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Phase 2 Final Design Report for 2011

Hudson River PCBs Superfund Site

Revised April 2011

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Phase 2 Final Design Report for 2011

Hudson River PCBs Superfund Site

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Table of Contents

Tables

Figures

Attachments

Appendices

1. Introduction

This Phase 2 Final Design Report for 2011 (2011 FDR) presents the Final Design for the first year of Phase 2 dredging to be conducted in 2011 (referred to herein as Phase 2, Year 1), as part of the remedy selected by the United States Environmental Protection Agency (EPA) to address polychlorinated biphenyls (PCBs) in sediments of the Upper Hudson River (the river), located in New York State. This report does not include design for the remainder of Phase 2 dredging, which is planned to take place after 2011. The final design for the remainder of Phase 2 will be completed after additional data collection and design support activities are completed for remaining Phase 2 areas and will be submitted to EPA, for each such subsequent year, in a revised FDR (or an addendum to this 2011 FDR) for that year.

This 2011 FDR has been prepared on behalf of the General Electric Company (GE) pursuant to an Administrative Order on Consent for Hudson River Remedial Design and Cost Recovery (RD AOC), effective August 18, 2003 (Index No. CERCLA-02-2003-2027; EPA/GE 2003). It has been prepared in accordance with the Remedial Design Work Plan (RD Work Plan; Blasland, Bouck & Lee, Inc. [BBL] 2003a), which is an attachment to the RD AOC, and builds upon GE's Preliminary Design Report (PDR; BBL 2004a) and Phase 2 Intermediate Design Report (Phase 2 IDR; ARCADIS 2008).

In accordance with the RD Work Plan, this 2011 FDR takes account of the information that has become available since the Phase 2 IDR, including the following:

- Final basis of design
- Final plans and specifications
- Summary of the Biological Opinions (if any) for the bald eagle and shortnose sturgeon or written concurrence with a "not likely to adversely affect" determination in the Biological Assessment (BA) and any related measures that EPA determines are necessary to be incorporated into the design
- Updated construction schedule

This report has also been developed to be consistent with the Remedial Action Consent Decree between GE and the United States (Civil Action No. 1:05-CV-1270) for the Hudson River PCBs Superfund Site (RA CD; EPA/GE 2005), entered on November 2, 2006. The CD includes, as Appendix B, a Statement of Work for

Remedial Action and Operations, Maintenance, and Monitoring (SOW), which sets forth a number of general requirements for the remedial action and includes several attachments specifying requirements for various aspects of the remedial action. In December 2010, EPA issued revised versions of the SOW (EPA 2010c) and its attachments for Phase 2. The revised attachments to the SOW include the following:

- Attachment A: Critical Phase 2 Design Elements (Phase 2 CDE)
- Attachment B: Phase 2 Remedial Action Monitoring Scope (Phase 2 RAM Scope)
- Attachment C: Phase 2 Performance Standards Compliance Plan Scope (Phase 2 PSCP Scope)
- Attachment D: Phase 2 Remedial Action Community Health and Safety Program Scope (Phase 2 CHASP Scope)
- Attachment E: Operation, Maintenance, and Monitoring Scope for Phase 2 of the Remedial Action (Phase 2 OMM Scope)
- Attachment F: Certification Unit Completion Approval/Certification Forms for Phase 2 (Phase 2 CU Certification Forms)

This 2011 FDR also addresses EPA's comments on the following interim final design deliverables that were submitted by GE to EPA after the Phase 2 IDR was approved:

- Draft Phase 2 final design for backfill and habitat construction, submitted to EPA for review on November 30, 2009; EPA comments provided on August 13, 2010 and February 3, 2011
- Draft Phase 2 final design interim submittal, submitted to EPA for review on March 31, 2010; EPA comments provided on August 13, 2010 and February 3, 2011
- Draft Division 1 specifications (general requirements), submitted to EPA for review on November 10, 2010; EPA comments provided on February 3, 2011
- Draft sheen response specification (Section 13871), submitted to EPA for review on January 18, 2011; EPA comments provided on February 4, 2011

- Draft cap design analysis technical memorandum, submitted to EPA for review on January 28, 2011; EPA comments provided on February 16, 2011

- Draft technical specifications (Divisions 2 through 13) for dredging, processing facility, and rail yard operations, submitted to EPA for review on January 31, 2011; EPA comments provided on February 14, 2011

Finally, this 2011 FDR also addresses EPA's April 8, 2011 comments on the version of the 2011 FDR that was submitted to EPA on March 15, 2011.

1.1 Project Setting

The Hudson River is located in eastern New York State and flows approximately 300 miles in a generally southerly direction from its source, Lake Tear-of-the-Clouds in the Adirondack Mountains, to the Battery, located in New York City at the tip of Manhattan Island. The Superfund Record of Decision (ROD) issued by EPA for this site (EPA 2002) calls for a remedial action to remove and dispose of PCB-containing sediments meeting certain criteria for mass per unit area (MPA) of PCBs and surface PCB concentrations or characteristics from the Upper Hudson River (i.e., the section of river upstream of the Federal Dam at Troy, New York).

EPA defined three sections of the Upper Hudson River for the sediment remediation activities outlined in the ROD. The location of each river section is illustrated on Figure 1-1 and described below.

- *River Section 1*: Former location of the Fort Edward Dam to the Thompson Island Dam (TID; from river mile [RM] 194.8 to RM 188.5; approximately 6.3 river miles)

- *River Section 2*: TID to the Northumberland Dam (from RM 188.5 to RM 183.4; approximately 5.1 river miles)

- *River Section 3*: Northumberland Dam to the Federal Dam at Troy (from RM 183.4 to RM 153.9; approximately 29.5 river miles)

The environmental history of the Hudson River PCBs Site has been well documented in previous reports and was used in developing certain aspects of this 2011 FDR. While this information is not repeated here, information sources are referenced throughout the Phase 2 IDR and this 2011 FDR.

1.2 Summary of the Remedy Selected by EPA and Phase 2 Decision Process

The remedy selected by EPA is described in the ROD. The remedial action components are described in further detail in the RD Work Plan, PDR, and RA CD, including its attachments.

The ROD calls for the removal of sediment from the Upper Hudson River based on criteria that vary by river section. In particular, the ROD specifies the following criteria:

- In River Section 1, removal of sediments based primarily on an MPA of 3 grams per square meter (g/m^2) or greater of PCBs with three or more chlorine atoms (Tri+ PCBs)

- In River Section 2, removal of sediments based primarily on an MPA of 10 g/m^2 or greater Tri+ PCBs

- In River Section 3, removal of selected sediments with high concentrations of PCBs and high erosion potential (New York State Department of Environmental Conservation [NYSDEC] Hot Spots 36, 37, and the southern portion of 39)

The sediment removal criteria, including criteria based on surface sediment concentrations of Tri+ PCBs, were further specified in EPA's decision in the dispute resolution proceeding on GE's initial Phase 1 Dredge Area Delineation Report (Phase 1 DAD Report; QEA 2005), which EPA issued in July 2004 (EPA 2004c).

The ROD calls for dredging in two distinct phases – Phase 1 and Phase 2. The Final Design for Phase 1 was described in the Phase 1 Final Design Report (Phase 1 FDR; BBL 2006a), which was approved by EPA on January 25, 2008 (EPA 2008), after resolution of EPA's comments and incorporation of numerous design addenda. Phase 1 dredging operations were conducted in 2009 and included dredging, processing, and disposal of approximately 286,000 cubic yards (cy) of sediment from Certification Unit 1 (CU01) through CU08, and CU17 and CU18 in River Section 1.

Following the completion of Phase 1 dredging, EPA and GE each prepared a Phase 1 Evaluation Report, which included respective evaluations of the Phase 1 dredging operations with regard to the Hudson River Engineering Performance Standards (EPS; EPA 2004a). The Phase 1 Evaluation Reports (Anchor QEA and ARCADIS 2010; EPA 2010a) summarized the key activities completed during Phase 1, evaluated the experience gained during Phase 1 relative to the EPS, and recommended changes to the EPS. An independent Peer Review Panel reviewed and evaluated the Phase 1 Evaluation Reports and supporting information provided by GE and EPA during and subsequent to public Peer Review Panel meetings that took place in February and May 2010. In September 2010, the Peer Review Panel issued a Peer Review of the Phase 1 Dredging Final Report (Bridges et al. 2010) summarizing the independent peer review of the Phase 1 Evaluation Reports issued by EPA and GE and supporting information, and recommending changes to the EPS for Phase 2.

On December 17, 2010, EPA issued its decision regarding the requirements for Phase 2, outlined in the following documents:

- Revised Engineering Performance Standards for Phase 2 (Phase 2 EPS; EPA 2010b)

- Technical Memorandum – Quality of Life Performance Standards – Phase 2 Changes (Ecology & Environment [E&E] 2010)

- Revised SOW (Appendix B to the RA CD) and its attachments (EPA 2010c)

On December 31, 2010, GE provided formal notice to EPA of GE's decision to implement Phase 2 of the project under the Consent Decree.

1.3 Phase 2 Performance Standards

EPA developed performance standards for both the engineering aspects of the project and quality of life considerations. The Phase 2 EPS cover resuspension during dredging and other in-river activities (Resuspension Standard), concentrations of residual PCBs in surface sediments after dredging (Residuals Standard), and productivity (Productivity Standard) (EPA 2010b). In addition, EPA modified their previously issued Substantive Water Quality Requirements (WQ Requirements; EPA 2005, 2006a) relating to in-river releases of constituents not subject to the EPS and relating to discharges from the sediment processing facility to adjacent surface waters. Those modifications for Phase 2 were set forth in Section 6 of the Phase 2 EPS document and in the Phase 2 RAM Scope and Phase 2 PSCP Scope. The Quality of Life Performance Standards (QoLPS) address project-related impacts on air quality, odor, noise, lighting, and river navigation (EPA 2004b). Revisions to the QoLPS for Phase 2 are detailed in a technical memorandum (E&E 2010), as well as several of the scopes attached to the revised SOW. The Phase 2 EPS, WQ Requirements, and

QoLPS (collectively referred to herein as the performance standards) are discussed as elements of the basis of design presented in Section 2.

1.4 Completion of Phase 2 Design

As mentioned above, this 2011 FDR includes updated Phase 2 drawings and specifications for dredging operations, processing facility operations, rail yard operations, and habitat construction associated with the dredging planned for Phase 2, Year 1. This 2011 FDR also references, where appropriate, other documents submitted for Phase 2, Year 1 under the 2010 revised SOW. These documents include:

- The Remedial Action Work Plan for Phase 2 Dredging and Facility Operations in 2011 (2011 RAWP; Parsons 2011a), and several appendices thereto – namely:
    - Appendix A: Phase 2 Dredging Construction Quality Control/Quality Assurance Plan for 2011 (2011 DQAP; Parsons 2011b)
    - Appendix B: Phase 2 Facility Operations and Maintenance Plan for 2011 (2011 Facility O&M Plan; Parsons 2011c)
    - Appendix C: Phase 2 Transportation and Disposal Plan for 2011 (2011 TDP; Parsons 2011f)
    - Appendix D: Phase 2 Performance Standards Compliance Plan for 2011 (2011 PSCP; GE 2011)
    - Appendix E: Phase 2 Property Access Plan for 2011 (2011 PAP; Parsons 2011d)
    - Appendix F: Phase 2 Community Health and Safety Plan for 2011 (2011 CHASP)
- Phase 2 Remedial Action Monitoring Quality Assurance Project Plan for 2011 (2011 RAM QAPP)

The final design for the remainder of Phase 2 will be completed after additional data collection and design support activities are completed for those portions of the river and will be submitted to EPA, for each such subsequent year, in a revised FDR (or an addendum to this 2011 FDR) for that year.

1.5 Report Organization

The 2011 FDR is organized into the sections shown in Table 1-1 below.

Table 1-1 2011 FDR Organization

Section	Description
1 – Introduction	Summarizes the remedial action selected by EPA, describes the project setting, discusses the purpose and scope of this 2011 FDR, and discusses completion of Phase 2 Design.
2 – Basis of Design and Supporting Information – Phase 2, Year 1	Provides the basis of design for the first year of Phase 2 (2011), and summarizes information from design support activities to document the project conditions and physical conditions under which Phase 2, Year 1 remedial activities will occur.
3 – Design Summary – Phase 2, Year 1	Summarizes the design, including dredging, dredged material transportation, resuspension control, sediment and water processing, transportation and disposal of processed sediment, backfilling/capping, and habitat construction, and quality of life evaluations.
4 – Contract Summary and Remedial Action Implementation – Phase 2, Year 1	Summarizes the contracts to be established for implementing the remedial action work for Phase 2, Year 1, describes the remedial action submittals for that work, and summarizes the schedule for implementation of the remedial action activities in Phase 2, Year 1.
5 – References	Provides a list of references cited in this 2011 FDR.
6 – Acronyms and Abbreviations	Provides the definitions of acronyms and abbreviations that are used in this 2011 FDR.
Tables	Provides the tables referenced in this 2011 FDR.
Figures	Provides the figures referenced in this 2011 FDR.
Attachments	Provides the attachments referenced in this 2011 FDR.
Appendices	Provides the drawings and specifications for the remedial action contracts for Phase 2, Year 1 activities.

2. Basis of Design and Supporting Information – Phase 2, Year 1

This section summarizes the Phase 2 performance requirements, discusses design support activities (e.g., engineering data), and summarizes the basis of design for the dredging operations targeted for Phase 2, Year 1.

2.1 Phase 2 Performance Requirements

Performance requirements guide the design presented in this 2011 FDR and provide a foundation for the basis of design. The performance requirements listed here include elements from the ROD, Phase 2 EPS, WQ Requirements, and QoLPS.

2.1.1 Record of Decision Requirements

The following major project elements are excerpted in summary form from the ROD and provide a basis for the Phase 2 Design:

- Removal of sediments based primarily on an MPA of 3 g/m^2 Tri+ PCBs or greater from River Section 1

- Removal of sediments based primarily on an MPA of 10 g/m^2 Tri+ PCBs or greater from River Section 2 *(not applicable to Phase 2, Year 1)*

- Removal of selected sediments with high concentrations of PCBs and high erosional potential (NYSDEC Hot Spots 36, 37, and the southern portion of 39) from River Section 3 *(not applicable to Phase 2, Year 1)*

- Dredging of the navigation channel, as necessary, to implement the remedy and to avoid hindering canal traffic during implementation

- Removal of PCB-containing sediments within areas targeted for remediation, with anticipated residuals of approximately 1 milligram per kilogram (mg/kg) Tri+ PCBs (prior to backfilling)

- Design to achieve the EPS and QoLPS developed by EPA

- Backfill of dredged areas with approximately 1 foot of clean material to isolate residual PCBs and to expedite habitat recovery, where appropriate

- Use of environmental dredging techniques to minimize and control resuspension of sediments during dredging

- Transport of dredged sediments via barge or pipeline to sediment processing/transfer facilities for dewatering and, as needed, stabilization

- Rail and/or barge transport of dewatered, stabilized sediments to an appropriate licensed offsite landfill for disposal

In addition to these requirements, EPA's July 2004 decision in the dispute resolution proceeding on GE's initial Phase 1 DAD Report (EPA 2004c) specified sediment removal criteria based on surface sediment Tri+ PCB concentrations of 10 mg/kg in River Section 1 and 30 mg/kg in River Sections 2 and 3 (the latter of which is not applicable to Phase 2, Year 1).

Further, in the ROD, EPA identified a number of federal and state environmental laws and regulations as Applicable or Relevant and Appropriate Requirements (ARARs) (see Tables 14-1 through 14-3 of the ROD; EPA 2002). These ARARs, which apply to onsite activities, fall into three broad categories – chemical-specific, location-specific, and action-specific requirements – based on the manner in which they are applied at a site. (These ARARs are also addressed in Paragraph 7 of the RA CD.) The Phase 1 IDR and Phase 1 FDR provided information on how the substantive requirements of the ARARs were incorporated into the Phase 1 Design. These substantive requirements have been considered in the Phase 2, Year 1 Specifications and Drawings included in Appendices 1 through 5. The Phase 2 IDR described how the substantive requirements would be incorporated into the Phase 2 Design.

2.1.2 Engineering Performance Standards

As previously noted, the Phase 2 EPS consist of a Resuspension Performance Standard, a Residuals Performance Standard, and a Productivity Performance Standard. These standards are set out in a document titled Hudson River PCBs Superfund Site – Revised Engineering Performance Standards for Phase 2, issued by EPA in December 2010 (EPA 2010a).

The Phase 2 EPS, as they apply to the Phase 2 Design, are summarized below.

2.1.2.1 Project-Related Resuspension

The Phase 2 Resuspension Performance Standard specifies three types of criteria:

1. An Advisory Level applicable to total suspended solids (TSS) concentrations at near-field monitoring stations (located within 300 meters [m] of the dredging activities).

2. A Control Level applicable to the net loads (i.e., loads above baseline) of Tri+ PCBs at far-field monitoring stations (located more than 1 mile downstream of dredging activities).

3. A Control Level applicable to the concentrations of total PCBs (TPCBs) at far-field monitoring stations.

The three types of criteria specified by the Phase 2 Resuspension Standard are described below.

Advisory Level for TSS Concentrations

Under the Phase 2 EPS, the Advisory Level for TSS concentrations in the near field is a net increase in TSS concentration of 100 milligrams per liter (mg/L) above ambient (upstream) conditions at the near-field monitoring station located 300 m downstream of the dredging operation. To exceed this criterion, this condition must exist on average for a sampling compositing period or for the daily dredging period (whichever is shorter).

Control Level for Tri+ PCB Net Loads

The far-field numerical net Tri+ PCB load criteria consist of a seasonal or cumulative net load that will be tracked via daily percent release criteria. As stated in the Phase 2 EPS, the cumulative net load criteria for each dredging season are 2 percent (at the first far-field monitoring station, which is at least 1 mile downstream of the dredging) and 1 percent (as monitored at the Waterford far-field monitoring station) of the Tri+ PCB mass removed during the dredging season, regardless of stream flow rates. These criteria will be applied daily as follows during the Phase 2, Year 1 dredging season, in which dredging will be performed only in River Section 1 (the Thompson Island Pool [TIP]):

- The daily PCB percent release criteria are 2 percent and 1 percent of the Tri+ PCB mass to be removed, as measured at the Thompson Island and Waterford monitoring stations, respectively, if concurrent stream flows measured at Fort Edward are less than 5,000 cubic feet per second (cfs) on average for that day. If the average flow for that day is greater than 5,000 cfs, the specified percentages increase to 3 percent and 2 percent at the Thompson Island and Waterford far-field monitoring stations, respectively.

- Attainment of the daily Tri+ PCB percent release criteria will be determined based on a 7-day running average as follows:

    - For the Thompson Island and Lock 5 far-field monitoring stations, the load Control Level will be considered to be exceeded if, for 14 or more consecutive days, the 7-day running average Tri+ PCB net load exceeds the Control Level percentage of the corresponding 7-day running average of the Tri+ PCB mass removed. The Control Level percentage is the 7-day running average of daily values of 2 percent on days during which the average river flow measured at Fort Edward is less than 5,000 cfs and 3 percent on days during which the average river flow measured at Fort Edward is at or more than 5,000 cfs. In the case of an exceedance, EPA may require GE to evaluate the dredging operations and/or to implement operational changes, which may include a slowdown (but not shutdown) of dredging operations.

    - For the Waterford far-field monitoring station, the load Control Level will be considered to be exceeded if, for 21 or more consecutive days, the 7-day running average Tri+ PCB net load exceeds the Control Level percentage of the corresponding 7-day running average of the Tri+ PCB mass removed. The Control Level percentage is the 7-day running average of daily values of 1 percent on days during which the average river flow measured at Fort Edward is less than 5,000 cfs and 2 percent on days during which the average river flow measured at Fort Edward is at or more than 5,000 cfs. In the case of an exceedance, EPA may require GE to evaluate the dredging operations and/or to implement operational changes, which may include a slowdown (but not shutdown) of dredging operations.

    - If EPA requires a slowdown of dredging operation, normal operations will resume when the 7-day running average Tri+ PCB load is below the 3 percent, 2 percent, or 1 percent load standard, as the case may be, for 2 consecutive days, or as otherwise allowed by EPA.

- Through adaptive management, EPA will consider adjustments to the 7-day running average period for the load criteria if high flow conditions in the river and the effect of time of travel on export rates are coincident with high frequency of exceedances at the far-field monitoring stations.

For the Phase 2, Year 1 dredging season, the cumulative net load criteria will be calculated as 2 percent (at Thompson Island) and 1 percent (at Waterford) of the Tri+ PCB mass removed during that season. The Tri+ PCB mass removed will be calculated using the methodology described in Section 7 of the Phase 2 EPS with the modifications set forth in Section 2.1.2 of the 2011 PSCP.

The running average daily percent release criteria will be calculated as follows:

- The dredge bucket files that are provided daily by the dredging contractor will be used to determine the area, depth, and volume dredged that day so that the associated calculated Tri+ PCB volumetric concentrations can be used to estimate the Tri+ PCB mass removed each day. The daily estimates will be revised weekly based on comparing the pre-dredging bathymetry with weekly post-dredging bathymetry.

- Each day, the daily Tri+ PCB mass removed will be summed for the most recent 7 days.

- The Tri+ PCB mass removed over the most recent 7 days will be divided into the net Tri+ PCB mass passing the Thompson Island and Waterford far-field monitoring stations over the most recent 7 days to determine the percent release at each station.

The net Tri+ PCB mass passing the Thompson Island and Waterford far-field monitoring stations will be calculated from estimated daily average net Tri+ PCB loads, which are calculated by subtracting the estimated baseline load from the gross load, using the methodology described in Section 4.3 of the Phase 2 EPS.

Control Level for Total PCB Concentrations

The Control Level for water column PCB concentrations is a TPCB concentration of 500 nanograms per liter (ng/L), equal to the federal Maximum Contaminant Level (MCL) for drinking water. This criterion will be applied as follows during Phase 2, Year 1, in which dredging will be performed only in River Section 1:

- A confirmed exceedance of the 500 ng/L criterion will be deemed to occur if the water column monitoring shows an initial occurrence of a TPCB concentration equal to or above 500 ng/L at a far-field monitoring station and the TPCB concentration of the sample collected at that station on the next day is equal to or greater than 500 ng/L.

- If there is a confirmed exceedance of 500 ng/L TPCBs at the Thompson Island or the Lock 5 monitoring station, EPA may require GE to evaluate the dredging operations and/or implement best management practices (BMPs) that do not require GE to slow down or shut down the dredging operations.

- If concentrations exceed 500 ng/L TPCBs at the Lock 5 monitoring station for 5 days out of any 7-day period (including non-dredging days), EPA may require GE to evaluate the dredging operations and/or implement operational changes, which may include a slowdown or shutdown of dredging operations. In general, a slowdown and evaluation of operations would be required before shutdown, with shutdown being the operational change of last resort.

- If there is a confirmed exceedance of 500 ng/L TPCBs at the Waterford monitoring station, EPA may require GE to evaluate the dredging operations and/or implement operational changes, which may include a temporary slowdown or shutdown of dredging operations. In general, a slowdown and evaluation of operations would be required before shutdown, with shutdown being the operational change of last resort.

If EPA does require a slowdown or shutdown of dredging operations, normal operations will resume when the TPCB concentration at the monitoring station in question is below 500 ng/L TPCBs for 2 consecutive days, or as otherwise allowed by EPA.

If at any time either the Town of Halfmoon or the Town of Waterford is unable to obtain water supplies from the City of Troy, EPA may at its discretion require a slowdown or shutdown of dredging based on a single exceedance or multiple exceedances of 500 ng/L TPCBs at Lock 5, Stillwater, or Waterford. Unless EPA allows otherwise, the slowdown or shutdown would continue until PCB levels return to a level below 500 ng/L TPCBs for 2 consecutive days, or until both Halfmoon and Waterford are once again obtaining water from Troy.

In the design analysis for the resuspension control element presented in Section 3.3, the PCB concentrations and net loads predicted at the far-field monitoring stations are compared with the Control Levels described above. The elements that form the basis of design for resuspension control and the results of the resuspension design analysis are discussed in Sections 2.3.2 and 3.3.

2.1.2.2 Dredging Residuals

The Phase 2 EPS (pp. 2-5 and 3-1) state that the primary objectives of the Phase 2 Residuals Standard are to:

- Achieve the design depth of contamination (DoC) elevation, also known as the elevation of contamination (EoC).

- Achieve an average residual concentration of no more than 1 mg/kg Tri+ PCBs, with subsequent backfilling, while minimizing the need for capping.

- Identify areas where capping or a second dredging pass is needed because the residual sediment arithmetic average Tri+ PCBs concentration is greater than 1 mg/kg in the top 6 inches.

- Identify areas where a second dredge pass is needed because PCB inventory remains at depth or Tri+ PCB concentrations of greater than or equal to 27 mg/kg are present in surface sediments after the first pass is complete.

- Identify areas where post-dredging TPCB concentrations are greater than or equal to 500 mg/kg so these can be removed in an additional dredging pass (or a third pass if necessary).

- Discern and map the extent to which the EoC has been accurately identified and interpolated as a basis to review the success of GE's application of the adjusted terrain model and other pertinent data to meet the capping limits set forth in the Phase 2 EPS.

- Provide data to evaluate the success of the remediation in attaining the true EoC and to provide a basis to adjust the design dredge elevation in subsequent

CUs or CU sub-units to minimize the number of passes and amount of non-target sediment removed.

With certain exceptions, GE has the discretion to establish design dredge elevations for each dredging pass to meet, in the way GE deems most efficient, the specified limits on the total extent of area that may be capped in Phase 2 and on the extent of the area that may be capped due to the presence of PCB inventory. Based on the descriptions in the Phase 2 EPS and the Phase 2 PSCP Scope, the key features of the Phase 2 Residuals Standard include the following:

- GE will establish design dredge elevations, taking into account the results of the sediment re-coring efforts and uncertainty regarding the DoC. While EPA will not prescribe those elevations, GE's establishment of those elevations will need to consider that there are specified limits on the allowable amount of capping, as discussed at the end of this subsection.

- Dredging must be sufficient to achieve the design dredge elevation in at least 95 percent of each dredging sub-unit (or CU if no sub-units have been designated in that CU). GE will require the dredging contractor to inform GE of how the target dredge elevation is set in a CU or sub-unit and communicate that information to EPA.

- Once the dredge elevation requirement is met, sampling must be conducted to determine at what level PCBs remain, both at the surface and at depth.

- Unless otherwise approved by EPA, a second dredging pass to a newly defined dredge elevation will be conducted at all nodes where inventory or elevated concentration residuals are found after the first pass. For this purpose, "inventory" means sediments containing a Tri+ PCB concentration equal to or greater than 6.0 mg/kg in any 6-inch segment of the post-dredging core other than the uppermost 6-inch segment, and "elevated concentration residuals" means sediments with a Tri+ PCB concentration equal to or greater than 27 mg/kg in the 0-6 inch segment.

- Those CUs or sub-units with an average surface concentration, after dredging, of less than or equal to 1 mg/kg Tri+ PCBs and no inventory (as defined above) present can be backfilled.

- Exclusive of the nodes identified with inventory or elevated concentration residuals (as defined above), if, after the first dredging pass, one or more nodes in a CU or sub-unit have PCB concentrations in the top 6 inches which drive the average surface concentration of the CU or sub-unit above 1 mg/kg Tri+ PCBs, that node(s) must either be capped or re-dredged, at GE's discretion, subject to the capping limits described at the end of this subsection. In addition, if the average surface Tri+ PCB concentration of the CU or sub-unit after the first dredging pass exceeds 1 mg/kg, GE may, at its discretion, re-dredge nodes that might, if not re-dredged, cause the average surface concentration of the CU or sub-unit to exceed 1 mg/kg Tri+ PCBs after the second pass.

- Where a second dredging pass is performed in a given location and the elevation requirement is demonstrated to have been achieved, sampling will be conducted to determine if the location will be capped, backfilled, or re-dredged. Capping, rather than backfill, is required in the event that:

  1. The Tri+ PCB concentration in surface sediment (i.e., in the top 6 inches) at that node causes the average Tri+ PCB concentration for the dredged area to exceed 1 mg/kg;

  2. The Tri+ PCB concentration in surface sediment is greater than or equal 27 mg/kg; or

  3. Inventory is found (i.e., concentrations of Tri+ PCBs are greater than or equal to 6 mg/kg in segments deeper than 6 inches).

  However, if the sample results show that TPCB concentrations equal to or greater than 500 mg/kg are present at any depth in that location after a second pass, a third dredging pass must be performed there to a newly defined dredge elevation. In addition, if any of the three above-listed conditions is present, but there are no TPCB concentrations at or above 500 mg/kg, GE may, on a case-by-case basis, request EPA to allow the performance of a third dredging pass, rather than capping the area; and GE may conduct such a third dredging pass if EPA so approves.

- Special procedures must be followed in dredging areas within the navigation channel in consideration of the navigation requirements and maintenance dredging of the New York State Canal Corporation (NYS Canal Corporation).

- Special procedures must also be followed in shoreline dredging areas in consideration of shoreline stability.

- As part of the Phase 2 EPS, EPA has established limits on the amount of capping that will be allowed in Phase 2. The limits provide that the total area capped may not exceed 11 percent of the total area dredged during Phase 2, and that, within that limit, the total area capped due to the presence of inventory (i.e., Tri+ PCB contamination greater than or equal to 6.0 mg/kg in a segment below the top 6-inch segment) may not exceed 3 percent of the total area dredged during Phase 2. These two percentage limits are referred to as the "Percentage Capping Limits." Capping in the following types of areas will not count against the Percentage Capping Limits:

    1. Locations capped due to structural offsets;

    2. Locations capped due to the presence of cultural resources;

    3. Locations capped in shoreline areas;

    4. Locations capped due to bucket refusal (i.e., where the presence of bedrock or other hard bottom or rocky conditions prevents deeper dredging); and

    5. Locations capped due to the presence of exposed Glacial Lake Albany Clay (GLAC).

2.1.2.3 Dredging Productivity

The Phase 2 Productivity Performance Standard establishes seasonal production targets for Phase 2 of the dredging project and guides progress to promote its completion in a timely fashion. The Phase 2 EPS states that the Productivity Standard is subordinate to the Resuspension and Residuals Performance Standards. This standard does not specify a definite timeframe for the completion of Phase 2.

Under the Phase 2 EPS, the target for productivity in Phase 2 is a volume of 350,000 cy per year, which applies to the volume of sediments dredged, processed, and shipped off site in that year. The Phase 2 Productivity Standard also states that:

- Stabilization of shorelines and backfilling or capping, as appropriate, of areas dredged during a dredging season in Phase 2 must be completed by the end of the work season.

- All dredged materials must be processed and shipped for disposal by the end of each calendar year, rather than being stockpiled for disposal the following dredging season. This standard is subject to an extension in the event that delays attributable to disposal facility(ies) and/or rail carriers prevent such offsite shipments by the end of the calendar year.

The Phase 2 Productivity Standard states that productivity will be reviewed at the completion of each Phase 2 dredge season. This review will be performed by EPA field office staff, the GE project team, and the contractors before the end of the calendar year to identify potential revisions to both in-river and processing facility operations that will increase overall efficiency and productivity and ultimately reduce the overall project duration, if possible.

Finally, it should be noted that aquatic vegetation will be planted in the late spring following each dredging season.

2.1.3 Quality of Life Performance Standards

The Phase 2 QoLPS consist of performance standards applicable to air quality, odor, noise, lighting, and navigation. These standards are described in a document titled Hudson River PCBs Superfund Site Quality of Life Performance Standards, issued by EPA in May 2004 (EPA 2004b), as modified by a memorandum titled Quality of Life Performance Standards – Phase 2 Changes, issued by EPA in December 2010 (E&E 2010), and the revised SOW attachments identified in Section 1. (These standards, as so modified, are collectively cited as Phase 2 QoLPS.)

2.1.3.1 Air Quality Performance Standard

The Air Quality Performance Standard includes numerical standards for PCBs in ambient air and for opacity (the reduction of visibility from air emissions), and requires an analysis of achievement of the National Ambient Air Quality Standards (NAAQS) for several other air pollutants. Further information on each of these aspects of the standard is presented below.

PCBs

The QoLPS for air quality includes standards and "concern levels" (at 80 percent of the standard levels) for TPCB concentrations in the ambient air. There are separate concern levels and standards for residential and commercial/industrial areas. They are:

- For residential areas, a concern level of 0.08 micrograms per cubic meter (µg/m^3) and a standard of 0.11 µg/m^3, both as 24-hour average PCB concentrations
- For commercial/industrial areas, a concern level of 0.21 µg/m^3 and a standard of 0.26 µg/m^3, both as 24-hour average PCB concentrations

The points of compliance for attaining these standards and avoiding concern levels are the locations of residential or commercial/industrial receptors. During Phase 2, these standards and concern levels will remain in effect, but monitoring for in-river operations will be more focused on nearby receptors, and mitigation measures will be required only if exceedances of a standard persist for 3 consecutive days.

Opacity

Opacity is a quantification of the reduction in visibility resulting from air emissions. The air quality standard for opacity, based on New York State air regulations (6 New York Codes, Rules, and Regulations [NYCRR] § 211.3), is that opacity during project operations must be less than 20 percent as a 6-minute average, except that there can be one continuous 6-minute period per hour of not more than 57 percent opacity. This standard will remain in effect in Phase 2, although monitoring will be performed only in response to observations or complaints.

This standard covers vessels, vehicles, and equipment, unless otherwise exempt under 6 NYCRR § 211.3. This standard will not apply to the line-haul locomotive engines used by the rail carriers, which are subject to EPA's national standards governing opacity (40 Code of Federal Regulations [CFR] Part 92). However, it will apply to the locomotives used to operate the rail yard.

NAAQS

Under the Federal Clean Air Act, EPA has promulgated the NAAQS for several pollutants (known as "criteria pollutants") to protect public health and welfare. These include: respirable particulate matter (i.e., particulates less than 10 micrometers in diameter; PM_{10}), fine particulate matter (i.e., particulates less than 2.5 micrometers in diameter; $PM_{2.5}$), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and ozone (O_3).

An air quality modeling analysis conducted during the Phase 1 final design demonstrated that the emissions of criteria pollutants from in-river activities and processing facility operations during Phase 1 were not predicted to cause exceedances of the NAAQS. The Phase 2 PSCP Scope and Phase 2 CHASP Scope require GE to evaluate the need for a revised NAAQS analysis for Phase 2 to reflect any anticipated changes in operations or equipment that could affect emissions of these pollutants. GE has conducted such an evaluation for Phase 2, Year 1. That evaluation is presented in Attachment H and summarized in Section 3.10.2.

2.1.3.2 Odor Performance Standard

The primary odor of concern during dredging and sediment processing activities would result from hydrogen sulfide (H_2S) released by decaying plants and other organic material found in the river sediments. PCBs are odorless. The QoLPS for odor establishes a standard for H_2S to minimize unwanted odors from the project. The standard for H_2S is 14 $\mu g/m^3$ or 0.01 parts per million (ppm) as a 1-hour average.

In addition, the QoLPS for odor specifies a “concern level” consisting of the presence of uncomfortable project-related odors identified by project workers or an odor complaint from the public, and an “exceedance level” consisting of an exceedance of the numerical H_2S standard or “frequent, recurrent odor complaints related to project activities.” (Thus, the “exceedance level,” as defined in the Phase 2 QoLPS, can occur even in the absence of a measured H_2S level exceeding the numerical H_2S standard – i.e., if there are “frequent, recurrent odor complaints related to project activities.”)

2.1.3.3 Noise Performance Standard

EPA established the Noise Performance Standard to limit the effects of project noise on the community. EPA categorized project activities that have the potential to generate noise as either short-term or long-term. In terms of the anticipated activities for the 2011 season, short-term activities include dredging, operation of the Work Support Marina, and backfilling/capping, and long-term activities include sediment processing and rail yard operations at the sediment processing facility (which will last throughout the year).

In developing its QoLPS for noise, EPA considered the effects of daytime and night-time dredging and sediment processing activities near residential areas. For example, a more restrictive residential noise standard has been developed for night-time hours, from 10 p.m. to 7 a.m. This more restrictive standard also applies to mixed commercial and residential areas. The numerical noise criteria set forth in the QoLPS are expressed in decibels using the A-weighted scale (dBA). They are as follows:

- Short-Term Criteria (applicable to dredging, Work Support Marina operations, and backfilling/capping activities):

Location	Performance Standard
Residential – Night-time Standard (10:00 pm – 7:00 am)	65 dBA (maximum hourly average)
Residential – Daytime Control Level	75 dBA (maximum hourly average)
Residential – Daytime Standard	80 dBA (maximum hourly average)
Commercial/Industrial Standard	80 dBA (maximum hourly average)

- Long-Term Criteria (applicable to processing facility operations):

Location	Performance Standard (Maximum)
Residential Standard	65 dBA (day-night, 24-hour average) (after addition of 10 dBA penalty to night levels from 10:00 pm to 7:00 am)
Commercial/Industrial Standard	72 dBA (maximum hourly average)

The points of compliance for attaining these numerical criteria are the locations of residential or commercial/industrial receptors.

The QoLPS for noise defines the “concern level” as an exceedance of the residential control level, an exceedance of an applicable noise standard that can be easily and immediately mitigated, or receipt of a project-related noise complaint. It defines the “exceedance level” as an exceedance of an applicable noise standard that cannot be easily and immediately mitigated or as “frequent, recurrent noise complaints related to project activities.”

The control levels and standards listed above have been incorporated into the basis of design for Phase 2, Year 1.

Actions included in the design to meet the Noise Performance Standard are summarized in Section 3.10.4.

2.1.3.4 Lighting Performance Standard

To meet EPA's Productivity Performance Standard, in-river dredging and on-shore processing are expected to be performed 24 hours a day, 6 days a week, which will unavoidably require night-time lighting of work areas to protect worker safety and sufficiently illuminate equipment, transport routes, and operational areas. Lighting is measured in footcandles using a light meter. The QoLPS establishes the following numerical standards for lighting, which vary depending on the type of area affected:

- For rural and suburban residential areas: 0.2 footcandle
- For urban residential areas: 0.5 footcandle
- For commercial/industrial areas: 1 footcandle

The QoLPS for lighting defines the "concern level" as an exceedance of an applicable numerical standard that can be easily and immediately mitigated, or receipt of a project-related lighting complaint. It defines the "exceedance level" as an exceedance of an applicable lighting standard that cannot be easily and immediately mitigated or as "frequent, recurrent complaints related to project activities."

As noted in the QoLPS, the Lighting Performance Standard will not supersede worker safety lighting requirements established by the Occupational Safety and Health Administration (OSHA; EPA 2004b).

The standards listed above have been incorporated into the basis of design for Phase 2, Year 1.

In addition to these numerical standards, the Lighting Performance Standard references certain statutory and regulatory requirements pertaining to lighting. These include the following (EPA 2004b):

- 33 CFR § 154.570, which requires adequate fixed lighting for bulk transfer facilities at night-time and states that lighting will be located or shielded so as not to mislead or otherwise interfere with navigation

- 33 U.S. Code (USC) §§ 2020 through 2024, specifying various lighting requirements for vessels

The Phase 2 Design incorporates these requirements, as well as 33 CFR §§ 84-88, Annex I and Annex V, and the other requirements specified in the Navigation Performance Standard governing lighting on vessels.

Actions included in the design to meet the Lighting Performance Standard are summarized in Section 3.10.5.

2.1.3.5 Navigation Performance Standard

EPA developed the QoLPS for navigation, in consultation with the NYS Canal Corporation, to regulate project-related vessel movement on the river. The Navigation Performance Standard requires that project vessels comply with the applicable provisions of federal and state navigation laws, rules, and regulations. In addition, it contains a number of other requirements relating to the relationship between project-related vessel traffic and non-project vessels. These requirements include:

- Restricting access to work areas and providing safe access around them in the navigational channel, to the extent practical

- Notifying the NYS Canal Corporation of in-river project activities and providing information to the NYS Canal Corporation and/or United States Coast Guard (USCG) so that they can issue Notices to Mariners

- Providing the public with a schedule of anticipated project activities

- Scheduling project river traffic so that non-project traffic is not unnecessarily hindered, while at the same time allowing efficient project operations and considering project vessels as commercial vessels for navigation purposes

- Coordinating lock usage with the NYS Canal Corporation and its lock operators

- Establishing temporary aids to navigation, such as lighting, signs, and buoys, to maintain safe and efficient vessel movement

The Navigation Performance Standard includes two action levels – a concern level and an exceedance level, as described below.

- The concern level occurs if there is a deviation from the requirements described above and the deviation can be easily mitigated or if a project-related navigation complaint is received from the public.
- The exceedance level occurs if remedial activities unnecessarily hinder overall non-project-related vessel movement and create project-related navigation interferences or if there are frequent recurrent complaints from the public that project activities are unnecessarily hindering non-project vessel movement.

Actions included in the Phase 2, Year 1 Design to meet the Navigation Performance Standard are summarized in Section 3.10.6.

2.1.3.6 Monitoring and Reporting

Routine monitoring, reporting requirements, and action levels for additional monitoring under the Phase 2 QoLPS for air quality, odor, noise, and lighting are described in the 2011 RAM QAPP. Specific actions that will be taken to address exceedance of the criteria in the Phase 2 QoLPS and associated reporting requirements are discussed in the 2011 PSCP (GE 2011).

2.1.4 Water Quality Requirements

The Phase 2 WQ Requirements consist of:

1. Requirements relating to in-river releases of constituents not subject to the EPS; and
2. Substantive requirements for discharges from the sediment processing facility to adjacent surface waters (i.e., the Champlain Canal and Bond Creek).

These WQ Requirements are set forth in documents titled Substantive Requirements Applicable to the Release of Constituents not Subject to Performance Standards, Substantive Requirements of State Pollutant Discharge Elimination System Permit for Potential Discharges to Champlain Canal (land cut above Lock 7), and Substantive Requirements of State Pollutant Discharges to the Hudson River, all of which were provided by EPA to GE on January 7, 2005 (EPA 2005) – as well as in a set of substantive requirements provided by EPA to GE on September 14, 2006 relating to stormwater discharges to Bond Creek (EPA 2006a) – with the modifications to the first of the above-listed documents that are set forth in Section 6 of the Phase 2 EPS and the revised SOW attachments identified in Section 1. (The above-cited documents, as so modified, are collectively cited as Phase 2 Substantive WQ Requirements.)

The WQ Requirements for in-river releases are divided into acute WQ standards, which apply to near-field monitoring stations, and health-based standards, which apply to far-field monitoring stations. These are summarized below, followed by a summary of the substantive requirements for discharges from the sediment processing facility to adjacent surface waters (i.e., the Champlain Canal and Bond Creek).

2.1.4.1 Aquatic Acute Water Quality Standards at Near-Field Monitoring Stations

The Phase 2 WQ Requirements for near-field monitoring stations include aquatic acute standards for certain metals (some of which are dependent on the hardness of the water), which apply to the dissolved form of those metals. Hardness varies along the length of the project area and will result in a range of calculated standards. For example, based on limited available data, average hardness values from Corinth and Waterford range from 18 to 55 ppm, respectively. The resulting ranges of WQ standards are as follows (where applicable, the formulas for calculating the standards are in brackets):

- Cadmium – Aquatic Acute A(A): 0.6 micrograms per liter (µg/L) to 2.0 µg/L [(0.85) exp(1.128[ln (ppm hardness)] – 3.6867)]

- Lead – Aquatic Acute A(A): 14.4 µg/L to 50.4 µg/L [{1.46203 – [ln (hardness) (0.145712)]} exp (1.273 [ln (hardness)] – 1.052)]

- Chromium (total – Aquatic Acute A(A): 140 µg/L to 349 µg/L [(0.316) exp (0.819 ln (ppm hardness)) + 3.7256)]

- Chromium (hexavalent) – Aquatic Acute A(A): 16 µg/L

- Mercury – Aquatic Acute A(A): 1.4 µg/L

In addition, the WQ Requirements for near-field monitoring stations include water quality standards for pH and dissolved oxygen (DO), as specified in NYCRR Title 6, Chapter X, Part 703.3. They are:

- pH must not be less than 6.5 nor more than 8.5.

- DO levels must not have a minimum daily average less than 5.0 mg/L and must not, at any time, be less than 4.0 mg/L.

2.1.4.2 Health (Water Source) Standards at Far-Field Monitoring Stations

The WQ Requirements for far-field monitoring stations establish health (water source) standards for certain metals, which apply to the total form of the metals and are not hardness dependent. When monitoring for these standards is required at a far-field station (as described in the 2011 RAM QAPP and 2011 PSCP), the following health (water source) standards will apply:

- Cadmium (total): 5 µg/L

- Chromium (total): 50 µg/L

- Mercury (total): 0.7 µg/L

- Lead (total): 15 µg/L (New York State Department of Health [NYSDOH] action level), with a “trigger level” of 10 µg/L at Stillwater and Waterford (as stated in 10 NYCRR Section 5-1.41)

An exceedance of these standards and the NYSDOH action level will be deemed to occur if a concentration exceeding the standard/action level is measured in a single 24-hour composite samples from a far-field station.

2.1.4.3 Substantive Requirements for Discharges to Champlain Canal and Bond Creek

The WQ Requirements for discharges from the sediment processing facility to surface water include effluent limitations, monitoring requirements, response actions, and reporting requirements for such discharges. There are three surface water discharge locations at the processing facility.

1. Treated water from sediment dewatering operations and Type I stormwater (i.e., stormwater draining from areas where PCB-containing sediment is managed) will be discharged at Outfall 001 to the Champlain Canal (land cut above Lock 7).

2. During periods of overflow of the sedimentation basins at the processing facility, non-contact (Type II) stormwater will be discharged from Outfalls 002 and/or 003 to Bond Creek.

WQ Requirements for the discharge from Outfall 001 were set forth in the Substantive Requirements of State Pollutant Discharge Elimination System Permit for Potential Discharges to Champlain Canal (land cut above Lock 7) and Substantive Requirements of State Pollutant Discharges to the Hudson River, which were provided by EPA to GE on January 7, 2005 (EPA 2005). EPA provided GE with the substantive requirements for the Type II stormwater discharges to Bond Creek on September 14, 2006 (EPA 2006a). All of these requirements will continue to apply to Phase 2 and thus will be followed during processing facility operations in 2011. This specific effluent limits for these discharges, as well as the associated monitoring requirements, response actions, and reporting requirements, will be presented in the 2011 PSCP.

2.1.4.4 Monitoring and Reporting

The monitoring requirements and action levels for additional monitoring for water quality are described in the 2011 RAM QAPP. Specific actions that will be taken to address the WQ Requirements and reporting requirements are described in the 2011 PSCP.

2.1.5 Turbidity Requirements

In addition to the Phase 2 WQ Requirements described in Section 2.1.4, the New York water quality regulations contain a standard of no increase in turbidity that would "cause a substantial visible contrast to natural conditions" (6 NYCRR § 703.2). Although this standard was not included in the WQ Requirements issued by EPA for this project, GE and EPA (after consultation with the New York State Department of Environmental Conservation) have agreed that this standard will be satisfied during Phase 2, Year 1 through application of a turbidity limit of 350 nephelometric turbidity units (NTU), as a 24-hour average measured at the near-field transect stations 300 meters downstream of dredging operations. However, a turbidity measurement above that level will be considered an exceedance of the standard only if a second 24-hour turbidity measurement confirms the initial 350 NTU exceedance. This will be considered an Advisory Level, and responses to a confirmed exceedance of that level will be the same as those for the TSS Advisory Level described in Section 2.1.2.1.

2.2 Summary of Phase 2 Design Support Activities

This section summarizes design support activities (e.g., design studies, design analyses, modeling) that were conducted to support the remedial design for Phase 2, Year 1. Additional details of the design support activities were presented in Section 2.2 of the Phase 2 IDR.

The dredge prisms for CU09 to CU16 were developed in the Phase 1 design; however, dredging was not completed in these CUs, and these areas are now included in the design for Phase 2, Year 1 dredging. As such, design support activities performed to support the Phase 1 remedial design in these CUs are also relevant to the Phase 2 Design for Phase 2, Year 1. The results of design support activities that were implemented during the Phase 1 Design are presented in the Phase 1 IDR and Phase 1 FDR, and are not repeated in this report. Additional data collected in CU09 to CU16 since the completion of Phase 1 have been used in the development of the design dredge prisms for Phase 2, Year 1 dredging.

2.2.1 Sediment Sampling and Analysis Program and Dredge Area Delineation

The physical and chemical characteristics of the river sediment samples collected in the Sediment Sampling and Analysis Program (SSAP) and Supplemental Engineering Data Collection (SEDC) Programs were used in development of the design for Phase 2, Year 1. The SSAP was initiated in October 2002, pursuant to the Administrative Order on Consent for Hudson River Sediment Sampling (Sediment Sampling AOC), effective July 26, 2002 (Index No. CERCLA-02-2002-2023; EPA/GE 2002). Additional sediment sampling for dredge area delineation was performed under the RD AOC, and was encompassed under the SEDC program (see Section 2.2.2). The results of the sampling activities were used in development of the Phase 1 DAD Report (QEA 2005) and the Phase 2 DAD Report (QEA 2007). The DAD Reports identified the dredge areas and quantified the volume and PCB mass targeted for removal. The delineation was based on criteria set by EPA for each river section.

Following approval of the Phase 1 DAD Report, additional sediment samples collected in near-shore areas were used to adjust the dredge area footprint and depth. These results were incorporated into the final design dredge prisms approved by EPA for Phase 1, and have been retained in the design dredge prisms for CU09 to CU16.

In addition, between September and November 2010, supplemental sediment sampling was conducted in areas targeted for dredging in Phase 2, Year 1 to provide additional data for delineating the DoC. The 2010 sediment sampling activities were conducted in accordance with the Supplemental Engineering Data Collection Work Plan for Sediment Sampling in Certification Units 09-16 and 19-30 (2010 SEDC Work Plan for Sediment Sampling; Anchor QEA 2010a). The results from this sampling program are summarized in the 2010 Supplemental Engineering Data Collection Data Summary Report (Anchor QEA 2011a). The data generated from the 2010 sediment sampling program were incorporated into the development of dredge prisms, along with previously collected data to establish the DoC and an associated EoC (described in Sections 2.3.1.1 and 3.1.6). The data generated from the 2010 sediment sampling program were also used to revise the estimate of PCBs mass to be removed in the areas targeted for removal during Phase 2, Year 1.

The mass used for design was developed using similar methods to those outlined in GE's Phase 1 Evaluation Report (Anchor QEA and ARCADIS 2010). These mass estimates were used to simulate resuspension during dredging (see Appendix C of this document). For the purposes of calculating percent release and assessing attainment of the Resuspension Performance Standard load criteria in the field in 2011, the mass removed will be re-calculated using the approach outlined in the Phase 2 EPS, with the modifications described in the 2011 PSCP, as approved by EPA.

The results of the sampling activities performed under the SSAP and SEDC programs are included in a database provided to EPA.

2.2.2 Supplemental Engineering Data Collection Program

SEDC activities have been performed to support development of the remedial design. The objectives of the SEDC Program are to fill engineering data gaps identified during evaluation of the SSAP data. SEDC activities have included infrastructure documentation, debris/obstruction surveys, select geophysical studies (e.g., magnetometer, multi-beam bathymetry, acoustic doppler [river velocity]), geotechnical studies in certain areas (e.g., test borings, cone penetrometer), and collection of sediment cores used to enhance the dredge area delineation (as described in Section 2.2.1).

SEDC activities performed and the findings of these activities are summarized in the following documents:

- Year 2 SEDC Interim Data Summary Report (Year 2 IDSR; BBL 2005a)

- Supplemental Engineering Data Collection Work Plan Addendum No. 1 (SEDC Work Plan Addendum No. 1; BBL 2005b)

- Supplemental Engineering Data Collection Work Plan Addendum No. 2 (SEDC Work Plan Addendum No. 2; BBL 2005c)

- Supplemental Engineering Data Collection Work Plan (SEDC Work Plan; BBL 2004b)

- Summary of Supplemental Investigations Performed in 2003 to Address EPA Comments on the Year 1 Data Summary Report: Side-Scan Sonar Groundtruth, Processing, Additional Fine-Grained Areas and Areas Lacking Side-Scan Coverage (QEA 2003)

- Phase 2 Supplemental Engineering Data Collection Work Plan (BBL 2006b)

- Phase 2 Supplemental Engineering Data Collection Work Plan Addendum No. 1 (ARCADIS BBL 2006)

- Phase 2 Supplemental Engineering Data Collection Data Summary Report (ARCADIS BBL 2007)

- Phase 2 Supplemental Engineering Data Collection Data Summary Report Addendum (Attachment D to ARCADIS 2008)

2.2.3 Phase 2 IDR Exclusion Areas

The Phase 2 IDR recommended that certain Phase 2 areas be excluded from dredging based on an assessment of engineering practicality. In support of these recommendations, exclusion areas SK_01_KX_C and SK_01_KX_D – located in CU27 – were identified for further delineation via probing to define the extent of the exclusion area. Four abandoned cores were located within or in the vicinity of proposed exclusion areas SK_01_KX_C and SK_01_KX_D, and several other samples in this area were reported as having shallow recovery. Based on side-scan sonar data, the portions of CU27 proposed for exclusion were mapped as Type IV sediment (transitional area) and immediately adjacent to Type V materials (extremely irregular subbottom typically associated with rocky areas – bedrock, boulders, and cobbles).

To further define the extent of proposed exclusion areas SK_01_KX_C and SK_01_KX_D, sediment probing activities were conducted during October 2009 and November 2010. The probing locations were accessed using a work boat, and the probing data were collected using a steel rod. The location of each probing point was determined using handheld global positioning system (GPS) equipment, and probing data (location, water depth, sediment depth/substrate) were documented.

The probing results are summarized in Table 2-1 and shown on Figure 2-1. The probing activities confirmed that thin layers of sediment or no sediment were present in portions of the proposed exclusion areas (and extending outside of the proposed exclusion area at the southern end of SK_01_KX_C). Thirty-eight of the probing locations were observed to contain less than 6 inches of sediment. Where sediments were found, they were observed to be underlain by hard bottom materials. The probing activities also identified locations where sediment deposits appear to be thicker (primarily at the northern portion of SK_01_KX_C and the eastern portion of SK_01_KX_D). The interpretation of these results is discussed in Section 3.1.4.

2.2.4 Baseline Monitoring Program

The Baseline Monitoring Program, as described in the Baseline Monitoring Program QAPP (QEA 2004), was conducted from 2004 through May 2009. The Baseline Monitoring Program water column monitoring was used to establish baseline conditions for river water quality to which future remedial action monitoring results can be compared.

To estimate the PCB mass flux passing the far-field monitoring station due to project activities, it is necessary to subtract the baseline mass flux from the total flux. The Baseline Monitoring Program was designed and implemented to provide baseline mass flux estimates for each month of the dredge season.

2.2.5 Treatability Studies

Treatability studies were conducted in 2004 and 2005 as part of the design process. Results of these studies were included in the Phase 1 IDR and Phase 1 FDR. No additional treatability studies were performed to support the design for Phase 2, Year 1.

2.2.6 Sediment Processing Facility Site Selection and Construction

EPA conducted a study to select the site for construction of the sediment processing facility (EPA 2004d). An approximate 110-acre parcel just east of the Village of Fort Edward and adjacent to the Champlain Canal above Lock 7 was selected (the Energy Park/Longe/NYS Canal Corporation site). The processing facility was constructed and used during Phase 1 to process dredged material and load the processed materials into railcars for offsite transportation and disposal. The processing facility will be used to dewater and process dredged sediment during Phase 2, Year 1.

2.2.7 Habitat Delineation and Habitat Assessment

Habitat delineation and habitat assessment were conducted in support of the project design to document the nature and distribution of habitats potentially affected by remediation, and to identify reference habitat locations that represent the distribution of existing conditions and that are not likely to be affected by remediation. The habitat delineation and habitat assessment information relating to Phase 2 areas was presented in the Habitat Delineation Report (HD Report; BBL & Exponent 2006) and the Habitat Assessment Report for Phase 2 Areas (Phase 2 HA Report; Anchor QEA 2009).

For the Phase 2 Design, the Upper Hudson River was delineated into four different habitat types – unconsolidated river bottom, aquatic vegetation bed (submerged aquatic vegetation [SAV]), shoreline, and riverine fringing wetlands (RFW), as described in the Habitat Delineation and Assessment Work Plan (HDA Work Plan; BBL 2003b), which is an attachment to the RD AOC. Data were collected in Phase 2 areas from all four habitat types and used in developing the habitat construction design. Detailed habitat maps are included in the HD Report. The results of the detailed habitat assessment of Phase 2 areas are presented and discussed in the Phase 2 HA Report, which was approved by EPA on July 24, 2009.

Subsequent to the approval of the Phase 2 HA Report, formal delineations were conducted for wetlands in Phase 2 areas. The wetland delineation sheets, figures depicting the wetland locations, and brief descriptions of each wetland were provided in the Wetland Delineation Report for Phase 2 Areas (Anchor QEA 2011b). For areas to be dredged in Phase 2, Year 1 and other RFW areas in River Section 1, those wetland boundaries will be used to identify the extent of wetland areas to be constructed following dredging. For River Sections 2 and 3, wetland boundaries will be re-checked in the year before dredging is planned for those areas.

2.2.8 Biological Assessment and Concurrence by Resource Agencies

In January 2006, E&E completed the Final BA (E&E 2006) on behalf of EPA. The primary purpose of the Final BA (developed after a review of comments received on a May 2005 draft) was to evaluate the potential direct, indirect, and cumulative impacts of the remedial action on two threatened and endangered species identified as potentially present in the project area – the bald eagle and the shortnose sturgeon – and where deemed appropriate, to specify conservation measures designed to minimize impacts on those species. The overall conclusion of the Final BA was that the project "may affect, but is not likely to adversely affect," the bald eagle and the shortnose sturgeon.

The bald eagle was removed from the federal list of threatened and endangered species on August 9, 2007. Even though they are delisted, bald eagles are still protected by the Migratory Bird Treaty Act (MBTA; 16 U.S.C. 703-712, Ch. 128; July 13, 1918: 40 Stat. 755), the Bald and Golden Eagle Protection Act (BGEPA; 16 U.S.C. 668-668d), and the New York State Environmental Conservation Law. On November 10, 2009, new rules under the BGEPA (74 Fed. Reg. 46836) went into effect. The bald eagle conservation measures described in the Final BA anticipated delisting and reflect recommendations in the National Bald Eagle Management Guidelines (USFWS 2007) and substantive requirements under BGEPA. Those conservation measures have been incorporated into the design (listed below) and will be implemented during Phase 2.

As summarized in the Phase 2 IDR, the relevant resource agencies (United States Fish and Wildlife Service [USFWS] and National Oceanic and Atmospheric Administration [NOAA] Fisheries) issued letters to EPA concurring with the Final BA's conclusion that the remedial action is not likely to adversely affect either species. The USFWS letter was dated January 20, 2006, and the NOAA Fisheries letter was dated December 23, 2005. The Final BA noted that EPA will coordinate with those agencies (as well as with NYSDEC, with respect to the bald eagle) as necessary throughout the implementation of the project if there are any unexpected developments that may affect either species.

As discussed in the Final BA, the bald eagle population that uses the northern segment of the Phase 2 dredge areas consists primarily of wintering eagles, although two new nesting pairs (identified in 2005) are located near Lock 1 and the Green Island area. Direct take (i.e., physical injury or death) of bald eagles is not expected as a result of the remedial action, and dredging and construction are not anticipated to disrupt nesting, breeding, foraging, or roosting activities. While there may be some loss of potential foraging or roosting trees and dredging may “flush out” eagles in the short term, the eagles are expected to readily acclimate to the changes because suitable habitat beyond the locations impacted by the project is widely available. The Final BA concludes that the “potential impacts are considered to be either discountable or insignificant.” The Final BA also states: “Overall, the bald eagle is expected to be positively affected by the proposed remedial action.” Additionally, the Final BA specifies that, although potential impacts of the remedial action on the bald eagle are expected to be minimal, a variety of conservation measures should be incorporated into the project design to further minimize impacts throughout the duration of the remedy. The conservation measures specified in the Final BA that are relevant to the remedial design include the following:

- EPA and GE will coordinate with the USFWS and NYSDEC in late winter or early spring of each dredge season to determine if a bald eagle nest has developed within 4,000 feet (1,200 m) of the sediment processing facility or areas targeted for dredging. Appropriate measures will be developed to avoid/minimize disturbance to nesting eagles.

- EPA will work with GE to schedule dredging activities in the vicinity of the site of any newly discovered nesting pairs after October 1 (or another date acceptable to the USFWS and NYSDEC) to minimize disturbance to nesting pairs.

- Operation of the processing facility and in-river dredging-related work will be implemented during periods least likely to affect the bald eagle. The majority of construction activities, including any tree clearing, also will be performed outside of the bald eagle wintering period (defined as occurring from December through March), and no tree cutting will proceed until the immediate area is clear of eagles.

- Potential perching or roosting trees within NYS-classified bald eagle critical habitat areas will not be removed during dredging activities. Preservation of potentially suitable perching, roosting, and nesting trees throughout the study area will be a priority to ensure that tree removal does not directly or indirectly impact eagles.

The shortnose sturgeon is not present in any of the Phase 2 dredge areas. The shortnose sturgeon was only retained in the Final BA because it was found to occur in proximity to one of the final two sites then being considered for the sediment processing facility construction (the OG Real Estate site). However, the processing facility was constructed at a different location, the Energy Park site in Fort Edward, New York, and that facility will be used for Phase 2, Year 1. Hence, there will be no impact on the shortnose sturgeon.

2.2.9 Phase 2 Cultural and Archaeological Resources Assessment Program

Archaeological resource assessments have been completed to document terrestrial and underwater archaeological resources that could be affected during the dredging operations. These are summarized in the following documents:

- Phase 1 Archaeological Resource Assessment Report (Phase 1 ARA Report; URS 2005)
- Terrestrial Archaeological Survey and Testing Report: Addendum I to the Archaeological Resources Assessment Report for Phase 1 Dredge Areas (URS 2006a)
- Underwater Archaeological Survey Report: Addendum II to the Archaeological Resources Assessment Report for Phase 1 Dredge Areas (URS 2006b)
- Archaeological Resources Assessment Report for Phase 2 Dredge Areas (Phase 2 ARA Report; URS 2008)
- Terrestrial Archaeological Resources Survey Work Plan for Phase 2 Dredge Areas in the Thompson Island Pool (URS 2009), including Addendum No. 1 to the work plan (URS 2010a)
- Underwater Archaeological Resources Survey Work Plan for Phase 2 Dredge Areas in the Thompson Island Pool (URS 2010b)
- Terrestrial Archaeological Survey and Evaluation for the Thompson Island Pool Section of the Phase 2 Dredge Areas (URS 2011)

In the areas targeted for dredging during Phase 2, Year 1, two areas have been designated as Sensitive Archaeological Shoreline areas based on archaeological resource assessments that have identified riverbank areas containing one or more significant archaeological resources. In addition, one area has been designated as a Sensitive Archaeological River Bottom area based on in-river areas containing one or more significant archaeological resources. The following sensitive archaeological areas have been identified in the area targeted for dredging during Phase 2, Year 1:

- *Sensitive Archaeological River Bottom:* located in the vicinity of Underwater Archaeological Resources U-8, U-9, and U-10 identified near the southwestern shoreline of Rogers Island.

- *Rogers Island Sensitive Archaeological Shoreline*: located in the vicinity of Archaeological Resources U-3 and U-4 identified near the southern tip of Rogers Island.

- *Area L Sensitive Archaeological Shoreline:* located along the western shore of the river on the NYSDEC boat ramp property, just south of Rogers Island. Archaeological investigations identified a multi-component archaeological site (state site #A09113.000072) in this area, including the presence of deeply buried prehistoric deposits and the cellar hole of a historic building. Subsequent field testing uncovered the foundation of a 19th century outbuilding of the historic Jones/Rogers estate and numerous prehistoric artifacts and features.

These sensitive archaeological areas are identified on Figures 2-2 and 2-3. The potential effects of dredging, backfilling/capping, and habitat construction on these resources have been evaluated during the remedial design, and measures to protect these resources are described in Sections 2.3.1.9 and 3.1.5.

2.2.10 Phase 2 River Hydrodynamic Analysis

Analyses were conducted to characterize river hydrodynamics within the Phase 2 dredge areas to define the likely range of in-river conditions that would be encountered in the project area. The hydrodynamic analyses were conducted using a two-dimensional, vertically averaged hydrodynamic model, which accounts for spatial variations in bathymetry and river velocity, as well as temporal changes in river flow rate. This model, its calibration, and its validation are summarized in Attachment D to the Phase 2 IDR.

The hydrodynamic model and the predicted river flow characterization (both velocity and flow volume) were used in the evaluation and design of dredging, resuspension, backfilling/capping, and habitat construction. The hydrodynamic model has not been updated because it was included in the Phase 2 IDR. Changes to the hydrodynamic model to account for post-dredging bathymetric conditions are unlikely to significantly affect predicted velocities.

2.2.11 Phase 2 Logistics Modeling

A logistics model was developed to simulate dredging, backfilling/capping, and dredged material transport to the sediment processing facility and ultimately to the disposal facility. Based on lessons learned during implementation of the Phase 1 project, the logistics model presented in the Phase 2 IDR has been updated and expanded using a new simulation software to better meet the challenges of modeling the multi-pool, multi-year Phase 2 dredging project.

The model has been used to provide insights into various design scenarios. Specific attributes offered by the logistics model include:

- The model is able to evaluate scenarios such as the effect of adding or removing project resources (e.g., dredges, barges, tugs, train sets, offloading equipment).

- The model can be used to support adjustments to the proposed design, including the evaluation and development of dredge plans and resource allocations.

- The model allows for a variety of conditions and constraints to be simulated to assess potential bottlenecks in the dredging, dredged material transport, and restoration activities.

- The model can also be used as a tool for predicting time-based logistical information, such as the movement of project vessels and the impact of recreational traffic on interactions with locks, accumulation of processed material, and rail movement to the disposal site.

An overview of the model, how it was constructed and used, and a summary of the revisions to the model since the Phase 2 IDR are provided in Attachment A. In addition, a description of the model evaluations that were developed to simulate Phase 2, Year 1 project activities is provided in Section 3.1.7 and in Attachment B. Output data generated during the logistics model effort are provided in Attachment B.

This model is a design tool that will be updated year-to-year as appropriate.

2.2.12 Resuspension Modeling

For the final design for Phase 2, Year 1 operations, the effects of sediment and PCB releases during dredging operations on water column PCB concentrations and net

PCB loads (i.e., loads over background) were estimated using a mechanistic mathematical model. This model is an updated version of the model previously described in The Upper Hudson River PCB Modeling System (Anchor QEA 2010b). It simulates the transport and fate of resuspended sediment and PCBs from dredge areas during the dredging season, accounting for mixing, settling, adsorption-desorption, and volatilization. Revisions to the baseline portion of the Upper Hudson Model are currently underway, including:

- Implementation of a revised sediment transport model with updates to the particle size class definitions, the bed grain size characteristics, and the composition of the incoming solids load, and which uses a more sophisticated, layered bed model in non-cohesive areas.

- Implementation of a kinetic PCB fate and transport model which allows simulating the adsorption/desorption process explicitly, and which also incorporates revised values of fraction organic carbon (class-specific in the bed and reach-specific in the water column).

The technical improvements to the dredging portion of the model, as well as the overall Upper Hudson Model, are currently under review by EPA.

A description of the model used to estimate resuspension is provided in Attachment C. A summary of the results of the resuspension modeling and description of how results were incorporated into the remedial design are provided in Section 3.3.

2.3 Basis of Design Summary

This section presents the technical basis of design for Phase 2, Year 1. The Critical Phase 2 Design Elements (Phase 2 CDE; Attachment A to the 2010 SOW) summarizes key decisions affecting critical elements of the design to be included in this FDR (or addenda) and serves as the basis of design for several significant design issues.

Specific basis of design information is summarized in the following tables:

- Table 2-2 – Basis of Design for Dredging and Dredged Material Transport

- Table 2-3 – Basis of Design for Resuspension Control

- Table 2-4 – Basis of Design for Backfilling/Capping and Habitat Construction
- Table 2-5 – Basis of Design for Processed Sediment Transportation and Disposal

In addition, key basis of design information for Phase 2, Year 1 is summarized below.

2.3.1 Dredging and Dredged Material Transport

Dredging is the first step of the sediment removal and disposal process. The dredging production rate and characteristics of the dredged material will affect subsequent project elements, including resuspension, the amount of solids and water requiring transport to the processing facility, sediment processing, water treatment, sediment transport and disposal throughput rates, and the rate at which dredged areas can be backfilled or capped. The basis of design for Phase 2 dredging and dredged material transport is summarized in Table 2-2 and in the subsections below.

2.3.1.1 Dredge Area Delineation and Prism Development

The dredging design process begins with the delineation of dredge areas. Dredge area delineation is a multi-step process and includes the identification of both the horizontal and vertical extents of dredging. Reports that provide the details of data collection and dredge area delineation are cited in Section 2.2.1.

Dredge prisms for Phase 2, Year 1 were developed by a process that is detailed in Section 2.4 of the Phase 2 CDE. In summary, the following analyses were conducted to develop the dredge prisms:

- Incorporating of the 2010 data into the sediment sample database, after accounting for changes in the sediment bed elevation between the 2005 bathymetric survey and sediment bed elevations measured during the core collection in 2010
- Determining the estimated DoC to the 1 mg/kg vertical horizon using core chemistry data using an interpolator
- Delineating areas GLAC, and determining where data indicate the elevation of GLAC defines the EoC

- Manually adjusting the results of the interpolation so depths are consistent and conservative (i.e., intended to increase the likelihood of achieving the 1 mg/kg target PCB concentration), taking into consideration bathymetry, historical information, and sub-bottom conditions

- Incorporating engineering adjustments such as slopes, shoreline, and structural offsets into the EoC surface to develop the final dredge prisms

The EoC surface was developed in accordance with Steps 1 through 3 of the dredge prism process specified in the Phase 2 CDE (as summarized in the first four bullets above). The results are more fully described in Attachment D.

Engineering considerations (the fifth bullet above) incorporated into the EoC surface to develop the final dredge prisms for Phase 2, Year 1 are described in Section 3.1.6 and Attachment E.

The dredge prisms for Phase 2, Year 1 were developed using multi-beam bathymetry surveys conducted in 2005, 2006, and 2009 along with elevation data collected during the 2010 sediment sampling activities. For future years of Phase 2, the multi-beam bathymetry surveys conducted in 2005, 2006, and 2009 will be used to develop the dredge prisms for the remainder of River Section 1 along with elevation data collected during supplemental sediment sampling conducted to provide additional data for delineating the DoC. For River Sections 2 and 3, multi-beam bathymetry surveys will be conducted and compared with the single-beam bathymetry data previously collected to support the design and the development of dredge prisms for those areas.

2.3.1.2 Dredge Areas Targeted for Phase 2, Year 1

The delineated dredge areas have been divided into CUs (CU01 to CU100) that were defined in accordance with guidelines presented in the Residuals Performance Standard (EPA 2004a). In general, each CU is approximately 5 acres in size.

Eighteen CUs (CU01 through CU18) were included in the approved Phase 1 design and initially targeted for removal during Phase 1. However, dredging operations during Phase 1 were not completed in CU09 through CU16. As such, dredging operations associated with CU09 through CU16 will be incorporated into Phase 2 of the remedial action.

The Phase 2 Productivity Standard targets the removal of 350,000 cy per year (EPA 2010a). The design for Phase 2, Year 1 includes dredging of CU09 through CU16 and CU19 through CU30 (referred to as "CU09 to CU30" for remainder of this report). The volume of sediment identified for removal by the "EoC surface" (described in Sections 2.3.1.1 and 3.1.6 and Attachment D) is approximately 342,500 cy for CU09 to CU30. The volume of sediment identified for removal in the design dredge prisms (described in Section 3.1.6 and Attachment E) is approximately 338,900 cy for CU09 to CU30. Table 2-6 summarizes the areas and design inventory volumes for CU09 to CU30.

Figure 2-4 shows the dredge areas targeted for removal during Phase 2, Year 1 in relation to the Phase 1 dredge areas, Lock 7, the sediment processing facility, and other project support areas (the Work Support Marina, Moreau Barge Loading Area, and General Support Property). Figure 2-5 shows CU09 to CU30 and the acreage for each CU.

The areal extent and volume of sediment that will be dredged during Phase 2, Year 1 will be dependent on several factors, which are discussed in Section 3.1.2.

2.3.1.3 Dredge Type

Consistent with Phase 1 and the Phase 2 CDE, dredging in Phase 2, Year 1 will be conducted using mechanical excavator-mounted, hydraulically closing environmental clamshell bucket dredges. Use of mechanical dredge equipment is expected to be the most effective and productive dredging technique for the areas targeted for dredging during Phase 2, Year 1.

Alternate dredge types may be considered in future design submittals for Phase 2, if appropriate.

2.3.1.4 Shoreline Definition

The elevation of the shoreline in the TIP (Reach 8; River Section 1) was initially based on aerial photos taken in the spring of 2002 and represents a river flow of approximately 5,000 cfs at Fort Edward, which corresponds to an elevation of about 119 feet (North American Vertical Datum of 1988 [NAVD88]). The exact river flow varies depending on the date and time photos were taken in different parts of the river. In fall 2008, a land survey of the 119-foot shoreline elevation was conducted for River Section 1, and a revised shoreline was defined for River Section 1 areas based on the surveyed location of the 119-foot elevation. This revised 119-foot shoreline has been incorporated into the basis of the design as the horizontal limit of dredging, backfilling, and habitat construction for River Section 1. The electronic data file of the shoreline coordinates is provided on the CD-ROM included with this report.

2.3.1.5 Near-shore Area Definition

EPA, as part of its review of the Phase 1 Design (EPA 2006b), selected the "in-river" boundary for the restoration of near-shore bathymetry. For Phase 1 areas, which were all in Reach 8, this "in-river" boundary was defined as 117.5 feet (NAVD88), which corresponds approximately to the flow event that occurs once every 3 years (1Q3; flow of 1,100 cfs at the United States Geological Survey [USGS] Fort Edward gage).

The near-shore boundary is defined as the 117.5-foot elevation for all dredge areas in Phase 2, Year 1. The near-shore area is defined as the area between the shoreline (119 foot elevation) and the 117.5-foot near-shore boundary elevation. Near-shore setpoints were established at intervals of approximately 100 feet, and at points of inflection, along the 117.5 ft contour line based on the 2005/2006 bathymetry survey data. The near-shore border extends between the near-shore setpoints to approximate the 117.5 feet bathymetric contour, but is not necessarily at elevations of 117.5 feet at all locations between the setpoints. Figures showing the near-shore setpoints and near-shore border relative to the 117.5 ft contour line are provided in Attachment I.

In addition, see Section 2.3.3.3, which describes the basis of design for placement of near-shore backfill. The electronic data file of the near-shore boundary is provided on the CD-ROM included with this report.

2.3.1.6 Dredged Material Transport

The basis of design for dredging and dredged material transport includes the use of hopper barges for transporting dredged materials to the sediment processing facility. The dredged material will be transported to the sediment processing facility, which is located on the Champlain Canal between Lock 7 and Lock 8. It is assumed that both dredged material transport and the locks will be operating 24 hours per day, 7 days per week for approximately 28 weeks (from early May through late November).

Based on NYS Canal Corporation design records, the lock length available for vessels is 300 feet. The project vessels used in material transport include both tug boats and barges. The hopper barge sizes that are expected to be used for this project are approximately 195 feet long by 35 feet wide. In certain shallow water areas, the use of smaller capacity barges, which require less draft, is anticipated. Dredged material loaded onto shallow draft barges would be transferred to larger hopper barges prior to transport to the sediment processing facility. The cycle time for Lock 7 was measured during the Phase 2 design and confirmed during Phase 1 implementation. The lock cycle time is approximately 20 minutes to move from an open position on the high-head side of the lock to an open position on the low-head side of the lock and approximately 20 minutes to reverse. These durations are input into the logistic model, along with an allowance for vessels to exit/enter the lock. The maximum number of daily lockages (one-way) based on the mechanical and logistical limitation of Lock 7 is assumed to be 48. This will be further tested in Phase 2.

2.3.1.7 Dredge Season

The duration of the dredge season has been assumed to be 120 dredge days and is constrained by the NYS Canal Corporation operating schedule (opening of the lock system in early May and closing of the locks by November 15) and the need to conduct post-removal sampling, backfilling/capping, decontamination, and demobilization before the canal system closes.

The assumed 120-day dredge season is based on dredging 6 days per week for 22 weeks from mid-May to mid-October. It assumes that dredging will not occur on Sundays and that no dredging will occur on three holidays during the dredge season (Memorial Day, Independence Day, and Labor Day). The 120-day dredge season assumption also includes an additional 9 days of downtime for in-river operations due to high-flow conditions, inclement weather, or other shutdowns. The actual number of operational days may differ.

2.3.1.8 Air Mitigation BMPs

In accordance with the Phase 2 CDE, air mitigation BMPs will be implemented in areas with potential to emit PCBs to the air at levels close to or exceeding the air quality standard based on the following criteria:

- Areas with an average total PCB concentration in the sediment of greater than 150 mg/kg over a 1-acre area;
- Areas with low water velocities (near the shore or in backwater areas); and
- Areas within 1,000 feet of a receptor.

Additional areas were considered for air mitigation BMPs based on the results of previous air modeling conducted as part of the Phase 1 FDR and the Phase 2 IDR. Based on this review, an area located along the eastern shoreline of CU24 and CU25 was identified as an air mitigation BMP area.

As required by the Phase 2 CDE, the air mitigation BMPs will include the following to reduce PCB emissions from these areas:

- Fully covering sediments contained in a barge with water;
- Alternatively, for sediments from areas with average total PCB concentrations greater than 150 mg/kg over a 1-acre area, fully covering those sediments in a barge with sediments from other areas with lower PCB concentrations (i.e., less than 150 mg/kg total PCB); and
- Retaining 5 feet of freeboard in the barge or else using a wind screen.

An additional BMP to reduce PCB emissions will include the prioritization for transport to the processing facility and unloading of barges containing sediments with high PCB concentrations (i.e., sediments from a 1-acre area with average total PCB concentrations greater than 150 mg/kg).

BMPs will also be implemented in dredge areas where measured PCB concentrations at a nearby receptor show an exceedance of the applicable air quality standard on 3 consecutive days, as described in Section 6.5.2 of the 2011 PSCP (GE 2011). These BMPs could also include, where appropriate, moving sediment transloading locations described in Section 3.2.1 farther away from receptors.

2.3.1.9 Archaeological Site Protection Measures

Areas designated as Sensitive Archaeological Shorelines and Sensitive Archaeological River Bottom are shown on the Drawings based on the findings of previous archaeological assessments (see Section 2.2.9).

The following archaeological site protection measures will be taken to ensure that the shoreline remains stable during dredging and restoration in areas designated as Sensitive Archaeological Shoreline Areas:

- The Dredging Contractor will be required to provide sufficient notice prior to conducting work in the vicinity of Sensitive Archaeological Shoreline areas.

- Prior to initiation of dredging operations, the Dredging Contractor will be required to mark the areas of Sensitive Archaeological Shorelines with distinctive buoys or other appropriate visual markers.

- A minimum shoreline offset of 10 feet will be applied in areas designated as Sensitive Archaeological Shorelines. This offset has been incorporated into the design dredge prisms (as described in Attachment E).

- If necessary, trees on the bank will be removed by hand using chainsaws. The root balls will be left in place to assist with bank stabilization. The offset may be increased in the field, if approved by EPA, to eliminate need to remove trees from sensitive shorelines.

- No backfill will be placed on the riverbank above the shoreline in Sensitive Archaeological Shoreline areas. Dredge areas that are off-shore from, but adjacent to, Sensitive Archaeological Shorelines will be backfilled to provide stability.

- Vessel speeds will be minimized when work is being conducted adjacent to Sensitive Archaeological Shorelines.

The following archaeological site protection measures will be taken during dredging and restoration in areas designated as Sensitive Archaeological River Bottom:

- The Dredging Contractor will be required to provide sufficient notice prior to conducting work in the vicinity of Sensitive Archaeological River Bottom areas.

- The dredge prism will include a setback and stable slope for underwater areas that are determined to be archaeologically sensitive and where avoidance is the applicable mitigation measure. This offset has been incorporated into the design dredge prisms.

- No work, including debris removal, dredging, backfill/cap placement, or mooring or anchoring of project vessels, will be conducted in areas designated as Sensitive Archaeological River Bottom.

- Prior to initiation of dredging operations, the Dredging Contractor will be required to mark the boundaries of Sensitive Archaeological River Bottom in the river with distinctive buoys or other appropriate visual markers.

- Vessel speeds will be minimized when work is being conducted adjacent to Sensitive Archaeological River Bottom.

If, during the dredging operations, potentially significant cultural resources are identified in areas where resources were not previously identified, activities in the immediate area that may damage or alter such resources will be halted and EPA will be notified. Additionally, in the event that human remains are discovered, work that may damage or alter these remains will be halted in the immediate area, and the local law enforcement agency, medical examiner, and EPA will be notified.

In addition, the Dredging Contractor will be required to notify the Construction Manager if debris encountered during debris removal or dredging extends into the riverbank in any dredge area. The Dredging Contractor will be instructed not to remove debris that extends into the riverbank unless otherwise directed by the Construction Manager, in consultation with EPA.

2.3.2 Resuspension Control

In accordance with the Phase 2 CDE, certain resuspension control BMPs are to be implemented during all in-river operations. In addition, if there is an exceedance of the Control Level for total PCB concentrations or Tri+ PCB net loads (measured as daily percent release) under the Resuspension Standard, contingent resuspension control BMPs may be required to be implemented. The resuspension control BMPs consist of operational controls to minimize the sediment resuspension and the release of PCBs. BMPs have also been developed for containing sheens of oil that are released from the sediment during the dredging operations.

The specific basis for the resuspension control design for Phase 2, Year 1 is presented in Table 2-3 and described below.

2.3.2.1 Resuspension Control BMPs

The following resuspension control BMPs will be implemented during all dredging operations in Phase 2, Year 1:

- Minimizing bucket bites
- Maintaining bucket closure unless prohibited by debris
- Maintaining expeditious movement of the closed bucket to the receiving barge after completing a cut to reduce water leakage from the clamshell bucket into the river, to the extent practicable
- Prohibiting “re-handling” or stockpiling of material on the river bottom
- Prohibiting dragging the bucket to level the dredge cut
- During pre-dredge debris removal, minimizing the number of attempts to remove an object
- Prohibiting raking for debris removal
- Avoiding the grounding of barges, and allowing water levels to rise before attempting to free grounded vessels
- Use of equipment appropriate for the water depth of the work area
- Deployment of oil/sheen control materials (containment booms and adsorbents) proactively (before dredging begins) in areas with average PCB concentrations greater than 200 mg/kg
- Limiting tug propeller revolutions per minute (RPMs)
- Prohibiting barge overflow
- Controlling the rate of placement of backfill and capping materials to minimize downstream transport

The Phase 2 CDE also included a requirement to promptly apply an initial 3 to 6 inches of sand or backfill cover after the final dredging pass has been completed in a 1-acre sub-unit and post-dredging samples have been collected. Based on further discussions with EPA after issuance of the Phase 2 CDE, placement of an initial cover material layer will not be required. Instead, unless there is evidence that a third dredge pass may be necessary (e.g., to address areas with total PCB concentrations greater than

500 ppm), direction will be provided to the Dredging Contractor after completion of the second dredge pass to promptly place backfill in compliant areas of the CU as indicated by the Construction Manager. When the results of the sediment sampling associated with the second dredge pass area are obtained, the Construction Manager will instruct the Dredging Contractor to promptly place backfill or a cap isolation layer in those areas.

2.3.2.2 Supplemental Resuspension Control BMPs

Additional contingency BMPs may need to be implemented if there is an exceedance of the Control Level for total PCB concentrations or Tri+ PCB net loads (measured as daily percent release). At a minimum, the contingency resuspension control BMPs that may need to be implemented include:

- Adjusting the sequence of dredging, including dredging areas with a low potential for resuspending PCBs (i.e., areas with low PCB concentration and/or low velocity) at the same time as high-potential locations

- Use of smaller equipment (i.e., with shallower draft and less powerful engines)

- Reducing the removal rate or temporarily suspend dredging if necessary (as stated in the Phase 2 EPS, in general a slowdown and evaluation of operations would be required before shutdown, with shutdown being the operational change of last resort)

- Restricting flow in areas where practical

2.3.2.3 Sediment Oil Sheen Response BMPs

The Phase 2 CDE requires that actions be taken to prevent, contain, and clean up oil sheens or evidence of non-aqueous phase liquid (NAPL) that are observed in the field. As part of the design for Phase 2, Year 1, a specification (Section 13871 – Sheen Response During Dredging Operations; see Appendix 2) has been developed to describe the Dredging Contractor’s requirements to address sheens and NAPL, including requirements for notification and reporting, development of a Sediment Oil Sheen Response Plan, implementation of BMPs, and sheen response actions if sheens are observed. Sheen control materials consisting of containment booms and adsorbents will be deployed proactively, before dredging begins, in areas with average PCB concentrations greater than 200 mg/kg.

2.3.2.4 Silt Curtains and Other Resuspension Control Barriers

In accordance with the Phase 2 CDE, silt curtains are not required to control resuspension except in specific circumstances identified by either GE or EPA. The use of silt curtains or other resuspension control barriers has not been identified for Phase 2, Year 1 operations. However, silt curtains and resuspension control barriers may be considered in future design for other Phase 2 dredge areas (e.g., for potential use in low flow or backwater areas) and, if proposed, they would be described in further Phase 2 design submittals.

2.3.3 Backfill/Cap Placement

The specific basis for the backfill/capping design for Phase 2, Year 1 is presented in Table 2-4 and described below. During Phase 1, a backfill processing area was established on the shoreline adjacent to CU09. This area will again be used in Phase 2, Year 1 to receive, blend, stage, and deliver backfill to barges.

2.3.3.1 Backfill/Cap Footprint

The total area targeted for dredging during Phase 2, Year 1 is approximately 98.1 acres for CU09 to CU30 (not including CU17 and CU18, which were completed during Phase 1). Dredged areas will be covered by backfill or cap material, based on residual sample results, except where backfill will not be placed in the navigation channel (as described below). As described in Section 2.1.2.2, the Phase 2 EPS limit the amount of capping that will be allowed in Phase 2. The limits provide that the total area capped may not exceed 11 percent of the total area dredged during Phase 2, and that, within that limit, the total area capped due to the presence of inventory (defined in Section 2.1.2.2) may not exceed 3 percent of the total area dredged during Phase 2. Capping in the following types of areas will not count against the Percentage Capping Limits: locations capped due to structural offsets, locations capped due to the presence of cultural resources, locations capped in shoreline areas, locations capped due to bucket refusal (i.e., where deeper dredging is prevented by bedrock or other hard-bottom or rocky conditions), and locations capped due to the presence of exposed GLAC.

In areas within the navigation channel, no backfill will be placed in the navigation channel unless the post-dredge elevation is below 101.7 ft (NAVD88). This elevation corresponds to a 15.5-foot water depth (the 14-foot post-backfill placement water depth required by the Phase 2 EPS plus the 12-inch thick backfill layer and the allowable backfill placement tolerance). For the areas targeted for removal during Phase 2, Year

1, approximately 32 acres of dredge areas within CU09 to CU30 are within the navigation channel. Within this area, approximately 22.6 acres are predicted (assuming dredging to the EoC) to have a post-dredging water depth less than 15.5 feet based on the design dredge prisms described as Attachment E.

Also, the areas that are not dredged due to offsets from riprap, culturally sensitive objects, and structures will not be covered, except for the area adjacent to Special Area 13 (see Section 3.4.2.3).

2.3.3.2 Backfill Layer Thickness

As required by the ROD (EPA 2002), dredged areas will be backfilled with approximately 1 foot of material, except in certain locations within the navigation channel, where no backfill material will be placed unless the post-dredge elevation is below 101.7 ft (NAVD88), and except as described in Sections 2.3.3.3 and 2.3.3.4.

2.3.3.3 Near-shore Backfill

In accordance with the Phase 2 CDE, near-shore backfill shall be used in River Section 1 to restore pre-dredge bathymetry between the 119 ft and 117.5 ft elevation (NAVD88) contours with supporting 3:1 (horizontal:vertical) side slopes. In River Section 1, the post-dredge surface will be returned to pre-dredge bathymetry by placing backfill from the point where the dredge prism intersects the shoreline (elevation 119.0 ft) laterally into the river to where the pre-dredge bed elevation equals 117.5 ft at near-shore setpoints, which are located along the pre-dredge bathymetric 117.5 ft elevation contour line.

2.3.3.4 Habitat Layer Backfill

In addition to the backfill to be placed over all dredge areas to a depth of 1 foot, additional backfill (hereafter habitat layer backfill) will be used for the creation of SAV beds in dredged areas that would otherwise no longer support such beds (i.e., deeper than 8 feet). Habitat layer backfill will be placed at locations that currently support SAV beds and have an elevation lower than 111 feet (NAVD88) after dredging and placement of the backfill layer or isolation caps is completed. The process for determining the locations for placement of the habitat layer backfill is presented in Attachment G.

Habitat layer backfill will be placed to either return the area to pre-dredging bathymetry or to an elevation of 114 feet (equivalent to a water depth of 5 feet below the 119 ft shoreline) based on the following:

- Areas with pre-dredging elevations between 111 feet and 114 feet will be returned to pre-dredging bathymetry.
- Areas with pre-dredging elevation between 114 feet and 117 feet will be returned to an elevation of 114 feet.

2.3.3.5 Riverine Fringing Wetland Construction Areas

RFW areas will be restored to pre-dredge bathymetry in areas where wetlands are disturbed during the dredging operations. A 1-foot layer of Type 3 backfill will be placed in RFW areas. If more than 12 inches of backfill is required to restore the wetland area to pre-dredge bathymetry, Type 2 material will be placed below Type 3 material. Supporting side slopes of 3:1 (horizontal:vertical) will be created extending from the edge of the RFW construction area down to the adjoining backfill surface.

2.3.3.6 Backfill Material Types

The choice of backfill type will be determined as follows:

- As in the Phase 1 design, Type 1 backfill material will be used in locations with estimated surface water velocities of 1.5 feet per second (ft/s) or less during a 2-year flow event, and Type 2 backfill material will be used in areas with estimated surface water velocities greater than 1.5 ft/s during a 2-year flow event.
- Only Type 2 backfill material will be placed in the navigation channel.
- Type 2 backfill material will be used for supporting side slopes associated with the placement of near-shore backfill, habitat layer backfill, and RFW construction areas.
- Type 2 backfill will also be designated for use as a base material layer for near-shore backfill and RFW construction areas.
- Type 3 backfill material will be used in the upper 1 foot of RFW construction areas.

The backfill material specifications are described in Specification Section 02206 (Backfill and Cap Material; Appendix 2).

2.3.3.7 Isolation Caps

The criteria requiring or allowing for installation of an engineered cap based on post-dredging residuals concentrations are set forth in the 2011 PSCP (GE 2011), subject to the capping limits discussed above.

The Phase 2 CDE describes the requirements of the cap design, one of which is the ability to isolate the contaminated sediments chemically such that the concentration of Tri+ PCBs in the upper 6 inches of the cap (excluding the stone armor layer) is 0.25 mg/kg or less in the long term, which is defined as 100 years for purposes of the chemical isolation modeling. The Phase 2 CDE also requires that the armor layer design be able to withstand a minimum 100-year recurrence interval flow event.

Caps located within the limits of the navigation channel are specified as the high-velocity cap design. The top elevation of caps within the navigation channel shall not exceed 103.2 feet (NAVD88) in River Section 1.

The isolation cap design analysis is summarized in Section 3.4.2 and detailed in Attachment F.

2.3.4 Habitat Construction

The specific basis for the habitat construction design for Phase 2, Year 1 is presented in Table 2-4 and described below.

The habitat construction design for each area is based on river velocity, water depth, the presence of SAV prior to dredging, and the presence of RFWs. The habitat construction designs presented in the Phase 2 IDR have been revised during Final Design to incorporate modifications due to changes to the Phase 2 CDE.

For SAV, specific areas were identified for planting (approximately one third of the designated SAV areas) or natural recolonization based on the anticipated post-dredging bathymetry and the results of an SAV model as described in Attachment H of the Phase 2 IDR. As described in the Phase 2 IDR, certain natural recolonization areas were identified as contingency SAV planting areas that may be used as planting areas based on actual post-dredging and backfill conditions.

RFW areas that existed prior to dredging will be reconstructed and planted after dredging.

A description of the habitat construction design is provided in Section 3.7.

2.3.5 Shoreline Stabilization

For the bank areas immediately below the defined shoreline elevation (i.e., 119.0-foot elevation in River Section 1), a shoreline construction framework was applied to minimize hardening of the shoreline. The framework was initially developed for and used in Phase 1 areas and is based on:

- The presence of shoreline structures including sheet piling, retaining walls, bridge abutments, boat launches, and outfalls
- The presence of maintained shoreline, including riprap, armor stone, and gabion baskets
- Thickness of dredge cut along the shoreline (shoreline areas with dredge cuts equal to or greater than 9 inches and shoreline areas with dredge cuts less than 9 inches)
- Property ownership along the shoreline, including whether the property is owned by the State of New York
- Proximity of the shoreline to the navigation channel

On October 20, 2008, GE and EPA conducted a field inspection to review the shoreline treatments proposed in the Phase 2 IDR for River Section 1 and obtain concurrence on the appropriate shoreline treatment for each area. Based on the experience during Phase 1, biologs will not be used to stabilize shorelines in Phase 2, Year 1, so the shoreline treatments have been modified in the areas that were previously designated to receive biologs. The shoreline treatment specified along the eastern shoreline of CU12 immediately south of Lock 7 was modified to be near-shore backfill at the NYS Canal Corporation's request.

Two shoreline treatment types have been retained in the final design for Phase 2, Year 1 – near-shore backfill and Type P armor stone. Additional information related to the shoreline stabilization design is provided in Section 3.8.

2.3.6 Sediment and Water Processing

The sediment processing facility constructed adjacent to the Champlain Canal between Lock 7 and Lock 8 is designed to offload debris and sediment from barges, separate debris and coarse material from the dredged sediment, and mechanically dewater the fine-grained sediment prior to shipment of the sediment off site to a disposal facility. Figure 2-6 shows a site plan of the sediment processing facility. That facility will be used for Phase 2, Year 1 operations. Water from the unloading, screening, and dewatering operations, along with stormwater collected from process areas, will be treated and discharged to the Champlain Canal.

Appendix E of GE's Phase 1 Evaluation Report (Anchor QEA and ARCADIS 2010) provides an overview of the processing, transport, and disposal elements as well as a detailed discussion of the processing and disposal results and productivity obtained during Phase 1.

One of the key findings of the Phase 1 evaluation was that the barge unloading rates were lower than anticipated in the Phase 1 design, which resulted in delays in returning empty barges to their dredge locations. The reduced average unloading rate appears to have been due to a number of factors, including the following:

- The cycle time for the grizzly and trommel feed chute was slower than planned.
- The amount of sediment in the barges was less than planned and the amount of water was greater than planned.
- Re-dredging passes in some dredge areas removed large amounts of clay, which resulted in the need to process at a slower rate and several equipment maintenance shutdowns at the sediment processing facility.

To improve the unloading rate at the sediment processing facility, GE is currently in the process of implementing the following modifications to the unloading and trommel feed system:

- The two-stage hydraulic trommel feed screen and chute will be replaced with an integrated feeder system, described below.

- The trommel feeder that was used during Phase 1 has been reconditioned so it can be used in event of a malfunction of the new feeder system.

- The barge haul winch system will be modified so that it can index a barge at the unloading wharf during unloading, thus allowing the tug to be more available for moving loaded barges to the decant station and empty barges away from the unloading station.

- The barge fendering system will be improved so that operation of the barge haul system and tug movements can be more efficient.

- Alternate material unloaders have been evaluated. The unloader to be used in Phase 2, Year 1 is specified in the revised 2011 RAWP.

The two-stage hydraulic grizzly/feed chute system (employed on the trommel during Phase 1) will be replaced with a new feeder system to improve loading rates to the trommel screen. The integrated feeder system includes a hopper, wobbler screen, and two apron feeders. Dredged material, depending on its consistency, will be unloaded from barges and fed into the hopper or loaded directly into trucks for transport to the coarse staging piles. The wobbler screen, which is located underneath the hopper, is a continuous mechanical feeder composed of several rotating shafts and discs. The elliptical discs are mounted on rotating shafts. Their shape promotes the conveying/separation process and reduces material jamming. The wobbler screen will separate debris larger than 4 inches. The wobbler screen underflow (i.e., material smaller than 4 inches) will discharge onto the apron feeder system for conveyance to the trommel for further separation. The modifications to the trommel feed system are scheduled for completion prior to the start of dredging in 2011.

Additionally, following completion of Phase 1, GE has implemented or is in the process of implementing the following process modifications at the processing facility to increase the reliability and productivity of the system. These improvements include:

- Replacement of the hydrocyclone slurry pumps with pumps containing high chromium parts

- Installation of duplex pumps for pumping the underflow from the intermediate screen to the sediment slurry tank

- Installation of an in-line spare plant water supply pump, located in the water treatment plant
- Installation of an in-line spare seal water pump, located in the water treatment plant
- Integration of new equipment into the Supervisory Control and Data Acquisition (SCADA) system
- Installation of a new catwalk for safer access to the intermediate screen elevated platform
- Installation of new catwalks to connect the elevated platforms for the filter presses to improve access and productivity
- Recoating the inside walls of the floc tanks for the three clarifiers in the water treatment plant
- Repacking of slurry pumps
- General equipment maintenance and reconditioning

2.3.7 Processed Sediment Transportation and Disposal

Dewatered sediments and debris generated as part of Phase 2, Year 1 will be loaded into railcars from staging areas at the processing facility. Prior to the placement of material into the railcar, each empty railcar will be lined with a disposable liner (or “packaging” pursuant to the applicable U.S. Department of Transportation [DOT] regulatory requirements in 49 CFR 173.240 for “sift-proof packaging”). The liners will be disposed of at the destination landfill along with the processed material.

Once a train is loaded, the processed materials will be transported by railroad to one or more authorized commercial disposal facilities. This design assumes that all dredged sediments contain PCBs greater than or equal to 50 mg/kg and thus are subject to Toxic Substances Control Act (TSCA) regulations. Accordingly, for Phase 2, Year 1, as described in the 2011 TDP (Parsons 2011f; Appendix C to the 2011 RAWP), these materials will be transported to facilities authorized to dispose of TSCA-regulated material. As also discussed in the 2011 TDP, based on existing analytical data, the dredged sediments will be considered not to constitute hazardous waste under

Resource Conservation and Recovery Act (RCRA) criteria; and while they would be considered state hazardous waste under NYSDEC regulations based on assumed PCBs concentrations greater than or equal to 50 mg/kg (but not on any other basis), it is not anticipated that they would constitute hazardous waste under the regulations of the states where the disposal facilities are located.

Additional information related to the basis of design for transportation and disposal is summarized in Table 2-5.

3. Design Summary – Phase 2, Year 1

As described in the PDR (BBL 2004a), the remedial action can be divided into the following eight key components or project "elements":

- Dredging
- Dredged Material Transport
- Resuspension Control
- Backfilling/Capping
- Sediment and Water Processing
- Transportation for Disposal
- Disposal
- Habitat Construction

This section summarizes the design related to each of these project elements for Phase 2, Year 1 of the project, followed by a discussion of actions included in the design to meet the Phase 2 QoLPS.

3.1 Dredging

Dredging is the first of several linked and mutually dependent project elements. As the initial project element, the rate and process of dredging affect the design of all subsequent project elements, including resuspension control, backfill/cap placement, sediment processing and water treatment, and transportation and disposal.

3.1.1 Shoreline Vegetation Pruning and Debris Removal

To allow the safe and effective operation of dredge and shoreline stabilization equipment and to minimize incidental damage to trees, shoreline vegetation that overhangs the dredge area will be pruned. Chipped material and logs generated during removal of shoreline vegetation that have not come in contact with river sediment will be transported to the General Support Property for re-use or disposal.

In addition, prior to dredging, debris will be removed in the sequence outlined below. Debris removal will consist of the removal and clearing of objects and obstructions from the riverbed and shoreline. Large items identified during survey and visual inspections will be removed in advance of dredging. Smaller debris will be removed by dredging equipment during dredging operations. Debris removed from the riverbed and/or shoreline will be placed on a barge and transported to the processing facility, where it will be offloaded and managed.

3.1.2 Targeted Dredge Areas and Volume

In accordance with EPA's Productivity Standard, 350,000 cy of sediment are targeted for removal during Phase 2, Year 1. As summarized in Section 2.3.1.2, the design for this season includes dredging in CU09 to CU30 (which occupy approximately 98.1 acres), of which approximately 31.8 acres are located within the navigation channel. Based on the Productivity Standard target of 350,000 cy, the planned average daily removal rate for Phase 2, Year 1 (assuming 120 dredge days) is approximately 2,900 cy/day.

The actual number of CUs that will be dredged depends on several factors, including, but not limited to:

- The area and volume of sediment that will be subject to re-dredging based on the residual sampling results compared to the Residuals Standard criteria, as set forth in the 2011 PSCP (GE 2011).

- The productivity of dredging operations to be completed (as described below) in an upstream-to-downstream sequence, while limiting the work area to three adjacent CUs.

- The extent of operational adjustments (slowdowns, shutdowns, adjustments to dredging sequencing) necessary to comply with the Performance Standards.

- The operational dates for the opening and closing of the Champlain Canal, determined by the NYS Canal Corporation.

- The frequency of high river flows that limit safe and productive dredging (which vary from year to year, as shown in Table 3-1), given that dredging operations will be shut down at flows greater than 10,000 cfs.

- The ability to unload and process dredged material and water transported to the sediment processing facility at the planned production rate.

- The ability to transport and dispose of processed material at a rate that prevents filling the Coarse Material Staging Areas and Filter Cake Staging Enclosures to their capacity.

- The rate of backfilling and capping operations and CU closure, because dredging (including re-dredging) will need to be terminated in sufficient time to allow for completion of backfilling and capping, closure of CUs, and demobilization before the canal closure date in November. The actual end date for dredging in Phase 2, Year 1 will be determined based on field conditions.

3.1.3 Dredging

The dredging activities are expected to commence in mid-May 2011 – weather and river flow permitting – and continue into October. Dredging is expected to occur 24 hours a day, 6 days a week. The seventh day of the week will be reserved for maintenance, make-up time for unplanned project interruptions, and as a contingency to achieve the productivity target.

The dredging will be conducted using multiple mechanical dredges equipped with hydraulically closing environmental clamshell buckets. The number and sizes of dredges and the type and size of the dredge buckets to be utilized will be determined by the Dredging Contractor based on the physical constraints of the river (including the location, depth, and width of the dredge areas), the sediment removal thickness, the type of sediment to be removed, the size of the barge, and resource and production plans (including the volume and rate of sediment removal throughout the season). For design purposes, it is estimated that four to six dredges will be utilized during Phase 2, Year 1 based on Phase 1 experience and the logistics model analysis described in Section 3.1.7. The number of dredges and type and size of buckets will be proposed by the Dredging Contractor and presented in the revised 2011 RAWP.

The dredging buckets selected by the Dredging Contractor will be designed to maintain enclosure of sediments when the bucket is being raised through the water column (unless bucket closure is prevented by debris); minimize, as much as practical, the generation of suspended sediments during bucket lowering, closing, and raising in the water column; and minimize the amount of water contained in the dredge bucket as it is closed. The bucket may include features designed by the bucket’s manufacturer that allow free water overlying the sediment in the bucket to drain once the dredge bucket has been raised above the water surface. The Dredging Contractor will be required to have an electronic bucket positioning system and indication of bucket closure.

Dredging will begin in the northern end of the project area (CU09) and will generally proceed downstream in a way that maximizes safety. In accordance with the Phase 2 EPS and as approved during the implementation of Phase 1, dredging as part of the initial design cut pass will only be allowed to occur concurrently in a maximum of three adjacent CUs at any given time. This will be termed “concurrent CU dredging”.

Each CU will be segmented into sub-units of approximately 1 acre in size (CU sub-units) to determine if dredging has met the required elevations and/or if additional dredging will be conducted. The size of the CU sub-units may be increased from the approximate 1-acre size based on field conditions and decisions made during the CU acceptance process.

The dredging process will involve initial dredging to remove the volume of targeted design inventory sediment identified in the dredge prisms (the “design cut”), and re-dredging (if necessary) in accordance with the Residuals Standard criteria, as specified in the 2011 PSCP.

The extent of dredging required for each dredging pass (the design cut or re-dredging cuts) will be shown in dredge prism files, which include electronic data that specify the horizontal (X and Y) and vertical (Z) extent of material to be removed as part of the dredging pass. The dredge prism files will contain X, Y, and Z values on a 1-foot by 1-foot grid within the footprint of the CUs and the adjoining side slope areas.

Attached to this report is the Design Dredge Prism XYZ File that identifies the sediment targeted for removal as part of the initial design cut. The Design Dredge Prism XYZ File was developed by Anchor QEA and Parsons using the procedures described in Section 2.3.1.1, Section 3.1.6, Attachment D, and Attachment E.

The Design Dredge Prism XYZ File will be modified to incorporate offsets from shoreline riprap and in-river structures in accordance with Drawing D-2801 (Appendix 2) based on the results of field probing and surveys conducted prior to dredging. The Design Dredge Prism XYZ File includes the offsets from shoreline riprap for CU09 to CU16, which were surveyed during Phase 1. The Design Dredge Prism XYZ File will also be modified to incorporate setbacks proposed by the Dredging Contractor. Such setbacks may be necessary where the Dredging Contractor believes that dredging operations cannot be implemented safely or where the Dredging Contractor believes that dredging operations cannot be implemented without compromising the integrity of public or private structures or utilities located in or along the banks of the river. These proposed setbacks will be submitted to EPA for approval prior to being incorporated into the dredge prisms. The modified dredge prisms (the Construction Dredge Prism XYZ File) will be provided to the Dredging Contractor and will serve as the basis for determining whether dredging has achieved the required elevations. When necessary, separate Construction Dredge Prism XYZ Files will be issued to the Dredging Contractor for re-dredge passes to identify the extent of additional dredging required based on the results of post-dredge residual sampling and compliance with the Residuals Standard as described in the 2011 PSCP.

In accordance with the Phase 2 EPS and Phase 2 CDE, and as provided in the 2011 PSCP, dredging will be required to achieve the elevations shown on the Construction Dredge Prism XYZ File in 95 percent or more of the total area dredged in each CU sub-unit. The project specifications include provisions for the Dredging Contractor to establish target cut elevations that may be below the Construction Dredge Prism XYZ File to assist in achieving the required elevations. The Dredging Contractor will provide the target cut elevations to the dredge operators and will be required to evaluate their performance. The Dredging Contractor will ensure that the dredge operators are consistently achieving the required elevation and improving the accuracy of dredging with the least number of bucket bites. These requirements are detailed in Specification Section 13803 (Dredging) in Appendix 2.

Post-dredging bathymetric surveys will be conducted to verify that the dredging has achieved the required elevations. In areas where bathymetric survey methods are not feasible (e.g., shallow water area), land survey methods will be used to verify compliance with the required elevations. Survey methods are described in the 2011 DQAP (Appendix A to the 2011 RAWP).

In areas where GLAC and/or bucket refusal due to the presence of bedrock or other hard-bottom or rocky conditions are encountered before the required elevation shown in the Construction Dredge Prism XYZ File is achieved, the specifications require the Dredging Contractor to stop dredging and document the GLAC and bucket refusal locations. The Construction Manager will be responsible for confirming the presence of GLAC and bucket refusal based on visual observation and will notify EPA when these conditions are encountered.

Following achievement of the required elevations in a CU sub-unit, sediment samples will be collected and analyzed to determine PCB concentrations in residual sediment after dredging. The 2011 RAM QAPP will specify the routine monitoring, reporting, and sediment sampling and analysis protocols; and the 2011 PSCP describes the data evaluation procedures and actions associated with the results.

3.1.4 Phase 2 IDR Exclusion Areas

Section 3.1.1.1 of the Phase 2 IDR recommended that certain Phase 2 areas be excluded from dredging based on an assessment of engineering practicality. Two of the exclusion areas proposed in the Phase 2 IDR (SK_01_KX_A and SK_01_KX_B in CU26 and CU27) have been removed from CU limits in the portion of the river targeted for removal during Phase 2, Year 1 based on EPA approval.

In addition, based on EPA comments on the Phase 2 IDR, two of the proposed exclusion areas (SK_01_KX_C and SK_01_KX_D – located in CU27 – see Figure 2-1) were identified for further delineation via probing to define the extent of the exclusion area (see Section 2.2.3). These exclusion areas were originally proposed based on the highly inefficient and unproductive operations that would result if the areas were dredged due to thin layers of sediment and the presence of rocks and cobbles.

Based on the probing results, the boundaries of the exclusion areas have been revised as shown on Figure 2-1. The limits of CU27 and CU28 have also been revised based on the results of the sediment probing. Areas of thicker sediment deposits are no longer considered for exclusion, while areas of thin sediment have been identified for exclusion.

3.1.5 Sensitive Archaeological Shorelines and Sensitive Archaeological River Bottom

As described in Section 2.2.9, two Sensitive Archaeological Shorelines and one Sensitive Archaeological River Bottom have been designated in the area targeted for dredging during Phase 2, Year 1, based on archaeological resource assessments that have identified areas containing one or more significant archaeological resources. In these areas, archaeological site protection measures will be implemented as described in Section 2.3.1.9 and as summarized below.

A shoreline offset of at least 10 feet will be applied in areas designated as Sensitive Archaeological Shorelines (see Drawing D-2801 in Appendix 2), and a setback and stable slope will be applied for the Sensitive Archaeological River Bottom. These dredging offsets/setbacks have been incorporated into the Design Dredge Prism XYZ File as described in Section 3.1.6 and Attachment E.

While not designated as a Sensitive Archaeological Shoreline, a structural offset of 15 feet will be applied along the western shoreline in CU14, CU15, and CU16 and along a portion of the shoreline in CU19 where wood cribbing was historically constructed (circa 1909-1910) and dredge spoils were placed behind it (Special Area 13). The NYS Canal Corporation has not been able to find any details for the construction of the cribbing, but its best assumption is that the cribs are stone-filled wooden cribs placed directly on the former river bottom. Historical records suggest that the wooden cribbing is present at or in close proximity to the defined shoreline in CU14, CU15, and CU16. Previous archaeological surveys identified this cribbing and found numerous timbers extending out into the water from the base of the riverbank (Archaeological Resource U-7). The structural offset is proposed in this area due to concerns regarding shoreline stability if dredging extends to the shoreline in this area. The dredging offset from the shoreline in this area has been incorporated into the Design Dredge Prism XYZ File described in Section 3.1.6 and Attachment E.

3.1.6 Dredge Prism Development

The Phase 2 CDE requires that GE develop an EoC surface that defines the elevation which captures the entire PCB inventory that meets the removal criteria within the targeted areas. The EoC surface was developed using primarily chemistry information (i.e., sediment core profiles of PCB concentrations), but sediment type, bathymetry, historical dredging information (when appropriate), probing information, and sub-bottom information (i.e., the existence of GLAC or bedrock) also influenced its development. As described in Attachment D, an initial EoC surface was developed for CU09 to CU30 to meet the requirements of the Phase 2 CDE. In areas dominated by incomplete cores (i.e., cores whose profiles did not reach the 1 mg/kg Total PCB horizon), conservative approaches were used to estimate the extent of the PCB inventory. These approaches included using historical dredging information and constant estimates of EoC in these areas to set the surface (as opposed to just relying on core-by-core profiles to produce a variable EoC surface). In addition, to account for uncertainty in the dredge prism, due to uncertainty in the coring results, an overcut (initially 12 inches, but this depth may be adjusted during 2011 based on residual results) is planned during the second pass in areas where re-dredging is required. That surface was then adjusted for engineering considerations to create the final dredge prisms (described in Attachment E).

The Design Dredge Prism XYZ File has been provided on a CD-ROM with this report. Post-removal elevation contours for the design cut are shown on Drawings D-2101 through D-2107 (Appendix 2) based on the Design Dredge Prism XYZ File.

3.1.7 Dredge Planning

The Phase 2 CDE requires a dredge plan that identifies the estimated dredging duration for each dredge area, sequencing of sediment removal by dredge area, estimated number of dredges to be employed, estimated hours of operation, and estimated weekly productivity.

The Phase 2 logistics model (described in Section 2.2.11 and Attachment A) was used to assist in development of the dredge plan. The logistics model aids in the evaluation of various dredging scenarios and resource allocations (e.g., dredges, barges, tugs, train sets, offloading equipment) to assess potential bottlenecks in the dredging and dredged material transport.

The most critical input for the logistics model is the sediment removal volume and locations, including an assumption of the amount (i.e., volume and area) of re-dredging that may be required, which is uncertain at this time. For modeling and dredge plan development purposes, the model used the EoC surface volume for the initial design cut dredge pass (approximately 357,000 cy). For re-dredging, the model assumed that re-dredging would be required in approximately 45 percent of the dredge areas at a re-dredge removal thickness of 1.5 feet. Based on these assumptions and the annual target volume of 350,000 cy in the Productivity Standard, the logistics model and dredge plan assume that dredging would be completed in CU09 to CU16 and CU19 to CU25 in Phase 2, Year 1 (for total volume of approximately 360,000 cy).

Additional input assumptions for dredging, dredged material transport, backfilling/capping, sediment processing, and rail yard operations were developed and used to run the logistics model. The required model inputs are described in Attachment A, and include, but are not limited to, the number of resources (e.g., dredges, barges, tugs, train sets, offloading equipment), sediment removal rates, water production rates, barge loading factors, backfill and capping fill rates, the sediment processing facility unloading rate, sediment characteristics, CU acceptance durations, lock operation parameters, rail yard operation parameters, and recreational boat traffic. The inputs were developed based on Phase 1 experience, the characteristics of the Phase 2, Year 1 dredge areas, and the design basis for the upcoming dredging season.

Numerous model iterations were conducted to evaluate the efficiency of the predicted operations and adjust the input parameters assumptions. The model input adjustments included modifying the assumed project resources and dredge sequence, among other inputs, to improve the model efficiency, project schedule, and to address bottlenecks.

Using the logistics model output data, a dredge plan was developed as required by the Phase 2 CDE. The dredge plan developed based on the Phase 2 logistics modeling is presented in Table 3-2.

Output data from the logistics model simulations were also used to develop the inputs to the resuspension model (Attachment C). Two logistics model scenarios were run to facilitate resuspension modeling: 1) dredging only design targeted sediment associated with CU09 to CU30 with no re-dredging (total volume of approximately 357,000 cy); and 2) design dredging and one re-dredge pass using the assumptions noted above within CU09 to CU25 (total volume of approximately 360,000 cy). The logistics model output data (including the dredge locations, durations, sequence, and rates of dredging for each area) for runs associated these scenarios were compiled and transmitted to Anchor QEA for use as input data for the resuspension modeling.

Additional details for the logistics modeling are provided in Attachment B, including the detailed input parameters and output data used to develop the dredge plan presented in Table 3-2.

The actual number of CUs and volumes that will be dredged in Phase 2, Year 1 and the dredging sequence depends on the project resources and schedule determined by the Dredging Contractor and the conditions encountered in the field. The Dredging Contractor will develop a dredge plan based on their proposed sequence of work and the proposed number and sizes of equipment (e.g., dredges, barges, tugs) to be utilized for the project. The actual number, productivity, and sequence of project resources implementing dredging and backfill/capping operations during Phase 2, Year 1 will be determined as a part of field implementation.

3.1.8 Anchoring Restrictions

As part of dredging and dredged material transport operations, anchoring will be restricted within areas where SAV or RFW habitat is present outside of dredge areas; in areas where SAV has been planted; in backfilled areas designated as SAV planting areas or natural colonization areas; in backfilled areas designated as RFW; in areas where caps have been placed; and in areas subject to future archaeological resource assessment. In addition, no anchoring of work-related vessels will be permitted in the navigation channel without approval from EPA in consultation with NYS Canal Corporation.

The anchoring restrictions are described in Specification Section 13820 (Anchoring Restrictions during Dredging Operations) and shown on Drawings D-4001 through D-4016 (Appendix 2).

3.1.9 River Access

During Phase 1, a Work Support Marina was constructed in River Section 1 along the western shoreline across from the southern tip of Rogers Island to provide an area for support vessels to dock and load or unload passengers and equipment. During Phase 2, Year 1, vessels will continue to use the Work Support Marina, including bathymetry survey boats, sediment sampling boats, water quality monitoring boats, and oversight boats. In addition, dredging crew boats will use the Work Support Marina to help with the efficient movement of crews and equipment to and from the dredges located in River Section 1. Dredged sediments will not be staged or processed at the Work Support Marina. The location of the Work Support Marina is shown on Figures 2-4 and 2-5 in relation to the dredge areas. A site plan showing the Work Support Marina is presented on Figure 3-1.

During Phase 1, a property known as the General Support Property, located on the east shore of the river at Route 4 (at approximate River Mile 192.3), was acquired and used to provide direct access to the Hudson River. During Phase 2, Year 1, the General Support Property will be used in a manner similar to that in Phase 1 to assemble and disassemble barges, dredges, and tugs needed prior to the opening of the Champlain Canal and throughout the dredging season. Use of the General Support Property reduces the traffic through Lock 7 and reduces the work required at the sediment processing facility Work Wharf. The location of the General Support Property is shown on Figures 2-4 and 2-5. A site plan showing the General Support Property is presented on Figure 3-2.

3.1.10 Access to Dredge Areas

Depending on river flow conditions during the dredging season, dredging of non-target material may be necessary to provide access to a limited number of areas of shallow-water dredge areas. For Phase 2, Year 1, it is assumed that access dredging will not be necessary. However, the need for access dredging will be determined in the field based on river flow conditions and equipment proposed by the Dredging Contractor. The Dredging Contractor may propose locations where access dredging is desirable to conduct the work, based on river flow conditions and actual equipment. The Dredging Contractor may also propose to sequence the work such that shallow areas are dredged early in the season when water elevations are likely to be higher. Any access dredging proposed by the Dredging Contractor will be reviewed by the Construction Manager based on an assessment of the benefit of the proposed access dredging compared to other potential project impacts.

3.1.11 Air Mitigation BMPs

In accordance with the CDE and as summarized in Section 2.3.1.8, air mitigation BMPs will be implemented in areas with potential to emit PCBs to the air at levels close to or exceeding the applicable air quality standard and in dredge areas where measured PCB concentrations at a nearby receptor results in exceedance of the air quality standard on 3 consecutive days, as described in the 2011 PSCP. The air mitigation BMPs are summarized in Section 2.3.1.8 and included in Specification Section 13803 (Dredging) (Appendix 2). Based on the criteria listed in the Phase 2 CDE (and summarized in Section 2.3.1.8), the areas with potential to emit PCBs to the air at levels close to or exceeding the air quality standard are shown on Drawings D-3101 through D-3107 (Appendix 2).

3.2 Dredged Material Transport

Dredged material will be loaded in barges for transport to the sediment processing facility for unloading. Barges with dimensions approximately 195 feet long and 35 feet wide are expected to be used. Tugs will move the barges to deliver the material to the processing facility. The number and sizes of tugs and barges will be determined by the Dredging Contractor based on the physical constraints of the river, including the depth and width of the channel, location, size of the barge (length, width, and draft), and volume and rate of sediment removal during dredging.

3.2.1 Barge Loading

When loading large barges, the dredge will be required to maintain continuous movement of the bucket toward the barge once the dredge bucket has been raised above the water surface until the dredged material is loaded into the barge. Free water overlying the sediment surface in the dredge bucket will be allowed to drain once the dredge bucket has been raised above the water surface; however, the dredge operator will not be allowed to pause the movement of the bucket to intentionally decant the water.

The Dredging Contractor will be required to conduct dredging and barge loading operations in a manner that will optimize the quantity of sediment in the barges while maintaining barge stability and integrity. Optimizing the quantity of sediment in the barges will minimize the number of barges transported to the processing facility for unloading. If access to the area being dredged is limited by shallow water depth, hopper barges may be light-loaded, or on-river transload operations may be necessary to optimize the quantity of material in the barges. The Dredging Contractor may propose that alternate equipment with less draft be used to receive, contain, and transfer dredged material to a hopper barge anchored in deeper water. If practical, based on the mix of on-river activities, and if overall production will be optimized, light-loaded barges may be transferred to other locations for additional loading.

The need and locations for transloading will be determined in the field by the Dredging Contractor based on available water depths and equipment availability. Requirements for barge loading and transloading are described in Specification Section 13803 (Dredging) in Appendix 2. The specific equipment to be used for sediment transport will be described in the 2011 RAWP.

3.2.2 Dredged Material Transport

Once material is loaded into hopper barges, it will be transported through Lock 7 and up the canal to the unloading wharf at the sediment processing facility. The type of material, transport operations, and frequency of delivery and unloading at the processing facility are critical to the efficiency of dredging and processing facility operations. Key factors include the quantity, character, and amount of debris, sediment, and water brought to the facility, as well as the timing of the movement of these transported materials.

Prior to Phase 1 dredging operations, a turning dolphin was installed approximately 60 feet south of Lock 7 to facilitate vessel movement and ensure safe turning of vessels. Additionally, a series of mooring dolphins was installed approximately 900 feet south of Lock 7 for temporary staging of project vessels. These dolphins are still in place and available for use in Phase 2.

It is assumed that Lock 7 will be operating 24 hours per day, 6 days per week for approximately 26 to 28 weeks, weather permitting (from early May through mid-

November). Operations may occur on Sunday, depending on the equipment maintenance requirements and the conditions encountered in the field.

The Dredging Contractor will be responsible for coordinating with the Processing Facility Operations Contractor prior to the transport of dredged materials. In addition, the Processing Facility Operations Contractor will be notified in advance of the delivery of a barge to the processing facility.

Barge trip logs will document the identity and integrity of the barge and its contents and will serve as the chain of custody between the Dredging Contractor and the Processing Facility Operations Contractor. Both the Dredging Contractor and the Processing Facility Operations Contractor will be responsible for filling out information on the barge trip log when the barge is in their respective custody.

Project vessel movements will be monitored, recorded, and coordinated using a vessel traffic service (VTS) center. The VTS staff will have access to a real-time vessel tracking system as well as multiple marine VHF radios. Using this system, the VTS staff will be able to coordinate project vessel movements with the NYS Canal Corporation lock operators, non-project users of the Champlain Canal, and the processing facility operators.

The requirements for barge loading, in-water transport, lock operations, and marine traffic control are described in the Specifications included in Appendix 2 (see Specification Sections 13803 [Dredging], 13810 [In-Water Material Transport], 13840 [Transport Procedures Through Canal Locks], 13845 [Aids to Navigation], and 13860 [Marine Traffic Control]).

3.3 Resuspension Control

In accordance with the Phase 2 CDE (see Section 2.3.2), certain resuspension control BMPs are to be implemented during all in-river operations, and contingent resuspension control BMPs may be required to be implemented if the Control Level for total PCB concentrations or Tri+ PCB net loads (measured as daily percent release) under the Resuspension Standard is exceeded. Section 3.3.1 presents an evaluation of the potential for resuspension of PCBs during Phase 2, Year 1 dredging.

Additionally, the Phase 2 CDE requires that the Phase 2 design describe requirements for prevention (including BMPs), containment, cleanup, and notification of spills and releases, including sheens that may be associated with PCB oils.

3.3.1 Resuspension Modeling

The potential for resuspension and transport of PCBs during Phase 2, Year 1 dredging was evaluated by mathematical modeling of PCB fate and transport during dredging.

The model was used to evaluate two dredging scenarios, one without re-dredging and one with re-dredging, under two flow conditions – the actual hydrograph from 2003 and a constant 5,000 cfs flow. Dredge plans developed from the logistics model analysis described above were used as a basis for the dredging scenarios. The 2003 hydrograph was selected because it constitutes a moderately, conservative high-flow series compared to the long-term median flows during the dredge season. The constant flow simulation was conducted to identify areas that may be problematic independent of flow. The dredge plan without re-dredging covers CU09 through CU30. The dredge plan with re-dredging includes an 18-inch second (re-dredging) pass over 45 percent of the area and covers dredging CU09 through CU25.

The model results are provided on Figures 3-3 through 3-6 for the dredging scenarios without re-dredging and with re-dredging, respectively.

The model predicts no exceedances of the total PCB concentration Control Level (500 ng/L) at Waterford for any of the simulations under any of the four scenarios. That level is exceeded at Lock 5 for 2 days in mid-September for the scenario without re-dredging, when CUs 26, 27, and 28 are dredged simultaneously, regardless of the hydrograph used. All of the scenarios produced several exceedances of this criterion at TID when dredging occurs in CU14/15/16, CU24/25, and CU26/27/28 (in the scenario without re-dredging).

The model predicts a number of exceedances of the Tri+ PCB net load criteria. The exceedances were generally coincident with periods of higher flows, which is the result of the velocity-dependent release function used in the model (see Attachment C for further discussion). The 2003 hydrograph produced more exceedances early in the dredging season for both dredging scenarios compared to the constant 5,000 cfs hydrograph – which is related to the overall higher flows under the 2003 hydrograph during that period. These exceedences are largely associated with dredging in the west channel of Rogers Island because this region experiences relatively high velocities at the high flows typical of May and June. Consequently, dredging in this area at the beginning of the dredging season could be problematic from a resuspension standpoint. Additional exceedances are predicted to occur in August and September for both dredging scenarios related to higher flows, in these cases, the 5,000 cfs flow.

The total mass of Tri+ PCB removed is estimated at 7,475 kg and 6,007 kg in the scenario without-re-dredging and the scenario with-re-dredging, respectively. These mass estimates were used to simulate resuspension during dredging (see Appendix C of this document). As previously noted, for the purposes of calculating percent release and assessing achievement of the load criteria in the Resuspension Performance Standard in the field in 2011, the mass removed will be re-calculated using the approach outlined in the Phase 2 EPS, with the modifications described in the 2011 PSCP, as approved by EPA. The estimated cumulative (seasonal) net loads at TID and Waterford based on the different flow regimes are summarized in Table 3-3. The model predicts that Phase 2, Year 1 dredging causes resuspension sufficient to exceed the seasonal Resuspension Standard net load limits of 2% at Thompson Island and 1% at Waterford. As noted in Attachment C, the resuspension model under-predicts the drop in PCB load between Thompson Island and Waterford that was observed during Phase 1. Therefore, the net load predicted at Waterford is likely an over-estimate. Moreover, the flow conditions and dredging sequence and rate that occur in Phase 2, Year 1 will undoubtedly differ from what was used in the modeling and the water column monitoring results during Phase 2, Year 1 are likely to differ from the predicted results from the modeling.

3.3.2 Resuspension Control BMPs

The Dredging Contractor will be required to implement certain resuspension control BMPs during all in-river operations, including, but not limited to, debris removal, dredging, transport of dredged material, vessel movement, and backfill/cap placement. The resuspension control BMPs consist of operational controls to minimize the sediment resuspension and the release of PCBs. Contingent resuspension control BMPs may also be required if there is an exceedance of the Control Level for total PCB concentrations or Tri+ PCB net loads (measured as daily percent release) under the Resuspension Standard. The routine and contingent resuspension control BMPs are summarized in Sections 2.3.2.1 and 2.3.2.2 and included in Specification Section 13805 (Resuspension Control; Appendix 2).

There are many factors to consider when evaluating the potential of a dredge area to contribute to the concentration of PCBs in the water column due to dredging-generated resuspension. In addition, the limitations of the modeling tools – the logistics model for constructing dredge plans and the PCB fate and transport models used to predict water column concentrations and loads – make the precise prediction of resuspension release during the project difficult, if not impossible. While these models can be used as a tool to identify potential areas of concern, several factors – such as the river flow and the actual dredge sequence and rates – that cannot be accurately predicted prior to the work will influence the actual resuspension release. Therefore, the need for and type of contingent BMPs will be determined in the field based on monitoring data obtained.

3.3.3 Resuspension Containment Systems

As discussed in the Phase 2 CDE, the use of resuspension containment systems (i.e., silt curtains) during Phase 1 for containing dissolved-phase PCBs was found to be relatively ineffective in the Hudson River. In addition, the Peer Review Panel did not support the use of silt curtains or other physical barriers to control loss of PCB due to resuspension during Phase 2. As discussed in Section 2.3.2.4, the Phase 2 CDE indicates that the use of silt curtains to control resuspension will not be required in Phase 2 except in specific circumstances identified either by GE or EPA. GE has not identified any areas where silt curtains or other resuspension control barriers are recommended for Phase 2, Year 1 dredging.

3.3.4 Sediment Oil Sheen Response

The Phase 2 CDE requires that actions be taken to prevent, contain, and clean up oil sheens or evidence of NAPL observed in the field or when dredging in areas with total PCBs greater than 200 mg/kg.

Specification Section 13871 (Sheen Response During Dredging Operations; Appendix 2) describes the Dredging Contractor's requirements to address sheens and NAPL, including requirements for notification and reporting, development of a Sediment Oil Sheen Response Plan, implementation of BMPs, and sheen response actions if sheens are observed. As discussed in Section 2.3.2.3, sheen control BMPs consisting of containment booms and adsorbents will be deployed proactively, before dredging begins, in areas with average PCB concentrations greater than 200 mg/kg. In those areas, the Dredging Contractor will be responsible for deploying and maintaining oil control booms, oil absorbent booms, and oil absorbent materials downstream of operations. Debris removal and dredging operations will not begin in those areas until the booms and absorbent materials have been deployed. Where sediment oil sheens are observed to have collected behind the control boom or other stationary locations, the Dredging Contractor will sweep the sheen areas with absorbent material and actively collect sheens and other floating debris in contact with the sheens. The sheen response team will be required to adjust the booms and absorbent materials to maximize the potential to control the sediment oil sheens.

Areas where sheen control BMPs will be required during all dredging and debris removal operations (i.e.., approximate 1-acre areas with average TPCB concentrations greater than 200 mg/kg) are identified on Drawings D-3101 through D-3107 (Appendix 2).

3.4 Backfilling/Capping

After dredging is complete in each CU or CU sub-unit, the dredged areas will be backfilled or capped, as appropriate, to isolate residual sediments and support habitat construction. The total and relative acreage of areas to be capped or backfilled will depend on the results of the residuals sampling and the number of CUs dredged.

The decision to place backfill or cap will be based on the post-dredging distribution of PCB concentrations in accordance with the Phase 2 EPS and 2011 PSCP or as otherwise approved by EPA.

Due to the limitations on water depth and the anticipated continued use of the Moreau Barge Loading Facility (identified on Figures 2-4 and 2-5) for backfill/cap material loading during project operations throughout Phase 2, no backfill or cap material will be placed during Phase 2, Year 1 in CU09 or CU10 within the access channel to the Moreau Barge Loading Facility. This area contains shallow water and the dredge prism elevations in much of the area have been established based on the elevation of GLAC (see Attachment D). Backfill and cap material will not be placed in this access channel so that the maximum water depth will be available for navigation. In addition, the water depths in this channel will be assessed by the Dredging Contractor to determine if additional access dredging below the target elevations would improve productivity. For this area, GE and EPA will review the residual sampling results to determine the appropriate actions to be taken. Based on discussions with EPA, the anticipated response actions may include additional dredging or deferring placement of backfill materials in this area to future years of the project. Based on the residual sampling results and post-dredge bathymetry, GE may request EPA approval not to place backfill or isolation caps in this area.

The backfill and cap material specifications are described in Specification Section 02206 (Backfill and Cap Material; Appendix 2). The backfill and cap material placement requirements are described in Specification Section 13720 (Backfill/Capping; Appendix 2).

3.4.1 Backfill

There are four main components of backfill in the design:

- Base backfill layer
- Near-shore backfill
- Habitat layer backfill
- RFW construction areas

The basis of design for each of these components was described in Section 2.3.3.

3.4.1.1 Base Backfill Layer

The base backfill layer consists of a 12-inch layer of Type 1 or Type 2 material placed on the river bottom following completion of dredging, except that no backfill material will be placed in the navigation channel when the post-backfill placement water depth is predicted to be less than 14 feet (103.2 ft elevation NAVD88 for River Section 1) based on the NYS Canal Corporation’s Barge Canal Datum low-pool elevation (BCD low-pool elevation) of 117.2 ft NAVD88 for TIP. Based on the allowable construction tolerance for placement described in the Specifications (see Specification 13720 – Backfilling/Capping in Appendix 2), no backfill material will be placed in the navigation channel where post-dredging water depths are less than 15.5 feet (101.7 ft elevation NAVD88 for River Section 1). This elevation is based on the required 14-foot post-backfill placement water depth plus the 12-inch thick backfill layer and the allowable backfill placement tolerance.

Type 1 backfill material will be used in locations with estimated surface water velocities of 1.5 ft/s or less during a 2-year flow event, and Type 2 backfill material will be used in areas with estimated surface water velocities above 1.5 ft/s under a 2-year flow event. Only Type 2 backfill material will be placed in the navigation channel.

Locations where Type 1 and 2 backfill materials would be applied are identified on Drawings B-2301 through B-2307 (Appendix 2).

3.4.1.2 Near-shore Backfill

Near-shore backfill will be placed to restore pre-dredge bathymetry between the 119 ft and 117.5 ft elevation (NAVD88) contours with supporting 3:1 (horizontal:vertical) side slopes.

Central to the near-shore backfill design process was development of a near-shore border for areas above the elevation of 117.5 feet that are likely to be disturbed by dredging. While many of these areas are within CU boundaries, dredging may also impact the near-shore areas outside of CU borders due to dredging side slopes. Near-shore setpoints were established at intervals of approximately 100 feet, and at points of inflection, along the 117.5 ft contour line based on the 2005/2006 bathymetry survey data. The near-shore border extends between the near-shore setpoints to approximate the 117.5 feet bathymetric contour, but is not necessarily at elevations of 117.5 feet at all locations between the setpoints. Near-shore backfill will be placed to original bathymetry in areas between the near-shore border and the shoreline (i.e., 119.0 feet elevation). The upper 1 foot of near-shore backfill material will consist of Type 1 or Type 2 material, as shown on Drawings B-2301 through B-2307 (Appendix 2). Type 2 material will be used below the upper 1 foot of near-shore backfill as needed. Supporting side slopes of 3:1 (horizontal:vertical) (i.e., the 3:1 near-shore backfill wedge) will extend from the edge of the near-shore backfill (i.e., at the near-shore border) down to the adjoining 1-foot backfill layer. The 3:1 near-shore backfill wedge will be constructed using Type 2 material.

Details and example cross-sections for near-shore backfill are shown on B-2102 (Appendix 2). The near-shore border and near-shore setpoints, along with locations where Type 1 and 2 backfill materials would be applied, are identified on Drawings B-2301 through B-2307 (Appendix 2). The coordinates for the near-shore setpoints are identified on Drawing B-2801 (Appendix 2).

3.4.1.3 Habitat Layer Backfill

The basis for the locations of the habitat layer backfill is described in Section 2.3.3.4 and presented in Attachment G. Habitat layer backfill will be placed in existing aquatic vegetation beds where the post-dredging and backfill layer placement water depth is greater than 8 feet. Based on the analysis summarized in Attachment G, an estimated volume of approximately 17,470 cy of additional backfill will be designated for placement as habitat layer backfill during Phase 2, Year 1 dredging in accordance with the requirements presented in the Phase 2 CDE. Note that this volume does not include the placement of the supporting 3:1 side slopes.

In areas where habitat layer backfill is required based on the criteria listed in the Phase 2 CDE and summarized in Section 2.3.3.4, backfill material will be placed to return bathymetry to an elevation of 114 feet at locations where the original bathymetry was above 114 feet and to return to original bathymetry in areas where the original bathymetry was between 111 and 114 feet.

The habitat layer backfill will consist of Type 1 or Type 2 material. Supporting side slopes of 3:1 (horizontal:vertical) will be created extending from the edge of the habitat layer backfill down to the adjoining backfill surface. The 3:1 supporting side slopes will be constructed using Type 2 material. Habitat layer backfill will be placed above caps (if placed in SAV areas) and may be placed above the 3:1 supporting side slopes for near-shore backfill.

Details and example cross-sections for habitat layer backfill are identified on Drawing B-2104 (Appendix 2). The potential locations where habitat layer backfill would be applied are identified on Drawings B-2301 through B-2307 (Appendix 2). The habitat layer backfill areas identified in Attachment G were modified for engineering and constructability considerations. Habitat layer backfill will not be placed in the Special Area 13 offset and slope area where an isolation cap will be placed as described in Section 3.4.2.3. The locations shown on the Drawings represent potential placement locations for the habitat layer backfill. These locations are subject to change. The actual locations for placement of the habitat layer backfill will be determined in the field based on the post-dredging elevations and corresponding water depths. Prior to backfill placement, the Dredging Contractor will be provided with the elevations and locations of the habitat layer backfill.

3.4.1.4 Riverine Fringing Wetland Construction Areas

RFW areas will be restored in areas where such wetlands are disturbed during the dredging operations. The shape of the RFW area to be constructed in CU19, near Special Area 13, has been changed due to the offset in this area; however, the total area to be constructed is the same as the delineated area.

A 1-foot layer of Type 3 backfill will be placed in RFW areas. Type 2 material will be placed first if more than 12 inches of backfill is required to restore the wetland area to pre-dredge bathymetry. Supporting side slopes of 3:1 (horizontal:vertical) will be created extending from the edge of the RFW area down to the adjoining backfill surface. The 3:1 supporting side slopes will be constructed using Type 2 material.

Verification that the RFW construction areas are restored to pre-dredge bathymetry will be based on land survey methods conducted along transects that will be spaced at approximately 25-foot intervals along the RFW construction area. At a minimum, elevation survey data will be collected along each transect at the outer limits of the RFW construction areas and at locations spaced approximately 20 feet along each transect. The survey data will be collected at the same locations along each transect prior to dredging and after backfill placement to verify that the restoration of the Riverine Fringing Wetland Construction Area is compliant with the specification (See Specification Section 13720 [Backfilling/Capping]; Appendix 2).

Details and example cross-sections for RFW construction areas are identified on Drawing B-2103 (Appendix 2). The potential RFW construction areas locations are identified on Drawings B-2301 through B-2307 (Appendix 2).

3.4.2 Cap Design – Phase 2, Year 1

Engineered caps will be installed in certain dredge areas in accordance with the Residuals Standard criteria to act as a physical barrier that both isolates and stabilizes the residual sediment. Placement of the cap will sequester residual sediment from direct interaction with the overlying water column or benthos. An armor layer will provide additional protection of the isolation layer through resistance to erosion due to currents, vessel wakes and waves, propeller wash, and ice.

The Phase 2 CDE describes the requirements for the Phase 2 cap design, which differ from the requirements defined for Phase 1. The specific design objectives of the engineered caps are described in Section 2.6 of the Phase 2 CDE, and the conditions and locations for placement of caps (based on the results of the residuals sampling) are set forth in the 2011 PSCP. As required by the Phase 2 CDE, a detailed cap design analysis has been performed for the dredge areas targeted for dredging in Phase 2, Year 1 (CU09 to CU30) and is presented in Attachment F (Phase 2 Cap Design for 2011 Dredge Areas).

The design analysis included transient modeling of Tri+ PCB transport through the isolation layer to meet the Phase 2 CDE requirements for the chemical isolation cap component. The transient modeling results showed that a total organic carbon (TOC) value of 1.8 percent would be required for a 9-inch thick isolation cap component. A TOC value of 2 percent has been assumed for the design to be conservative. The modeling shows that the cap design meets the criterion of less than an average of 0.25 mg/kg Tri+ PCBs in the upper 6 inches of the isolation layer after 100 years. If the isolation layer is thicker than 9 inches, a lower TOC content would still achieve the capping goals.

Based on the design analysis presented in Attachment F, two cap prototype designs (summarized in Table 3-4 below) have been developed to address the range of conditions expected to be encountered in dredge areas.

Table 3-4 Summary of Design for Prototype Caps

Cap Type	Area	Cap Materials and Thickness
Isolation Cap Type C, Medium- and Low-Velocity	Outside navigation channel, with average water velocities ≤ 5 feet per second (fps) based on a 100 yr event	A minimum 9-inch isolation layer of Type 2 material with 2% organic carbon content
		A 6-inch armor layer of Type N material (see Specification Section 02206 [Backfill/Cap Material], Appendix 2)
Isolation Cap Type C, High-Velocity	Within navigation channel, or outside navigation channel with average water velocities >5 fps based on a 100 yr event	A minimum 9-inch isolation layer of Type 2 material with 2% organic carbon content
		A 6-inch armor layer of Type O material (see Specification Section 02206 [Backfill/Cap Material], Appendix 2)

Details and example cross-sections for these prototype isolation caps are identified on Drawing C-2101 (Appendix 2). Refer to Attachment F for design objectives, basis of design, and detailed cap analysis. The potential locations where the medium- and high-velocity isolation caps will be placed are identified on Drawings C-3101 through C-3107 (Appendix 2).

As required by the Phase 2 CDE, caps located within the limits of the navigation channel will consist of high-velocity caps. In addition, the top elevation of caps after placement must provide at least 14 feet of water depth (103.2 ft elevation NAVD88 for River Section 1) based on the NYS Canal Corporation's BCD low-pool elevation of 117.2 ft NAVD88 for the TIP.

3.4.2.1 Lock 7 Area – Cap Analysis

As described in Attachment F, the cap design analysis evaluated the area of the navigation channel in the vicinity of Lock 7 (approximate 400 ft buffer area at the lock entrance) to estimate the armor stone size necessary to withstand forces from maneuvering vessels. Based on the analysis presented in Attachment F, the High-Velocity Type C isolation cap that is specified for the navigation channel will also be specified for the approach to Lock 7.

3.4.2.2 Access Channel to Moreau Barge Loading Facility in West Rogers Island – Cap Analysis

As described in Attachment F, the cap design analysis evaluated the west channel of Rogers Island (WRI) area to consider the transport of backfill/cap materials from the Moreau Barge Loading Facility. Based on the available water depth in the WRI and the equipment anticipated for use during the project, it is expected that the transport vessels would be operating primarily within the access channel illustrated on Figure F-5 (Attachment F). The water depths in this channel will be assessed by the Dredging Contractor to determine if additional access dredging would improve productivity.

Due to the limitations on water depth and the anticipated continued use of the Moreau Barge Loading Facility for backfill/cap material loading during project operations after 2011, caps will not be placed in CU09 or CU10 within the access channel. For this area, GE and EPA will review the residual sampling results to determine the appropriate actions to be taken. Based on discussions with EPA, the anticipated response actions may include additional dredging or deferring placement of backfill materials in this area to future years of the project. Based on the residual sampling results and post-dredge bathymetry, GE may request EPA approval not to place backfill or isolation caps in this area.

Caps will also be avoided in CU11 and CU12 within the access channel so that the maximum water depth will be available for navigation; however, a cap design analysis (Attachment F) for CU11 and CU12 was conducted in the event that caps are placed in this portion of the access channel. For this portion of the access channel, a propeller wash analysis was performed to estimate the stone size necessary to withstand forces from the transport of backfill/cap material barges. The vessel underway analysis was performed for this portion of the access channel downstream of RM 193.9. Based on the analysis presented in Attachment F, the Medium-Velocity Type C isolation cap will be specified for the majority of the access channel in CU11 and CU12, and High-Velocity Type C isolation cap will be specified for a small portion of the access channel in CU11.

3.4.2.3 Special Area 13 – Cap Analysis

As described in Attachment E, the dredge prism along the western shoreline in CU14, CU15, and CU16 and a portion of the shoreline in CU19 includes a 15-foot offset from a timber bulkhead at the shoreline where no dredging will occur to avoid the timber crib structure and avoid destabilizing the shoreline. At the 15-foot offset, the dredge prism includes a cut at a 3:1 (horizontal:vertical) slope until it intersects with the EoC. A cap will be placed over the 1.4 acres within this offset and on the slope. This area is illustrated on Figure F-7 in Attachment F. Because this is an offset from a structure, this area is not subject to the capping limits described in the Phase 2 FDR.

Attachment F describes an analysis of the cap design for this area. While the average volume-weighted Tri+ PCB concentrations for each hydrodynamic grid cell in the area to be capped is less than 200 mg/kg Tri+ PCBs, there are individual cores that contain Tri+ PCBs in excess of 200 mg/kg (Figure F-7). Therefore, the cap model was re-run using an increased isolation thickness of 10 inches to evaluate the residual Tri+ PCB concentration to confirm that the design criteria is achieved for this area (i.e., average concentration of Tri+ PCBs in the upper 6 inches of the isolation layer is 0.25 mg/kg or less after 100 years). The model analysis indicates that a 10-inch isolation layer would achieve the design criteria for residual concentrations in excess of 20,000 mg/kg Tri+ PCBs, which significantly exceeds any of the Tri+ PCB core sample results for this area. Therefore, a 10-inch isolation layer with Type 2 material with 2 percent TOC will be specified in this area.

To provide an increased level of protection at EPA’s request, Modified Type O material will be used as armoring for this area.

Based on the analysis presented in Attachment F, the cap design developed for Special Area 13 is the High Velocity Isolation Cap Type D as summarized in Table 3-5 below.

Table 3-5 Summary of Design for Special Area 13 Isolation Cap

Cap Type	Area	Cap Materials and Thickness
Isolation Cap Type D, High-Velocity	Special Area 13 offset and slope area	A minimum 10-inch isolation layer of Type 2 material with 2% organic carbon content (see Specification Section 02206 [Backfill/Cap Material], Appendix 2)
		A 6-inch armor layer of Type O material (see Specification Section 02206 [Backfill/Cap Material], Appendix 2)

Attachment F also summarizes a geotechnical evaluation that was conducted to consider cap slope stability and consolidation of underlying sediment in the Special Area 13 offset and slope area. The stability analysis performed as part of this geotechnical evaluation indicates an acceptable factor of safety for areas where the isolation cap materials are placed above the 3:1 dredge prism. However, the stability analysis indicates that the capped slope condition does not meet the acceptable factor of safety in areas where the in-river slope is steeper than the 3:1 dredge prism template (i.e., areas where the dredge prism does not extend below the existing bathymetry and no material is removed). In these areas, the design includes details to construct the top slope of the cap at 3:1 (horizontal:vertical) (see Detail 3 on Drawing C-2102 [Appendix 2]).

The Special Area 13 offset and slope area are shown on Drawings C-3103 and C-3104. Details and example cross-sections for the Special Area 13 isolation caps are identified on Drawing C-2102 (Appendix 2).

Placement of the isolation cap in the Special Area 13 offset and slope area will be conducted as soon as possible after the residual sampling results indicate that no additional dredging is required adjacent to the Special Area 13 offset and slope area.

3.4.3 Backfill and Cap Material Placement Techniques

Based on a review of other completed projects and experience during Phase 1 activities, it is anticipated that backfill and cap materials will be placed using conventional techniques (e.g., excavator with a clamshell bucket) from a barge. Placement using this method can be achieved using either surface or subsurface discharge. This method is applicable to Hudson River backfilling and capping operations due to the accuracy of the placement materials, the range of materials, and in-river conditions.

Final details on the methods to be used for backfill and cap placement will be determined by the Dredging Contractor and described in the 2011 RAWP. Cap isolation layer placement will need to be performed with care to achieve 2 percent TOC upon placement, and the cap placement techniques may require adjustments in the field. The Dredging Contractor may propose different methods for cap material placement, and these alternate methods will be considered as long as the required accuracy and efficiency of material placement are achieved.

3.4.4 Backfill and Cap Material Sources

Potential sources of backfill and cap materials, the capability of these sources to meet the required material types and quantities, and the routes of delivery will be described in the revised 2011 RAWP.

3.5 Sediment and Water Processing

The processing facility operation requirements are described in Specification Section 13750 (Processing Facility Operations; Appendix 1). Sediment and water processing involves the unloading and preparation of dredged sediments for transportation and offsite disposal. The processing facility will receive barges and unload dredged sediment from the barges at the waterfront. Debris and other large objects will be separated from the sediment at this location, and the sediment will be classified according to particle size into fine and coarse fractions. It is anticipated that a portion of the dredged material will be free draining and will be able to be directly unloaded without processing, as was done in Phase 1. The fine fraction of the sediment will be thickened, dewatered, and staged for subsequent loading into railcars. The separated coarse fraction will also be staged for subsequent loading into railcars and transportation for disposal. Water from the unloading, screening, and dewatering operations, along with stormwater collected from process areas of the site, will be treated and discharged to the Champlain Canal.

In general, the same unit processes and equipment constructed for Phase 1 will be utilized during Phase 2. This 2011 FDR does not include any design modifications to the processing facility. However, as noted in Section 2.3.6, GE has implemented or is in the process of implementing several modifications at the processing facility since the completion of Phase 1 to improve efficiency of the system. Additionally, the specifications for processing facility operation require:

- Decanting of water from the barge at a dedicated station before the barge reaches the sediment unloading station

- Assignment of a Wharf Logistics Manager with the responsibility to communicate with the Dredging Contractor and provide input to the vessel tracking system

Based on the target annual productivity of 350,000 cy and an assumed 129 days of processing, the required daily average rate of processing for the sediments targeted for dredging in Phase 2, Year 1 is estimated at approximately 2,700 cy/day. The assumed 129 days of processing is based on processing 6 days per week for 22 weeks from mid-May to mid-October. It assumes that processing will not occur on Sundays and that no processing will occur to observe three holidays during the dredge season. (Note: The assumed dredge season of 120 days as referenced in Section 2.3.1.7 assumes an additional 9 days of downtime for in-river operations due to high-flow conditions, inclement weather, or other shutdowns).

The processing facility was not designed to process clay. However, incidental amounts of clay that mixed with sediment during the initial dredge pass are not expected to upset operations at the facility. The Dredging Contractor will coordinate with the Processing Facility Operations Contractor to help identify which barges contain clay and the estimated amount. The Processing Facility Operations Contractor will use this information to make operational decisions regarding the sequence/schedule for barge unloading and whether adjustments to processing operations are needed to address the quantity of clay actually arriving in barges. If the amount of clay transported to the processing facility is expected to have a significant impact on facility operations, alternative procedures for handling the clay may include:

- Stabilization of the material with lime;

- Direct unloading the material, if housekeeping and spill containment measures are not compromised; and/or

- Processing of the material on Sundays.

As an air mitigation BMP, as described in Section 2.3.1.8, barges containing sediments with high PCB concentrations (i.e., sediments from a 1-acre area with average total PCB concentrations greater than 150 mg/kg) will be prioritized for transport and unloading at the processing facility. Other measures to reduce PCB emissions will include wetting down haul roads and material staging piles, applying appropriate covers on trucks hauling fine or dusty material, and covering staging piles. Requirements for dust and air emission controls are described in Specification Sections 02371 (Dust, Soil Erosion, and Sediment Control) (Appendix 1) and 13750 (Processing Facility Operations) (Appendix 1).

3.6 Processed Sediment Transportation and Disposal

After the dredged sediments are processed, the dewatered sediment (as well as debris removed during dredging activities) will be transported to the selected disposal facility(ies) by rail.

The railcar loading requirements are described in Specification Section 13751 (Railcar Loading Facility Operations) (Appendix 1), and the rail yard operation requirements are described in Specification Section 13900 (Rail Yard Operations) (Appendix 4).

3.6.1 Railcar Sets

Transportation of processed sediment and other project waste material will be by rail using “unit trains,” each composed of 81 gondola railcars (a “unit train” consists entirely of railcars traveling from an origin to a single destination, instead of small groups of railcars that are included in trains carrying other commodities to different destinations). Railcars will be equipped with a sift-proof packaging system in accordance with DOT requirements**.** Each railcar will be weighed before leaving the processing facility rail yard to verify that the load meets the weight restrictions of the commercial carriers. Once a unit train of 81 cars is filled with processed sediment and other project waste material, it will be picked up by the commercial rail carrier.

It is anticipated that there will be about a 4- to 6-week lag period from the start of dredging before there is sufficient material staged at the processing facility to begin loading railcars. The rate of loading and movement of railcars will be determined by the dredging and sediment processing productivity and will also be dependent on train movements controlled by the rail carriers.

Upon return to the processing facility, railcars will be kept in a secure area of the rail yard with restricted access prior to their reuse. Before being used for any other purpose (e.g., at the end of the project), railcars will be decontaminated in accordance with applicable regulations.

3.6.2 Disposal Facility(ies)

Once a train is loaded, the processed materials will be transported by railroad to one or more authorized commercial disposal facilities.

The selected disposal facilities are identified in the 2011 TDP (Appendix C to 2011 RAWP).

Upon arrival at the landfill, the railcars will be unloaded and set for the return trip to the processing facility. The unloaded waste material will be disposed of by the landfill operator in accordance with the landfill's operating permits and authorizations.

3.7 Habitat Construction

The approach for habitat construction in Phase 2 areas is consistent with the habitat construction design presented in the Phase 2 IDR. The habitat design for each area is based on river velocity, water depth, presence of vegetation prior to dredging, presence of RFWs, and the results of an SAV model. The model evaluates whether conditions are suitable for the planting and growth of SAV and is further described in Attachment H of the Phase 2 IDR. The SAV model was not updated for this Phase 2, Year 1 final design. However, the locations and volumes of additional backfill required by the Phase 2 CDE have been revised as described in Attachment G.

3.7.1 Unconsolidated River Bottom

As described in the Phase 2 IDR, unconsolidated river bottom (UCB) habitat will be reconstructed through the placement of Type 1 or Type 2 backfill. The locations where Types 1 and 2 backfill would be applied are shown on Drawings B-2301 through B-2307 (Appendix 2).

3.7.2 Aquatic Vegetation Beds

SAV beds will be constructed through both planting and natural recolonization. Planting areas were selected based on the presence of vegetation prior to dredging, the SAV model scores, location of additional backfill material, and water depth, as described in Attachment G. SAV planting will not be conducted in the area to be capped adjacent to Special Area 13. In addition, the SAV beds located in CU24 and CU25 have been identified as contingent planting areas due to the uncertain subbottom conditions in these areas. Instead of planting in these areas, SAV planting areas have been designated for other SAV beds.

The planting, contingency, and natural recolonization areas are shown on Drawings H-2101 through H-2107 (Appendix 3). Representative aquatic vegetation bed construction details for Phase 2 areas in River Section 1 are provided on Drawing H-2501 (Appendix 3).

3.7.3 Riverine Fringing Wetlands

RFWs affected by the remediation will be replaced at their current locations, to the extent practicable. The RFW construction areas are shown on Drawings H-2101 through H-2107 (Attachment 3). As noted in Section 3.4.1.4, the shape of the RFW area to be constructed in CU19, near Special Area 13, has been changed due to the offset in this area; however, the total area to be constructed is the same as the delineated area.

Construction of replacement RFWs will involve returning the area to pre-dredging elevations, with Type 3 backfill material as the surface sediments to provide a planting substrate. Type 3 backfill comprises a combination of Type 1 backfill and topsoil, resulting in a pre-placement TOC content of 2 percent. RFW areas will then be planted and seeded using species native to the Upper Hudson River. Representative wetland construction details are provided on Drawing H-2502 (Appendix 3).

3.8 Shorelines

Shoreline construction is separated into two components: shoreline stabilization in areas immediately below the designated shoreline elevation (e.g., 119.0 feet elevation in River Section 1) and shoreline repair in areas above the designated shoreline elevation.

3.8.1 Shoreline Stabilization

Shoreline stabilization (or shoreline treatments) will be applied in areas where dredging is performed up to the designated shoreline elevation, and will include implementation of stabilization measures below the shoreline elevation. The types of shoreline treatments include near-shore backfill and Type P armor stone.

Shoreline stabilization requirements are described in Specification Section 13898 (Shoreline Stabilization, Appendix 2). Details for the shoreline stabilization treatments are identified on Drawing B-2201 (Appendix 2). The types and locations for each shoreline stabilization treatment are shown on Drawings B-3101 to B-3107 (Appendix 2).

3.8.2 Shoreline Repair

The Dredging Contractor will be responsible for repairing any shoreline areas above the designated shoreline elevation.

If disturbed, areas above the designated shoreline elevation will be constructed as moderate- or low-energy shorelines based on surface water velocity profiles (above and below 1.5 ft/s, respectively). Shoreline construction will consist of seeding (low-energy) or seeding and live staking (moderate-energy).

Requirements for repair of shoreline areas disturbed during the dredging operations are presented in Specification Section 13705 (Shoreline Repair and Planting) and typical shoreline repair details are shown on Drawing B-2202 (Appendix 2).

3.9 Threatened and Endangered Species Considerations

The conservation measures listed in Section 2.2.8 for bald eagles will be followed to minimize disturbances to eagles. These are incorporated into Specification Section 01140 (Work Restrictions) in Appendix 5.

3.10 Evaluations of Attainment of Quality of Life Standards

This design has been developed with the objective of achieving the numerical criteria set forth in the Phase 2 QoLPS for air quality, odor, noise, lighting, and navigation, which are described in Section 2.1.3. A summary of the design evaluations conducted for the QoLPS parameters for Phase 2, Year 1 is provided below along with the design requirements associated with these standards.

3.10.1 Air Quality – PCBs

In accordance with the Phase 2 CDE and as summarized in Section 2.3.1.8, air mitigation BMPs will be implemented in areas with a potential to emit PCBs to the air at levels close to or exceeding the applicable PCB air quality standard, based on criteria defined in the Phase 2 CDE. Such areas are shown on Drawings D-3101 through D-3107 (Appendix 2), and the air mitigation BMPs to be implemented in those areas are summarized in Section 2.3.1.8 and included in Specification Section 13803 (Dredging; Appendix 2).

In addition, contingent BMPs will be implemented in dredge areas where measured PCB concentrations at a nearby receptor show an exceedance of the applicable PCB air quality standard on 3 consecutive days. Such contingent air mitigation BMPs may include those listed in Section 6.5.2 of the 2011 PSCP.

3.10.2 Air Quality - NAAQS

An air quality modeling analysis conducted during the Phase 1 design demonstrated that the emissions of criteria pollutants from in-river activities and processing facility operations during Phase 1 were not predicted to cause exceedances of the NAAQS. As discussed in Section 2.1.3.1, the Phase 2 PSCP Scope and Phase 2 CHASP Scope require GE to evaluate the need to revise the prior analysis to reflect any anticipated operational or equipment changes in Phase 2 that could affect these pollutants. If no such change is anticipated, no additional modeling or further evaluation of criteria pollutants is needed, and no provisions for monitoring or control of those pollutants will be necessary during Phase 2.

In accordance with the Phase 2 PSCP Scope and Phase 2 CHASP Scope, GE has evaluated the need for a revised NAAQS analysis to reflect any anticipated operational or equipment changes for Phase 2, Year 1 that could affect these criteria pollutants. That evaluation, presented in Attachment H, confirms that the Phase 1 analysis demonstrating compliance with the NAAQS should likewise apply to the Phase 2, Year 1 activities, and that there is no need for a more detailed revised NAAQS analysis for Phase 2, Year 1. As a result, no provisions for monitoring or contingency actions for the criteria pollutants are necessary during Phase 2, Year 1. (If design changes are necessary in subsequent years of Phase 2 that could cause a substantive change to this analysis, a revised analysis will be presented in revised design submittals for those year[s].)

Nevertheless, preventative or contingency measures have been included in the specifications to prevent the generation of particulates, in the form of dust, during Phase 2, Year 1 operations. These measures include the following:

- Site-specific Dust Prevention and Control Plans will be prepared by the contractors that detail the methods to be used to prevent and control onsite dust generation and migration from the site during operations.

- Haul roads and material staging piles will be wetted down, as needed, to minimize dust generation, and appropriate covers will be used on trucks hauling fine or dusty material.

- The Processing Facility Operations Contractor will be required to prevent and mitigate spills of sediment on haul roads.

3.10.3 Odor

It is not anticipated that sediments dredged in Phase 2, Year 1 will generate odors that will reach the concern or exceedance levels in the QoLPS. Routine monitoring, reporting requirements, and action levels for additional monitoring under the Phase 2 QoLPS for odor will be described in the 2011 RAM QAPP. Specific actions that will be taken to address exceedance of the criteria in the Phase 2 QoLPS and associated reporting requirements are discussed in the 2011 PSCP (GE 2011).

3.10.4 Noise

The Phase 2 CHASP Scope and Phase 2 RAM Scope require that the Phase 2 design include an updated evaluation of noise intensity generated by equipment, processes, and traffic associated with site operations based on Phase 1 noise measurements. They provide that, if Phase 2 includes equipment changes or changes to the processing facility that could result in increased noise levels over those experienced in Phase 1, this evaluation must include noise attenuation modeling, and GE must conduct a study at the beginning of dredging or processing facility operations (as applicable) to validate the modeling analysis.

For Phase 2, Year 1, the changes at the processing facility and the dredging operations are not expected to cause an increase in noise impacts over those experienced during Phase 1, as discussed below:

- The new wobbler screen and apron feeder system that will be used to feed the trommel will replace the feed screen and chute used during Phase 1. The wobbler screen is enclosed, and the discharge for the oversize fraction is closer to the ground and farther from receptors than the discharge point for the equipment used in Phase 1. The equipment for Phase 1 used a hydraulic power pack, which is not needed in the new system. All motors for the wobbler screen, apron feeders, and associated pumps are electric and will be run with power distributed from the substation. No diesel engines or generators are needed to run the new feeder system.

- The new pumps for the intermediate screen will replace a rental pump that was run with a generator during Phase 1.

- At the wharf, the winch system will be used to move the barge as it is being unloaded, which will reduce the tug movements at the unloading wharf.

- Productivity in Phase 2, Year 1 is expected to be greater than in Phase 1, which will result in slightly more barge trips to the processing facility and more truck trips between the size separation area and coarse material staging area. However, potential noise impacts associated with this activity were modeled in Phase 1 and in the Phase 2 IDR.

- On the river, fewer dredges will be used than during Phase 1, and the distance to receptors will generally be greater.

For these reasons, GE has not updated the prior noise modeling analysis, and is not planning to conduct a general noise study at the beginning of Phase 2, Year 1 dredging or facility operations. (Note that the Phase 2 IDR did contain a preliminary noise modeling assessment; however, for the above reasons, that assessment has not been updated.)

During Phase 2, Year 1, noise monitoring will be conducted by the Dredging Contractor or Processing Facility Operations Contractor at the initial start-up of any operation or equipment that is different from that previously used and that could result in increased noise levels. This monitoring will not be considered monitoring for compliance with the Noise Standard. However, if a sound level based on the contractor monitoring is above the numerical criteria in the Noise Standard, additional monitoring will be conducted at a location closer to the nearest receptor(s) to assess attainment of those criteria; and a noise level above those criteria will be considered an exceedance only if confirmed by that follow-up monitoring. Noise monitoring will also be conducted in response to noise complaints. Routine monitoring, reporting requirements, and action levels for additional monitoring under the Phase 2 QoLPS for noise will be described in the 2011 RAM QAPP.

Specification Section 02931 (Noise Restrictions and Controls) (Appendices 1 through 4) outlines the noise standards, requirements, restrictions, and controls during the project operations. This specification identifies the routine noise monitoring that will be conducted by the contractors at the initial start-up of any operation or equipment and for any changes in equipment, procedures, or conditions. If compliance noise monitoring (whether conducted as a follow-up to the contractor monitoring or in response to a complaint) shows an exceedance of an applicable noise standard, the contractor will be responsible for implementing engineering controls or other mitigation measures, as appropriate, to address such exceedance.

3.10.5 Lighting

The Phase 2 CHASP Scope requires that the Phase 2 design include an updated evaluation, based on Phase 1 light measurements, of light intensity generated by illumination of active dredge areas, processing areas, loading and staging areas, administration areas, and other work areas on and near the river, considering any equipment changes anticipated for Phase 2 that could affect lighting levels. For Phase 2, Year 1, the operations are not expected to cause an increase in lighting impacts over those experienced during Phase 1. Therefore, the Phase 1 lighting analysis has not been updated.

During Phase 2, Year 1, light monitoring will be conducted by the Dredging Contractor or Processing Facility Operations Contractor at the initial start-up of any operation or equipment that is different from that used previously and that could result in increased light levels. This monitoring will not be considered monitoring for compliance with the Lighting Standard. However, if a light level based on contractor monitoring is above a lighting standard, additional monitoring will be conducted at a location closer to the nearest receptor(s) to assess attainment of the standard; and a light level above the level of a standard will be considered an exceedance only if confirmed by that follow-up monitoring. Light monitoring will also be conducted in response to lighting complaints. Routine monitoring, reporting requirements, and action levels for additional monitoring under the Phase 2 QoLPS for lighting will be described in the 2011 RAM QAPP.

Specification Section 02936 (Lighting Restrictions and Controls) (Appendices 1 through 4) outlines the lighting standards, requirements, restrictions, and controls during the project operations. This specification identifies routine light monitoring that will be conducted by the contractors at the initial start-up of any operation or equipment and for any changes in equipment, procedures, or conditions. If compliance light monitoring (whether conducted as a follow-up to the contractor monitoring or in response to a complaint) shows an exceedance of an applicable lighting standard, the contractor will be responsible for implementing engineering controls or other mitigation measures, as appropriate, to address such exceedance.

3.10.6 Navigation

To meet the Phase 2 QoLPS for navigation, this project will be implemented to maintain safety and productivity while avoiding unnecessary disruption of non-project-related navigation, allowing efficient performance of the project. The final design incorporates certain accommodations, preventative control systems, notification protocols, contingencies, and mitigation measures to maximize safety and productivity and to avoid unnecessary disruption of non-project-related navigation, while allowing efficient performance of the project. Specifically, the design includes the following general requirements relating to navigation:

- *Prohibition on obstructing navigation* **–** To the extent practicable and consistent with meeting other goals and performance standards, project-related vessels will not be tied or anchored in the navigation channel in a manner that would prevent or obstruct passage of other vessels.

- *Vessel lighting and signals* **–** Project-related vessels will comply with applicable federal and state regulations regarding proper lighting and signaling for safe and orderly navigation, day and night.

- *Piloting* **–** Project-related vessels will comply with applicable federal and state regulations regarding piloting by qualified and properly trained personnel.

- *Restricting access* **–** Non-project-related access to active work areas will be restricted in coordination with the NYS Canal Corporation.

- *Marine traffic control* **–** Project vessels will be tracked via radio dispatch to schedule and control traffic to optimize productivity while minimizing interference with non-project-related vessels.

- *Use of locks* **–** Use of Lock 7 on the Champlain Canal will be coordinated with the NYS Canal Corporation and will be reduced by staging and routing project support vessels (i.e., vessels other than barges and associated tugs) from the Work Support Marina. Use of other locks, if necessary, will be also coordinated with NYS Canal Corporation.

- *Temporary aids to navigation* **–** Safe and efficient navigation near active project areas will be facilitated by use of buffer zones and temporary aids to navigation, including lighting, signs, buoys, and other aids specified by the NYS Canal Corporation and USCG.

- *Routine notices* **–** The NYS Canal Corporation and USCG will be provided verbal and written routine notices regarding project schedules, which will allow those agencies to issue Notices to Mariners regarding anticipated access restrictions, project vessel scheduling, lock scheduling, contingencies, or other information. The general public will also be provided a schedule of anticipated project activities that may affect navigation, as will be discussed in more detail in the 2011 CHASP.

- *Monitoring, notifications and reporting* **–** Marine traffic will be routinely monitored after dredging operations begin. This routine monitoring will involve the recording in daily logs of information about river navigation activities in the vicinity of in-river project operations, along with any resulting navigation issues.

- *Deviations from navigation requirements and complaint management* **–** If on-river operations deviate from applicable navigation regulations or from the design plans relating to navigation, the procedures to be specified in the 2011 PSCP and 2011 CHASP for reporting and taking contingency actions will be followed. Complaints from the public relating to navigation will be handled as described in the 2011 CHASP.

Specification Sections 01140 (Work Restrictions), 02936 (Lighting Restrictions and Controls), 13810 (In-Water Material Transport), 13820 (Anchoring During Dredging Operations), 13840 (Transport Procedures Through Canal Locks), 13845 (Aids to Navigation), 13860 (Marine Traffic Control), and 13897 (Marine Equipment) (all included in Appendix 2) include the requirements, restrictions, and controls during the project operations to meet the Navigation Performance Standard.

Additional information regarding the scope of navigation monitoring, notification, contingencies, mitigation, and complaint management are provided in the 2011 PSCP and will be provided in the 2011 CHASP.

4. Contract Summary and Remedial Action Implementation – Phase 2, Year 1

The implementation of Phase 2, Year 1 involves contractor selection, development of a RAWP, implementation of dredging, sediment processing, rail yard operations, and transport and disposal during 2011, and habitat construction during 2012.

This section summarizes the contracts to be awarded to implement the remedial action work for Phase 2, Year 1 and provides a general description of the remedial action activities to be performed under each contract. Also included in this section is a description of the remedial action submittals for Phase 2, Year 1 and a summary of the schedule for implementation of the remedial action activities.

4.1 Remedial Action Contracts – Phase 2, Year 1

The remedial action for Phase 2, Year 1 has been organized into the following contracts, based on the nature of work to be accomplished under each (the appendix that contains the corresponding Project Specifications and Drawings for each is noted in parentheses):

- Contract 30 – Processing Facility Operations (Appendix 1)
- Contract 40 – Dredging Operations (Appendix 2)
- Contract 50 – Habitat Construction (Appendix 3)
- Contract 60 – Rail Yard Operations (Appendix 4)

All these contracts are subject to the same general conditions (Appendix 5). Contracting has been initiated. The work for each of these contracts is summarized in the following subsections. These summaries are not intended to define the scope of work for the contracts, but are presented only to provide general overviews of work to be conducted under each contract. Refer to the corresponding Specifications and Drawings in Appendices 1 through 4 for additional detail.

4.1.1 Contract 30 – Processing Facility Operations

As described in Appendix 1, the processing facility operations work under Contract 30 will consist of seasonal start-up, commissioning, and sediment processing operations at the processing facility, including, but not limited to, the following:

- Preparing operation plans and submittals
- Mobilizing equipment, materials, and personnel and preparing the site for sediment processing operations
- Barge unloading, coarse material separation, sediment dewatering, material staging, and loading of dewatered sediment, coarse material, and debris into railcars
- Managing stormwater at the facility and treating process water and stormwater prior to discharge (including management and treatment of stormwater during the off season following the 2011 dredging season)
- Performing general operation and maintenance activities, including dust control, cleaning, lawn mowing, snow removal, and other activities
- Winterizing the processing facility after completion of sediment processing and railcar loading
- Removing, decontaminating, and demobilizing equipment, materials, and personnel

4.1.2 Contract 40 – Dredging Operations

Dredging operations under Contract 40, as described in Appendix 2, will include, but not be limited to, the following:

- Preparing operation plans and submittals
- Mobilizing equipment, materials, and personnel and preparing the site and support areas for dredging operations (including installation of the floating dock at the Work Support Marina)

- Pruning shoreline vegetation and removing in-river debris to facilitate dredging
- Dredging sediment within the targeted dredge areas and implementing BMPs as necessary to control resuspension, air emissions, and sediment oil sheens
- Transporting dredged sediment and debris to the processing facility
- Installing appropriate shoreline stabilization measures and repairing and planting of shoreline areas disturbed above the 119-foot shoreline
- Backfilling and capping, including procurement of backfill and cap materials, transport of those materials to the dredge areas, and placement in accordance with the design for each CU
- Providing marine traffic control services
- Removing and demobilizing equipment, materials, and personnel and performing decontamination activities

4.1.3 Contract 50 – Habitat Construction

Habitat construction activities will be performed following completion of dredging and backfilling/capping operations. Due to the limited growing season, planting activities under Contract 50 will be conducted in the spring of 2012 for the areas dredged in 2011. As described in Appendix 3, the habitat construction work will include, but not be limited to:

- Preparing operation plans and submittals
- Mobilizing equipment, materials, and personnel and preparing the habitat construction areas and support areas for habitat construction
- Supplying vegetation and seed, and planting aquatic vegetation beds and RFW areas (the river bottom and shoreline substrate will be installed during capping/backfilling operations under Contract 40)
- Monitoring and replacing vegetation to the extent described in the Contract 50 Specifications and Drawings (Appendix 3)

- Removing and demobilizing equipment, materials, and personnel

4.1.4 Contract 60 – Rail Yard Operations

As described in Appendix 4, the rail yard operations work under Contract 60 will consist of activities required to set up outbound loaded trains and receive inbound empty trains. The railroad that operates the track at and near the processing facility (Canadian Pacific Railroad [CPR]) will drop a set of empty rail cars on one of the receiving and delivery (R&D) tracks. The Rail Yard Operations Contractor will use a yard engine dedicated to the project to break down the train set and switch the cars to the loading track. When the cars are loaded, the Rail Yard Operations Contractor will weigh the cars, move the loaded cars to a vacant R&D track, and continue to set empty cars on the loading track. The loaded cars will be assembled into unit trains of 81 cars, which will be set on the R&D track for pickup by CPR and transported to the selected disposal facility.

As described in Appendix 4, the rail yard operations work will include, but not be limited to:

- Inspecting, maintaining, and operating the rail yard and track, an onsite rail support building, drainage structures, grade crossings, equipment, and a weigh-in-motion scale

- Moving, switching, and weighing railcars, including setting railcars for loading by the Processing Facility Operations Contractor

- Preparing unit trains for departure

- Providing logistical support services to facilitate the movement of railcars within the rail yard and coordinating the movement of railcars to and from the disposal facility

4.2 Remedial Action Work Plan and Other Remedial Action Submittals – Phase 2, Year 1

For the work to be performed in each construction year of Phase 2, Section 3.1 of the revised SOW (EPA 2010c) requires GE to submit, by February 15 of that year (or such alternate date as is agreed to by GE and EPA), a RAWP for Phase 2 Dredging and Facility Operations for the dredging to be performed in that year. As noted in Section

1.4 above, an initial version of the 2011 RAWP was submitted to EPA on February 15, 2011, and has since been revised (Parsons 2011a). The 2011 RAWP describes the dredging and facility operations and habitat construction activities to be performed as part of Phase 2, Year 1, the equipment staging for dredging operations and habitat construction, a construction schedule, and a dredge production schedule. The 2011 RAWP includes, as appendices, the following plans listed in Section 1.4 above: 2011 DQAP, 2011 Facility O&M Plan, 2011 TDP, 2011 PSCP, 2011 PAP, and 2011 CHASP.

GE has also submitted the Phase 2 Remedial Action Health and Safety Plan for 2011 (2011 RA HASP; Parsons 2011e). The RA HASP addresses potential worker health and safety issues for GE and its contractors' workers, describes potential hazards and impacts to project workers, and identifies the steps that GE and its contractors will take to prevent and respond to them.

The 2011 RAM QAPP describes in detail the monitoring and sampling activities to be conducted by GE during Phase 2, Year 1, including the sample collection, analysis, and data handling activities.

In accordance with the revised SOW, the above-listed documents will be further revised and updated for each subsequent year of Phase 2, and will be submitted to EPA for review and approval.

4.3 Remedial Action Implementation Schedule – Phase 2, Year 1

The schedule for implementation of Phase 2, Year 1 dredging and facility operations, as well as the subsequent habitat construction activities to be performed in 2012 for the areas dredged in 2011, is provided in the revised 2011 RAWP.

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6. Acronyms and Abbreviations

ARA	Archaeological Resources Assessment
ARAR	Applicable or Relevant and Appropriate Requirement
AOC	Administrative Order on Consent
BA	Biological Assessment
BBL	Blasland, Bouck & Lee
BCD	Barge Canal Datum
BMP	Best Management Practice
CDE	Critical Design Elements
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHASP	Community Health and Safety Plan
CO	carbon monoxide
CPR	Canadian Pacific Railroad
CU	Certification Unit
cy	cubic yards
cy/day	cubic yards per day
DAD	Dredge Area Delineation
dBA	A-weighted decibels
DO	dissolved oxygen

DoC	Depth of Contamination
DOT	U.S. Department of Transportation
DQAP	Dredging Construction Quality Control/Quality Assurance Plan
E&E	Ecology & Environment
EoC	Elevation of Contamination
EPA	U.S. Environmental Protection Agency
EPS	Engineering Performance Standards
FDR	Final Design Report
fps	feet per second
ft/s	feet per second
g/m^2	grams per square meter
GE	General Electric Company
GLAC	Glacial Lake Albany Clay
GPS	Global Positioning System
HA	Habitat Assessment
HASP	Health and Safety Plan
HD	Habitat Delineation
HDA	Habitat Delineation and Assessment
H_2S	hydrogen sulfide

IDR	Intermediate Design Report
IDSR	Interim Data Summary Report
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
m	meters
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MPA	mass per unit area
NAAQS	National Ambient Air Quality Standards
NAPL	non-aqueous phase liquid
NAVD88	North American Vertical Datum of 1988
ng/L	nanograms per liter
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NYCRR	New York Codes, Rules, and Regulations
NYS Canal Corporation	New York State Canal Corporation
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O_3	ozone

O&M	Operations and Maintenance
OMM	Operations, Maintenance, and Monitoring
OSHA	Occupational Safety and Health Administration
PAP	Property Access Plan
PCB	polychlorinated biphenyl
PDR	Preliminary Design Report
$PM_{2.5}$	particulates less than 2.5 micrometers in diameter
PM_{10}	particulates less than 10 micrometers in diameter
ppm	parts per million
PSCP	Performance Standards Compliance Plan
QAPP	Quality Assurance Project Plan
QoLPS	Quality of Life Performance Standard
RA CD	Remedial Action Consent Decree
RAM	Remedial Action Monitoring
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
R&D	Receiving and Delivery
RD AOC	Administrative Order on Consent for Hudson River Remedial Design and Cost Recovery
RFW	riverine fringing wetland

RM	River Mile
ROD	Record of Decision
RPM	revolutions per minute
SAV	submerged aquatic vegetation
SCADA	Supervisory Control and Data Acquisition
SEDC	Supplemental Engineering Data Collection
SO_2	sulfur dioxide
SOW	Statement of Work
SSAP	Sediment Sampling and Analysis Program
TDP	Transportation and Disposal Plan
TID	Thompson Island Dam
TIP	Thompson Island Pool
TOC	total organic carbon
TPCB	total polychlorinated biphenyls
Tri+ PCBs	PCBs with three or more chlorine atoms
TSCA	Toxic Substances Control Act
TSS	Total Suspended Solids
UCB	Unconsolidated River Bottom
USC	United States Code
USCG	United States Coast Guard

USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VTS	vessel traffic service
WQ	Water Quality
WRI	west channel of Rogers Island

Tables

Table 2-1
Exclusion Area Probing Results

Phase 2 Final Design Report for 2011
General Electric Company - Hudson River PCBs Superfund Site

Probe Location ID	Date	Coordinates		Water Depth (ft)	Probe Depth - Sediment Thickness (ft)	Description
		Easting	Northing			
1-1	10/28/09	732406.99	1606574.39	7.4	1.5	Sand over rock
1-2	10/28/09	732425.91	1606580.88	8.4	2.7	Sand over rock
1-3	10/28/09	732444.83	1606587.36	9.2	2.5	Sand over rock
1-4	10/28/09	732463.75	1606593.85	8.9	1.3	Gravel over sandy clay over rock
1-5	10/28/09	732482.67	1606600.33	8.5	0.0	Rock
2-1	10/28/09	732422.57	1606520.36	6.6	4.0	Fine sand over sandy clay
2-2	10/28/09	732441.49	1606526.84	6.0	0.0	Rock
2-3	10/28/09	732460.41	1606533.33	6.8	0.0	Rock
2-4	10/28/09	732479.33	1606539.81	6.9	0.0	Rock
2-5	10/28/09	732498.25	1606546.30	7.3	0.1	Sand over rock
3-1	10/28/09	732465.15	1606474.91	4.8	0.0	Rock
3-2	10/28/09	732482.48	1606484.89	7.3	0.0	Rock
3-3	10/28/09	732499.81	1606494.88	7.4	0.1	Sand over rock
3-4	10/28/09	732517.14	1606504.86	7.3	0.5	Sand over rock
4-1	10/28/09	732468.90	1606437.70	3.7	0.0	Rock
4-2	10/28/09	732487.70	1606444.52	5.3	0.0	Rock
4-3	10/28/09	732506.50	1606451.34	7.0	0.0	Rock
4-4	10/28/09	732525.30	1606458.16	7.4	0.0	Rock
4-5	10/28/09	732544.10	1606464.98	7.1	0.8	Sand over rock
5-1	10/28/09	732516.68	1606399.58	5.1	0.2	Sand over rock
5-2	10/28/09	732535.88	1606405.20	7.2	0.0	Rock
5-3	10/28/09	732555.07	1606410.83	7.6	0.0	Rock
5-4	10/28/09	732574.26	1606416.45	7.4	0.5	Sand over rock
6-1	10/28/09	732401.65	1606585.19	7.5	1.5	Sandy clay over rock
6-2	10/28/09	732395.76	1606597.42	6.9	0.5	Sand over rock
7-1	10/28/09	732441.18	1606598.11	8.9	2.7	Sand over rock
7-2	10/28/09	732436.98	1606610.38	8.6	2.2	Gravel over sandy clay over rock
8-1	10/28/09	732524.08	1606388.90	6.4	0.1	Sand over rock
8-2	10/28/09	732532.10	1606376.84	6.5	0.0	Rock
8-3	10/28/09	732543.18	1606360.19	7.1	0.0	Rock
8-4	11/3/10	732556.49	1606343.21	7.1	0.1	Sand and gravel over rock
8-5	11/3/10	732563.12	1606324.31	9.1	1.2	Sand and gravel over rock
8-6	11/3/10	732575.34	1606308.98	8.3	0.5	Sand and gravel over rock
8-7	11/3/10	732583.48	1606288.80	8.4	2.0	Sand and gravel over rock
8-8	11/3/10	732593.35	1606275.97	8.2	2.2	Sand and gravel over rock
8-9	11/3/10	732606.63	1606262.79	6.3	2.4	Sand and gravel over rock
9-3	11/3/10	732580.05	1606364.68	6.0	1.0	Sand and gravel over rock
9-1	11/3/10	732565.01	1606399.46	7.1	0.5	Sand and gravel over rock
9-2	11/3/10	732577.97	1606380.93	7.1	1.1	Sand and gravel over rock
9-4	11/3/10	732592.50	1606351.51	6.5	3.0	Sand and gravel over rock
10-1	11/3/10	732604.99	1606396.57	8.2	2.3	Sand and gravel over rock
10-2	11/3/10	732616.98	1606379.43	10.2	2.0	Sand and gravel over rock
10-3	11/3/10	732622.86	1606363.72	7.4	2.1	Sand and gravel over rock
11-1	11/3/10	732614.71	1606534.09	7.8	0.2	Sand and gravel over rock
11-2	11/3/10	732631.46	1606520.87	9.0	0.0	Rock
11-3	11/3/10	732652.36	1606510.73	10.5	0.5	Sand and gravel over rock
11-4	11/3/10	732670.35	1606499.63	9.1	0.5	Sand and gravel over rock
12-1	11/3/10	732640.06	1606573.30	8.0	0.2	Sand and gravel over rock
12-2	11/3/10	732656.84	1606560.71	9.3	0.6	Sand and gravel over rock
12-3	11/3/10	732670.20	1606553.61	10.3	0.7	Sand and gravel over rock
12-4	11/3/10	732687.25	1606542.94	9.9	0.2	Sand and gravel over rock
13-1	11/3/10	732672.22	1606605.08	9.4	0.3	Sand and gravel over rock
13-2	11/3/10	732684.82	1606595.64	9.6	0.2	Sand and gravel over rock
13-3	11/3/10	732706.00	1606583.46	10.2	0.8	Sand and gravel over rock
13-4	11/3/10	732723.00	1606572.00	11.1	0.3	Sand and gravel over rock
14-1	11/3/10	732695.80	1606645.78	10.5	0.3	Sand and gravel over rock
14-2	11/3/10	732717.85	1606637.98	10.4	0.5	Sand and gravel over rock
14-3	11/3/10	732731.03	1606627.36	10.2	0.0	Rock

Table 2-1
Exclusion Area Probing Results

Phase 2 Final Design Report for 2011
General Electric Company - Hudson River PCBs Superfund Site

Probe Location ID	Date	Coordinates		Water Depth (ft)	Probe Depth - Sediment Thickness (ft)	Description
		Easting	Northing			
14-4	11/3/10	732752.10	1606616.13	12.3	0.3	Sand and gravel over rock
15-1	11/3/10	732776.95	1606697.64	15.4	0.3	Sand and gravel over rock
15-2	11/3/10	732781.10	1606677.93	10.6	0.4	Sand and gravel over rock
15-3	11/3/10	732775.20	1606655.13	15.7	0.2	Sand and gravel over rock
15-4	11/3/10	732779.85	1606631.35	15.4	0.2	Sand and gravel over rock
16-1	11/3/10	732795.82	1606645.92	16.2	3.8	Sand and gravel over rock
16-2	11/3/10	732816.55	1606649.69	14.0	2.5	Sand and gravel over rock
17-1	11/3/10	732799.14	1606604.84	17.2	4.0	Sand and gravel over rock
17-2	11/3/10	732819.43	1606600.20	14.4	3.0	Sand and gravel over rock
18-1	11/3/10	732795.08	1606555.99	17.0	2.8	Sand and gravel over rock
18-2	11/3/10	732819.75	1606560.78	14.9	5.0	Sand and gravel over rock
19-1	11/3/10	732768.19	1606504.32	13.0	1.5	Sand and gravel over rock
19-2	11/3/10	732762.65	1606480.87	15.0	3.8	Sand and gravel over rock
19-3	11/3/10	732766.94	1606460.97	14.0	2.1	Sand and gravel over rock
20-1	11/3/10	732719.83	1606500.33	11.1	1.8	Sand and gravel over rock
20-2	11/3/10	732716.91	1606484.44	12.5	0.1	Sand and gravel over rock
20-3	11/3/10	732725.44	1606462.06	13.0	0.4	Sand and gravel over rock
20-4	11/3/10	732722.29	1606444.12	12.0	0.5	Sand and gravel over rock
20-5	11/3/10	732720.68	1606417.32	10.5	2.4	Sand and gravel over rock
20-6	11/3/10	732719.77	1606397.93	10.0	7.0	Sand and gravel over rock
21-1	11/3/10	732665.01	1606501.05	10.2	0.2	Sand and gravel over rock
21-2	11/3/10	732673.63	1606481.04	10.1	0.1	Sand and gravel over rock
21-3	11/3/10	732677.05	1606464.36	10.3	0.3	Sand and gravel over rock
21-4	11/3/10	732671.87	1606443.47	10.0	0.6	Sand and gravel over rock
21-5	11/3/10	732667.23	1606421.44	9.0	2.7	Sand and gravel over rock
21-6	11/3/10	732671.18	1606402.07	9.8	1.0	Sand and gravel over rock

Notes:

1. Probing conducted based on EPA comments on the Phase 2 Intermediate Design Report (ARCADIS 2008).
2. Probing was conducted by ARCADIS field personnel on October 28, 2009 and November 3, 2010.

Table 2-2
Basis of Design for Dredging and Dredged Material Transport

Phase 2 Final Design Report for 2011
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
PCB MPA threshold for sediment removal in River Section 1	3 g/m^2 Tri+ PCBs	• Record of Decision (EPA 2002)
Surface sediment threshold for sediment removal in River Section 1	10 mg/kg Tri+ PCBs	• Specified in Phase 2 DAD Report (QEA 2007) • EPA's Final Decision Regarding GE's Disputes on Draft Phase 1 DAD Report and Draft Target Area Identification Report (EPA 2004a)
Location and depth of dredging	Design inventory dredge depths are based on removal to 1 mg/kg Total PCBs	• EoC surface was developed by Anchor QEA based on the Dredge Prism Development. Steps included in the Phase 2 CDE and sediment PCB data (see Attachment D). • Dredge prisms provided with this 2011 FDR were developed by Parsons based on the Dredge Prism Development. Steps included in the Phase 2 CDE and the EoC surface developed by Anchor QEA (see Attachment E). • Location and depth of 2011 dredging based on the planned removal of approximately 350,000 cy of sediment (Phase 2 EPS)
Post-dredge sediment PCB concentration target	1 mg/kg Tri+ PCBs	• From Phase 2 EPS, additional criteria of 6 and 27 mg/kg Tri+ PCBs and 500 mg/kg total PCBs require various response actions
Target sediment removal volume – Phase 2, Year 1	350,000 cy	• Phase 2 EPS
CUs targeted for removal – Phase 2, Year 1	CU09 to CU30	• The volume for CU09 through CU30 is approximately 357,800 cy, based on the EoC surface (see Attachment D). The engineering adjustments (Attachment E) are not factored into this value. • The actual number of CUs completed, and volume of sediment dredged during Phase 2, Year 1 will be dependent on the extent of re-dredging required, among other factors
Dredge elevation tolerance requirement	Achievement of required dredge elevation in at least 95% of the dredge area	• Phase 2 EPS and Phase 2 CDE • Compliance based on 1-ft by 1-ft grid cells in the near-shore area and 10-ft by 10-ft grid cells in areas outside of the near-shore area
Canal season	Approximately 28 weeks	• Assumed length of the navigational season (i.e., early May to mid-November) based on NYS Canal Corporation operational data • Actual length of navigational season is controlled by the NYS Canal Corporation and the actual opening and closing dates may differ from the assumed early May to mid-November season • Assumes that sufficient water flows will be available for uninterrupted lock operations • Assumes that the locks will be operational during the lock season

Table 2-2
Basis of Design for Dredging and Dredged Material Transport

Phase 2 Final Design Report for 2011
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Dredge season (both the design cut and re-dredge passes)	Approximately 22 weeks (120 dredging days)	• Design assumption based on dredging between May 16, 2011 and October 17, 2011 including dredging 6 days per week, observation of 3 non-working holidays (Memorial Day, Independence Day, and Labor Day) and 9 days of downtime assumed for conditions such as inclement weather (fog, lightning, heavy rain), or high river flows, slow down or shutdown per the Performance Standards, and unexpected conditions • Actual number days available for dredging will depend on field conditions and other factors and could be more or less than 120 • Design assumption of 120 dredge days provides approximately 1 month for completion of backfilling/capping operations, equipment decontamination, and demobilization prior to the NYS Canal Corporation closing the lock system (assumed to be mid-November)
Dredging hours of operation	24 hours/day; 6 days/week (with contingent seventh day)	• Assumption – based on Phase 1 experience
Dredge type	Mechanical dredge with clamshell bucket	• Phase 2 CDE • Based on the design evaluation for Phase 1 and Phase 2 areas (see Phase 1 IDR; BBL 2005a)
Design Inventory Volume for each CU	See Table 2-6	• Volumes based on the design dredge prism developed in accordance with the Phase 2 CDE • Volumes do not account for the application of shoreline or structure offsets that will be incorporated into the final construction dredge prism based on field survey and contractor input prior to dredging
Average Dredge rate	2,900 cy/day (average over 120 dredge days)	• Average daily removal rate needed to remove 350,000 cy over an assumed period of 120 dredge days • The actual number and size of dredges necessary to meet the project requirements will be identified in the RAWP based on Dredging Contractor input • Peak daily dredge rates will exceed average rate • Dredge rates may vary based on several factors, including, but not limited to: o Startup coordination with the Processing Facility Operations Contractor o Operational adjustments (slowdowns, shutdowns, adjustments to dredging sequencing) necessary based on compliance with the Performance Standards o High river flows or other conditions (e.g., fog) that limit safe and productive dredging o Processing facility unloading/processing rates
Dredge bucket size	5 cy clamshell	• Design assumption for dredge buckets expected to be used during Phase 2, Year 1
Effective dredging uptime	55%	• Assumes 45% downtime associated with barge changeout/movement, dredge movement, shift change, maintenance, repair, and inclement weather

Table 2-2
Basis of Design for Dredging and Dredged Material Transport

Phase 2 Final Design Report for 2011
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Bucket fill factor	60% (average) in dredge areas with sediment removal thicknesses greater than 2 ft 50% (average) in other dredge areas	• Phase 1 Evaluation Report (Anchor QEA and ARCADIS 2010) • Remaining volume assumed to be water
Bucket cycle time	130 to 150 seconds (average)	• Design assumption for bucket cycle time anticipated for Phase 2, Year 1
Dredge bucket overlap	20%	• Design assumption for bucket overlap anticipated for Phase 2, Year 1
Re-dredge volume	To be determined	• Estimated volume of 81,500 cy is assumed in sensitivity analysis for dredge planning purposes, based on assumption that re-dredging will be required in 45% of the dredge area at a removal thickness of 1.5 feet (see Section 3.1.7) • The extent of re-dredging required may reduce the number of CUs completed and the volume of sediment removed during Phase 2, Year 1
Maximum of number of adjacent CUs allowed for inventory dredging at any given time (termed "concurrent CU dredging")	3 CUs	• Phase 2 EPS • Based on Phase 1 experience
Shoreline definition	119.0 ft elevation NAVD88 for River Section 1	• Shoreline is based on river flow during conditions in spring 2002 when aerial photography was taken (approximate flow rate of 5,000 cfs at the Fort Edward USGS Gauge Station). In fall 2008, a land survey of the 119-foot shoreline elevation was conducted for River Section 1 and a revised shoreline was defined for River Section 1 areas.
Near-shore area	Area between the 119 ft shoreline and the 117.5 ft in-river pre-dredge elevation	• Phase 2 EPS
Existing conditions – river bottom contours	Multi-beam bathymetry surveys by OSI – electronic files	• For CU09 to CU16, OSI bathymetric surveys conducted as part of Phase 1 operations in 2009 • For CU19 to CU30, OSI bathymetric surveys conducted in 2005 and 2006
Geotechnical properties of subsurface materials	Key parameters identified in the Phase 2 SEDC Work Plan (BBL 2006b). Data summarized in SEDC summary reports (see Section 2.2.2).	• Data collected during the SEDC Program
Water depths	Depth varies	• Varies based on river flow • Pre-dredge water depths based on OSI bathymetric surveys conducted as part of Phase 1 operations in 2009 (for CU09 to CU16) and in 2005 and 2006 (for CU19 to CU30) • Post-dredge water depths (before backfill/cap material placement) based on the Dredge Prism XYZ File
Navigation channel	As shown on the Drawings	• Location provided by Anchor QEA based on information from NYSCC, USACE, and field measurements by Anchor QEA
Sediment chemistry	Key Parameters • PCBs • Metals	• SSAP database (see Section 2.2.1)

Table 2-2
Basis of Design for Dredging and Dredged Material Transport

Phase 2 Final Design Report for 2011
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Geotechnical properties of shoreline	Key parameters identified in the Phase 2 SEDC Work Plan (BBL 2006b). Data summarized in SEDC summary reports (see Section 2.2.2).	• Data collected during the SEDC Program
In-river debris	As shown on the G-Series Existing Condition Reference Drawings and figures in the appendices of the Phase 2 Supplemental SEDC Summary Report Addendum (ARCADIS 2008b) (Attachment B to the Phase 2 IDR)	• Data collected during SEDC Program. OSI surveys conducted in 2002 and 2005. Nature and location could change prior to implementation. • Note that debris removal activities were conducted in CU09 to CU16 as part of Phase 1
Presence of shoreline structures	As shown on the G-Series Existing Condition Reference Drawings	• Data collected during SEDC Program. Nature and location could change prior to dredging. • Updated to incorporate findings from a shoreline survey conducted by Parsons during 2010 • To be verified by contractor prior to dredging
Presence of in-water structures	As shown on the G-Series Existing Condition Reference Drawings	• Data collected during SEDC Program. Nature and location could change prior to dredging. • Updated to incorporate findings from a field reconnaissance conducted by Parsons during 2010 • To be verified by contractor prior to dredging
Sediment type	Varies	• Based on side scan sonar and probing data collected during the SEDC Program
Presence of bedrock or hardpan	Data summarized in Year 2 SEDC Interim DSR (BBL 2005b) and Phase 2 SEDC DSR (ARCADIS BBL 2007)	• Data collected during SEDC Program and SSAP
Presence of clay	Location and elevation varies. See D-series Drawings.	• Approximate locations and elevation of clay delineated by Anchor QEA based on data collected during the SSAP and SEDC Program • The approximate limits of clay shown on the D-series drawings represent areas where it is estimated that the top of Glacial Lake Albany Clay (GLAC) will be encountered during the design cut dredge pass
Presence and type of vegetation	Data summarized in habitat delineation and assessment reports	• See Section 2.2.7
Presence of archaeological resources	Data summarized in archaeological assessment reports	• See Section 2.2.9
Dredged material transport hours of operation (including lock operations)	24 hours/day, 7 days/week	• Design assumption based on Phase 1 experience
Lock dimensions	Length – 328 feet Width – 45 feet <u>Area Available for Vessels:</u> Length – 300 feet Width – 43.5 feet	• NYS Canal Corporation design records

Table 2-2
Basis of Design for Dredging and Dredged Material Transport

Phase 2 Final Design Report for 2011
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
One-way lockage time	30 minutes for Lock 7	• Design assumption to stage and position vessel in the lock, drain or fill the lock, and exit the lock, based on operational data collected during Phase 1. Actual duration will vary and depends on the stage of lock upon vessel arrival and vessel traffic.
Distance between Lock 7 and Processing Facility	1.8 miles	• Aerial mapping by Chas H. Sells 2002
Tugboat sizes	25-foot length 14-foot beam 400 hp and 600 hp	• Size of tugs procured for use on the project • The actual number and size of tugs necessary to meet the project requirements will be specified in the 2011 RAWP based on Dredging Contractor input
Dredged material transport barge dimensions and capacity	195-foot by 35-foot barges 1,650 tons (includes dredged material and water)	• Size of barges procured for use on the project • Barge capacity based on an assumed average barge draft of 7.75 ft and ullage tables for barges used during Phase 1 • The actual number and size of barges necessary to meet the project requirements will be specified in the 2011 RAWP based on Dredging Contractor input
Small barge capacity (for shallow water, restricted draft areas)	100 cy	• Design assumption for the capacity of deck barges for use in shallow water areas with limited access • The actual number and size of barges necessary to meet the project requirements will be specified in the 2011 RAWP based on Dredging Contractor input
Barge staging areas	Sta. 61+00 to 65+00	• Barges can be staged at staging dolphins south of Lock 7 or outside the navigation channel where there is sufficient water depth and where there are no restrictions on anchoring
Anchoring restrictions	See D-series Drawings	• Anchoring will be restricted within areas where SAV is present outside of dredge areas, where SAV has been planted, where natural colonization areas have been designated, where caps have been placed, and in areas subject to future archaeological resource assessment • No anchoring of work-related vessels will be permitted in the navigation channel without approval from EPA in consultation with New York State Canal Corporation
Average speed of tug and barge (loaded, upstream)	6 mph	• Design assumption based on weight of barge, material in barge, horsepower of tug and vessel maneuvering characteristics for safe operations
Average speed of tug and barge (empty, downstream)	7 mph	• Design assumption based on weight of barge, material in barge, horsepower of tug and vessel maneuvering characteristics for safe operations
Air quality, odor, noise, lighting, and navigation performance standards	See Section 2.1.3	• Hudson QoLPS (EPA 2004) • Memorandum titled "Quality of Life Performance Standards – Phase 2 Changes" (EPA 2010) • Requirements specified in the Phase 2 PSCP Scope (Attachment C to the SOW for the Hudson River RA CD; EPA/GE 2010)
Air Mitigation BMPs	See Section 2.3.1.8	• Phase 2 CDE

Notes:
1. References are defined in Section 5 of the 2011 FDR.
2. Acronyms and abbreviations are defined in Section 6 of the 2011 FDR.

Table 2-3
Basis of Design for Resuspension Control

Phase 2 Final Design Report for 2011
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Control Level (Tri+ PCB Net Loads)	The Resuspension Standard is summarized in Section 2.1.2.1	• Phase 2 EPS • 2011 PSCP
Control Level (Total PCB Concentration)	The Resuspension Standard is summarized in Section 2.1.2.1	• Phase 2 EPS • 2011 PSCP
Advisory Level (TSS Concentrations)	The Resuspension Standard is summarized in Section 2.1.2.1	• Phase 2 EPS • 2011 PSCP
Resuspension BMPs	See Section 2.3.2.1	• Phase 2 CDE
Supplemental Resuspension BMPs	See Section 2.3.2.2	• Phase 2 CDE
Sheen Response BMPs	See Section 2.3.2.3	• Phase 2 CDE
Silt Curtains and other Resuspension Control Barriers	See Section 2.3.2.4	• Phase 2 CDE
Far-field monitoring stations	Thompson Island, Schuylerville, Lock 5, Stillwater, and Waterford	• Locations of the far-field stations shown in the Phase 2 RAM QAPP (Anchor QEA 2011)
Mass of PCBs targeted for removal (kg)	Total PCBs – 21,647 kg (CU09 to CU30) Tri+ PCBs – 7,475 kg (CU09 to CU30)	• See Table 4-1 in Attachment C • The mass used in resuspension modeling is based on the EoC surface (Attachment D) and differs from that in the final dredge prisms (Attachment E)
River flow	Varies – See Attachment C	• The hydrodynamics that drive the sediment transport and PCB fate models are based on two flow conditions: 1) the 2003 hydrograph; and 2) a 5,000 cfs steady-state flow at Fort Edward throughout the entire dredging season
Sediment bed initial conditions, including the bed composition and PCB concentrations	Varies	• See Attachment C
Dredge rate, volume, duration, and number of dredges for modeling the fate and transport of PCBs associated with sediment resuspended during dredging	Based on output (dredge plan) from the Phase 2 Logistics Model. See Attachment B.	• These are assumed model input conditions; the actual number and sequence of dredges and their associated removal rates during operations will likely vary from these model inputs

Notes:
1. References are defined in Section 5 of the 2011 FDR.
2. Acronyms and abbreviations are defined in Section 6 of the 2011 FDR.

Table 2-4
Basis of Design for Backfilling/Capping and Habitat Construction

Phase 2 Final Design Report for 2011
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Backfill/cap footprint	Approximately 97.6 acres of dredge area would be considered for backfill and/or cap placement within CU09 to CU30	• The Nearshore Area within CU09 to CU30 occupies approximately 5.5 acres • There are approximately 0.4 acres of RFW in CU09 to CU30 • The estimated area where habitat layer backfill will be applied is 4.4 acres (based on the analysis provided in Attachment G). Actual areas of placement are dependent on the post-dredging elevations in the delineated SAV areas. • No backfill will be placed in the navigation channel unless the post-dredge elevation is below 101.7 ft (NAVD88). Based on the design dredge prism, approximately 22.6 acres of the navigation channel have a post-dredge elevation above 101.7 ft (NAVD88). • No backfill or cap material will be placed in CU09 or CU10 within the access channel to the Moreau Barge Loading in the west channel of Rogers Island (approximately 3.5 acres) • The Phase 2 EPS limits the amount of capping that will be allowed in Phase 2 (see Section 2.1.2.2)
Top elevation of caps within the navigation channel	103.2 ft (NAVD88)	• 14 feet of water depth above the cap based on the NYSCC's Barge Canal Datum low-pool elevation (BCD low-pool elevation) of 117.2 ft NAVD88 for Thompson Island Pool • Phase 2 EPS, Phase 2 CDE
The top elevation of backfill within the navigation channel	103.2 ft (NAVD88)	• 14 feet of water depth above the backfill material based on the NYSCC's BCD low-pool elevation of 117.2 ft NAVD88 for Thompson Island Pool • No backfill will be placed in the navigation channel unless the post-dredge elevation is below 101.7 ft (NAVD88). This elevation corresponds to a 15.5-foot water depth (the 14-foot post-backfill placement water depth required by the Phase 2 EPS plus the 12-inch thick backfill layer and the allowable backfill placement tolerance). • Phase 2 EPS, Phase 2 CDE
Backfill thickness	Varies	• The backfill layer will be 12 inches (1 foot) (ROD; EPA 2002) • Near-shore backfill will be restored to original bathymetry between the 119.0 and 117.5 ft elevation in locations where dredging extends to the defined shoreline (Phase 2 CDE) • Where placed, habitat layer backfill will be placed to either return the area to pre-dredging bathymetry or to an elevation of 114 feet (equivalent to a water depth of 5 feet below the 119 ft shoreline) (Phase 2 CDE). Habitat layer backfill may also be required above isolation caps where determined appropriate by EPA (Phase 2 CDE). • RFW areas will be restored to original bathymetry
Near-shore area	Area between the 119 ft shoreline and the 117.5 ft in-river pre-dredge elevation	• Near-shore backfill will be restored to original bathymetry in the near-shore area (Phase 2 CDE) • Pre-dredge bed elevation equals 117.5 ft at near-shore setpoints, which are located along the pre-dredge bathymetric 117.5 ft elevation contour line based on OSI bathymetric surveys conducted in 2005 and 2006
Flow velocities and flow return frequency – backfill design	≤ 1.5 ft/s – Type 1 backfill > 1.5 ft/s – Type 2 backfill 2-year flow return frequency	• These flow regimes are used as the basis for the backfill design • Flow velocities based on the Phase 2 Hydrodynamic Model (Attachment H of the Phase 2 IDR)

Table 2-4
Basis of Design for Backfilling/Capping and Habitat Construction

Item	Basis	Source/Notes
Backfill Material Types	Type 1, Type 2, Type 3	• Type 1 backfill material will be used in locations with estimated surface water velocities of 1.5 ft/s or less during a 2-year flow event • Type 2 backfill material will be used in areas with estimated surface water velocities above 1.5 ft/s during a 2-year flow event • Only Type 2 backfill material will placed in the navigation channel • Supporting side slopes for near-shore backfill, habitat layer backfill, and RFW construction areas will be constructed using Type 2 material • Base materials (depths of greater than 1 foot below the final backfill surface) for near-shore backfill and RFW construction areas will be constructed using Type 2 material • Type 3 backfill material will be used to provide a planting surface in restored RFW construction areas
Residuals sediment concentration triggers following dredging	1 mg/kg Tri+ PCBs 27 mg/kg Tri+ PCBs 500 mg/kg Total PCBs	• See Section 2.1.2.2 (Phase 2 EPS)
Water depth after dredging	Varies	• Function of location in the river and dredging depths (range based on bathymetric data)
Flow velocities and flow return frequency – Cap design	• ≤ 5 ft/s – Medium-velocity isolation cap • > 5 ft/s – High-velocity isolation cap • 100-year flow return frequency	• These flow regimes are used as the basis for the cap design (Attachment F) • Flow velocities based on the Phase 2 Hydrodynamic Model (Attachment H of the Phase 2 IDR) • The basis for the flow return frequency related to the isolation cap design was set forth in the Phase 2 CDE
Caps in the navigation channel	High-velocity isolation caps	• Phase 2 CDE
Maximum residual sediment concentration subject to capping	500 mg/kg Total PCBs	• Areas with residual total PCB concentrations greater than 500 mg/kg (which is approximately equivalent to 200 mg/kg Tri+ PCBs) will be subject to re-dredging (Phase 2 EPS)
Tri+ PCB concentration in the top 6 inches of the isolation layer after 100 years	≤ 0.25 mg/kg	• Phase 2 CDE
Groundwater seepage velocity	0.18 L/m^2/hr	• Highest average value for study sites cited in Investigation of Groundwater Seepage in the Upper Hudson River (HSI Geotrans 1997)
Dissolved organic carbon	33.7 mg/L	• TIP Report (QEA 1998) • Butcher and Garvey (2004)
log K_{OC}	5.55	• Erickson et al. (2005)
log K_{doc}	4.55	• 1991 Sediment Sampling and Analysis Program (OBG 1993)
Residual sediment TOC	2.5%	• This value represents the mid-point of the range of 1% to 4% observed in the SSAP (QEA 2002) • Supported by evaluation of SSAP data from area to be dredged in 2011 (Reach 8) which yielded an average of 4.1% (see Attachment F)
Thickness of isolation layer	9 inches	• See Attachment F
Cap bulk density	1.74 mg/cm^3	• Assumed (typical value for sands) • Consistent with available density information for backfill/cap material loaded onto barges in Phase 1
Cap porosity	0.33	• Assumed (typical value for sands)

Table 2-4
Basis of Design for Backfilling/Capping and Habitat Construction

Phase 2 Final Design Report for 2011
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Ice conditions	Varies	• Basis for isolation cap design • See Attachment F
Vessel effects	Varies	• Basis for isolation cap design • See Attachment F
Planting locations	• Locations of RFWs • Locations of SAV beds • River velocities (2-year return) • Post-dredging water depths	• HD Report (Arcadis and QEA 2008) • Phase 2 HA Report (Anchor QEA 2009b) • Wetland Delineation Report for Phase 2 Dredge Areas (Anchor QEA 2011)
SAV Planting Zone	• Water depths between 2 and 8 feet (111 ft elev to 117 ft elev) based on 119 ft shoreline elevation	• HD Report (Arcadis and QEA 2008) • Phase 2 HA Report (Anchor QEA 2009b)

Notes:
1. References are defined in Section 5 of the 2011 FDR.
2. Acronyms and abbreviations are defined in Section 6 of the 2011 FDR.

Table 2-5
Basis of Design for Processed Sediment Transportation and Disposal

Phase 2 Final Design Report for 2011
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Tonnage of material to be transported and disposed during Phase 2, Year 1	402,500 tons – Target Productivity	• Based on target production of 350,000 for Phase 2, Year 1 – Phase 2 EPS (EPA 2010) • Assumes average processing facility output density of approximately 1.15 tons/*in situ* cy (based on Phase 1 data)
PCB concentration for waste disposal characterization	Variable	• Actual PCB concentrations will vary depending on dredge area and processing • All processed sediment and debris will be assumed to be TSCA-regulated waste for transportation and disposal purposes
Processed sediment shipping season	June 13 to December 31 (~29 weeks)	• Initial shipments are assumed to begin 4 to 6 weeks after dredging is initiated to allow adequate volume to accumulate for load out and shipment • Based on the plan that all material will be shipped from processing facility by end of calendar year • Shipment of all staged sediment and debris by the end of the calendar year may be subject to an extension in the event that delays attributable to actions of the disposal facility operator or rail carriers prevent such removal by the end of the calendar year (Phase 2 EPS)
Available staging area capacity for processed material	Coarse Material: 116,000 cy Fine Material: 41,000 cy	• Constructed at the processing facility during Phase 1
Landfill destination	To be determined.	• The processed materials will be transported by railroad to one or more authorized commercial disposal facilities • The selected disposal facility(ies) will be identified in the Transportation and Disposal Plan to be provided as part of the 2011 RAWP
Delivery mode	Rail, using gondola rail cars	• Rail delivery in unit trains directly to selected disposal facility(ies) • Material will be packaged in rail cars by a method meeting DOT performance standards
Debris	Size limited and segregated from filter cake	• Debris is defined as any single piece of material greater than 4 feet in any length, or any single piece of material weighing more than 1 ton and less than 6 tons • Rail cars loaded with debris will be designated so that they can be easily identified at the landfill
Moisture content of processed material	Pass paint filter test	• TSCA regulations (40 CFR 761)
RCRA designation	Non-Hazardous	• SSAP data

Notes:
1. References are defined in Section 5 of the 2011 FDR.
2. Acronyms and abbreviations are defined in Section 6 of the 2011 FDR.

Table 2-6
Certification Unit Areas and Design Volumes

Phase 2 Final Design Report for 2011
General Electric Company - Hudson River PCBs Superfund Site

Certification Unit (CU)	CU Area (acres) [1]	EoC Surface Volume (cy) [2,4]	Design Dredge Prism Volume (cy) [3,4]
CU09	4.99	11,800	9,465
CU10	4.86	10,400	10,495
CU11	4.93	18,800	16,537
CU12	4.95	16,700	14,773
CU13	4.86	16,500	17,685
CU14	5.00	24,700	21,682
CU15	4.87	24,000	23,809
CU16	5.50	14,400	14,633
CU19	4.98	17,100	17,096
CU20	5.06	15,500	15,690
CU21	4.99	15,200	15,509
CU22	5.03	16,100	16,547
CU23	5.01	16,600	16,932
CU24	5.03	27,000	27,456
CU25	5.04	19,500	19,558
CU26	4.24	17,000	17,420
CU27	4.18	13,100	14,910
CU28	4.72	19,000	19,189
CU29	4.95	14,300	14,570
CU30	4.95	14,800	14,941
TOTAL - CU09 to CU30	**98.14**	**342,500**	**338,897**

Notes:

1. Certification Unit (CU) Area based on the area within the CU boundary limits and does not include adjustments associated with offsets/setbacks within the CU limits or engineering sideslopes outside the CU boundaries.

2. The Elevation of Contamination (EoC) surface was developed by Anchor QEA based on the Dredge Prism Development Steps included in the Phase 2 CDE and sediment PCB data (see Attachment D).

3. Design dredge prisms were developed by Parsons based on the Dredge Prism Development Steps included in the Phase 2 CDE and the EoC surface developed by Anchor QEA (see Attachment E).

4. Volumes for the EoC surface and the design dredge prisms are based on comparison with the existing bathymetry data, which is based on bathymetric surveys conducted as part of Phase 1 operations in 2009 (for CU09 to CU16) and bathymetric surveys conducted in 2005 and 2006 (for CU19 to CU30). The Design Dredge Prism Volumes include engineering sideslopes that are outside of the CU boundaries.

Table 3-1
USGS Fort Edward Gage Data - Days with Average Daily Flows above 10,000 cfs

Phase 2 Final Design Report for 2011
General Electric Company - Hudson River PCBs Superfund Site

Year	Days with Average Daily Flows above 10,000 cfs	
	January 1st - December 31st	May 15th - November 15th
1999	10	0
2000	46	12
2001	18	0
2002	14	6
2003	39	6
2004	11	5
2005	37	6
2006	51	30
2007	40	0
2008	35	0

Source: USGS gaging station 01327750 at Fort Edward, NY http://waterdata.usgs.gov/usa/nwis/uv?site_no=01327750)

Table 3-2
Dredge Plan

Phase 2 Final Design Report for 2011
General Electric Company - Hudson River PCBs Superfund Site

Week	Day	Daily Removal Volumes by Certification Unit (cy)															Total Design Cut Volume (cy)	Total Re-Dredge Volume (cy)	Total Volume by Day (cy)	Total Volume by Week (cy)
		CU09	CU10	CU11	CU12	CU13	CU14	CU15	CU16	CU19	CU20	CU21	CU22	CU23	CU24	CU25				
	1																0	0	**0**	
	2																0	0	**0**	
	3																0	0	**0**	
1	4																0	0	**0**	**0**
	5																0	0	**0**	
	6																0	0	**0**	
	7	*No dredging assumed during the first 2 weeks.*															0	0	**0**	
	8																0	0	**0**	
	9																0	0	**0**	
	10																0	0	**0**	
2	11																0	0	**0**	**0**
	12																0	0	**0**	
	13																0	0	**0**	
	14																0	0	**0**	
	15	1,611	2,327														3,939	0	**3,939**	
	16	1,598	2,104														3,702	0	**3,702**	
	17	1,574	1,859														3,433	0	**3,433**	
3	18	1,598	1,984														3,583	0	**3,583**	**18,517**
	19	1,898	1,963														3,860	0	**3,860**	
	20	*Assumed Down Day*															0	0	**0**	
	21	*Sunday*															0	0	**0**	
	22	1,461	980	681													3,122	0	**3,122**	
	23	1,507		2,216													3,722	0	**3,722**	
	24	1,647		1,996													3,643	0	**3,643**	
4	25	958		1,911													2,870	0	**2,870**	**16,603**
	26	820		2,426													3,246	0	**3,246**	
	27	*Assumed Down Day*															0	0	**0**	
	28	*Sunday*															0	0	**0**	
	29	*Memorial Day Holiday*															0	0	**0**	
	30	38	1,510	2,344													2,381	1,510	**3,891**	
	31		1,137	1,688													1,688	1,137	**2,825**	
5	32		887	1,459	619												2,078	887	**2,966**	**15,629**
	33		540	1,616	639												2,255	540	**2,795**	
	34		438	1,536	1,178												2,714	438	**3,152**	
	35	*Sunday*															0	0	**0**	
	36		168	1,912	1,315												3,227	168	**3,395**	
	37	400		1,361	1,990												3,352	400	**3,751**	
	38	1,234		160	1,306												1,466	1,234	**2,700**	
6	39	1,214			1,289												1,289	1,214	**2,503**	**17,991**
	40	589			1,464	516											1,980	589	**2,569**	
	41	620			1,809	642											2,451	620	**3,072**	
	42	*Sunday*															0	0	**0**	
	43	579			1,878	649											2,527	579	**3,106**	
	44	575			1,589	887											2,475	575	**3,050**	
	45				1,520	1,478											2,998	0	**2,998**	
7	46			1,229	540	1,629											2,169	1,229	**3,398**	**18,517**
	47			1,351	863	798											1,661	1,351	**3,013**	
	48			1,477	130	1,345											1,475	1,477	**2,952**	
	49	*Sunday*															0	0	**0**	
	50			648		1,847	1,090										2,937	648	**3,585**	
	51					2,096	1,282										3,379	0	**3,379**	
	52					1,344	1,768										3,112	0	**3,112**	
8	53					1,691	1,491										3,181	0	**3,181**	**19,171**
	54					805	1,412	619									2,837	0	**2,837**	
	55						1,572	1,506									3,078	0	**3,078**	
	56	*Sunday*															0	0	**0**	

Table 3-2
Dredge Plan

Phase 2 Final Design Report for 2011
General Electric Company - Hudson River PCBs Superfund Site

Week	Day	Daily Removal Volumes by Certification Unit (cy)															Total Design Cut Volume (cy)	Total Re-Dredge Volume (cy)	Total Volume by Day (cy)	Total Volume by Week (cy)
		CU09	CU10	CU11	CU12	CU13	CU14	CU15	CU16	CU19	CU20	CU21	CU22	CU23	CU24	CU25				
	57						1,415	1,705									3,120	0	**3,120**	
	58						1,725	1,191									2,916	0	**2,916**	
	59						1,328	1,763									3,090	0	**3,090**	
9	60						1,529	1,551									3,080	0	**3,080**	**18,131**
	61						1,851	1,299									3,149	0	**3,149**	
	62				364		1,548	863									2,411	364	**2,775**	
	63	***Sunday***															0	0	**0**	
	64	***Independence Day Holiday***															0	0	**0**	
	65				668		1,273	894									2,167	668	**2,835**	
	66				866	38	1,596	293									1,890	904	**2,794**	
10	67				1,400	959	833										833	2,359	**3,191**	**14,250**
	68				942	1,067	645										645	2,009	**2,654**	
	69				224	1,172	984	396									1,379	1,396	**2,775**	
	70	***Sunday***															0	0	**0**	
	71					854	911	1,504									2,416	854	**3,270**	
	72					697	674	1,803									2,477	697	**3,174**	
	73						1,051	1,870	660								3,581	0	**3,581**	
11	74						806	1,377	1,000								3,184	0	**3,184**	**19,440**
	75						619	1,811	817								3,247	0	**3,247**	
	76						18	1,832	1,135								2,985	0	**2,985**	
	77	***Sunday***															0	0	**0**	
	78							1,717	1,309								3,026	0	**3,026**	
	79							1,294	1,537								2,831	0	**2,831**	
	80							1,386	1,530								2,916	0	**2,916**	
12	81							1,813	1,300								3,113	0	**3,113**	**17,320**
	82							1,070	1,117	348							2,535	0	**2,535**	
	83								1,579	1,320							2,899	0	**2,899**	
	84	***Sunday***															0	0	**0**	
	85								1,336	1,100							2,436	0	**2,436**	
	86						2,128			941							941	2,128	**3,069**	
	87						1,940			980							980	1,940	**2,920**	
13	88						1,354		19	1,100	25						1,144	1,354	**2,498**	**16,847**
	89								1,013	1,210	804						3,027	0	**3,027**	
	90							1,258	257	1,137	246						1,640	1,258	**2,897**	
	91	***Sunday***															0	0	**0**	
	92							2,294		1,244							1,244	2,294	**3,538**	
	93							1,385		1,711							1,711	1,385	**3,097**	
	94							979		1,300	600						1,900	979	**2,879**	
14	95							928		1,311	540						1,851	928	**2,778**	**18,472**
	96							1,018		1,640	649						2,289	1,018	**3,307**	
	97							308		1,185	942	438					2,565	308	**2,873**	
	98	***Sunday***															0	0	**0**	
	99									541	1,369	562					2,471	0	**2,471**	
	100									841	1,379	445					2,665	0	**2,665**	
	101									302	1,497	1,021					2,820	0	**2,820**	
15	102										1,631	1,289					2,920	0	**2,920**	**17,505**
	103										1,674	1,687					3,361	0	**3,361**	
	104								533		1,578	1,157					2,735	533	**3,269**	
	105	***Sunday***															0	0	**0**	
	106								1,717		639	803					1,442	1,717	**3,159**	
	107								1,362		989	650					1,638	1,362	**3,000**	
	108								1,424			1,162					1,162	1,424	**2,586**	
16	109								511	859		1,430					1,430	1,370	**2,801**	**17,572**
	110									1,489		1,593					1,593	1,489	**3,082**	
	111									1,473		1,277	196				1,472	1,473	**2,945**	
	112	***Sunday***															0	0	**0**	

Table 3-2
Dredge Plan

Phase 2 Final Design Report for 2011
General Electric Company - Hudson River PCBs Superfund Site

Week	Day	CU09	CU10	CU11	CU12	CU13	CU14	CU15	CU16	CU19	CU20	CU21	CU22	CU23	CU24	CU25	Total Design Cut Volume (cy)	Total Re-Dredge Volume (cy)	Total Volume by Day (cy)	Total Volume by Week (cy)
	113									1,482		883	975				1,858	1,482	**3,340**	
	114									600			1,525	933			2,458	600	**3,058**	
	115									295	355		1,358	591			1,949	650	**2,598**	
17	116										819		1,379	809			2,188	819	**3,007**	**17,934**
	117										1,416		1,529	55			1,584	1,416	**3,001**	
	118										499		1,590	841			2,431	499	**2,930**	
	119								*Sunday*								0	0	**0**	
	120										501		1,449	696			2,145	501	**2,646**	
	121										269	974	942	378			1,320	1,243	**2,564**	
	122											1,574	1,740				1,740	1,574	**3,314**	
18	123											1,537	2,115				2,115	1,537	**3,652**	**17,882**
	124											945	1,726				1,726	945	**2,672**	
	125											344	955	1,501	235		2,691	344	**3,035**	
	126								*Sunday*								0	0	**0**	
	127								*Labor Day Holiday*								0	0	**0**	
	128												390	1,479	1,188		3,057	0	**3,057**	
	129													1,592	1,444		3,036	0	**3,036**	
19	130													1,621	1,272		2,892	0	**2,892**	**15,128**
	131													1,733	1,279		3,012	0	**3,012**	
	132													1,466	1,664		3,130	0	**3,130**	
	133								*Sunday*								0	0	**0**	
	134													905	2,064		2,969	0	**2,969**	
	135													565	3,035		3,600	0	**3,600**	
	136													384	1,950	638	2,972	0	**2,972**	
20	137														2,188	1,333	3,521	0	**3,521**	**19,455**
	138														2,330	1,072	3,402	0	**3,402**	
	139														1,709	1,282	2,991	0	**2,991**	
	140								*Sunday*								0	0	**0**	
	141														1,552	1,484	3,036	0	**3,036**	
	142												30		1,957	1,201	3,158	30	**3,187**	
	143												839		1,469	459	1,928	839	**2,768**	
21	144												803		1,660	414	2,074	803	**2,877**	**17,365**
	145												1,644	648	806		806	2,292	**3,098**	
	146												864	1,056	479		479	1,919	**2,399**	
	147								*Sunday*								0	0	**0**	
	148												807	1,575			0	2,382	**2,382**	
	149												638	1,228		215	215	1,866	**2,081**	
	150															2,159	2,159	0	**2,159**	
22	151														1,566	1,214	1,214	1,566	**2,780**	**15,660**
	152														2,933	710	710	2,933	**3,643**	
	153														1,931	685	685	1,931	**2,616**	
	154								*Sunday*								0	0	**0**	
	155														303	875	875	303	**1,178**	
	156															1,240	1,240	0	**1,240**	
	157															1,238	1,238	0	**1,238**	
23	158															786	786	0	**786**	**4,442**
	159																0	0	**0**	
	160																0	0	**0**	
	161								*Sunday*								0	0	**0**	
	162																0	0	**0**	
	163															902	0	902	**902**	
	164															2,574	0	2,574	**2,574**	
24	165															1,476	0	1,476	**1,476**	**6,270**
	166															1,177	0	1,177	**1,177**	
	167															141	0	141	**141**	
	168								*Sunday*								0	0	**0**	

Table 3-2
Dredge Plan

Phase 2 Final Design Report for 2011
General Electric Company - Hudson River PCBs Superfund Site

Week	Day	Daily Removal Volumes by Certification Unit (cy)															Total Design Cut Volume (cy)	Total Re-Dredge Volume (cy)	Total Volume by Day (cy)	Total Volume by Week (cy)
		CU09	CU10	CU11	CU12	CU13	CU14	CU15	CU16	CU19	CU20	CU21	CU22	CU23	CU24	CU25				
Total Design Cut Volume (cy)		14,710	11,217	21,305	18,131	15,727	27,421	29,558	14,608	18,210	14,562	14,396	17,868	15,549	28,281	17,004	--	--	--	--
Total Re-dredge Volume (cy)		5,211	4,681	4,705	4,464	4,787	5,422	8,170	5,547	6,197	3,860	5,374	5,625	4,506	6,733	6,270	--	--	--	--
Total Volume (cy)		19,922	15,898	26,010	22,595	20,514	32,844	37,728	20,155	24,407	18,422	19,770	23,494	20,056	35,014	23,274	278,548	81,553	360,100	360,100

Notes:

1. Dredge plan develop based on output data from the Phase 2 logistics model (Run #P2FDR94) for planning purposes only. See Attachment B for additional details.
2. The initial design cut volumes are based on the Elevation of Contamination (EoC) (see Attachment D). The re-dredging volume assumes that a single additional re-dredge pass would be conducted in 45 percent of the dredge areas at a removal thickness of 1.5 feet.
3. Shaded cells indicate volumes associated with the re-dredge pass.
4. The Dredging Contractor will be responsible for developing a dredge plan in accordance with the requirements of Specification Section 13803 (Dredging; Appendix 2).
5. The actual number of CUs and volumes that will be dredged depends on several factors including, but not limited to:
    - The startup plan developed by the Dredging Contractor and the Processing Facility Contractor
    - The area and volume of sediment that will be subject to re-dredging based on the residual sampling results compared to the Residuals Standard
    - The productivity of dredging operations to be completed in an upstream to downstream sequence, while limiting the work area to three adjacent certification units
    - The degree of operational adjustments (slowdowns, shutdowns, adjustments to dredging sequencing) necessary based on compliance with the Performance Standards
    - The operational dates for the Champlain Canal
    - The frequency of high-river flows that limit safe and productive dredging. Dredging operations are shutdown at flows greater than 10,000 cfs.
    - The ability to unload and process dredged material and water transported to the Processing Facility at the planned production rate.
    - The rate of backfilling and capping operations and CU closure. Dredging (including re-dredging) will need to be terminated in time to allow for closure of CUs and demobilization before the canal closure date. The actual end date for dredging in 2011 will be determined based on field conditions.

Table 3-3
Seasonal Percent Release at Thompson Island Dam and Waterford

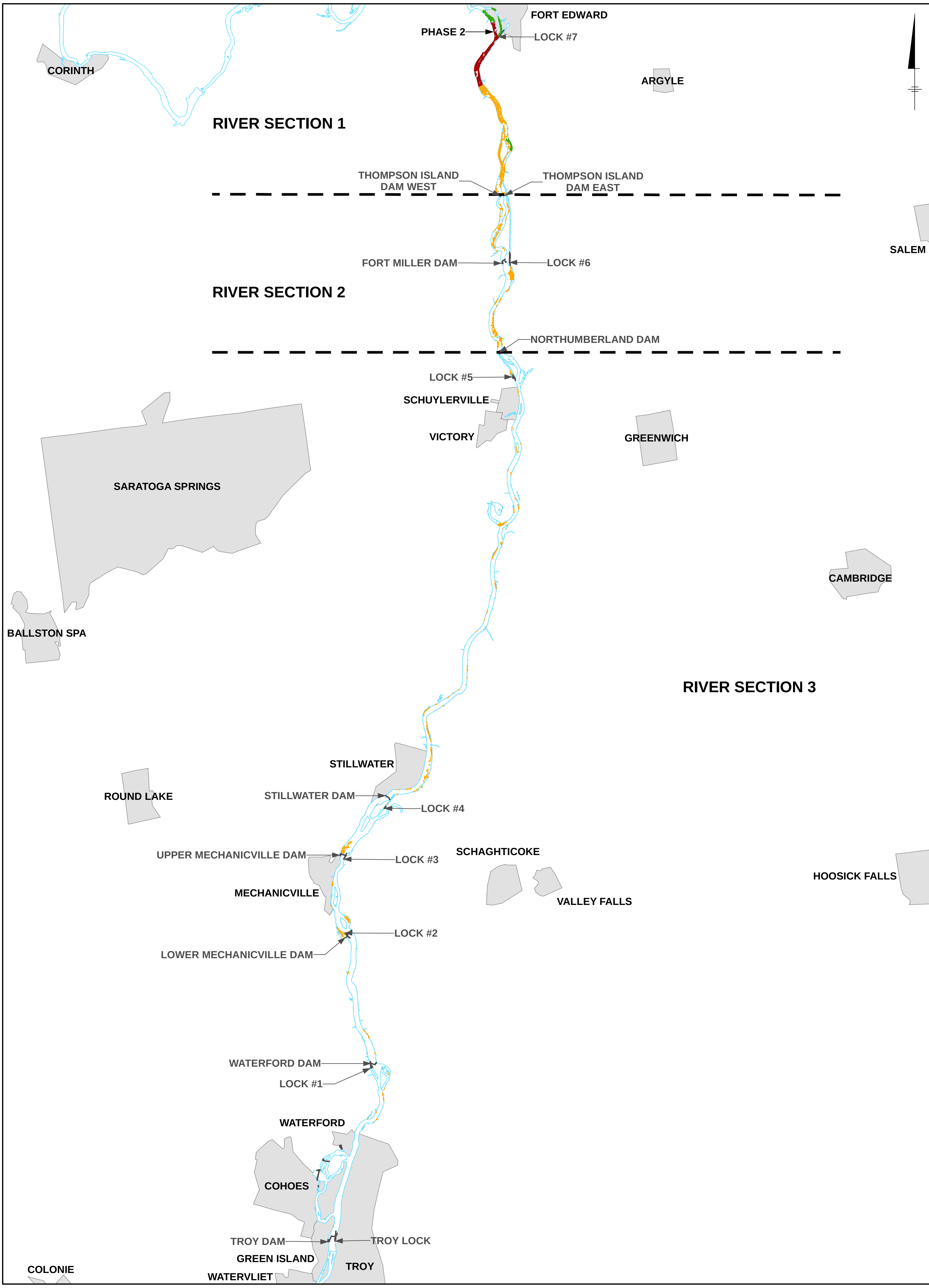
Phase 2 Final Design Report for 2011
General Electric Company – Hudson River PCBs Superfund Site

Design Run		Total Tri+ PCB Dredged (kg)	Thompson Island Dam		Waterford	
			Total Net Load (kg)	Percent Release Predicted During Dredging Season	Total Net Load (kg)	Percent Release Predicted During Dredging Season
2003 Hydrograph	Without Re-dredging	7475	182	2.4%	106	1.4%
5000 cfs Constant Flow	Without Re-dredging	7475	241	3.2%	157	2.1%
2003 Hydrograph	With Re-dredging	6007	162	2.7%	95	1.6%
5000 cfs Constant Flow	With Re-dredging	6007	205	3.4%	135	2.2%

Note:
1. Resuspension modeling conducted by Anchor QEA. See Attachment C (Phase 2 Resuspension Modeling Report) for a description of the modeling conducted to estimate resuspension and a summary of the results of the modeling simulations.

Figures

City: SYR Div/Group: 90 Created By: mkohberger Last Saved By: MKOHBERGER
GE Hudson River (B0031087.2009.02100)
R:\GE_GIS\GE_HudsonRiver\Phase2_FDR\DredgeAreaDelineation\mxd\Phase 1 and Phase 2 DAs with River Sections.mxd 3/9/2011 11:36:33 AM



LEGEND:
- DAM/LOCK
- PHASE I DREDGE AREA
- PHASE II YEAR 1 DREDGE AREA
- PHASE II REMAINDER DREDGE AREA
- INCORPORATED AREA
- SHORELINE

NOTE:
1. BASEMAPPING PROVIDED BY ANCHOR QEA, LLC.

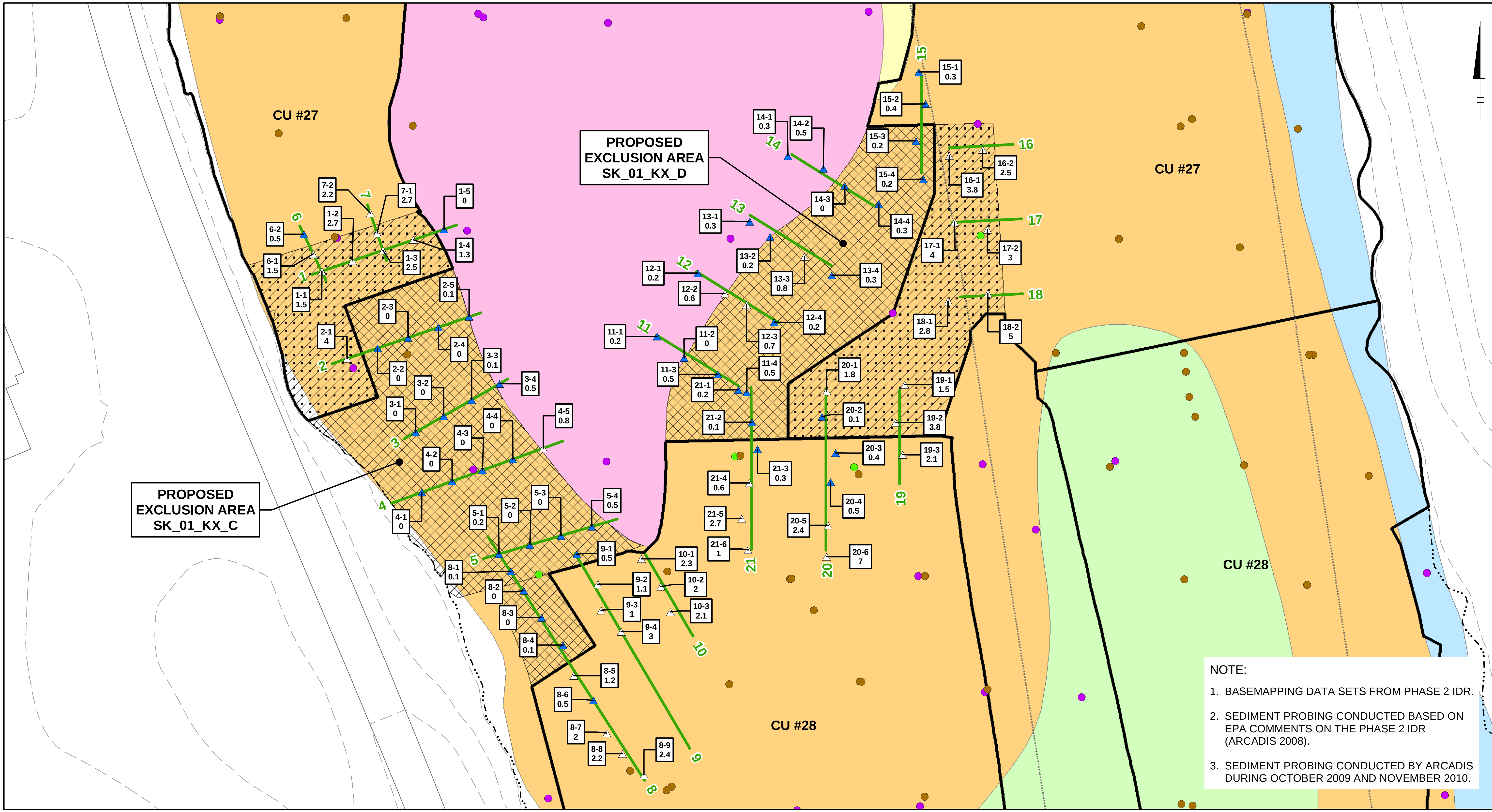
0 2.7 5.4 Miles
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 2 FINAL DESIGN REPORT FOR 2011

UPPER HUDSON RIVER

ARCADIS

FIGURE
1-1



NOTE:

1. BASEMAPPING DATA SETS FROM PHASE 2 IDR.
2. SEDIMENT PROBING CONDUCTED BASED ON EPA COMMENTS ON THE PHASE 2 IDR (ARCADIS 2008).
3. SEDIMENT PROBING CONDUCTED BY ARCADIS DURING OCTOBER 2009 AND NOVEMBER 2010.

LEGEND:

- SEDIMENT CORE DATA EXCEED DAD CRITERIA
- SEDIMENT CORE REFUSAL LOCATION
- SEDIMENT CORE DATA MEET DAD CRITERIA

PROBE LOCATION:

- SEDIMENT PROBE LOCATION - SEDIMENT THICKNESS 6 INCHES OR LESS
- SEDIMENT PROBE LOCATION - SEDIMENT THICKNESS GREATER THAN 6 INCHES
- SEDIMENT PROBE TRANSECT
- UPLAND ELEVATION CONTOUR
- NAVIGATION CHANNEL
- PHASE 2 CERTIFICATION UNIT (APPROXIMATE)
- SHORELINE (APPROXIMATE)
- PROPOSED EXCLUSION AREA - PHASE 2 IDR
- PROPOSED EXCLUSION AREA - BASED ON SEDIMENT PROBING
- PORTION OF PHASE 2 IDR EXCLUSION AREA PROPOSED TO BE ADDED TO CU
- SEDIMENT TYPE 1
- SEDIMENT TYPE 2
- SEDIMENT TYPE 3
- SEDIMENT TYPE 4
- SEDIMENT TYPE 5
- SK_01_KX_C PROPOSED EXCLUSION AREA ID
- 5-1 ← SEDIMENT PROBE LOCATION; 0.2 ← SEDIMENT THICKNESS (FT)

0 60 120 Feet

GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE

PHASE 2 FINAL DESIGN REPORT FOR 2011

PROPOSED CU REVISIONS BASED ON EXCLUSION AREA SEDIMENT PROBING

ARCADIS

FIGURE **2-1**

City: SYR Div/Group: 90 Created By: mkohberger Last Saved By: MKOHBERGER
GE Hudson River (B0031087.2009.002100)
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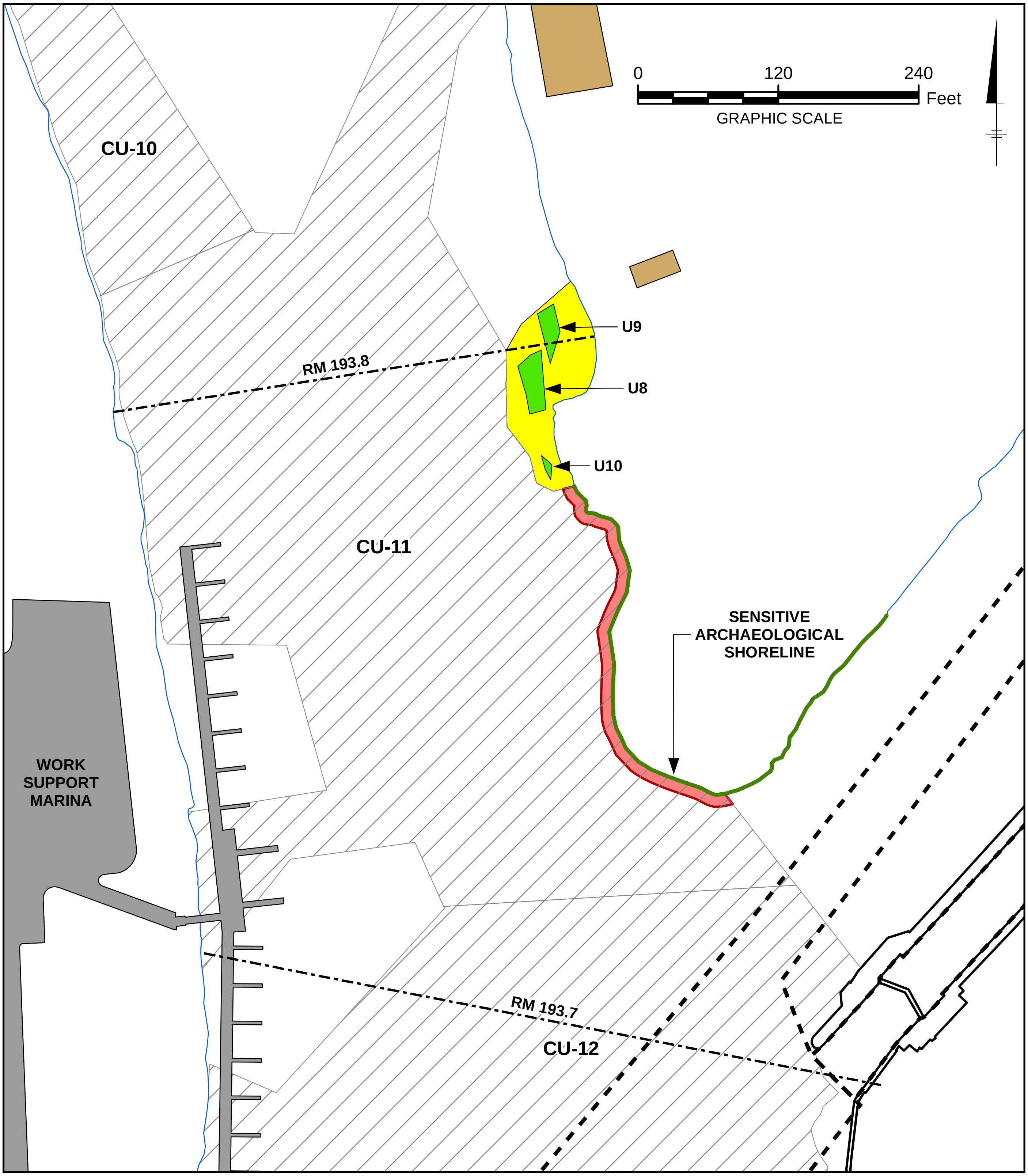

LEGEND:

- RIVER MILE MARKER
- STREET CENTERLINE
- STRUCTURE
- SHORELINE (APPROXIMATE)
- NAVIGATION CHANNEL
- CERTIFICATION UNIT
- SENSITIVE ARCHAEOLOGICAL SHORELINE
- SENSITIVE ARCHAEOLOGICAL SHORELINE 10 FT OFFSET
- SENSITIVE ARCHAEOLOGICAL RIVER BOTTOM
- ARCHAEOLOGICAL RESOURCES U8, U9, AND U10
- WORK SUPPORT MARINA

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE

PHASE 2 FINAL DESIGN REPORT FOR 2011

SENSITIVE ARCHAEOLOGICAL SHORELINE OFFSET - CU11

ARCADIS

FIGURE
2-2

City: SYR Div/Group: 90 Created By: mkohberger Last Saved By: MKOHBERGER
GE Hudson (B0031087.2009.2100)
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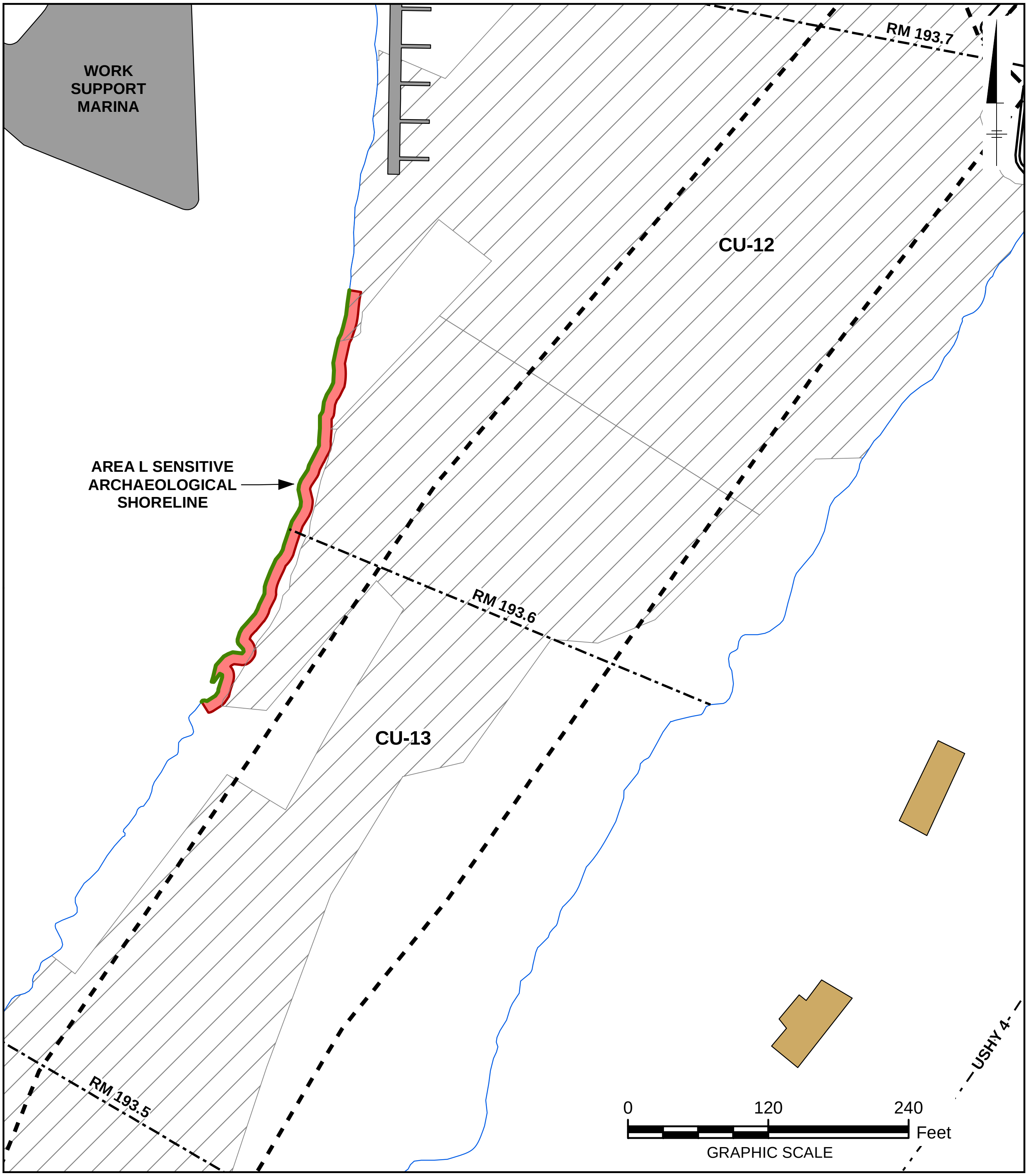

LEGEND:

- RIVER MILE MARKER
- STREET CENTERLINE
- STRUCTURE
- SHORELINE (APPROXIMATE)
- NAVIGATION CHANNEL
- CERTIFICATION UNIT
- SENSITIVE ARCHAEOLOGICAL SHORELINE
- SENSITIVE ARCHAEOLOGICAL SHORELINE 10 FT OFFSET
- WORK SUPPORT MARINA

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE

PHASE 2 FINAL DESIGN REPORT FOR 2011

SENSITIVE ARCHAEOLOGICAL SHORELINE OFFSET - CU12 AND CU13

ARCADIS

FIGURE
2-3

City: SYR Div/Group: 90 Created By: mkohberger Last Saved By: MKOHBERGER
GE Hudson (B0031087.2009.2100)
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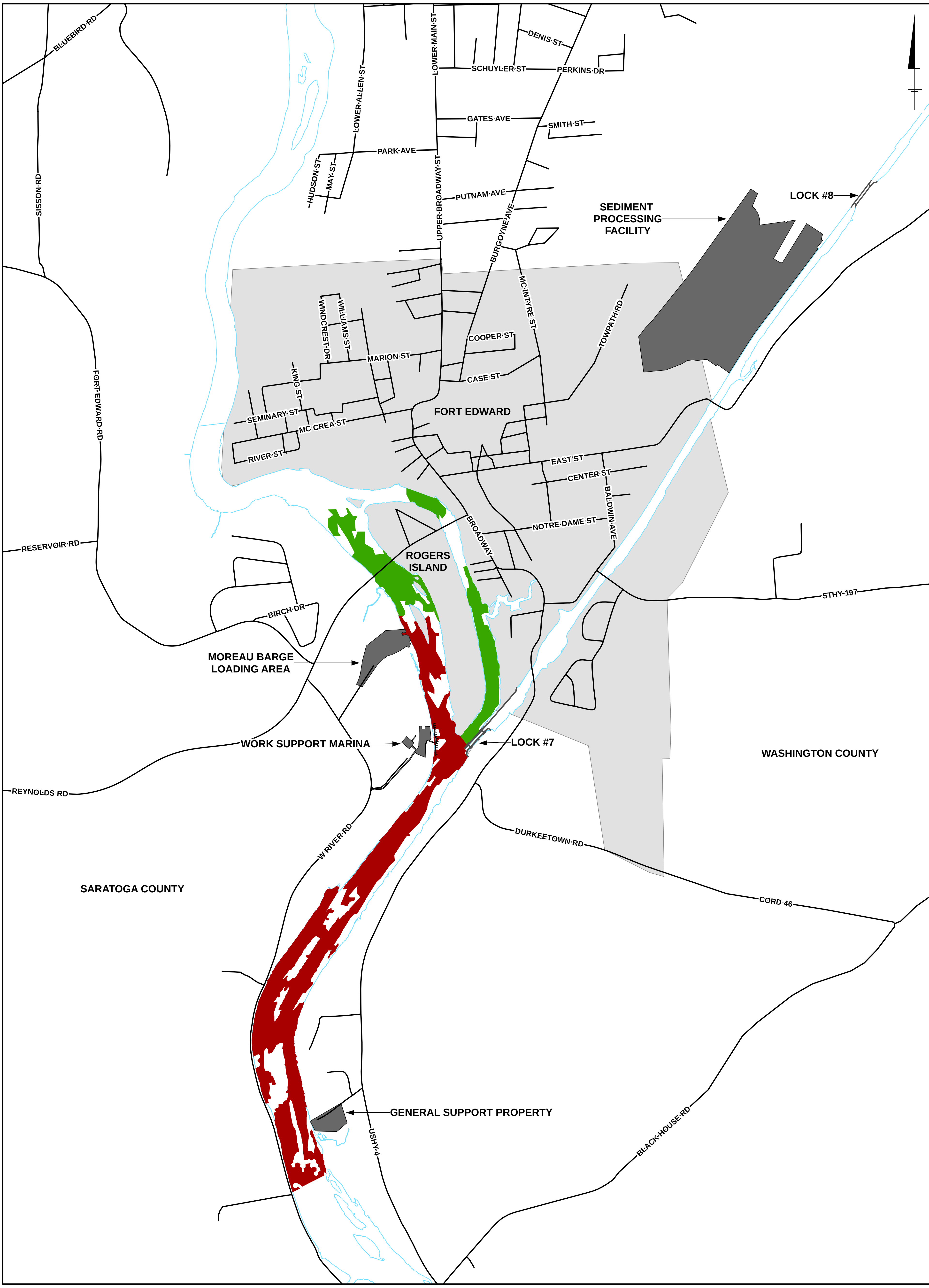

LEGEND:

- STREET CENTERLINE (APPROXIMATE)
- PHASE 1 DREDGE AREA
- PHASE 2, YEAR 1 DREDGE AREA
- INCORPORATED AREA
- SHORELINE

NOTE:

1. BASE MAPPING PROVIDED BY ANCHOR QEA, LLC.

0 1,600 3,200 Feet

GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 2 FINAL DESIGN REPORT FOR 2011

PHASE 2, YEAR 1 DREDGE AREAS

ARCADIS

FIGURE
2-4

City: SYR Div/Group: 90 Created By: mkohberger Last Saved By: MKOHBERGER
GE Hudson River (B0031087.2009.02100)
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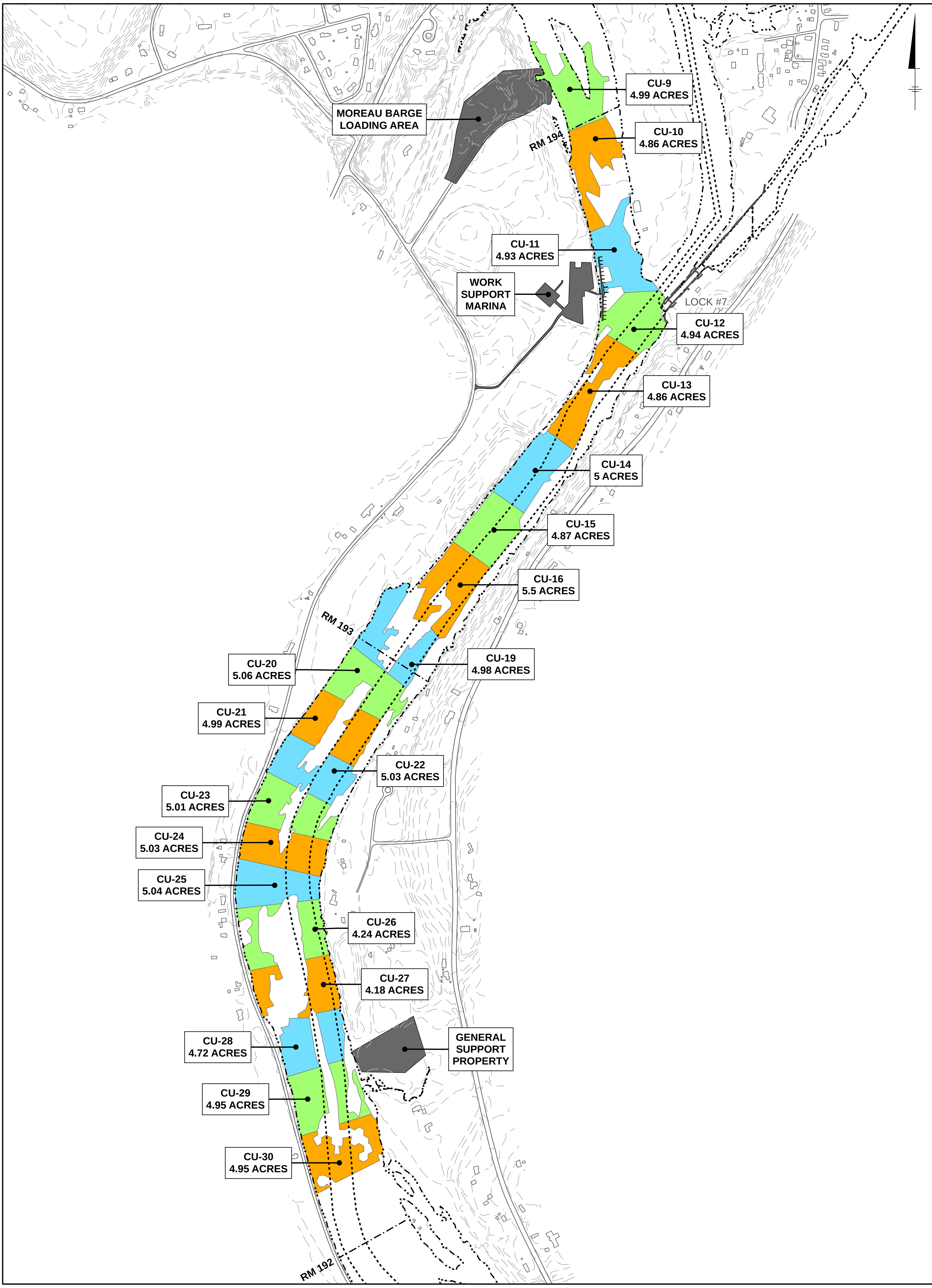


LEGEND:
- RIVER MILE MARKER
- UPLAND ELEVATION CONTOUR
- NAVIGATION CHANNEL
- SHORELINE (APPROXIMATE)

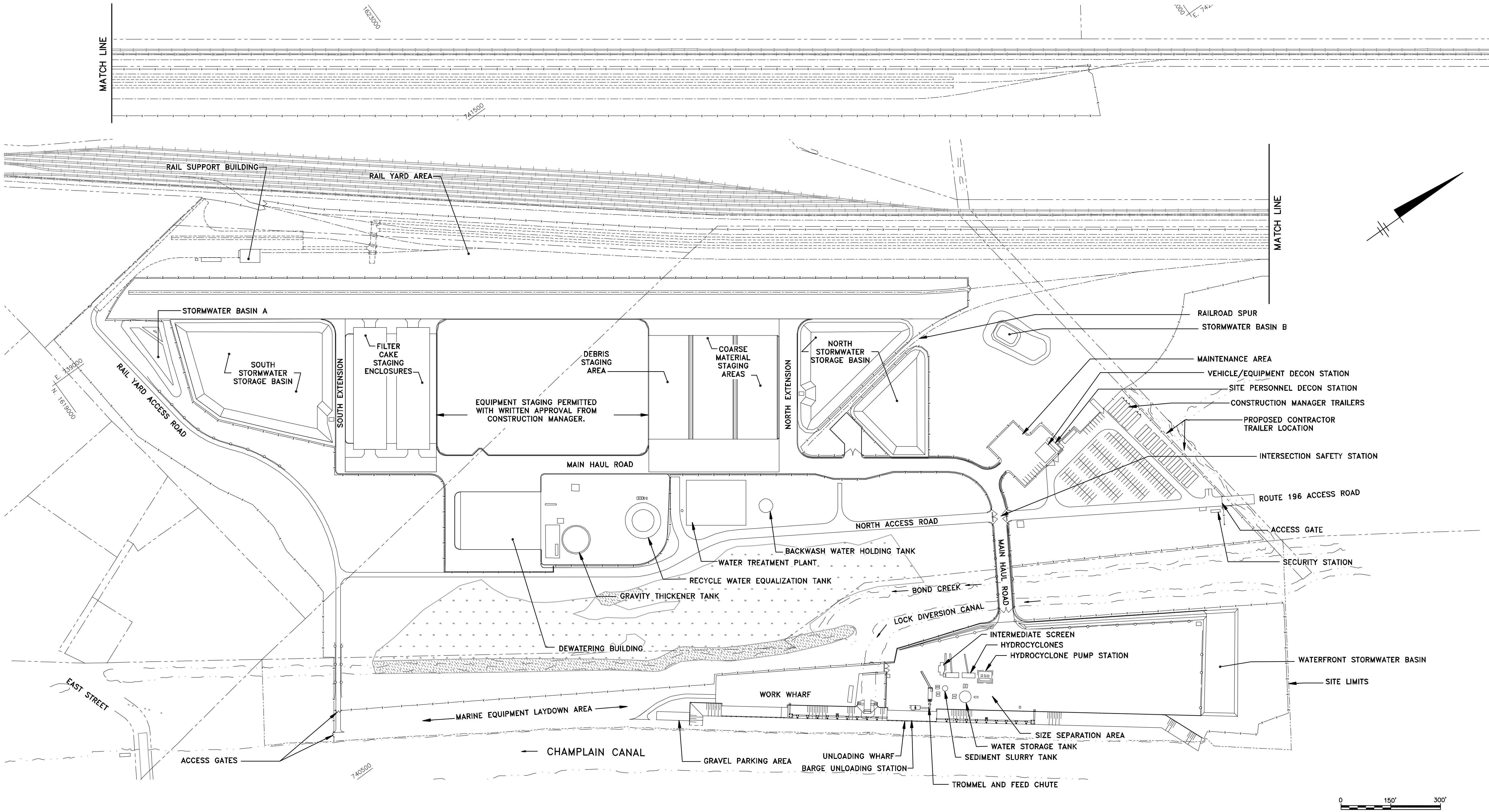
0 800 1,600 Feet
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 2 FINAL DESIGN REPORT FOR 2011

PHASE 2, YEAR 1 CERTIFICATION UNITS CU09 TO CU30

ARCADIS

FIGURE
2-5



NOTE:

1. ALL LOCATIONS SHOWN ARE APPROXIMATE.

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 2 FINAL DESIGN REPORT FOR 2011

SEDIMENT PROCESSING FACILITY - SITE PLAN

ARCADIS

FIGURE
2-6

CITY: SYRACUSE, NY DIV/GROUP: 141/ENVCAD DB: L.POSENAUER LD:(Opt) PIC:(Opt) PM: C.GUEST TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
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XREFS:
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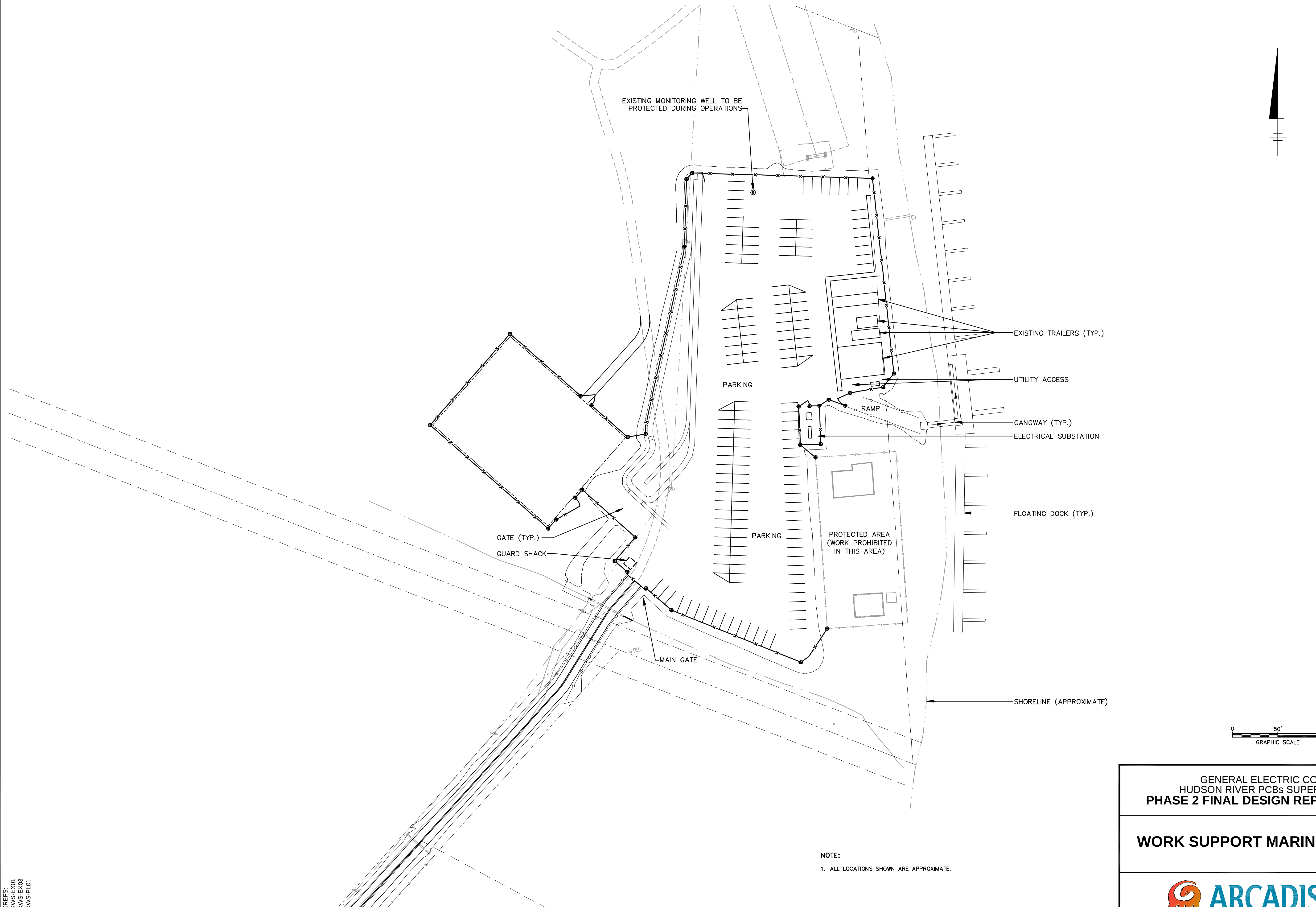
XGN-EX03
XGN-EX01



NOTE:

1. ALL LOCATIONS SHOWN ARE APPROXIMATE.

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 2 FINAL DESIGN REPORT FOR 2011

WORK SUPPORT MARINA - SITE PLAN

ARCADIS

FIGURE
3-1

CITY: SYRACUSE, NY DIV/GROUP: 141/ENVCAD DB: L.POSENAUER LD:(Opt) PIC:(Opt) PM: C.GUEST TM:(Opt) LYR:(Opt)ON=*;OFF=*REF* V:\ENVCAD\SYRACUSE\ACT\B0031087\2009\01500\PHASE2FDR\REPORT\K30310878O2.dwg LAYOUT: 3-1 SAVED: 3/1/2011 4:25 PM ACADVER: 18.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 3/8/2011 8:50 AM BY: POSENAUER, LISA
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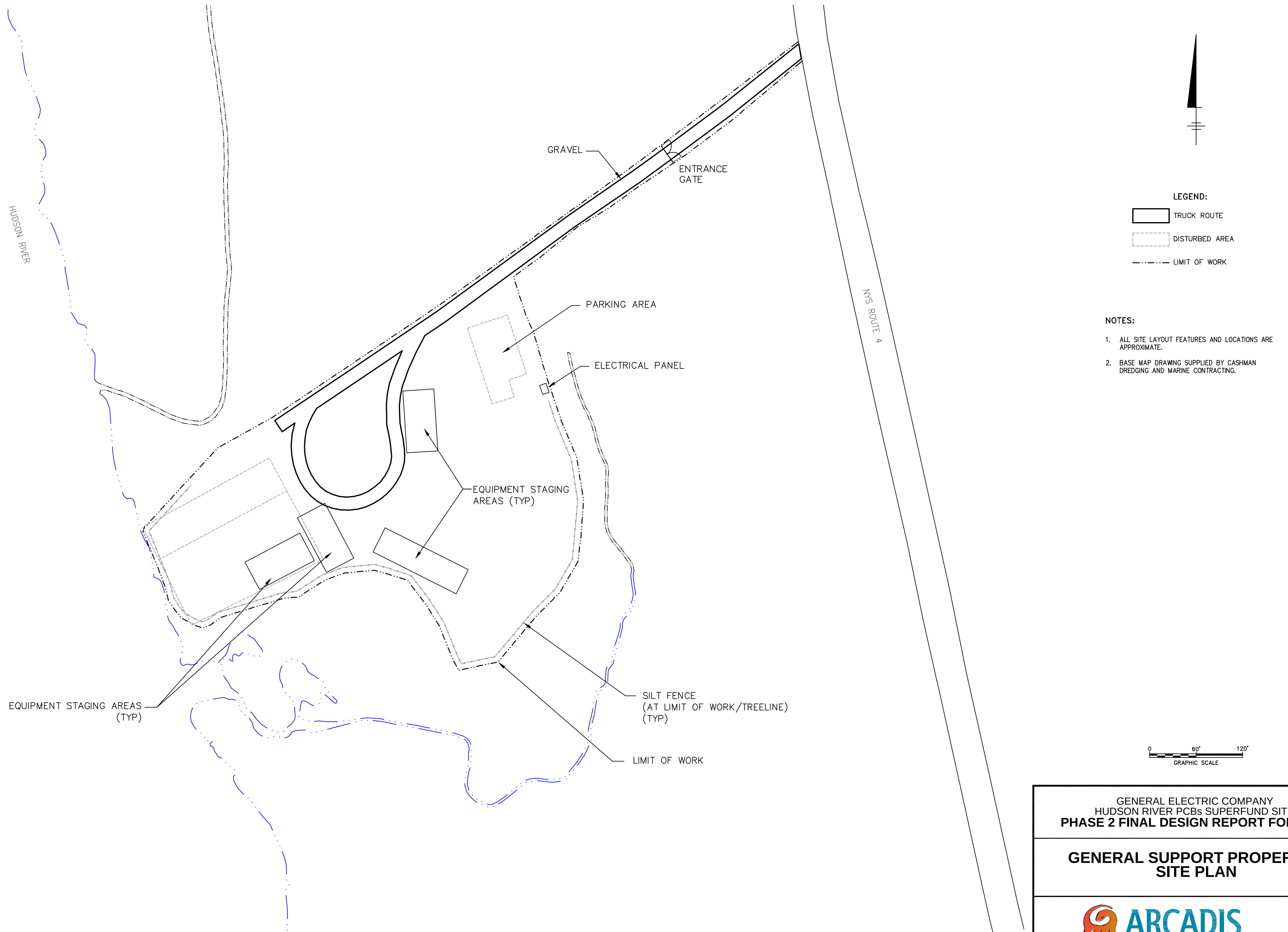
XWS-EX03
XWS-PL01



GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 2 FINAL DESIGN REPORT FOR 2011

GENERAL SUPPORT PROPERTY - SITE PLAN

ARCADIS

FIGURE
3-2

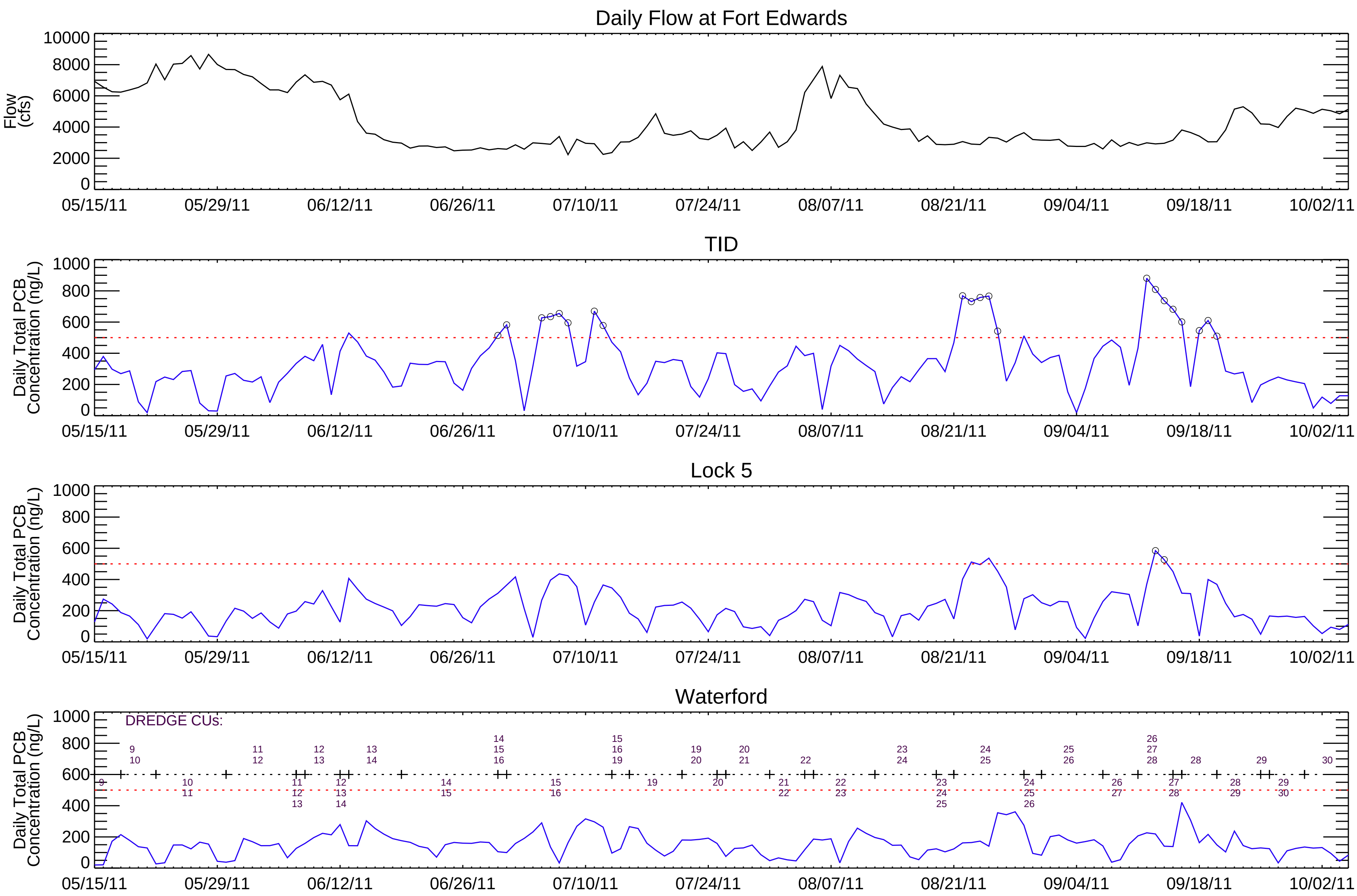


Figure 3-3a

Model Predicted Daily Total PCB Concentration at Thomson Island Dam, Lock 5, and Waterford, without re-dredging, 2003 hydrograph

ANCHOR QEA

Concentration
Control Level
Exceedance

Model run: DS3_1102-01
Resistance Phase: Di- 56:44, Tri+:17:83

Logistics Model: P2FDR-75-MG_DS-SC3_20110217 , Hydro Year: 2003

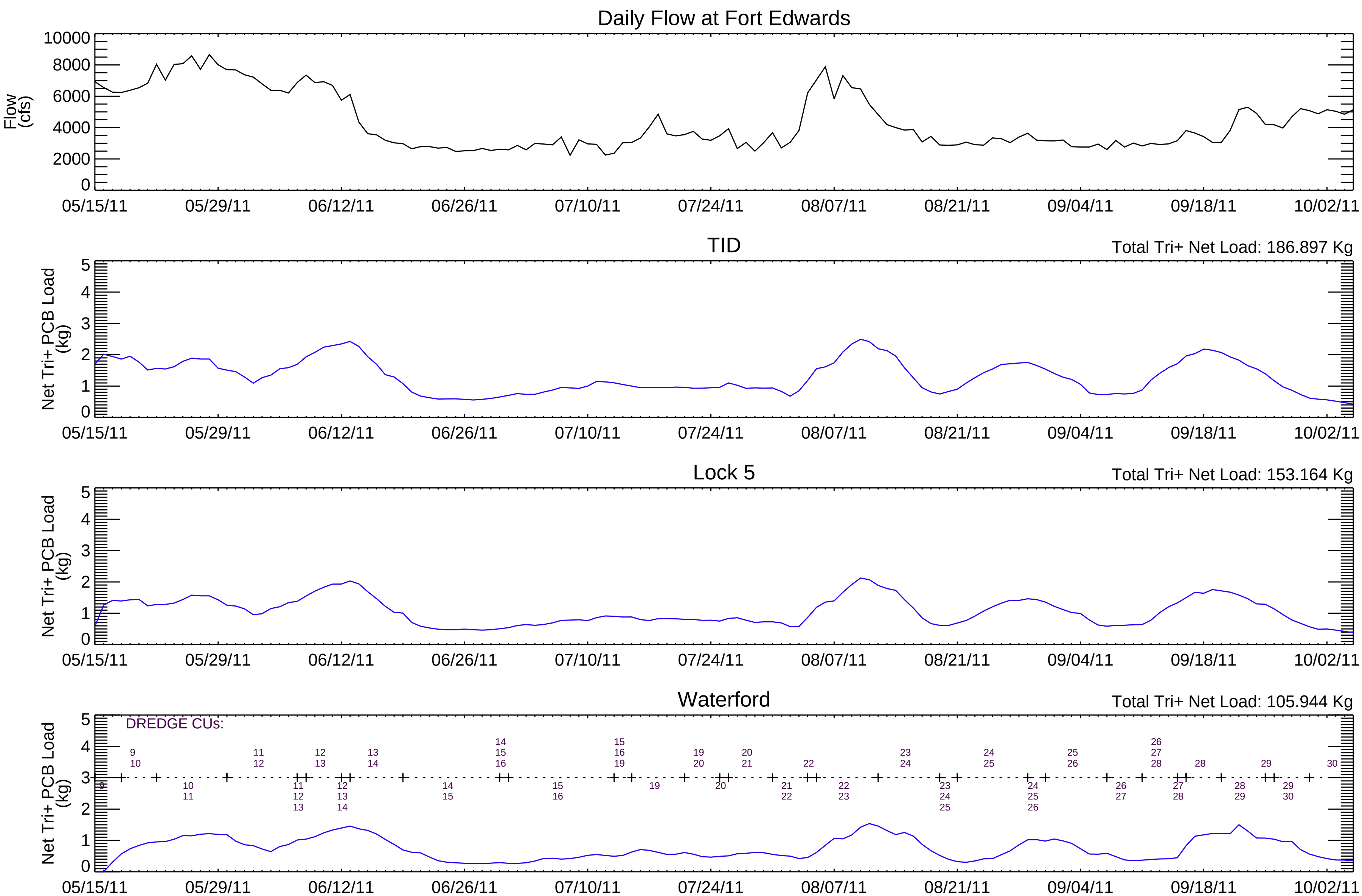


Figure 3-3b

Model Predicted 7 Day Average Net Tri+ PCB Load at Thomson Island Dam, Lock 5, and Waterford, without re-dredging, 2003 hydrograph

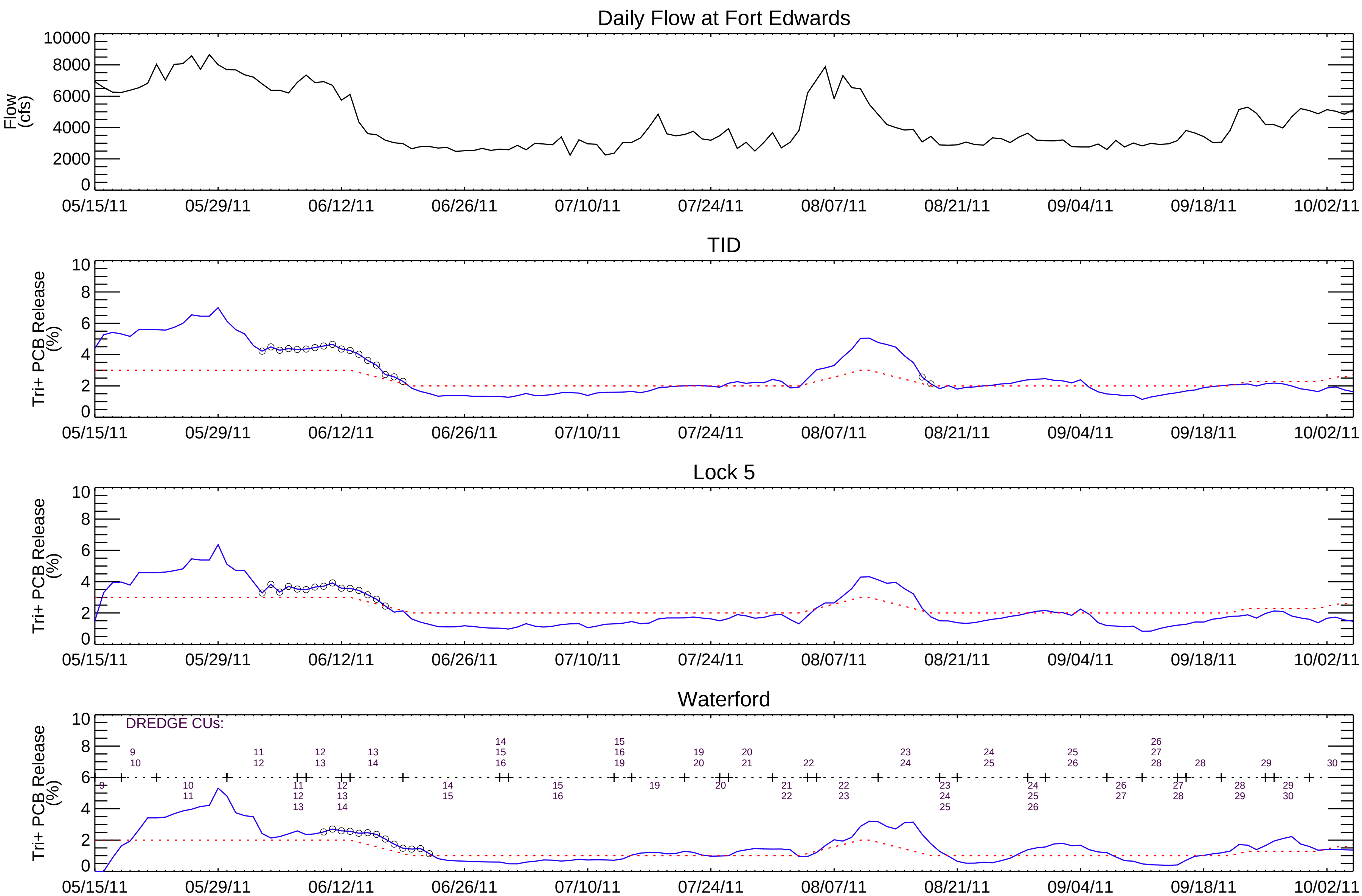
ANCHOR QEA

7-day Avg. Load

Net Tri+ PCB Load calculated as running 7 day average
Model Run: DS3_1102-01, Tri+ Resistance Phase: 17:83

MF - \\nereus\e_drive\GENmod\Model\EFDC\POSTPROCESS\Chemfate\Engr_Design\resus_postprocess__p_conc_load_exceed.pro Sun Mar 13 18:49:15 2011

Logistics Model: P2FDR-75-MG_DS-SC3_20110217 , Hydro Year: 2003



Percent Release
Control Level
Exceedance

Figure 3-3c

Model Predicted Percent Release of Tri+ Loads at Thomson Island Dam, Lock 5, and Waterford, without re-dredging, 2003 hydrograph

% Release = (Net 7-Day Avg Water Column Load)/(7-Day Avg Dredge Load)
Net Water Column Load = (WC Load in Dredging) - (Base WC Load)
Dredge Model Run: DS3_1102-01, Base Model Run: PS1_1102-02, Tri+ Resistance Phase: 17:83
Plot scale capped at 10% Tri+ PCB Release

MF - \\nereus\e_drive\GENmod\Model\EFDC\POSTPROCESS\Chemfate\Engr_Design\resus_postprocess__p_conc_load_exceed.pro Sun Mar 13 18:49:15 2011

Figure 3-4a

Model Predicted Daily Total PCB Concentration at Thomson Island Dam, Lock 5, and Waterford, without re-dredging, 5,000 cfs flow

Model run: DS3_1102-02
Resistance Phase: Di- 56:44, Tri+:17:83

Logistics Model: P2FDR-75-MG_DS-SC3_20110217 , Hydro Year: const5Kcfs_2003

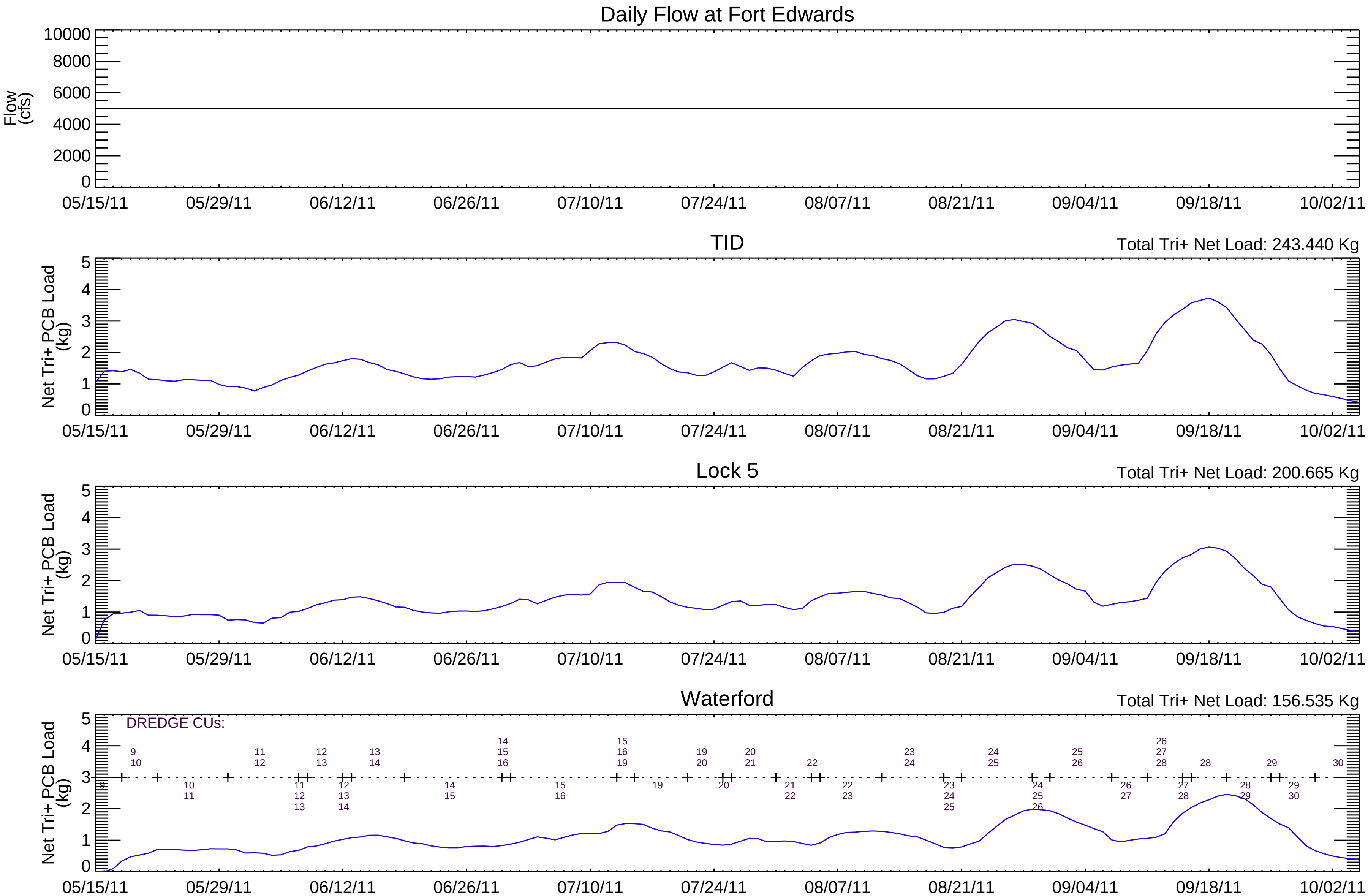


Figure 3-4b

Model Predicted 7 Day Average Net Tri+ PCB Load at Thomson Island Dam, Lock 5, and Waterford, without re-dredging, 5,000 cfs flow

ANCHOR QEA

7-day Avg. Load

Net Tri+ PCB Load calculated as running 7 day average
Model Run: DS3_1102-02, Tri+ Resistance Phase: 17:83

MF - \\nereus\e_drive\GENmod\Model\EFDC\POSTPROCESS\Chemfate\Engr_Design\resus_postprocess__p_conc_load_exceed.pro Mon Mar 14 09:46:19 2011

Logistics Model: P2FDR-75-MG_DS-SC3_20110217 , Hydro Year: const5Kcfs_2003

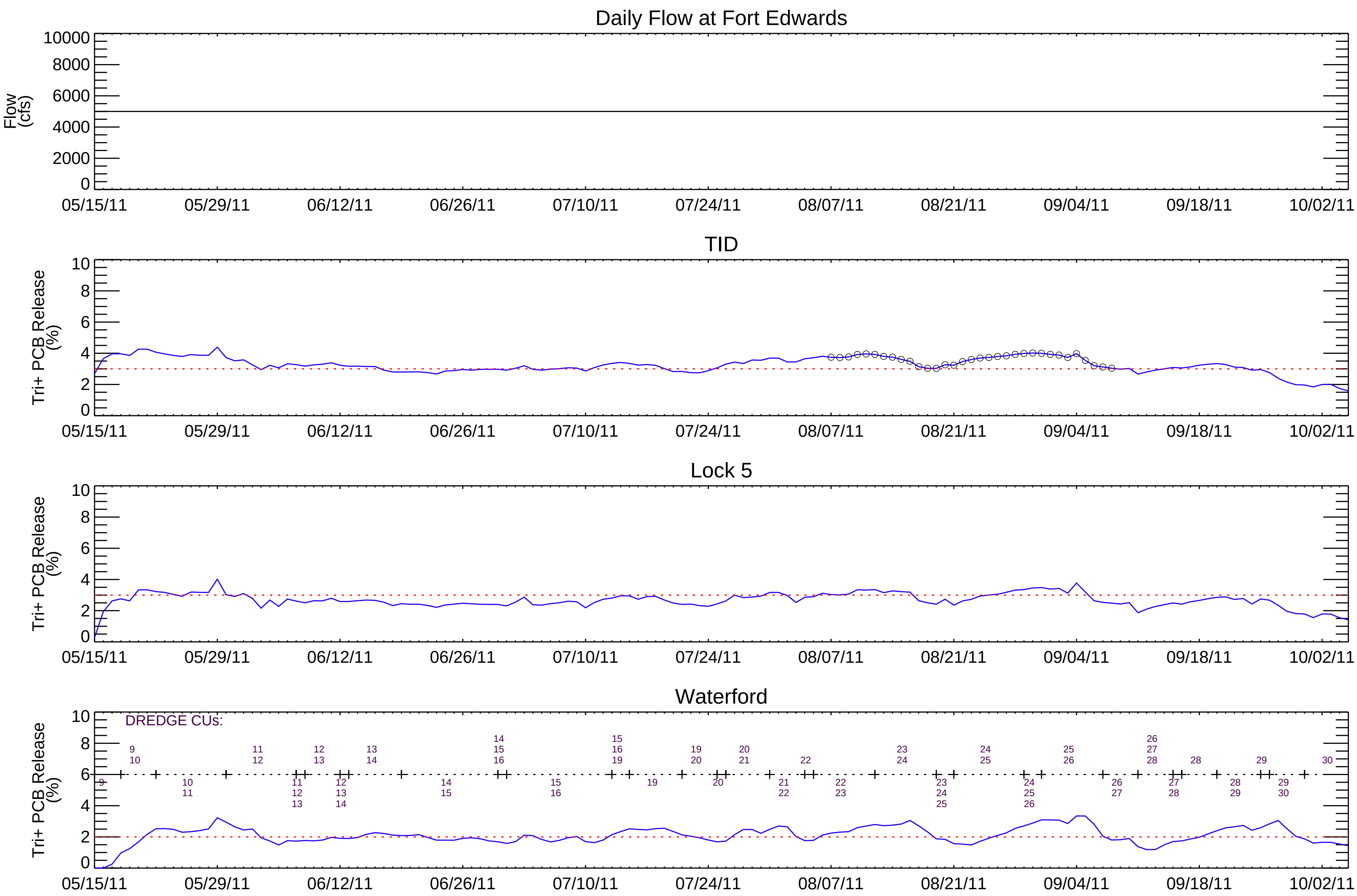


Figure 3-4c

Model Predicted Percent Release of Tri+ Loads at Thomson Island Dam, Lock 5, and Waterford, without re-dredging, 5,000 cfs flow

% Release = (Net 7-Day Avg Water Column Load)/(7-Day Avg Dredge Load)
Net Water Column Load = (WC Load in Dredging) - (Base WC Load)
Dredge Model Run: DS3_1102-02, Base Model Run: PS1_1102-03, Tri+ Resistance Phase: 17:83
Plot scale capped at 10% Tri+ PCB Release

MF - \\nereus\e_drive\GENmod\Model\EFDC\POSTPROCESS\Chemfate\Engr_Design\resus_postprocess__p_conc_load_exceed.pro Mon Mar 14 09:46:19 2011

Logistics Model: P2FDR-76-2Pass_DS-SC4_20110217 , Hydro Year: 2003

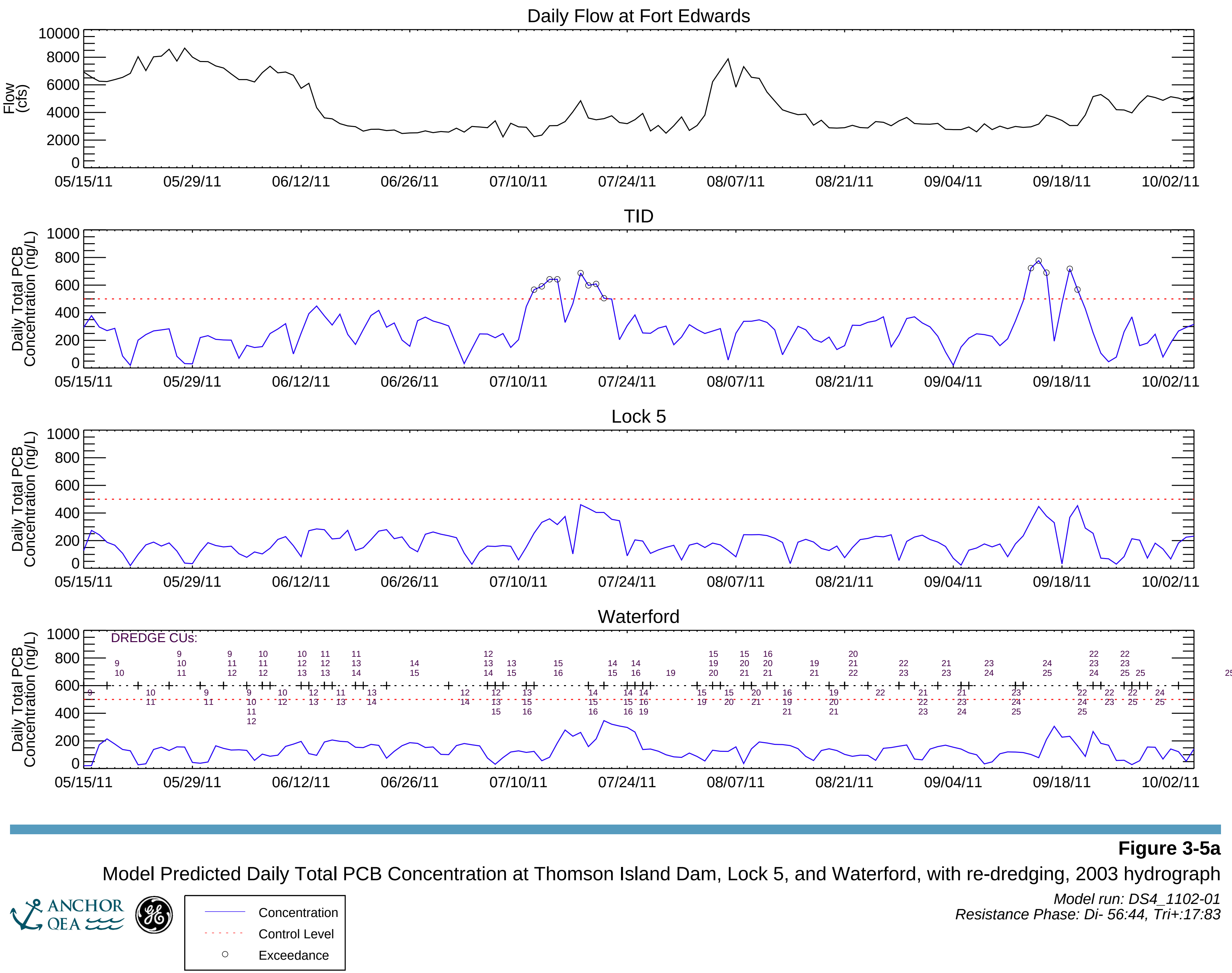


Figure 3-5a

Model Predicted Daily Total PCB Concentration at Thomson Island Dam, Lock 5, and Waterford, with re-dredging, 2003 hydrograph

Model run: DS4_1102-01
Resistance Phase: Di- 56:44, Tri+:17:83

MF - \\nereus\e_drive\GENmod\Model\EFDC\POSTPROCESS\Chemfate\Engr_Design\resus_postprocess__p_conc_load_exceed.pro Mon Mar 14 09:42:28 2011

Logistics Model: P2FDR-76-2Pass_DS-SC4_20110217 , Hydro Year: 2003

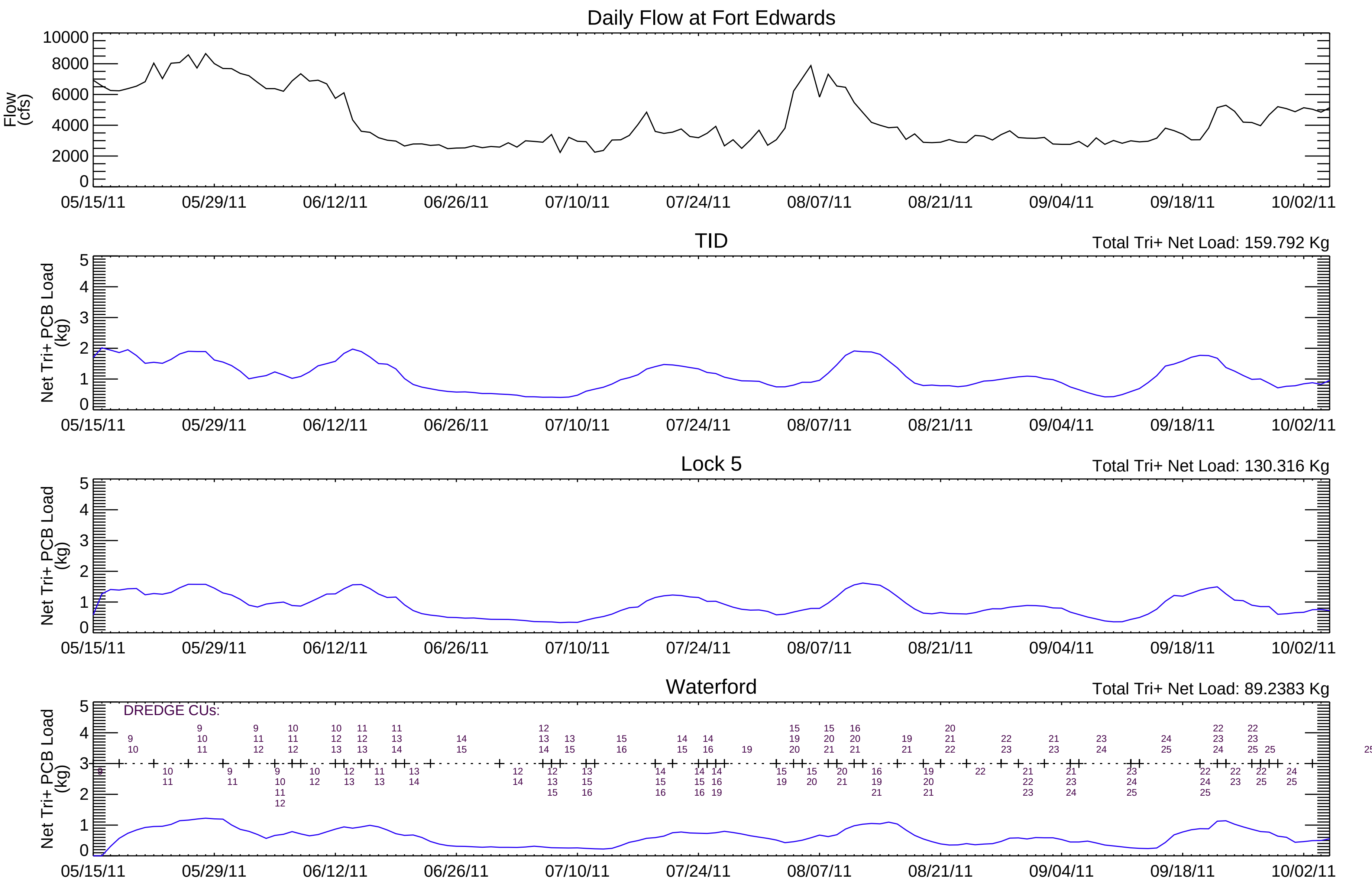


Figure 3-5b

Model Predicted 7 Day Average Net Tri+ PCB Load at Thomson Island Dam, Lock 5, and Waterford, with re-dredging, 2003 hydrograph

ANCHOR QEA

7-day Avg. Load

Net Tri+ PCB Load calculated as running 7 day average
Model Run: DS4_1102-01, Tri+ Resistance Phase: 17:83

MF - \\nereus\e_drive\GENmod\Model\EFDC\POSTPROCESS\Chemfate\Engr_Design\resus_postprocess__p_conc_load_exceed.pro Mon Mar 14 09:42:29 2011

Logistics Model: P2FDR-76-2Pass_DS-SC4_20110217 , Hydro Year: 2003

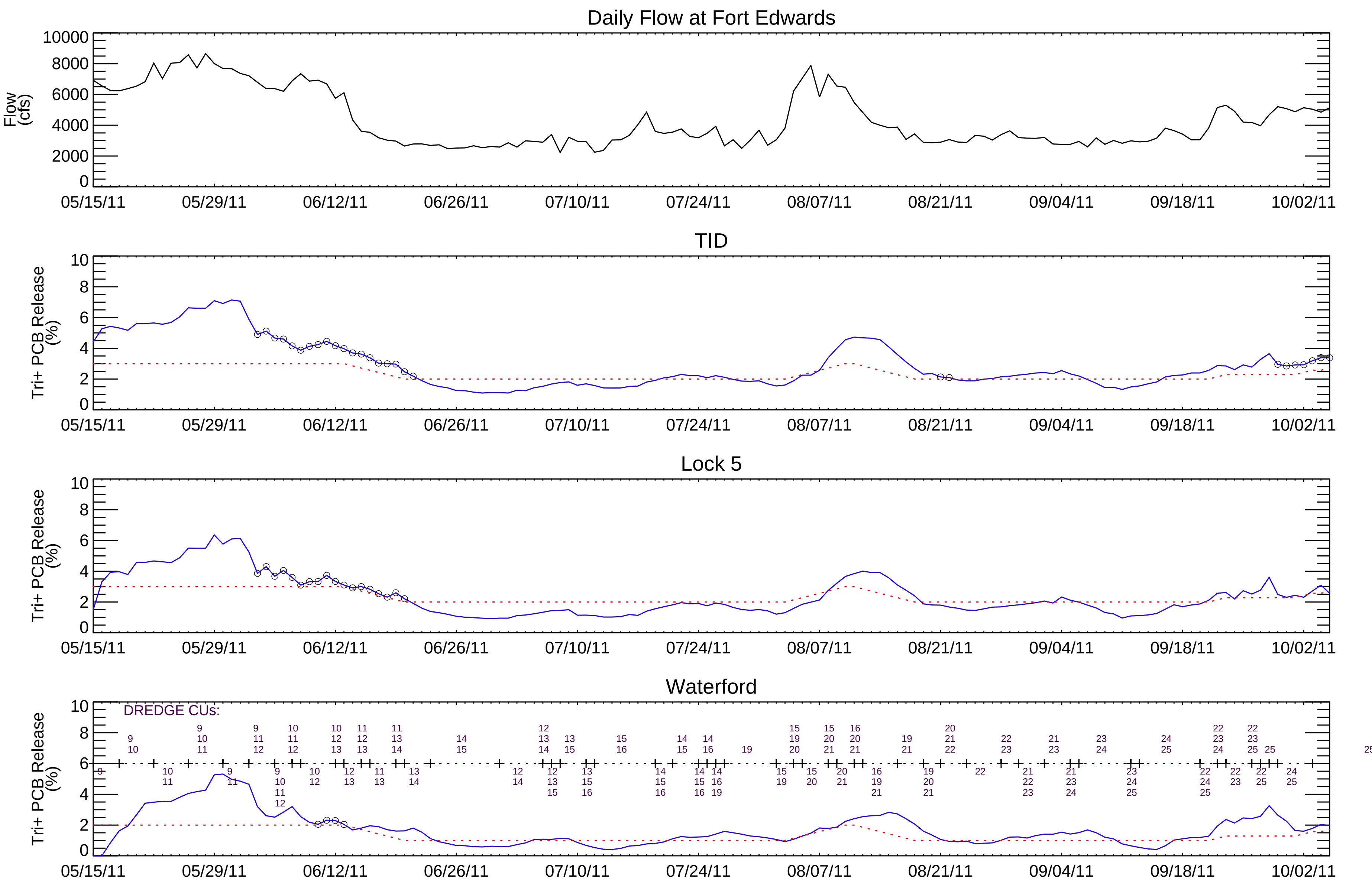


Figure 3-5c

Model Predicted Percent Release of Tri+ Loads at Thomson Island Dam, Lock 5, and Waterford, with re-dredging, 2003 hydrograph

—	Percent Release
······	Control Level
○	Exceedance

% Release = (Net 7-Day Avg Water Column Load)/(7-Day Avg Dredge Load)
Net Water Column Load = (WC Load in Dredging) - (Base WC Load)
Dredge Model Run: DS4_1102-01, Base Model Run: PS1_1102-02, Tri+ Resistance Phase: 17:83
Plot scale capped at 10% Tri+ PCB Release

MF - \\nereus\e_drive\GENmod\Model\EFDC\POSTPROCESS\Chemfate\Engr_Design\resus_postprocess__p_conc_load_exceed.pro Mon Mar 14 09:42:29 2011

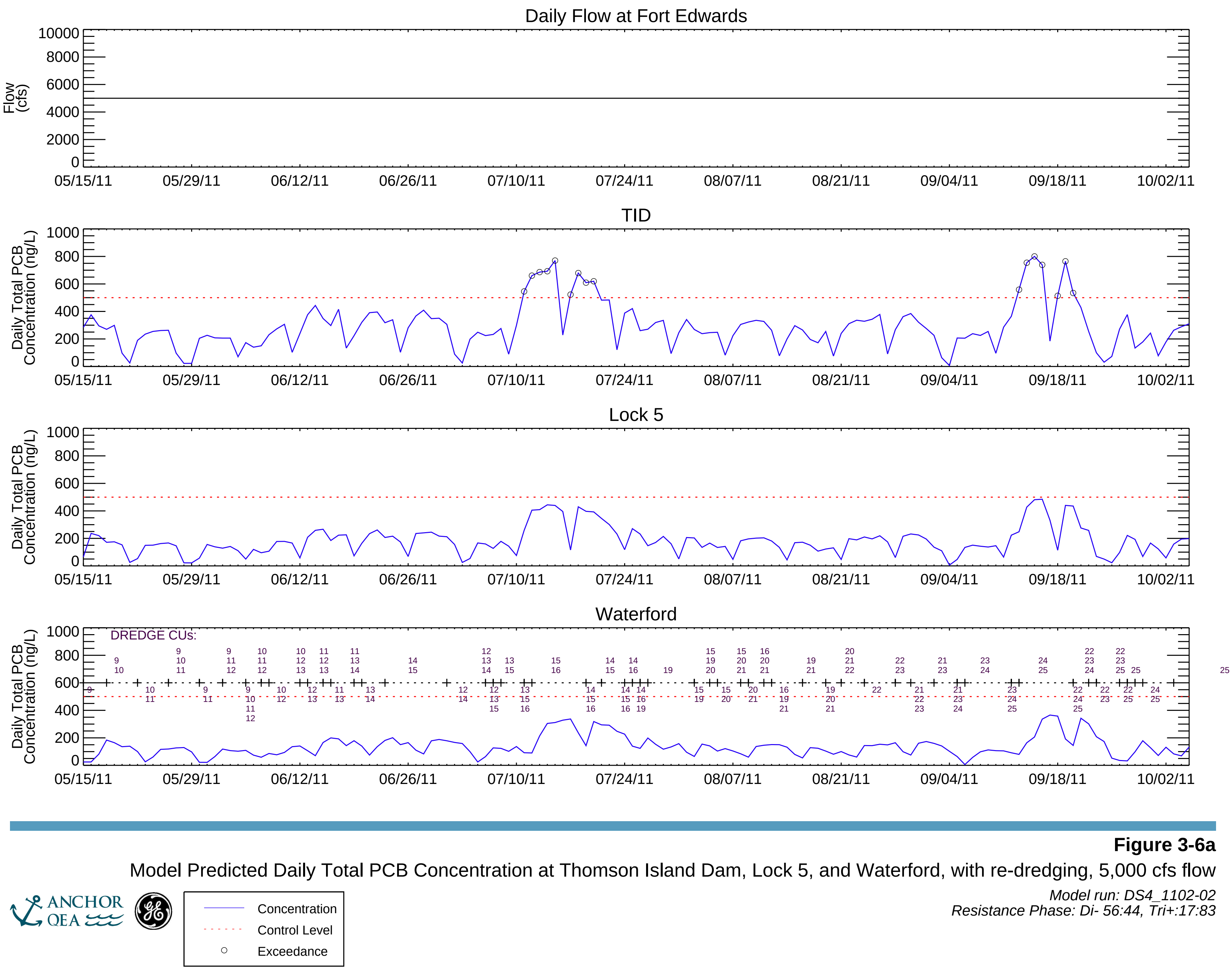


Figure 3-6a

Model Predicted Daily Total PCB Concentration at Thomson Island Dam, Lock 5, and Waterford, with re-dredging, 5,000 cfs flow

Model run: DS4_1102-02
Resistance Phase: Di- 56:44, Tri+:17:83

Logistics Model: P2FDR-76-2Pass_DS-SC4_20110217 , Hydro Year: const5Kcfs_2003

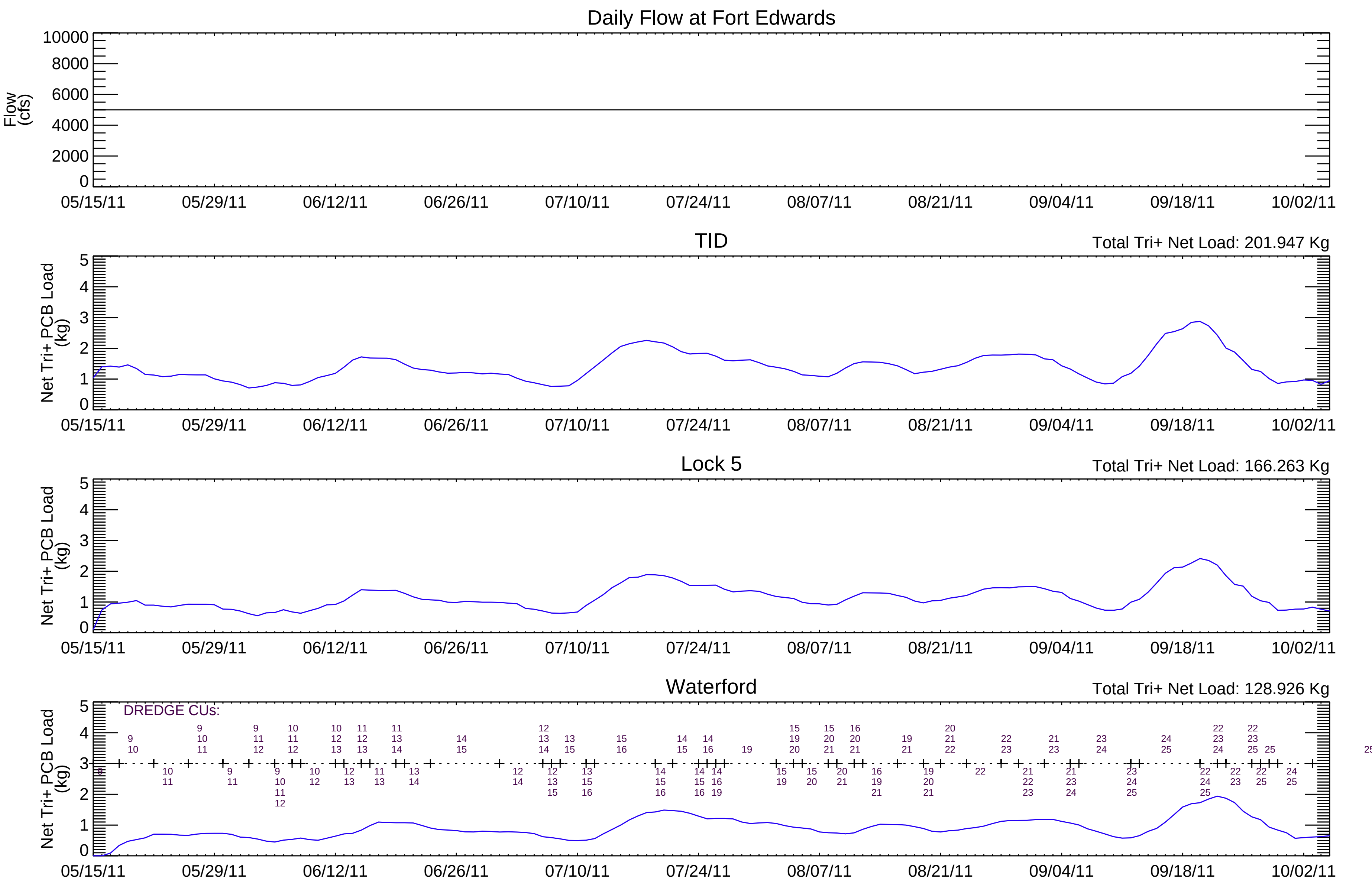


Figure 3-6b

Model Predicted 7 Day Average Net Tri+ PCB Load at Thomson Island Dam, Lock 5, and Waterford, with re-dredging, 5,000 cfs flow

ANCHOR QEA

7-day Avg. Load

Net Tri+ PCB Load calculated as running 7 day average
Model Run: DS4_1102-02, Tri+ Resistance Phase: 17:83

MF - \\nereus\e_drive\GENmod\Model\EFDC\POSTPROCESS\Chemfate\Engr_Design\resus_postprocess__p_conc_load_exceed.pro Mon Mar 14 09:39:12 2011

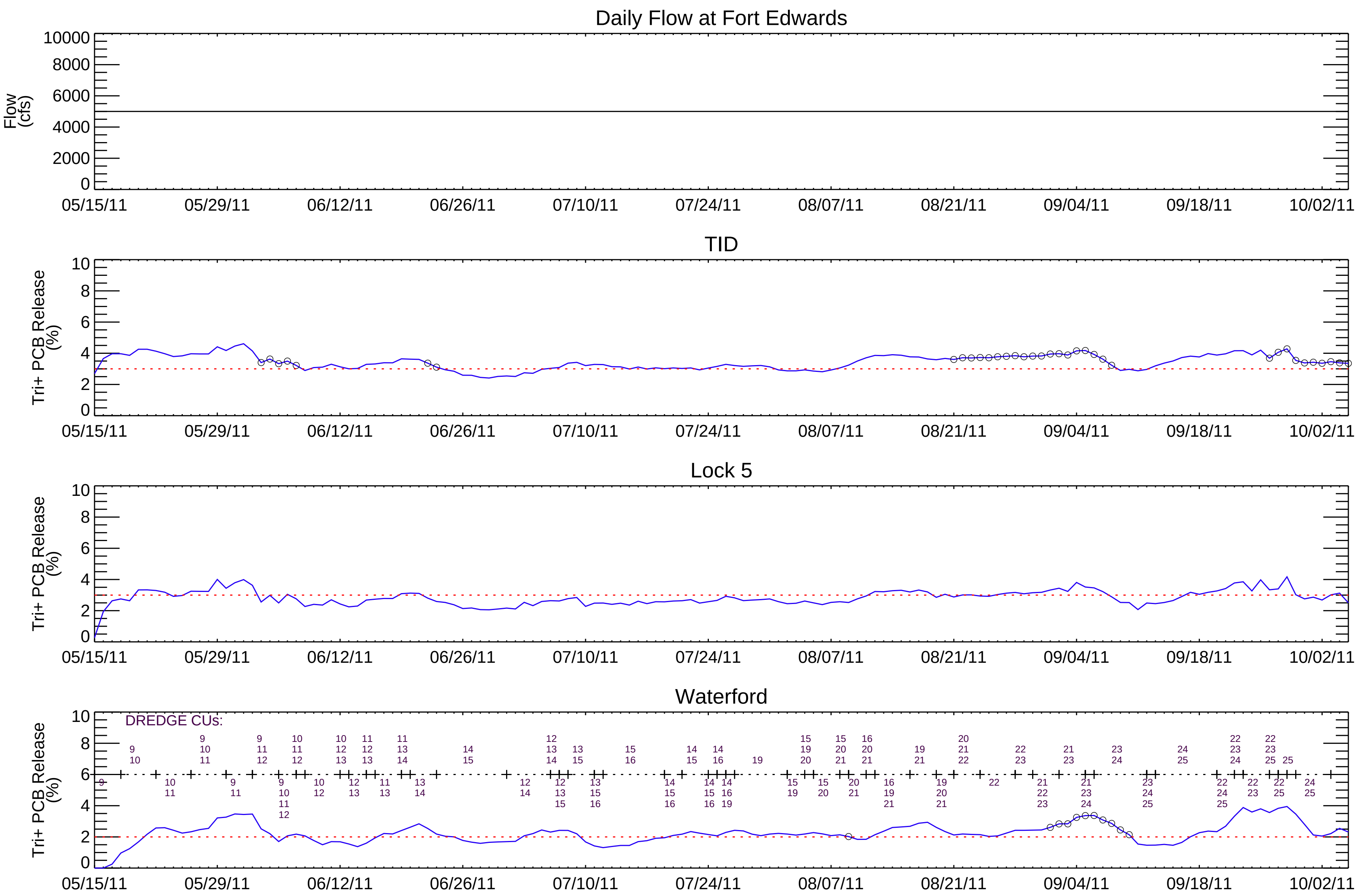


Figure 3-6c

Model Predicted Percent Release of Tri+ Loads at Thomson Island Dam, Lock 5, and Waterford, with re-dredging, 5,000 cfs flow

ANCHOR QEA

Percent Release
Control Level
Exceedance

% Release = (Net 7-Day Avg Water Column Load)/(7-Day Avg Dredge Load)
Net Water Column Load = (WC Load in Dredging) - (Base WC Load)
Dredge Model Run: DS4_1102-02, Base Model Run: PS1_1102-03, Tri+ Resistance Phase: 17:83
Plot scale capped at 10% Tri+ PCB Release