CRDL) greater than the Instrument Detection Limit(IDL).
6. D - Analysis was performed at a secondary dilution factor.
7. B - Indicates the compound was found in the associated method blank as well as the sample.
8. N - Spiked sample recovery is not within control limits.

TABLE 3-1

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

SUMMARY OF 1996 HOUSATONIC RIVER WATER COLUMN PCB DATA
COLLECTED UPSTREAM/DOWNSTREAM OF BUILDING 68 AREA

TOTAL PCB CONCENTRATIONS
(Results presented in parts per million, ppm)

	Newell Street Bridge		Footbridge to Newell Street Parking Lot	
Sampling Date	Unfiltered	Filtered	Unfiltered	Filtered
5/1/96	0.000207	0.00071	0.000036	ND (0.000022)
5/15/96	0.000049	ND (0.000022)	0.000073	0.000033
6/11/96	0.000056	ND (0.000022)	0.000032	ND (0.000022)
7/17/96	0.000057*	0.000028	0.000025*	0.000022
8/13/96	0.000124	0.000033	0.000256	0.000058
Average	0.000099	0.000031	0.000084	0.000027

Notes:

1. All samples were collected by Blasland, Bouck & Lee, Inc. and analyzed by Northeast Analytical Services.
2. * - Results represent average of temporal duplicate concentrations collected approximately two minutes apart.
3. One-half detection limit was utilized for non-detect values in computing average PCB concentrations for each location.

PCB MASS FLUX
(Results presented in pounds per day, lbs/day)

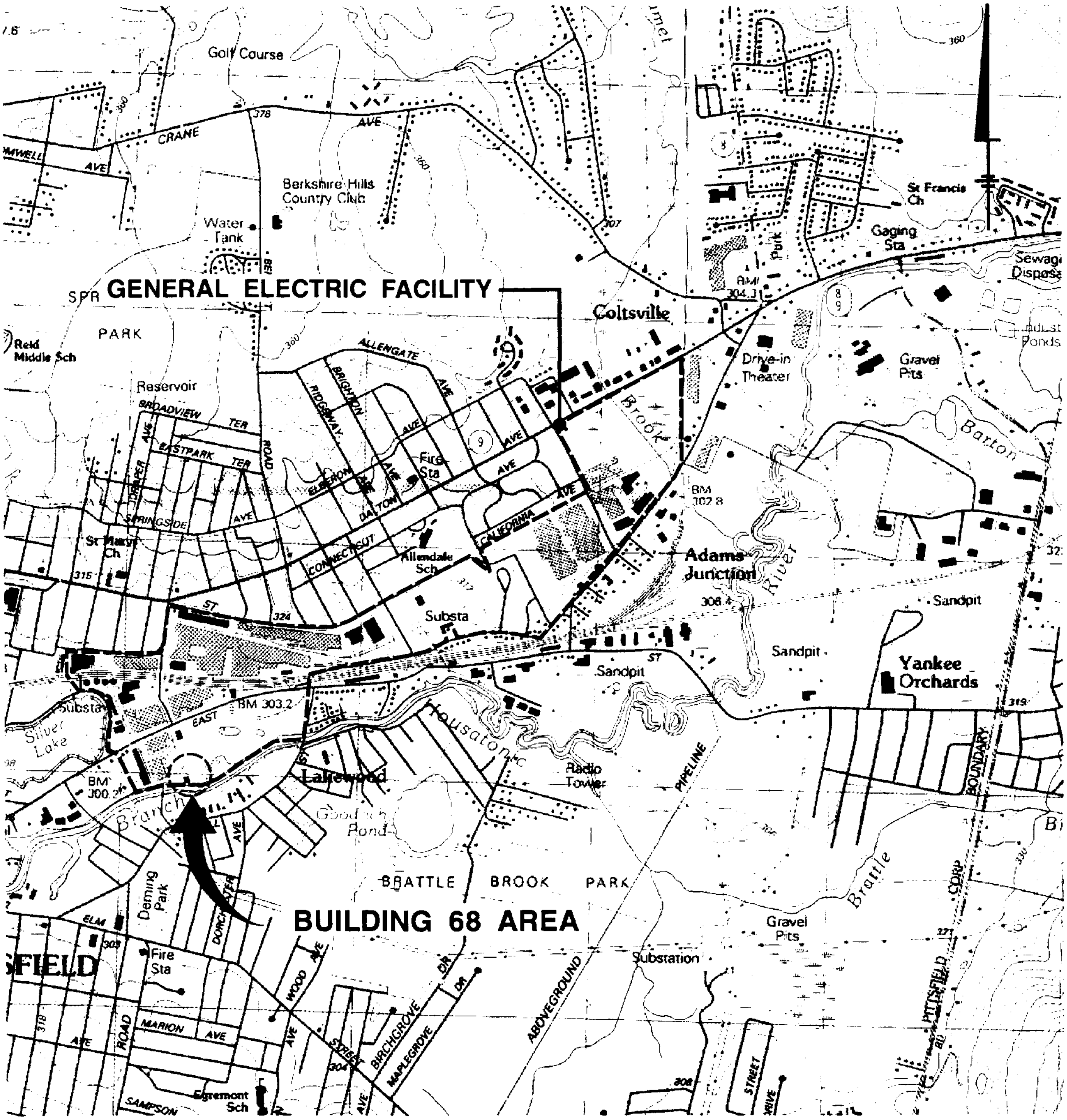
	Newell Street Bridge		Footbridge to Newell Street Parking Lot	
Sampling Date	Unfiltered	Filtered	Unfiltered	Filtered
5/1/96	0.94	0.32	0.17	<0.1
5/15/96	0.06	<0.03	0.09	0.04
6/11/96	0.06	<0.02	0.04	<0.03
7/17/96	0.14	0.07	0.08	0.06
8/13/96	0.03	0.01	0.07	0.02
Average	0.25	0.09	0.09	0.05

Notes:

1. Mass flux calculated as follows:
   Flux (lbs/day) = Flow (cfs) x 28.32 (liters per cubic foot) x unfiltered or filtered PCBs (ppb, or micrograms PCBs per liter) x 86,400 (seconds per day) / 1,000,000 (micrograms per gram) x 0.0022 (pounds per gram).
2. River flow at these locations were estimated based on measured velocities upstream and downstream of this area and river miles.
3. < - values denoted with a "less than" reflect values calculated based upon a detection limit of 0.000022 ppm, since PCBs were not detected.

Figures

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

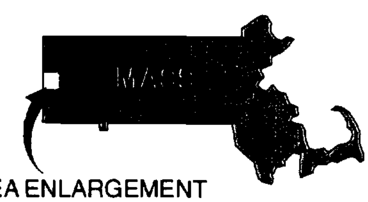


REFERENCE: PITTSFIELD EAST MASS. USGS QUADS., 7.5 MIN. SERIES, 1988

2000' 0 2000'

APPROXIMATE SCALE: 1" = 2000'

Originals in color.



AREA ENLARGEMENT

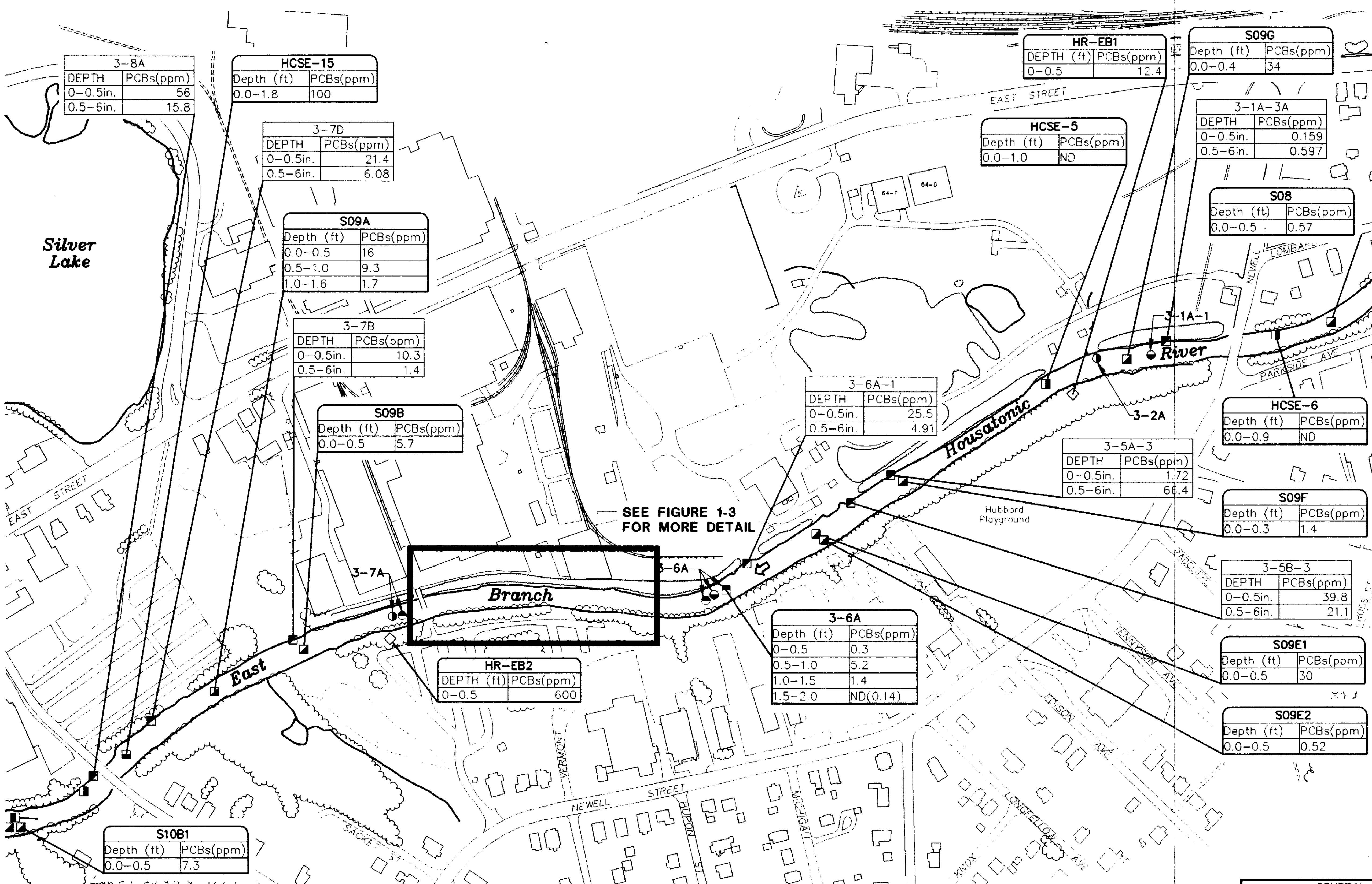
GENERAL ELECTRIC COMPANY
PITTSFIELD MASSACHUSETTS
IMMEDIATE RESPONSE ACTION PLAN FOR BUILDING 68 AREA

SITE LOCATION MAP

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

FIGURE 1-1

10/96 SYR-D54-DJH
10197057/10197n02.CDR



3-8A	
DEPTH	PCBs(ppm)
0-0.5in.	56
0.5-6in.	15.8

HCSE-15	
Depth (ft)	PCBs(ppm)
0.0-1.8	100

3-7D	
DEPTH	PCBs(ppm)
0-0.5in.	21.4
0.5-6in.	6.08

S09A	
Depth (ft)	PCBs(ppm)
0.0-0.5	16
0.5-1.0	9.3
1.0-1.6	1.7

3-7B	
DEPTH	PCBs(ppm)
0-0.5in.	10.3
0.5-6in.	1.4

S09B	
Depth (ft)	PCBs(ppm)
0.0-0.5	5.7

HR-EB2	
DEPTH (ft)	PCBs(ppm)
0-0.5	600

S10B1	
Depth (ft)	PCBs(ppm)
0.0-0.5	7.3

HR-EB1	
DEPTH (ft)	PCBs(ppm)
0-0.5	12.4

S09G	
Depth (ft)	PCBs(ppm)
0.0-0.4	34

HCSE-5	
Depth (ft)	PCBs(ppm)
0.0-1.0	ND

3-1A-3A	
DEPTH	PCBs(ppm)
0-0.5in.	0.159
0.5-6in.	0.597

S08	
Depth (ft)	PCBs(ppm)
0.0-0.5	0.57

3-6A-1	
DEPTH	PCBs(ppm)
0-0.5in.	25.5
0.5-6in.	4.91

HCSE-6	
Depth (ft)	PCBs(ppm)
0.0-0.9	ND

3-5A-3	
DEPTH	PCBs(ppm)
0-0.5in.	1.72
0.5-6in.	66.4

S09F	
Depth (ft)	PCBs(ppm)
0.0-0.3	1.4

3-5B-3	
DEPTH	PCBs(ppm)
0-0.5in.	39.8
0.5-6in.	21.1

3-6A	
Depth (ft)	PCBs(ppm)
0-0.5	0.3
0.5-1.0	5.2
1.0-1.5	1.4
1.5-2.0	ND(0.14)

S09E1	
Depth (ft)	PCBs(ppm)
0.0-0.5	30

S09E2	
Depth (ft)	PCBs(ppm)
0.0-0.5	0.52

LEGEND:

- SEDIMENT SAMPLE LOCATION (1996)
- RIVER BANK SAMPLE LOCATION (1996)
- MCP HAZARDOUS CONSTITUENTS SEDIMENT SAMPLE LOCATION (1994)
- MCP/RFI PCB SEDIMENT SAMPLE LOCATION (1994)
- MCP HAZARDOUS CONSTITUENTS SEDIMENT SAMPLE LOCATION (1990-1992)
- MCP SEDIMENT SAMPLE LOCATION (1990-1991)
- STEWART LABORATORIES SAMPLE LOCATION (1981-1982)
- MCP/RFI CORE LOCATION FOR CESIUM-137 SCREENING (1994)
- MCP/RFI CORE LOCATION FOR GRAIN SIZE, OIL & GREASE, AND TOTAL ORGANIC CARBON ANALYSES (1994)
- MCP/RFI CORE LOCATION FOR SPECIFIC GRAVITY, BULK DENSITY, WATER CONTENT, AND TIME RATE OF CONSOLIDATION ANALYSES (1994)
- EDGE OF WATER
- PAVED ROADWAY
- UNPAVED ROADWAY OR TRAIL
- RAILROAD
- VEGETATION
- ND NOT DETECTED
- NA NOT ANALYZED
- ** ARCHIVED SAMPLE ANALYZED OUTSIDE OF HOLDING TIMES

GENERAL NOTES:

1. THE BASE MAP FEATURES PRESENTED ON THIS FIGURE WERE PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
2. ALL SAMPLE LOCATIONS ARE APPROXIMATE.
3. MULTIPLE ANALYSES PERFORMED BY MULTIPLE ANALYTICAL LABORATORIES.
4. 1981-1982 SAMPLES WERE COLLECTED BY STEWART LABORATORIES, INC. AND WERE FIELD LOCATED USING LOCAL LANDMARKS AND COMPASS BEARINGS. THE RESULTING SAMPLE LOCATIONS SHOWN MUST BE CONSIDERED AS APPROXIMATE.
5. 1990-1996 SAMPLES WERE COLLECTED BY BBL INC. (OR BLASLAND & BOUCK ENGINEERS P.C.) AND ARE SURVEYED TO KNOWN PHYSICAL FEATURES. LOCATIONS SHOWN ON THIS MAPPING ARE APPROXIMATE, HOWEVER, ACTUAL SURVEY DATA ARE AVAILABLE TO IDENTIFY PRECISE SAMPLE LOCATIONS.
6. PCB DATA ARE PRESENTED IN DRY WEIGHT PARTS PER MILLION (PPM) AND DATA PRESENTED IN BRACKETS REPRESENTS DUPLICATE ANALYSIS.

XREF: 101X1X02
L: ON =*, OFF = *REF*
PCP: 10197G09.PCP
10/4/96 SYR-54-JLG RLP
10197057/10197G09.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN FOR THE BUILDING 68 AREA

LOCATION PLAN

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

FIGURE **1-2**

LEGEND

- SEDIMENT SAMPLE LOCATION (STEWART LABORATORIES, 1982)
- SEDIMENT SAMPLE LOCATION (BBL, 1990)
- SEDIMENT SAMPLE LOCATION (BBL, MAY 1996)
- SEDIMENT SAMPLE LOCATION (BBL, MAY 1996, AUGUST 1996))
- SEDIMENT SAMPLE LOCATION (BBL, AUGUST 1996)
- SEDIMENT SAMPLE LOCATION (BBL, AUGUST/SEPTEMBER 1996)
- SEDIMENT SAMPLE LOCATION (BBL, SEPTEMBER 1996)
- BANK SOIL SAMPLE LOCATION (BBL, MARCH 1996, AUGUST 1996)
- BANK SOIL SAMPLE LOCATION (BBL, MAY 1996)
- BANK SOIL SAMPLE LOCATION (BBL, AUGUST 1996)
- BANK SOIL SAMPLE LOCATION (BBL, SEPTEMBER 1996)
- BANK SOIL SAMPLE/MONITORING WELL LOCATION (BBL, AUGUST 1996)
- BANK SOIL SAMPLE/MONITORING WELL LOCATION (BBL, SEPTEMBER 1996)
- MONITORING WELL
- A——A' CROSS SECTION LOCATION

NOTES:

1. THE BASE MAP FEATURES PRESENTED ON THIS FIGURE WERE PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
2. BASE MAP FEATURES INCLUDING THE FORMER BUILDING 68 STRUCTURE AND ASSOCIATED TANKS AND DRAINAGE PITS WERE ADDED BASED ON GE PLANT ENGINEERING MAP #792D285 DATED AUGUST 21, 1969 (SCALE OF 1:480), GE PLANT ENGINEERING MAP #113-D-6003 DATED NOVEMBER 11, 1969 (SCALE OF 1:120) AND APRIL 1969 AERIAL PHOTOS (SCALE OF 1:4800).
3. * – SAMPLES COLLECTED BY STEWART LABORATORIES INC. WERE FIELD LOCATED USING LOCAL LANDMARKS AND COMPASS BEARINGS. THE RESULTING SAMPLE LOCATIONS SHOWN MUST BE CONSIDERED AS APPROXIMATE.
4. 1990–1996 SAMPLES WERE COLLECTED BY BBL INC. (OR BLASLAND & BOUCK ENGINEERS, P.C.) AND ARE SURVEYED TO KNOWN PHYSICAL FEATURES. LOCATIONS SHOWN ON THIS MAPPING ARE APPROXIMATE. HOWEVER, ACTUAL SURVEY DATA ARE AVAILABLE TO IDENTIFY PRECISE SAMPLE LOCATIONS.

0 60' 120'

APPROXIMATE SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD MASSACHUSETTS
IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

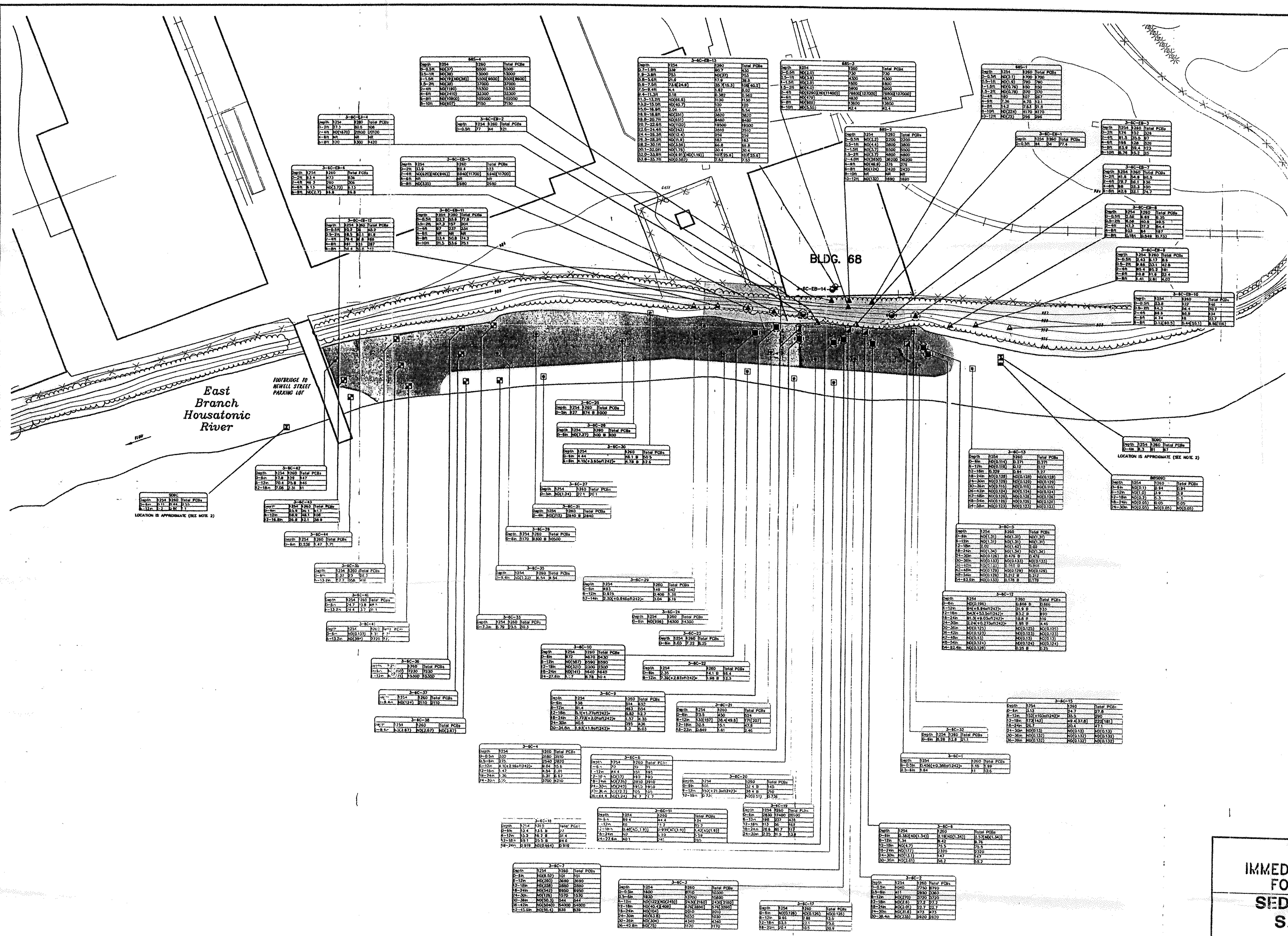
SITE PLAN

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

FIGURE 1-3

Original includes color coding.

X: 10193X02,10193X03,10193X04
L: ON=*, OFF=*REF*
P: 10193G03
10/96 SYR-54-RCB RLP PMC
10193001\10193G03.DWG



LEGEND

- SEDIMENT SAMPLE LOCATION (STEWART LABORATORIES, 1982)
- SEDIMENT SAMPLE LOCATION (BBL, 1990)
- SEDIMENT SAMPLE LOCATION (BBL, MAY 1996)
- SEDIMENT SAMPLE LOCATION (BBL, MAY 1996, AUGUST 1996))
- SEDIMENT SAMPLE LOCATION (BBL, AUGUST 1996)
- SEDIMENT SAMPLE LOCATION (BBL, AUGUST/SEPTEMBER 1996)
- SEDIMENT SAMPLE LOCATION (BBL, SEPTEMBER 1996)
- BANK SOIL SAMPLE LOCATION (BBL, MARCH 1996, AUGUST 1996)
- BANK SOIL SAMPLE LOCATION (BBL, MAY 1996)
- BANK SOIL SAMPLE LOCATION (BBL, AUGUST 1996)
- BANK SOIL SAMPLE LOCATION (BBL, SEPTEMBER 1996)
- BANK SOIL SAMPLE/MONITORING WELL LOCATION (BBL, AUGUST 1996)
- BANK SOIL SAMPLE/MONITORING WELL LOCATION (BBL, SEPTEMBER 1996)
- APPROXIMATE LIMIT OF SEDIMENTS AFFECTED BY 1968 TANK RUPTURE
- APPROXIMATE LIMIT OF BANK SOILS AFFECTED BY 1968 TANK RUPTURE

KEY

LOCATION NAME
DEPTH (ft. OR in. AS INDICATED)
AROCLOR 1254 (ppm)
AROCLOR 1260 (ppm)
TOTAL PCBs (ppm)

3-6C-1			
Depth	1254	1260	Total PCBs
0-0.5in	0.456(+0.386of1242)*	1.15	1.99
0.5-6in	1.64	11	12.6

NOTES:

1. THE BASE MAP FEATURES PRESENTED ON THIS FIGURE WERE PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
2. SAMPLES COLLECTED BY STEWART LABORATORIES INC. WERE FIELD LOCATED USING LOCAL LANDMARKS AND COMPASS BEARINGS. THE RESULTING SAMPLE LOCATIONS SHOWN MUST BE CONSIDERED AS APPROXIMATE.
3. 1990-1996 SAMPLES WERE COLLECTED BY BBL INC. (OR BLASLAND & BOUCK ENGINEERS, P.C.) AND ARE SURVEYED TO KNOWN PHYSICAL FEATURES. LOCATIONS SHOWN ON THIS MAPPING ARE APPROXIMATE. HOWEVER, ACTUAL SURVEY DATA ARE AVAILABLE TO IDENTIFY PRECISE SAMPLE LOCATIONS.
4. PCB DATA ARE PRESENTED IN DRY WEIGHT PARTS PER MILLION (PPM) AND DATA PRESENTED IN BRACKETS REPRESENTS DUPLICATE ANALYSIS.
5. ABBREVIATIONS/QUALIFIERS:

   B = INDICATES AN ESTIMATED VALUE. THE ANALYTE IN THE ASSOCIATED BLANK AT A LEVEL EXCEEDING THE PRACTICAL QUANTIFATION LIMIT (PQ.).

   HELD = SAMPLE ARCHIVED FOR POTENTIAL FUTURE PCB ANALYSIS

   NA = NOT ANALYZED

   ND = COMPOUND WAS ANALYZED FOR BUT NOT DETECTED.

   NR = NO SAMPLE RECOVERY.

   * = AROCLOR 1242 IS BEING USED TO REPORT AN ALTERED PCB PATTERN EXHIBITED BY THE SAMPLE. ACTUAL AROCLOR 1242 IS NOT PRESENT IN THE SAMPLE, BUT IS REPORTED TO MORE ACCURATELY QUANTIFY PCB PRESENT IN SAMPLE THAT HAS UNDERGONE ENVIRONMENTAL ALTERATION.

0 40' 80'
APPROXIMATE SCALE

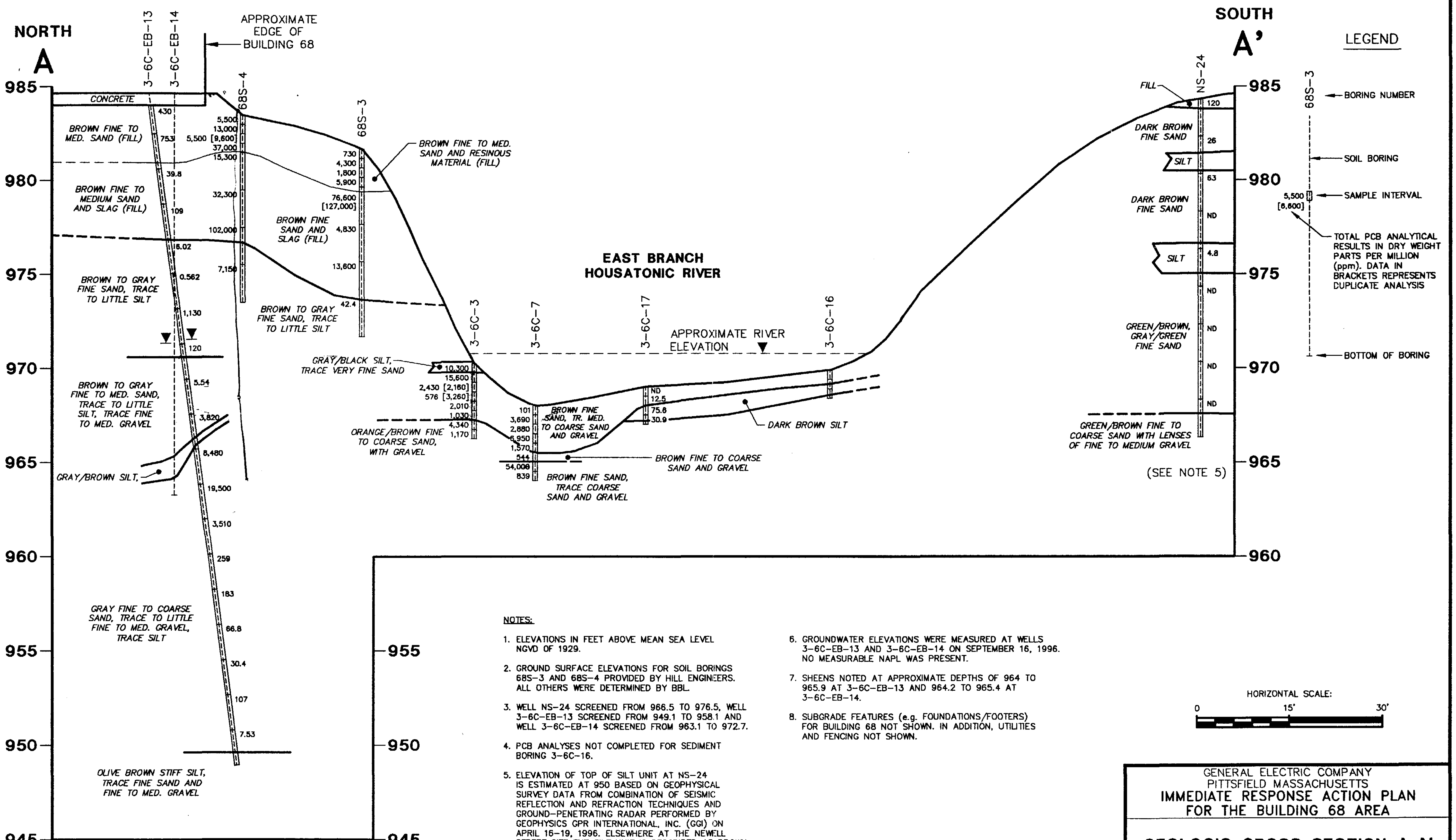
T: ARBLDG68.TXT
X: 10193X02, 10193X04
L: ON=*, OFF=*REF*,*LABELS
P: 10193G02
10/17/96 SYR-54-RCB RLP
10193001\10193G02.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD MASSACHUSETTS
IMMEDIATE RESPONSE ACTION PLAN FOR THE BUILDING 68 AREA

SEDIMENT AND BANK SOIL SAMPLING LOCATIONS AND PCB DATA

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

FIGURE 2-1



NOTES:

1. ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL NGVD OF 1929.
2. GROUND SURFACE ELEVATIONS FOR SOIL BORINGS 68S-3 AND 68S-4 PROVIDED BY HILL ENGINEERS. ALL OTHERS WERE DETERMINED BY BBL.
3. WELL NS-24 SCREENED FROM 966.5 TO 976.5, WELL 3-6C-EB-13 SCREENED FROM 949.1 TO 958.1 AND WELL 3-6C-EB-14 SCREENED FROM 963.1 TO 972.7.
4. PCB ANALYSES NOT COMPLETED FOR SEDIMENT BORING 3-6C-16.
5. ELEVATION OF TOP OF SILT UNIT AT NS-24 IS ESTIMATED AT 950 BASED ON GEOPHYSICAL SURVEY DATA FROM COMBINATION OF SEISMIC REFLECTION AND REFRACTION TECHNIQUES AND GROUND-PENETRATING RADAR PERFORMED BY GEOPHYSICS GPR INTERNATIONAL, INC. (GGI) ON APRIL 16-19, 1996. ELSEWHERE AT THE NEWELL STREET SITE THE SILT UNIT IS DESCRIBED AS BROWN AND OLIVE STIFF TO VERY STIFF SILT WITH TRACE AMOUNTS OF FINE SAND AND FINE GRAVEL.
6. GROUNDWATER ELEVATIONS WERE MEASURED AT WELLS 3-6C-EB-13 AND 3-6C-EB-14 ON SEPTEMBER 16, 1996. NO MEASURABLE NAPL WAS PRESENT.
7. SHEENS NOTED AT APPROXIMATE DEPTHS OF 964 TO 965.9 AT 3-6C-EB-13 AND 964.2 TO 965.4 AT 3-6C-EB-14.
8. SUBGRADE FEATURES (e.g. FOUNDATIONS/FOOTERS) FOR BUILDING 68 NOT SHOWN. IN ADDITION, UTILITIES AND FENCING NOT SHOWN.

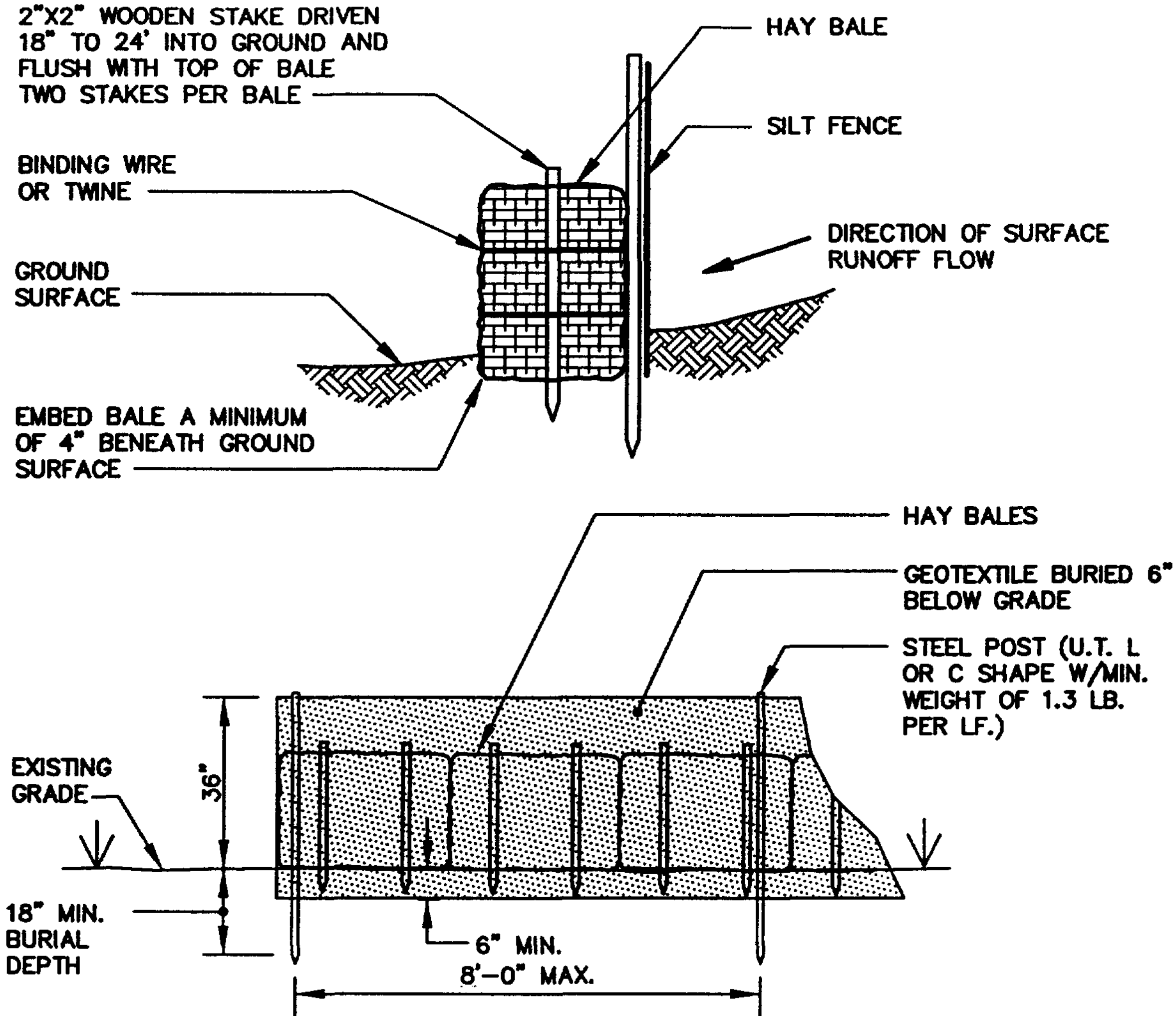
GENERAL ELECTRIC COMPANY
PITTSFIELD MASSACHUSETTS
IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

GEOLOGIC CROSS SECTION A-A'

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

FIGURE 3-1

T: ARBLDG68.TXT
X: 10193X01
L: ON=*, OFF=*REF*
P: CSA
10/10/96 SYR-54-DMW
10193001\10193CSA.DWG



NOTES:

1. THE CONTRACTOR SHALL REMOVE ACCUMULATIONS WHEN THE DEPOSIT REACHES APPROXIMATE ONE-HALF OF THE HEIGHT OF SILT FENCE.

2. THE SILT FENCE SHALL REMAIN IN PLACE UNTIL THE OWNER DIRECTS THAT IT BE REMOVED. UPON REMOVAL, THE CONTRACTOR WILL REMOVE AND PROPERLY DISPOSE OF EXCESS SILT ACCUMULATIONS AND VEGETATE ALL BARE AREAS.

3. THE CONTRACTOR SHALL MAINTAIN THE INTEGRITY OF THE SILT FENCE AS LONG AS THEY ARE NECESSARY.

4. SILT FENCE SHALL BE INSTALLED IN CONJUNCTION WITH HAY BALES.

HAY BALE/SILT FENCE DETAIL

NOT TO SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

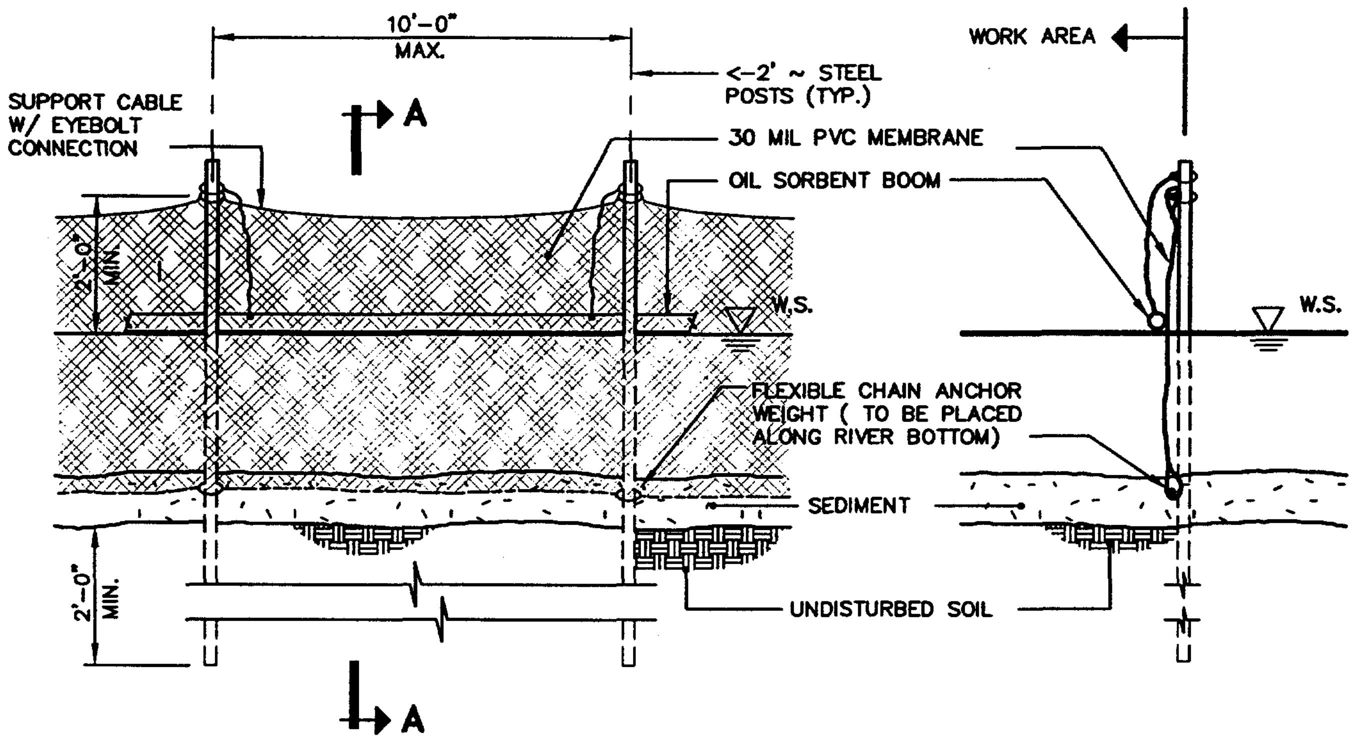
IMMEDIATE RESPONSE ACTION PLAN FOR THE BUILDING 68 AREA

HAY BALE/SILT FENCE DETAIL

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

FIGURE **4-1**

X: (XREF)
L: (LAYER)
P: STD-PCP/AP
10/3/96 SYR-54 MFS
10197057/10197G19.DWG



SILT CURTAIN DETAIL

NOT TO SCALE

SECTION A-A

NOT TO SCALE

NOTES:

1. THE SILT CURTAIN SHALL REMAIN IN PLACE UNTIL THE OWNER DIRECTS THAT IT BE REMOVED.

2. THE CONTRACTOR SHALL MAINTAIN THE INTEGRITY OF THE SILT CURTAIN AS LONG AS THEY ARE NECESSARY.

L: ON=*; OFF=REF
P: STD-PCP/AP
9/98 SYR-54-NES MFS
10197057/10197G18.DWG

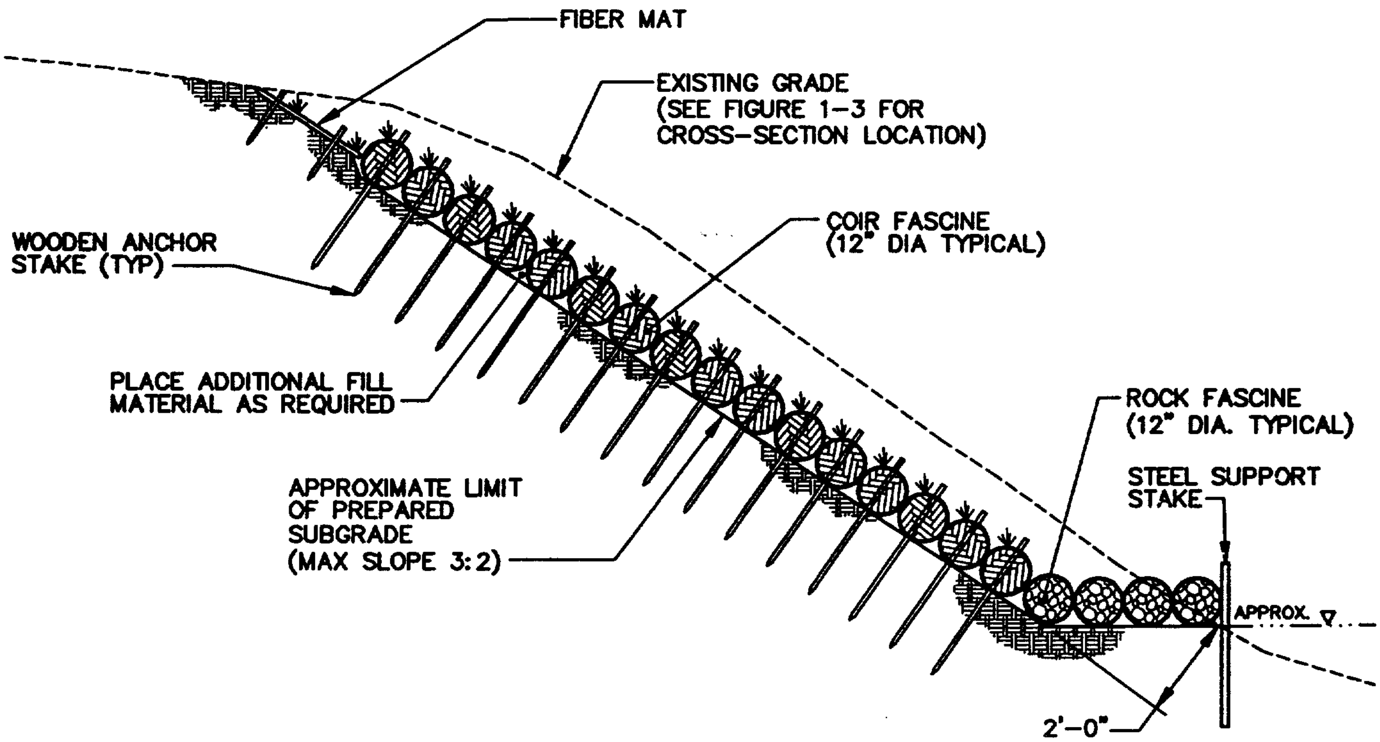
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

IMMEDIATE RESPONSE ACTION PLAN FOR THE BUILDING 68 AREA

SILT CURTAIN DETAIL

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
4-2



NOTES:

1. PLANT VEGETATIVE SPECIES WITHIN COIR FASCINES AND FIBER MAT CONSISTENT WITH THE REGION (E.G. SOFT RUSH, LOX SEDGE, WOOL GRASS, BLACK WILLOW ETC.). SPACING TO BE AS APPROPRIATE FOR SPECIES.

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

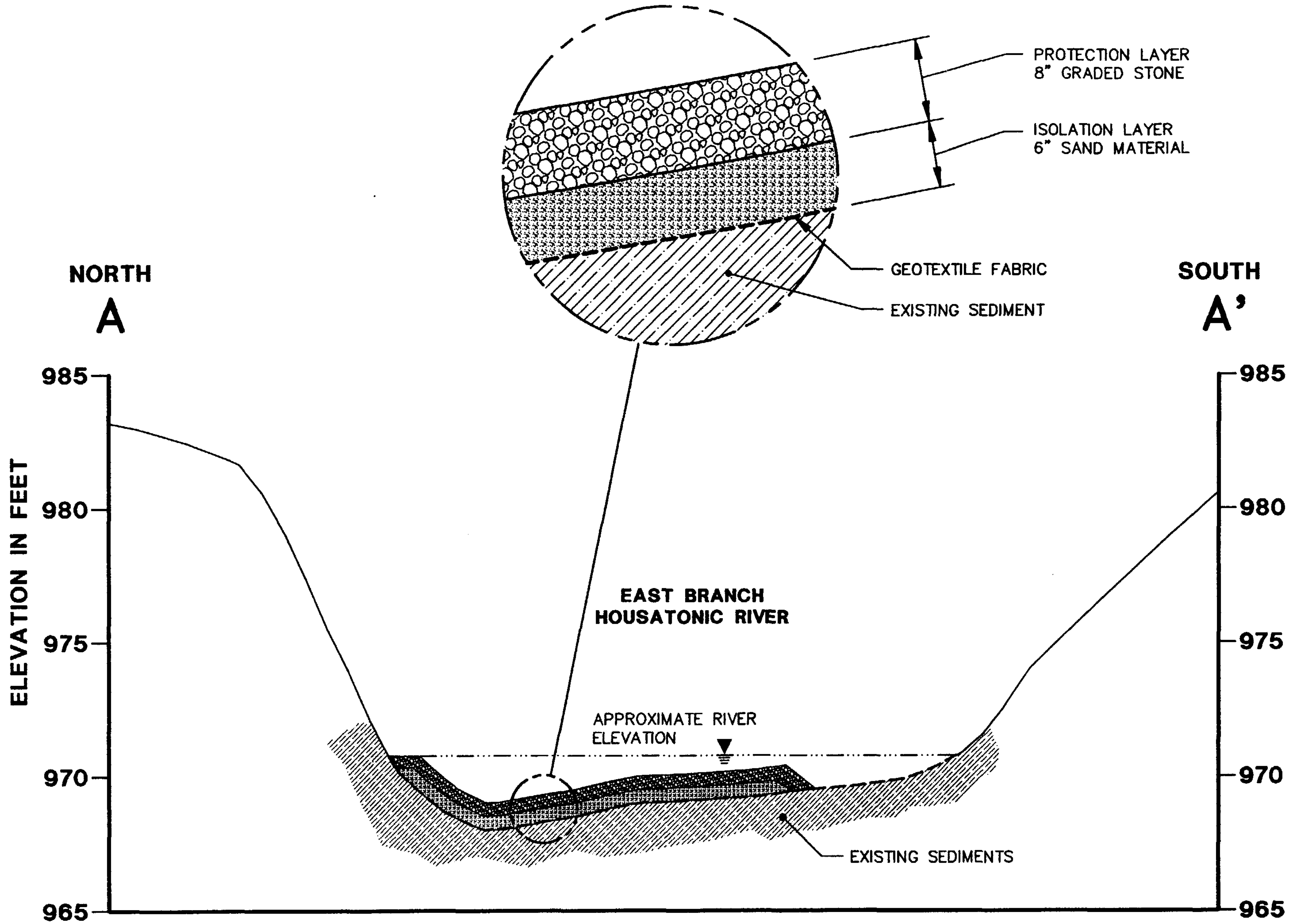
IMMEDIATE RESPONSE ACTION PLAN FOR THE BUILDING 68 AREA

TYPICAL CROSS SECTION- ENGINEERED VEGETATIVE COVER

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

FIGURE **4-3**

X: (XREF)
L: (LAYER)
P: STD-PCP/AP
8/16/96 SYR-54 MFS
10197057/10197G16.DWG



0 15' 30'
HORIZONTAL SCALE

NOTES:

1. ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL NGVD OF 1929.
2. SEE FIGURE 1-2 FOR CROSS-SECTION LOCATION.

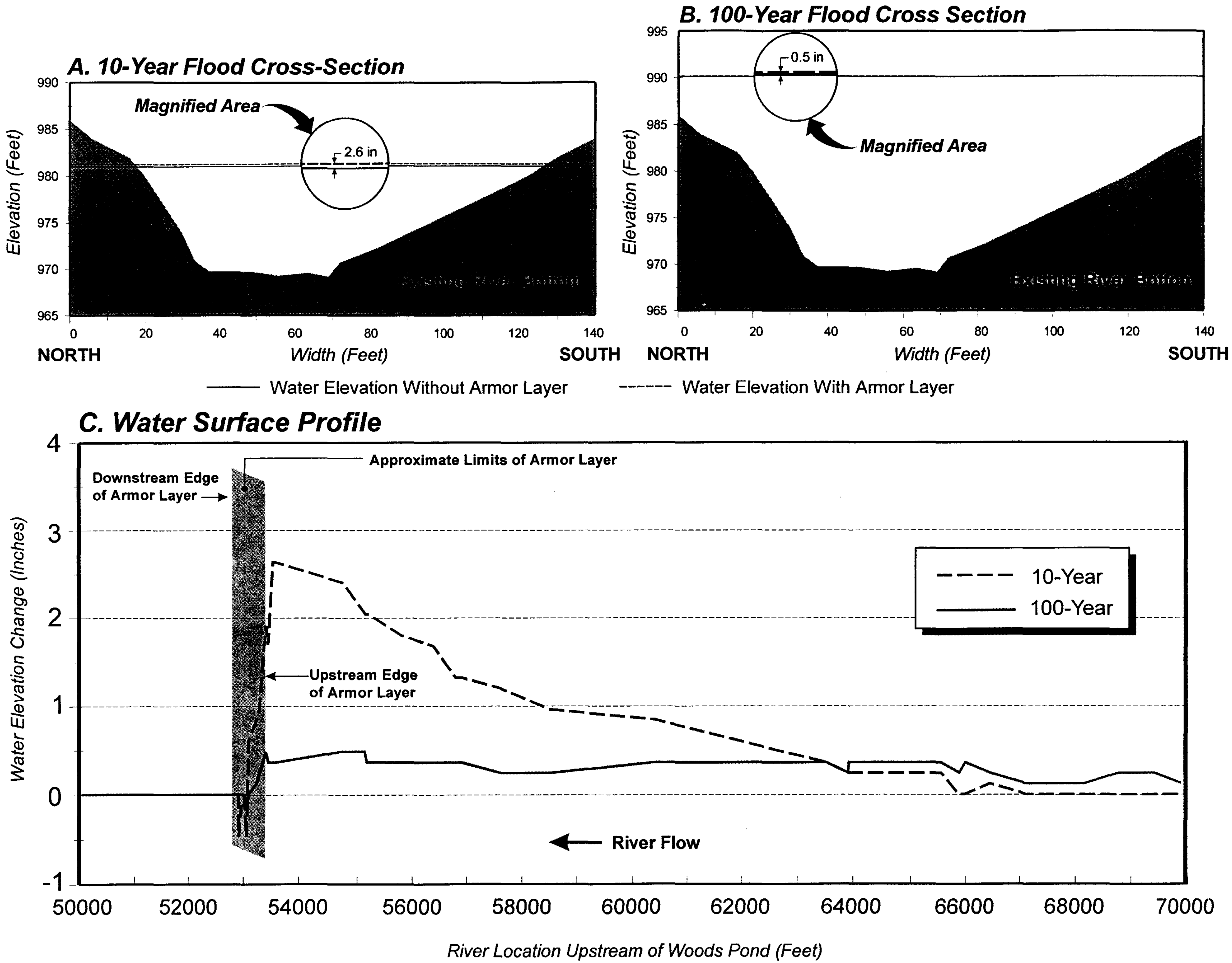
GENERAL ELECTRIC COMPANY
PITTSFIELD MASSACHUSETTS
IMMEDIATE RESPONSE ACTION PLAN
FOR THE BUILDING 68 AREA

TYPICAL CROSS-SECTION
ENGINEERED ARMOR LAYER

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

FIGURE
4-4

L: ON=*, OFF=*REF*
STD/BL
10/96 SYR-54-MFS PMC
10197057\10197G20.DWG



NOTE:

1. Graph "C" represents the water surface profile elevation change resulting from installation of the engineered armor layer for a portion of the Housatonic River.

GENERAL ELECTRIC COMPANY
PITTSFIELD MASSACHUSETTS
IMMEDIATE RESPONSE ACTION PLAN FOR THE BUILDING 68 AREA

WATER SURFACE PROFILE AND CROSS-SECTIONS

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

FIGURE 4-5

10/96 SYR-D54-DJH
10197057/10197n03.CDR

Appendices

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

APPENDIX A

Boring Log/Well Construction

Date Start/Finish: 08/07/96 - 08/07/96
Drilling Company: Maxymillian Drilling Company
Driller's Name: Keith Hoag and Bob Herbert
Drilling Method: Tripod with 140-lb hammer
Bit Size: **Auger Size** :
Rig Type: B&S 5hp Cathead
Spoon Size: 2-in.
Hammer Weight: 140-lb
Height of Fall: 30-in.

Northing:
Easting:
Borehole Depth: 12 ft.
Ground Surface Elev.: ft.

Geologist: Ronald D. Kuhn

Boring No. 68S-1

Client:
General Electric Company

Site:
Building 68
Pittsfield, Massachusetts

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Boring Construction
gs elevation ft.	0									GROUND SURFACE	
		(0-2')								Previously sampled.	Boring backfilled with bentonite chips 0.0' to 12.0'bgs
		(2-4')		12 4 4 5	8	1.6	0.7			Brown fine SAND, trace Silt and natural organics roots, loose damp. Brown fine SAND and black porous light-weight slag material, trace Silt, loose, damp. Medium dense.	
5	-5	(4-6')		5 5 12 12	17	1.8	3.1			At 4.9'bgs 0.2' thick tan and orange (oxidized) fine SAND, trace Silt. At 5.1' bgs brown fine SAND and black porous light-weight slag material, trace Silt, medium dense, damp.	
		(6-8')		12 12 5 4	17	0.4	2.7				
		(8-10')		4 5 5 5	10	1.8	2.9			Brown and orange (oxidized) fine SAND, trace Silt, medium dense, damp.	
10	-10	(10-12')		7 9 4 4	13	1.2	31.4			Brown fine SAND, little Silt, medium dense, wet.	
										Bottom of boring at 12.0' below ground surface (bgs). Borehole collapsed at 12.0'.	
15	-15										

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

Remarks:

Soil samples (2-4'), (4-6'), (6-8'), (8-10'), (10-12') submitted to Northeast Lab for PCB analysis. Soil sample (10-12') submitted to Compuchem Lab for VOC analysis.

Saturated Zones

Date / Time	Elevation	Depth

Date Start/Finish: 08/07/96 - 08/07/96
Drilling Company: Maxymillian Drilling Company
Driller's Name: Keith Hoag and Bob Herbert
Drilling Method: Tripod with 140-lb hammer
Bit Size: **Auger Size**:
Rig Type: B&S 5hp Cathead
Spoon Size: 2-in.
Hammer Weight: 140-lb
Height of Fall: 30-in.

Northing:
Easting:
Borehole Depth: 12 ft.
Ground Surface Elev.: ft.

Geologist: Ronald D. Kuhn

Boring No. 68S-2

Client:
General Electric Company

Site:
Building 68
Pittsfield, Massachusetts

gs elevation ft. 0

GROUND SURFACE

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Boring Construction
		(0-2')								Previously sampled.	Boring backfilled with bentonite chips 0.0' to 12.0'bgs
		(2-4')		12 9 8 5	17	1.2	6.8			Brown medium dense fine SAND and black porous slag material, trace Silt, ~2.0' to 2.2' bgs held together w/ resinous material. Trace red brick, no resinous material, damp.	
5	-5	(4-6')		12 12 9 9	21	1.4	3.4				
		(6-8')		8 10 6 6	16	1.2	9.1				
		(8-10')		4 4 4 4	8	0.0	NA			No recovery 8.0' to 10.0' bgs.	
10	-10	(10-12')		7 7 5 4	12	1.2	7.8			Brown fine SAND and black porous slag, little Silt, medium dense, damp. Brown fine SAND, little Silt, medium dense, moist to wet.	
										Bottom of boring at 12.0' bgs. Borehole collapsed at 12.0'.	
15	-15										

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

Remarks:
NA = Not available. Soil samples (2-4'), (4-6'), (6-8'), and (10-12') submitted to Northeast Lab for PCB analysis.

Saturated Zones

Date / Time	Elevation	Depth

Project: 101.93.31
Script: GEPITT8
Date: 10/18/96

Date Start/Finish: 08/07/96 - 08/07/96 **Drilling Company:** Maxymillian Drilling Company **Driller's Name:** Keith Hoag and Bob Herbert **Drilling Method:** Tripod with 140-lb hammer **Bit Size: Auger Size :** **Rig Type:** B&S 5hp Cathead **Spoon Size:** 2-in. **Hammer Weight:** 140-lb **Height of Fall:** 30-in.	**Northing:** **Easting:** **Borehole Depth:** 10 ft. **Ground Surface Elev.:** ft. **Geologist:** Ronald D. Kuhn	**Boring No. 68S-3** **Client:** General Electric Company **Site:** Building 68 Pittsfield, Massachusetts

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Boring Construction
gs elevation ft	0									**GROUND SURFACE**	
		(0-2')								Previously sampled.	Boring backfilled with bentonite chips 0.0' to 10.0'bgs
		(2-4')		10 12 14 14	26	1.8	6.3			Brown fine to medium SAND and resinous material, medium dense, damp. At 2.2' bgs brown fine SAND and black porous light-weight slag material, medium dense, damp.	
5	-5	(4-6')		9 12 12 12	24	1.2	5.9			Tan brick. Loose.	
		(6-8')		5 3 3 3	6	1.8	661			Dark brown fine SAND and SILT, loose, moist, odor.	
		(8-10')		4 8 3 5	11	1.2	1175			Brown fine SAND, little Silt, medium dense, wet, slight odor.	
10	-10									Bottom of boring at 10.0' bgs. Borehole collapsed at 10.0'.	
15	-15										

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Remarks:

Soil samples (2-4'), (4-6'), (6-8'), (8-10') submitted to Northeast Lab for PCB analysis; (6-8') for VOC analyses and (8-10') for Appendix IX+3 analyses submitted to Compuchem

Saturated Zones

Date / Time	Elevation	Depth

Project: 101.93.31 Script: GEPITT B Date: 10/18/96

Date Start/Finish: 08/08/96 - 08/08/96 **Drilling Company:** Maxymillian Drilling Company **Driller's Name:** Keith Hoag and Bryan Keys **Drilling Method:** Tripod with 140-lb hammer **Bit Size:** **Auger Size:** **Rig Type:** B&S 5hp Cathead **Spoon Size:** 2-in. **Hammer Weight:** 140-lb **Height of Fall:** 30-in.	**Northing:** **Easting:** **Borehole Depth:** 12 ft. **Ground Surface Elev.:** ft. **Geologist:** Ronald D. Kuhn	**Boring No. 68S-4** **Client:** General Electric Company **Site:** Building 68 Pittsfield, Massachusetts

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Boring Construction
gs elevation ft.	0									GROUND SURFACE	
		(0-2')		NA		1.0	4.2			Brown fine to medium SAND, trace Silt, fine Gravel and glass, damp.	
		(2-4')		15 45 13 10	58	1.2	88.5			Brown fine to medium SAND and black porous light-weight slag, trace Silt and fine Gravel, very dense, damp.	Boring backfilled with bentonite chips 0.0' to 10.0'bgs
5	-5	(4-6')		20 14 12 12	26	1.4	168			Trace red brick, medium dense.	
		(6-8')		10 5 5 5	10	1.4	82.0			Brown fine SAND, little Silt, trace natural organics (roots), dense, damp, odor.	
		(8-10')		8 4 7 5	11	0.8	1015			Moist.	
10	-10									Bottom of boring at 10.0' bgs. Borehole collapsed at 10.0'.	
15	-15										

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Remarks:

NA = Not available. Soil samples (2-4'), (4-6'), (6-8'), (8-10') submitted to Northeast Lab for PCBs and to Compuchem Lab for VOC analysis; (0-2') submitted to Compuchem for select Appendix IX+3 parameters.

Saturated Zones

Date / Time	Elevation	Depth

Date Start/Finish: 08/07/96 - 08/07/96 **Drilling Company:** Maxymillian Drilling Company **Driller's Name:** Keith Hoag and Bob Herbert **Drilling Method:** Tripod with 140-lb hammer **Bit Size:** **Auger Size** : **Rig Type:** B&S 5hp Cathead **Spoon Size:** 2-in. **Hammer Weight:** 140-lb **Height of Fall:** 30-in.	**Northing:** **Easting:** **Borehole Depth:** 10 ft. **Ground Surface Elev.:** 978.5 ft. **Geologist:** Ronald D. Kuhn	**Boring No.** 3-6C-EB-3 **Client:** General Electric Company **Site:** Building 68 Pittsfield, Massachusetts

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Boring Construction
gs elevation 978.5 ft.										**GROUND SURFACE**	
		(0-2')		4 4 4 4	8	1.4	3.2			Brown fine SAND, trace Silt, fine Gravel and natural organics (roots, leaves), loose, damp. Trace Silt and slag, loose, damp.	
	975	(2-4')		4 4 5 7	9	1.6	3.6				2-in steel riser 2.5' ags to 5.8' bgs
5		(4-6')		5 5 4 6	9	0.4	3.4				
		(6-8')		4 4 4 4	8	0.4	3.3			Brown fine to medium SAND, trace Silt, loose, wet at tip of spoon. Saturated.	
	970	(8-10')		3 4 1 2	5	1.4	6.7				2-in diameter, 0.010-in slotted stainless steel well screen 5.8' to 10.8' bgs
10										Bottom of boring at 10.0' bgs. Borehole collapsed at 10.0'.	0.7-ft stainless steel well point driven to 11.5' bgs
15	965										

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Remarks:

Soil samples (0-2'), (2-4'), (4-6'), (6-8'), (8-10') submitted to Northeast Lab for PCB analysis.

Saturated Zones

Date / Time	Elevation	Depth

Date Start/Finish: 08/08/96 - 08/08/96 **Drilling Company:** Maxymillian Drilling Company **Driller's Name:** Keith Hoag and Bryan Keys **Drilling Method:** Tripod with 140-lb hammer **Bit Size:** **Auger Size** : **Rig Type:** B&S 5hp Cathead **Spoon Size:** 2" OD-in. **Hammer Weight:** 140 lb.-lb **Height of Fall:** 30-in.-in.	**Northing:** **Easting:** **Borehole Depth:** 8 ft. **Ground Surface Elev.:** 977.16 ft. **Geologist:** Ronald D. Kuhn	**Boring No.** 3-6C-EB-4 **Client:** General Electric Company **Site:** Building 68 Pittsfield, Massachusetts

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Boring Construction
gs elevation 977.16 ft.										**GROUND SURFACE**	
		(0-2')		4 4 3 3	7	0.4	NA			Brown fine SAND, trace Silt and natural organics (roots), loose, damp.	
	975	(2-4')		4 4 3 2	7	0.2	NA				2-in steel riser 2.5' ags to 3.8' bgs
5		(4-6')		4 4 3 4	7	0.0	NA			No recovery 4.0' to 6.0' bgs.	
	970	(6-8')		2 3 2 3	5	1.6	992			Brown fine SAND, trace Silt, loose, wet, slight odor, slight sheen.	2-in diameter, 0.010-in slotted stainless steel well screen 3.8' to 8.8' bgs
										Bottom of boring at 8.0' bgs. Borehole collapsed at 8.0'.	0.7-ft stainless steel well point driven to 9.5' bgs
10											
	965										
15											

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Remarks:

NA = Not available. Soil samples (0-2'), (2-4'), (6-8') submitted to Northeast Lab for PCB analysis; (6-8') submitted to Compuchem for VOC analysis.

Saturated Zones

Date / Time	Elevation	Depth

Project: 101.93.31 Script: GEPITT B Date: 10/18/96

Date Start/Finish: 08/08/96 - 08/08/96
Drilling Company: Maxymillian Drilling Company
Driller's Name: Keith Hoag and Bryan Keys
Drilling Method: Tripod with 140-lb hammer
Bit Size: **Auger Size:**
Rig Type: B&S 5hp Cathead
Spoon Size: 2-in.
Hammer Weight: 140-lb
Height of Fall: 30-in.

Northing:
Easting:
Borehole Depth: 8 ft.
Ground Surface Elev.: 976.0 ft.

Geologist: Ronald D. Kuhn

Boring No. 3-6C-EB-5

Client:
General Electric Company

Site:
Building 68
Pittsfield, Massachusetts

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Boring Construction
gs elevation 976.0 ft.										GROUND SURFACE	
	975	(0-2')		3 4 3 3	7	0.4	8.2			Brown fine SAND, trace Silt and natural organics (roots), loose, damp.	Boring backfilled with bentonite chips 0.0' to 8.0'bgs
		(2-4')		2 2 1 2	3	1.4	2.4			Very loose.	
5		(4-6')		3 1 4 2	5	0.0	NA			No recovery 4.0' to 6.0' bgs. (first and second attempt)	
	970	(6-8')		2 2 2 2	4	2.0	36.6			Brown fine SAND, little Silt, loose.	
10	965									Bottom of boring at 8.0' bgs. Moved 2' west for reattempt sampling at 4-6' and 6-8'.	
15											

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Remarks:
NA - Not available. Soil samples (0-2'), (2-4'), (6-8') submitted to Northeast Lab for PCB analysis; (6-8') submitted to Compuchem for VOC analysis.

Saturated Zones

Date / Time	Elevation	Depth

Project: 101.93.31
Script: GEPITT B
Date: 10/18/96

Date Start/Finish: 08/08/96 - 08/08/96
Drilling Company: Maxymillian Drilling Company
Driller's Name: Keith Hoag and Bryan Keys
Drilling Method: Tripod with 140-lb hammer
Bit Size: **Auger Size**:
Rig Type: B&S 5hp Cathead
Spoon Size: 2-in.
Hammer Weight: 140-lb
Height of Fall: 30-in.

Northing:
Easting:
Borehole Depth: 8 ft.
Ground Surface Elev.: 977.4 ft.

Geologist: Ronald D. Kuhn

Boring No. 3-6C-EB-8

Client:
General Electric Company

Site:
Building 68
Pittsfield, Massachusetts

gs elevation 977.4 ft.

GROUND SURFACE

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Boring Construction
		(0-2')		2 3 1 2	4	0.4	1.0			Brown fine SAND, trace Silt and natural organics (roots), loose, damp.	Boring backfilled with bentonite chips 0.0' to 8.0'bgs
	975	(2-4')		2 3 3 3	6	0.8	2.3			Trace black porous light-weight slag.	
5		(4-6')		4 3 2 1	5	1.8	9.1			Brown fine SAND, little Silt, trace natural organics (reed), loose, moist to wet.	
	970	(6-8')		1 2 1 2	3	0.4	8.9			Very loose.	
										Bottom of boring at 8.0' bgs.	
10											
	965										
15											

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Remarks:
Soil samples (0-2'), (2-4'), (4-6'), (6-8') submitted to Northeast Lab for PCB analysis.

Saturated Zones

Date / Time	Elevation	Depth

Project: 101.93.31 Script: GEPITTB Date: 10/18/96

Date Start/Finish: 08/07/96 - 08/07/96 **Drilling Company:** Maxymillian Drilling Company **Driller's Name:** Keith Hoag and Bob Herbert **Drilling Method:** Tripod with 140-lb hammer **Bit Size:** **Auger Size:** **Rig Type:** B&S 5hp Cathead **Spoon Size:** 2-in. **Hammer Weight:** 140-lb **Height of Fall:** 30-in.	**Northing:** **Easting:** **Borehole Depth:** 8 ft. **Ground Surface Elev.:** 977.8 ft. **Geologist:** Ronald D. Kuhn	**Boring No.** 3-6C-EB-7 **Client:** General Electric Company **Site:** Building 68 Pittsfield, Massachusetts

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Boring Construction
gs elevation 977.8 ft.										**GROUND SURFACE**	
		(0-2')		7 4 6 8	10	1.2	0.0			Brown fine SAND, trace Silt and natural organics (roots), medium dense, damp.	Boring backfilled with bentonite chips 0.0' to 8.0' bgs
	975	(2-4')		6 6 6 6	12	0.6	2.0			Trace black slag material.	
5		(4-6')		7 7 6 6	13	0.6	4.1			Brown fine to medium SAND, trace fine Gravel and natural organics (roots), medium dense, damp.	
	970	(6-8')		5 5 5 5	10	0.4	0.5			Wet at tip of spoon.	
										Bottom of boring at 8.0' bgs. Borehole collapsed at 8.0'.	
10											
	965										
15											

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Remarks:
Soil samples (0-2'), (2-4'), (4-6'), (6-8') submitted to Northeast Lab for PCB analysis.

Saturated Zones

Date / Time	Elevation	Depth

Project: 101.93.31
Script: GEPITT B
Date: 10/18/96

Date Start/Finish: 09/04/96 - 09/04/96 **Drilling Company:** Maxymillian Drilling Company **Driller's Name:** Keith Hoag and Dick Lapointe **Drilling Method:** Tripod with 140-lb hammer **Bit Size:** **Auger Size** : **Rig Type:** B&S 5hp Cathead **Spoon Size:** 2-in. **Hammer Weight:** 140-lb **Height of Fall:** 30-in.	**Northing:** **Easting:** **Borehole Depth:** 8 ft. **Ground Surface Elev.:** ft. **Geologist:** Ronald D. Kuhn	**Boring No.** 3-6C-EB-8 **Client:** General Electric Company **Site:** Building 68 Pittsfield, Massachusetts

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Boring Construction
gs elevation ft	0									**GROUND SURFACE**	
		(0-2')		2 4 2 4	6	1.4	NA			Brown fine SAND, trace Silt and natural organics (leaf litter and roots), loose, damp.	
		(2-4')		2 2 3 2	5	1.6	0.0			Brown fine SAND, trace Silt, fine Gravel and roots, loose, damp.	Boring backfilled with bentonite chips 0.0' to 8.0'bgs
5	-5	(4-6')		3 3 3 2	6	2.0	0.0			Wet at 6.0' bgs.	
		(6-8')		2 2 2 2	4	2.0	0.0			Brown fine SAND, trace Silt and natural organics (roots), loose. Two natural organic peat layers ~0.5" thick at 6.8' and 7.4' bgs, saturated at ~7.0' bgs.	
										Bottom of boring at 8.0' bgs.	
10	-10										
15	-15										

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Remarks:
NA = Not available. Soil samples (0-0.5'), (0.5-2'), (2-4'), (4-6'), (6-8') submitted to Northeast Lab for PCB analysis.

Saturated Zones

Date / Time	Elevation	Depth

Date Start/Finish: 09/04/96 - 09/04/96 **Drilling Company:** Maxymillian Drilling Company **Driller's Name:** Keith Hoag and Dick Lapointe **Drilling Method:** Tripod with 140-lb hammer **Bit Size:** **Auger Size:** **Rig Type:** B&S 5hp Cathead **Spoon Size:** 2-in. **Hammer Weight:** 140-lb **Height of Fall:** 30-in.	**Northing:** **Easting:** **Borehole Depth:** 8 ft. **Ground Surface Elev.:** ft. **Geologist:** Ronald D. Kuhn	**Boring No.** 3-6C-EB-9 **Client:** General Electric Company **Site:** Building 68 Pittsfield, Massachusetts

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Boring Construction
gs elevation ft. 0										GROUND SURFACE	
		(0-2')		2 3 3 2	6	1.0	NA			Brown fine SAND, trace Silt and natural organics (leaf litter and roots), loose, damp.	Boring backfilled with bentonite chips 0.0' to 8.0' bgs
		(2-4')		1 3 2 2	5	1.4	5.3			Trace Silt, orange oxidized fine Sand and natural organics (roots), loose, damp.	
										Trace Silt and natural organics (roots), very loose, damp.	
5	-5	(4-6')		1 1 1 2	2	1.6	67.4			Gray-brown fine to medium SAND, trace Silt, very loose, wet.	
		(6-8')		1 1 1 22	2	1.8	89.0			Saturated at 7.0' bgs. Tree root from 7.2' to 7.8' bgs.	
										Bottom of boring at 8.0' bgs.	
10	-10										
15	-15										

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Remarks:
NA = Not available. Soil samples (0-0.5'), (0.5-2'), (2-4'), (4-6'), (6-8') submitted to Northeast Lab for PCB analysis. Soil samples (4-6'), (6-8') submitted to Compuchem for VOC analysis.

Saturated Zones

Date / Time	Elevation	Depth

Project: 101.93.31 Script: GEPITT B Date: 10/18/96

Date Start/Finish: 09/04/96 - 09/04/96 **Drilling Company:** Maxymillian Drilling Company **Driller's Name:** Keith Hoag and Dick Lapointe **Drilling Method:** Tripod with 140-lb hammer **Bit Size:** **Auger Size** : **Rig Type:** B&S 5hp Cathead **Spoon Size:** 2-in. **Hammer Weight:** 140-lb **Height of Fall:** 30-in.	**Northing:** **Easting:** **Borehole Depth:** 8 ft. **Ground Surface Elev.:** ft. **Geologist:** Ronald D. Kuhn	**Boring No.** 3-6C-EB-10 **Client:** General Electric Company **Site:** Building 68 Pittsfield, Massachusetts

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Boring Construction
gs elevation ft	0									**GROUND SURFACE**	
		(0-2')		2 3 3 4	6	1.0	NA			Brown fine SAND, trace Silt and natural organics (roots), loose, damp.	Boring backfilled with bentonite chips 0.0' to 8.0' bgs
		(2-4')		3 5 3 3	8	1.6	0.0			Trace orange oxidized fine Sand, Silt, and natural organics, damp.	
5	-5	(4-6')		2 4 4 3	8	2.0	34.8			Trace Silt and natural organics (~0.5"), peat layers 4.4' to 5.6' bgs, damp.	
		(6-8')		2 3 3 3	6	2.0	53.2			Brown fine SAND, trace Silt and natural organics (roots), loose, slight odor, saturated at ~7.0' bgs.	
										Bottom of boring at 8.0' bgs.	
10	-10										
15	-15										

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Remarks:

Soil samples (0-0.5'), (0.5-2'), (2-4'), (4-6'), (6-8') submitted to Northeast Lab for PCB analysis. Soil samples (4-6'), (6-8') submitted to Compuchem for VOC analysis.

Saturated Zones

Date / Time	Elevation	Depth

Date Start/Finish: 09/04/96 - 09/04/96
Drilling Company: Maxymillian Drilling Company
Driller's Name: Keith Hoag and Dick Lapointe
Drilling Method: Tripod with 140-lb hammer
Bit Size: **Auger Size**:
Rig Type: B&S 5hp Cathead
Spoon Size: 2-in.
Hammer Weight: 140-lb
Height of Fall: 30-in.

Northing:
Easting:
Borehole Depth: 10 ft.
Ground Surface Elev.: ft.

Geologist: Ronald D. Kuhn

Boring No. 3-6C-EB-11

Client:
General Electric Company

Site:
Building 68
Pittsfield, Massachusetts

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Boring Construction
gs elevation ft	0									GROUND SURFACE	
		(0-2')		2 2 5 4	7	1.0	NA			Brown fine SAND, trace Silt and natural organics (roots), loose, damp. Trace black light-weight porous slag (large piece in tip of spoon).	Boring backfilled with bentonite chips 0.0' to 10.0'bgs
		(2-4')		3 4 5 10	9	0.8	2.2				
5	-5	(4-6')		8 5 3 2	8	0.0	NA			No recovery 4.0 to 6.0' bgs.	
		(6-8')		3 3 3 2	6	1.2	4.9			Brown fine SAND, little Silt, loose, moist. Saturated at ~8.0' bgs.	
		(8-10')		2 2 4 5	6	2.0	0.0				
10	-10									Bottom of boring at 10.0' bgs.	
15	-15										

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Remarks:
NA = Not available. Soil samples (0-0.5'), (0.5-2'), (2-4'), (6-8'), (8-10') submitted to Northeast Lab for PCB analysis.

Saturated Zones

Date / Time	Elevation	Depth

Project: 101.93.31
Script: GEPITTB
Date: 10/18/96

Date Start/Finish: 09/04/96 - 09/04/96 **Drilling Company:** Maxymillian Drilling Company **Driller's Name:** Keith Hoag and Dick Lapointe **Drilling Method:** Tripod with 140-lb hammer **Bit Size:** **Auger Size**: **Rig Type:** B&S 5hp Cathead **Spoon Size:** 2-in. **Hammer Weight:** 140-lb **Height of Fall:** 30-in.	**Northing:** **Easting:** **Borehole Depth:** 8 ft. **Ground Surface Elev.:** ft. **Geologist:** Ronald D. Kuhn	**Boring No.** 3-6C-EB-12 **Client:** General Electric Company **Site:** Building 68 Pittsfield, Massachusetts

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Boring Construction
gs elevation ft.	0									GROUND SURFACE	
		(0-2')		3 2 3 2	5	0.8	NA			Brown fine SAND, trace Silt and natural organics (roots), loose, damp. (Had to take spoon next to boring for 0.5'-2.0' sample due to low recovery).	Boring backfilled with bentonite chips 0.0' to 8.0'bgs
		(2-4')		3 7 6 6	13	0.8	0.0			Medium dense.	
5	-5	(4-6')		6 8 4 4	12	0.3	NA			Brown fine SAND and black porous light-weight slag, medium dense, damp.	
		(6-8')		4 3 3 4	6	1.2	0.4			Loose, saturated at ~7.0' bgs.	
										Bottom of boring at 8.0' bgs.	
10	-10										
15	-15										

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Remarks:

Soil samples (0-0.5'), (0.5-2'), (2-4'), (4-6'), (6-8') submitted to Northeast Lab for PCB analysis.

Saturated Zones

Date / Time	Elevation	Depth

Project: 101.93.31
Script: GEPITTB
Date: 10/18/96

Date Start/Finish: 09/05/96 / 09/05/96
Drilling Company: Geologic Drilling Company
Driller's Name: Tony Martinelli/Ron Krekorian
Drilling Method: Pneumatic Push
Bit Size: **Auger Size** :
Rig Type: Diedrich D-25
Spoon Size: 1-in.

Northing:
Easting:
Well Casing Elev.: 984.36 ft.
Corehole Depth:
Borehole Depth: 38 ft.
Ground Surface Elev.: 984.64 ft.

Geologist: Ronald D. Kuhn

Well No. 3-6C-EB-13

Client:
General Electric Company

Site:
Building 68
Pittsfield, Massachusetts

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Well Construction
gs elevation 984.64 ft										The boring was drilled at an angle 20 degrees from vertical. All DEPTH measurements represent distance along the boring, not depth below grade. **GROUND SURFACE**	4-in. steel flushmount protective casing, locking well cap
										Concrete.	Concrete pad ground surface to 0.7' depth
		(0-2')				1.0	0.0			Black fine SAND, trace Silt, damp.	
										Brown fine to medium SAND, trace fine Gravel, damp.	
		(2-4')				1.4	0.0			Brown/black fine SAND, trace Silt and glass, damp.	
										Trace black light-weight porous slag.	
5		(4-6')				0.8	0.0				1-in. OD Schedule 40 PVC casing 0.4' to 28.25' depth
		(6-8')				1.6	2.0			Brown/black fine SAND, trace Silt, glass, and black light-weight porous slag, damp.	
	976.74									**FILL/NATIVE MATERIAL CONTACT**	
		(8-10')				1.6	20.0			Brown fine SAND, tace Silt, damp.	Bentonite seal 0.5' to 26.0' depth
10										Trace natural organics (roots).	
		(10-12')				2.0	0.0				
										Moist.	
		(12-14')				1.8	7.0			Dark gray fine SAND, trace Silt and wood fragments (roots), wet.	
										Trace Silt, saturated.	
15		(14-16')				0.4	3.0				

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Remarks:
To convert from DEPTHs to distance below grade, multiply by 0.94.

Water Levels

Date / Time	Elevation	Depth
09/16/96	971.57	13.61

Site:
Building 68
Pittsfield, Massachusetts

Client:
General Electric Company

Well No. 3-6C-EB-13

Total Depth = 38 ft.

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Well Construction
		(14-16')				0.4	3.0				
		(16-18')				0.8	3.0			Dark gray fine to medium SAND, trace fine Gravel, saturated.	1-in. OD Schedule 40 PVC casing 0.4' to 28.25' depth
		(18-20')				2.0	60.0			Odor.	
	966.34									Gray brown SILT, moist, odor.	
20	965.84	(20-22')				1.5	60.0			Gray fine to coarse SAND, little fine to medium Gravel, trace Silt, saturated, sheens, odor.	
		(22-24')				1.2	68.0			Dense, slight sheen when soil mixed with water, odor.	Bentonite seal 0.5' to 26.0' depth
25		(24-26')				1.0	38.0			Increasing density with depth.	
		(26-28')				1.1	28.0				
		(28-30')				1.4	24.0				
30		(30-32')				1.2	18.0				1-in. OD 0.010 slotted Schedule 40 PVC screen 28.25' to 37.75' depth
		(32-34')				1.4	22.0				Grade #0 silica sand pack 26.0' to 38.0' depth
35		(34-36')				1.6	10.0				

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Remarks:

Soil samples were submitted to Northeast Lab for PCB analysis and to Compuchem Lab for VOC analysis.

Water Levels

Date / Time	Elevation	Depth
09/16/96	971.57	13.61

Project: 101.93.31

Script: GEPITT W
Date: 10/10/96

Site:
Building 68
Pittsfield, Massachusetts

Client:
General Electric Company

Well No. 3-6C-EB-13

Total Depth = 38 ft.

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Well Construction
		(34-36')				1.6	10.0				
	949.50	(36-38')				1.2	3.1			Olive brown SILT, trace fine to medium Gravel and fine Sand, stiff, moist.	1-in. OD Schedule 40 PVC sump 37.75' to 38.0' depth
	948.94									Total length of angled boring 38.0'. distance below grade of the base of the boring is 35.7'.	
40											
45											
50											
55											

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Remarks:

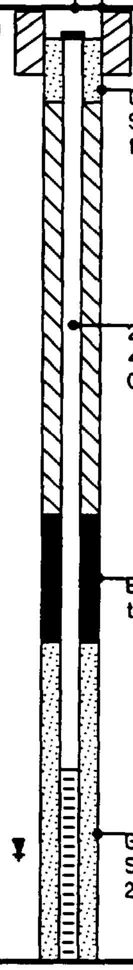
Water Levels

Date / Time	Elevation	Depth
09/16/96	971.57	13.61

Project: 101.93.31 Script: GEPITT W Date: 10/10/96

Date Start/Finish: 09/12/96 / 09/12/96 **Drilling Company:** Maxymillian **Driller's Name:** Keith Hoag **Drilling Method:** HSA **Bit Size:** **Auger Size** : 4.25-inch ID **Rig Type:** Mobile B-57 **Spoon Size:** 1-in.	**Northing:** **Easting:** **Well Casing Elev.:** 984.20 ft. **Corehole Depth:** **Borehole Depth:** 22 ft. **Ground Surface Elev.:** 984.68 ft. **Geologist:** Ronald D. Kuhn	**Well No. 3-6C-EB-14** **Client:** General Electric Company **Site:** Building 68 Pittsfield, Massachusetts

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Well Construction
gs elevation 984.68 ft.										**GROUND SURFACE**	7-in. steel flushmount protective casing, locking well cap; Concrete pad ground surface to 1.0' bgs
										Augered continuously to a depth of 12 feet below ground surface. See subsurface boring log for well 3-6C-EB-13 for detailed geologic descriptions.	Grade #2 Silica Sand drain 0.5' to 1.5' bgs
5	980										2-in. ID Schedule 40 PVC casing 0.48' to 12.0' bgs
10	975										Bentonite seal 8.0' to 10.0' bgs
		(12-14')		3 2 2 5	4	1.6	0.0			Gray brown fine SAND, trace medium Sand and Silt, wet, saturated at tip of splitspoon.	Grade #2 Silica Sandpack 10.0' to 21.5' bgs
15	970	(14-16')		1 4	9	1.5	0.0				



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Remarks:

No analytical soil samples were obtained at this location.

Water Levels

Date / Time	Elevation	Depth
09/16/96	971.34	13.34

Site:
Building 68
Pittsfield, Massachusetts

Client:
General Electric Company

Well No. 3-6C-EB-14

Total Depth = 22 ft.

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Well Construction
		(14-16')		5 7	9	1.5	0.0			@ 14.0', Dark gray fine to medium SAND, trace Silt, medium Gravel, and roots, saturated, slight odor.	
		(16-18')		6 7 9 10	16	1.6	0.0			Dark gray fine to medium SAND, trace coarse Sand, fine to medium Gravel, and Silt, saturated, slight odor.	2-in. ID 0.010 slotted Schedule 40 PVC screen 12.0' to 21.5' bgs
20	965	(18-20')		4 6 5 8	11	1.8	31.3			Gray brown SILT, trace fine Sand, saturated, slight odor, slight sheens.	
		(20-22')		5 11 12 8	23	1.4	0.0			Gray fine to coarse SAND, little fine to medium Gravel, trace Silt, saturated, slight odor.	2-in. ID Schedule 40 PVC sump 21.5' to 22.0' bgs
										End of boring at 22.0' below ground surface.	Bentonite seal 21.5' to 22.0' bgs
25	960										
30	955										
35	950										

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engineers & scientists

Remarks:

Water Levels

Date / Time	Elevation	Depth
09/16/98	971.34	13.34

Project: 101.93.31
Script: GEPITT W
Date: 10/10/98

APPENDIX B

Information Regarding Armoring at Other, Similar Sites

APPENDIX B

Information Regarding Armoring at Other, Similar Sites

Armoring has been employed at a number of sites across the country for the remediation of sediments containing PCBs. This Appendix includes a discussion of various pilot- or bench-scale studies performed by the United States Army Corp of Engineers (USACE) and summary of full-scale armoring projects involving sites/conditions similar to the Housatonic River. While the scope of remedial actions for these other sites is necessarily different, the experience gained from these projects provides beneficial insight regarding the applicability and feasibility of similar actions for the Building 68 area sediments.

Bench-Scale Studies

Armoring has been extensively studied by the USACE in bench-scale studies. The USACE has performed both small- and large-scale laboratory (bench) testing at its Waterways Experiment Station (WES) in Vicksburg, Mississippi, to evaluate the effectiveness of various armoring materials and thicknesses. As part of those laboratory analyses, the USACE has tested PCB-containing sediments from several waterways, including New Bedford Harbor, Dutch Kills, and Indiana Harbor. These studies are described below.

New Bedford Harbor (MA)

Sturgis and Gunnison (1988) used small-scale test units to evaluate the effectiveness of capping New Bedford Harbor sediments (containing 2,200 ppm PCBs). The evaluation used "clean" sediments from the harbor (containing 8.4 ppm PCBs) as a capping medium and concluded that a 35-cm (14-inch) cap constructed on native sediments was effective in preventing the release of soluble tracers (ammonium-nitrogen, orthophosphate-phosphorus) and the migration of PCBs from the sediments into the water column.

Dutch Kills (NY)

Experiments using Buttermilk Channel sediments (containing 1 ppm PCBs) as a cap material for isolating Dutch Kills sediment (containing 18 ppm PCBs) were performed by Brannon et al. (1986), employing both small- and large-scale testing units. Small-scale tests showed that a cap thickness of 22 cm (9 inches) was sufficient to prevent transfer of dissolved constituents into overlying water.

Indiana Harbor (IN)

The effectiveness of capping Indiana Harbor sediments (containing 22 ppm PCBs) using Lake Michigan sediments (containing 0.013 ppm PCBs) was studied at WES (Environmental Laboratory 1987). Both small- and large-scale testing units were used. The small-scale tests concluded that a cap was sufficient in preventing transfer of constituents into overlying water. The large-scale studies indicated that a 30-cm (12-inch) cap prevented the migration of organic constituents, namely PCBs and polycyclic aromatic hydrocarbons (PAHs), from underlying sediment into the water column. The USACE recommended that a minimum cap thickness of 50 cm (20 inches) be used to protect against the effects of deep burrowing biota.

The general conclusion to be drawn from these pilot-scale studies is that sediment armoring can be an effective means to control the accessibility and mobility of contaminants present in aquatic media. Since these studies involved PCBs, conclusions drawn have a high level of applicability to the proposed IRA for sediments in the Building 68 area.

Large-Scale Applications

Several large-scale applications of sediment armoring have been performed throughout the country, a number of which involved PCBs. These applications are summarized below:

Fort Edward Dam (NY)

In 1973, when the Fort Edward Dam on the Hudson River was removed, the water in the dam pool receded, exposing large remnant deposits containing concentrations of PCBs up to 2,000 ppm. The deposits consisted of unconsolidated deposits of silty sand, gravel, sawdust, and wood products, and extended from near-edge river sediments, over the river bank, and to the former dam pool elevations. To mitigate potential sediment erosion into the Hudson River, certain remnant deposits were armored in 1974 using rip rap armor stone underlain by a geotextile (Canonie 1990). From 1988 through 1990, during further investigations to address the remaining remnant deposits, it was observed that the armor stone had prevented further erosion of the sediments for 15 years. In 1991, the remainder of the remnant deposits were armored on the banks using the same stone size and stone geometry. The remnant deposit cap included (from bottom up) a minimum 8-inch sand base layer, a CLAYMAX® bentonite geocomposite, a 12-inch sand drainage layer, and a 6-inch vegetated topsoil layer. Along the shoreline, the cap configuration included (from bottom up) a geotextile, a CLAYMAX® bentonite geocomposite, a 12-inch filter stone layer, and 18 inches of rip rap. The bank armoring system has been successful for over 20 years in preventing sediment erosion and transport from the remnant deposits (Harrington 1996).

Waukegan Harbor (IL)

At the Waukegan Harbor Superfund Site in Waukegan, Illinois, armoring was used to address a section of sandy soil in a drainage ditch containing PCB concentrations of 1,000 to 10,000 ppm. These materials could not be removed due to the proximity of nearby high-voltage power transmission lines. The ditch was subject to rapid water level fluctuations from Lake Michigan during strong winds from the east. Because of the potential for loss of these soils during storms and to protect a soil-bentonite slurry wall running parallel to the ditch, armoring was used on the bank deposits. The armoring system consists of a geotextile layer overlain with 18 inches of 2-inch by 9-inch armor stone (Canonie 1991). The system was installed in the summer of 1992 and has performed well for the past three years (Brissette 1996). Performance is assessed qualitatively by comparing the armored section of the ditch to unarmored sections of the ditch, where bank erosion has occurred since the ditch was cleaned in 1992.

Sheboygan Harbor (WI)

Armoring was determined to be potentially applicable for PCB-containing sediment within the Sheboygan River and Harbor Superfund Site in Sheboygan, Wisconsin. Therefore, an armoring pilot study was implemented to further evaluate the effectiveness of this technology (Blasland & Bouck 1990). Approximately 26,000 square feet of sediment in the Sheboygan River was identified for armoring, which involved constructing an armor cap consisting of geotextile, bank run gravel, and stone over several sediment areas in the river in the fall of 1989 and spring of 1990. The typical water depth in these areas was 1 to 2 feet, indicating that this study may be an applicable comparison for evaluating the proposed IRA. In September 1994, a visual inspection by representatives from the USEPA, Wisconsin Department of Natural Resources, and Tecumseh Products Company indicated that the armoring was in excellent physical condition and continues to withstand the erosional forces of the river after six years of implementation (Thimke 1996).

Summary

Relevant experience has shown that armoring is an effective, reliable, and implementable technology for addressing PCB-containing sediments. Armoring reduces the mobility of the contaminants in the sediments and at the same time prevents exposure of human and ecological receptors to those contaminants. At the Waukegan Harbor, Sheboygan River, and Hudson River (Fort Edward) sites, armoring systems have been performing effectively since they were installed.

The information obtained from the armoring projects summarized in this Appendix supports the feasibility of armoring the sediments in the Building 68 area.

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APPENDIX C

Basis of Design-Sediment IRA Armoring Layer

C-1 Site-Specific Analysis of Isolation Layer Configuration

C-2 Site-Specific Computational Study of Protective Layer

APPENDIX C

Basis of Design Sediment IRA
Armoring Layer

C-1. Site-Specific Analysis of Isolation Layer Configurations

The design and installation of a sediment armoring system can involve a number of configurations; one possible component is the presence of an isolation layer positioned directly above the sediment. When used in conjunction with an overlying erosion protection layer, a two-component armoring system of this type provides an effective barrier between the PCB-containing sediment and the overlying water column. From a remedial action perspective, a properly designed, constructed, and maintained armoring system can be highly effective in isolating the affected sediment and reducing the potential for the following three primary conditions:

- resuspension of PCB-containing sediments into the water column;
- desorption of PCBs from the sediments into the water column; and
- direct contact of humans and biological receptors to the sediment.

The presence of an isolation layer (as part of an overall armoring system) provides a long-term reduction of PCB flux (i.e., migration) from the sediment into the water column by addressing the following physicochemical processes that 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.

With respect to the proposed use of armoring for this IRA, the principles discussed above can be evaluated through mathematical modeling. Modeling has the ability to evaluate the comparative effectiveness of potential armoring layer configurations. The results of this effort (summarized below) are useful in understanding the potential applications and performance of an isolation layer for the PCB-containing sediments.

The assessment of potential isolation layer configurations involves the comparative evaluation between existing and post-armoring conditions. To conduct this evaluation, several parameters were initially established, including the existing sediment conditions for the river reach, and the potential isolation layer configurations. Sediment-related parameters selected for this evaluation were based on the available data, while the initial isolation layer parameters were based on professional experience and judgment. A summary of evaluation parameters is presented below.

Existing Conditions

PCB Concentration - 2,041 ppm as Aroclor 1260 (based on the spatial average observed PCB concentration in the top 6 inches).

Total Organic Carbon - 2 percent (based on the arithmetic average of observed TOC concentrations in the top 6 inches)

Isolation Layer Configurations

No. 1 - 6-inch sandy silt, 0.25 percent TOC
No. 2 - 6-inch sandy silt, 0.5 percent TOC
No. 3 - 6-inch sandy silt, 1 percent TOC

Through various techniques, presented below, the transport of PCBs via diffusion and advection/dispersion from the sediment into the water column was estimated. The effectiveness of a given isolation layer configuration (in comparison to existing conditions or other configurations) was then evaluated using two primary criteria. The first criterion is the time during which the isolation layer eliminates the releases of PCBs to the water column. During this period of time, the isolation layer materials are capable of adsorbing any PCBs that are released or disturbed from the sediment. The second evaluation criterion was the ultimate reduction in flux of PCBs released from the sediments into the water column.

The results of the modeling efforts described below indicate PCB breakthrough times to be greater than 700 years for all isolation layer configurations that were evaluated. Thus, a 6-inch sandy silt isolation layer would be sufficient. In addition, even if and when breakthrough may theoretically occur, the total flux (diffusion and advection) from the sediments to the water column would be significantly reduced. Additional information regarding the assumptions, calculations, and other parameters utilized in this evaluation is presented below.

Due to the conservative nature of this evaluation, the calculated PCB transport rates from the sediments under "baseline" and isolated conditions are also considered conservative. The remainder of this appendix is organized as follows:

In addition, a number of tables and figures are presented to support the appendix narrative.

1.0 Selection of "Baseline" Site Conditions

As part of the evaluation of sediment isolation layer configurations, a variety of "baseline" conditions were considered. These conditions were developed based on available sediment data, and were utilized to identify the rate of PCB migration from sediment to the water column (for subsequent comparison purposes). These conditions were:

- Based on available sediment data, a total organic carbon (TOC) concentration of 2 percent was selected to be representative along with an arithmetic average PCB concentration of 2,041 ppm (as Aroclor 1260); and

- For the purposes of this evaluation, a groundwater seepage velocity of 1 meter per year was conservatively assumed for the isolation layer evaluations for the Housatonic River.

2.0 Estimates of Sediment Porewater PCB Concentrations

The theoretical PCB concentration in sediment porewater consists of two phases: a freely dissolved phase and a dissolved organic carbon (DOC)-sorbed phase. The dissolved phase equilibrium PCB concentration in porewater is described by the partitioning equation:

$$C_{DIS} = C_{SED}/(f_{oc} \times K_{oc})$$

where:

C_{DIS} = PCB concentration in porewater (mg/L)
C_{SED} = PCB concentration in the sediment (mg/kg)
f_{oc} = fraction of organic carbon in the sediment (gm/gm)
K_{oc} = organic carbon partitioning coefficient for PCB (L/kg)

The equilibrium concentration of PCBs sorbed to DOC in porewater can be described by the partitioning equation:

$$C_{DOC} = (M_{DOC} \times K_{DOC}) \times [C_{SED}/(f_{oc} \times K_{oc})]$$

where:

C_{DOC} = Concentration of PCB sorbed to dissolved organic carbon (mg/L)
M_{DOC} = Concentration of DOC in porewater (mg/L)
K_{DOC} = Dissolved organic carbon partitioning coefficient (L/kg)

Using the assumptions that

K_{oc} = K_{ow} (octanol-water partitioning coefficient)
K_{DOC} = $0.1 \times K_{oc}$ and
M_{DOC} = $15 \times 10^{-4} f_{oc}$

the calculation of C_{DOC} simplifies to:

$$C_{DOC} = C_{SED} \times 1.5 \times 10^{-4}$$

This relationship indicates that the estimated concentration of PCBs associated with DOC is a function of the assumed sediment PCB concentration, independent of either sediment TOC or the partitioning coefficients.

The total porewater PCB concentration (C_{pw}) is then described by:

$$C_{pw} = C_{DIS} + C_{DOC}$$
$$= C_{SED}\,[(1.5 \times 10^{-4}) + (f_{oc} \times K_{oc})^{-1}]$$

Figure 1 shows this relationship as a function of sediment f_{oc} assuming a sediment concentration of 2,041 ppm as Aroclor 1260 (log K_{oc} = 6.6). This situation represents a "baseline" condition for the Housatonic River. From Figure 1 it may be noted that even at relatively low sediment TOC concentrations, a majority of the PCBs in porewater is associated with DOC. Table 1 presents the calculated freely dissolved, DOC-associated and total PCB concentration for the sediments to be evaluated. Due to the effect of partitioning of PCB to the DOC equilibrium, porewater concentrations for the Housatonic River sediments remain relatively constant even if sediment TOC concentration varies.

3.0 Estimates of PCB Transport Under "Baseline" Conditions

To estimate the diffusive flux of PCB from sediment to the water column under "baseline" conditions (for comparison to the flux after isolating), a sediment/water exchange coefficient (K_f) of 0.019 m/day was estimated. This estimate was based on average sediment PCB and TOC concentrations, river bed surface area, and baseflow water column PCB concentrations. Note this estimate does not include PCBs that may be introduced into the water column by physical resuspension of un-armored sediments.

The flux from existing, un-armored sediments is determined by the equation:

$$Flux = K_f A\, C_{pw}$$

For Housatonic River sediment with 2 percent TOC and an average PCB concentration of 2,041 ppm:

$$Flux = (0.019 \text{ m/day})(4040 \text{ m}^2\text{/acre})(332 \times 10^{-6} \text{ gm/L})(1000 \text{ L/m}^3)$$
$$= 25.5 \text{ gm/acre/day}$$
$$= 9.3 \text{ kg/acre/yr (20.5 pounds/acre/year)}$$

4.0 Estimated PCB Transport Through Isolation Layer

4.1 PCB Transport by Diffusion

Where groundwater flow through the isolation layer is absent, molecular diffusion is the determining transport mechanism controlling the movement of PCB through the isolation layer. To estimate the breakthrough time (t_b), time to achieve steady state (t_{ss}), and steady-state flux rate through the isolation layer, the equations presented in Wang and others (1991) and Thoma and others (1993) were used. This method is equivalent to the method used by Thibodeaux and others (1990) to evaluate the effectiveness of capping PCB sediments at New Bedford Harbor, Massachusetts. Murray and others (1994) have used these models for determining the potential migration of copper through a cap in Long Island Sound. The verification of these models for PCB-containing sediments in laboratory simulations has been previously documented by Formica and others (1988).

As previously indicated for this evaluation, isolation layer thicknesses of 6 inches (15 cm) were used for the silty sand layer. Three organic carbon contents for the sand layer were used: 0.25, 0.5, and 1.0 percent. The background river water column PCB concentrations were conservatively assumed to be zero (i.e., worst case). Due to the low relative migration rate, the average PCB concentrations in sediments were assumed to remain constant over time. Local equilibrium and linear partitioning between sediment (or armored) particles and the aqueous phase also were assumed. Finally, it was assumed that additional sediment would not accumulate over the isolation layer, and that degradation of the PCBs would not occur within the sediment bed.

Equations 8 and 9 of Wang and others (1991) and Equation 11 of Thoma and others (1993) were used to analyze breakthrough and steady-state times. The first six terms of the infinite series in Equation 8 from Wang and others, with time-dependent flux rate equal to 5 percent of maximum flux, were used to calculate time to breakthrough.

For breakthrough time (t_b):

$$0.95 = -2\sum_{N=1}^{6}(^{-}1)^{N}\exp\left[\frac{-D_t N^2\pi^2 t_b}{L^2}\right]$$

where t_b = breakthrough time (sec)
L = isolation layer thickness (cm)
D_t = transient transport effective diffusion coefficient = D_e/R_f
R_f = retardation factor = $\epsilon + \rho_b K_p$
D_e = effective diffusivity = $D_w \epsilon^{1.33}$
D_w = chemical diffusivity
ϵ = porosity of isolation layer material
K_p = partitioning coefficient for isolation layer material = $K_{oc} \times f_{oc}$
K_{oc} = PCB distribution coefficient with organic carbon
f_{oc} = fraction organic carbon in the isolation layer

Values for parameters used in the analysis of diffusive transport are presented in Table 2.

The first term of the infinite series produces an estimate with minimal error for steady state. For time to steady state, t_{ss} (95 percent of maximum flux), only a single term of Equation 8 from Wang and others was required:

$$t_{SS} = \frac{3.69 L^2}{D_t \pi^2}$$

The steady state flux is computed by:

$$Total\ Flux = D_e \frac{(C_{pw})}{L} Area$$

where C_{pw} = Porewater PCB concentration from Table 1.

Results of the diffusive transport through the potential isolation layer configuration are presented in Table 3. Figure 2 presents the diffusive breakthrough curves for the Housatonic River isolation scenarios. Breakthrough times for the 6-inch layers increase from 6,400 years for f_{oc} = 0.0025 to 25,800 years for f_{oc} = 0.01.

The maximum (steady-state) diffusive fluxes for the 6-inch sand isolation layer is 26.7 gm/acre/yr (or 0.06 pounds/acre/year).

4.1.1 Colloidal Enhancement of Diffusive Transport

The flux rates and breakthrough times estimated may be affected by the presence of DOC or other organic chemicals. For this analysis only the effect of DOC, which has concentrations several orders of magnitude higher than other organic parameters, has been considered. Colloidal particles which are the dominant fraction of DOC may sorb hydrophobic compounds and through their own Brownian diffusion enhance the movement of the compounds through the pore water. The degree to which this enhancement may take place is highly dependent on the characteristics of the colloidal material, the hydrophobicity of the compound, and the interaction of each with the solid phase present (Reible and others 1991). Because of the high degree of uncertainty in estimating the physiochemical parameter to adequately model the potential effects of collected transport, these effects were not included in the prior computation of diffusive flux, and are presented only to provide an approximation of their potential impact.

Due to the larger size of the colloidal material its diffusivity in water is not as high as the PCB molecule. Based on limited available DOC size data for any location a value of 1 x 10^{-6} cm/sec has been selected for the diffusivity of DOC (D_{CW}). This is equivalent to a the diffusivity 0.003 um particle (~1500 AMU's; 4-5 times larger than a PCB molecule). Assuming a log K_{OC} of 6.2 and a pore water DOC concentration of 100 mg/l, the extent of colloidal enhancement can be estimated as follows (Thoma and others, 1991):

$$FluxEnhancement = \sqrt{\frac{D_w + D_{cw}K_{oc}M_{DOC}}{D_w}}$$

$$= \sqrt{\frac{(3.4x10^{-6}) + (1x10^{-6})(10^{5.2})(10^{-4})}{(3.4x10^{-6})}}$$

$$= \sqrt{5.6} = 2.37$$

This would indicate a decrease in breakthrough and steady-state time by a factor of 5.6 and an increase in flux of 2.4 times. This enhancement does not consider the retardation and possible re-adsorption of some DOC as it passes through the cap material, which has a solid phase with only 0.5 percent organic carbon, significantly less than the organic carbon content of the sediment from which the DOC originated. Given the relatively small effect of DOC, other organics at much lower concentration would not significantly contribute to enhanced PCB migration.

4.2 PCB Transport by Advection/Dispersion

If groundwater movement through the sediment and isolation layer occurs, advective transport processes will control the steady state rate of PCB movement through the isolation layer. The rate limiting mechanism for PCB movement is the rate at which PCBs are transferred from the sediments to the isolation layer. This rate is, therefore, also the maximum flux at the water isolation layer interface if steady state is assumed.

To estimate a maximum advective flux, the equilibrium porewater PCB concentration was assumed for groundwater passing through the sediment. The advective steady-state flux is therefore computed as:

$$Flux = V \times A \times C_{pw}$$

where:

V = groundwater seepage velocity (1 m/yr assumed)
A = 1 acre = 4040 m^2
C_{pw} = porewater PCB concentration (from Table 1)

The steady-state advective flux (assuming a groundwater velocity of 1 m/yr) for the sediments is 1,340 gm/acre/yr (or 3.0 pounds/acre/year).

To estimate the breakthrough and steady-state times associated with advective transport of PCB through the isolation layer, a one-dimensional advective/dispersive equation, incorporating a retardation factor to account for adsorption of PCB, was used. The equation takes the form:

$$\frac{\partial C}{\partial t} = \frac{D_H}{R}\frac{\partial^2 C}{\partial x^2} - \frac{V}{R}\frac{\partial C}{\partial x}$$

The solution in this case becomes (Bedient and others, 1985; Fetter, 1993):

$$C(x,t) = \frac{C_o}{2}\left[erfc\left(\frac{Rx - Vt}{2\sqrt{RD_H t}}\right) + \exp\left(\frac{Vx}{D_H}\right) erfc\left(\frac{Rx + Vt}{2\sqrt{RD_H t}}\right)\right]$$

The second term of the equation can be neglected where advective processes are the predominant mechanism of transport without introduction of measurable error (Ogata and Bank, 1961). When x is set to the isolation layer thickness *(L)*, the equation reduces to:

$$\frac{C}{C_o} = \frac{1}{2} erfc\left(\frac{RL - Vt}{2\sqrt{RD_H t}}\right)$$

where:

C = concentration at the sediment/water interface at time t
R = retardation factor
L = isolation layer thickness in meters
V = groundwater velocity (1 m/yr)
t = time in seconds
D_H = hydrodynamic dispersion coefficient = 1×10^{-10} m²/s

The value of the complementary error function was approximated using the first eight terms of the infinite series:

$$erfc\,(x) = 1 - \frac{2}{\sqrt{\pi}}\left(x - \frac{x^3}{3} + \frac{x^5}{5*2!} - \frac{x^7}{7*3!} + \ldots\right)$$

At low porewater velocities, the value of the hydrodynamic dispersion coefficient approaches the transient molecular diffusion coefficient. Both coefficients are affected by the retardation factor. The transient molecular diffusion coefficient (D_t) was approximately 3×10^{-13} m^2/sec. A more conservative

1×10^{-10} m^2/sec (Tchobanoglous and Schroeder, 1987) has been used for the hydrodynamic dispersion coefficient, D_H in Equation 12. Times to breakthrough (5 percent of maximum flux) and steady state (95 percent of maximum flux) for each configuration assumption are presented in Table 3. Figure 3 presents the advective breakthrough curves for the 6-inch silty sand layer with varying TOC concentrations. The breakthrough time increases from 732 years for f_{oc} = 0.0025 to 2,935 years for f_{oc} = 0.01.

5.0 Effects of Altering Sediment or Isolation Layer Parameters

The computed results, while indicative of general patterns in the ability of the isolation layer to control the migration of PCB, are specific to the sediment and/or isolation layer conditions assumed. The effects of altering the assumed conditions are, in general, simple ratios between the initial and revised value for any single parameter. Below is a brief description of the effects of various parameters on the predicted effectiveness of the isolation layer.

Sediment properties are primarily responsible for determining the sediment porewater PCB concentration. Sediment characteristics which may affect the effectiveness of an isolation layer include:

- PCB Concentration - Equilibrium porewater concentration increases with increasing sediment PCB concentration, barring solubility limits.

- TOC - For low levels of sediment TOC, the freely dissolved equilibrium porewater PCB concentration increases with decreasing sediment TOC, until a point where the concentration is limited by solubility. For higher TOC concentrations, the DOC-associated PCB phase will control the PCB porewater concentration, with only minor changes in PCB concentration over a large range in sediment TOC.

- The total mass of PCB present, or thickness of affected sediments, is not of primary importance in the calculations. The mass of PCB may determine if, given the long periods to achieve steady-state conditions, there is significant depletion of the initial PCB mass due to migration from the sediments.

For the isolation layer, the two major design parameters are the organic carbon content and the layer thickness. In unusual cases, the particle surface area of the isolation layer material becomes an important factor is determining the ability to mitigate PCB mobility, surpassing the TOC in determining the degree of partitioning between the aqueous and solid phases.

- Organic Carbon Content - The organic carbon content of the isolation layer material increases the ability to sorb PCB, providing a greater retardation of PCB migration through the isolation layer. For both diffusion and advection, t_b and t_{ss} are approximately proportional to isolation layer material f_{oc}, while the steady-state flux for each is independent of f_{oc}.

- Isolation Layer Thickness - As isolation layer thickness increases, the times for migration through the isolation layer also increases. For diffusive transport, breakthrough and steady-state times are proportional to thickness squared (L^2), and the flux is proportional to the inverse of layer thickness ($1/L$). For advective transport, times are proportional to L, but the steady-state flux is virtually independent of thickness.

- Particle Surface Area - For very small diameter particles (clays) or highly internally fractured material (activated carbons), the total surface area may play a more significant role in determining the sorptive capacity of the isolation layer. In these cases, the K for the specific material replace the term f_{oc} x K_{oc}.

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Table 1

Computed Porewater PCB Concentration

	Assumed TOC (%)	**C_{DIS} (ug/L)**	**C_{DOC} (ug/L)**	**C_{pw} (ug/L)**
Housatonic River Sediments				
Assumed Sediment PCB Concentration (Aroclor 1260, 2,041 ppm)	2	26	306	332

Notes:

C_{DIS} = Concentration of freely dissolved PCB.
C_{DOC} = Concentration of DOC-associated PCB.
C_{pw} = Total concentration of PCB in porewater (C_{DIS} + C_{DOC})

Table 2

Assumed Parameters for PCB Diffusion and Advection Calculations

Isolation Layer Material	Housatonic River
	Silty Sand
PCB Aroclor	1260
Isolation Layer Thickness (inches)	6
Groundwater Velocity (cm/day)	0.27
Total Organic Carbon (% dry weight)	0.25, 0.5, 1
Bulk Density of Isolation Layer Material (g/cm^3)	1.5
Porosity of Isolation Layer Material	0.4
Diffusion Coefficient (cm^2/sec)	3.2E-06
Hydrodynamic Dispersion Coefficient (m^2/sec)	1.00E-10

Table 3

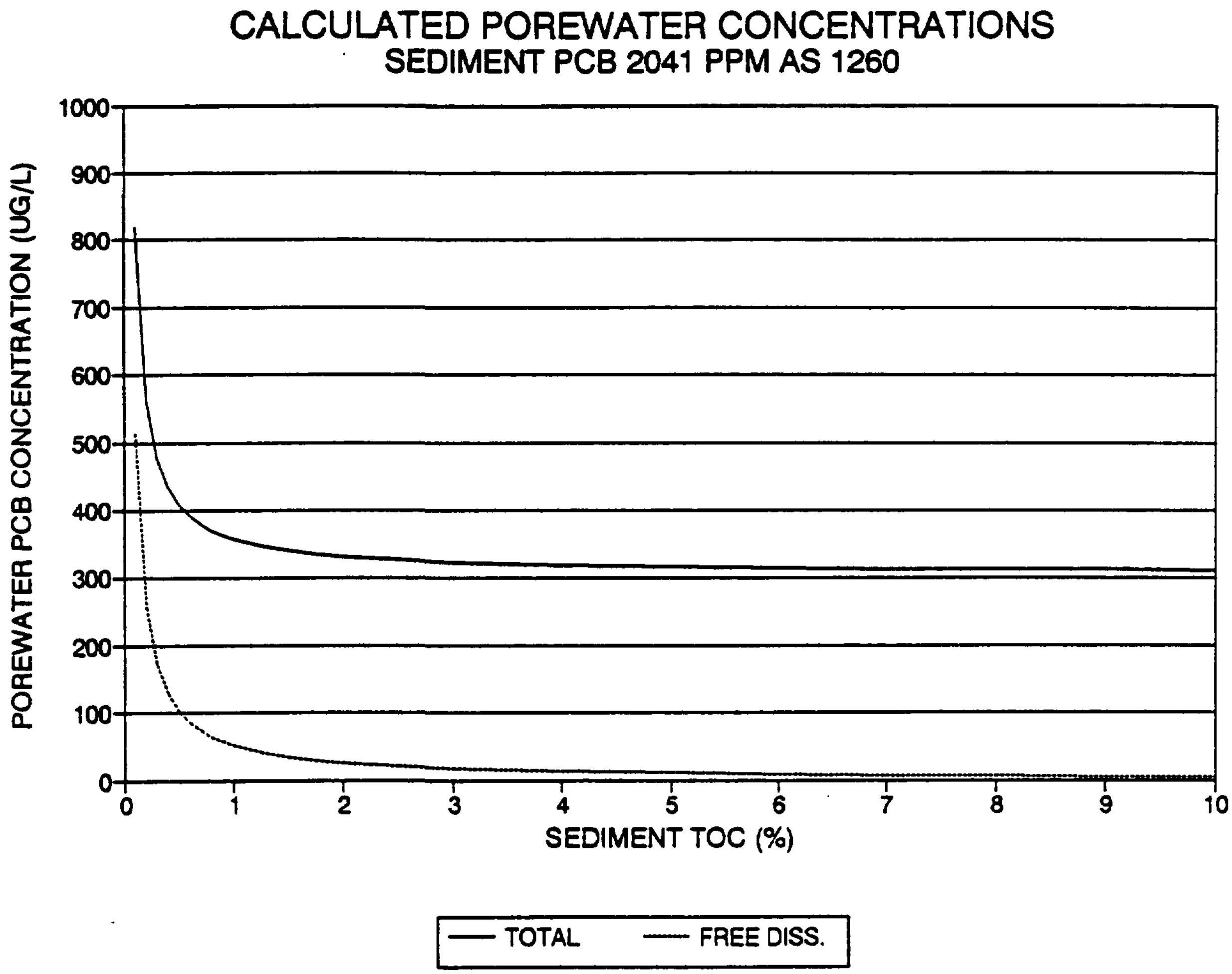
Breakthrough Time and Steady-State PCB Flux for Various Isolation Layer Configurations

Isolation Layer Configuration	Diffusive PCB Transport			Advective PCB Transport		
	Years to Breakthrough[1]	Years to Steady-State[2]	Steady-State Flux (gm/acre/year)	Years to Breakthrough[1]	Years to Steady-State[2]	Steady-State Flux (gm/acre/year)
Housatonic River (assuming 2,041 ppm as Aroclor 1260 and 2% TOC)						
Existing Conditions	NA	NA	9,300	NA	NA	1,340
6" sand, TOC - 0.25%	6,400	43,700	26.7	730	1,100	1,340
6" sand, TOC = 0.50%	12,500	87,700	26.7	1,500	2,300	1,340
6" sand, TOC = 1.0%`	25,800	173,000	26.7	2,900	4,500	1,340

Notes:

[1] Breakthrough is at time when flux equals 5 percent of calculated steady-state flux.
[2] Steady-state is at time when flux equals 95 percent of calculated steady-state flux.
NA Not applicable.

Figure 1



CALCULATED POREWATER CONCENTRATIONS
SEDIMENT PCB 2041 PPM AS 1260
POREWATER PCB CONCENTRATION (UG/L)
1000
900
800
700
600
500
400
300
200
100
0
0
1
2
3
4
5
6
7
8
9
10
SEDIMENT TOC (%)
TOTAL
FREE DISS.

Figure 2

Diffusive Breakthrough Curves for a 6-Inch Silty Sand Cap Over Aroclor 1260 Housatonic River Sediment

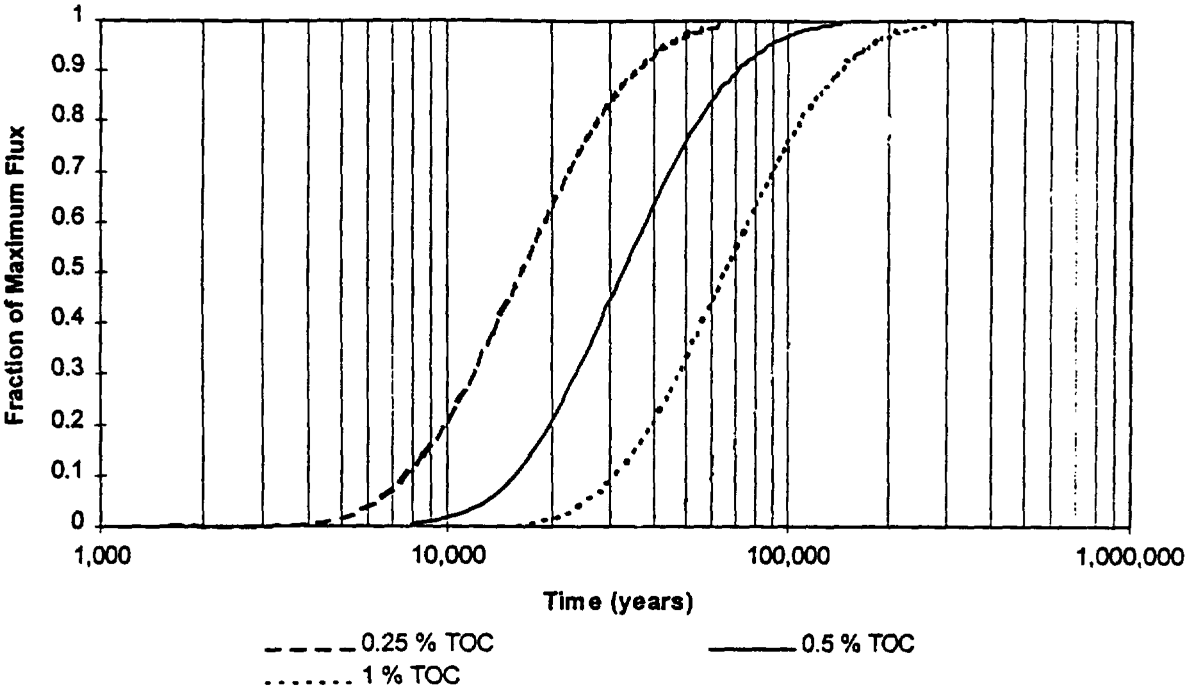
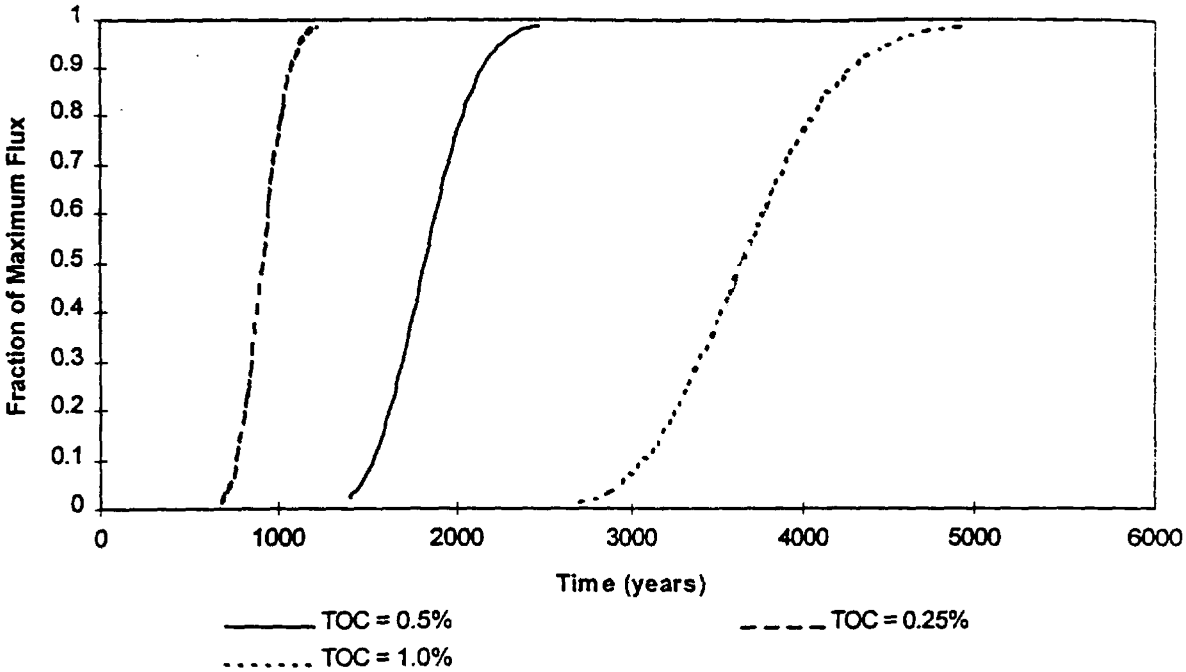


Figure 3

Advective Breakthrough Curves For a 6-Inch Silty Sand Cap Over Aroclor 1260 Housatonic River Sediment



C-2. Site-Specific Computational Study of Protection Layer

As discussed previously, an armoring system includes an isolation layer to prevent PCB-containing sediment transport and exposure to humans and biological receptors. However, the isolation layer alone may not be capable of withstanding potential erosional effects associated with the given water body. Erosional forces on an isolation layer may be the result of several factors, including flow currents/patterns within the river channel, wind-induced wave action, propeller action from navigational equipment, or disturbances due to ice movement. Given the relatively unobstructed nature and current uses of the Housatonic River in this region, erosional forces due to wind, propeller action, and ice movement are not considered critical. However, erosional forces associated with flow are relevant and have been further evaluated. Typically, to protect an isolation layer against these forces, a protection layer consisting of gravel or stone rip-rap would be installed on top of the isolation layer.

To evaluate the protection layer requirements for this IRA, calculations were performed using the engineering manual for Hydraulic Design of Flood Control Channels (USACE 1991). These calculations follow. Several generalized, yet representative, assumptions regarding the river hydraulics were required as part of this evaluation. These assumptions are further described below.

The design of an erosion control layer for in-channel applications is primarily dictated by the river flow velocities under conservative conditions. The type, size, and thickness of the erosion control materials must be properly designed to protect against scouring, resuspension, and downstream transport of the armoring materials. For the purposes of this evaluation, available information concerning the cross-sectional geometry of the river at various locations, river velocities and water depth in response to the 100-year event [velocity and depth were estimated through the use of the USACE Hydrologic Engineering Center-2 (HEC-2) model], and USACE design guidance was utilized.

In the area of the IRA, the values for river velocity and water depth obtained from the HEC-2 model of the 25-year storm event were 7.4 feet per second (fps) and 12 feet, respectively. The maximum modeled velocities in this area occurs at the 25-year flood because the water elevation has not yet topped the bank. Using these values, it was calculated that an armoring material with less than 30 percent of the particles smaller than 4 inches in size, and with a maximum particle size of 7.5 inches, would be resistant to erosion. With respect to armor layer thickness, a thickness equal to the maximum particle size would be recommended. This would result in a 8-inch layer thickness. Additional information regarding the assumptions, calculations, and other parameters utilized in this evaluation is presented below.

Design of Protection Layer

The engineering and design manual titled Hydraulic Design of Flood Control Channels (USACE 1991) was used to design the erosion control protection layer for the sediment armoring system. Site specific input data used in the calculations was obtained from the HEC-2 model developed for the 25-year storm event. Equation 3-3 (pg. 3-5, USACE 1991) for determination of stone size is as follows:

$D_{30} = S_f C_s C_V C_T d \{[\gamma_w/(\gamma_s-\gamma_w)]^{0.5}[V/(K_1 gd)^{0.5}]\}^{2.5}$

Where:

D_{30}	=	Stone size of which 30 percent is finer by weight.
S_f	=	Safety factor = 1.1 for basic use. Increased to 1.2 to account for severe freeze-thaw heaving.
C_s	=	Stability coefficient for incipient failure = 0.36 for rounded rock.
C_v	=	Vertical Velocity distribution coefficient = 1.0 for straight channels
C_T	=	Thickness coefficient = 1.0
D	=	Local depth of flow = 12 feet from the HEC-2 model of the 25-year storm event
γ_s	=	Unit weight of the selected armoring rock = 165 lbs/ft^3
γ_w	=	Unit weight of water = 62.4 lbs/ft^3
V_{bottom}	=	Bottom velocity = $V_{avg}[1.74 - 0.52\log(R/W)] = 7.4[1.74 - 0.52\log(50)] = 6.3$ ft/sec

Where:

V_{avg} = 7.4 ft/sec, the average velocity in the channel based on the 25-year storm event (Note: Maximum velocity occurs at the 25-year event because the water elevation has not yet topped the bank)

W = the width of the river in feet

R = the bend radius in feet

(R/W is large for a straight channel section - use R/W = 50)

g = Gravitational constant = 32.2 ft/sec^2

K_1 = side slope correction factor = $1 - (\sin^2\theta/\sin^2\phi) = 1 - \sin^2(30)/\sin^2(40) = 0.63$

Where:

θ = the angle of side slope with horizontal = 30 degrees

ϕ = the angle of repose of the riprap = 40 degrees

Using Equation 3-3, D30 for the straight channel equals:

$$D_{30} = S_f C_s C_V C_T d \{[\gamma_w/(\gamma_s-\gamma_w)]^{0.5}[V/(K_1 gd)^{0.5}]\}^{2.5}$$
$$= (1.2)(0.36)(1.0)(1.0)(12)\{[62.4/(165 - 62.4)]^{0.5}[6.3/((0.63)(32.2)(12))^{0.5}]\}^{2.5}$$
$$= 0.29 \text{ feet or } 3.5 \text{ inches}$$

Using Table 3-1 (pg. 3-3, USACE 1991) to determine D_{100} = 7.5 inches (interpolated)

In accordance with paragraph 3.2e 1 and 2 (pg. 3-4) the layer thickness should equal $1.0D_{100}$ = 7.5 inches (for practicality use 8 inches as a minimum thickness)