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General Electric Company

Revised Conceptual Removal Design/Removal Action Work Plan for Silver Lake Sediments

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Table of Contents

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Tables

Figures

Appendices

1. Introduction

1.1 General

On October 27, 2000, a Consent Decree (CD) executed in 1999 by the General Electric Company (GE), the United States Environmental Protection Agency (EPA), the Massachusetts Department of Environmental Protection (MDEP), and several other government agencies was entered by the United States District Court for the District of Massachusetts. The CD requires (among other things) the performance of Removal Actions to address polychlorinated biphenyls (PCBs) and other hazardous constituents present in soil, sediment, and groundwater in several Removal Action Areas (RAAs) located in or near Pittsfield, Massachusetts, which are part of the GE-Pittsfield/Housatonic River Site (Site) (see Figure 1-1). One of these RAAs is the Silver Lake Area, which includes both the lake itself and certain areas adjacent to the lake. This report addresses the sediments within Silver Lake.

The CD and accompanying *Statement of Work for Removal Actions Outside the River* (SOW) (Blasland, Bouck & Lee, Inc. [BBL], 1999) establish Performance Standards that must be achieved, as well as specific work plans and other documents that must be prepared to support the response actions for each RAA. For most of the Removal Actions, these work plans/documents generally include the following: Pre-Design Investigation Work Plan, Pre-Design Investigation Report, Conceptual Removal Design/Removal Action (RD/RA) Work Plan, and Final RD/RA Work Plan (Final Work Plan). These include the Silver Lake Area Removal Action, which includes removal and capping activities for the sediments within the Lake and remediation of the soils in certain areas on or adjacent to the banks of the Lake. On July 3, 2008, GE submitted a Conceptual RD/RA Work Plan for the Silver Lake Sediments, which addressed the sediment remediation component of the Silver Lake Area Removal Action. In a conditional approval letter dated March 2, 2009, EPA directed GE to make certain modifications and clarifications to that Work Plan, and to submit a revised Conceptual RD/RA Work Plan for Silver Lake Sediments. In response, GE has made the modifications and clarifications specified in EPA's letter and is submitting this document as the Revised Conceptual RD/RA Work Plan for the Silver Lake Sediments (Conceptual Work Plan for Sediments).

As set forth in the SOW and subsequent decisions by EPA, the Performance Standards for Silver Lake sediment remediation are briefly summarized below:

- GE shall remove a maximum of 400 in-situ cubic yards (cy) of sediments from an area in the general vicinity of existing outfall 01A, replace the removed sediments, and restore and vegetate that portion of the affected area that is not underwater in

coordination with the installation of the sediment cap, and perform natural resource restoration/enhancement activities.

- GE shall install a cap over the entire bottom of the lake to achieve the design standards set forth in Attachment K to the SOW, including an isolation layer consisting of silty sand with a presumptive thickness[1] of 12 inches if geotextile is placed between the sediments and the cap or 14 inches without a geotextile, a total organic carbon (TOC) content of 0.5%, and concentrations of PCBs at non-detectable levels and other constituents at background levels.

- The capping system shall include an overlaying armor layer of stone incorporated along the shoreline as necessary to prevent potential erosion of the isolation layer due to wind-induced wave action.

- GE shall construct a shallow-water shelf along the shorelines of the lake to provide an improved habitat for aquatic species. This shallow-water shelf shall consist of an armoring layer of stone to be placed around the shoreline as part of the capping system. GE shall place a three-inch layer of gravel and sand over the armoring stone to facilitate fish usage on the shelf.

The CD and SOW also require GE to conduct natural resource restoration and enhancement activities at the Silver Lake Area. The Performance Standards for those activities are described below in Section 3.7.

This Conceptual Work Plan for Sediments proposes the scope of response actions to achieve the Performance Standards for sediments within Silver Lake as set forth in the CD and SOW. As such, the pre-design and proposed RD/RA activities summarized in this Work Plan pertain to sediments only. Activities relating to soils on or adjacent to the banks of Silver Lake have been addressed in separate submittals to EPA, and although integration with the remedial actions related to soils adjacent to Silver Lake is discussed in this document, the overall scope of Removal Actions with respect to such soils is not addressed herein. GE has submitted a separate Revised Conceptual RD/RA Work Plan for Soils Adjacent to Silver Lake (Revised Conceptual Work Plan for Soils) on October 22, 2008, and EPA issued a separate conditional approval letter for that submittal on March 4, 2009.

[1] Pursuant to EPA's letter dated August 17, 2004 conditionally approving GE's *Pre-Design Investigation Report for Silver Lake Sediments* (Sediments PDI Report) (BBL, 2004), the indicated thicknesses were increased by 2 inches from the presumptive thicknesses of 10 inches with geotextile and 12 inches without geotextile specified in the SOW.

However, following EPA approval of this Conceptual Work Plan for Sediments, to ensure coordination between the sediment and soil remediation activities, GE will conduct the remaining design activities for those activities jointly, and will submit a Final Work Plan addressing both sediments and soils on the schedule described in Section 6.[2] Activities concerning groundwater associated with the Silver Lake Area are being addressed separately as part of the Plant Site 1 Groundwater Management Area (GMA 1) monitoring program.

GE has previously submitted the following documents relating to the sediments within Silver Lake (in addition to the prior version of this Conceptual Work Plan for Sediments):

- *Pre-Design Investigation Work Plan for the Silver Lake Removal Action Area* (PDI Work Plan), submitted in January 2003 and conditionally approved by EPA in a letter of February 11, 2003.

- *Pre-Design Investigation Report for Silver Lake Sediments* (Sediments PDI Report), initially submitted in February 2004 and conditionally approved by EPA by letter dated August 17, 2004.

- *Supplemental Pre-Design Investigation for Silver Lake Sediments* (Supplemental Sediments PDI), submitted in April 2005 and conditionally approved by EPA in a letter dated May 15, 2005.

- *Bench-Scale Study Work Plan for Silver Lake Sediments* (Bench Scale Work Plan) submitted in January 2005, and conditionally approved by EPA in a letter dated February 25, 2005.

- *Bench-Scale Study Report for Silver Lake Sediments* (Bench Scale Report) submitted in March 2006, conditionally approved by EPA in a letter dated May 2, 2006, revised and resubmitted in May 2006, and approved by EPA as revised in a letter dated June 19, 2006.

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[2] EPA's conditional approval letter of March 2, 2009 for the prior version of this Conceptual Work Plan for Sediments attached a letter from the Natural Resource Trustees (Trustees), dated December 23, 2008, conditionally approving the natural resource restoration/enhancement activities described in that version of the Work Plan. GE is addressing some of the Trustees' comments herein, will address the Trustees' comments concerning shoreline activities in a separate submittal prior to the Final Work Plan (as directed in EPA's March 4, 2009 conditional approval letter for the Conceptual Work Plan for Soils), and will provide final design details on all of the natural resource restoration/enhancement activities in the combined Final Work Plan.

- *Pilot Study Work Plan for Silver Lake Sediments* (Pilot Study Work Plan) initially submitted in June 2006, conditionally approved by EPA in a letter dated July 18, 2006; revised and resubmitted in August 2006, and approved by EPA as revised in a letter dated August 30, 2006.

- *Pilot Study Report for Silver Lake Sediments* (Pilot Study Report) initially submitted in September 2007, conditionally approved by the EPA in a letter dated December 10, 2007; revised and resubmitted in January 2008, and conditionally approved by EPA as revised in a letter dated April 7, 2008.

The above-referenced documents include descriptions of the field investigation and sample collection and analysis activities performed during the investigation of the sediments and related environmental characteristics comprising the Silver Lake Area. This Conceptual Work Plan for Sediments builds upon the results of those prior activities conducted by GE, and based on the results of the investigations described in the reports listed above, presents: (1) a summary of the results of the pre-design investigation, bench- and field-scale study activities; (2) a proposal for conceptual sediment-related remediation activities, including natural resource restoration and enhancement activities; and (3) a discussion of the proposed construction related and long-term environmental and performance monitoring programs.

1.2 Site Description

Silver Lake is located in Pittsfield, Massachusetts (Figure 1-1). The lake is bordered to the north by Silver Lake Boulevard and to the west and south by several commercial and residential properties. Silver Lake has a surface area of approximately 26 acres and a maximum water depth of approximately 30 feet (Figure 1-2). The lake receives stormwater discharges from several municipal stormwater outfalls, as well as several adjacent residential and commercial/industrial properties. Silver Lake discharges to the East Branch of the Housatonic River through a 48-inch-diameter concrete pipe located in the southwest portion of the lake. This pipe conveys surface water from Silver Lake as well as stormwater runoff from Fenn and East Streets to the Housatonic River.

It should be noted that, at the time of the SOW, it was believed that the recreational areas along the banks on the northern and eastern sides of the lake were publicly owned. However, as noted by GE in the Revised Conceptual Work Plan for Soils, more recent information, based on historical research into deed records, indicates that portions of these areas adjacent to Silver Lake Boulevard and Fourth Street are in private ownership, with a portion owned by GE, a portion owned by Western Massachusetts Electric Company (WMECo), and other portions owned by entities that are no longer in existence. These

ownership issues are currently being addressed, as discussed further in Section 3.7 below, and the ownership status of these areas will be described in the Final Work Plan.

Further, as required by EPA's April 7, 2008 Conditional Approval letter associated with the Pilot Study Report, GE has performed supplemental bank and near-shore survey activities at additional locations around the banks of the lake. The survey information was collected by Hill Engineers of Pittsfield, MA, and was combined with the existing topographic and bathymetric data to provide additional details in the transition area between the banks and the sediment. Figure 1-2 illustrates the results of these activities.

1.3 Scope and Format of Work Plan

The remainder of this Conceptual Work Plan for Sediments is presented in four sections. A brief overview of each section is presented below:

Section 2 – Summary of Pre-Design Activities, provides a brief summary of the pre-design investigations conducted by GE related to sediments within the Silver Lake.

Section 3 – Conceptual Design Information, provides a description of the methods and materials proposed for conducting the sediment-related response actions, including sediment and soil removal, construction of the cap, and implementation of the natural resource restoration and enhancement activities.

Section 4 – Monitoring Program, provides a description of the environmental and performance monitoring program proposed for implementation during and after performance of the construction activities proposed in this Conceptual Work Plan.

Section 5 – Future Design-Related Activities, summarizes any remaining actions necessary to prepare for remediation activities. In addition, this section discusses the integration of the sediment- and bank soil-related response action, and proposes the contents of a Final Work Plan. As discussed below, to ensure integration of the work regarding soils and sediments in the Silver Lake Area, GE proposes to submit a single Final Work Plan addressing both soils and sediments.

Section 6 – Schedule, discusses future activities and provides a schedule for completion of the response action.

2. Summary of Pre-Design Activities

2.1 General

The CD and SOW require the characterization of sediments within the Silver Lake Area and the collection of other relevant site information prior to submittal of the Conceptual Work Plan for the Silver Lake sediments. These investigative activities, collectively referred to as pre-design activities, serve as the basis for the subsequent technical RD/RA submittals. This section provides a brief description of pre-design investigation activities performed by GE as well as a summary of the entire pre-design program related to Silver Lake sediments. These activities have primarily involved the performance of sediment sampling and analyses, a bench-scale study, and a field-scale pilot study. Such activities have been previously summarized in a number of documents previously submitted to and approved by EPA, as listed in Section 1.1.

In addition, GE has recently conducted other pre-design activities to supplement the sediment characterization program and to support the conceptual design presented herein. These additional activities include the performance of a supplemental detailed bank topographic survey and a further evaluation of outfalls to the lake. A brief summary of pre-design activities is provided below.

2.2 Summary of Pre-Design Activities

2.2.1 Summary of Pre-Design Sediment Investigations

As discussed above, prior investigative activities for the Silver Lake sediments (performed by GE, EPA, and others) have included significant sediment collection and analysis activities, and the performance of bench and field-scale studies. The results of these pre-design investigative activities support the proposed remedial activities for Silver Lake sediments.

2.2.1.1 Pre-design Sediment Sample Collection and Analysis

In 2003, a pre-design investigation (PDI) was performed in and around Silver Lake to support the detailed design of a sediment removal action and sediment cap, and to verify a number of key design parameters and assumptions documented in Attachment K of the SOW (BBL, 1999). As part of these activities, geophysical and chemical analyses were conducted, as well as water budget calculations.

Geophysical analysis of Silver Lake indicates the sediments are generally characterized by three distinct layers: a surface layer consisting of soft black silt with a sludge-like consistency, an intermediate layer consisting of soft silt and marl of an olive or brown color, and a bottom layer consisting of sand and silt. Generally, the three layers have relatively low strength characteristics for their respective classifications.

Sediment sampling for PCBs has been performed on several occasions in Silver Lake, resulting in the collection of more than 200 samples. In general, the results of these analyses indicate that PCB concentrations are greater in the sub-surface samples than in surface samples and generally greater in the eastern portion of the lake.

Pre-design investigation activities also were performed to evaluate the velocity of groundwater flowing into and out of Silver Lake. To quantify groundwater seepage, groundwater gradient measurements and data from seepage meters and piezometers were evaluated to develop a water budget. The rate of potential groundwater seepage that was estimated using the available data was low and was significantly below the seepage rate assumed in the conceptual design. As a result, to be very conservative, the value assumed in the conceptual design of 2.74 liters per square meter per day ($L/m^2/day$) was selected for use in the design.

A complete discussion of the results of the pre-design investigative activities can be found in the Sediments PDI Report (BBL, 2004).

2.2.2 Summary of Bench-Scale Study Activities

The primary objective of the bench-scale study was to evaluate the physical and chemical responses of Silver Lake sediments to the placement of cap materials. Specific objectives of the bench-scale study included the evaluation of the potential for mixing and consolidation of sediments and cap materials during and after cap placement, the potential for PCB mobility during and after cap placement, and investigation of the potential for groundwater flux or gas-induced PCB transport in sediments and cap materials.

In general, the study consisted of an evaluation of total consolidation of sediments following cap material placement, as well as an investigation of potential PCB transport as a result of cap placement. Performance of the bench-scale study involved the collection and maintenance of sediment cores in Lexan tubes in approximate in-situ conditions. Within each tube, representative cap materials were placed in thin lifts over the native sediments to investigate the potential physical and chemical responses to placement of a cap.

The results of the bench-scale study showed no discernible indication of consolidation-based or gas-enhanced PCB mobility, which led to the following overall conclusions:

- The cap materials and configurations used in the bench-scale study provided an effective physical and chemical barrier in isolating sediment PCBs from the overlying cap materials.

- Study data and analyses did not show a correlation between the presence of either gas generation or TPH and PCB mobility.

- There are no indications that modifications to the conceptual cap design (as described in the SOW) or the approach to the pilot study are warranted.

A detailed discussion of the design, performance, and results of the bench-scale study is presented in the Bench-Scale Report (BBL, 2006).

2.2.3 Summary of Field-Scale Pilot Study Activities

The Pilot Study was designed and performed to confirm the conclusions derived from the bench-scale study and to support the design of response actions necessary to achieve the applicable performance standards for the Silver Lake Sediments. To adequately identify potential constructability issues that might arise during the construction of the full-scale engineered capping system, the Pilot Study was performed on the east shore of the lake, to include areas of relatively steep slopes, sediments that are relatively low in strength, and sediments containing elevated PCB concentrations.

Performance of the Pilot Study included construction of a sediment cap over a continuous one-acre area with three different cap configurations for comparative purposes. Placement of the cap was performed using construction methods anticipated for use in the full-scale construction, and was monitored throughout to investigate potential responses of the sediment to cap placement and to evaluate the relative ability of the sediment to support the weight of the cap.

The Pilot Study led to the following overall conclusions:

- A granular sand cap can be installed in thin lifts over the sediments of Silver Lake with minimal disturbance to the underlying sediments. Observations obtained during construction of the Pilot Study indicated that isolation layer materials could be placed in either 1- or 2-inch lifts, and that a barge-mounted spreader box assembly has the ability

to place these lifts sufficiently thin to minimize mixing and avoid deleterious settlement and/or slope failure.

- There is not a significant benefit to cap construction from the use of geosynthetic materials as a capping component.

- Observations of mixing of the sediment and isolation layer materials were minimal, and where observed, were limited to the bottom 0- to 2-inch layer of isolation layer material.

- There did not appear to be any indications of significant movement of the underlying sediments, or failure (e.g., shear, rotational) in those sediments receiving cap materials in thin lifts via the spreader box.

- Based on the available data, it appears that the cap constructed during the Pilot Study provides an effective barrier to the PCBs present in the underlying sediments.

- No observations made or analytical results obtained suggest that modifications to the conceptual cap design are warranted.

A detailed discussion of the design, implementation, and results of the Pilot Study is presented in the Pilot Study Work Plan (ARCADIS BBL, 2007) and the Pilot Study Report (ARCADIS BBL, 2008).

3. Conceptual Design Information

3.1 General

This section presents the general approach and conceptual design information for the proposed remediation activities and discusses Applicable or Relevant and Appropriate Requirements (ARARs) for the remediation and associated actions to be conducted for Silver Lake sediments. In general, the remediation activities for Silver Lake sediments will be implemented in accordance with GE's *Construction Quality Assurance Plan* (CQAP), which is part of GE's *Project Operations Plan* (POP; Latest revision – March 2007). The CQAP contains several technical specifications, which will serve as the basis for the performance of the proposed remedial activities, with appropriate modifications and/or supplements as necessary. Potential sources of backfill, soil cover, and cap material will be identified and characterized in accordance with GE's Soil Cover/Backfill Characterization Plan, which is also part of the POP.

3.2 Identification of ARARs

The remediation and associated activities to be conducted for Silver Lake sediments will be subject to several ARARs. Attachment B to the SOW (BBL, 1999) identifies the chemical-, action-, and location-specific ARARs for the Removal Actions Outside the River. As noted above, the remediation activities for Silver Lake sediments will involve removal of some sediments and placement of a cap over the entire Lake. In addition, certain natural resource restoration/enhancement activities will be conducted. The remediation and restoration activities for Silver Lake sediments will be subject to the following ARARs identified in Attachment B to the SOW, to the extent pertinent to the remediation, restoration, and associated activities to be conducted for Silver Lake sediments:

- The action-specific ARARs identified in Table 2**,** subsection E ("Sediment and Bank Soil Removal at Silver Lake"), subsection F ("Capping of Silver Lake Sediments"), subsection G ("Natural Resource Restoration/Enhancement Activities"), and potentially subsection K ("Other").

- The location-specific ARARs identified in Table 3, subsection A ("Rivers, Streams, and Lakes"), and subsection B ("Floodplains, Wetlands, and Banks").

Further, to the extent that remediation activities involve the removal and on-site storage (at the GE Plant Area) of free product, intact drums, and/or other materials that will be subsequently disposed of off-site, such storage will be subject to the action-specific ARARs identified in Table 2 of Attachment B, subsection H ("Temporary On-Site Storage of Free

Product, Drums, and Equipment That Will Be Disposed of Off-Site"). Similarly, any remediation activities that may involve the disposal of materials in the Hill 78 On-Plant Consolidation Area will be subject to the action-specific ARARs identified in Table 2 of Attachment B, subsection I ("Permanent Consolidation of Non-TSCA Non-RCRA Soils at Hill 78 Consolidation Area").

In addition to the ARARs listed above, EPA's March 2, 2009 conditional approval letter for the Conceptual Work Plan for Sediments identified as an additional ARAR the EPA and U.S. Army Corps of Engineers compensatory mitigation regulations regarding aquatic resources (40 CFR 230 and 33 CFR 332). GE does not believe that these regulations constitute ARARs because, among other reasons, they were promulgated in April 2008, long after the selection of this Removal Action.[3] While GE will consider these regulations, as appropriate, in the final design of this Removal Action, GE preserves its position on this issue and reserves the right to challenge any requirements that EPA may seek to impose based on or deriving from these regulations. In addition, as further directed by EPA in its March 4, 2009 conditional approval letter, GE will consider, as appropriate, two guidance documents identified by EPA – namely, the Corps of Engineers' *New England District Mitigation Guidance* (January 12, 2007) and the Massachusetts Wildlife Habitat Protection Guidelines for Inland Wetlands (mass.gov/dep/water/laws/policies.htm#wetlguide) – although guidance documents do not qualify as ARARs and do not establish binding requirements.

3.3 Site Preparation and Controls

Various site preparation activities and site controls and security measures will be implemented during removal and capping operations to limit potential construction impacts on the surrounding areas. These include set-up of appropriate material and equipment staging areas, installation of erosion and stormwater control measures, and establishing site security and traffic control. Each of these is discussed in more detail below.

[3] Requirements that are promulgated after selection of a remedy are not ARARs unless they call into question the protectiveness of the remedy (see 1990 preamble to National Contingency Plan, 55 Fed. Reg. at 8757), which is not the case here. While the SOW allows for the possibility of specifying additional ARARs for a Removal Action that are not listed in Attachment B to the SOW (see SOW, p. 14), the SOW does not provide for the identification of subsequently promulgated regulations as ARARs. Rather, any requirements not listed in Attachment B that are specified as additional ARARs must still qualify as ARARs, and requirements promulgated long after the selection of the Removal Action do not qualify as ARARs.

3.3.1 Staging and Dewatering Areas

Three areas to the north shore of the lake have been identified as suitable for potential use as staging areas to facilitate removal and capping activities: (1) the available space along the north shore of the lake, (2) Silver Lake Boulevard, and (3) a portion of an industrial property north of Silver Lake Boulevard. It is anticipated that these three areas will all be used as staging areas for various activities (e.g., materials staging and preparation, water access, site facilities) during cap construction, subject to GE's ability to obtain permission to access these areas.

During the Pilot Study the strip of land between the lake and Silver Lake Boulevard was used for materials preparation and provided access to the water's edge for delivery of material, machinery, and labor. During cap construction, it is anticipated that, as necessary, a boat launch and/or a temporary bulkhead may be constructed in this area to facilitate the transfer of construction materials and equipment from the shore to construction vessels (i.e., barges, boats).

It is currently anticipated that a portion of Silver Lake Boulevard adjacent to the area described above will be closed to public traffic during construction to allow for one contiguous staging area extending north and east from the lake. GE has preliminarily discussed the closure of Silver Lake Boulevard with the City of Pittsfield. The potential road closure would extend from the intersection of Silver Lake Boulevard and Fourth Street to the approximate location of the proposed PEDA outfall. This proposed area is anticipated to be large enough for the staging of heavy equipment and clean construction materials necessary for the performance of combined removal and capping activities.

Additionally, a portion of property adjacent to Silver Lake Boulevard owned by the Western Massachusetts Electric Company (WMECO) and/or another entity is also being considered for use as a supporting staging area. A portion of this area was used during implementation of the Pilot Study, and, subject to access permission, would likely be used for staging construction equipment, and associated support facilities (e.g., trailer, construction worker parking). The proposed staging area locations are depicted on Figure 3-1.

Temporary staging of materials removed from the lake or the adjacent banks is anticipated to be limited to within actual construction areas (e.g., bank removal areas, scrub-shrub island) that will be subject to remediation/restoration, and within GE's Building 65, as discussed in Section 3.4.

3.3.2 Erosion and Sedimentation Controls

3.3.2.1 Erosion Protection

Throughout construction activities, appropriate erosion control measures will be implemented. Erosion controls (e.g., silt fencing, hay bales, catch-basin protection) will be installed to limit the potential for the erosion of disturbed areas and/or staged materials and related storm-water runoff. Such erosion and sediment control practices will be in place during construction activities and will remain in place until such time that they are no longer necessary. During construction activities, erosion and sedimentation control devices will be inspected each work day and maintained and/or adjusted as necessary, based on site conditions and site activities.

3.3.2.2 Stormwater Outfalls/Structures

As part of the PDI activities, a comprehensive survey and physical inspection has been conducted of the banks and shoreline of Silver Lake related to the presence of stormwater or other discharge pipes. During this evaluation outfall pipes (e.g., drain tiles, municipal culverts) and structures were mapped and photographed. Additional information related to the presence of pipes, culverts and/or other structures located on the banks of Silver Lake was obtained from previous bank surveys/inspections, recent and historic GE Facility information, information provided by EPA, and available municipal mapping received from the City of Pittsfield. The approximate locations of identified outfalls and other structures are shown on Figure 1-2. Note that the list and locations of the outfalls identified on Figure 1-2 are the same as what was submitted with the EPA approved Revised Conceptual Work Plan for Soils.

For those pipes that are considered active, protective measures (e.g., scour protection, outfall aprons) will be implemented during capping activities to mitigate the potential erosion of cap materials. The invert elevation of active pipes will be considered prior to armor stone placement, and as necessary, some pipes may be extended to facilitate the flow of discharge water. For any pipes/culverts and/or bank structures that are determined to be inactive or abandoned, removal is proposed. For outfalls located below the water line that are found to be inactive, the pipes will be considered debris and removed to below grade and abandoned. Above-grade pipes, debris, and remnant bank structures that are determined to be inactive will either be cut-off below-grade and plugged with hydraulic cement (as necessary for former outfalls), or demolished and removed from the bank. In either event, every location will be removed to such an extent that the terminus of the pipe/structure does not interfere with the successful construction of the cap, armor layer and the related bank and surface restoration. Table 3-1 summarizes the list of the outfalls that

have been identified around the perimeter of the lake, and presents the proposed action for each location. Note that, as necessary, follow-up investigations related to the potential source and status of each outfall (for which such information is not known) will be performed prior to preparation of the Final Work Plan. Surveyed locations of each outfall as well as details associated with the plan for the removal and/or maintenance of specific outfalls will be included in the forthcoming Final Work Plan.

Note that certain outfall locations identified in this Work Plan may also require removal or relocation due to remedial activities associated with the bank soils adjacent to Silver Lake. A full description of such potential activities (e.g., protection, abandonment) and the coordination of the sediment and bank soil remedial activities will be presented in the Final Work Plan.

3.3.2.3 Turbidity Controls

Prior to the initiation of construction-related activities, turbidity control measures will be installed at or in the vicinity of the Silver Lake outfall to the Housatonic River. Such measures will be installed prior to the initiation of construction-related activities to minimize the potential for transport of solids suspended in the water column from Silver Lake to the Housatonic River. Similar to the control measures utilized during the Pilot Study, full-depth silt curtains will be deployed in the outfall channel such that three curtains are used one behind the other. This design will allow for progressive settling and retention of suspended materials as the water approaches the outfall to the river. In addition, between the first and second curtains a sheetpile rectangular weir, outfitted with stop-logs, will be installed to enhance the ability to control the water surface elevation within the lake. Both the silt curtains and weir will be visually inspected on a daily basis and maintained throughout the construction period to maximize their effectiveness. A conceptual layout and cross section of the turbidity control measures to be installed in the outfall are illustrated on Figure 3-2. In addition, alternative means of reducing turbidity, including controlling lake elevations during construction, are being evaluated by GE. The results of this assessment will be submitted under separate cover no later than June 1, 2009.

As discussed in Section 4, turbidity monitoring will be performed throughout construction activities. If the results of such monitoring indicates the need for modifications to the existing turbidity controls, additional turbidity control measures will be considered for implementation in the channel before the outfall to the Housatonic River. Additionally, the stop-log configuration may be used to temporarily limit flow out of Silver Lake if conditions should indicate such control measures are necessary.

In addition to the control measures to be installed at the outfall channel, full depth silt curtains will be installed within the lake boundaries around all areas associated with the performance of debris removal, sediment removal or scrub-shrub island restoration activities, as discussed below, to contain solids potentially suspended during these activities.

During all construction activities, any visual observations of sheens will be noted, and appropriate measures (e.g., booms) will be available to contain and recover surface sheens.

3.3.3 Site Security and Traffic Control

Appropriate temporary fencing will be installed to restrict site access and protect monitoring and construction equipment. A visitor sign-in and sign-out protocol will be implemented to monitor all non-worker traffic within the work area, and if necessary, security guards will be retained to monitor the site during non-working hours. In addition traffic control will be provided as necessary, since construction activities may interfere with normal vehicle or pedestrian traffic in the vicinity of the work area.

3.4 Sediment, Soil, and Debris Removal

As required in the SOW, prior to capping activities, a maximum of 400 cy of sediment in the northeast corner of the lake will be removed. Removal of soil will also be required within the scrub/shrub island area to facilitate cap placement and the prescribed restoration, as well as along the shoreline to facilitate installation of the cap and armor system. In addition, previous investigations have indicated the presence of certain debris that must be removed to facilitate cap placement. This section presents a summary of available data to support the removal of certain debris and sediment from Silver Lake, along with a discussion of conceptual methods anticipated to be employed during performance of these removal activities.

3.4.1 Debris Removal

As fully discussed in the Sediments PDI Report, a side-scan sonar survey was conducted within Silver Lake to identify specific features of the lake bottom that may interfere with cap placement. This section presents the results of the side-scan sonar survey, as well as potential methods to be used to remove certain debris.

3.4.1.1 Side-Scan Sonar Survey

A side-scan sonar survey was performed to provide a graphical representation of the debris present on the lake bottom. The mosaic generated as a result of this survey is illustrated on Figure 3-3. A discussion of the side-scan sonar survey is presented in the PDI Report.

As presented on Figure 3-3, a total of 48 submerged targets were identified during the survey. These objects generally consist of several automobiles, discarded tires, woody debris, etc. in varying sizes, as summarized on Table 3-2. Additional features such as pilings and concrete structures have been observed and noted by field personnel during various investigative activities associated with Silver Lake and/or by divers utilized during performance of the Pilot Study. The locations of these additional debris areas (e.g., pilings, flumes) are also illustrated on Figure 3-3, and included on Table 3-2.

As discussed above, certain targets could potentially interfere with construction activities, and/or the performance of the cap and these objects are proposed for removal as presented in Table 3-2. Debris within the footprint of the sediment cap that appear to protrude more than 1 foot in height above the sediment surface, as identified by the side-scan sonar, will be removed. In addition, significant debris in the area of the shoreline protection system will also be removed to ensure cap integrity. Further, as requested by EPA, GE has considered and decided to remove the above grade portion of the concrete base structures located along the east shore and in the southeast corner of Silver Lake. Presently, a total of 16 side-scan sonar targets and two areas of piles**,** as well as the concrete base structures mentioned above (see Figure 3-3 and Table 3-2) have been identified for removal.

3.4.1.2 Methods

At this time, it is anticipated that a barge-mounted crane, equipped with a clamshell bucket will be used to remove debris from the majority of the locations identified on Figure 3-3. However, certain larger items, such as automobiles, may require a grapple to facilitate removal. As necessary, larger items (i.e., automobiles) may, with the assistance of divers, be floated to the surface and guided to the shore for removal. In development of the Final Work Plan, GE will evaluate available removal equipment types and environmental controls with regard to minimizing the potential for re-suspension and/or transport during debris removal. Details related to the performance of debris removal will be determined in consultation with the selected remediation contractor.

Following any initial gravity dewatering within the work area, it is anticipated that removed materials will be transported in lined trucks to Building 65, for stockpiling and appropriate

management (e.g., dewatering, cutting into smaller size). As discussed in Section 3.3.1, while staged, materials removed from the lake will be placed on and covered with polyethylene sheeting. Any water collected at the staging areas will be tankered and transported to Building 64G for treatment and discharge. Samples will be collected from the debris for appropriate waste characterization prior to transportation for off-site disposal.

3.4.2 Sediment Removal

As discussed above, the SOW calls for the removal of certain sediments with elevated concentrations of PCBs. This section presents a summary of available data to support the proposed sediment removal, as well as the methods anticipated to be used during performance of the removal activities.

3.4.2.1 Sediment Data

Sediment sampling for PCBs has been performed on several occasions in Silver Lake, resulting in the collection of more than 200 samples. Sediment sampling efforts in 1992 identified a location with some of the highest PCB levels in surface sediments (top foot) in the northeast corner of Silver Lake. Performance standards detailed in the SOW require delineation and removal of a maximum of 400 in-situ cy of Silver Lake sediment from an area in the general vicinity of existing Outfall 01A to address the presence of elevated PCBs (BBL, 1999).

Sediment sampling was performed in 2003 to better define the vertical and horizontal extent of PCBs in this area, to assist in determining the limits of sediment removal. Sediment sampling were conducted at seven locations around the perimeter of location N02(92) and from the location itself (see Figure 3-4). Samples were collected from the 0- to 1 and 1- to 3-foot depth increment at each location and analyzed for PCBs. Additional details on the sediment sampling and analytical results are included in the Sediments PDI Report.

A summary of the sediment PCB data collected in the northeast corner of the lake is presented on Figure 3-4. Based on this information, and consistent with the preliminary removal areas discussed in the SOW [i.e., in the vicinity of Outfall 01A and sample location NO2(92)], a conceptual removal area has been selected such that removal in this area performed to a depth of 3 feet would result in the removal of 400 cy of sediment. As illustrated on Figure 3-4, and consistent with the area proposed in the EPA-approved Sediments PDI Report, this removal will encompass the majority of the sample locations in this area with relatively high sediment PCB concentrations in the top three feet. Specifically, PCB concentrations in the materials proposed for removal (i.e., the top three

feet in the area illustrated on Figure 3-4) range from 51 to 36,000 parts per million (ppm) with a mean concentration of approximately 5,000 ppm.

3.4.2.2 Methods

It is anticipated that the sediment removal approach will involve mechanical removal "in the wet" from shore using conventional equipment (e.g. long reach excavator with an environmental bucket). In the development of the Final Work Plan, GE will evaluate available removal equipment and environmental controls in consideration of minimizing potential resuspension and/or transport. Actual removal methods may be modified in consultation with the selected remediation contractor.

Sediment materials subject to excavation have been identified as containing PCBs in excess of 50 ppm. Therefore, these materials will be excavated, handled, and disposed of in accordance with the Toxic Substances Control Act (TSCA).

To the extent practicable, excavated materials will be direct loaded into lined vehicles for transport to Building 65 for temporary staging. However, it is anticipated that certain removed materials may require dewatering before transport. Any excavated materials that may not be direct loaded, will be gravity dewatered within the work area to allow for the drainage of free liquids. If necessary, drying agents (e.g., Portland cement dust, lime-kiln dust, or other inert materials) will be added to the removed materials for off-site transport. While staged, excavated materials will be placed on and covered with polyethylene sheeting. Any water collected at the staging areas will be tankered and transported to Building 64G for treatment and discharge. Following sufficient dewatering and/or stabilization, excavated materials will be transported to Building 65 for further dewatering, if necessary, and storage. Materials that have been staged and prepared for transport to Building 65 will be loaded into lined over-the-road vehicles for transport to an approved off-site disposal facility.

Following completion of removal activities, clean granular backfill (e.g., silts and sands) will be placed over the excavated area such that the lake bottom is restored to the approximate pre-removal elevation. As discussed further in Section 3.5, the entire lake bottom (including this removal area) will be covered with a continuous cap following completion of removal activities.

3.4.2.3 Verification of Removal

Sediment will be removed from an area illustrated on Figure 3-4 to a maximum depth of 3 feet, resulting in the removal of 400 in-situ cy of sediment. The removal footprint will be

delineated using conventional survey techniques. In consultation with EPA, removal volume verification will be determined using the known volume of the dredge bucket and by counting the number of buckets of sediment removed from the lake.

3.4.3 Shrub-Scrub Island Removal

This section presents a summary of the Performance Standards applicable to the Scrub-Shrub Island area, the available information to support the soil removal and capping activities in this area, and anticipated methods to be used to remove the targeted soil.

3.4.3.1 Removal Extent

A sediment "island," which consists of two peninsulas a total of approximately 30 yards wide, is located in the northeastern corner of the lake, as shown on Figure 3-5. SOW Performance Standards for this area require capping as described in Section 3.7 below as well as planting of appropriate wetlands vegetative species on the surface of the cap following installation. Similar to the sub-aqueous cap to be placed over the sediments, the cap placed within this area will be approximately 14 inches thick. As required in the SOW, following cap placement, an additional eight inches of topsoil will be placed over the top of this capped area for a total thickness of 22 inches, as shown (not to scale) on Figure 3-6. Further, in accordance with the SOW, the finished surface within the scrub-shrub island area will generally be graded such that final surface elevation of the island is approximately 976.9 ft (i.e., one foot above the approximate mean water surface elevation of 975.9 ft). Finished grades near the bank will be blended with the existing (or finished in restored bank areas) bank elevations such that there are no abrupt elevation changes between the scrub-shrub island surface and the adjacent banks. To accommodate the placement of cap and topsoil materials in the shrub-scrub area, existing materials in this area will be excavated to an elevation of approximately 975.1 ft (i.e., approximately 22 inches below the generally anticipated finished elevation within the scrub-shrub island). Complete details related to the proposed removal and restoration of the scrub-shrub island, including detailed cross-sections at a spacing of 50 feet (or less as necessary) illustrating the elevations and thicknesses of the removal and replacement activities, as well as integration with adjacent bank soil removal areas, will be provided in the Final Work Plan.

The scrub/shrub island is separated into two peninsulas split by a channel conveying discharge waters from Outfall 01A. The SOW discusses capping the entire shrub-scrub "island" area such that the area is transformed into one contiguous peninsula, and required GE to evaluate extending the existing discharge pipe so that the discharge occurs outside the "island" area. GE has considered extending the discharge pipe. In light of the relative elevations and hydraulic gradients, however, GE believes that extending the outfall pipe

would not be advisable. Specifically, because of the large diameter (48 inches) and existing invert elevation (977.1 ft) of the outfall pipe, extending the discharge through the center of the "island" area would create a "mounded" area well above the anticipated finished grade of the scrub-shrub area. Additionally, previous investigations in this area indicate that the soft sediment in this area would not likely be able to support the overburden associated with such a large outfall pipe, which may lead to increased consolidation in this area and/or pipe failure. In addition, filling in the gap between the two peninsulas would raise issues concerning flood storage compensation. Therefore, during restoration of this area, GE proposes to restore the current channel between the two existing peninsulas, maintaining the opportunity for periodic natural flooding of this area to enhance the anticipated biologic communities. As with the remainder of the scrub-shrub island, the existing channel will be excavated to sufficient elevations to facilitate cap and armor stone placement within the channel to restore the channel to existing grades and maintain conveyance of discharge from Outfall 01A.

3.4.3.2 Methods

Due to the proximity of the shrub-scrub "island" to the sediment removal area discussed above, removal activities for the two areas will likely be coordinated and conducted at the same time. It is anticipated that the general removal approach will involve mechanical excavation from shore using conventional equipment; however, in the development of the Final Work Plan, GE will evaluate available removal equipment and environmental controls in consideration of minimizing potential resuspension and/or transport.

Following removal and capping activities, GE shall place eight inches of topsoil over the top of the capped area such that the top of the island remains approximately one foot above mean water surface elevation (i.e., 976.9 ft). As described in Section 3.7, GE shall then plant appropriate vegetative species at the spacing and planting density indicated in the SOW.

3.5 Sediment Capping

Following the completion of the removal activities described above, a sediment cap will be placed over the entire lake bottom. This section describes the composition of the cap as well as the conceptual activities associated with the construction methods anticipated to be employed during implementation.

3.5.1 Cap Composition

As prescribed in the SOW and revised by EPA's August 17, 2004 conditional approval letter for the Sediments PDI Report, the sediment cap will consist of a 14-inch thick cover. This cap will be composed of three layers: a 2-inch "mixing" zone, a 6-inch isolation layer, and a 6-inch bioturbation zone, as shown on Figure 3-7. The cap material will consist of granular materials with a minimum total organic carbon (TOC) of 0.5% in the isolation layer, as prescribed in the SOW.

3.5.2 Sand and Total Organic Carbon Source

During performance of the Pilot Study, a blended topsoil was ultimately selected as the granular cap material. As confirmed by pre-placement sample collection and analysis, the blended topsoil used in that Pilot Study had TOC levels of approximately 1.0%. As described in the Pilot Study, the blended topsoil is a well-graded silty sand that comes from the supplier relatively free of trash, woody-debris, or other obstructions that may create potential difficulties during placement. Materials specifications associated with the blended topsoil used during performance of the Pilot Study are included with this document as Appendix A.

In addition to the potential use of a blended topsoil, at the request of EPA, the availability and feasibility of the use of alternate TOC sources and/or alternative means of controlling or reducing turbidity are currently being assessed. The results of this assessment will be submitted under separate cover no later than June 1, 2009.

During performance of the Pilot Study, the cap was installed in a series of thin (i.e., 1- to 2-inch) lifts. This method of placement was successful in minimizing the mixing of the cap and underlying sediments and enabled placement of the weight associated with the cap over an extended period of time. Prior to and throughout placement activities, the cap materials will be sampled for pre-characterization and approval for use in the lake. Specifically, dry cap materials will be sampled at an approximate frequency of one sample per 500 cubic yards (cy) for analysis of TOC content, one sample per 2,000 cy for analysis of PCBs, and one sample per 5,000 cy for analysis of Appendix IX + 3. Analytical results will be presented to EPA for pre-approval for use in the dry cap materials mix.

As further discussed in Section 4, cap material sample collection is anticipated to be performed after the first 4 lifts of cap material have been placed. At that time, samples of the isolation layer will be collected and submitted for analysis of TOC content. If laboratory results indicate that the TOC content is not meeting the required minimum standard, GE will, in consultation with EPA, implement measures to either modify the cap application

method or incorporate the addition of supplemental materials to the dry cap material mix to enhance the TOC content of the remaining portion of the isolation layer.

Additionally, if the results of the assessment of TOC and cap thickness after 4 lifts suggest that Performance Standards are not being achieved, GE will perform a similar sample collection and analysis program after 8 lifts have been placed.

3.5.3 Use of Geotextile

One particular objective of the Pilot Study was an evaluation of the effectiveness of incorporating geotextile materials into the cap design to enhance the integrity and stability of the cap. Based on a review of the visual, geotechnical, and analytical data collected both during and following cap placement, the use of geosynthetic materials leads to little apparent difference in the integrity or stability of the cap. Further, as fully discussed in the Pilot Study Report, installation of geotextile layers prior to cap placement proved relatively difficult to accomplish. Based on these results, a geotextile layer will not be included in the final remedial design related to capping the Silver Lake sediments.

3.5.4 Cap Placement Method

In general, cap materials are anticipated to be slurried and placed in thin lifts by broadcasting materials to the water surface, as described below. It is anticipated that each lift would be placed across the entire lake bottom and allowed to settle to the sediment surface before successive lifts are added thus minimizing the potential for bottom disturbance.

3.5.4.1 Open Water Areas

Similar to the approach used in the Pilot Study, it is anticipated that a slurry of cap materials will be broadcast to the water surface over the vast majority of Silver Lake. Dry cap materials will be staged and mixed, if necessary, onsite in the staging areas discussed above. Once prepared and approved for placement, dry cap materials will be placed into a slurry with water drawn from the lake and conveyed to a barge via a reverse dredge head and a flexible pipeline. From the barge, the slurry will be broadcast to the water surface via a barge-mounted spreader assembly (spreader box) similar to the one fabricated for the Pilot Study. Upon entering the spreader assembly, the cap material slurry will move through a perforated diffuser pipe across the top of the spreader box. The spreader box and diffuser pipe will be designed to optimally dissipate the energy potentially associated with the pressurized flow.

To minimize the potential for disturbance of underlying sediment during placement of the cap, the cap materials will be placed in thin lifts by broadcasting a slurry of uniform consistency to the water surface to achieve a lift thickness of approximately 1-inch. As in the Pilot Study, and in consultation with EPA, after the first 8-inches of the cap have been installed it is anticipated that the rate of cap material delivery will be modified such that the remainder of the cap will be placed in approximate 2-inch lifts.

It is anticipated that a system of anchor and travel cables will be used to move the barge across Silver Lake. The barge will be pulled along the cable at the desired speed to maintain relatively constant distribution during each pass. Upon completion of a pass, the travel cable would then be moved, the barge turned around, and the process repeated (in the opposite direction) in an immediately adjacent path. In this way, the spreader box would progress across the lake until one complete lift has been placed over the lake bottom, at which time the barge will be returned to the starting point to begin a subsequent lift. A conceptual barge and spreader box layout is illustrated on Figure 3-8.

Note that final design considerations related to the actual spreader assembly and conveyance of slurried materials will be made in consultation with the selected remedial contractor. Similarly, methods of propulsion and control of the barge will be determined in consultation with the selected contractor, and may be modified from the conceptual approach described herein.

3.5.4.2 Near Shore Areas

As discussed above, the majority of the Silver Lake sediment cap is anticipated to be broadcast in a slurry to the water surface via a barge mounted spreader box. However, alternative methods may be necessary in certain near shore areas due to shallow water depths. Two alternative placement methods will be considered. One technique would be, slurry placement by using a diffuser pipe mounted on the side of the barge which would extend from the side of the barge towards shore and over the shallow areas, broadcasting the slurry to the water surface adjacent to or in front of the barge. Alternatively, a rotatable broadcast nozzle could be mounted on the end of the barge, spraying the slurry to the water surface in a sweeping arc. Any such slurry conveyance performed in this manner would be operated only while needed in near shore areas.

Another potential method for placement of the cap over shallow water near-shore areas is to place dry isolation layer material mechanically using an on-shore excavator. In this instance, the excavator will access the near shore area from an adjacent parcel, and will place dry materials that are staged in a nearby dump truck. The excavator operator will lower the bucket to near the water surface, and will slowly tip the bucket to place thin lifts,

feathered along the extent of the bucket arm's reach. Based on observations during the Pilot Study, it is important to monitor the rate at which the dry materials are placed and to ensure that sufficient control and supervision are utilized to maintain the ability to place cap materials in thin lifts.

As previously discussed, this Work Plan presents the anticipated methods for cap placement. Final determination of the selected methods will be made in consultation with the selected remedial contractor. Significant departure from the methods presented in this Work Plan or any final design documents will be discussed with EPA prior to implementation.

3.6 Shoreline Armoring

As prescribed in the SOW, to maintain the integrity of the installed sediment cap and protect the cap from naturally occurring erosive forces, the cap design includes location-specific shoreline erosion protection measures that will be installed around the perimeter of the lake. This section describes the proposed methods to place armor stone in specific locations around the shoreline of Silver Lake, and to create an underwater gravel habitat layer.

3.6.1 Bank Grading and Preparation

Prior to construction of the shoreline protection system, the bank area will be cleared of vegetation, and soil removal, as necessary for armor stone placement, will be completed. At this time, similar to the Pilot Study, it is not anticipated to be necessary to remove sub-surface vegetation (i.e., roots and stumps) that do not interfere with armor stone placement. Any removed materials or cleared vegetation will be handled in accordance with appropriate material removal procedures discussed in Section 3.4. Existing vegetation in the banks that are not subject to plantings will be documented in the Final Work Plan, and GE will revegetate these banks with species similar to those present pre-remediation, with the exception of non-native and/or invasive species. A proposed revegetation plan and inspection and maintenance plan for these banks will be included in the Final Work Plan.

It is anticipated that certain activities described in the Revised Conceptual Work Plan for Soils may overlap with the installation of the shoreline armoring system described in this section. The Revised Conceptual Work Plan for Soils indicates that certain areas of the banks around the lake will require material removal to meet applicable Performance Standards. Included in these proposed removal areas are certain areas immediately adjacent to the approximate mean water surface elevation. In these instances, it is anticipated that bank soil removal activities will be completed prior to armor stone installation.

Note that completion of the removal/restoration activities related to the bank soils and/or activities associated with armor stone placement will be performed such that there will be no anticipated net loss of floodplain storage. In those areas where armor stone placement coincides with proposed removal related to the Bank Soils Area, backfill of the removal area would be completed to location specific grades, and the ensuing placement of the armor stone layers would return each area to its pre-existing elevations. In areas where bank soil materials are not being removed to achieve applicable Performance Standards, soil removal will be conducted for installation of the shoreline protection system so that finished grades are returned to approximate pre-existing elevations. Additionally, the upper extent of the shoreline protection system will be blended into the surrounding area such that there are no abrupt elevation changes between the armor system and the adjacent banks. Complete details related to the proposed removal activities and implementation of the armor system, including cross-sections at 100-foot intervals (or the distance between detailed survey transects) except as otherwise specified illustrating the elevations and thicknesses of the removal and replacement activities and integration with adjacent bank soil removal areas, will be provided in the Final Work Plan. These cross-sections will show the existing grades, proposed excavation grades, and proposed final grades from the edge of pavement (or similar distance to the lake for areas that do not abut Silver Lake Boulevard) extending 25 feet into the Lake. The cross-sections will account for anticipated sediment consolidation, the placement of the armor stone and anchor trench, bank excavation, bank stability and recontouring, bank replantings (in the NRD/EA areas), and construction of the walking path. In areas where the bank contours are modified from existing conditions, GE will demonstrate how soil Performance Standards are met in consideration of post-construction grades. The Final Work Plan will also demonstrate compliance with flood storage capacity requirements.

As discussed in a March 19, 2007 letter associated with performance of soil removal associated with the Pilot Study, stained materials were encountered during excavation activities. Similar staining has been observed at several locations around the perimeter of the lake during the performance of bank soil investigations. A contingency plan related to the potential discovery of stained materials, non-aqueous phase liquids (NAPL), or other petroleum based products during implementation will be developed and submitted with the Final Work Plan. This contingency plan will include a proposed method(s) for the identification and characterization of such materials as well as provisions for the control and remediation, as practicable, of any such identified materials. GE is also currently coordinating with the Pittsfield Economic Development Authority (PEDA) to appropriately manage and dispose of such material (if any) prior to or during the installation by PEDA of a stormwater box culvert and drainage swale associated with PEDA's ongoing development of the former 30's and 40's complexes on the former GE Facility. Complete discussion of

the performance of the combined bank soils and sediment remediation activities will be presented in a forthcoming Final Work Plan.

3.6.2 Geotextile Layer

Following removal activities described above, a geotextile layer will be installed prior to armor stone placement. As in the Pilot Study, a woven geotextile will be anchored to shore and placed over the extent of the area to be armored to enhance slope stability and provide a suitable surface for armor stone installation, as well as to act as a filter material between the armor layer and the underlying cap materials. An illustration of the armor system is detailed in Figure 3-9.

3.6.3 Armor Stone Layer

At this time it is anticipated that the armor layer will be implemented using conventional equipment (e.g., excavator) located on the shore. The armor stone will be placed over the woven geotextile, as described above. A cross-section of the proposed armoring configuration is illustrated on Figure 3-9. The stone size, layer thickness, and placement extent of the armor stone layer will be based on previous design information presented in the Sediments PDI Report and the SOW.

The armor layer has been designed using the United States Army Corps of Engineers (USACE) Shore Protection Manual (SPM; USACE, 1984) and the United States Department of Agriculture (USDA) Technical Release No. 69 (TR 69; USDA 1983). As described in the Sediments PDI Report, the predominant cause of erosion in Silver Lake is wind-driven wave action. Therefore, the armor system has been designed and will be constructed so as to protect the cap, above and below the mean water surface elevation, from potential erosion caused by wind driven waves. Complete material specifications for anticipated components of the armor system are included in Appendix A.

Using the design references listed above, the armor system has been conservatively designed to protect the cap from wind-driven waves associated with a 100-year wind event. Note that because predominant winds on Silver Lake are from the west/northwest, two armor layer design dimensions have been prepared; one for areas subject to the predominant winds (i.e., the east and south shore) and a separate design for the areas that do not face the predominant winds (i.e., the west and north shore). Figure 3-10 illustrates the conceptual layout of the two armor stone configurations.

The armor stone layer for the eastern and southern shore will be similar to that of the Pilot Study, and will consist of a 12-inch thick layer of well-graded rip rap, with a median diameter

(i.e., D_{50}) of 5- to 6-inches. However, on the western and northern shore where there is less wind-driven wave action, smaller stone will be required. To determine the armor stone layer design specifications for the western and northern shores, the wind data analysis focused on the fastest mile wind speeds from 100-year return period storms for the easterly wind data, thereby assuming worst case scenarios. Specifically, the maximum fastest mile easterly wind speed of 37 miles per hour (mph), as projected for the Albany airport, was selected for use in design calculations for the armor layer on the western shore. The armor stone design for the western shore will consist of a 6-inch thick layer of graded rip rap, with a D_{50} of 3- to 4-inches. For all design considerations, stone placement is anticipated to proceed from the lake toward the land portion so that each subsequent armor stone placed at higher elevations are supported by those placed below. Complete material specifications for anticipated components of the armor system are included in Appendix A.

For the armor system design described above, a mean water surface elevation (WSE) for Silver Lake was initially assumed to be 975.9 feet based on data associated with periodic staff gauge readings and an array of piezometer clusters installed within the lake (as presented in the PDI Report.) As requested by EPA, GE has re-assessed the approximate mean WSE to include more recent data collected as part of various monitoring programs. Data associated with these programs, include frequent readings of a staff gauge located in the northeast corner of Silver Lake (i.e., survey reference point BM-SL-5) and a water depth measurement taken from a fixed location at the outlet from Silver Lake.

The available data used in re-evaluating the mean WSE of Silver Lake are summarized below:

- In 2003 and 2004 the approximate lake water surface elevations was measured 61 times using piezometers installed in the lake during performance of the PDI activities.

- Starting in 2001, periodic staff gauge readings of the lake elevation have been made 200 times.

- Starting in 2007, a measurement of the water depth and elevation at the Silver Lake outfall has been recorded 30 times.

Summaries of the water surface elevation estimates associated with the lake piezometers, staff gauge readings, and the outfall discharge measurements can be found in Tables 3-3, 3-4 and 3-5, respectively. A review of the overall compiled data (including 291 discrete records, as itemized above) indicates a mean WSE of 976.0 feet.

GE's review of the water surface elevation data for the lake, including data recorded since submittal of the PDI Report, indicates that there has been no significant difference in the water surface elevations observed for Silver Lake from the elevation of 975.9 feet referenced in the PDI Report. Moreover, the median WSE considering all the data is 975.9 feet. As such, GE believes that the specifications and elevations associated with the shoreline protection system remain representative of lake conditions, and are appropriate for use in development of the armor system design.

Based on the specific design required for a given location, the armor layer will be constructed to extend between certain elevations above and below this mean water surface elevation. For the eastern shore, armor stone shall be placed approximately 2-feet above and below the mean surface (i.e., between 977.9 and 973.9). For the western shore, armor stone shall be placed approximately 1-foot above and below the mean water surface (i.e., between 976.9 and 974.9). In addition, at the request of EPA, and as agreed in GE's *Revisions to Pre-Design Investigation Report for Silver Lake Sediments* (December 15, 2004), the armor layer will be extended laterally to a maximum water depth of 5.3 feet in select locations. The location selected for the armor layer extension is in the northwest corner of the lake near the intersection of Fourth Street and Silver Lake Boulevard, as shown on Figure 3-10.

At EPA's request, GE has also assessed potential influences on the WSE in the lake with respect to flood conditions in the Housatonic River. As discussed in the *Pre vs. Post Remediation HEC-RAS Modeling & Flood Storage Capacity Report, 1.5 Mile Removal Reach, General Electric (GE)-Pittsfield/Housatonic River Site* (Weston, 2008), a post-construction HEC-RAS hydraulic model was created for the 1½-Mile Reach of the Housatonic River (1½-Mile Reach) to assess potential changes in water surface elevations and associated water velocities in the River following completion of 1½-Mile Reach remediation activities. Because the discharge from Silver Lake is located within the 1½-Mile Reach, and the lake and river are hydraulically linked, the results of the HEC-RAS model may provide some indication of the potential changes in Silver Lake WSE caused by various storm events in the River.

Generally, in river systems the armor stone protection is designed to extend up to the bank-full elevation, typically associated with the 1.5- to 2-year flood flows. Table 3-6 summarizes the flow and related WSE in the 1½-Mile Reach for various flood events. The WSE near the Silver Lake outfall to the river associated with the 2-year flood event is approximately 976.8 feet. This elevation is less than the maximum elevation of the bank armoring in the lake (i.e., 977.9 feet). In addition, a review of the Silver Lake water elevation data summarized in Tables 3-3 through 3-5 indicates that over an approximate 8 year period, none of the measured elevations exceeded that of the top of the bank armoring in the lake

(i.e., 977.9 feet). As a result, the height of the armor stone in the lake is considered to be conservative and consistent with what would be typical in the river adjacent to the outfall.

GE will continue to monitor water surface elevations in the lake up to and throughout implementation of the remedial activities described herein. A complete description of the armor system design process and related calculations is included in Appendix B.

3.6.4 Gravel Habitat Layer

A gravel habitat layer will be placed over the underwater extent of the armor stone as described in the SOW. Per the SOW, a 3-inch layer of gravel and sand will be placed over the armoring stone to facilitate fish usage in shallow-water areas. The 3-inch layer will consist of processed sand and gravel with a material diameter of 3 inches or less, with the greatest proportion of materials exhibiting diameters of 1-inch or less. These materials will be placed from shore via conventional equipment (i.e. an excavator bucket). GE will monitor the placement of such materials to confirm that the shallow-water shelf/gravel habitat layer is 3 inches thick one month after placement. This monitoring will consist of a visual inspection of the shallow water area for evidence of exposed rip-rap and depth measurements at a minimum of 10 locations around the lake.

3.7 Natural Resource Restoration/Enhancement Activities

In addition to sediment remediation to meet the specified Performance Standards, the CD and SOW require implementation of a number of natural resource restoration/enhancement activities in and around Silver Lake. These are described in detail in Attachment I to the SOW, as modified by the Eighth Modification of Consent Decree approved by the Court on June 23, 2008. The Performance Standards for natural resource restoration and enhancement generally require the following:

- Creation of a shallow-water shelf along the shorelines of the lake to provide an improved habitat for aquatic species, with this shelf to consist of a stone armoring layer with a three-inch layer of gravel and sand over the armoring stone to facilitate fish usage.

- Funding of activities in the amount of $75,000 to be performed by the Natural Resource Trustees for restoration work related to fish removal in Silver Lake.

- Capping the scrub-shrub “island” or peninsulas near the discharge outfall and, following installation of the cap, planting of appropriate wetlands vegetative species on the surface of the cap.

- Construction of a walking path and two picnic areas in non-privately owned areas along the eastern and northern sides of the lake.

- Planting of a line of trees along the recreational portions of the eastern and northern banks, approximately 8 feet apart, with an understory community of shrubs in patches approximately 50 feet apart, and planting of herbaceous species on the remaining banks where response actions are conducted.

GE will undertake (or has undertaken) the following measures to satisfy these Performance Standards:

Shallow-Water Shoreline Shelf

As discussed in Section 3.6.4, a 3-inch layer of gravel and sand will be placed over the armor stone in near-shore areas to create a shallow-water shelf to facilitate fish usage.

Payment to Natural Resource Trustees

GE has previously paid the required $75,000 to the Natural Resource Trustees.

Scrub-Shrub Island

As discussed in Section 3.6.3, following the removal and capping activities, eight inches of topsoil will be placed over the scrub-shrub island, and the soil will be graded such that the top of the island remains approximately one foot above the mean water surface elevation (i.e., 976.9 ft). When the finished grades have been achieved, the appropriate wetlands vegetative species will be planted to increase the diversity of the plant community on the island, as well as the wildlife usage.

The current channel between the two existing peninsulas will be maintained to preserve the existing natural habitat of the scrub-shrub area. The center of each peninsula will be planted with a mixture of red-osier dogwood and buttonbush on four-foot centers to allow for the development of cover for shore birds and waterfowl. The red-osier dogwood will be planted more toward the drier area of the island (i.e., area with higher elevation, likely toward the center), while the buttonbush will be planted towards the edges of the island (i.e., the more wet areas). These shrubs will be approximately two to three feet in size (subject to commercial availability) and will be container grown.

To form an understory for the planted shrubs, a wetlands mixture of herbaceous species will be planted in the section of the “island” on which the shrubs are planted. The mixture will

likely include species such as Canada manna grass, fringed sedge, bearded sedge, lurid sedge, joe-pye-weed, green bulrush, hop sedge, boneset, woolgrass, chufa, blue vervian, and red-top panic grass, but will be subject to commercial availability. The wetlands mixture of herbaceous species will be seeded at a rate of one pound per 2,500 square feet.

Above the armoring layer, the periphery of the island will be planted with an emergent mixture of soft-stem bulrush, soft rush, and blue-flag iris. These species will be two-inch peat pot plants, and will be installed on two-foot centers. To the extent practicable, in those areas around the perimeter of the scrub-shrub island where exposed armoring is present, the voids in the stone will be filled with topsoil and seeded with a wetlands mixture of herbaceous species similar to the mixture used to form an understory layer, to promote repopulation of these transitional areas between the island and open water.

Walking Path, Associated Measures, and Plantings on Banks

As indicated above, the SOW provides that, following the performance of bank soil removal activities and the associated restoration of the banks, a walking path and picnic areas will be installed in "non-privately-owned areas" along the eastern and northern sides of the lake (SOW, Attachment I, pp. 17, 20). At that time, as noted in Section 1.2 above, it was believed that the recreational areas on the eastern and northern sides of the lake were publicly owned. However, GE's recent review of deeds records has revealed that those recreational areas are in fact privately owned – with the portions of those areas on Silver Lake Boulevard owned by GE and WMECo and the portion along Fourth Street owned by Pittsfield Industrial Development Company (which no longer exists), as well as some individual heirs who no longer exist. However, the City has easements through these properties for the City streets. In these circumstances, GE is currently discussing with EPA, the Trustees, and the City mechanisms for these properties to be transferred to public ownership so that the walking path and other structures can be placed in publicly owned areas, as provided in the SOW.

Once these issues are worked out, GE will provide an updated submittal relating to the walking path and other natural resource restoration/enhancement measures to be implemented on the eastern and northern sides of the lake, as required by EPA's March 4, 2009 conditional approval letter for the Conceptual Work Plan for Silver Lake Soils. That submittal will provide further details regarding the walking path, the picnic areas (or, with the Trustees' approval, benches), and the trees and shrubs to be planted along the northern and eastern sides of the lake. As directed by EPA, that submittal will address the Trustees' comments relating to those items, as set forth in the Trustees' December 23, 2008 letter attached to EPA's conditional approval letter for the Conceptual Work Plan for Silver Lake Sediments.

General

In addition to the information to be provided in the above-referenced submittal, further implementation details on all these natural resource restoration/enhancement measures will be provided in the Final RD/RA Work Plan addressing both sediments and soils.

4. Monitoring Program

4.1 General

This section presents the proposed construction and long-term monitoring activities to be performed before, during and/or after construction activities. A summary and general schedule for the performance and duration of the various components of the monitoring program is included in Figure 4-1. All sample collection, processing, and analyses described herein will be performed in a manner consistent with the requirements of the *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP; BBL 2002b).

4.2 Pre-Construction Monitoring

This section presents site assessment or monitoring activities to be completed prior to the initiation of RD/RA construction.

4.2.1 Pre-Placement Total Organic Carbon Analysis

Dry isolation materials intended for use in the cap will have a target TOC of between 0.5 and 1.0%. It is anticipated that during placement activities, the dry cap materials will be sampled at the supplier's stockpile for pre-characterization prior to mobilization to the site. The dry cap materials will be sampled approximately one sample per 500 cubic yards (cy) for analysis of TOC content, one sample per 2,000 cy for analysis of PCBs, and one sample per 5,000 cy for analysis of Appendix IX + 3. If any of the related results indicate that the candidate cap materials are not appropriate for use in the lake (e.g., insufficient TOC, PCB detections), the stockpiled materials will be set aside and not used in the lake until further determinations can be made in consultation with EPA.

4.2.2 Water Quality Monitoring

Since June 2006, water quality samples have been collected at the outfall to the Housatonic River for analysis of PCBs and total suspended solids (TSS) as part of GE's Housatonic River monthly water column monitoring program. It is anticipated that this program will continue for the foreseeable future. These data will be used to provide baseline information for comparison to similar samples collected during construction activities (as discussed below).

Real-time measurements of lake water turbidity will be initiated starting two weeks prior to initiation of construction activities to provide baseline information for comparison to similar data collected during construction. As part of this monitoring program, continuous turbidity

measurements will be recorded at two locations; one location upstream of the proposed turbidity control system (MON-1), and an interim location within the proposed turbidity control system (MON-2), as shown on Figure 4-2. Continuous turbidity measurements will be made and recorded using a turbidity probe and submersible battery powered data logger suspended at the approximate mid-depth elevation.

4.3 During-Construction Monitoring

Monitoring performed during construction activities will allow for assessment of any construction related impacts to water column conditions within the lake water, ongoing evaluation of the overall interim cap thickness, and adjustment to the soil cap construction process to ensure that the constructed cap meets design requirements.

4.3.1 Water Quality Monitoring

4.3.1.1 Water Column Sample Collection

Water column monitoring performed during the Pilot Study indicated that during capping activities, PCB concentrations in the water column decreased to levels that were lower than the lake's pre-capping baseline concentrations. During the implementation of the full-scale cap, weekly water samples will be collected from MON-2 (near the outfall to the Housatonic River, Figure 4-2) for analysis of PCBs and TSS. Analytical results from these during-construction samples will be compared to pre-construction data to provide information on changes that may be occurring in the lake water as a result of construction activities.

4.3.1.2 Turbidity Monitoring

As with the pre-construction turbidity monitoring, real-time measurements of lake water turbidity during construction activities will be evaluated to assess the effectiveness of the turbidity control system located at the outfall.

Continuous turbidity measurements will be made and recorded using the same method described above for the pre-construction turbidity monitoring program. During construction activities, the continuous turbidity readings will be reviewed and evaluated at least once per day. Continuous turbidity readings at the outfall, recorded downstream of the turbidity controls implemented during performance of the Pilot Study, were generally below 30 to 35 nephelometric turbidity units (NTUs), and exceeded 50 NTUs on very few occasions. During performance of the construction activities described in this Work Plan, should data recorded at MON-2 indicate turbidity levels greater than 50 NTUs, GE will evaluate the changes in the turbidity data, inspect the turbidity control measures installed at the outfall

(discussed in Section 3.5), and, collect surface water grab samples from locations MON-1 and MON-2 and analyze them for PCBs and TSS in accordance with the protocols used in the Pilot Study.

Note that during the Pilot Study, water column samples were collected for PCB and TSS analysis if and when turbidity levels near the outfall exceeded 50 NTUs. In general, the results of these analyses showed that although TSS levels increased with turbidity, there was no correlation between elevated turbidity and increases in surface water PCB concentrations. Further, the PCB levels in surface water samples collected during construction were generally less than those associated with pre-construction data. Note that if initial data suggest similar findings to those from the Pilot Study (i.e., no apparent correlation between elevated turbidity and surface water PCBs), GE may request from EPA a reduction in the number and/or frequency of surface water grab samples collected.

4.3.2 Cap Composition and Thickness Monitoring

During cap placement activities, an interim assessment of the characteristics, composition and thickness of the isolation layer will be made. The results of the during-construction sample collection will provide a comparison and assessment of any potential changes in the TOC of the isolation layer since placement. With regard to cap thickness, several assessment methods were utilized during implementation of the Pilot Study, and based on the effectiveness and applicability of the respective techniques, a refined approach, including the use of sediment collection pans and core collection, is proposed for performance during implementation of the Silver Lake sediment cap.

4.3.2.1 Sediment Collection Pans

During placement of the capping material, sediment collection pans will be deployed by the Contractor on a daily basis to provide a field check of individual lift thickness. The pans (approximately 2-ft square) will be placed on the sediment surface directly in the path of the placement barge, providing an estimate of the cap material thicknesses as it is deposited on the lake bottom. Similar collection pans were used during the Pilot Study and provided insight into the approximate thickness of each lift being placed. Initially, the collection pans will be collected on a daily basis and the accumulated thickness measured to provide a direct indication of lift thickness. Once the daily assessment of the collection pans indicates that cap materials are being placed relatively uniformly and at the anticipated thickness, or other conditions are observed that suggest a reduction or discontinued use of the collection pans, GE will propose a plan for approval by EPA to reduce the frequency of sediment pan collection or discontinue use of the pans.

4.3.2.2 Cap Materials Core Collection and Thickness Assessment

During-construction cores of the cap material will be collected after 4 lifts of cap material have been placed, and potentially again after 8 lifts of material have been placed following consultation with EPA regarding the achievement of the Performance Standards during the initial core collection. Divers will collect representative cores by physically pushing 3-inch Lexan tubes to the apparent bottom of the cap and just into the native sediment such that sediment and cap materials are recovered at the same time. Cores will be collected at 26 proposed locations, as shown on Figure 4-2. In general, the proposed collection locations have been selected to include a minimum of one sample per acre. Note that all sample collection locations may be adjusted based on field conditions. In the event that significant departure from the proposed locations is necessary, GE will discuss such modifications with EPA.

Care will be taken to minimize material disturbance and/or loss during sediment and cap material collection activities. Although GE has collected many sediment cores from within Silver Lake, and will continue to employ the collection methods and practices as fully described in the Field Sampling Plan/Quality Assurance Project Plan for the GE-Pittsfield/Housatonic River Ste (most recently revised in 2007), GE recognizes that the granular, less-cohesive nature of the saturated cap materials may possibly cause difficulties with standard sediment core collection techniques. As necessary, alternative methods of core collection or divers may be employed to facilitate core collection if conventional direct-push collection from the surface is infeasible. Should the need arise to use any modified collection procedures GE will discuss these modifications with EPA prior to implementation.

Recovered materials will be measured for approximate recovery lengths to assess the interim overall cap thickness.

4.3.2.3 TOC Analysis

Additionally, during-construction cores will be processed by sectioning each core into two specific layers: the approximately 0- to 2-inch layer as measured relative to the apparent interface between the cap material and the underlying sediments, and the remaining materials (i.e., 2-inch to top of core), which represent the isolation layer. From each core, a bulk sample will be taken from the isolation layer materials (the 2-inch to top of core interval) and submitted for analysis of TOC, as illustrated on Figure 4-3. If the results of the TOC analyses indicate that the Performance Standard requiring 0.5% TOC has not been achieved, GE will modify the cap materials application method and/or add supplemental materials to enhance the TOC content in the isolation layer. Any such modifications or

additional sampling activities will be discussed with EPA and implemented after approval by EPA.

4.4 Post-Construction Monitoring

Immediately following the completion of cap placement activities, the monitoring program will include the collection of field data to confirm the post-construction success of the completed RD/RA construction.

4.4.1 Cap Composition and Thickness Monitoring

Similar to the during-construction collection program, cap materials will be collected by divers at 26 locations to assess cap composition and thickness. To avoid locations that may have been previously sampled, cap cores collected after construction will be located approximately 5-feet to the south of those collected during construction. Note that all sample collection locations may be adjusted based on field conditions; however, GE will discuss any significant departure from the proposed locations, with EPA. Once recovered, cores will be measured to verify the composite cap thickness of 14-inches.

4.4.2 TOC and Chemical Analysis

Once measured, collected cores will be processed by sectioning each core into layers as measured relative to the apparent interface between the cap material and the underlying sediment layer. Collected cores will be sectioned into three intervals, as measured relative to the apparent interface between the cap and the underlying sediment. These three intervals are the approximate 0- to 2-inch mixing zone, the top one inch (TOP layer), and the remaining materials (nominally the 2- to 13-inch increment) (REM layer), as illustrated on Figure 4-3. Processed samples from the REM and TOP intervals from each of the 26 cores will be analyzed for TOC. The REM and TOP interval of ten of these core locations (consistent with the requirements of the SOW) will also be analyzed for PCBs. These ten locations have been chosen to give even spatial coverage throughout the lake, as illustrated on Figure 4-2. The results of this analytical testing from the REM and TOP intervals will provide a baseline for comparison and assessment of any potential changes in the chemical characteristics of the isolation layer and/or any future deposition of PCBs on the surface of the cap.

4.5 Long-Term Monitoring

The Long-Term Monitoring program will be implemented to ensure that the cap system installed over the lake bottom and scrub-shrub island area meets the design standards

specified in the SOW (BBL, 1999). This section provides a general description of monitoring activities for the isolation layer and shoreline armoring system to be performed in the first five years following completion of construction activities; at the end of this initial 5-year period, GE will propose a long-term monitoring program for EPA approval. Details of the Long-Term Monitoring program will be provided in the Post-Removal Site Control Plan that will be submitted to EPA following approval of the Final Work Plan for Silver Lake.

4.5.1 Isolation Layer Monitoring

As described above, the post-construction coring program will be utilized to assess cap thickness and integrity. Additionally, the analysis of isolation layer samples from these locations will be used to assess PCB migration, if any, from the underlying sediment.

For the first five years after the cap system is installed, annual monitoring and inspections will be conducted to assess the cap thickness. These inspections will include a sediment core sampling program performed at the 26 locations shown on Figure 4-2. The post-construction core collection program will be performed by divers, who will also make a visual inspection of the surface of the cap in the vicinity of the core collection locations. To avoid locations that may have been previously sampled, cap cores collected during each long-term monitoring event will be located near those collected during construction (i.e., at a set distance, in a set direction, from the during-construction boring). Note that all sample collection locations may be adjusted based on field conditions, however, as necessary, GE will discuss any significant departure from the proposed locations with EPA. Once recovered, cores will be used to quantify the thickness of the in-place cap.

During the first-and fifth-year post-construction long-term monitoring event, certain cap material samples collected for assessing cap thickness will also be analyzed for PCBs. During each of these events, cores will be collected from the same ten locations selected for the post-construction monitoring program (discussed above) and sectioned into three intervals, similar to the post-construction program described in Section 4.4.2.

Processed samples from the REM and TOP layers from each of the ten locations will be analyzed for PCBs. The results of the analytical testing from these intervals will provide a comparison to previously established baseline chemical characteristics of the isolation layer, if any, that may be related to migration and/or deposition.

If the results of this analysis indicate the presence of PCBs as a result of deposition on the surface of the cap, as opposed to the migration of PCBs through the cap from the underlying sediments, the source of the PCBs will be investigated. To the extent practical, attempts will be made to determine whether the PCBs are attributed to sources other than

erosion or surface runoff from the banks or from currently known discharges of PCBs into the lake from NPDES-permitted or other outfalls. If the surface PCBs can be attributed to such other sources that are located within property owned by GE, potential source control measures shall be evaluated and a report on such evaluations and any recommendations shall be submitted to EPA.

In addition to sediment cores, GE will install sediment traps in five locations, as shown on Figure 4-4, to further assess the present and ongoing sedimentation rate in Silver Lake. The thickness of the sediment that settles in the traps will be measured annually for two years following cap construction. Although the thickness of sediment in the traps will be measured, no analytical work will be performed.

Should routine monitoring indicate that the design standards have not been achieved and maintained, or that the isolation layer is not performing as generally predicted, GE will evaluate and propose to EPA appropriate corrective measures to achieve those design standards and will implement such measures upon approval by EPA. At the end of the fifth year monitoring event, GE shall propose to EPA an appropriate long-term monitoring program, as well as any other modifications to the monitoring program, and will implement that long-term monitoring program upon approval by EPA.

4.5.2 Shoreline Armoring Monitoring

Following installation of the armor layer and completion of restoration activities, GE will perform inspections of the shoreline semi-annually for five years. Further, as discussed in Section 3.6, since it is anticipated that certain flow events in the Housatonic River may correlate with increased water surface elevations in the Silver Lake, a shoreline inspection will also be performed after flow events in the Housatonic River that exceed 3,500 cubic feet per second (i.e., the approximate 5-year storm event as recorded at the USGS Gauge in Coltsville).) These erosion inspections will consist of inspections of the armoring system to assess the effects, if any, of shoreline wave and/or wind action over time on the sediment cap along the shoreline. In addition, GE will initiate a program to track local wind speeds and the occurrence of major wind events (i.e., wind speeds greater than the design parameter of 37 and 59 miles per hour for easterly and westerly winds, respectively). Such wind event data will then be considered in conjunction with the results of the initial semi-annual shoreline inspection program to determine if any erosion or material losses can be linked to significant wind events. If erosion of the shoreline is observed (e.g., ruts, gullies, washouts or sloughing), GE will repair the eroded areas and evaluate whether there are eroded soils remaining in the lake and whether they need to be removed. At the end of the five year period, GE will propose to EPA for approval an appropriate long-term monitoring program.

4.5.3 Natural Resource Restoration/Enhancement Area Monitoring

After completion of Natural Resource Restoration/Enhancement Activities, GE will monitor and maintain the restored areas in accordance with the Performance Standards set forth in the SOW.

The long-term monitoring program will consist of two visits during each of the first three years after planting and one visit during both the fifth and seventh year after planting. In each of the first three years after planting, visits will be conducted in the late spring after the first leaf flush (May/June) and in the summer (July/August) to assess plant survival. The single visit in the fifth year and seventh year will be conducted in the summer (July/August). In the event of a significant loss of plantings or growth failure, GE will restore that area, and restart the timing for monitoring and inspections of that area.

During each field visit, personnel conducting the inspection, supported by a certified arborist (if feasible, the arborist who observed the plant installation), will perform a stem count of planted trees and shrubs to determine survival rates estimate groundcover by herbaceous species, and/or the presence of invasive species. Indications of damage from trespassing or herbivory will be noted. Any dead trees or shrubs in excess of 20% of the original planting will be replaced to ensure an 80% survival rate, and any herbaceous planting area with less than 100% cover (outside the foliar coverage of the trees) will be supplemented with additional planting and seeding. Additionally, personnel conducting the inspection will verify that no greater than 5% of any area subject to restoration is covered with invasive species. Recommendations will also be made for supplemental activities such as additional fertilizing or watering, and implementation of measures to reduce herbivory. GE will also inspect the walking path and picnic areas or benches on a yearly basis for three years following installation.

GE will prepare and submit event-specific reports on these inspections, monitoring, and maintenance activities, as well as an annual report summarizing such performance.

5. Future Design Related Activities

This Conceptual Work Plan for Sediments has preliminarily identified sediment areas and depths subject to remediation, as well as initial design considerations for installation of a sediment cap within and around the perimeter of Silver Lake. Following EPA approval of this Conceptual Work Plan for Sediments, GE will proceed with detailed and final design activities to support the performance of these remediation actions. As previously noted, these final design activities for the sediment remediation will be coordinated with the final design activities for the remediation of the soils adjacent to Silver Lake in accordance with the Revised Conceptual Work Plan for Soils, as conditionally approved by EPA on March 4, 2009, GE will then submit a single Final Work Plan which will provide the final design and implementation details for both the sediment and soil remediation activities.

At a minimum, the Final Work Plan will include the following information:

- Detailed design of the sediment removal, debris removal, scrub-shrub island restoration and capping activities, including the design-related information described in Section 3. For the scrub-shrub island, these details will include detailed cross-sections at a spacing of 50 feet (or less as necessary) illustrating the elevations and thicknesses of the removal and replacement activities.

- Final bank soil removal limits and depths associated with either the installation of the armor stone layer or to achieve applicable bank soil Performance Standards.

- The other information listed in Section 5.6 of the Revised Conceptual Work Plan for Soils relating to the soil remediation, as well as the information required by EPA's March 4, 2009 conditional approval letter for that work plan.

- Plans for how the sediment remediation activities will be coordinated with the soil remediation activities, particularly with regard to the coordination of the bank soil removals necessary to facilitate installation of the sediment cap with armor stone on the lake banks. These plans will include cross-sections at 100-foot intervals (or the distance between detailed survey transects) except as otherwise specified illustrating the elevations and thicknesses of the removal and replacement activities and integration with adjacent bank soil removal areas. The cross-sections will show the existing grades, proposed excavation grades, and proposed final grades from the edge of pavement (or similar distance to the lake for areas that do not abut Silver Lake Boulevard) extending 25 feet into the Lake. The cross-sections will account for anticipated sediment consolidation, the placement of the armor stone

and anchor trench, bank excavation, bank stability and recontouring, bank replantings (in the NRD/EA areas), and construction of the walking path.

- In areas where the bank contours are modified from existing conditions, a demonstration of how soil Performance Standards are met for the post-construction grades.

- Discussion of specific measures to be implemented during the course of the proposed removal activities to provide sedimentation and turbidity controls associated with the lake and the Housatonic River.

- An assessment of potential NAPL or sheen observations during remediation and an associated contingency plan to be implemented during remediation.

- Details regarding the implementation of the natural resource restoration/ enhancement measures to be conducted both on the Silver Lake banks and within Silver Lake.

- Specific calculations regarding the impact of the soil and sediment remediation activities, including bank stabilization activities on flood storage capacity (and any flood storage compensation required).

- Description, as necessary, of the procedures to be implemented to ensure attainment of the ARARs (identified in Section 3.2).

- Identification of the Removal Action team, including key personnel, roles and responsibilities, and lines of authority.

- Proposed implementation sequencing and schedule.

- Any necessary, updates or supplements to the CQAP.

- Post-Removal Site Control Plan or summary of anticipated Post-Removal Site Control activities following completion of the Removal Action.

- For the natural resource restoration/enhancement measures, a Restoration Project Monitoring and Maintenance Plan in accordance with the CD and SOW.

- A summary of project close-out requirements.

6. Schedule

Pursuant to EPA's March 2, 2009 conditional approval letter for the initial version of this Conceptual Work Plan for Sediments, and as discussed in Sections 3.3.2.3 and 3.5.2, GE will submit no later than June 1, 2009 an evaluation of the availability and feasibility of the use of alternate TOC sources and/or alternative means of controlling or reducing turbidity, including controlling lake elevations during construction.

In accordance with EPA's March 4, 2009 conditional approval letter for the Conceptual Work Plan for Soils and as discussed in Section 3.7 above, GE will provide an updated submittal addressing the Trustees' December 23, 2008 comments relating to the natural resource restoration/enhancement measures on the Silver Lake banks prior to the submittal of the Final Work Plan. GE will provide that submittal on a schedule to be determined based on the status of discussions among GE, EPA, and others relating to the bank ownership issues.

Subsequently, as noted above, to ensure coordination of the sediment and soil remediation activities, GE will submit a single Final Work Plan addressing both sediments and soils. GE proposes to complete the remaining design-related activities and submit that Final Work Plan within the later of: (a) 5 months of EPA's approval of this Conceptual Work Plan for Sediments or (b) 2 months of the Trustees approval of the submittal described in the prior paragraph. Upon EPA's approval of the Final Work Plan, GE will initiate final design activities and begin development of a Request for Proposal (RFP) that provides the Technical Drawings and Technical Specifications for performance of the remediation and restoration activities. GE will provide, in the Final Work Plan, an anticipated schedule for selection of a Remediation Contractor and performance of the remediation work for both the sediments in Silver Lake and the soils in areas adjacent to the lake.

7. References

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ARCADIS BBL. 2007. *Conceptual Removal Design/Removal Action Work Plan for Soils Adjacent to Silver Lake.*

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BBL. 2002. *Silver Lake Pre-Design Investigation Work Plan for the Silver Lake Area Removal Action.*

BBL. 2004. *Pre-Design Investigation Report for Silver Lake Sediments.*

BBL. 2006. *Bench-Scale Study Report for Silver Lake Sediments.*

United States Army Corps of Engineers. 1984. *Shore Protection Manual* (SPM).

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ARCADIS

Tables

TABLE 3-1
OUTFALLS IDENTIFIED AROUND SILVER LAKE

REVISED CONCEPTUAL RD/RA WORK PLAN FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Item #	Description	Origin/Destination	Status	Additional Information	Proposed Action
1	48" Pipe	Outlet to Housatonic River	Active	Weir elevation of 976.5'; Mean water surface elevation of 975.9' (based on piezometer and surface water data)	Placement of turbidity controls within channel prior to construction activities
2	Partially submerged clay pipe	Unknown	Unknown	Noted in EPA's September 23, 2008 CAL; No source identified	Conduct follow-up investigation; Discuss potential maintenance with City of Pittsfield
3	Partially silted in outfall pipe	Located in the vicinity of City storm drain	Unknown	Located in vicinity of 4" Water Blowoff valve noted in 2006 Hill Survey; Water blowoff valve not located in 2008 ARCADIS investigation; Outfall pipe noted in EPA's September 23, 2008 CAL	Conduct follow-up investigation
4	Subsurface outfall pipe	Located in the vicinity of City storm drain	Unknown	Noted in EPA's September 23, 2008 CAL	Conduct follow-up investigation
5	12" RC Pipe	Located in the vicinity of City storm drain	Unknown		Conduct follow-up investigation
6	12" Steel pipe	Unknown	Plugged	No source identified	Conduct follow-up investigation; Proposed for removal
7	20" Steel pipe (former NPDES outfall 004)	Originates from property transferred to PEDA	Not active	To be replaced by new PEDA outfall; No longer monitored under the GE NPDES program - Transferred to PEDA	Plugged; Proposed for removal
8	15" CMP	Unknown	Active	No source identified	Conduct follow-up investigation; Discuss potential maintenance with City of Pittsfield
9	12" Steel pipe and weir	Unknown	Not active	No source identified; Sheens occasionally noted behind weir	Conduct follow-up investigation; Discuss potential removal with City of Pittsfield
10	7" CI Pipe	Unknown	Unknown	No source identified. One storm drain shown on municipal storm drain figures in this area of the bank, unable to determine which pipe is indicated.	Conduct follow-up investigation; Discuss potential removal with City of Pittsfield
11	6" CI Pipe				
12	9" CI Pipe				
13	8" CI Pipe (former NPDES outfall 003)	Originates from property transferred to PEDA	Unknown	No longer monitored under the GE NPDES program - Transferred to PEDA	Conduct follow-up investigation; Discuss potential maintenance with City of Pittsfield
14	Submerged 48" pipe (former NPDES outfall 001)	Discharge from oil/water separator 31W	Active	No longer monitored under the GE NPDES program - Transferred to PEDA	Discuss potential maintenance with the City of Pittsfield
15	48" pipe and channel (former NPDES outfall 01A)	Bypass flow associated with oil/water separator 31W	Active	No longer monitored under the GE NPDES program - Transferred to PEDA	Discuss potential maintenance with the City of Pittsfield
16	16" CMP	Located in the vicinity of City storm drain	Active		Conduct follow-up investigation; Discuss potential maintenance with City of Pittsfield
17A	Subsurface steel pipe	Unknown	Unknown	No source identified; Not located during the 2008 ARCADIS investigation; 16" pipe noted in EPA's September 23, 2008 CAL	Conduct follow-up investigation; Discuss potential removal with City of Pittsfield
17B	Partially silted-in pipe	Unknown	Unknown	No source identified; Noted in EPA's September 23, 2008 CAL	Conduct follow-up investigation; Discuss potential removal with City of Pittsfield
18	16" CMP	Located in the vicinity of City storm drain	Unknown		Conduct follow-up investigation; Discuss potential maintenance with the City of Pittsfield
19	Steel outfall pipe	Located in the vicinity of City storm drain	Unknown	Noted in EPA's September 23, 2008 CAL	Conduct follow-up investigation; Discuss potential maintenance with City of Pittsfield
20	42" Concrete box culvert	Originates from Fourth Street (north to Curtis St) drainage	Active		Discuss potential maintenance with the City of Pittsfield
21	12" CI Pipe	Unknown	Unknown	No source identified; Pipes are submerged	Conduct follow-up investigation; Discuss potential removal with City of Pittsfield
22	8" CI Pipe				
23	4" CI Pipe				
24	8" CI Pipe				
25	12" Terracotta clay pipe	Located in the vicinity of City storm drain	Unknown		Conduct follow-up investigation; Discuss potential mainenance with the City of Pittsfield
26	Indications of underground pipe	Located in the vicinity of City storm drain	Unknown	Observed by EPA during 2008 survey with ARCADIS	Conduct follow-up investigation; Discuss potential maintenance with the City of Pittsfield

Notes:
1. 2006 Survey performed on 9/26/06 by Hill Engineers.
2. 2008 Survey performed during March/April 2008 by ARCADIS, with EPA/Weston oversight.
3. Items summarized in this table are shown on Figure 1-2.
4. Proposed origin/destination locations based on available City mapping.
5. Information presented in this table is consistent with that submitted in the Revised Conceptual RD/RA Work Plan for Bank Soils Adjacent to Silver Lake (October 2008).

TABLE 3-2
DEBRIS/REMNANT STRUCTURES IDENTIFIED IN SILVER LAKE

REVISED CONCEPTUAL RD/RA WORK PLAN FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

OSI Target #	Approximate Height Above Sediment (ft)	Description of target	Proposed for Removal
1	7	Square structure with submerged pilings	Yes
2	1	Tire	No
3	<1	Area of 3 small objects	No
4	1	Round object	No
5	<1	Linear object	No
6	1	Tire	No
7	1	Tire	No
8	1	Tire	No
9	1	Tire	No
10	1	Tire	No
11	1	Tire	No
12	<1	Pipe or linear object	No
13	1	Tire	No
14	5	Automobile	Yes
15	1	Unknown object	No
16	<1	Tire	No
17	<1	Unknown object	No
18	1	Area of debris	No
19	3	Area of pilings and debris	Yes
20	3	Pilings	Yes
21	3	Piling	Yes
22	3	Area of debris	Yes
23	<1	Rectangular object	No
24	3	Pilings	Yes
25	3	Piling	Yes
26	2	Piling	Yes
27	1	Unknown object	No
28	1	Area of debris	No
29	3	Piling	Yes
30	1	Unknown object	No
31	1	Area of debris	No
32	1-3	Area of debris	Yes
33	5	Possible automobile	Yes
34	1	Area of debris - pipes	No
35	1	Area of debris - 1-4' blocks	No
36	1	Area of debris - 1-4' blocks	No
37	<1	Unknown object	No
38	1	Two linear objects in a "T" formation	No
39	1	Linear object - possible pipes	No
40	1-3	Area of debris - tires, pipes, unknown	Yes
41	4	Automobile	Yes
42	<1	Area of debris - tires, unknown	No
43	1	Area of debris - tires, unknown	No
44	2	Unknown object	Yes
45	<1	Unknown object	No
46	1	Unknown object	No
47	1-3	Area of submerged pilings	Yes
48	<1	Area of possible ropes or cables	No
--	NA	Group of pilings extending perpendicular to north shore	Yes
--	NA	Group of pilings extending perpendicular to east shore near cofferdam	Yes
--	NA	Cofferdam on east shore	Yes
--	NA	Cofferdam on shore at southeast corner	Yes

Notes:
1. Survey performed by Ocean Surveys, Inc. on June 10-13 2003.
2. Approximate locations of items summarized in this table are illustrated on Figure 3-3.
3. NA - Information Not Available

TABLE 3-3
SUMMARY OF SILVER LAKE PIEZOMETER
WATER SURFACE ELEVATION MEASUREMENTS

REVISED CONCEPTUAL RD/RA WORK PLAN FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Piezometer	Date	Datum Elevation (ft)	Distance to Water (ft BMP)	Estimated Water Surface Elevation (ft)
SLPZ-04	7/15/2003	977.60	2.00	975.60
SLPZ-05	7/15/2003	981.40	5.80	975.60
SLPZ-07	7/15/2003	979.60	3.70	975.90
SLPZ-08	7/15/2003	981.20	5.50	975.70
SLPZ-10	7/15/2003	981.40	5.60	975.80
SLPZ-01	7/16/2003	981.50	5.40	976.10
SLPZ-02	7/16/2003	982.10	6.20	975.90
SLPZ-03	7/16/2003	981.60	5.60	976.00
SLPZ-06	7/16/2003	980.80	5.10	975.70
SLPZ-09	7/16/2003	981.20	6.10	975.10
SLPZ-01	8/6/2003	981.50	5.49	976.01
SLPZ-02	8/6/2003	982.10	6.15	975.95
SLPZ-03	8/6/2003	981.60	5.65	975.95
SLPZ-04	8/6/2003	977.60	1.65	975.95
SLPZ-05	8/6/2003	981.40	5.39	976.01
SLPZ-06	8/6/2003	980.80	4.85	975.95
SLPZ-07	8/6/2003	979.60	3.92	975.68
SLPZ-08	8/6/2003	981.20	5.30	975.90
SLPZ-09	8/6/2003	981.20	5.31	975.89
SLPZ-10	8/6/2003	981.40	5.32	976.08
SLPZ-10	8/15/2003	981.40	4.86	976.54
SLPZ-10	8/22/2003	981.40	5.53	975.87
SLPZ-10	8/28/2003	981.40	5.65	975.75
SLPZ-01	9/3/2003	981.50	5.44	976.06
SLPZ-02	9/3/2003	982.10	6.10	976.00
SLPZ-03	9/3/2003	981.60	5.59	976.01
SLPZ-04	9/3/2003	977.60	1.66	975.94
SLPZ-05	9/3/2003	981.40	5.42	975.98
SLPZ-06	9/3/2003	980.80	4.79	976.01
SLPZ-07	9/3/2003	979.60	3.60	976.00
SLPZ-08	9/3/2003	981.20	5.25	975.95
SLPZ-09	9/3/2003	981.20	5.25	975.95
SLPZ-10	9/3/2003	981.40	5.26	976.14
SLPZ-01	9/8/2003	981.50	5.59	975.91
SLPZ-02	9/8/2003	982.10	6.30	975.80
SLPZ-03	9/8/2003	981.60	5.76	975.84
SLPZ-04	9/8/2003	977.60	1.73	975.87
SLPZ-05	9/8/2003	981.40	5.58	975.82
SLPZ-06	9/8/2003	980.80	4.95	975.85
SLPZ-07	9/8/2003	979.60	3.56	976.04
SLPZ-08	9/8/2003	981.20	5.40	975.80
SLPZ-09	9/8/2003	981.20	5.41	975.79
SLPZ-10	9/8/2003	981.40	5.44	975.96
SLPZ-10	9/22/2003	981.40	5.94	975.46
SLPZ-01	10/30/2003	981.50	4.80	976.70
SLPZ-02	10/30/2003	982.10	5.60	976.50
SLPZ-03	10/30/2003	981.60	5.20	976.40
SLPZ-04	10/30/2003	977.60	1.20	976.40
SLPZ-05	10/30/2003	981.40	4.90	976.50
SLPZ-06	10/30/2003	980.80	4.40	976.40
SLPZ-07	10/30/2003	979.60	3.10	976.50
SLPZ-08	10/30/2003	981.20	4.70	976.50
SLPZ-09	10/30/2003	981.20	4.80	976.40
SLPZ-10	10/30/2003	981.40	4.80	976.60
SLPZ-01 (SW)	4/16/2004	981.50	5.02	976.48
SLPZ-02 (SW)	4/16/2004	982.10	5.50	976.60
SLPZ-04 (SW)	4/16/2004	977.60	0.95	976.65
SLPZ-01 (SW)	6/24/2004	981.50	5.73	975.77
SLPZ-02 (SW)	6/24/2004	982.10	6.24	975.86
SLPZ-04 (SW)	6/24/2004	977.60	1.65	975.95
SLPZ-07 (SW)	6/24/2004	979.60	5.04	974.56

Notes:
1. BMP = Below Measuring Point

TABLE 3-4

SUMMARY OF SILVER LAKE STAFF GAUGE
WATER SURFACE ELEVATION MEASUREMENTS

REVISED CONCEPTUAL RD/RA WORK PLAN FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Gauge Name	Date	Datum Elevation (ft)	Distance to Water (ft BMP)	Estimated Water Surface Elevation (ft)
Lake	8/9/2001	975.03	0.76	975.79
Lake	8/16/2001	975.03	0.74	975.77
Lake	8/23/2001	975.03	0.70	975.73
Lake	8/30/2001	975.03	0.68	975.71
Lake	9/7/2001	975.03	0.68	975.71
Lake	9/13/2001	975.03	0.78	975.81
Lake	9/20/2001	975.03	0.68	975.71
Lake	9/27/2001	975.03	0.82	975.85
Lake	10/4/2001	975.03	0.64	975.67
Lake	10/11/2001	975.03	0.62	975.65
Lake	10/18/2001	975.03	0.82	975.85
Lake	10/26/2001	975.03	0.92	975.95
Lake	11/1/2001	975.03	0.94	975.97
Lake	11/9/2001	975.03	0.70	975.73
Lake	11/15/2001	975.03	0.62	975.65
Lake	11/29/2001	975.03	0.70	975.73
Lake	12/6/2001	975.03	0.66	975.69
Lake	12/13/2001	975.03	0.68	975.71
Lake	12/19/2001	975.03	1.00	976.03
Lake	12/27/2001	975.03	0.76	975.79
Lake	1/24/2002	975.03	0.78	975.81
Lake	2/14/2002	975.03	0.72	975.75
Lake	2/21/2002	975.03	0.74	975.77
Lake	2/28/2002	975.03	0.72	975.75
Lake	3/8/2002	975.03	0.72	975.75
Lake	3/14/2002	975.03	0.80	975.83
Lake	3/21/2002	975.03	0.86	975.89
Lake	3/28/2002	975.03	0.86	975.89
Silver Lake Gauge	7/7/2005	980.30	4.55	975.75
Silver Lake Gauge	7/12/2005	980.30	4.55	975.75
Silver Lake Gauge	7/21/2005	980.30	4.51	975.79
Silver Lake Gauge	7/28/2005	980.30	4.62	975.68
Silver Lake Gauge	8/4/2005	980.30	4.72	975.58
Silver Lake Gauge	8/11/2005	980.30	4.71	975.59
Silver Lake Gauge	8/18/2005	980.30	4.62	975.68
Silver Lake Gauge	8/25/2005	980.30	4.71	975.59
Silver Lake Gauge	8/31/2005	980.30	4.38	975.92
Silver Lake Gauge	9/6/2005	980.30	4.73	975.57
Silver Lake Gauge	9/14/2005	980.30	4.71	975.59
Silver Lake Gauge	9/20/2005	980.30	4.71	975.59
Silver Lake Gauge	9/29/2005	980.30	4.51	975.79
Silver Lake Gauge	10/5/2005	980.30	4.71	975.59
Silver Lake Gauge	10/19/2005	980.30	3.78	976.52
Silver Lake Gauge	10/25/2005	980.30	3.05	977.25
Silver Lake Gauge	10/26/2005	980.30	3.05	977.25
Silver Lake Gauge	11/2/2005	980.30	3.95	976.35
Silver Lake Gauge	11/9/2005	980.30	3.78	976.52
Silver Lake Gauge	11/16/2005	980.30	3.31	976.99
Silver Lake Gauge	11/23/2005	980.30	3.22	977.08
Silver Lake Gauge	11/29/2005	980.30	3.16	977.14
Silver Lake Gauge	12/6/2005	980.30	3.07	977.23
Silver Lake Gauge	12/29/2005	980.30	3.15	977.15

TABLE 3-4

SUMMARY OF SILVER LAKE STAFF GAUGE
WATER SURFACE ELEVATION MEASUREMENTS

REVISED CONCEPTUAL RD/RA WORK PLAN FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Gauge Name	Date	Datum Elevation (ft)	Distance to Water (ft BMP)	Estimated Water Surface Elevation (ft)
Silver Lake Gauge	1/4/2006	980.30	2.95	977.35
Silver Lake Gauge	1/11/2006	980.30	3.10	977.20
Silver Lake Gauge	1/18/2006	980.30	2.85	977.45
Silver Lake Gauge	1/24/2006	980.30	2.98	977.32
Silver Lake Gauge	2/1/2006	980.30	2.94	977.36
Silver Lake Gauge	2/8/2006	980.30	2.95	977.35
Silver Lake Gauge	2/15/2006	980.30	3.00	977.30
Silver Lake Gauge	2/22/2006	980.30	2.97	977.33
Silver Lake Gauge	3/1/2006	980.30	3.09	977.21
Silver Lake Gauge	3/8/2006	980.30	3.18	977.12
Silver Lake Gauge	3/15/2006	980.30	2.98	977.32
Silver Lake Gauge	3/22/2006	980.30	3.15	977.15
Silver Lake Gauge	3/31/2006	980.30	3.61	976.69
Silver Lake Gauge	4/5/2006	980.30	3.28	977.02
Silver Lake Gauge	4/10/2006	980.30	3.75	976.55
Silver Lake Gauge	4/11/2006	980.30	3.80	976.50
Silver Lake Gauge	4/18/2006	980.30	3.78	976.52
Silver Lake Gauge	4/25/2006	980.30	3.85	976.45
Silver Lake Gauge	5/2/2006	980.30	4.19	976.11
Silver Lake Gauge	5/9/2006	980.30	4.28	976.02
Silver Lake Gauge	5/17/2006	980.30	4.18	976.12
Silver Lake Gauge	5/24/2006	980.30	4.22	976.08
Silver Lake Gauge	5/30/2006	980.30	4.46	975.84
Silver Lake Gauge	6/7/2006	980.30	4.33	975.97
Silver Lake Gauge	6/13/2006	980.30	4.43	975.87
Silver Lake Gauge	6/21/2006	980.30	4.35	975.95
Silver Lake Gauge	6/28/2006	980.30	4.05	976.25
Silver Lake Gauge	7/5/2006	980.30	4.50	975.80
Silver Lake Gauge	7/12/2006	980.30	4.51	975.79
Silver Lake Gauge	7/19/2006	980.30	4.56	975.74
Silver Lake Gauge	7/25/2006	980.30	4.51	975.79
Silver Lake Gauge	8/2/2006	980.30	4.53	975.77
Silver Lake Gauge	8/9/2006	980.30	4.58	975.72
Silver Lake Gauge	8/16/2006	980.30	4.56	975.74
Silver Lake Gauge	8/23/2006	980.30	4.98	975.32
Silver Lake Gauge	8/30/2006	980.30	4.48	975.82
Silver Lake Gauge	9/6/2006	980.30	4.55	975.75
Silver Lake Gauge	9/13/2006	980.30	4.65	975.65
Silver Lake Gauge	9/20/2006	980.30	4.44	975.86
Silver Lake Gauge	9/29/2006	980.30	4.31	975.99
Silver Lake Gauge	10/4/2006	980.30	4.45	975.85
Silver Lake Gauge	10/11/2006	980.30	4.56	975.74
Silver Lake Gauge	10/16/2006	980.30	4.50	975.80
Silver Lake Gauge	10/24/2006	980.30	4.37	975.93
Silver Lake Gauge	10/31/2006	980.30	4.32	975.98
Silver Lake Gauge	11/8/2006	980.30	3.92	976.38
Silver Lake Gauge	11/15/2006	980.30	4.28	976.02
Silver Lake Gauge	11/21/2006	980.30	3.72	976.58
Silver Lake Gauge	11/28/2006	980.30	3.68	976.62
Silver Lake Gauge	12/6/2006	980.30	4.43	975.87
Silver Lake Gauge	12/13/2006	980.30	4.49	975.81

TABLE 3-4

SUMMARY OF SILVER LAKE STAFF GAUGE
WATER SURFACE ELEVATION MEASUREMENTS

REVISED CONCEPTUAL RD/RA WORK PLAN FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Gauge Name	Date	Datum Elevation (ft)	Distance to Water (ft BMP)	Estimated Water Surface Elevation (ft)
Silver Lake Gauge	12/20/2006	980.30	4.55	975.75
Silver Lake Gauge	12/27/2006	980.30	4.45	975.85
BM-SL-5	1/3/2007	980.30	4.45	975.82
BM-SL-5	1/10/2007	980.30	4.21	976.06
BM-SL-5	1/17/2007	980.30	4.30	975.97
BM-SL-5	1/24/2007	980.30	4.38	975.89
BM-SL-5	1/30/2007	980.30	4.28	975.99
BM-SL-5	2/28/2007	980.30	4.32	975.95
BM-SL-5	3/14/2007	980.30	4.24	976.03
BM-SL-5	3/28/2007	980.30	3.83	976.44
BM-SL-5	4/4/2007	980.30	4.12	976.15
BM-SL-5	4/13/2007	980.30	4.27	976.00
BM-SL-5	4/18/2007	980.30	3.92	976.35
BM-SL-5	4/24/2007	980.30	4.21	976.06
BM-SL-5	5/2/2007	980.30	4.27	976.00
BM-SL-5	5/9/2007	980.30	4.40	975.87
BM-SL-5	5/15/2007	980.30	4.40	975.87
BM-SL-5	5/23/2007	980.30	4.40	975.87
BM-SL-5	5/30/2007	980.30	4.50	975.77
BM-SL-5	6/6/2007	980.30	4.24	976.03
BM-SL-5	6/13/2007	980.30	4.41	975.86
BM-SL-5	6/20/2007	980.30	4.36	975.91
BM-SL-5	6/27/2007	980.30	4.48	975.79
BM-SL-5	7/3/2007	980.30	4.52	975.75
BM-SL-5	7/11/2007	980.30	4.48	975.79
BM-SL-5	7/18/2007	980.30	4.48	975.79
BM-SL-5	7/25/2007	980.30	4.52	975.75
BM-SL-5	8/1/2007	980.30	4.52	975.75
BM-SL-5	8/7/2007	980.30	4.60	975.67
BM-SL-5	8/15/2007	980.30	4.52	975.75
BM-SL-5	8/22/2007	980.30	4.62	975.65
BM-SL-5	8/27/2007	980.30	4.63	975.64
BM-SL-5	9/5/2007	980.30	4.65	975.62
BM-SL-5	9/12/2007	980.30	4.18	976.09
BM-SL-5	9/17/2007	980.30	4.57	975.70
BM-SL-5	9/26/2007	980.30	4.65	975.62
BM-SL-5	10/2/2007	980.30	4.68	975.59
BM-SL-5	10/8/2007	980.30	4.60	975.67
BM-SL-5	10/17/2007	980.30	4.59	975.68
BM-SL-5	10/24/2007	980.30	4.48	975.79
BM-SL-5	10/29/2007	980.30	4.33	975.94
BM-SL-5	10/30/2007	980.30	4.33	975.94
BM-SL-5	11/6/2007	980.30	4.40	975.87
BM-SL-5	11/14/2007	980.30	4.55	975.72
BM-SL-5	11/21/2007	980.30	4.48	975.79
BM-SL-5	11/28/2007	980.30	4.47	975.80
BM-SL-5	12/5/2007	980.30	4.49	975.78
BM-SL-5	12/12/2007	980.30	4.47	975.80
BM-SL-5	1/9/2008	980.30	4.31	975.96
BM-SL-5	1/16/2008	980.30	4.35	975.92
BM-SL-5	1/23/2008	980.30	4.40	975.87

TABLE 3-4

SUMMARY OF SILVER LAKE STAFF GAUGE
WATER SURFACE ELEVATION MEASUREMENTS

REVISED CONCEPTUAL RD/RA WORK PLAN FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Gauge Name	Date	Datum Elevation (ft)	Distance to Water (ft BMP)	Estimated Water Surface Elevation (ft)
BM-SL-5	2/6/2008	980.30	3.76	976.51
BM-SL-5	2/13/2008	980.30	3.74	976.53
BM-SL-5	2/20/2008	980.30	3.87	976.40
BM-SL-5	3/5/2008	980.30	3.62	976.65
BM-SL-5	3/12/2008	980.30	4.11	976.16
BM-SL-5	3/19/2008	980.30	4.12	976.15
BM-SL-5	3/26/2008	980.30	4.15	976.12
BM-SL-5	4/4/2008	980.30	4.02	976.25
BM-SL-5	4/8/2008	980.30	4.09	976.18
BM-SL-5	4/14/2008	980.30	4.16	976.11
BM-SL-5	4/23/2008	980.30	4.29	975.98
BM-SL-5	4/30/2008	980.30	4.20	976.07
BM-SL-5	5/7/2008	980.30	4.40	975.87
BM-SL-5	5/14/2008	980.30	4.42	975.85
BM-SL-5	5/19/2008	980.30	4.25	976.02
BM-SL-5	5/27/2008	980.30	4.30	975.97
BM-SL-5	6/2/2008	980.30	4.51	975.76
BM-SL-5	6/10/2008	980.30	4.45	975.82
BM-SL-5	6/18/2008	980.30	4.38	975.89
BM-SL-5	6/25/2008	980.30	4.36	975.91
BM-SL-5	7/2/2008	980.30	4.48	975.79
BM-SL-5	7/9/2008	980.30	4.50	975.77
BM-SL-5	7/15/2008	980.30	4.58	975.69
BM-SL-5	7/23/2008	980.30	4.44	975.83
BM-SL-5	7/30/2008	980.30	4.32	975.95
BM-SL-5	8/5/2008	980.30	4.46	975.84
BM-SL-5	8/13/2008	980.30	4.38	975.89
BM-SL-5	8/20/2008	980.30	4.55	975.72
BM-SL-5	8/27/2008	980.30	4.62	975.65
BM-SL-5	9/3/2008	980.30	4.64	975.66
BM-SL-5	9/10/2008	980.30	4.27	976.00
BM-SL-5	9/17/2008	980.30	4.48	975.79
BM-SL-5	9/26/2008	980.30	4.38	975.89
BM-SL-5	10/1/2008	980.30	4.30	976.00
BM-SL-5	10/8/2008	980.30	4.40	975.87
BM-SL-5	10/15/2008	980.30	4.30	975.97
BM-SL-5	10/22/2008	980.30	4.20	976.10
BM-SL-5	10/27/2008	980.30	4.20	976.07
BM-SL-5	11/5/2008	980.30	3.98	976.32
BM-SL-5	11/12/2008	980.30	4.14	976.16
BM-SL-5	11/19/2008	980.30	4.08	976.22
BM-SL-5	11/26/2008	980.30	4.10	976.20
BM-SL-5	12/3/2008	980.30	3.98	976.32
BM-SL-5	12/10/2008	980.30	3.73	976.57
BM-SL-5	12/17/2008	980.30	3.82	976.48
BM-SL-5	12/30/2008	980.30	3.75	976.55

Notes:
1. BMP = Below Measuring Point

TABLE 3-5
SUMMARY OF SILVER LAKE OUTLET DISCHARGE
WATER SURFACE ELEVATION MEASUREMENTS

REVISED CONCEPTUAL RD/RA WORK PLAN FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Date	Datum Elevation (ft)	Distance to Water (ft BMP)	Estimated Water Surface Elevation (ft)
04/04/07	979.16	3.00	976.16
04/11/07	979.16	3.18	975.98
04/17/07	979.16	2.57	976.59
04/19/07	979.16	2.94	976.22
04/26/07	979.16	3.10	976.06
05/03/07	979.16	3.17	975.99
05/09/07	979.16	3.27	975.89
05/17/07	979.16	3.18	975.98
05/21/07	979.16	3.15	976.01
07/26/07	979.16	3.36	975.80
09/05/07	979.16	3.46	975.70
09/26/07	979.16	3.48	975.68
10/30/07	979.16	3.28	975.88
11/27/07	979.16	3.24	975.92
12/20/07	979.16	3.37	975.79
01/29/08	979.16	3.33	975.83
02/28/08	979.16	3.20	975.96
03/26/08	979.16	2.97	976.19
04/30/08	979.16	3.03	976.13
05/28/08	979.16	3.21	975.95
06/25/08	979.16	3.22	975.94
07/31/08	979.16	3.18	975.98
08/26/08	979.16	3.38	975.78
09/24/08	979.16	3.36	975.80
10/30/08	979.16	2.02	977.14
11/18/08	979.16	2.80	976.36
12/16/08	979.16	2.60	976.56
01/22/09	979.16	2.96	976.20
02/26/09	979.16	3.03	976.13
03/26/09	979.16	2.95	976.21

Notes:
1. BMP = Below Measuring Point

TABLE 3-6
SUMMARY OF ESTIMATED FLOOD EVENT WATER SURFACE ELEVATIONS
SILVER LAKE OUTLET TO THE HOUSATONIC RIVER

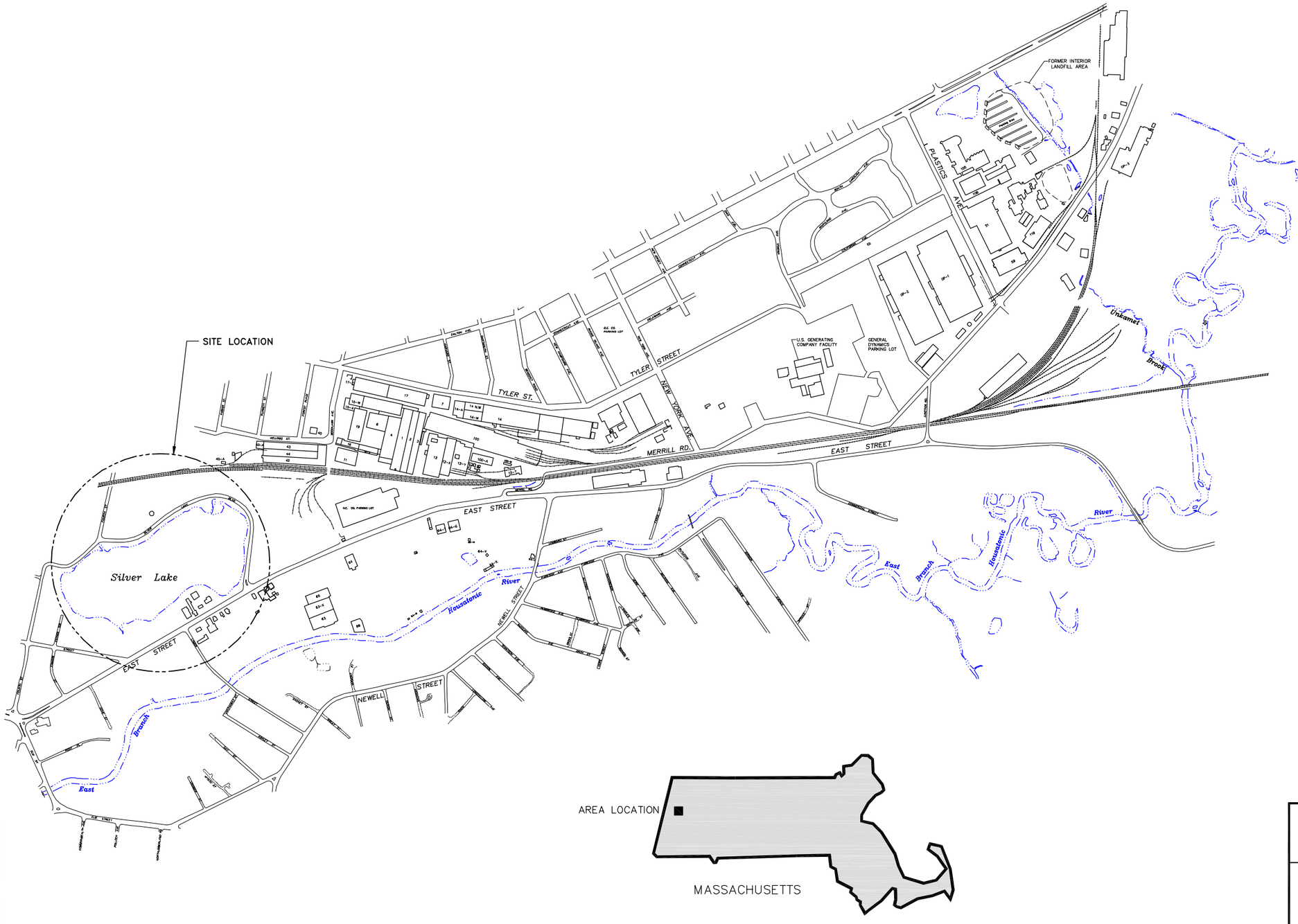
REVISED CONCEPTUAL RD/RA WORK PLAN FOR SILVER LAKE SEDIMENTS
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Return Period	Flow (cfs)	As-Built WSE (ft)
Average Annual	134	970.23
0.5-year	1,422	975.32
1-year	1,670	975.96
1.5-year	1,760	976.18
2-year	2,047	976.82
5-year	3,336	979.45
10-year	4,375	981.48
50-year	7,239	985.36
100-year	8,721	986.97

Note:
1. WSE = Water Surface Elevation

ARCADIS

Figures



LEGEND

APPROXIMATE WATER SURFACE

NOTES:

1. MAPPING IS BASED ON AERIAL PHOTOGRAPHS AND PHOTOGRAMMETRIC MAPPING BY LOCKWOOD MAPPING, INC. – FLOWN IN APRIL 1990; DATA PROVIDED BY GENERAL ELECTRIC COMPANY; AND BLASLAND & BOUCK ENGINEERS, P.C. CONSTRUCTION PLANS.
2. NOT ALL PHYSICAL FEATURES SHOWN.
3. SITE BOUNDARIES/LIMITS ARE APPROXIMATE.

0 500' 1000'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

LOCATION MAP

ARCADIS

FIGURE
1-1

CITY:SYRACUSE DIV/GROUP:ENVCAD DB:K.SARTORI G.STOWELL L.FORAKER LD:DMW PIC:P.KEANEY PM:T.CRIDGE TM:L.PUTNAM
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L:PUTNAM LYR:ON=*;OFF=*REF*

CITY:SYRACUSE DIV/GROUP:ENVCAD DB:K.SARTORI G.STOWELL L:FORAKER LD:DMW PIC:P.KEANEY PM:T.CRIDGE TM:L.PUTNAM LYR:ON=*;OFF=*REF
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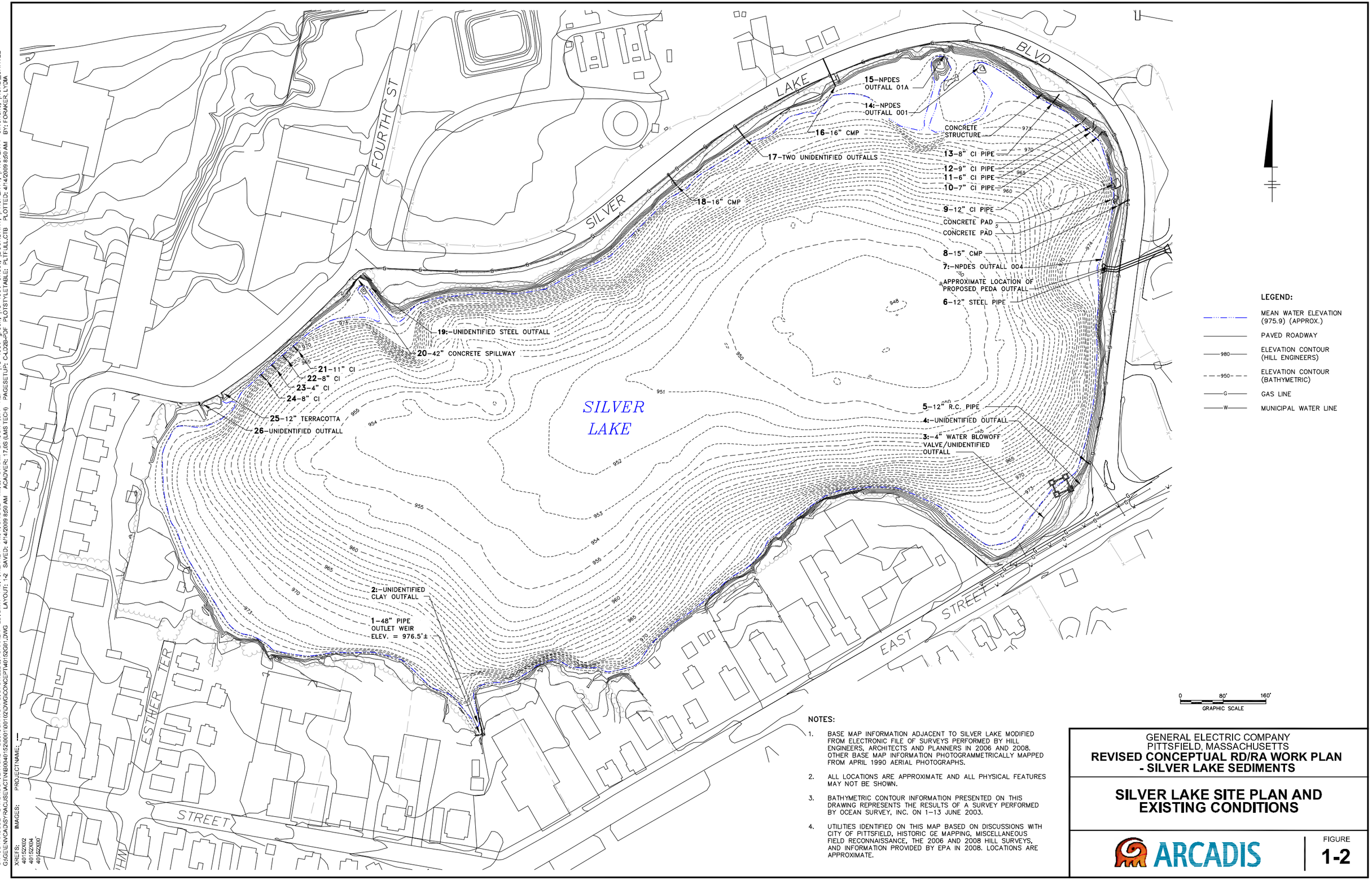
401520X04
401520X00



NOTES:

1. BASE MAP INFORMATION ADJACENT TO SILVER LAKE MODIFIED FROM ELECTRONIC FILE OF SURVEYS PERFORMED BY HILL ENGINEERS, ARCHITECTS AND PLANNERS IN 2006 AND 2008. OTHER BASE MAP INFORMATION PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
2. ALL LOCATIONS ARE APPROXIMATE AND ALL PHYSICAL FEATURES MAY NOT BE SHOWN.
3. BATHYMETRIC CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEY, INC. ON 1–13 JUNE 2003.
4. UTILITIES IDENTIFIED ON THIS MAP BASED ON DISCUSSIONS WITH CITY OF PITTSFIELD, HISTORIC GE MAPPING, MISCELLANEOUS FIELD RECONNAISSANCE, THE 2006 AND 2008 HILL SURVEYS, AND INFORMATION PROVIDED BY EPA IN 2008. LOCATIONS ARE APPROXIMATE.

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

SILVER LAKE SITE PLAN AND EXISTING CONDITIONS

ARCADIS

FIGURE 1-2

CITY:SYRACUSE DIV/GROUP:ENVCAD DB:K.SARTORI G.STOWELL L.FORAKER LD:DMW PIC:P.KEANEY PM:T.CRIDGE TM:L.PUTNAM LYR:ON=*OFF=*REF*
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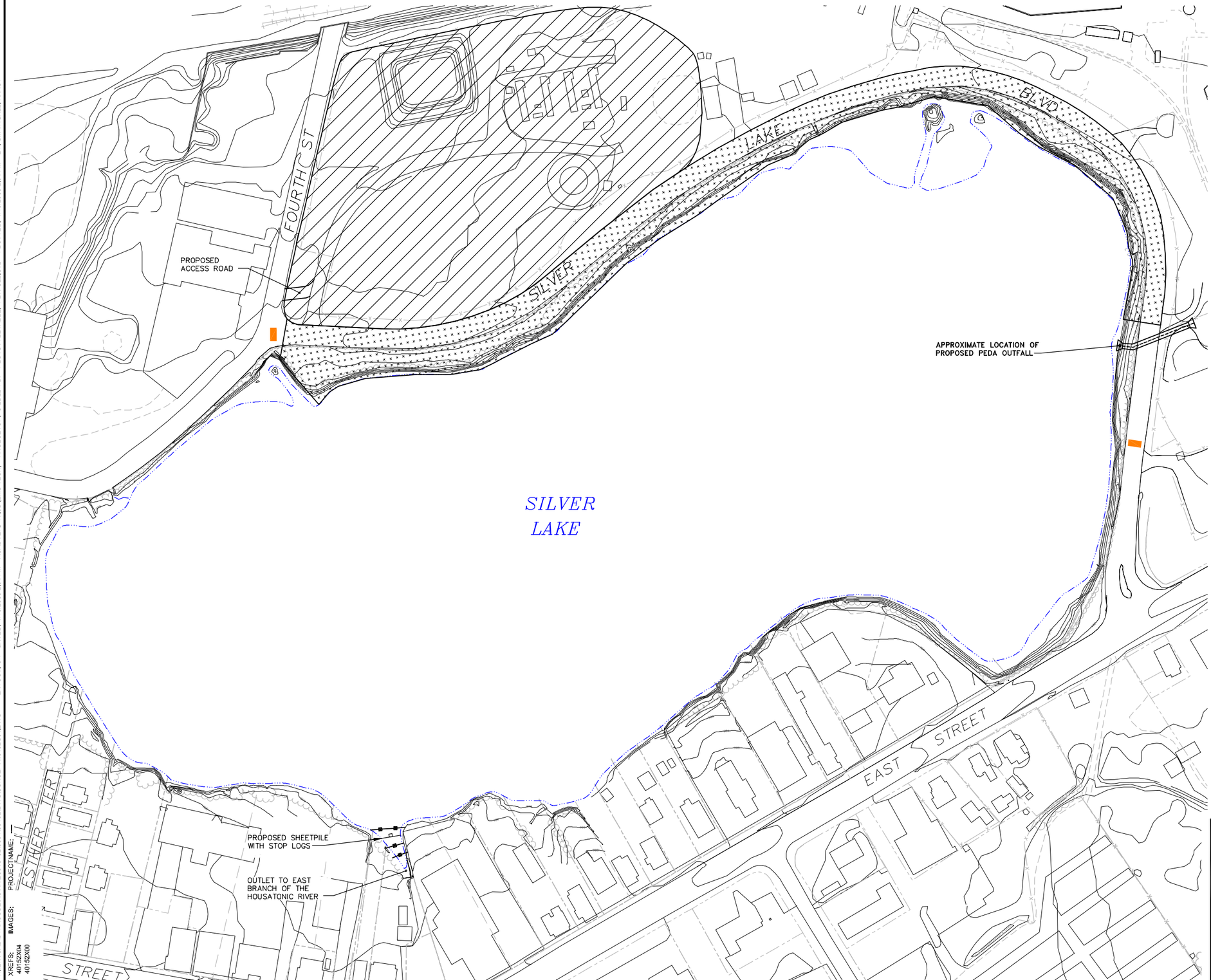

LEGEND:

- MEAN WATER ELEVATION (975.9) (APPROX.)
- PAVED ROADWAY
- VEGETATION
- FENCELINE
- GUARDRAIL
- 985 ELEVATION CONTOUR (HILL ENGINEERS)
- SILT FENCE
- PROPOSED STAGING AREA
- POTENTIAL ADDITIONAL STAGING AREA
- ROAD CLOSED SIGN

NOTES:

1. BASE MAP INFORMATION ADJACENT TO SILVER LAKE MODIFIED FROM ELECTRONIC FILE OF SURVEYS PERFORMED BY HILL ENGINEERS, ARCHITECTS AND PLANNERS IN 2006 AND 2008. OTHER BASE MAP INFORMATION PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
2. ALL LOCATIONS ARE APPROXIMATE AND ALL PHYSICAL FEATURES MAY NOT BE SHOWN.

0 80' 160'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

PROPOSED STAGING AREA

ARCADIS

FIGURE
3-1

CITY: SYRACUSE DIV/GROUP: ENVCAD DB: L. FORAKER G. STOWELL L. FORAKER LD: DMW PIC: P. KEANEY PM: T. CRIDGE TM: L. PUTNAM LYR: ON=*;OFF=*REF*
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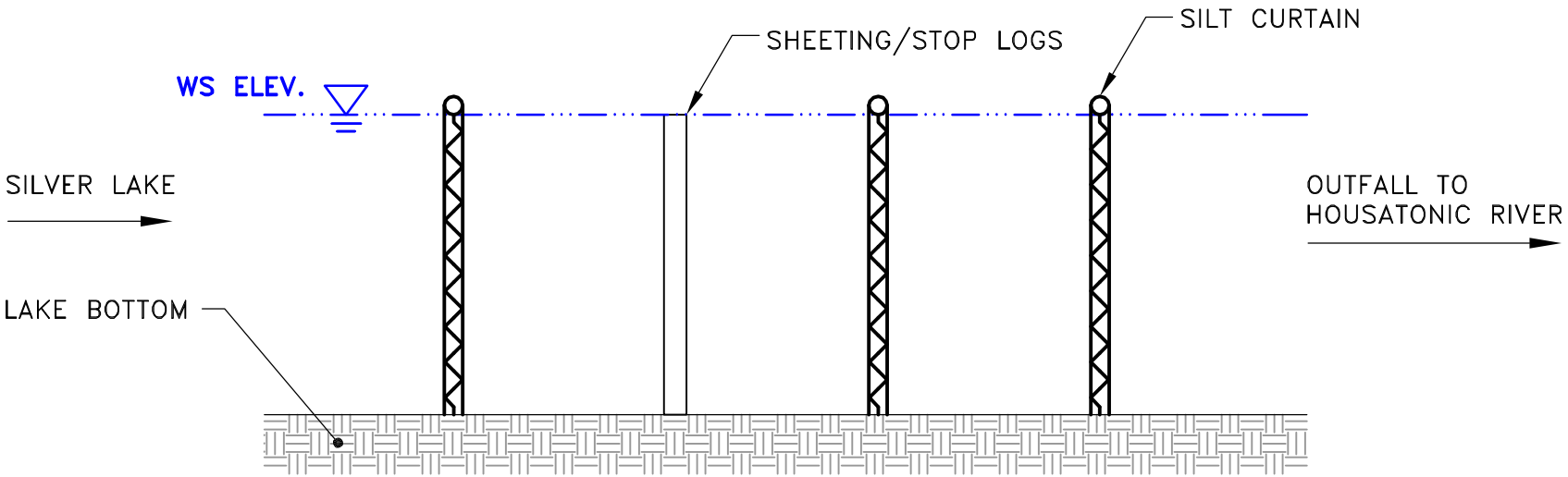
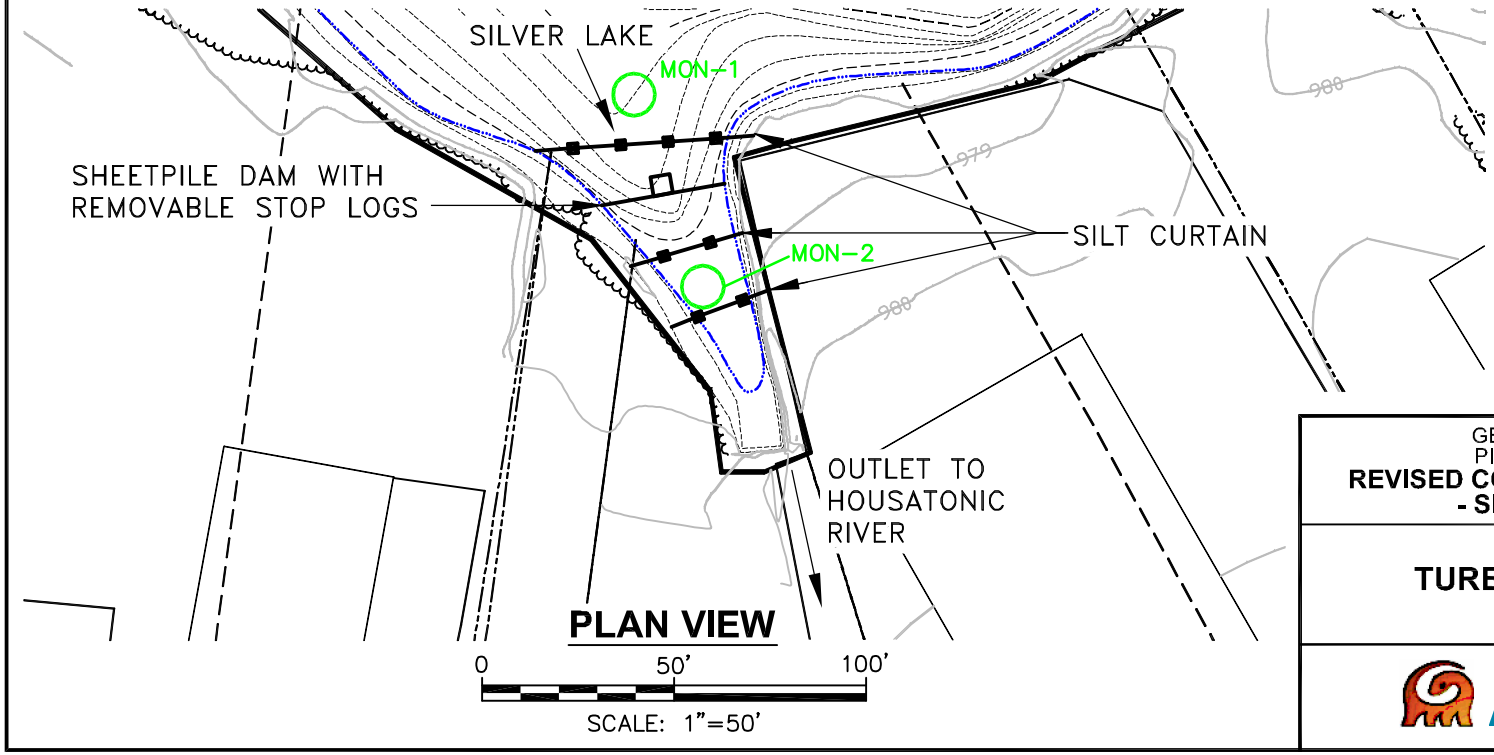


CROSS SECTION

NOT TO SCALE



PLAN VIEW

SCALE: 1"=50'

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

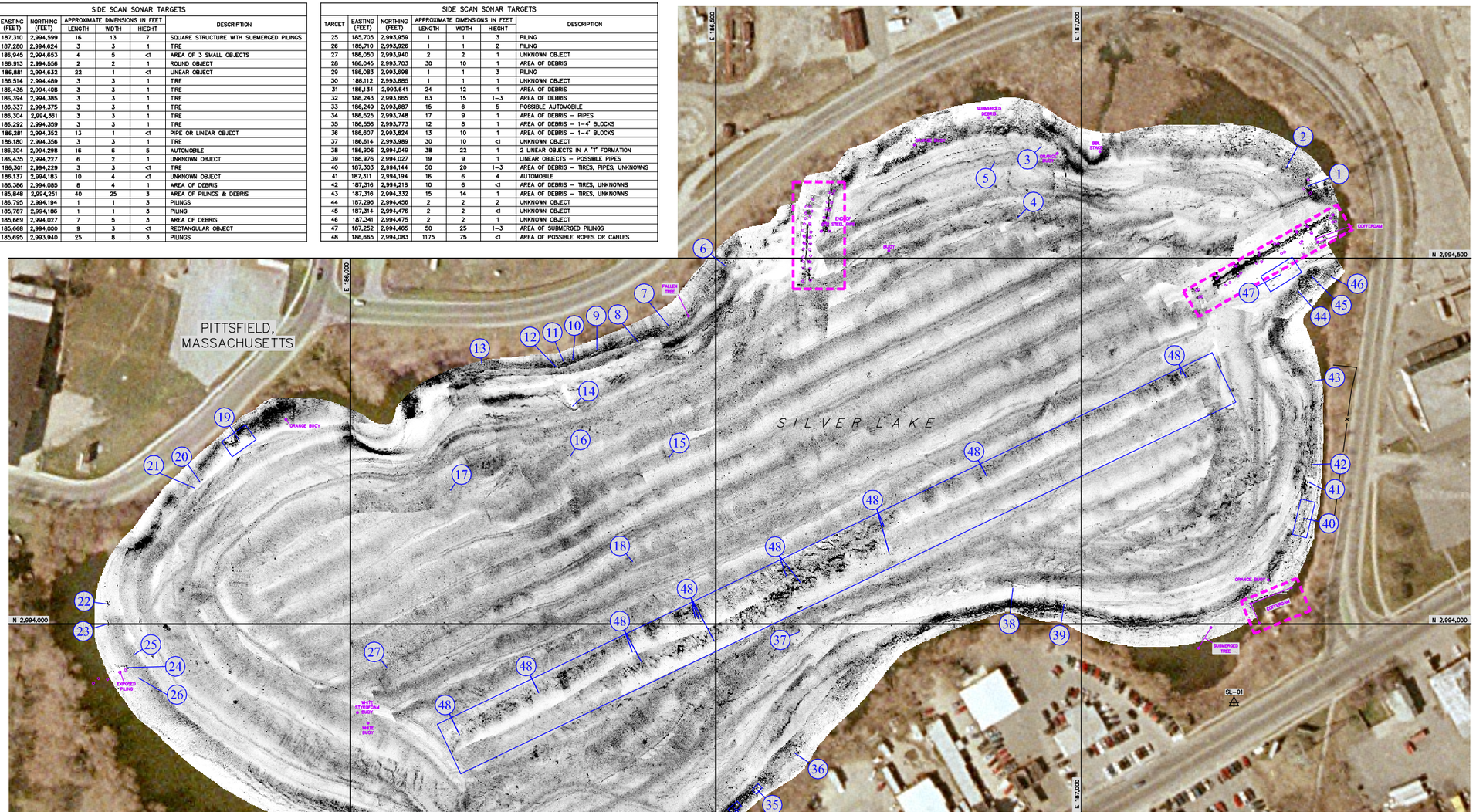
CONCEPTUAL TURBIDITY/SEDIMENTATION CONTROL PLAN

ARCADIS

FIGURE
3-2

SIDE SCAN SONAR TARGETS						
TARGET	EASTING (FEET)	NORTHING (FEET)	APPROXIMATE DIMENSIONS IN FEET			DESCRIPTION
			LENGTH	WIDTH	HEIGHT	
1	187,310	2,994,599	16	13	7	SQUARE STRUCTURE WITH SUBMERGED PILINGS
2	187,280	2,994,624	3	3	1	TIRE
3	186,945	2,994,653	4	5	<1	AREA OF 3 SMALL OBJECTS
4	186,913	2,994,656	2	2	1	ROUND OBJECT
5	186,881	2,994,632	22	1	<1	LINEAR OBJECT
6	186,514	2,994,489	3	3	1	TIRE
7	186,435	2,994,408	3	3	1	TIRE
8	186,394	2,994,385	3	3	1	TIRE
9	186,337	2,994,375	3	3	1	TIRE
10	186,304	2,994,361	3	3	1	TIRE
11	186,292	2,994,359	3	3	1	TIRE
12	186,281	2,994,352	13	1	<1	PIPE OR LINEAR OBJECT
13	186,180	2,994,356	3	3	1	TIRE
14	186,304	2,994,298	16	6	5	AUTOMOBILE
15	186,435	2,994,227	6	2	1	UNKNOWN OBJECT
16	186,301	2,994,229	3	3	<1	TIRE
17	186,137	2,994,183	10	4	<1	UNKNOWN OBJECT
18	186,386	2,994,085	8	4	1	AREA OF DEBRIS
19	185,848	2,994,251	40	25	3	AREA OF PILINGS & DEBRIS
20	186,795	2,994,194	1	1	3	PILINGS
21	185,787	2,994,186	1	1	3	PILING
22	185,669	2,994,027	7	5	3	AREA OF DEBRIS
23	185,668	2,994,000	9	3	<1	RECTANGULAR OBJECT
24	185,695	2,993,940	25	8	3	PILINGS

SIDE SCAN SONAR TARGETS						
TARGET	EASTING (FEET)	NORTHING (FEET)	APPROXIMATE DIMENSIONS IN FEET			DESCRIPTION
			LENGTH	WIDTH	HEIGHT	
25	185,705	2,993,959	1	1	3	PILING
26	185,710	2,993,926	1	1	2	PILING
27	186,050	2,993,940	2	2	1	UNKNOWN OBJECT
28	186,045	2,993,703	30	10	1	AREA OF DEBRIS
29	186,083	2,993,698	1	1	3	PILING
30	186,112	2,993,685	1	1	1	UNKNOWN OBJECT
31	186,134	2,993,641	24	12	1	AREA OF DEBRIS
32	186,243	2,993,665	63	15	1–3	AREA OF DEBRIS
33	186,249	2,993,687	15	6	5	POSSIBLE AUTOMOBILE
34	186,525	2,993,748	17	9	1	AREA OF DEBRIS – PIPES
35	186,556	2,993,773	12	8	1	AREA OF DEBRIS – 1–4' BLOCKS
36	186,607	2,993,824	13	10	1	AREA OF DEBRIS – 1–4' BLOCKS
37	186,614	2,993,989	30	10	<1	UNKNOWN OBJECT
38	186,906	2,994,049	38	22	1	2 LINEAR OBJECTS IN A "T" FORMATION
39	186,976	2,994,027	19	9	1	LINEAR OBJECTS – POSSIBLE PIPES
40	187,303	2,994,144	50	20	1–3	AREA OF DEBRIS – TIRES, PIPES, UNKNOWNS
41	187,311	2,994,194	16	6	4	AUTOMOBILE
42	187,316	2,994,218	10	6	<1	AREA OF DEBRIS – TIRES, UNKNOWNS
43	187,316	2,994,332	15	14	1	AREA OF DEBRIS – TIRES, UNKNOWNS
44	187,296	2,994,456	2	2	2	UNKNOWN OBJECT
45	187,314	2,994,476	2	2	<1	UNKNOWN OBJECT
46	187,341	2,994,475	2	2	1	UNKNOWN OBJECT
47	187,252	2,994,465	50	25	1–3	AREA OF SUBMERGED PILINGS
48	186,665	2,994,083	1175	75	<1	AREA OF POSSIBLE ROPES OR CABLES



LEGEND:

- SL-01 — CONTROL POINT
- FEATURES OBSERVED DURING SURVEY OPERATIONS
- SUBMERGED PILING OBSERVED DURING SURVEY OPERATION
- (1) SIDE SCAN SONAR TARGET
- AREA WITH OTHER FEATURES PROPOSED FOR REMOVAL
- SIDE SCAN SONAR TARGET AREA

NOTES:

1. GRID SYSTEM IS IN FEET AND IS THE MASSACHUSETTS MAINLAND STATE PLANE COORDINATE SYSTEM (NAD83).
2. SHORELINE AND FEATURES ARE APPROXIMATE AND WERE TAKEN FROM DIGITAL ORTHOPHOTO QUADRANGLES OBTAINED FROM THE MASSACHUSETTS GEOGRAPHIC INFORMATION SYSTEM (MASSGIS) AND OBSERVATIONS MADE IN THE FIELD.
3. THE INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10–13 JUNE 2003 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

0 80' 160'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

SIDE SCAN SONAR MOSAIC

ARCADIS

FIGURE
3-3

CITY: SYRACUSE DIV/GROUP: ENVCAD DB: K. SARTORI G. STOWELL L. FORAKER LD: DMW PIC: P. KEANEY PM: T. CRIDGE TM: L. PUTNAM LYR: ON=OFF=*REF*
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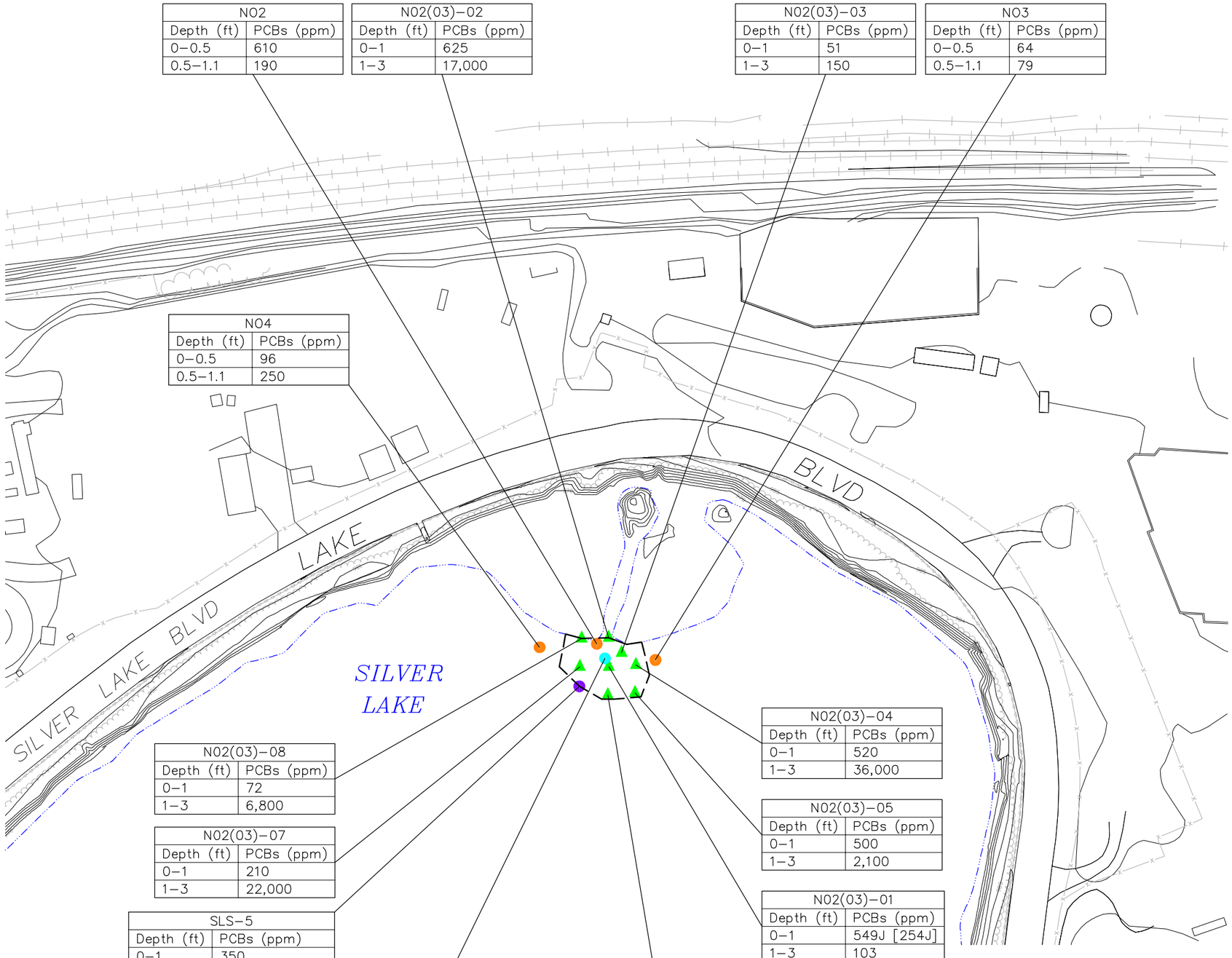

NO2	
Depth (ft)	PCBs (ppm)
0–0.5	610
0.5–1.1	190

N02(03)–02	
Depth (ft)	PCBs (ppm)
0–1	625
1–3	17,000

N02(03)–03	
Depth (ft)	PCBs (ppm)
0–1	51
1–3	150

NO3	
Depth (ft)	PCBs (ppm)
0–0.5	64
0.5–1.1	79

NO4	
Depth (ft)	PCBs (ppm)
0–0.5	96
0.5–1.1	250

N02(03)–08	
Depth (ft)	PCBs (ppm)
0–1	72
1–3	6,800

N02(03)–07	
Depth (ft)	PCBs (ppm)
0–1	210
1–3	22,000

SLS–5	
Depth (ft)	PCBs (ppm)
0–1	350
1–2	300
2–3	420
3–4	640
4–5	290
5–6	11,000 [13,000]
6–6.67	18,000

N02(92)	
Depth (ft)	PCBs (ppm)
0–1	20,689

N02(03)–06	
Depth (ft)	PCBs (ppm)
0–1	197
1–3	360

N02(03)–04	
Depth (ft)	PCBs (ppm)
0–1	520
1–3	36,000

N02(03)–05	
Depth (ft)	PCBs (ppm)
0–1	500
1–3	2,100

N02(03)–01	
Depth (ft)	PCBs (ppm)
0–1	549J [254J]
1–3	103

LEGEND:

- STEWART LABORATORIES SAMPLING LOCATION (1982)
- MISCELLANEOUS GRAB SAMPLING LOCATION (1992)
- MCP/RFI SEDIMENT SAMPLING LOCATION (1995)
- PRE–DESIGN SEDIMENT SAMPLING LOCATION (2003)
- EDGE OF WATER
- PAVED ROADWAY
- RAILROAD
- VEGETATION
- FENCELINE
- GUARDRAIL
- ELEVATION CONTOUR (HILL ENGINEERS)
- APPROXIMATE SEDIMENT REMOVAL AREA

NOTES:

1. BASE MAP INFORMATION ADJACENT TO SILVER LAKE MODIFIED FROM ELECTRONIC FILE OF SURVEYS PERFORMED BY HILL ENGINEERS, ARCHITECTS AND PLANNERS IN 2006 AND 2008. OTHER BASE MAP INFORMATION PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
2. ALL SAMPLE LOCATIONS ARE APPROXIMATE. HOWEVER, LOCATIONS SAMPLED IN 1991, 1994, 1995 AND 2003 WERE SURVEYED BY BLASLAND, BOUCK & LEE, INC.
3. ALL SEDIMENT DATA ARE PRESENTED IN DRY WEIGHT – PARTS PER MILLION (ppm). DUPLICATE RESULTS ARE SHOWN IN BRACKETS.
4. J – ANALYTE WAS POSITIVELY IDENTIFIED BUT THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION.

0 50' 100'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

SELECT SEDIMENT SAMPLING LOCATIONS AND APPROXIMATE REMOVAL AREA

ARCADIS

FIGURE
3-4

CITY: SYRACUSE DIV/GROUP: ENVCAD DB: K.SARTORI G.STOWELL L. FORAKER LD: DMW PIC: P. KEANEY PM: T. CRIDGE TM: L. PUTNAM LYR: ON=*OFF=*REF*
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LEGEND:

- EDGE OF WATER
- PAVED ROADWAY
- RAILROAD
- VEGETATION
- FENCELINE
- GUARDRAIL
- 970 — ELEVATION CONTOUR (HILL ENGINEERS)
- 950 — ELEVATION CONTOUR (BATHYMETRIC)
- APPROXIMATE SEDIMENT REMOVAL AREA
- APPROXIMATE AREA OF SCRUB-SHRUB ISLAND
- NPDES OUTFALL
- SILT CURTAIN
- PROPOSED STAGING AREA
- POTENTIAL ADDITIONAL STAGING AREA

NOTES:

1. BASE MAP INFORMATION ADJACENT TO SILVER LAKE MODIFIED FROM ELECTRONIC FILE OF SURVEYS PERFORMED BY HILL ENGINEERS, ARCHITECTS AND PLANNERS IN 2006 AND 2008. OTHER BASE MAP INFORMATION PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
2. ALL LOCATIONS ARE APPROXIMATE AND ALL PHYSICAL FEATURES MAY NOT BE SHOWN.
3. BATHYMETRIC CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEY, INC. ON 1-13 JUNE 2003.

0 50' 100'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

APPROXIMATE AREA OF SCRUB-SHRUB ISLAND AND REMOVAL AREA

ARCADIS

FIGURE
3-5

CITY:SYRACUSE DIVGROUP:ENVCAD DB:K.SARTORI G.STOWELL L.FORAKER LD:DMW PIC:P.KEANEY PM:T.CRIDGE TM:L.PUTNAM LY:R:ON=*OFF=*REF*
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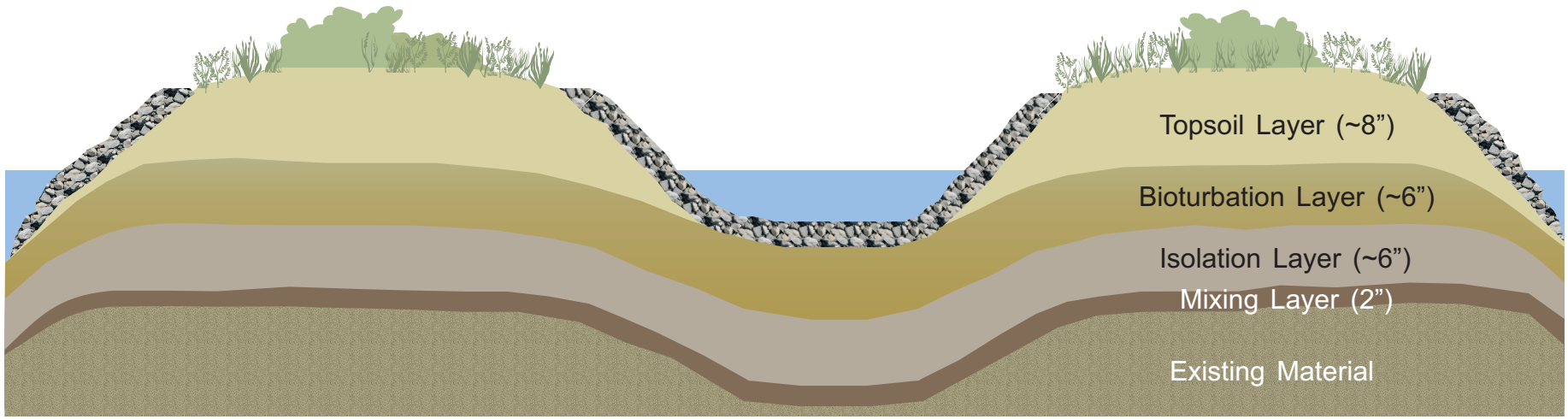


NOT TO SCALE

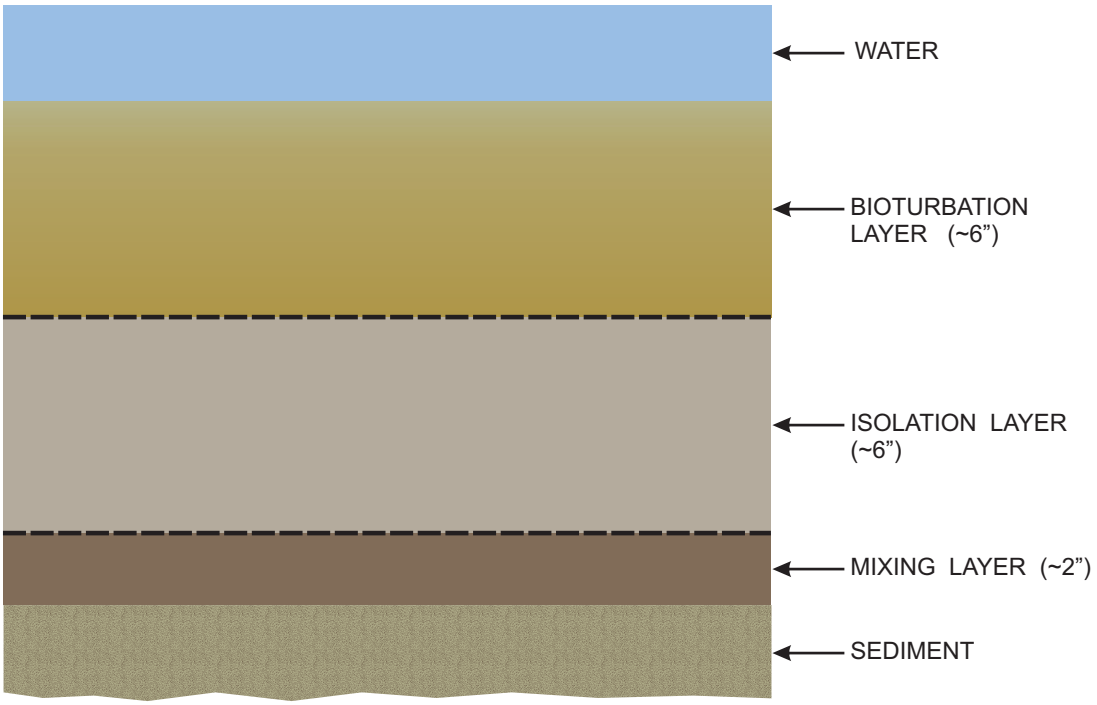
NOTE:
1. EXISTING MATERIALS WILL BE REMOVED TO AN APPROXIMATE ELEVATION OF 975.1-FT. TO FACILITATE PLACEMENT OF CAP MATERIALS AND TOPSOIL SUCH THAT THE TOP OF THE ISLAND IS GENERALLY ONE FOOT ABOVE THE MEAN WATER SURFACE ELEVATION.

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

CONCEPTUAL SCRUB-SHRUB ISLAND CROSS-SECTION

ARCADIS

FIGURE
3-6



TYPICAL CAP CROSS-SECTION

NOT-TO-SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

TYPICAL CAP CROSS-SECTION

ARCADIS

FIGURE
3-7

04/14/09 SYRACUSE-NY-ENV141-DHOWES
GE-CADIN-ACTIB0040152\0001\00102\CDR\40152G02.CDR

LEGEND:

- MEAN WATER ELEVATION (975.9) (APPROX.)
- PAVED ROADWAY
- RAILROAD
- VEGETATION
- FENCELINE
- GUARDRAIL
- ELEVATION CONTOUR (HILL ENGINEERS)
- 970 ELEVATION CONTOUR (BATHYMETRIC)
- PROPERTY BOUNDARY
- PROPOSED STAGING AREA
- POTENTIAL ADDITIONAL STAGING AREA
- SILT CURTAIN

NOTES:

1. BASE MAP INFORMATION ADJACENT TO SILVER LAKE MODIFIED FROM ELECTRONIC FILE OF SURVEYS PERFORMED BY HILL ENGINEERS, ARCHITECTS AND PLANNERS IN 2006 AND 2008. OTHER BASE MAP INFORMATION PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
2. ALL LOCATIONS ARE APPROXIMATE AND ALL PHYSICAL FEATURES MAY NOT BE SHOWN.
3. BATHYMETRIC CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEY, INC. ON 1–13 JUNE 2003.

0 100' 200'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

CONCEPTUAL CAP PLACEMENT

ARCADIS

FIGURE
3-8

CITY: SYRACUSE DIV/GROUP: ENVCAD DB: K. SARTORI G. STOWELL L. FORAKER LD: DMW PIC: P. KEANEY PM: T. CRIDGE TM: L. PUTNAM
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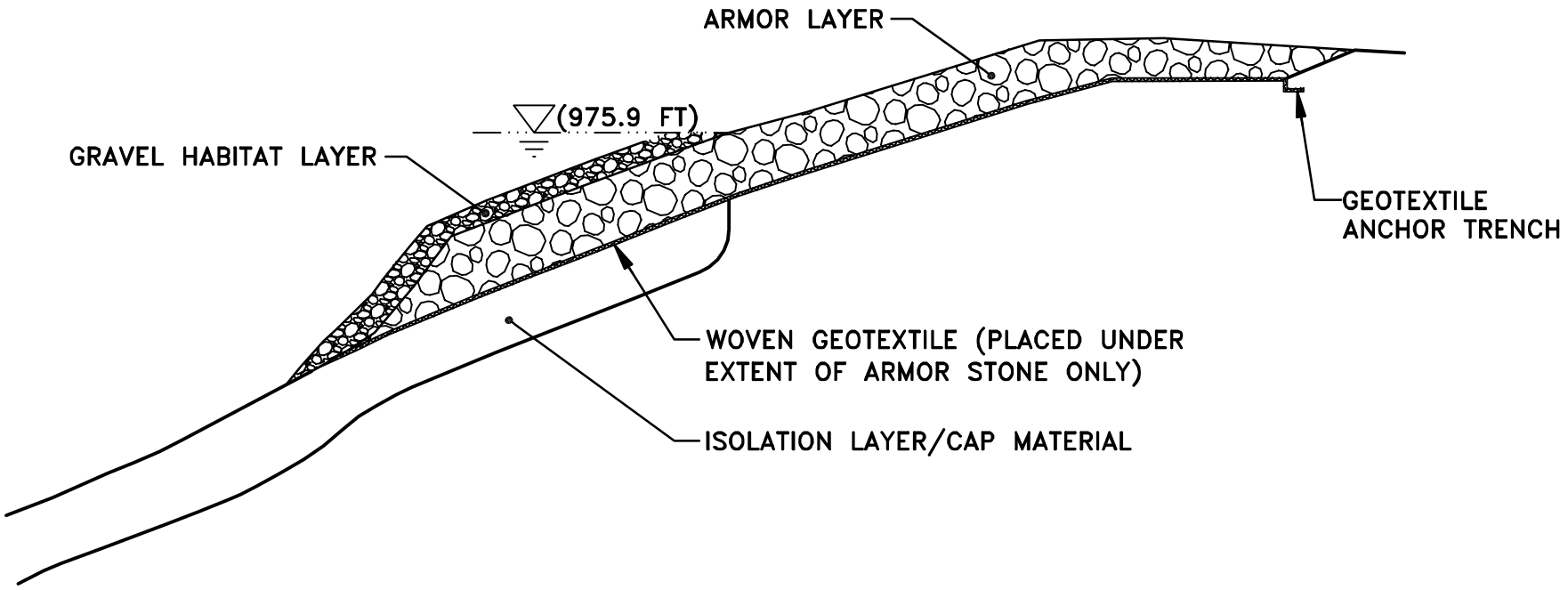

TYPICAL ARMOR LAYER CONFIGURATION

NOT TO SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

TYPICAL ARMOR LAYER CONFIGURATION

ARCADIS

FIGURE
3-9

LEGEND:

- MEAN WATER ELEVATION (975.9) (APPROX.)
- PAVED ROADWAY
- RAILROAD
- VEGETATION
- FENCELINE
- GUARDRAIL
- ELEVATION CONTOUR (HILL ENGINEERS)
- ELEVATION CONTOUR (BATHYMETRIC)
- PROPERTY BOUNDARY
- EAST SHORE ARMOR CONFIGURATION
- WEST SHORE ARMOR CONFIGURATION
- APPROXIMATE AREA OF SCRUB–SHRUB ISLAND
- PROPOSED EXTENT OF ADDITIONAL ARMOR

NOTES:

1. BASE MAP INFORMATION ADJACENT TO SILVER LAKE MODIFIED FROM ELECTRONIC FILE OF SURVEYS PERFORMED BY HILL ENGINEERS, ARCHITECTS AND PLANNERS IN 2006 AND 2008. OTHER BASE MAP INFORMATION PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS..
2. ALL LOCATIONS ARE APPROXIMATE AND ALL PHYSICAL FEATURES MAY NOT BE SHOWN.
3. BATHYMETRIC CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10–13 JUNE 2003.

0 100' 200'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

PROPOSED ARMOR LAYER LAYOUT

ARCADIS

FIGURE
3-10

CITY:SYRACUSE DIV/GROUP:ENVCAD DB:K.SARTORI G.STOWELL L.FORAKER LD:DMW PIC:P.KEANEY PM:T.CRIDGE TM:L.PUTNAM
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XREFS: IMAGES: PROJECTNAME: ---
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401520X04

LEGEND:

- MEAN WATER ELEVATION (975.9) (APPROX.)
- PAVED ROADWAY
- RAILROAD
- VEGETATION
- FENCELINE
- GUARDRAIL
- PROPERTY BOUNDARY
- 985 — ELEVATION CONTOURS (HILL ENGINEERS)
- EAST SHORE ARMOR CONFIGURATION
- WEST SHORE ARMOR CONFIGURATION
- APPROXIMATE AREA OF SCRUB–SHRUB ISLAND
- PROPOSED EXTENT OF ADDITIONAL ARMOR

NOTES:

1. BASE MAP INFORMATION ADJACENT TO SILVER LAKE MODIFIED FROM ELECTRONIC FILE OF SURVEYS PERFORMED BY HILL ENGINEERS, ARCHITECTS AND PLANNERS IN 2006 AND 2008. OTHER BASE MAP INFORMATION PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
2. ALL LOCATIONS ARE APPROXIMATE AND ALL PHYSICAL FEATURES MAY NOT BE SHOWN.
3. LOCATION OF WALKING PATH IS CONCEPTUAL AND FOR DISCUSSION PURPOSES ONLY. ACTUAL LOCATION WILL BE SUBJECT TO ACQUISITION OF NECESSARY ACCESS PERMISSION AND AGENCY APPROVAL.

0 60' 120'
GRAPHIC SCALE

SILVER LAKE BLVD

NEW BENCH (TYP.)

5' WIDE WALKING PATH (TYP.)

NEW PAINTED CROSSWALK

NEW PAINTED CROSSWALK

SILVER LAKE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

CONCEPTUAL RESTORATION PLAN

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FIGURE
3-11

CITY:SYRACUSE DIV/GROUP:ENVCAD DB:K.SARTORI G.STOWELL L.FORAKER LD:DMW PIC:P.KEANEY PM:T.CRIDGE TM:L.PUTNAM
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Monitoring Event	Description	Time Relative to Construction Activities			
		Pre	During	Post	Long-term
Cap Material					
Cap Material Analysis	Sampling and analysis of cap materials for PCB, TOC, and Appendix IX + 3	X	X		
Sediment/Cap Core Collection					
Sediment Collection Traps	Monitoring of individual lift thickness and sedimentation rate		X	X	X
During-construction Chemical/Physical Coring	During-construction collection of sediment/cap material samples for assessment of total cap thickness and TOC analysis		X		
Post-construction Chemical/Physical Coring	Post-construction collection of sediment/cap material samples for assessment of total cap thickness, and TOC and PCB analysis			X	X
Surface Water Quality Monitoring					
Surface Water Sampling	Monthly sample collection from one location with analysis for PCB and TSS (conducted weekly during construction)	X	X	X	X
Continuous Turbidity Monitoring	Continuous turbidity monitoring at two locations	X	X		
Cap Integrity and Armor System Inspection					
Cap Integrity	Annual collection of cores to assess cap thickness and integrity as well as analysis for TOC and/or PCBs				X
Erosion Inspection	Semi-annual erosion inspections to monitor the integrity of the armor system				X
Natural Resource Restoration/Enhancement Areas					
Restored Areas Vegetation	Two visits during each of the first three years after planting, and one visit each during both the fifth and seventh year after planting				X
Engineered Structures	Annually for three years to ensure structure integrity and ability to function				X

GENERAL ELECTRIC COMPANY
PITTSFIELD , MASSACHUSETTS

REVISED CONCEPTUAL RD/RA WORK PLAN -SILVER LAKE SEDIMENTS

PROPOSED MONITORING PROGRAM SCHEDULE

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FIGURE 4-1

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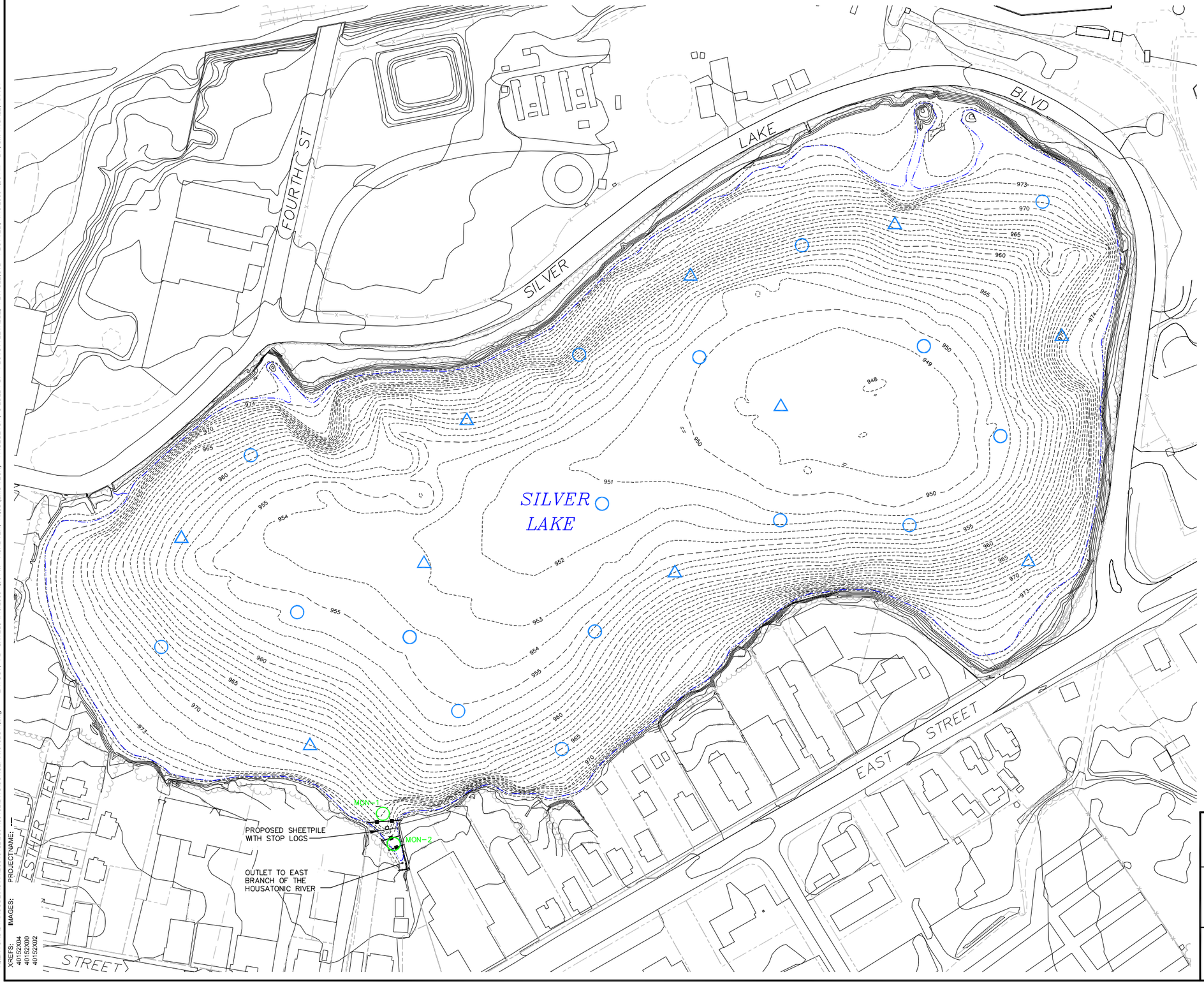

LEGEND:

- MEAN WATER ELEVATION (975.9) (APPROX.)
- PAVED ROADWAY
- VEGETATION
- FENCELINE
- GUARDRAIL
- ELEVATION CONTOUR (HILL ENGINEERS)
- SILVER LAKE ELEVATION CONTOUR
- SILT CURTAIN
- PROPOSED WATER MONITORING LOCATION
- PROPOSED CAP MATERIAL CORE LOCATION
- PROPOSED CAP MATERIAL CORE LOCATION INCLUDING PCB ANALYSIS

NOTES:

1. BASE MAP INFORMATION ADJACENT TO SILVER LAKE MODIFIED FROM ELECTRONIC FILE OF SURVEYS PERFORMED BY HILL ENGINEERS, ARCHITECTS AND PLANNERS IN 2006 AND 2008. OTHER BASE MAP INFORMATION PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
2. ALL LOCATIONS ARE APPROXIMATE AND NOT ALL PHYSICAL FEATURES MY NOT BE SHOWN.
3. BATHYMETRIC CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10–13 JUNE 2003.

0 80' 160'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

PROPOSED CONSTRUCTION AND LONG-TERM MONITORING LOCATIONS

ARCADIS

FIGURE
4-2

CITY: SYRACUSE DIV/GROUP: ENVCAD DB: K. SARTORI G., STOWELL L, FORAKER LD: DMW PIC: P. KEANEY PM: T. CRIDGE TM: L. PUTNAM LYR: ON=*;OFF=*REF*
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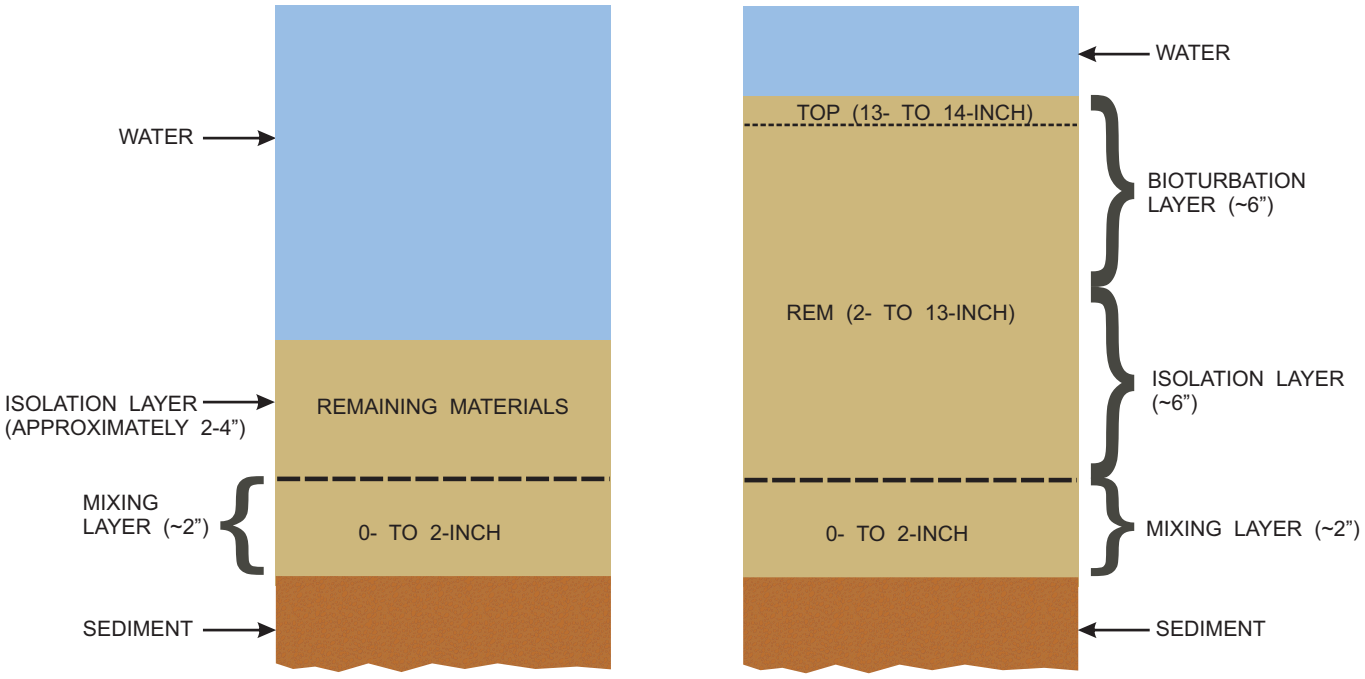

DURING CONSTRUCTION

NOT-TO-SCALE

POST-CONSTRUCTION

NOT-TO-SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

TYPICAL CORE SECTION

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FIGURE
4-3

04/14/09 SYRACUSE-NY-ENV141-DHOWES
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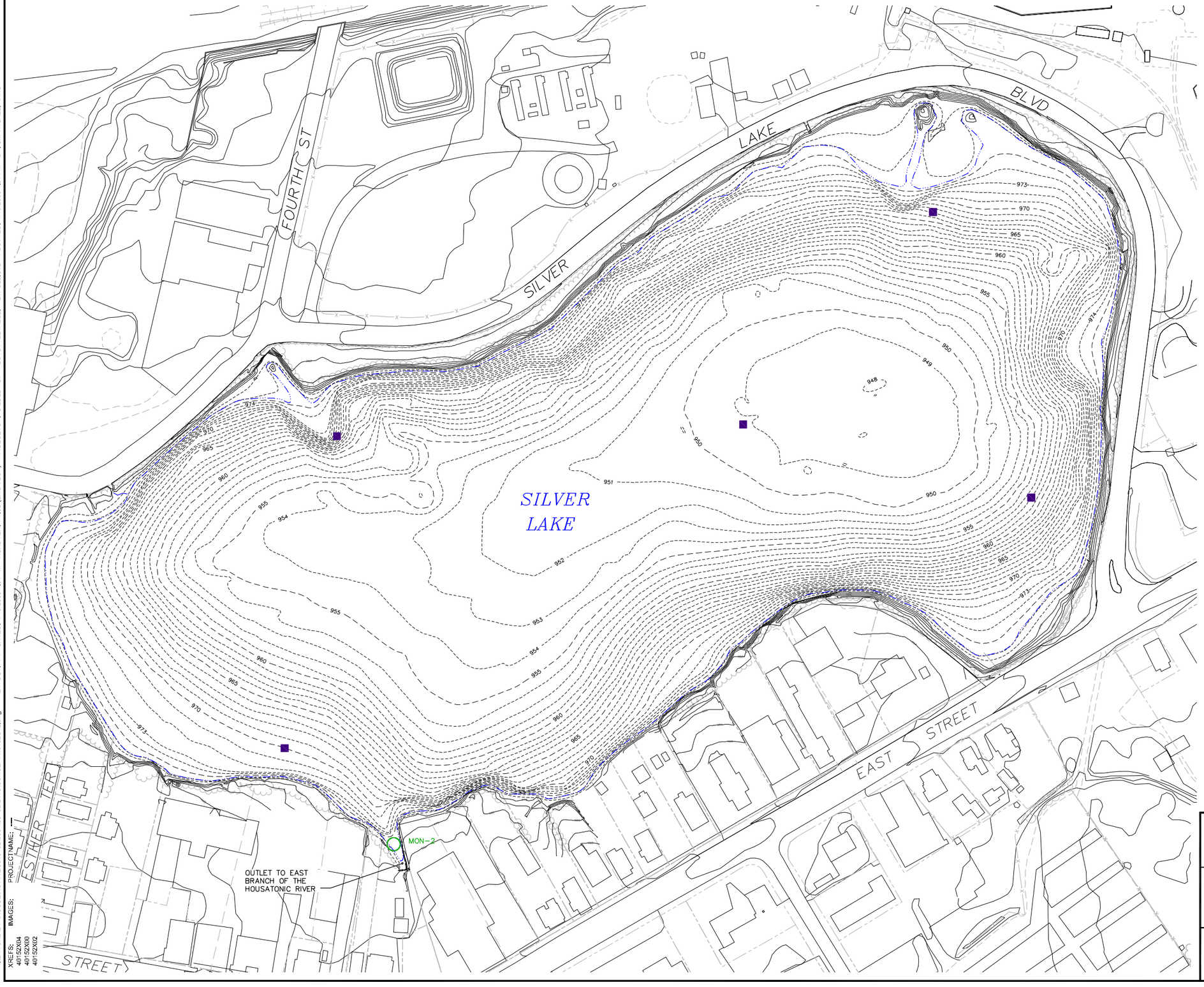

LEGEND:

- MEAN WATER ELEVATION (975.9) (APPROX.)
- PAVED ROADWAY
- VEGETATION
- FENCELINE
- GUARDRAIL
- ELEVATION CONTOUR (HILL ENGINEERS)
- SILVER LAKE ELEVATION CONTOUR
- PROPOSED SEDIMENT TRAP LOCATION
- PROPOSED LONG-TERM WATER MONITORING LOCATION

NOTES:

1. BASE MAP INFORMATION ADJACENT TO SILVER LAKE MODIFIED FROM ELECTRONIC FILE OF SURVEYS PERFORMED BY HILL ENGINEERS, ARCHITECTS AND PLANNERS IN 2006 AND 2008. OTHER BASE MAP INFORMATION PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
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3. BATHYMETRIC CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10-13 JUNE 2003.

0 80' 160'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CONCEPTUAL RD/RA WORK PLAN - SILVER LAKE SEDIMENTS

PROPOSED LONG-TERM MONITORING SEDIMENT TRAP LOCATIONS

ARCADIS

FIGURE
4-4

CITY:SYRACUSE DIV/GROUP:ENVCAD DB:K.SARTORI G.STOWELL L.FORAKER LD:DMW PIC:P.KEANEY PM:T.CRIDGE TM:L.PUTNAM LYR:ON=*;OFF=*REF*
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Appendices

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Appendix A

Materials and Performance Specifications

Appendix A
Materials and Performance Specifications

Revised Conceptual RD/RA Work Plan for Silver Lake Sediments
General Electric Company - Pittsfield, Massachusetts

1. Isolation Layer Materials

A. Granular Isolation Layer Material

- **Use** – Isolation layer placed over sediment.
- **Specification**
  - Approximate grain size distribution:
    - 5% Gravel; 75% Sand; 20% Silt/Clay
  - Average Minimum Total Organic Carbon (TOC):
    - 5,000 parts per million (ppm)
- **Testing Frequency**
  - TOC (Lloyd Kahn Method):
    - Once every 500 cubic yards (cy) prior to placement
  - Polychlorinated Biphenyls (PCB) (SW-846 Method 8082) and grain size – sieve (ASTM D422):
    - Once every 2,000 cy prior to placement
  - Appendix IX+3 – inorganics (methods 6010B/7000A, 9010B, 9030B), SVOCs (method 8270C), VOCs (method 8260B):
    - Once every 5,000 cy prior to placement

2. Armor Layer Material

A. Armor Stone

- **Use** – Protective armor stone placed along shoreline in vicinity of water line.
- **Specification** – Angular, poorly-graded rip rap:
  - East Shore: D_{50}: 6-inches, D_{100}: 8-inches
  - West Shore: D_{50}: 3-inches, D_{100}: 5-inches
- **Testing Frequency** – Particle Size (ASTM D5519-94(2001)):
  - Once every 2,000 cy prior to placement

B. Gravel and Sand

- **Use** – Habitat layer placed over underwater extent of armor stone.
- **Specification** – Well graded gravel and sand:
  - 3-inch minus
- **Testing Frequency** – Particle Size
  - Once

C. Woven Geotextile

- **Use** – Installed between sediment/banks soils and armor layer.
- **Specification** – Mirafi 100-X or equivalent.
- **Testing Frequency** – None.

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Appendix B

Armor System Design Methodology

Appendix B
Armor System Design Methodology

Revised Conceptual RD/RA Work Plan for Silver Lake Sediments
General Electric Company - Pittsfield, Massachusetts

As described in the Pre-Design Investigation Report for Silver Lake Sediments (Sediments PDI Report; BBL, 2003), the predominant cause of bank erosion (if any) in Silver Lake appears to be wind-driven wave action. To maintain the integrity of the Silver Lake cap, measures will be incorporated to protect the cap from such naturally occurring erosive forces. This Appendix to the *Conceptual RD/RA Work Plan for Silver Lake Sediments* (Work Plan) presents the recommended armor layer configuration for installation on top of the sediment cap in the vicinity of the water line.

In general, the Silver Lake bank armoring system was designed using standard United States Army Corps of Engineers (USACE) guidance for the protection of river and lake banks, channel bottoms, and shorelines. Specifically, the Shore Protection Manual (SPM; USACE, 1984) presents a series of calculations incorporating site-specific environmental conditions, including (but not limited to) prevailing winds and wind speeds; to conservatively estimate the location adjusted wind stress factor. Additional site-specific environmental conditions including (but not limited to) bank slopes, predominant fetch, and water depth were assessed with Technical Release No. 69 (TR-69), published by the United States Department of Agriculture (USDA; USDA 1983), and used in conjunction with the wind stress factor calculated using the SPM. These combined methods result in a conservative estimate for median armor stone size and subsequent armor layer thicknesses for protection from erosion and material loss.

Using the design references listed above, the armor system has been conservatively designed to protect the cap from wind-driven waves associated with a 100-year wind event. Note that because predominant winds on Silver Lake are from the west/northwest, two armor layer design dimensions have been prepared. As shown on Figure 3-8 of the Work Plan, the lake has been divided into two sections labeled as the East Shore and West Shore Armor Configurations. The East Shore Armor Configuration encompasses the entire eastern shore of Silver Lake, and much of the southern shore. The West Shore Armor Configuration encompasses the entire western and northern shore of Silver Lake, as well as the remaining portion of the southern shore in the southwest corner of the lake. As presented in the Sediments PDI Report, the predominant wind is from the west/northwest, and longest length of Silver Lake is in the East/West direction, and as such a more robust armor system has been designed for the section of shore that routinely faces the predominant wind (East Shore Armor Configuration).

Wind Data Analysis

As part of the PDI, wind data was analyzed from three nearby locations:

- Albany International Airport
- Hartford Bradley International Airport
- Pittsfield NOAA Wind Gauge

All three data sets showed that the predominant winds are west/northwest with wind maximum observed speeds exceeding 40 miles per hour (mph). The Albany and Hartford records contained daily wind speed and direction records spanning 19 years (1965-1983) (NCDC, 2001a and 2001b). The Pittsfield record was relatively new and spanned only 4 years (1999-2003). Due to its proximity to Pittsfield and the robustness of the data set relative to the NOAA wind gauge, the Albany wind data was used in the calculations used to estimate armor system design.

To create a conservative armor system, wind data associated with the fastest mile wind speeds from 100-year return period storms was used, with analysis focused on the easterly and westerly wind data (i.e., along the longest length of the lake), thereby assuming worst case scenarios. Specifically, for design of the Silver Lake armor system, the maximum fastest mile easterly and westerly wind speeds of 37 and 59 miles per hour (mph), respectively, as projected for the Albany airport, were selected for use in design calculations for the armor layer on the western and eastern shores, respectively.

As discussed in the *Pilot Study Work Plan for Silver Lake Sediments* (PSWP; BBL, 2006), the methodology to determine the design wave and resultant armoring requirements considers several factors including fetch length and wind speed (as briefly discussed above), water depth, and wind duration. Wind Stress was determined using the SPM, a similar method to that which is described in detail in the PSWP. This information was then used to determine fetch, wave growth, and armor stone diameter based on the more detailed specifications set forth in TR- 69. Below is a summary of the calculations performed to determine the two armor stone configurations for the banks of Silver Lake.

Wind Stress Determination

Using fastest mile westerly wind data from the Albany Airport, wind stresses, and resultant wave heights were determined by applying a series of calculated adjustments to estimate maximum wind speeds for Silver Lake. The following steps detailed in the SPM were used to develop a site-specific wind stress parameter:

1) Elevation Adjustment

2) One-Hour Wind speed Adjustment

3) Stability Adjustment

4) Location Adjustment

5) Drag Adjustment

As detailed in the PSWP, the overall wind velocity (U_W) can be related to the overland wind velocity (U_L) using the following formula:

$$U_W = 0.589 \cdot \left(R_L \cdot R_T \cdot \frac{U_L}{1.29} \cdot \left(\frac{32.8}{z} \right)^{1/7} \right)^{1.23}$$

Where: U_L = selected fastest mile overland wind velocity

R_L = Ratio of Wind speed over water to wind speed over land (0.9; USACE, 1984)

R_T = Correction Factor for air-water temperature differences (1.1; USACE, 1984)

z = adjustment factor to represent Silver Lake conditions ~20 ft

Using 59 mph as the fastest mile overland westerly wind velocity for the design calculations for the eastern shore armor layer design produces U_W of 69.9 mph. An overall wind velocity for the western shore armor layer design can be calculated as 39.4 mph for U_W using 37 mph as the fastest mile overland easterly wind velocity. The design wind velocity (U_D) will be set equal to U_W for this Site.

Fetch Determination

Fetch is defined as the length of the unobstructed open water surface across which the wind can generate waves (National Oceanic and Atmospheric Administration [NOAA], 2001). As applied to the conceptual design of the cap, for an irregularly shaped body of water, an effective fetch (Fe) can be calculated through a technique outlined in TR-69. Using this technique, a central radial is drawn across the longest distance of open water in the average wind direction. Seven radials are then drawn on either side of this central radial at 6° intervals. The length of each of these 15 radials (X_i) is recorded and multiplied by the square of the cosine of the angle between the individual radial and the central radial ($\cos^2\alpha$). The effective fetch can then be calculated as

$$F_e = \frac{\sum (X_i \cdot \cos^2 \alpha)}{\sum \cos \alpha}$$

Using this method, the maximum fetch length determined for the eastern shore armor layer design was approximately 985 feet (0.19 miles). The maximum fetch length determined for the western shore armor layer design was approximately 816 feet (0.15 miles).

Wave Growth

Finally, a design wave height to be carried forward in armor stone calculations can be estimated as follows:

$$H = \frac{0.0026 \cdot (U_D)^2 \cdot \left(\frac{g \cdot F_e}{(U_D)^2} \right)^{0.47}}{g}$$ (USDA, 1983)

Where: g = gravitational acceleration (32.2 feet/s^2)

H = design wave height (feet)

U_D = wind speed/stress factor (feet/s)

F_e = fetch length (985 feet for eastern shore design, 816 feet for western shore design)

Solving for *H*, a design wave height of 1.4 feet will be carried forward for use in calculation of armor stone size and layer thickness for the eastern shore armor layer design, and a wave height of 0.7 feet will be carried forward for the western shore armor layer design.

Median Armor Stone Diameter (D_{50}) Determination

A design wave height was determined using methods described above. The corresponding armor stone size that is required to yield the level of protection necessary for the shoreline was calculated using the Hudson equation:

$$W_{50} = \frac{19.5 \cdot G_s \cdot H^3}{(G_s - 1)^3 \cdot \cot \phi} \quad \text{(USDA, 1983)}$$

Where: W_{50} = median weight of individual armor unit

γ_r = unit weight of armor material (165 lbs/ft^3)

γ_w = unit weight of water (62.4 lbs/ft^3)

$G_s = \gamma_r / \gamma_w$ = specific gravity of armor material

H = design wave height (1.4 feet for eastern shore design, 0.7 feet for western shore design)

$\cot \phi$ = angle between seaward structure slope and horizontal (3 for slope of 3H:1V)

Slope calculations were conducted for over 50 transects around Silver Lake, and on average the West shore area used for design calculations has a shallower slope than that of the East shore area. However, for the purpose of this design, a conservative estimate of 3 was used for the slope of the banks of Silver Lake in calculations for both the East and West shore armor stone systems. Solving the above equation for W_{50}, the median weight of an individual armor unit for the eastern shore is 11.3 lbs, and the median weight of an individual armor unit for the western shore is 1.4 lbs.

By using the unit weight of armor material, as noted above, the median stone volume (V_{50}) for the eastern shore is calculated to be 0.0025 cy, and for the western shore the stone volume is calculated to be 0.0003 cy. The median stone diameter (D_{50}) can be calculated by assuming a stone geometry. For conservative estimates, the stones are assumed to be spherical (D_{50s}) and then cubical (D_{50c}), as follows.

$$D_{50s} = \sqrt[3]{\frac{6 \cdot V_{50}}{\pi}} \quad , \quad D_{50c} = \sqrt[3]{V_{50}} \qquad \text{(USDA, 1983)}$$

From this, the median stoned diameter (D_{50}) can be calculated by averaging together the two values and rounding up to produce a design D_{50} of approximately 6 inches for the eastern shore and 3 inches for the western shores.

Finally the process outlined in TR-69 indicates that the extent of stone cover below the mean waterline is assumed to be 1.5 times the wave height (H), or approximately 2.1 feet for the eastern shore and 1.1 feet for the western shore. Additionally, the extent of stone cover above the mean waterline is the sum of two quantities: the wave run-up (R) and the wave set-up (S). S is assumed to be 0.1 times H. R can be calculated using Figures 11 and 12 in TR-69. By combining these two values, the extent of stone cover above the mean waterline is approximately 1.9 feet for the eastern shore, and 1.0 feet for the western shore, for a total of approximately 4 feet and 2 feet of stone cover respectively.

As outlined in TR-69, the rock riprap layer thickness is commonly approximated as two times the D_{50} size of rock, which yields a conservative thickness of approximately 12 inches for the eastern shore, and 6 inches for the western shore.

Summary Results

Following the steps detailed above, the following table summarizes the key assumptions of the calculations, as well as the median stone weight (W_{50}), diameter (D_{50}), layer thickness, and vertical extent of the armor layer above and below the mean surface elevation (MSE; 975.9 feet).

Summary of Calculation Results

Specification	East Shore Design	West Shore Design
Maximum Overland Wind Speed (mph)	59	37
Design Wave Height (ft)	1.4	0.7
W_{50} (lbs)	11.3	1.4
D_{50} (in)	6	3
Layer Thickness (in)	12	6
Extent Above/Below MSE (ft)	1.9/2.1	1.0/1.1

References

Blasland, Bouck, and Lee, an ARCADIS Company (BBL). Pilot Study Work Plan for Silver Lake Sediments. August 2006.

NOAA (2001). *Glossary of Coastal Terminology.* [Online]. http://www.csc.noaa.gov/text/glossary.html (last updated 2001). National Ocean and Atmospheric Administration - Coastal Services Center. Silver Spring, MD.

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