REPORT

Phase 1 Final Design Report
Hudson River PCBs Superfund Site

General Electric Company
Albany, New York

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Submitted by:

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Executive Summary

The United States Environmental Protection Agency (EPA) issued a Superfund Record of Decision (ROD) on February 1, 2002 (EPA, 2002a) calling for, among other things, the dredging and disposal of certain sediments from the Upper Hudson River containing polychlorinated biphenyls, or PCBs. The remedy selected by EPA is precedent setting in scope, and the design process has been extraordinarily complex. Plans and specifications have been developed for the river-based activities such as dredging, backfilling/capping, and habitat reconstruction as well as the construction and operation of the land-based sediment processing facility and project rail yard. The dewatered sediment will be loaded into rail cars dedicated to the project, then transported out of the Hudson River Valley for final disposal. The project was designed considering quality of life concerns, cultural and archaeological resources, threatened and endangered species, and wetlands (in-river and at the processing facility). Adaptive management protocols for habitat replacement and reconstruction have also been developed.

The ROD states that dredging will occur in two distinct phases. Phase 1 is defined as the first year of dredging, and is the focus of this report. Phase 1 also includes preparatory work, such as the construction of the land-based sediment processing facility, as discussed below. Since an environmental dredging project of this scale has never before been implemented in the United States, the division of the project into two phases is a critical element of the overall design. During Phase 1, each component of the remedy will be tested to determine the appropriateness and validity of the guiding assumptions incorporated into the design. Equipment and systems will be operated and examined, production and processing rates will be assessed, and safety measures will be evaluated and enhanced. In addition, water, sediments, and air will be monitored for a variety of parameters throughout the project, and the results will be compared to the Engineering and Quality of Life Performance Standards established by EPA.

Although considerable effort has gone into developing a remedial design capable of achieving the many goals of the project, a number of assumptions had to be incorporated into the Phase 1 design. As a result, there is no guarantee that these goals can be achieved at all times, either individually or in combination. At the end of Phase 1, all the quantitative and qualitative information collected will be reviewed by EPA and the General Electric Company (GE), and before moving into Phase 2 (which includes all subsequent years of dredging), changes to the project, design, or performance standards may be necessary or appropriate.

Before dredging can begin, discussions related to finalizing plans for securing a full range of services, property, and equipment have to be concluded. In addition, contractors will be hired to construct the land-based sediment processing facility and rail yard in Fort Edward, as well as a marine support facility in Moreau. The areas in the river targeted for sediment removal in Phase 1 are the northern portion of the Thompson Island Pool – a stretch from the northern end of Rogers Island to a half mile south of Lock 7 – and an area in the vicinity of Griffin Island.

The Phase 1 Final Design

On August 18, 2003, the GE and EPA entered into a formal agreement called the Administrative Order on Consent for Hudson River Remedial Design and Cost Recovery (RD AOC) (Index No. CERCLA-02-2003-2027) (EPA/GE, 2003), under which GE agreed to design the remedy outlined in the ROD. Since that time, GE and its consultants have been developing the design for Phase 1 of the remedial action. This design also reflects commitments contained in the Consent Decree (CD) signed by GE and EPA, which governs implementation of the remedial action. The CD was filed in federal district court in October 2005 (EPA/GE, 2005) for the court's approval.

This *Phase 1 Final Design Report* (Phase 1 FDR) is the final step in the design of Phase 1. This report builds upon the *Preliminary Design Report* (BBL, 2004a) and *Phase 1 Intermediate Design Report* (Phase 1 IDR) (BBL, 2005a), both approved by EPA. The design is based on a comprehensive series of support activities, including sediment sampling, geotechnical investigations, river bathymetry and geophysics, treatability studies, cultural resources assessments, habitat evaluations, and baseline monitoring activities, and takes full account of the performance standards developed by EPA.

Phase 1 of the project is designed for the dredging, dewatering, and disposal of 265,000 cubic yards (cy) of sediment from areas of the river covering 94 acres. A series of inter-related project elements has been designed to handle this sediment as safely and efficiently as possible. During dredging operations, targeted sediments will be removed from the river using environmental clamshell dredging equipment, and then transported by barge to the land-based sediment processing facility. At the processing facility, sediments will go through a multi-stage dewatering process before being loaded into railcars for transport to a licensed landfill. After sediment removal, dredged areas will be backfilled or capped with approximately 1 foot of clean material, habitat replacement and reconstruction will be conducted, and disturbed shorelines will be stabilized and restored.

Construction of the Processing Facility and Rail Yard

A sediment processing facility and rail yard will be constructed at the 100+-acre Energy Park/Longe/New York State Canal Corporation Site (Energy Park site) located between the Champlain Canal and Towpath Road in the Town and Village of Fort Edward. These construction activities are expected to begin in the Fall of 2006. A new 2-mile access road connecting the existing truck route on New York State Route 196 in the Town of Kingsbury to the northern boundary of the site, will be built as the primary access for bringing labor, equipment, and materials to the Energy Park site. The new access road will be built along the west bank of the Champlain Canal and will allow access to the site without travel on Village of Fort Edward streets. A gate to the west of Lock 8 will restrict access to the project site. The site plan, depicted on Figure 1-2 of the Phase 1 FDR, shows the location and features of the processing facility, work support marina, site access road, and other aspects of the project.

Site construction will include:

- Approximately 15,000 linear feet of fence and security gates;
- Approximately 20,000 linear feet of erosion control fencing;
- Approximately 90,000 cy of structural fill to be brought in to establish the necessary subgrades for the rail yard and the stormwater collection system;
- Over 5 miles of railroad track, including onsite repair tracks, two controlled switches to the main rail line, and inspection roads to allow for the safe staging and loading of rail cars (a switcher locomotive will be dedicated to the project);
- Over 55,000 square yards of pavement for haul roads, parking, and work areas;
- A 41,000-square-foot, 40-foot high building to house 12 filter presses;
- A 25,000-square-foot building for a 2-million-gallon-per-day water treatment plant;
- Two lined enclosures for storage of up to 38,000 cy of processed fine sediments;
- Approximately 28,000 square feet of administrative space;
- A 1,500-foot barge unloading facility along the Champlain Canal, and a work/maintenance wharf, including 40,000 square feet of pavement;
- The widening of the Champlain Canal at the processing facility location by 65 feet; and

- The installation of four mooring dolphins south of Lock 7 to allow for barge mooring while recreational traffic on the river accesses the lock.

Construction, commissioning, and thorough testing of the processing facility equipment and procedures are required before any dredged sediment can be brought to the facility.

To reduce the number of project vessels going through Lock 7, a marine staging area will be constructed on the west shore of the river, on New York State-owned property accessible from West River Road in the Town of Moreau. This facility will support the marine operations, and will provide parking for project personnel and dockage for support vessels such as survey, sampling, and oversight boats. Dredged sediments will not be transported to or processed at this marina. Large vessels (dredges, tugs, and barges) will not use this marina, and access by the public will be restricted. This facility will include 550 feet of floating dock with approximately 30 boat slips, administration trailers, and a parking area.

Dredging

Phase 1 dredging activities will begin in mid-May of the Phase 1 dredging season – weather and river flow permitting – and continue into November. Approximately 265,000 cy of sediment from initial "inventory" dredging are targeted for removal. To meet EPA's Productivity Performance Standard, dredging is expected to occur 24 hours a day, 6 days a week. The seventh day will be reserved for maintenance, make-up time for unplanned project interruptions, and as a contingency to satisfy EPA's productivity requirements.

As many as eight backhoe-mounted, hydraulically closing clamshell mechanical dredges will be used. Dredging will begin in the northern end of the project area and will generally proceed downstream in such a way as to maximize safety and efficiency while not unnecessarily hindering non-project navigation on the river. Dredging in one area further south, near Griffin Island, will begin early in the program to gather valuable information on sediment resuspension.

Sediment dredged from the river will be placed directly into one of approximately 14 barges. If there is limited accessibility to the area being dredged, dredged sediment may be placed into a hopper and then transferred to a barge. The barges, moved by tug boats, will transport dredged sediment and debris through Lock 7 on the Champlain Canal, and up the canal to the unloading wharf at the processing facility. During peak operations, there may be as many as 30 daily one-way barge trips through Lock 7, including barges that could potentially transport backfill to dredge areas. If barges hauling backfill come from the south, the number of daily trips through Lock 7 will be reduced.

A computer-assisted numerical model was developed during the design process to evaluate the potential impacts on water quality due to sediment resuspension. Based on the modeling results, controls (e.g., sheet piles, silt curtains) are not necessary to maintain water quality standards. However, as a preventive and protective measure, a rock dike, silt curtains, and/or steel sheet piles will be installed in the eastern channel of Rogers Island and in an area east of Griffin Island. Control equipment (e.g., sheet piles) will also be available in two other areas as a contingency, in the event that monitoring during project activities indicates they are necessary. To allow limited passage of non-project vessels to and from the Fort Edward Yacht Basin, a gate will be designed in the barrier placed at the southern end of the east channel of Rogers Island. Recreational vessels will be able to travel through this gate each day during a ½-hour period between the hours of 7 am and 9 am, and again during a ½-hour period between 3 pm and 5 pm. The specific ½-hour slot within these 2-hour time periods will be determined by the dredging operations contractor.

Sediment Processing and Dewatering

The primary purpose of the sediment processing and dewatering facility is to separate river water from dredged sediment in preparation for transport offsite. At the facility's wharf, dredged sediment will be unloaded from barges by either a crane or excavator, and large debris such as rocks and tree limbs or other bulky materials will be sorted out. The remaining sediment will be processed through trommel screens and two banks of 10 hydrocyclones to sort out additional debris, gravel, and sand. This debris, gravel, and sand will be transferred by dump truck to an onsite staging area near the rail loading area. The remaining fine sands and silt will be mixed with polymers to enhance dewatering, and pumped through large filter presses. The "filter cake" removed from the presses will be transferred by truck to onsite enclosed areas near the rail yard.

Water collected during the dewatering process, along with stormwater from any area at the site that might come in contact with dredged sediment, will be collected for treatment. The onsite stormwater management system was conservatively designed to manage a 100-year storm. The water treatment plant will be able to handle approximately 2 million gallons of water a day. Once treated, water will be discharged to the Champlain Canal and monitored to verify compliance with discharge limitations established by EPA.

As with dredging, operations at the processing facility are expected to occur 24 hours a day, 6 days a week. The seventh day will be reserved for maintenance, make-up time for unplanned interruptions, and as a contingency to satisfy EPA's productivity requirement.

Transportation for Disposal

Dewatered sediments will be staged in lined storage areas near the rail yard, and then loaded into lined rail cars. A fleet of approximately 450 gondola rail cars will be procured and dedicated to the project. A switcher locomotive will assemble 81-car unit trains and stage them on a departure track for pickup by Canadian Pacific Railway (CPR). Multiple rail carriers will be required to transport trains to a landfill outside of the Hudson River Valley. After unloading at the landfill, empty trains will return to the processing facility and be set by CPR on a receiving track. On average, one full train will leave the processing facility and one empty train will return about every 4 to 5 days. Participating rail carriers and the landfill will be identified once contract discussions are completed.

Backfilling/Capping and Habitat Replacement and Reconstruction

After EPA and GE agree that dredging is completed in a particular area, either clean backfill will be placed, or an engineered cap will be installed, to stabilize the sediment bed, support habitat replacement/reconstruction, or (in the case of a cap) further isolate remaining sediments in place. Several backfill and cap configurations have been developed, and the approach in each area will be based primarily on how fast the river flows. The type of river bottom, residual PCB concentrations, and habitat goals will also be considered. The material used for backfilling/capping will be acquired from local or regional quarries, and will be transported by barges and tugboats to dredged areas. The quarries to be used will be selected by the dredging operations contractor.

After backfilling, a habitat replacement and reconstruction program will be conducted. Four different types of habitat have been identified and mapped in the Phase 1 area. The aquatic vegetation, wetlands, and riverbank habitats disturbed during dredging will be replaced or reconstructed. The primary goal of this program will be to replace the functions and characteristics of impacted habitats so that they return to the range of functions and characteristics found in similar areas of the river not impacted by dredging. Since dredging, backfilling, and capping may not end until November, some planting activities may not occur until the following year's planting season. Approximately 120,000 plants, consisting of a variety of submerged aquatic and wetland species, will be planted in dredged areas targeted for replacement/reconstruction, while other dredged areas will be allowed to recover naturally. Details on the various habitat types and selection criteria used to determine which areas would be planted are described in the *Phase 1 Adaptive Management Plan* (Attachment H of this document).

Performance Standards

GE developed the Phase 1 Final Design to address the Engineering and Quality of Life Performance Standards established by EPA for this project. Further, GE's goal was to design Phase 1 of the remedy as it does all projects: with an emphasis on worker and community safety. As a result, numerous features to prevent, monitor, and control environmental and community impacts relative to several performance standards and other regulatory-based requirements established by EPA were incorporated into the design.

For example, GE will implement several measures designed to mitigate levels of air emissions, odor, noise, lighting, and navigation disruption. Modeling and other design analyses indicate that these standards can be met for the vast majority of Phase 1 activities. One exception is the possible generation of noise above EPA's standard for brief periods of time at two locations along the river related to driving piles for resuspension control structures and barge mooring dolphins. GE is continuing to evaluate this issue. Best management practices will be followed, such as specifying that contractors use noise attenuation methods (particularly at the processing facility), properly maintain diesel powered equipment to control noise and emissions, cover tanks and staging areas that may be a significant source of PCB emissions to air, and control stormwater run-off and minimize dust generation at the processing facility. For the water-based activities, specification of a project vessel management system will reduce the potential for interference with non-project vessels, and specific procedures are defined for communicating with mariners. Finally, a total suspended solids limit downstream of the dredge that is much more restrictive than a corresponding provision in the EPA performance standard has been specified. If monitoring results indicate unacceptable levels of air emissions, odor, noise, lighting, or navigation interference, contractors will be required to implement appropriate contingency and mitigation measures to address the source of the problem.

Monitoring Activities

To gauge the effectiveness of dredging, sediment processing, water treatment, and other aspects of the Phase 1 work relative to performance standards and water quality requirements, GE has designed an extensive environmental monitoring program. The overall goal of the program is to provide GE and EPA with the data and information needed to *prevent* conditions that could lead to an exceedance of a performance standard. Monitoring data will also provide information on how the project is progressing, and when contingency or mitigation actions may be warranted.

A variety of monitoring activities will be carried out on land and on the river throughout the project, including monitoring of water, sediments, air quality and odor, noise, lighting, and water discharged at the processing facility. The *Phase 1 Environmental Monitoring Plan* (Appendix 7 of this document) and the *Remedial Action Community Health and Safety Plan* (Appendix 8 of this document) provide details of all the monitoring activities and associated contingency and mitigation plans for the performance standards and water quality requirements.

Moving Toward Remedial Action

Much work remains before dredging can begin. First, GE will initiate a process to select contractors to perform the Phase 1 work. GE must also conclude negotiations for a full range of services, property, and equipment. GE will then work with the selected contractors to develop a series of *Remedial Action Work Plans*. In conjunction with the Phase 1 FDR, these work plans will ultimately guide the construction and implementation of the first phase of the Hudson River dredging project.

After these tasks are completed, construction of the processing facility and its associated rail yard will begin. Once these facilities are built and the processing and transport systems are fully operational, the dredges, barges and other support vessels can be mobilized to the site.

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1. Introduction

This *Phase 1 Final Design Report* (Phase 1 FDR) has been prepared on behalf of the General Electric Company (GE) and presents the Final Design for Phase 1 of the remedy selected by the United States Environmental Protection Agency (EPA) to address polychlorinated biphenyls (PCBs) in sediments of the Upper Hudson River, located in New York State. This Phase 1 FDR was prepared 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), consistent with the Superfund Record of Decision (ROD) issued by EPA for the Site on February 1, 2002 (EPA 2002a). This Phase 1 FDR has been prepared in accordance with the *Remedial Design Work Plan* (RD Work Plan) (Blasland, Bouck & Lee, Inc. [BBL], 2003a), and builds upon the *Preliminary Design Report* (PDR) (BBL, 2004a), and the *Phase 1 Intermediate Design Report* (Phase 1 IDR) (BBL, 2005a), which was approved by EPA on November 1, 2005.

As set out in the RD Work Plan, the Phase 1 FDR is to take account of the information that has become available after the Phase 1 IDR and will include the following information:

- Final Basis of Design;
- Final plans and specifications;
- Adaptive management protocols for habitat replacement and reconstruction;
- 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 and any related measures that EPA determines are necessary to be incorporated into the design;
- Wetland mitigation measures (if needed) related to the sediment processing/transfer facility(ies) and associated terrestrial routes to the river; and
- Updated construction schedule.

This Phase 1 FDR also addresses EPA's comments on the Phase 1 IDR that accompanied EPA's November 1, 2005 approval of the Phase 1 IDR and that were assigned by EPA to be addressed in the Final Design. Other comments were responded to in the *Responses to USEPA Comments on the Phase 1 Intermediate Design Report* (GE, December 26, 2005).

In addition, this Phase 1 FDR was developed in a manner consistent with the following EPA guidance documents:

- *Guidance for Scoping the Remedial Design* (EPA, 1995a);
- *Remedial Design/Remedial Action Handbook* (EPA, 1995b); and
- *Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties* (EPA, 1990).

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 ROD calls for, among other things, a remedial action comprising the removal and disposal of PCB-contaminated sediments meeting certain mass per unit area (MPA) and surface concentration or characteristic criteria from the Upper Hudson River (EPA, 2002a), i.e., the section of river upstream of the Federal Dam at Troy, New York. The remedial action is to be conducted in two distinct phases. This report addresses the design for Phase 1, which includes site development, processing facility construction and operations, waterfront construction, rail yard construction, dredging, sediment processing, transportation and offsite disposal of processed sediment, and habitat replacement and reconstruction.

EPA defined three sections of the Upper Hudson River for the sediment remediation activities outlined in the 2002 ROD. The location of each river section is illustrated on Figure 1-1 and described below.

- **River Section 1:** Former location of Fort Edward Dam to Thompson Island Dam (TID) (from river mile [RM] 194.8 to RM 188.5; approximately 6.3 river miles);
- **River Section 2:** TID to Northumberland Dam (from RM 188.5 to RM 183.4; approximately 5.1 river miles); and
- **River Section 3:** Northumberland Dam to the Federal Dam at Troy (from RM 183.4 to RM 153.9; approximately 29.5 river miles).

Phase 1 of the project has been designed to occur entirely in River Section 1.

The environmental history of this site has been well documented in previous reports and is not repeated in this introduction. This information, however, has been used in developing certain aspects of this Phase 1 design, and the reports will be referenced in the relevant sections of this Phase 1 FDR.

1.2 Summary of the Remedial Action Selected by EPA

The remedy selected by EPA is described in the ROD. Additional descriptions of the remedial action can be found in the PDR and RD Work Plan.

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, sediment is to be removed based primarily on an MPA of 3 grams per square meter (g/m^2) of PCBs with three or more chlorine atoms (Tri+ PCBs) or greater;
- In River Section 2, sediment is to be removed based primarily on an MPA of 10 g/m^2 Tri+ PCBs or greater; and
- In River Section 3, sediments with concentrations of PCBs deemed high and potential for erosion deemed high (New York State Department of Environmental Conservation [NYSDEC] *Hot Spots* 36, 37, and the southern portion of 39) are to be removed.

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

In the Feasibility Study for the Hudson River PCBs Superfund Site (FS) (EPA, 2000), using data available at the time and using criteria discussed in the FS, EPA estimated that a total volume of 2.65 million cubic yards (cy) of sediments would be removed from the Upper Hudson River. The ROD recognized that the actual volume to be removed would be developed using data to be collected during remedial design. The ROD calls for the dredging to be undertaken in two distinct phases. Phase 1, the subject of this design report, includes site development, processing facility construction, waterfront construction, rail yard construction and the first year of dredging, in which sediment removal will be conducted at a reduced rate relative to the anticipated Phase 2 production (with at least 1 month at full-scale production).

Since the ROD was issued in 2002, additional data and information have been collected and assessed, and the volume of sediment targeted for removal has been refined during the remedial design process. The additional data collection activities, conducted 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), have been performed in all three river sections, including areas of the river to be addressed during Phase 1. The data have been used to delineate dredge areas and volumes for Phase 1 dredging, as described in the revised Phase 1 DAD Report, which was approved by EPA on March 30, 2005.

Phase 1 dredging will occur in the following areas:

- The northern portion of the Thompson Island Pool from the northern end of Rogers Island to approximately one-half mile south of Lock 7, i.e., the area of the river between RM 194.6 and RM 193.0; and
- The area of the river in the vicinity of Griffin Island, between RM 190.4 and RM 189.9.

EPA has developed performance standards for both the engineering aspects of the project and quality of life considerations. The *Hudson River Engineering Performance Standards* (Hudson EPS) cover productivity, resuspension during dredging and other in-river activities, and concentrations of residual PCBs in surface sediments after dredging for Phase 1 (EPA, 2004a). The *Hudson River Quality of Life Performance Standards* (Hudson QoLPS) address project-related issues/impacts associated with air quality, odor, noise, lighting, and river navigation for Phase 1 (EPA, 2004b).

An objective of the Phase 1 work is to test the effectiveness of the remedial activities relative to the performance standards. The Hudson EPS and QoLPS are discussed as elements of the basis of design presented in Section 2 of this Phase 1 FDR. In addition, more detail on proposed methods to monitor compliance with the performance standards during remediation activities is discussed in Section 4 and the *Phase 1 Environmental Monitoring Plan* (Phase 1 EMP) appended to this Phase 1 FDR. The Phase 1 EMP is an updated version of the *Remedial Action Monitoring Scope* (RA Monitoring Scope), which was included as Attachment B of Appendix B of the Consent Decree for Hudson River Remedial Action (CD) (EPA/GE, 2005).

Following submission of the Phase 1 IDR, the CD was executed by EPA and GE and lodged in the United States District Court for the Northern District of New York. The CD includes a *Statement of Work (SOW) for Remedial Action and Operations, Maintenance and Monitoring* and several attached documents that specify requirements applicable to the design and implementation of Phase 1 of the remedial action. These documents include the *Critical Phase 1 Design Elements* (CDE), the RA Monitoring Scope, the *Performance Standards Compliance Plan Scope* (PSCP Scope), the *Remedial Action Community Health and Safety Program Scope* (RA CHASP Scope), and the *Operation, Maintenance, and Monitoring Scope* (OM&M Scope). The Final Design described in this Phase 1 FDR has been developed to be consistent with those documents.

1.3 Purpose and Scope of the Phase 1 Final Design

The primary objective of the remedial design for the Upper Hudson River is to develop plans and specifications for implementing, in a safe and efficient manner, the EPA-selected remedy set out in the ROD, consistent with the goal of achieving the performance standards.

Activities to accomplish the remedial design objectives are described in detail in the Phase 1 IDR, PDR and RD Work Plan, and include the following:

- Develop remedial design deliverables to allow timely execution of the Phase 1 and Phase 2 dredging programs;
- Collect and analyze data necessary to support the remedial design for the Upper Hudson River. This activity has included sediment sampling, geophysical investigations, bathymetric surveys, and other tasks;
- Develop engineering and design specifications to support EPA efforts in identifying and evaluating land-based sites necessary for project implementation, including the processing facilities;
- Design facilities to handle and process dredged sediment and prepare the sediment for transport and disposal;
- Design a dredging program with a total target project duration of 6 years (1 year for Phase 1 and 5 years for Phase 2), consistent with the Productivity Performance Standard provided in the Hudson EPS;
- Develop engineering and design information to support the identification and selection of the areas where sediment will be removed during the Phase 1 dredging program;

- Delineate sediment to be removed from the Upper Hudson River consistent with the criteria in the ROD, the RD Work Plan, EPA's decision in the Phase 1 DAD dispute resolution proceeding, and subsequent agreements between GE and EPA;
- Develop design documents for the Phase 1 and Phase 2 dredging programs with the goal of achieving the performance standards established by EPA;
- Develop an effective monitoring program, starting with implementation of a baseline monitoring program, to allow an assessment of the results of remedy implementation relative to the performance standards and remedial goals established by EPA; and
- Design the system by which: 1) the dredged and processed sediment will be efficiently and safely transported by rail and/or barge from the processing facilities to the disposal facility(ies); and 2) the backfill/cap material will be transported by rail and/or barge to the Upper Hudson River area prior to placement in the river.

This Phase 1 FDR and the Phase 1 Project Specifications and Contract Drawings provide the approach for those remedial design objectives that are applicable to Phase 1 of the project.

1.4 Description of the Phase 1 Project

This section briefly describes the Final Design of Phase 1 of the Hudson River dredging project. Each of the primary project implementation elements is described below in a narrative format, and the goal of this section is to provide an overall description of the Final Design for Phase 1, taking into account the additional design analyses and basis of design completed since submittal of the Phase 1 IDR and discussed in Section 2. This section is not intended to define the scope of work of the six Phase 1 contracts GE expects to award. The scope of the work of each Contract is contained within the six Phase 1 Project Specifications and Contract Drawings packages appended to this Phase 1 FDR:

- Phase 1 Project Specifications and Contract Drawings for Contract 1 – Facility Site Work Construction (Appendix 1);
- Phase 1 Project Specifications and Contract Drawings for Contract 2 – Rail Yard Construction (Appendix 2);

- Phase 1 Project Specifications and Contract Drawings for Contract 3 – Processing Facility Construction and Operations (Appendix 3);
- Phase 1 Project Specifications and Contract Drawings for Contract 4 – Dredging Operations (Appendix 4);
- Phase 1 Project Specifications and Contract Drawings for Contract 5 – Habitat Construction (Appendix 5); and
- Phase 1 Project Specifications and Contract Drawings for Contract 6 – Rail Yard Operations (Appendix 6).

A summary of the scope of work for each contract is provided in Section 3.

1.4.1 Initial Phase 1 Construction Activities

The initial Phase 1 construction activities will include the construction of the sediment processing facility, where dredged sediment will be brought by barge for processing, and then loaded into rail cars and shipped to an approved landfill outside New York State (NYS) for disposal. Based on the site selection process documented in the Phase 1 IDR, EPA selected the Energy Park/Longe/New York State Canal Corporation (EP/L/NYSCC) site (referred to as the Energy Park site) as the location of the proposed sediment processing facility. As shown on Figure 1-2, the Energy Park site is situated along the shore of the Champlain Canal land cut between Locks 7 and 8.

Prior to initiation of in-river dredging, the Energy Park property must be transformed from its current condition to a fully functional and secure sediment handling and processing facility. As discussed in Section 3.1 of this Phase 1 FDR, the initial construction activities will include the following:

- **Site Work, Roads, and Utilities –** Contractors will perform initial site preparation activities including land clearing and grubbing, installation of site perimeter security fencing and control gates, and construction of an electrical substation to support the supply of power and the connection to primary utilities (water, sewer, telephone). Up to 90,000 cy of select material will be brought in to the site to provide a structural sub-grade for roads, tanks, buildings, wharfs, and rail beds. Nearly 4 miles of access and haul roadways will be built to provide access to the site, and utilities, fences, gates, signs, and other infrastructure will be developed to support operations. Stormwater collection and management systems will be developed to control all water falling on all developed areas at the site, and methods to control stormwater run-on (drainage from neighboring sites) will also be constructed. Concrete paving will be installed in certain other locations, and box culverts will be installed to allow construction of roads over Bond Creek and the Diversion Canal.

- **Wharf Area Construction –** A work wharf and unloading wharf along the Champlain Canal will be constructed so that barges moored to them will be outside of the canal's existing navigation channel. Work will begin by performing earthwork including clearing, grubbing, and excavation. The contractor will construct the wharves by installing pile, revetments, and rip-rap; building the structural steel superstructure and framework; and installing the concrete deck and its rails. The unloading area will be paved with concrete, the decontamination areas constructed, and primary utilities brought to the area.

- **Processing Facility Construction –** After the site work is sufficiently completed, contractors will construct the sediment processing facility, including a coarse material separation area, a thickening and filter press system, and water collection and treatment systems. Materials and equipment to be brought in as part of the processing facility construction include curbing, conveyors, tanks, pumps, hydrocyclones, filter presses, screens, piping, electrical systems, controls, clarifiers, filters, and related accessories.

- **Buildings and Coverings –** Initial construction activities will also include the erection of buildings and coverings to house sediment dewatering (filter presses) and water treatment equipment to protect it from the elements, and other processes requiring year-round operation (such as stormwater treatment) to provide climate-controlled conditions. A maintenance shop will also be constructed in the rail yard area. Temporary modular structures will be mobilized by contractors and set in the administration area for project management functions, and for personal decontamination. Enclosures for processed fine sediments (filter cake) will also be constructed to prevent addition of rainfall and to control potential volatilization of PCBs during storage prior to loading onto rail cars.

- **Processed Material Storage Area, Loadout Facilities, and Rail Yard** – To facilitate efficient sequencing and continuous loading of rail cars, processed material storage areas will be constructed alongside a rail yard. These areas will be used to stockpile sediment material that has been separated into size classes of debris, coarse material, and fine material. The rail yard itself will consist of approximately 31,000 feet of track. Ballasted track and special work (e.g., crossings, other ancillary facilities and installations) will be constructed, including the placement of ties, rail, and other track material. This work will also include the construction of a rail maintenance building and a weigh-in-motion scale.

- **Material Delivery Areas** – The processing facility includes a fuel depot to be used for refueling site vehicles (trucks, loaders, excavators) during processing operations. A polymer transfer station will be constructed in the sediment dewatering area. In addition, a rail spur will be constructed so the operations contractor has the flexibility to use rail as a delivery means for other supplies.

- **Work Support Marina Construction –** The NYS property immediately north of the NYSDEC boat launch property on West River Road will be used as a river access and support facility to reduce project marine traffic passing through Lock 7 and at the processing facility wharf. This property will be upgraded beginning with construction of access roads, earthwork to clear and grub the site, grading and preparation of parking areas, and installation of trailers. Primary utilities will be brought to the site, and a dock system will be constructed. The cultural and archeological resource and wetland assessments will be completed as part of the acquisition process for this property. The results of these assessments may modify the layout of this facility.

- **River Mooring Installations –** To facilitate barge movement, control, and staging, river moorings will be installed near the downstream entrance of Lock 7, including one turning dolphin and four mooring dolphins.

1.4.2 Dredging and Dredged Material Transport

Upon completion of construction and testing of the processing facility and work support facility, dredging (the first of several linked and mutually dependent project operational elements) can begin. As the initial project operational element, the rate and process of dredging and dredged material transport affect the design and operation of all subsequent project components.

A relatively small amount of navigational dredging will be required at the beginning of the dredging operations, to allow sufficient depth for transport of fully loaded barges within the Champlain Canal between Locks 7 and 8.

In the Phase 1 IDR, the plan was to restrict access to the channel leading to the Fort Edward terminal wall to the east of Rogers Island. The closure of the channel was proposed as a safety measure due to the large number of project vessels in this area for most of Phase 1 and the presence of resuspension control barriers. After consultation with the NYSCC during Final Design, this plan has been revised. Non-project vessels will be allowed to travel to and from the terminal wall in Fort Edward during a ½-hour period between the hours of

7:00am and 9:00 am, and again between 3:00 pm and 5:00 pm. The specific ½-hour slot in these 2-hour time periods will be at the discretion of the dredging contractor. These windows will be reported in a Notice to Mariners and the safe passage of recreational craft will be coordinated with the NYSCC. The gate in the resuspension barrier will be designed to allow passage of recreational vessels.

During Phase 1, 265,000 cy of sediment have been targeted for removal in Northern Thompson Island Pool (NTIP) and in the East Griffin Island Area (EGIA). The areas targeted for dredging cover approximately 94 acres of the river. These areas are shown on Figure 1-3, and the characteristics of each of these dredge areas are summarized in Table 3-2 of the Phase 1 IDR. Graphical depictions of the final Phase 1 dredge areas are presented on the dredge prisms (see Appendix 4, Drawings D-001 through D-020).

Dredging will be conducted using backhoe-mounted, hydraulically closing environmental clamshell mechanical dredges. The selection of mechanical dredges was explained in the Phase 1 IDR. The dredging season is planned to start in mid-May (or later if weather or river flow conditions prohibit the safe start-up of marine operations) and continue through the end of October. Closure operations (backfilling, capping, and shoreline restoration) may continue into November. To achieve EPA's Productivity Performance Standard, the design is based on up to eight dredges operating at any one time to complete the initial "inventory" dredging and any re-dredging (the "residual" dredging) necessary in areas where PCB levels in residual sediment are not met in the initial dredge pass. The criteria that will be used for deciding when dredging is done are described in Section 3.3.6 of the Phase 1 IDR, and operations are planned 24 hours a day, 6 days a week. The seventh day will be reserved for maintenance, make up time for unplanned outages, or as a contingency to make up lost productivity.

Dredging will begin in sub-area NTIP01, and work will generally proceed from upstream to downstream. The only exception to this is that dredging in one area near East Griffin Island (EGIA01) will start approximately 2 weeks into the Phase 1 program. It is expected that valuable information about the need for and effectiveness of resuspension controls (discussed further in Sections 1.4.3, 2.3.4, and 4.3.1 below) will be learned in EGIA01, and this information may influence activities in other Phase 1 dredge areas. The residuals dredging – which is any follow up dredging that may be necessary based on the residuals sampling results conducted to assess attainment of EPA's Residuals Performance Standard – will begin approximately 1 month after inventory dredging, and will continue through the end of October. The ability to attain EPA's Productivity Performance Standard will also be evaluated during Phase 1 and the inventory dredge schedule includes the removal of 89,000 cy of inventory sediments during a 1-month period.

Material dredged from the river will be placed directly into a barge, or if there is limited accessibility to the area being dredged, the dredged material may be placed into a hopper and then pumped to a barge. The design is based on a fleet of approximately 14 barges to transport dredged sediment and debris to the Energy Park processing facility. Once loaded with dredged material from the river, transport barges will be moved by tugboats and will proceed through Lock 7 to the processing facility. Barges will then be maneuvered and moored to the wharf at the processing facility for unloading by a crane or excavator. Barge and tugboat traffic will be monitored to optimize efficiency of the operations and to reduce impacts to other traffic on the canal. Navigational lighting and other precautions will be used to maintain safety of the vessels, personnel, and all on-water operations.

1.4.3 Resuspension Control

The various in-river activities that will be implemented during the Hudson River dredging project – removing debris, dredging, backfilling, capping, moving and anchoring barges and work boats, installing/removing resuspension controls – could resuspend sediments. Some of the fine sands, silt, and clay may remain in suspension and move downstream, causing increases in concentrations of PCBs and/or total suspended solids (TSS). Also, PCBs may desorb into the river when the sediment is mixed by dredging and related activities. This Phase 1 design includes an assessment of the need for resuspension controls. Section 3.3 of the Phase 1 IDR included discussions of the various control options, the basis of the design of this element, as well as a description of the model used to identify the activities most likely to resuspend sediments at levels that need to be controlled, the timing of those activities, and locations where controls would be most effective. Updated resuspension modeling results are provided in Section 2.3.4.

The modeling was performed assuming certain resuspension rates from the dredge, based on information collected during dredging at other sites. Such data are very limited, but are the best information available to be used in predicting the release of solids from dredging operations. Similar data are not available for other dredging-related operations, such as debris removal, installing/removing resuspension controls, maneuvering dredges/barges, and backfill/capping. Therefore, the model was run using a range of resuspension rates at the dredge. Although the results indicate that no controls are necessary to comply with the Resuspension Performance Standard, the design has included two general areas where resuspension containment will be installed during Phase 1, either as part of contingency planning or as a test of the effectiveness of the controls:

- As a contingency measure, a rock dike will be installed at the northern end of the eastern channel of Rogers Island, and silt curtains will be installed at the southern end of Rogers Island. These control structures will be installed during the first 2 to 4 weeks of the dredging season. The rock dike will reduce the flow of water through this portion of the river and the silt curtain will reduce the downstream transport of resuspended sediments, and also act to control access to this section of the river, for safety purposes.

- Due to the nature of the sediments in the area east of Griffin Island targeted for dredging during Phase 1 (EGIA01), dredging in this area is expected to provide valuable information on the effectiveness, reliability, and operation of different resuspension control structures. Therefore, the dredge schedule in EGIA01 calls for 2 weeks of dredging with no resuspension controls, 1 week of dredging within a sheet-piled enclosure, and 2 weeks of dredging within an area enclosed by silt curtains.

Additional information on the design of resuspension controls is presented in Section 2.3.4 below, and Final Design details are presented in the Phase 1 Project Specifications and Contract Drawings for Dredging Operations, included as Appendix 4 to this Phase 1 FDR.

1.4.4 Sediment and Water Processing

This section briefly explains how dredged material travels from the river transport barges through a set of process steps to remove water and make the sediment ready for transport by rail car for offsite disposal.

The primary objective of sediment and water processing is to effectively separate river water from sediment solids so that the solids can be efficiently transported offsite while process water is collected, treated and discharged to the Champlain Canal within applicable water quality requirements. Below is a brief overview of the primary steps involved in this dewatering process as sediments are offloaded from barges, treated and handled in controlled on-shore facilities, and then loaded onto rail cars for offsite transport (refer also to Figure 1-2 for a visual overview of the processing facilities site plan at the Energy Park site):

- **Unloading at Waterfront Facilities –** To keep pace with inventory and residuals dredging at a peak rate of 5,100 *in situ* cy per day, waterfront facilities at the Energy Park site will have the capacity to accommodate the coming and going of up to 20 barges per day (this number does not include additional barges needed to transport backfill and cap materials, which could add up to 10 additional barge trips per day through the Champlain Canal if the source of these materials is north of the Energy Park site). The unloading wharf and the adjacent maintenance/staging work wharf will stretch approximately 1,500 feet along the shoreline, and will provide direct access to the land-based sediment processing facilities. The surface of the wharf will be sloped away from the Champlain Canal to collect runoff and help prevent material from entering the canal during sediment unloading activities at the wharf. Also, a drip plate will be placed under the path of the unloading bucket to cover the gap between the moored barge and the unloading wharf.

- **Size Separation –** At the waterfront, sediments will be separated for further processing. Debris and other objects on the order of 2 feet in size or larger will be removed and transported to the debris storage area next to the rail yard (all drainage water generated during debris management will be collected and treated). Debris may be temporarily staged on the pad next to the unloading wharf.

  A rotating trommel screen will be used to separate larger particles from offloaded sediment and to break up larger clumps of sediment for further processing. Material ⅝-inch in diameter or greater will be removed and placed in coarse solids stockpiles near the rail yard (drainage water will be captured and treated), while smaller particles will be diverted to a sediment slurry tank capable of holding 25,000 gallons of material.

  Up to 5,000 gallons per minute (gpm) of sediment slurry having a desired 25% solids content by weight will be pumped into an array of twenty 10-inch diameter hydrocylones (including standby units) to further separate solids into a "sand" portion and a slurry of fine sediment. The "sand" portion will be further dewatered by vibratory dewatering screens and transported to the coarse material storage areas (drainage water will be captured and treated). These coarse materials will be temporarily stockpiled on the pad next to the unloading wharf before being transferred to the storage areas. Meanwhile, the remaining fine sediment slurry will be piped to a gravity thickener near the center of the processing facility site.

- **Sediment Dewatering and Thickening –** The objective of this operation is to thicken the sediment slurry. Up to 5,000 gpm of slurry will be pumped from the hydrocyclones in the separations area through nearly a half-mile of 12-inch pipes to an 80-foot diameter gravity thickener where coagulants and flocculents (polymers like those used in municipal wastewater treatment plants) will be added to the slurry to cause the fine particles to bind together. As the fine particles clump together and grow heavier, they will settle into the bottom of the gravity thickener, while the resulting clarified water is collected and treated in the onsite water treatment facility. The settled material then will be pumped to the filter presses for dewatering.

- **Final Dewatering by Filter Presses –** The final processing step before loading fine sediment material into the fine material staging building is feeding the conditioned (high solids content) sediment from the thickener through one of 12 plate-and-frame filter presses. Within the dewatering building, two rows of six filter presses will occupy an area approximately 250 feet long and 165 feet wide. Exposed to 100 pounds per square inch (psi) of pressure within the presses, water will be squeezed from the sediment to produce a filter cake, with a goal of 55% solids content or higher. After inspection to determine if the filter cake is dry enough for transport, it will be carried by truck in containers to fines storage buildings near the rail yard where it will be placed to await shipment offsite. The materials will be subsequently loaded into lined gondola rail cars that will be taken from the site by rail carriers for final disposal.

- **Water Treatment Facility –** All water from sediment processing and stormwater runoff from areas where sediment is managed will be contained and controlled at all times. The facility is designed so that 2 million gallons of water per day can be treated before discharge to the Champlain Canal. Multiple-stage treatment components include flocculation tanks, clarifiers and filters to remove solids, and granular-activated carbon (GAC) units to remove PCBs from the water. The treatment facility is designed to operate 24 hours a day, 7 days a week, and to accommodate all process flows from dewatering dredged sediment, as well as stormwater that may be generated during weather events up to a 100-year storm. Water discharged to the Champlain Canal will be monitored in accordance with the discharge monitoring requirements specified in the water quality requirements (WQ requirements) provided by EPA to GE in January 2005 (EPA, 2005), as described in the Phase 1 EMP (Appendix 7).

1.4.5 Processed Sediment Transportation and Disposal

The processed sediment transportation and disposal element of the project involves the transportation by commercial rail carrier of processed sediment and other project waste material to a Toxic Substances Control Act (TSCA) authorized landfill location for final disposal. The process employed to identify, evaluate and select the mode of transportation and a short list of candidate landfills was explained in Sections 3.7 and 3.8 of the Phase 1 IDR.

Transportation of processed sediment and other project waste material during Phase 1 will be by rail using unit trains comprising 81 gondola rail cars (as described in the Phase 1 IDR, a unit train consists entirely of rail cars traveling from the origin to the destination, instead of small groups of rail cars that are included in trains carrying other commodities to different destinations). Each rail car will be weighed before leaving the site to verify that the load meets weight restrictions of the commercial carriers. Rail cars will be fitted with a watertight liner system, a watertight lid, or a combination of both to meet applicable regulatory requirements. The carrier serving the Energy Park site is the Delaware & Hudson Railway Company, Inc., a subsidiary of Canadian Pacific Railway (CPR). While CPR owns and operates the rail line adjacent to the processing facility site, and is therefore the origin carrier for purposes of the movement of project waste materials by rail, it must "hand off" trains to an interconnected carrier for purposes of delivery to the final destination.

A fleet of approximately 450 rail cars (including an allowance for spare cars to accommodate routine and unexpected maintenance needs) will be dedicated to the project during Phase 1. On average, one train of 81 loaded rail cars will depart from (and one train of 81 empty cars will arrive at) the rail yard at the processing facility every 4 to 5 days during Phase 1, although once off the site, the actual frequency of train movements will be controlled by the rail carriers.

During Phase 1, all waste materials destined for landfilling will be disposed of at a single TSCA authorized landfill regardless of PCB concentration (this approach was referred to in the Phase 1 IDR as the "monofill" scenario) at a location outside of NYS. Currently, GE is in final negotiations with the disposal site. The use of a single TSCA-authorized landfill for all project waste materials eliminates the need to segregate material according to PCB concentration at the processing facility, resulting in a more efficient design for storage, sampling, loading and rail car management.

Upon arrival at the landfill, the cars will be unloaded, then set for the return trip to the processing facility. The unloaded waste material will be conveyed to the active working area of the landfill, where it will be disposed of by the landfill operator in accordance with the landfill's operating permits and authorizations. Because the rail cars will be dedicated and will only transport processed sediment and other project waste materials, decontamination of the interior of the cars prior to leaving the landfill facility will not be required. Upon return to the processing facility, rail cars will be kept in a secure area of the rail yard with restricted access prior to their reuse. Prior to use for any other purpose (either at the end of Phase 1 or upon completion of Phase 2), rail cars will be decontaminated in accordance with applicable regulations.

1.4.6 Backfilling/Capping and Habitat Replacement Reconstruction

Once inventory and residuals dredging are complete in a given portion of each dredge area (referred to as a "certification unit," or CU), the process of placing backfill or cap material can begin. The checklist that will be used to certify completion of dredging is included as Attachment K. The decision to place backfill or cap will be based on the post-dredging distribution of PCB concentrations. There are three different types of backfill that may be used primarily based on the surface water velocity regime for that portion of the river. Type 1 backfill (medium sand) is designed for placement in low velocity portions of the river. Type 2 backfill (gravel) is designed for areas of the river with moderate to high velocities. Type 3 backfill (medium sand amended with organics) is targeted for low velocity areas where planting or recolonization of aquatic vegetation is planned to occur. Placement of backfill of any type will not occur in the navigation channel unless the post-dredge water depth is 15 feet or more.

For locations where a cap will be placed, several different options are available and the decision of which type of cap is suitable for each given area is a function of the PCB concentrations that remain in the sediment after dredging and the surface water velocities in that portion of the river. “Type A” caps will be used for situations where the average Tri+ PCB concentration after dredging is less than or equal to 6 milligrams per kilogram (mg/kg) and capping is necessary; and the “Type B” cap would be placed in a CU where the average Tri+ PCB concentration is greater than 6 mg/kg after dredging. The decision to install this type of cap would be made after GE and EPA have agreed that additional dredging is not required. There are two Type A cap designs, one for low velocity areas and a second design for areas with moderate to high flow velocities. The Type B cap design includes three options including low, moderate, and high velocity areas.

The replacement and reconstruction of habitat substrate will take place within a CU once dredging and backfilling/capping operations are complete. A combination of natural re-colonization and planting has been specified. Given the seasonality of planting, this may not be completed until the planting season following Phase 1 dredging. The process for selection of habitats for a given area is discussed in Section 2.3.7.3 below.

1.5 Phase 1 Final Design Report Organization

This Phase 1 FDR builds upon the information presented in the PDR and Phase 1 IDR. Information in these documents is referenced, as applicable. Design analyses that have been modified or advanced since the Phase 1 IDR are described in detail in this Phase 1 FDR.

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

Table 1-1 – Phase 1 FDR Organization

Section	Description
1 – Introduction	Provides a summary of the proposed remedial action selected by EPA, a description of the project setting, the purpose and scope of this Phase 1 FDR, and a brief description of the Phase 1 project.
2 - Basis of Design and Supporting Information	Provides summary information from design support activities to document the project conditions and physical conditions under which the remedial action will occur. Also provides basis of design summary tables and an overview of key design decisions that have occurred since publication of the Phase 1 IDR.
3 – Phase 1 Construction and Implementation Contract Summaries and Schedule	Summarizes the various remedial action contracts planned for Phase 1 of this project and presents a schedule for Phase 1 of the remedial action.
4 – Phase 1 Monitoring and Compliance with Performance Standards	Summarizes the environmental monitoring that will be implemented during Phase 1 of the remedial action to evaluate the performance against the numerical criteria in the Hudson EPS, Hudson QoLPS, and water quality requirements.
5 – References	Provides references cited in this Phase 1 FDR.
6 – Acronyms	Provides definitions of acronyms that are used in this Phase 1 FDR.
Tables	Provide tables referenced in this Phase 1 FDR.
Figures	Provide figures referenced in this Phase 1 FDR.
Attachments	Provide attachments referenced in this Phase 1 FDR.
Appendices	Provide, in separately bound volumes: Phase 1 Project Specifications and Contract Drawings, Phase 1 EMP, and *Phase 1 Community Health and Safety Plan* (Phase 1 CHASP).

2. Basis of Design and Supporting Information

This section summarizes the Phase 1 performance requirements; and the design support activities and analyses completed since submittal of the Phase 1 IDR. The final basis of design for the Phase 1 project is presented in a series of tables referenced in Section 2.3.

2.1 Phase 1 Performance Requirements

Performance requirements guide the design presented in this Phase 1 FDR. These requirements are derived from the following:

- ROD (EPA, EPA, 2002a);
- Hudson EPS (EPA, 2004a);
- Hudson QoLPS (EPA, 2004b);
- Water quality requirements (WQ requirements) (EPA, 2005), which include the following: *Substantive Requirements Applicable to Releases of Constituents not Subject to Performance Standards*; and *Substantive Requirements of State Pollutant Discharge Elimination System Permit for Potential Discharges to Champlain Canal (land cut above Lock 7)*; and
- *Hudson River PCBs Site Final Biological Assessment* (Final BA) (E&E, 2006).

The Hudson EPS, the Hudson QoLPS, and the WQ requirements further develop details of the performance requirements beyond those listed in the ROD. The actions that GE will perform to meet these requirements are set forth in the following documents:

- Phase 1 EMP, appended to this Phase 1 FDR as Appendix 7, which is an updated version of the RA Monitoring Scope attached to the CD, with additional details to be described in the *Phase 1 Remedial Action Monitoring Quality Assurance Project Plan* (Phase 1 RAM QAPP) to be developed in accordance with the SOW;
- PSCP Scope attached to the CD, with additional details to be specified in the *Phase 1 Performance Standards Compliance Plan* (Phase 1 PSCP) to be developed in accordance with the SOW; and

- *Phase 1 Remedial Action Community Health and Safety Plan* (Phase 1 RA CHASP), appended to this Phase 1 FDR as Appendix 8, which includes the requirements specified in the RA CHASP Scope attached to the CD.

2.1.1 ROD Requirements

The ROD sets out, in short form, the following elements of the project that have determined the Phase 1 Design:

- Removal of sediments based primarily on an MPA of 3 g/m^2 Tri+ PCBs or greater from River Section 1 (all Phase 1 areas are in River Section 1);
- Dredging of the navigation channel, as necessary, to implement the remedy and to avoid hindering canal traffic during implementation;
- Removal of all PCB-contaminated sediments within areas targeted for remediation, with an anticipated residual of approximately 1 mg/kg Tri+ PCBs (prior to backfilling);
- Design to achieve the Engineering and Quality of Life Performance Standards developed by EPA (discussed below);
- Performance of the dredging in two phases whereby remedial dredging will occur at a reduced rate during the first year of dredging (Phase 1);
- Backfill of dredged areas with approximately 1 foot of clean material to isolate residual PCB contamination and to expedite habitat recovery, where appropriate;
- Use of rail and/or barge for transportation of clean backfill materials within the Upper Hudson River area;
- 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; and
- Rail and/or barge transport of dewatered, stabilized sediments to an appropriate licensed offsite landfill(s) for disposal.

In the ROD, EPA identified as Applicable or Relevant and Appropriate Requirements (ARARs) a number of federal and state environmental laws and regulations (see Tables 14-1 through 14-3 of the ROD). Sections 2.2.5 and 6 of the Phase 1 IDR provided more information on potentially applicable regulatory requirements. Section 2.2.7 of this Phase 1 FDR further discusses the incorporation of the substantive requirements of these potentially applicable regulatory requirements into the Final Design documents.

2.1.2 Engineering Performance Standards

In 2003, EPA issued draft EPS for resuspension, residuals, and productivity (collectively referred to as the Hudson EPS) for the remedy. A peer-review panel evaluated the draft standards, and the final Hudson EPS for Phase 1 of the remedial action were issued in a five-volume report in 2004. These standards expand upon and refine the requirements set forth in the ROD.

Specific activities that will be undertaken to address the Hudson EPS during Phase 1 are set forth in the Phase 1 EMP (appended to this Phase 1 FDR) and the PSCP Scope (attached to the CD), with additional details to be specified in the Phase 1 RAM QAPP and Phase 1 PSCP to be developed in accordance with the SOW. Summaries of the EPS, as they apply to the Phase 1 design, are briefly discussed in the following sections. The analysis to assess the project's ability to comply with the EPS is presented in Section 4.3.

2.1.2.1 Project-Related Resuspension

The Resuspension Performance Standard is a basis of design for dredging, backfilling, capping, and resuspension controls. This standard specifies three action levels – Evaluation, Control, and Standard. These action levels apply to PCBs and/or TSS in surface water at either near-field stations (located within 300 meters [m] of the dredging activities) or far-field stations (located more than 1 mile downstream of dredging activities). The Phase 1 EMP appended to this Phase 1 FDR sets out the scope of the routine monitoring, reporting requirements, and action levels used to trigger additional monitoring during the remedial action, as well the scope of that additional monitoring. The PSCP Scope describes the response actions that will be taken when the resuspension action levels are exceeded (with additional details to be provided in the Phase 1 PSCP). More details on how the Resuspension Performance Standard relates to the design, including a description of the resuspension model used in the design analysis and the initial results, were presented in Section 2.2.2.1 of the

Phase 1 IDR. Since that time, the resuspension modeling has been updated. A discussion of the updated results is presented in Section 2.3.4.

2.1.2.2 Dredging Residuals

The Residuals Performance Standard is a component of the basis of design for dredging, backfilling, and capping. This standard describes action levels for Tri+ PCBs in surface sediment that remains after dredging. The action levels will be applied on a CU basis. CUs are described in Section 3.3 of the Phase 1 IDR, and are initially identified on the dredge prism drawings included in the Phase 1 Contract Drawings for Dredging Operations appended to this Phase 1 FDR. The Phase 1 EMP appended to this Phase 1 FDR provides an overview of the routine monitoring, reporting requirements, and requirements for sediment sampling and analysis under this performance standard; and the PSCP Scope describes the other actions that will be taken to implement the Residuals Performance Standard (with additional details to be provided in the Phase 1 PSCP).

2.1.2.3 Dredging Productivity

The Productivity Performance Standard is a component of the basis of design for the dredging, dredged material transport, sediment processing, and transportation and disposal elements of the remedial action. This standard specifies the annual minimum and target volumes of sediment (inventory sediment volumes, excluding residuals dredging volumes) to be removed, processed, and shipped offsite during Phase 1 (Hudson EPS, Volume 4, p. 27). The target removal volume for Phase 1 is defined as 265,000 cy of sediment, with a minimum required removal volume of 200,000 cy. The productivity schedule for Phase 1 dredging is described in the appended Phase 1 Project Specifications. Certain contingency actions will be implemented if productivity monitoring indicates that productivity is behind schedule; monitoring thresholds and contingency actions are discussed in the PSCP Scope and will be set forth in more detail in the Phase 1 PSCP.

2.1.3 Quality of Life Performance Standards

In May 2004, EPA issued the Hudson QoLPS. The Hudson QoLPS address air quality, odor, noise, lighting, and river navigation during implementation of the remedial action. The Hudson QoLPS are a component of the basis of design for all design elements except offsite transportation and disposal. The design analysis to assess the quality of life impacts of the project was described in Section 3.11 of the Phase 1 IDR and is further discussed in Section 4.4 of this Phase 1 FDR.

The Phase 1 EMP appended to this Phase 1 FDR provides an overview of the routine monitoring, reporting requirements, and action levels for additional monitoring under the QoLPS for air quality, odor, noise, and lighting. Specific response actions to be taken to address the Hudson QoLPS are discussed in the Phase 1 RA CHASP (appended to this Phase 1 FDR) and the PSCP Scope and will be set forth in more detail in the Phase 1 PSCP.

2.1.4 Water Quality Requirements

The WQ requirements contain numerical standards/limitations and monitoring requirements both for: 1) in-water releases of constituents not subject to the Hudson EPS (notably, metals and physical parameters); and 2) discharges of pollutants from the land-based facilities to the river. These requirements are a component of the basis of design for dredging, backfilling, capping, resuspension controls, and sediment and water processing. The monitoring requirements for releases during dredging activities and discharges from the sediment and water processing operations, including the sample and analytical methods, contingency monitoring, and reporting requirements are provided in the Phase 1 EMP, which is appended to this Phase 1 FDR. Specific response actions to be taken to address the WQ requirements are discussed in the PSCP Scope and will be set forth in more detail in the Phase 1 PSCP. The analysis to assess the design of the water treatment facilities with respect to these requirements is presented in Section 3.6.4 and Attachment G of the Phase 1 IDR. In addition, the completion of the Rapid Small-Scale Column Tests (RSSCTs), described in Section 2.2.1 of this Phase 1 FDR, helped confirm the analysis presented in the Phase 1 IDR.

2.1.5 Biological Assessment and Concurrence by Resource Agencies

In January 2006, Ecology and Environment, Inc. 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 in the project area – the bald eagle (*Haliaeetus leucocephalus*) and the shortnose sturgeon (*Acipenser brevirostrum*) – 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 relevant resource agencies – i.e., the U.S. Fish and Wildlife Service (USFWS) with respect to bald eagles and the National Oceanic and Atmospheric Administration (NOAA) Fisheries (formerly known as the National Marine Fisheries Service) with respect to the shortnose sturgeon – 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, there are no known nesting pairs of bald eagle in the vicinity of the Phase 1 project 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 since suitable habitat beyond the locations impacted by the project is widely available. The Final BA concludes that "potential impacts discussed in this BA are considered to be either discountable or insignificant," and that "[o]verall, the bald eagle is expected to be positively affected by the proposed remedial action." The Final BA also 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 Phase 1 design and are not covered elsewhere in this Phase 1 FDR include the following:

- EPA and the design team will coordinate with the USFWS and NYSDEC in late winter or early spring of each dredging season to determine if a bald eagle nest has developed within 4,000 feet (1,200 m) of the sediment processing facility site or areas targeted for dredging. Appropriate measures will be developed to avoid/minimize disturbance to nesting eagles.
- EPA will work with the dredging contractor and 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 done outside of the bald eagle wintering period (defined as occurring from December through March) and no tree cutting activities will proceed until the immediate area is clear of eagles.
- Power and utility lines serving the sediment processing facility will be designed in accordance with prevailing state and local standards and requirements. Wires will be properly grounded to ensure that no take of eagles occurs if there is contact between eagles and power lines. In addition, utility lines will be placed to minimize the potential for eagle collisions and electrocutions.
- Site layout of the processing facility will be designed to minimize, to the extent practicable, disturbance to suitable bald eagle perching/roosting trees.
- Potential perching or roosting trees within the 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 USFWS recently reopened a public comment period on a proposal to remove the bald eagle from the federal list of threatened and endangered species. The comment period ends on May 17, 2006. Even if the bald eagle is removed from the federal list of threatened and endangered species, the conservation measures incorporated into the design of the remedial action (listed above) will still be implemented.

The shortnose sturgeon is not present in any of the Phase 1 or Phase 2 dredge areas, and in fact, was only retained in the Final BA because it occurs in proximity to the OG Real Estate site – one of the final two sites considered for the processing facility. However, in June 2005, EPA announced that a single processing facility located at the Energy Park site would be suitable for Phase 1. As a result, the Phase 1 project should not have any impact on the shortnose sturgeon.

2.2 Final Design Support Activities

A comprehensive series of design support activities has been conducted to support the remedial design. Information from the various design support activities that were implemented during the Preliminary and Intermediate stages of the design was presented in Section 2 of the Phase 1 IDR, and is not repeated in this document. The objectives, methods, and results of these activities are reported in the following design support documents:

- *Phase 1 Target Area Identification Report* (QEA, 2004a);
- *Phase 1 Data Summary Report* (QEA, 2004b);
- *Year 2 SEDC Interim Data Summary Report* (BBL, 2005c);
- *Supplemental Delineation Sampling Program Data Summary Report* (QEA, 2005b);
- *Phase 1 Dredge Area Delineation Report* (QEA, 2005a);
- *Hudson River PCBs Superfund Site Final Facility Siting Report* (EPA, 2004c);
- *Habitat Delineation Report* (HD Report) (BBL and Exponent, 2005a);
- *Habitat Assessment Report for Candidate Phase 1 Areas* (Phase 1 HA Report) (BBL and Exponent, 2005b);
- *Archeological Resources Assessment Report for Phase 1 Dredge Areas* (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);
- *Baseline Monitoring Program – Quality Assurance Project Plan* (QEA, 2003a); and
- River hydrodynamic analyses originally reported in Section 2.3.9 of the Phase 1 IDR.

In addition to the previous work, a limited number of supplemental Design Support Activities have been completed as part of the development of the Final Design; findings from these activities are summarized below.

2.2.1 Additional Treatability Studies

Treatability studies were conducted between July 2004 and September 2005 to support the design of the remedial action and to provide data to guide equipment selection and sizing during the remedial design. The activities were described in the *Treatability Studies Work Plan* (TS Work Plan) (BBL, 2004b); changes to the procedures outlined in the TS Work Plan were described in a series of eight Treatability Studies Corrective

Action Memoranda (TS CAMs) submitted to EPA for review and approval, and related correspondence between GE and EPA.

The treatability tests that were complete and the results that were available as of May 2005 were documented in the *Treatability Studies Report* (TS Report) (BBL, 2005b). Treatability study testing continued through September 2005, during the development of the Phase 1 Final Design. These additional treatability studies were as follows:

- Primary Sedimentation Tests – conducted to examine the sedimentation of suspended solids under flocculent settling conditions;
- Dewatering Polymer Tests – conducted to identify the preferred polymer conditioning to be used in the mechanical dewatering of hydraulically processed sediments; and
- RSSCTs – conducted to estimate carbon consumption rates and removal efficiencies for the design of GAC treatment systems.

These additional treatability studies and associated results are described in the *Addendum to the Treatability Studies Report,* which is provided as Attachment A to this Phase 1 FDR. The results of these tests are a basis for the design of the sediment dewatering and water treatment processes, as described in Section 2.3.5. The results of the primary sedimentation tests and dewatering polymer tests were used to confirm the design of the thickener and filter press dewatering system, while the results of the RSSCTs confirmed that the GAC system specified for water treatment would provide adequate service life.

2.2.2 Additional Year 2 Supplemental Engineering Data Collection (SEDC) Work

Since submission of the Phase 1 IDR, a variety of work conducted as part of the SEDC Program has been completed. The overall goal of the SEDC Program is to gather the engineering field data needed to support the development of the remedial design, as described in the *Supplemental Engineering Data Collection Work Plan* (SEDC Work Plan) (BBL, 2004c). SEDC results have been reported in various documents, which were summarized in Section 2.3.6 of the Phase 1 IDR.

Additional geotechnical needs were identified during Intermediate Design. These additional data needs were addressed in two addenda to the SEDC Work Plan:

- *Supplemental Engineering Data Collection Work Plan Addendum No. 1 – Year 2* (Year 2 SEDC Work Plan Addendum No. 1) (BBL, 2005d) – submitted to and approved by EPA in June 2005. This addendum was developed to define the processes to collect geophysical survey data, and outlined plans to conduct multibeam bathymetry, sub-bottom profiling, and magnetometer surveys in the Phase 1 dredge areas. The geophysical work was completed in August 2005, and raw data were submitted to EPA at that time.

- *Supplemental Engineering Data Collection Work Plan Addendum No. 2 – Phase 1* (Phase 1 SEDC Work Plan Addendum No. 2) (BBL, 2005e) – submitted to and approved by EPA in September 2005. The primary objective of Addendum No. 2 was to describe the collection of additional geotechnical engineering data to support the design of resuspension containment systems in portions of the Phase 1 dredge areas. The work was specifically focused on gathering additional data to assess the *in situ* strength characteristics of the sediments, and the depth to firm layers or bedrock in areas where sheet piling may be installed or where previous field efforts did not fully satisfy the data needs of the remedial design. Conventional drilling was supplemented by cone penetrometer tests (CPTs) to enhance the design team's ability to correlate the character of the sediments with *in situ* strength and mechanical properties. Field work started in mid-October 2005 and was completed in early November 2005.

The results of the geophysical and geotechnical investigations conducted in accordance with the above addenda are described in the *Year 2 SEDC Data Summary Report*, which is provided as Attachment B to this Phase 1 FDR. As discussed in that report, the results have been used in the design as follows: The multibeam bathymetry data have been used to develop dredge prisms provided in Appendix 4 and to calculate dredged material quantities. The sub-bottom profiling work was not useful and so has not been incorporated in the design. The magnetometer data have been used to locate ferrous objects in the river. The additional geotechnical testing results have been used in the design of the resuspension containment systems, by providing data on the location of rock and the strength of underlying materials.

2.2.3 Additional Geotechnical Investigation Activities

Since submission of the Phase 1 IDR, new geotechnical information has been collected to support development of this Final Design, as summarized below:

- A general geotechnical evaluation was performed in September 2005 at the Energy Park site to support the Final Design of the processing facility. Borings were advanced on the upland portion of the Energy Park site and in the Champlain Canal to collect general geotechnical information on the geology, sediments, and substrata in these areas; and rock cores were collected from borings advanced along the shore of the Champlain Canal. Split-spoon samples were collected during the advancement of the borings and subjected to a variety of physical tests to assess geotechnical parameters.
- During the development of the Phase 1 Final Design, the feasibility of constructing a potential mooring site for barges and installing a potential snubbing post (turning point) for barges just south of Lock 7 was assessed. In conjunction with the November 2005 field work conducted as described in the Phase 1 SEDC Work Plan Addendum No. 2, borings were advanced in the river to gather the necessary geotechnical information to support the feasibility assessment and design of these facilities.
- Geotechnical work was also completed between December 2005 and February 2006 to support the assessment and design of a new two-mile access road to the processing facility from Route 196 along NYSCC property. Split-spoon samples were collected during the advancement of borings and subjected to a variety of physical tests to assess geotechnical parameters.
- In February 2006, more deep borings were advanced to locate the rock surface within the central portion of the Energy Park site to provide a basis for building and tank foundation design.

The results of these additional geotechnical investigations are discussed in the *Geotechnical Investigation Summary Report* provided in Attachment C. The geotechnical data from these investigations provide a basis for the design of the mooring posts in the River, the new access road from Route 196, and the foundations at the processing facility.

2.2.4 Habitat Delineation and Assessment (HDA)

The first step in the development of the habitat replacement and reconstruction component of the project was to identify a range of representative areas to target for habitat assessment. As described in the *Habitat Delineation and Assessment Work Plan* (HDA Work Plan) (BBL, 2003b), the Upper Hudson River was delineated into four different habitat types – unconsolidated river bottom, aquatic vegetation bed, shoreline, and riverine fringing wetlands. Detailed information and habitat maps are included in the HD Report (BBL and Exponent, 2005a), which will be revised and re-submitted based on comments received from EPA on February 10, 2006.

As part of the habitat assessment effort, data have been collected from each of the four habitats and used to establish a baseline range of habitat-specific physical and biological variables that are related to the ecological functions provided in the surveyed areas of the Upper Hudson River. Data were collected in both target areas (locations that will be dredged) and reference areas (locations that will not be dredged) in 2003, 2004, and 2005. Locations of target and reference stations in the river were identified in the *Supplemental Habitat Assessment Work Plan* (SHAWP) (BBL and Exponent, 2005c), which was approved by EPA in November 2005. The results of the 2003 and 2004 habitat assessment activities in Phase 1 areas were presented and discussed in the *Habitat Assessment Report for Candidate Phase 1 Areas* (Phase 1 HA Report) (BBL and Exponent, 2005b), which was approved by EPA in November 2005.

Data were collected in Phase 1 areas from all four habitat types and used to develop the habitat replacement and reconstruction designs, the Adaptive Management Program (described in Attachment H), and the Functional Capacity Index (FCI) models. FCI models were developed for each habitat type, and will be used to evaluate whether and when functions of habitats directly impacted by dredging return to the range of functions found in similar habitats that have not been impacted by dredging. The data collected during the 2005 field work in Phase 1 dredge areas and associated reference stations are presented in Exhibit A to the *Phase 1 Adaptive Management Plan* (Phase 1 AM Plan), which is Attachment H to this Phase 1 FDR, and updated FCI models for the Phase 1 dredge areas and associated reference stations are discussed in Exhibit B to that Phase 1 AM Plan.

2.2.5 Wetland Mitigation

During the processing facility site selection process conducted by EPA, wetland areas on the Energy Park site were delineated. As discussed in Section 2.3.5.1 below, the access road to the Energy Park site has been moved from the location shown in the Phase 1 IDR, which necessitated the movement of the administration area to the north side of the property. The revised site plan has been developed to avoid direct construction activities on the delineated wetland areas and, as stated in Section 3.10.2.5 of the Phase 1 IDR, no additional wetland mitigation measures are anticipated. However, because of seasonal constraints, a wetland investigation of the proposed access road alignment has not yet been performed – this investigation will be completed prior to construction.

2.2.6 Cultural and Archaeological Resources Assessment (CARA) Update

Since submittal of the Phase 1 IDR, additional field work has been completed to further characterize archaeological resources that could be impacted by Phase 1 dredging activities. As described in Section 2.3.8 of the Phase 1 IDR, the primary goal of the CARA program is to evaluate the potential effects of dredging, backfilling/capping, and habitat replacement and reconstruction on cultural and historical resources within portions of the Upper Hudson River that are targeted for remediation in Phase 1. Program efforts have focused primarily on identifying, evaluating, and cataloging submerged and shoreline resources that could be disturbed or rendered unstable by dredging activities. Where potentially significant resources were identified, program efforts also included an assessment to determine the resource's eligibility for listing on the National Register of Historic Places (NRHP). In addition, EPA conducted a separate assessment of the Energy Park processing facility site, which did not identify any cultural resources eligible for the NRHP (EPA, 2004c). An assessment of the areas to be disturbed during the construction of the access road will be completed during the property acquisition (NYSCC permit) process.

In April 2005, the Phase 1 ARA Report (URS, 2005) was submitted to EPA, NYSDEC, and the State Historic Preservation Office (SHPO). That report, which addressed resources in the Phase 1 areas and was approved by EPA in July 2005, indicated that additional field work was needed to refine characterizations of potentially important submerged and shoreline resources. As a result, additional field work and analyses were conducted throughout the remainder of 2005, and two addenda were submitted to EPA:

- *Terrestrial Archaeological Survey and Testing Report: Addendum I to the Archaeological Resources Assessment Report for Phase 1 Dredge Areas*, submitted to EPA on February 7, 2006 (URS, 2006a). This addendum was originally submitted to EPA on October 19, 2005 and subsequently revised to incorporate additional data and to respond to EPA's comments dated December 14, 2005. A subset of test areas containing resources potentially eligible for the NRHP was investigated under a Phase II work plan approved by EPA on November 10, 2005, and the results are included in the February 7, 2006 addendum.
- *Underwater Archaeological Survey Report: Addendum II to the Archaeological Resources Assessment Report for Phase 1 Dredge Areas,* submitted to EPA on January 31, 2006 (URS, 2006b). This addendum was originally submitted on October 31, 2005 and subsequently revised based on EPA's comments dated December 14, 2005.

The major findings of these addenda as they relate to Final Design analyses are summarized below. Refer to the addenda themselves for complete background and analyses of the studies.

2.2.6.1 Updated Findings of Terrestrial Archaeological Survey

Terrestrial archaeological studies in the Phase 1 dredge areas were completed during 2005. Eighteen terrestrial survey areas (designated as Test Areas A through R) were investigated within the project area for the presence of archaeological resources potentially eligible for the NRHP. Of particular interest were potentially sensitive shoreline areas where dredging could destabilize or disturb intact resources.

Test Areas G, H, and L were found to have resources that may be eligible for listing on the NRHP. Further assessment concluded that the potentially sensitive shoreline resources in Test Area G are not eligible for listing, and that Areas H and L have resources either eligible or already listed on the NRHP. These three areas are described further below.

- Test Area G is located on the eastern shore of the river, just south of the concrete terminal wall of the Fort Edward Yacht Basin. Although artifact deposits and a stone foundation were found during the initial survey, subsequent more detailed investigation indicates that the foundation is of early 20th century origins, and associated deposits do not appear to reveal information important to the history of Fort Edward, making this site ineligible for the NRHP. In any event, dredging is not expected to destabilize or disrupt resources in Test Area G because the river bank where the dredge prism reaches the shoreline is protected by rock riprap or a wooden retaining wall. This area is identified on the Phase 1 Contract Drawings for Dredging Operations (Appendix 4).
- Test Area H is located on the eastern shore of the river, south of the railroad bridge in Fort Edward and north of the mouth of Little Wood Creek. The area includes a previously recorded historic site that is eligible for the NRHP (State Site A11542.0003 – the location of the 18th century fort for which Fort Edward is named). Archaeological test excavations revealed some intact 18th century deposits, but they are protected under 19th century fill or are located far enough from the river and dredge prisms as not to be impacted by dredging activities. No intact archaeological deposits are likely to extend out into the riverbed in the vicinity of this area. This area is identified on the Phase 1 Contract Drawings for Dredging Operations (Appendix 4), and the specifications note that work is prohibited in this area.

- Test Area L is located on the western shore of the river on the NYSDEC boat ramp property, just south of Rogers Island. Initial CARA investigations identified a multi-component archaeological site (state site #A09113.000072), including the presence of deeply buried prehistoric deposits and the cellar hole of an 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. Test Area L appears to be eligible for the NRHP, but no intact archaeological deposits are likely to extend out into the riverbed in the vicinity of this area. This area is identified on the Phase 1 Contract Drawings for Dredging Operations (Appendix 4), and the specifications note that work is prohibited in this area.

In summary, based on the presence of a retaining wall along the shoreline of Test Area G, the position of resources in Areas H and L away from the river/shoreline, the lack of intact deposits extending out into the riverbed in these areas, and the implementation of appropriate shoreline protection measures during dredging, Phase 1 dredging activities will not adversely impact any terrestrial archeological sites listed on or eligible for the NRHP. Measures to protect these resources during nearby dredging are described in Section 2.3.3.

2.2.6.2 Updated Findings of Underwater Archaeological Survey

Underwater archaeological studies in the Phase 1 dredge areas were completed in September 2005. The addendum reporting these studies identified 10 underwater resources (designated U-1 through U-10) as potentially eligible for the NRHP, but noted that currently available data are insufficient to make a conclusive determination of eligibility for any of these areas since the overlying sediments obscure the resources and make it difficult to fully assess their physical integrity and structure. These resources included a number of vessels such as work barges and canal boats that likely date to the 19th and early 20th centuries when the Champlain Canal (completed in 1823) was a vital component of regional commerce and culture. They also include one potential landing, one potential slipway, and one wharf.

The underwater resources addendum indicated that eight of the 10 identified resources are within areas containing sediments targeted for removal and therefore may be impacted during dredging. These eight resources are located within the following dredge areas (as identified in the Phase 1 IDR and discussed further in Section 2.3.2 below): NTIP02B on the east side of Rogers Island; NTIP02E and NTIP02F near the western and southern end of Rogers Island; and NTIP02G south of Rogers Island. The remaining two resources (U-8 and U-9) are on the edge of or just east of dredge area NTIP02F.

In comments on the October 31, 2005 submittal of the underwater resources addendum, EPA stated that systematic avoidance of all the potentially NRHP-eligible submerged resources was not a viable option, as PCB-containing sediments above targeted concentrations would be left behind, and the resources themselves would become vulnerable to erosion.

After considering EPA's comments, the following courses of action have been identified, as described further in the underwater resources addendum, to address the 10 potentially eligible underwater resources:

- Resource U-1 in NTIP02B is a pile of ballast rock that may have been used in the 18th century as a landing. The rocks are in stable condition and can feasibly be avoided during dredging, as discussed further in Section 2.3.2. These resources are identified on the Contract Drawings, and a prohibition on work in this area is provided in the specifications. Methods to protect these resources during nearby dredging are described in Section 2.3.3.
- Resources U-8 and U-9 (barge and canal boat) can also be feasibly avoided during dredging, as discussed further in Section 2.3.2. These resources are identified on the Contract Drawings and a prohibition on work in the area of these resources is provided in the specifications. Methods to protect these resources during nearby dredging are described in Section 2.3.3.
- The remaining seven potentially eligible resources are embedded in PCB-containing sediments identified for dredging and cannot feasibly be avoided in the Phase 1 while dredging in a manner consistent with the Productivity Performance Standard. As a result, these resources will be removed as in-river debris during Phase 1 dredging activities. However, mitigation plans will be prepared and implemented for these resources so that as much data as practicable can be documented before dredging occurs in these areas. Under these plans, non-intrusive archaeological data recovery will be carried out prior to dredging, including additional cartographic, photographic, and physical documentation of those portions of the resources that are currently exposed and accessible.

2.2.7 Permit Equivalency Analysis

The remedy for the Upper Hudson River is being performed pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). As a result, no federal, state, or local permit is required for work being performed "onsite" [42 USC § 9621(e); 40 CFR § 300.400(e)]. EPA interprets these provisions to exempt onsite activities from the permitting and procedural requirements of these laws and regulations.

The CD provides that no permit will be required for Work conducted "on-site," defined in the CD as "within the areal extent of contamination or in very close proximity to the contamination and necessary for implementation of the Work," including the processing facilities. For purposes of the CERCLA permit exemption, onsite activities include: 1) all on-river operations, including dredging, sediment transport, backfilling/capping, monitoring, and habitat replacement and reconstruction; and 2) all near-river operations, including construction and operation of the land-based facilities including: Marine Support Facility in the Town of Moreau for supporting dredging and river monitoring operations, and the Energy Park site in Town and Village of Ft. Edward for barge unloading, sediment processing, and the rail yard operations, as well as infrastructure development needed to make the site functional (e.g., construction and operation of access roads, power-transmission lines, utilities, and other related systems and facilities). It should be noted that this definition of "onsite" applies specifically for purposes of the CERCLA permit exemption; the term "Site" has a different meaning in the Contract Documents attached as Appendices 3 through 8 and other project design documents from the use of that term in the CD and associated documents.

CERCLA exempts the need to get permits or implement administrative requirements under federal law (e.g., dredge and fill permits), state law (e.g., water discharge permits), and local law (e.g., building construction permits relative to fire prevention, electrical, and other code requirements).

Notwithstanding the permit exemption, remedial action under CERCLA must comply with the substantive requirements of federal, state and local laws and regulations if they are ARARs as identified in the ROD [42 USC § 9621(d); 40 C.F.R. § 300.430(f)]. Compliance with the substantive requirements of federal, state and local laws is also referred to as "permit equivalency."

In addition, certain activities being conducted as part of the remedial design, such as the HDA Program and the CARA Program, are being performed so as to satisfy relevant statutory requirements. For example, the HDA Program provides data to satisfy the substantive requirements of federal and state laws that mandate the evaluation of potential impacts on wetlands from the dredging program or other aspects of the remedial action. The CARA Program provides assurance that the project will comply with the substantive requirements of federal laws governing the protection of cultural resources (e.g., the National Historic Preservation Act, 16 USC § 470 et seq.).

The concept of permit equivalency is also addressed in the planning process to implement the Hudson EPS (EPA, 2004a) and the Hudson QoLPS (EPA, 2004b) issued by EPA. Portions of the performance standards are intended to take account of and satisfy the substantive requirements of other laws. For example, the Resuspension Performance Standard is intended, in part, to ensure that drinking water drawn from the Hudson River meets the drinking water standards for PCBs established under the Safe Drinking Water Act. Accordingly, for purposes of this permit equivalency analysis, it is presumed that compliance with an EPS or QoLPS will satisfy the relevant substantive requirements of federal or state laws and regulations that the standards are intended to address (consistent with EPA's authority under CERCLA). In addition, the QoLPS address many of the same concerns that local ordinances and regulations address (e.g., noise, odor, and lighting requirements).

CERCLA also exempts the need to obtain permits for onsite activities that would otherwise be required under local laws and regulations. Further, to the extent that such local requirements conflict with, and present an obstacle to, the performance of the remedy, they may be preempted by CERCLA. Nonetheless, to the extent that such local laws are implicated, GE will attempt to address any substantive concerns.

The Phase 1 IDR (Section 6) described, in narrative form, how the substantive requirements of applicable statutory and regulatory provisions would be incorporated into the Final Design. To the extent identified, those substantive requirements have now been reflected in the individual Phase 1 Project Specifications and Contract Drawings that contractors will be required to meet. GE will be seeking all requisite regulatory approvals to implement the design for the coarse sediment containment area, as proposed. When implemented, the design will meet all such requirements. Note also that in some instances, the substantive requirements of applicable statutory and regulatory provisions will be the subject of future submissions. For example, requirements applicable to closing and decommissioning the processing facility will be addressed in detailed plans developed at that time.

Offsite activities will remain subject to all applicable statutory and regulatory requirements, including permits and administrative requirements. For example, waste materials shipped for offsite disposal will be subject to relevant manifesting requirements. Those requirements have also been incorporated into the relevant specifications.

2.3 Final Design Analyses and Basis of Design

The Phase 1 IDR presented a detailed "Phase 1 Design Analysis," which described how the findings from the Design Support Activities have been used in developing the design, including the rationale for engineering decisions such as equipment sizing and selection, dredge selection, and others. The design of a number of aspects of the project has been updated and/or brought to completion since submittal of the Phase 1 IDR, including those that were modified in response to a Failure Mode Effects Analysis conducted to guide the specification of redundant and/or contingent equipment and operations; and a constructability review to evaluate alternatives for construction of the project that may improve efficiencies or reduce cost. This section of the Phase 1 FDR summarizes these changes to the Phase 1 design. Where appropriate, more detailed design analyses are included as attachments and referenced in this section.

Many aspects of the design have not changed since submittal of the Phase 1 IDR, other than by bringing the design to completion. The design analyses for those items remain as presented in the Phase 1 IDR and are not repeated in this Phase 1 FDR.

2.3.1 Design Optimization Modeling

A logistics model has been developed for the Hudson River project to simulate the movement of sediment from the dredge areas to the disposal facility. The model allows a variety of conditions and constraints to be simulated to assess potential bottlenecks in the material processing systems or sequencing of activities. In this way, the computer-assisted numerical model can help with testing and optimizing systems for efficient movement of equipment (e.g., barges, rail cars) and dredged material on the river, through the processing facility, and into the hands of the railroads for their transport to the disposal site.

An overview of the model, how it was constructed and used, and the results and applicability of simulations are provided in Section 3.12 of the Phase 1 IDR (BBL, 2005a) and Attachment D of this Phase 1 FDR. Highlights from the modeling effort are briefly summarized below:

- The logistics model is a tool to evaluate scenarios such as the effect of adding or removing rail car sets, barges and tugs; it is used for making minor adjustments to the proposed design.

- The logistics model can also be used as a communication tool providing animation on a computer screen showing items such as the movement of barges on the river, recreational traffic, interactions with locks, accumulation of processed material, and rail movement to the disposal site.
- The model has been used during the Phase 1 Final Design to:
  - Evaluate the dredging, barging, capping, and backfill schedules (described in Section 2.3.2); and
  - Evaluate the effect of changing the number of rail car sets and locomotives on stockpile sizes (coarse and fine grain materials) and project completion dates.

The contractors that will eventually develop proposals for the project will be allowed to determine the number of tugs, barges, etc., that they believe will best support their overall operations.

2.3.2 Dredging and Dredged Material Transport

Since submittal of the Phase 1 IDR, the development of dredge prisms has been completed. The process by which dredge prisms were to be developed during Final Design was set out in Section 3.3.3 of the Phase 1 IDR, was finalized in the CDE (Attachment A to the SOW for the CD), and is not repeated here. This process was followed in developing the dredge prisms. Dredge prism development has also necessitated amendment of the dredge and barge schedules, to account for a slightly larger total dredge area than that anticipated during development of the Phase 1 IDR. The design analyses supporting these design updates are summarized in this section. Revised Phase 1 dredge and barge schedules are presented in Tables 2-1 through 2-7. As described later in this section, these schedules were developed for various planning purposes, including logistics, analysis of resuspension, and barge traffic. Actual dredge and barge plans will be developed by the contractors, within design constraints.

To achieve the target inventory removal volume of 265,000 cy, the dredge prisms were developed for a subset of the Phase 1 areas identified in the February 2005 Phase 1 DAD Report (QEA, 2005a). The areas targeted for removal in Phase 1 are shown on Figure 1-3 and include parts of the Northern Thompson Island Pool (NTIP01, NTIP02A through NTIP02G), and East Griffin Island Area (EGIA01).

A narrow strip of shoreline sediment in dredge area NTIP02A initially shown in the Phase 1 IDR has not been carried forward into Final Design, because the material to be removed is primarily rock and cobble (four of five sampling locations were abandoned and only 2 inches of sediment were collected in the one core); and the sediment in this area is a small quantity (10 cy) and contains low PCB mass. Additional justification for the exclusion of this area was provided to EPA as part of the responses to comments on the Phase 1 IDR, and included the following:

- The proximity of this area to the Ft. Edward Yacht Basin and low productivity due to the material type would cause closure of the yacht basin for a longer period of time;
- The Village of Fort Edward water line is located in this area, and EPA has expressed concern about the integrity of this line and damage that may occur during dredging;
- The abutments for the railroad and Route 197 bridge would obstruct work in this area;
- A neighborhood of private homes is located adjacent to this area that may be impacted by noise during dredging operations; and
- Results of the terrestrial archaeological survey designate the shoreline in this area (Test Area H) as "potentially significant."

In conformance with the CDE, the following analyses were conducted to develop dredge prisms:

- The results of the 2005 data gap sampling (QEA, 2006) were integrated into the development of the depth of contamination (DoC).
- The DoC surface was compared with the underlying DoC data to identify inconsistencies or instances in which single point data values at variance with neighboring data caused local mounds or troughs in the interpolated surface. This included cores that "popped through" the DoC surface and cores that fell short of the DoC surface. The net effect of this analysis increased the sediment removal volume by approximately 440 cy. Details of this process are provided in Attachment E.
- Dredge prism boundaries were modified to avoid impacting certain cultural resources identified as being potentially significant. As described in Section 2.2.6, these included Resource U-1 in dredge area NTIP02B, which appears to be a pile of ballast rock that may have been used in the 18th century as a landing (URS, 2006b). These rocks are shown on Drawing G-0004 of the Phase 1 Contract Drawings for Dredging Operations (Appendix 4), and can feasibly be avoided during dredging provided that approximately 87 cy of adjoining sediment and rock (that otherwise would be targeted for removal) are not dredged. Two additional resources that are potentially significant have been identified along the western shore of Rogers

Island in dredge area NTIP02F (URS, 2006b). These two resources are U-8 (a suspected barge) which is located along the edge of NTIP02F, and U-9 (a suspected canal boat) which is located just outside of the boundary of NTIP02F but could be destabilized by the nearby dredging (see Drawing G-0005 of the Phase 1 Contract Drawings for Dredging Operations [Appendix 4]). The estimated volume of target sediment that is not being dredged to avoid destabilizing these two potentially significant resources is approximately 50 cy.

- The results of the geophysical analyses (high-resolution bathymetry data) were integrated into the development of the final dredge prisms.

Following development of the dredge prisms, CUs were defined. CUs are described in Section 3.3 of the Phase 1 IDR, and are initially identified on the dredge prism drawings included in the Phase 1 Contract Drawings for Dredging Operations (Appendix 4).

The resulting dredge prisms are shown on the Phase 1 Contract Drawings for Dredging Operations (Appendix 4). The plan view drawings with final cut-line design elevations are shown on Drawings D-002 through D-0019. The associated cross-section drawings are presented on Drawings D-0100 through D-0121.

While the Phase 1 target volume of 265,000 cy has remained constant, the overall footprint of the Phase 1 dredge area has increased from the area presented in the Phase 1 IDR by approximately 14 acres to a total of approximately 94 acres. The 80-acre dredge area presented in the Phase 1 IDR was derived using volumes that were 115% of those indicated by the dredge area delineation in an attempt to account for yet-to-be-collected data and the dredge prism steps described above. The area of removal presented in this Phase 1 FDR is based on the final Phase 1 dredge prisms that were developed using a refined DoC surface based on newly collected high-resolution bathymetric data and the results of the 2005 data gap sampling. This updated DoC surface was further refined based on the evaluation conducted during the Phase 1 Intermediate Design, which excluded a small portion of NTIP02A in the east channel of Rogers Island from dredging and adjusted the DoC surface based on neighboring data. Engineering considerations, such as slope stability, were then included in the development of dredge prisms for NTIP01, NTIP02A through NTIP02G, and EGIA. Finally, as discussed above, the dredge prisms were adjusted to exclude dredging in two small areas due to the presence of archaeological resources.

The dredge cut-line elevations shown on the Drawings D-002 through D-0019 of the Phase 1 Contract Drawings for Dredging Operations (Appendix 4) are considered to define minimum removal volumes based on the approach contained in the specifications. This approach includes the use of high-resolution bathymetry data to assess the post-dredge elevations, using the criteria that removal of inventory sediment will not be considered complete unless: a) the elevation over a 1-acre area within the CU is on average equal to or lower than the design elevation; and b) based on an analysis of the bathymetric data on a 10-foot by 10-foot grid basis, no individual grid cell is more than 3 inches higher than the target elevation for that given cell. An analysis was conducted that evaluated the tolerance around the target elevation assuming nearly 400 "bites" of the dredge bucket per acre, and that 95% of the dredge "bites" will be within +/- 4 inches of the target elevation and that the error will be normally distributed. If these assumptions hold, the resulting dredge surface will be on average within 0.2 inch of the target elevation (based on a 95% confidence limit) and about 26 of the bites (6.7%) will be short by 3 to 6 inches (requiring re-dredging by the dredging contractor to meet the requirement that no individual grid cell be more than 3 inches higher than the target elevation).

After the initial inventory dredging is complete in a CU, the process for sampling for residuals, re-dredging (if necessary), and backfilling/capping depending on the results of the residual sampling, will be implemented. Drawings D-0250 through D-0254 present the geographic definitions of the CUs for Phase 1. These CUs are considered preliminary and may be modified by the selected contractor.

Drawing D-0020 illustrates where approximately 1,500 cy of sediment will be removed for navigational purposes between Lock 7 and the processing facility. These sediments will be removed to provide sufficient water depth for fully loaded barges to be transported to the processing facility. This work will need to be completed early in the project.

Several dredge, backfill and barge schedules initially developed during the Phase 1 Intermediate Design were amended during the Phase 1 Final Design to reflect the final dredge prisms, including an increase in the surface area of the Phase 1 project. These amended schedules consist of:

- Phase 1 Inventory Dredge Schedule (Table 2-1);
- Phase 1 Residual Dredge Schedule (Table 2-2);
- Phase 1 Inventory Barge Schedule (Table 2-3);
- Phase 1 Residual Barge Schedule (Table 2-4);
- Phase 1 Backfill/Cap Schedule (Table 2-5); and
- Phase 1 Backfill/Cap Barge Schedule (Table 2-6).

These dredge and barge schedules represent one of many possible approaches to the project, and were developed for the purpose of assessing feasibility of logistics and to provide an input into the resuspension analyses. The selected dredging contractor will create its own Dredging Plan reflecting its specific equipment and approach. Certain operational constraints are placed on the dredging contractor in the Phase 1 Project Specifications for Dredging Operations, including conducting work for 2 weeks in NTIP01 before dredging in any other areas, working upstream to downstream in the NTIP, completing work on both sides of Rogers Island before dredging south of Lock 7 (with the exception of the test of resuspension in dredge area EGIA), and limiting the volume of sediment delivered per day to the processing facility to 5,100 cy, as well as specific requirements derived from the Hudson EPS and QoLPS.

The various schedules identified above were also used to develop a revised estimate of daily barge traffic at Lock 7; they include an average of 11 one-way barge trips per day with a maximum of 30 one-way barge trips on the busiest of days (including barges used to transport backfill material to dredged areas – if these barges do not need to pass through Lock 7, the maximum number of daily barge trips would be 20). The results of this analysis are presented in Table 2-7.

The ability of the Glens Falls Feeder Canal (which supplies water to the Champlain Canal upstream of Lock 8) to meet the needs of the project in light of this predicted increase in traffic at Lock 7 was also evaluated during Final Design. Because each lockage from the Champlain Canal through Lock 7 to the Hudson River results in the loss of approximately 800,000 gallons of water, the feeder canal must be able to supply, on average, approximately an additional 4.8 million gallons per day to the Champlain Canal to meet the demands of the project. Based on a visual inspection of the canal and a review of existing information, it appears the required water demand is within the canal's existing capacity.

Another amendment to the dredged material transportation design made as part of Final Design is the addition of a snubbing post (turning dolphin) at the south end of the east channel of Rogers Island, to ensure safe turning of barges in the vicinity of Lock 7. Four mooring post clusters (mooring dolphins) have also been added to the design to allow for barges to wait as recreational traffic uses Lock 7. These amendments to the design are shown in the Phase 1 Project Specifications and Contract Drawings for Dredging Operations (Appendix 4).

The specific basis of design for dredging and dredged material transport is summarized in Table 2-8.

2.3.3 Archaeological Site Protection Measures

During dredging adjacent to the onshore archaeological resources identified as Test Areas L and H, the contractor will ensure that the shoreline remains stable during dredging and restoration. Measures to be employed may include, but are not limited to, the following.

- Prior to dredging, any large trees that are overhanging the riverbank and obstructing the dredge equipment will be trimmed or removed as needed. In these archaeologically sensitive zones, all tree removal will be by hand with a chainsaw. Tree branches and trunks may be cut to the extent necessary to implement the work. Root balls will not be removed to assist in keeping the bank stable.
- With the dredge equipment mounted on a barge, a vertical cut no more than 2 feet deep will be made at the shoreline for dredge areas that come in contact with the shoreline (no dredge equipment will be operated from the shore).
- Following completion of dredging activities, backfill or cap material will be placed into the dredged areas to approximate the pre-dredge bottom contours, but no backfill will be placed on the river bank above the shoreline adjacent to these archaeological sites.
- Sheet piling is not planned to be installed along the shoreline of archaeologically sensitive areas shown on the G-series Drawings included in Appendix 4.

Impacts to underwater archaeological resources U-1, U-8, and U-9 will be avoided and the resources will be protected by the following measures.

- These are marked on the drawings in Appendix 4 as "off-limit" sensitive resource locations where no impacts are allowed. No debris removal, dredging, or mooring or anchoring of project vessels will be allowed in these areas.
- The resource locations will be delineated in the river by distinctive buoys or other appropriate visual markers.
- Sediment removal will be prohibited within 10 feet of the known edge of these resources.

In addition to measures described above, the areas in which project activities are occurring will be monitored for previously unidentified and unanticipated potentially significant archaeological resources, such as shipwrecks, wooden structures, and large metallic objects. Small objects such as pottery jugs and glass bottles are likely to be scattered throughout the in-river dredge areas and may be recovered by the dredge equipment – these do not constitute potentially significant cultural resources. As described in the specifications provided in Appendix 4, if potentially significant cultural resources are identified in areas where no resources were previously identified, activities in the immediate area that may damage or alter such resources will be halted. EPA will be notified, and the halted work activities will be resumed following notification from EPA.

In the event that human remains are discovered, work will be halted in the immediate area that may damage or alter the human remains, and the local law enforcement agency and medical examiner will be notified. If remains are found not to be of recent origin, EPA will be notified.

2.3.4 Resuspension Control

Design of resuspension controls in the Phase 1 Final Design have been updated from the design presented in the Phase 1 IDR to reflect the following:

- Geotechnical data from the SEDC Work Plan Addendum No. 2 (BBL, 2005e);
- Final dredge areas shown on Drawings D-0002 through D-0019 of the Phase 1 Contract Drawings for Dredging Operations (Appendix 4);
- Updated Phase 1 dredge schedule presented in Table 2-1 of this Phase 1 FDR;
- Results of updated PCB release modeling as described in Attachment F;
- Results of water quality modeling to assess the potential impacts of using a hydraulic control structure at the northern end of Rogers Island to divert river flow from the east channel to the west channel as described in Attachment G; and
- Operational changes that will allow non-project traffic to traverse the length of the east channel of Rogers Island during certain time periods each day.

The Resuspension Performance Standard specifies three action levels – Evaluation, Control, and Standard – that apply to concentrations of PCBs and/or TSS in surface water at either near-field stations (located within 300 m of the dredging activities) or far-field stations (located more than 1 mile downstream of dredging activities). A modeling effort to evaluate the fate and transport of sediment and associated PCBs resuspended during the dredging operation was conducted to assess the impacts of dredging in terms of compliance with the near-field and far-field water quality requirements set forth in the Resuspension Performance Standard. Initial results of the resuspension modeling were reported in Section 3.5 and Attachment E of the Phase 1 IDR. More recent efforts are described in Attachment F to this Phase 1 FDR, and are briefly summarized below.

The initial resuspension modeling effort described in the Phase 1 IDR was conducted assuming no resuspension controls and a design loss rate (%R) of 0.35. The %R is the percent of resuspendable sediment dredged that is resuspended and assumed to be lost downstream. The 0.35 %R value was used by EPA in its assessment of resuspension associated with dredging operations. In addition, resuspension modeling has also been completed using a %R of 0.70 – twice the loss rate used by EPA – to be conservative. The results of modeling using a loss rate of 0.35% indicate that suspended solids in the near and far field would be well below the numeric standards and that PCB concentrations in the surface water would be below the Control Level, with a total Phase 1 PCB load at TID well below the 65 kilograms (kg) established by EPA, and therefore resuspension control systems would not be required. When a 0.70% resuspension loss rate is used, the results indicate more frequent exceedances of the 600 grams per day (g/day) Control Level at TID, suggesting that resuspension controls would need to be available as contingencies in areas that contribute to the potential exceedance.

The modeling results indicate that dredging in the east channel at Rogers Island and in EGIA contribute a significant fraction of the PCBs lost to resuspension, indicating the need for contingent controls in these areas. To avoid the potential schedule impacts if such controls become necessary during dredging, GE has decided to install controls in these two areas as discussed below. This will also serve as a test of the effectiveness of the resuspension controls. There are also two relatively small areas in the east and west channels of Rogers Island where contingent controls will be available if necessary during dredging. Locations for contingent controls in the east and west channels at Rogers Island are identified on Figure 3-26 of the Phase 1 IDR. Contingent controls in these areas would only be included if the results of monitoring indicated that they were needed.

The first area in which resuspension controls will be employed is in the eastern channel of Rogers Island, where a rock dike will be installed. (Based on the shallow depth to bedrock in the area north of Rogers Island, use of a sheet pile wall to divert flow from the east channel to the west channel as discussed in the Phase 1 IDR was deemed not to be practical.) In addition, silt curtains will be installed at the southern end of Rogers Island. The rock dike is shown on Drawing D-0200 of the Phase 1 Contract Drawings for Dredging Operations (Appendix 4). The permeable nature of this rock structure is estimated to allow approximately 100 cubic feet per second (cfs) of flow to enter the east channel with the remaining flow passing down the west channel at river flow conditions below 10,000 cfs as measured at United States Geological Survey (USGS) Gauging Station No. 01327750. At river flows above 10,000 cfs, on-river dredging operations will not be allowed and river water will pass over the top of the rock dike. Maintaining a minimum flow of 100 cfs into the east channel is necessary to prevent water quality parameters, including dissolved oxygen (DO) and ammonia within the channel, from dropping below state standards. Details of the water quality modeling conducted to estimate the flow necessary to maintain these conditions are provided in Attachment G.

In addition to the 100 cfs of river flow that will pass through the rock dike and enter the east channel, two 42-inch corrugated metal pipe culverts will be installed in the rock dike to allow up to an additional 100 cfs of river flow to enter the east channel, if needed to meet water quality standards in the channel. To assist in controlling the amount of river flow that enters the east channel, gate valves will be installed in each of the 42-inch culverts as shown on Drawing D-0204. Following completion of the remedial operations in the east channel of Rogers Island, the culvert and gate valve structures will be removed and the rock materials used to construct the rock dike will be distributed across the river bed in a layer that is approximately 6 to 12 inches thick. These rock materials are generally consistent with substrate in this area and are considered as features that will support appropriate habitat.

As stated in Section 1.4.3, a gate will be designed in the resuspension control barrier near the southern tip of Rogers Island to allow passage of non-project vessels to and from the Terminal Wall in Fort Edward during a ½-hour period between the hours of 7:00 am and 9:00 am, and again during a ½-hour period between 3:00 pm and 5:00 pm. The specific ½-hour slot within these 2-hour time periods will be at the discretion of the dredging contractor.

The second area in which resuspension controls will be employed is in EGIA. Both rigid (e.g., sheet pile) and flexible (e.g., silt curtain) containment systems will be installed in EGIA01 to reduce downstream transport of PCBs and to test and evaluate the effectiveness, reliability, and operation of different resuspension control structures. The assessment will include the degree to which the controls minimize the release of dissolved and particulate PCBs, the potential impacts of the controls on residual PCB concentrations, and potential impacts associated with the installation and removal of the control systems. Therefore, the dredge schedule in EGIA01 calls for 2 weeks of dredging with no resuspension controls, 1 week of dredging within a sheet-piled enclosure, and 2 weeks of dredging within an area enclosed by silt curtains. The design analysis for this component of the resuspension controls is discussed in the Phase 1 IDR.

The specific basis of the resuspension control design is summarized in Table 2-9.

2.3.5 Sediment and Water Processing

Since submission of the Phase 1 IDR, several Final Design analyses have been completed for the sediment processing facility infrastructure and equipment. These are summarized below and reflected in the Project Specifications and Contract Drawings appended to this Phase 1 FDR. The results of these Final Design analyses provide for the final basis of design, which is presented in Table 2-10.

2.3.5.1 Estimated Quantities of Sediment Types

The Phase 1 IDR described four sediment categories used for treatability testing and subsequent design of the processing facility (S-1 through S-4), and reported the specific gravity, solids content, PCB concentration, and total organic carbon (TOC) concentration for each type. During Final Design, an estimate of the quantities of each sediment type making up the total inventory dredging target volume of 265,000 cy was developed, as follows:

- Sediment Type S-1: 5,900 cy
- Sediment Type S-2: 210,400 cy
- Sediment Type S-3: 46,600 cy
- Sediment Type S-4: 2,100 cy

2.3.5.2 Access Road Configuration

As shown on the Phase 1 Contract Drawings for Facility Site Work Construction (Appendix 1), an update of the design since submittal of the Phase 1 IDR is the relocation of the site access point from East Street to Route 196. The new access road is approximately 2 miles in length, and will follow an existing, unpaved NYSCC service road. The relocated access road will reduce the amount of construction traffic, noise, and vehicular loading on local roads within the Town of Fort Edward. Trucks traveling to the processing facility would follow existing truck routes to the Route 196 entrance to the access road. The new access road will follow the existing NYSCC gravel service road that parallels the west side of the Champlain Canal (within land owned by the NYSCC). The existing surface road will be widened to 24 to 30 feet and reconstructed to support the vehicular loads expected during the construction and operation of the processing facility.

In addition, the existing intersection at Route 196 will be shifted approximately 80 feet to the west to increase sight distance and align the proposed facility entrance across from an existing drive. Due to substantial grade differences, both the horizontal and vertical alignment of the access road approach to Route 196 will also be modified. Property easements are necessary to modify this intersection.

The relocation of this access road resulted in the relocation of the administrative area to the north area of the processing facility and reorientation of several roads within the processing facility. These changes are reflected in the site plan shown on Figure 1-2. Design details for the access road will be provided in an Addendum to the Phase 1 Project Specifications and Contract Drawings for Facility Site Work Construction.

2.3.5.3 Rail Yard Site Plan

As a result of more detailed analysis of the rail car loading and rail logistics requirements for Phase 1, the number of tracks to be installed at the onsite rail yard has been slightly reduced compared with the layout presented in the Phase 1 IDR. These modifications include the elimination of one of the two loading tracks and one of the three receiving and departure (R&D) tracks shown in the Phase 1 IDR. The Phase 1 Final Design allows for the addition of a second loading track and a third R&D track if necessary to support Phase 2 operations. The updated rail yard layout is presented in the Phase 1 Project Specifications and Contract Drawings for Rail Yard Construction (Appendix 2).

2.3.5.4 Slurry Force Main Sizing and Route

Another amendment to the Phase 1 IDR is the routing for force main pipelines that convey sediment slurry from the hydrocyclone overflow pump station located at the waterfront size separation area to the gravity thickener system located at the thickening and dewatering facility. During Final Design, the final sizing necessary to accommodate design flows and required flow velocities needed to keep sediment particles in suspension was calculated. Based on these analyses, the selected force main system will consist of three, 12-inch diameter high-density polyethylene (HDPE) force mains (two operating and one spare). The force main route will be located adjacent to the main haul road within the Type 1 stormwater containment area. The pipelines will be installed above ground within the shoulder area along the main haul road, and protected from vehicular traffic by using roadway barriers (e.g., Jersey barriers). This design is relatively simple to construct, inspect, maintain, and repair; it controls potential leaks or spills by being located within the Type 1 containment area; and the system can be expanded if necessary. Force main routes located outside of the Type 1 area will be constructed with double-contained piping to prevent spills and leaks of sediments in "clean" areas.

The locations of the updated force main routes are shown on the Phase 1 Contract Drawings for Processing Facility Construction & Operations (Appendix 3).

2.3.5.5 Gravity Thickener Sizing and Selection

Final Design engineering work that has continued since the submittal of the Phase 1 IDR includes the sizing and selection of the processing facility's proposed gravity thickener system. Gravity thickening units are needed to increase the sediment slurry solids content of the hydrocyclone overflow to approximately 15% before the material is sent to the filter presses for final dewatering. The Final Design sediment loading rate to the gravity thickener system is based on the daily rate of sediments expected to be dredged during both inventory and residuals dredging, with the peak rate occurring during the 1-month period when removal volumes are targeted to achieve rates anticipated to be required during Phase 2 dredging. Final design selection and sizing of the gravity thickener system must accommodate a hydraulic flow rate and a solids loading rate for anticipated sediment types being offloaded at a rate of 5,100 cy per day. In addition, the primary sedimentation treatability studies data (see Section 2.2.1 and Attachment A) were used in sizing the thickener system. A single 80-foot diameter unit has been specified. To increase reliability, performance, and service life, the thickener will be fitted with an upgraded drive and rake mechanism. The thickener design details are presented on the Phase 1 Contract Drawings for Processing Facility Construction & Operations (Appendix 3).

2.3.5.6 Filter Press Sizing and Selection

In addition to the sizing and selection of the gravity thickener system, Final Design activities included the sizing and selection of the proposed filter presses. After the solids content of the sediment slurry is increased by the gravity thickener, the array of filter presses provide the final dewatering step before filter cake will be transported to the fines staging area for loading and offsite transport for final disposal. The Phase 1 Final Design selection and sizing of filter presses must accommodate the solids generated from the gravity thickener at a peak sediment offloading rate of 5,100 cy per day. The dewatering polymer treatability studies data (see Section 2.2.1 and Attachment A) was used in specifying the presses. Filter presses fitted with recessed chamber plates have a proven track record for sediment applications. These Final Design analyses support selection of 12 filter presses fitted with 2-meter by 2-meter recessed chamber plates. To meet design capacity and flow rates, these units are expected to operate 24 hours per day at 100-psi pressure, with an average cycle time of 3 hours to fill, dewater, and unload filter cake. The filter cake is expected to have a solids content of approximately 55%.

2.3.5.7 Stormwater System Design

Since submittal of the Phase 1 IDR, the overall site stormwater management design has been revised. Three above-ground stormwater storage tanks have been replaced with three stormwater basins to accommodate a gravity drained system, thereby eliminating pumping of stormwater.

2.3.5.8 Site Work Cut and Fill Requirements

The cut and fill calculations for initial site work at the Energy Park site have been updated to reflect the Final Design needs of the facilities to be constructed at the site. A number of amendments to the layout of the processing facilities have been made as part of the Phase 1 Final Design (some described above), and the site grading needs have been modified to reduce the requirements for general and select fill needed for site development. These changes are summarized below.

- **Site Access Road from Route 196 –** As discussed above, the main site access road has been moved from the location shown in the Phase 1 IDR. This aspect of the site work will result in a significant amount of cut that may be suitable for use as fill during site work development, although the final quantities of material have not been estimated as design of this road is still being completed.
- **Waterfront Loading Platform** – An additional 16-foot cut, back into the existing canal bank, and a reduction in overall waterfront area design elevation were added to the design since submittal of the Phase 1 IDR. This additional cut will result in fill material that may be suitable for use as both general and select fill.
- **Administration/Support Area** – As shown on the Phase 1 Contract Drawings for Facility Site Work Construction (Appendix 1), the location of the administration/support area has been moved from the south

side of the site to the north side to accommodate the relocated site access road. This modification resulted in a net increase of the amount of fill required, because the terrain to the north is generally at a lower elevation than the terrain to the south.

- **Stormwater System Design** – The changes to the stormwater system design discussed above resulted in the generation of more material being available for use as general fill during facility development.

Based on the final grading contours, roadway layout, rail yard layout, and other design needs as depicted in the Phase 1 Final Design, balancing the cut and fill volumes results in the need for approximately 90,000 cy or less of select fill material to be delivered to the site. The actual volume of material to be delivered will depend upon how much of the material excavated during site development meets the gradation specifications for the various types of select fill for specialty uses such as foundation sub-grade material, utility trench backfill, and road sub-base. Some of this fill, in particular the ballast materials to be used in the construction of the rail yard, may be delivered to the site by rail. The construction contractors will procure the fill materials specified, therefore, the source of these materials will be selected by the contractors. The delivery method for all of the fill types will be established by the selected contractors.

2.3.6 Processed Sediment Transportation and Disposal

In the Phase 1 IDR, the design of the processed sediment transportation and disposal element of Phase 1 had been advanced to the point of selecting the mode of transportation (rail), and identifying a "short list" of candidate disposal facilities (landfills) for the project. During the development of the Phase 1 Final Design, a TSCA authorized landfill at a location outside of NYS has been selected, pending the completion of contracts with the landfill and rail carriers. Currently, GE is in final negotiations with the disposal site, as well as with the specific rail carriers that will provide transportation from the processing facility to the destination. The use of a single TSCA-authorized landfill for all project waste materials eliminates the need to segregate material according to PCB concentration at the processing facility, resulting in a more efficient design for storage, sampling, loading and rail car management. The specific basis for the transportation element design is summarized in Table 2-11.

2.3.7 Backfilling/Capping and Habitat Replacement and Reconstruction

Since submission of the Phase 1 IDR, additional Final Design analyses have been completed for the backfilling and capping elements, as well as the habitat replacement and reconstruction elements of the project. These are summarized below and are reflected in the detailed Phase 1 Project Specifications and Contract Drawings appended to this Phase 1 FDR. The results of these Final Design analyses provide for the final basis of design, which is presented in Table 2-12.

2.3.7.1 Backfilling

The design for backfill presented in the Phase 1 IDR has been updated during the Phase 1 Final Design to reflect the final Phase 1 dredge prisms, the integration of high-resolution bathymetry data, and updated modeling of surface water velocities. Consistent with the Phase 1 IDR, Type 1 (medium sand) and Type 2 (gravel) backfill materials will be placed in areas where flow velocities are estimated to be below and above 1.5 feet per second (ft/s) for a 2-year flow event, respectively. Locations where Type 1 and 2 backfill would be applied are shown on Drawings B-0002 through B-0019 of the Phase 1 Contract Drawings for Dredging Operations (Appendix 4). Locations for a third type of backfill developed during Final Design (Type 3), has been included for specific habitat situations, are also shown on these drawings where applicable. Type 3 backfill comprises a combination of Type 1 backfill and topsoil resulting in a pre-placement TOC content of 2%. The drawings also depict areas where additional backfill is included to raise the post-dredging elevation to the photic zone to allow for planting and/or recolonization of submerged aquatic vegetation (SAV). Type 3 backfill and locations where backfill is to be raised into the photic zone are further discussed in Section 2.3.7.3, below.

Representative cross section details for backfill are shown on Drawing B-0020 and cover river, shoreline, and in-channel situations. The backfilling element also includes a requirement in the Phase 1 Project Specifications for Dredging Operations (Appendix 4) that areas of the navigation channel dredged to depths of 15 feet or greater will include backfill. Type 2 backfill is planned for all locations in the navigation channel.

As part of Final Design, the transport and placement of backfill/cap materials were re-evaluated and are presented in the Phase 1 Backfill/Cap Schedule and Phase 1 Backfill/Cap Barge Schedule (Tables 2-5 and 2-6, respectively). These tables demonstrate that while placement of the backfill/cap materials can be accomplished within the Phase 1 construction season, there is little time available in November for additional work. As was discussed in the Phase 1 IDR, it is impossible to predict exactly how much of the post-dredging river bottom will be suitable for backfilling versus how much will require capping to address residuals. While the backfill/cap placement table uses a blended rate that reflects the placement of 50% backfill and 50% cap materials over the entire Phase 1 dredge areas, it is not anticipated that cap will be placed 50% of the time. This assumption was used only for the purpose of ensuring that more than enough equipment and materials will be available in the event that the Residuals Performance Standard is not met. This conservative assumption, used only for logistics planning, is not and was not intended to be a prediction of the amount of residuals capping that will be necessary. The precise amount of capping will not be known until after both inventory and residuals dredging have been completed and post-dredging sediment samples are collected. The contractor will procure backfill and cap materials. Therefore, the source of these materials will be selected by the contractor. Changes in the ratio of backfill to cap materials will not affect the schedule as the rate-limiting step for placement of backfill or cap materials is the completion of the dredging in a CU in advance of the placement. In other words, the analysis presented in Tables 2-5 and 2-6 demonstrate that the materials required for placement prior to the close out of all of the CUs in Phase 1 can be completed regardless of whether they need to be backfilled or capped.

2.3.7.2 Capping

Similar to backfill, the cap design presented in the Phase 1 IDR has been amended in the Phase 1 Final Design to reflect the final Phase 1 dredge prisms, the integration of high-resolution bathymetry data, and updated modeling of surface water velocities. Capping will occur only after the PCB inventory has been dredged and, if necessary, residual sediments have been removed in accordance with residual standard provisions in the PSCP Scope. In the event that a small amount of PCB residual is left after dredging, the cap or backfill will be placed consistent with the Residuals Performance Standard. The decision on when to cap will also be made on the basis of the Residuals Performance Standard, as defined in the PSCP.

Consistent with the Phase 1 IDR, Isolation Cap Type A will be placed in a CU where the average Tri+ PCB concentration after dredging is less than or equal to 6 mg/kg and capping is necessary; and Isolation Cap Type B will be placed in a CU where the average Tri+ PCB concentration is greater than 6 mg/kg after dredging, and after GE and EPA have determined that additional dredging is not required. The Phase 1 Contract Drawings for Dredging Operations (Appendix 4) include plan view drawings showing where both Cap Type A and Cap Type B would be placed, should capping be necessary. The decision to install a Cap Type A or Cap Type B will be made after GE and EPA have agreed that additional dredging is not required in a particular area. Actual locations of each cap type (if capping is necessary) cannot be determined until dredging is completed and will be based on the results of the residual sampling.

Plan view locations of Cap Type A are shown on Drawings C-0002 through C-0019. These drawings identify locations where the cap is designed for surface water velocities above and below 1.5 ft/s based on a 10-year flow event (i.e., low and medium to high velocity areas). Typical cross section views for these two variants of the Type A cap are shown on Drawings C-0038 and C-0039. Integration of the different cap types with backfill are shown on Drawing C-0038. Placement of the various cap types in the shoreline areas is shown on Drawing C-0039. Design of Cap Type B includes three velocity regimes (i.e., low, medium and high) based on surface flow velocities for the 100-year flow event equal to or below 1.5 ft/s, above 1.5 ft/s and less than or equal to 3.5 ft/s, and above 3.5 ft/s. Plan view locations for these three variations of the Cap Type B are shown on Drawings C-20 through C-37. Typical cross section details of a Cap Type B are shown on Drawings C-0038 and C-0039.

2.3.7.3 Habitat Replacement and Reconstruction

The design for habitat replacement and reconstruction presented in the Phase 1 IDR has also been revised during Final Design to reflect the habitat assessment data for 2005 that are presented in Exhibit A of the Phase 1 AM Plan, which is included as Attachment H to this Phase 1 FDR. The decision matrix for using these data to develop the habitat design is shown on Figure 2-1 and explained in detail in Section 3 of the Phase 1 AM Plan. As discussed there, the habitat design for each area to be backfilled is based on river velocity, water depth, presence of vegetation prior to dredging, presence of riverine fringing wetlands, and the results of an aquatic vegetation model that evaluates whether suitable conditions in which aquatic vegetation habitat can develop are present.

A final element of the habitat design process included identifying locations where aquatic vegetation beds exist (pre-dredging) in areas that are currently less than 8 feet deep (based on long term average summer flow conditions) but will be greater than 8 feet deep following dredging. At these locations, additional backfill material may be used to return the area to within the photic zone (defined as 8 feet deep for the design) to facilitate the recolonization or planting of aquatic vegetation. This approach implements the provision in the CDE (Attachment A to the SOW for the CD) that additional backfill, up to 15% of the total estimated during design to be placed as part of the entire project (1 foot over all dredge areas), will be allocated for creation of SAV beds in dredged areas where such additional backfill is necessary to support SAV.

For illustrative purposes in this Phase 1 FDR, the decision criteria were used to develop base maps to indicate the locations where the habitat-specific designs would be implemented. These maps are provided as Figures 3-2 and 3-3 in the Phase 1 AM Plan. Condition-specific "aggregation" criteria were included in the development of these maps to reduce the number of small, isolated areas that would be difficult to construct and/or manage. The base maps and details regarding the aggregation process are provided in the Phase 1 AM Plan.

The resulting plans for habitat replacement and reconstruction are shown on Drawings H-0002 through H-0019 (Appendix 5). Typical details for planting SAV are shown on Drawing H-0020, typical planting details for a riverine fringing wetland are shown on Drawing H-0021, and typical shoreline details are included on Drawings H-0022 through H-0024. Typical shoreline details are provided for moderate and low energy shoreline environments based on surface water velocity profiles (above and below 1.5 ft/s, respectively). Typical shoreline details are also provided for low energy shoreline areas behind planned riverine fringing wetlands (called lowest energy shorelines). Shoreline construction approaches are presented as "typical" because the dredging contractor will be responsible for not disturbing shoreline areas above an elevation of 119 feet, the shoreward extent of dredging.

Representative details of the material to be used at the shoreline to provide short-term stability (during dredging to keep the dredge cut intact and prevent disturbance to the bank above the cut line) and long-term stability (to prevent bank erosion) are shown on Drawings H-0022 and H-0023. In moderate energy areas, a rock wedge consisting of 6- to 9-inch rocks would provide short- and long-term stability. A geotextile layer may also be used under the rock wedge to provide a stable base. Water levels adjacent to the river bank are usually lower than 119 feet during the summer months, and the area is subject to potential erosion from boat wakes and wind driven waves that require the use of the stone for stabilization. In low energy areas, topsoil material will be placed within interstitial spaces of the rock wedge along with live stakes of non-invasive species to provide vegetative cover. Short-term stability in these low energy areas would be provided by a silt fence, wood sheathing, or similar structural support. In lowest energy areas, short-term bank stability will be accomplished using coir fiber logs (or similar devices). The area behind the fiber log will be planted and the log will eventually be integrated into the shoreline by the roots of the vegetation to provide long-term stability.

3. Phase 1 Construction and Implementation Contract Summaries and Schedule

The construction and implementation stage of Phase 1 of the Hudson River remedial action involves contractor selection and development of RA Work Plans, followed by site work and construction of land-based facilities and implementation of dredging and processing operations. Upon submittal of this Phase 1 FDR to EPA, GE will initiate the final contractor selection process to fulfill the six onsite work contracts that are summarized in this section. Contracting for offsite rail transport and disposal has already been initiated and is not described further in this section. GE is also working directly with utilities (water, sewer, electric, and communications) to have services brought to the site. After contractor selection, GE will work with the contractors to develop and submit to EPA three RA Work Plans:

- *RA Work Plan for Phase 1 Facility Site Work Construction*;
- *RA Work Plan for Phase 1 Processing Equipment Installation*; and
- *RA Work Plan for Phase 1 Dredging and Facility Operations*.

The contractor selection process and details regarding the planned contents of each RA Work Plan are described in the SOW, which is Appendix B to the CD. Although the SOW specified three general categories of contracts for Phase 1 (facility site work construction, processing equipment installation and remaining site work, and dredging and facility operations), these categories have been further subdivided into six contracts to facilitate contracting. Section 3.1 below summarizes the work for each of the six contracts that will be tendered to implement Phase 1 of the Upper Hudson River remedial action, and Section 3.2 summarizes the Phase 1 construction schedule. Section 3.2 also describes the relationship between the three general categories in the SOW and the six contracts discussed in this section.

This section is not intended to define the scope of work of the six Phase 1 contracts that GE expects to award. The scope of the work of each Contract is contained within the appended Phase 1 Project Specifications and Contract Drawings.

3.1 Phase 1 Remedial Action Contracts

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

- Contract 1 – Facility Site Work Construction (see Section 3.1.1 and Appendix 1);
- Contract 2 – Rail Yard Construction (see Section 3.1.2 and Appendix 2);
- Contract 3 – Processing Facility Construction & Operations (see Section 3.1.3 and Appendix 3);
- Contract 4 – Dredging Operations (see Section 3.1.4 and Appendix 4);
- Contract 5 – Habitat Construction (see Section 3.1.6 and Appendix 5); and
- Contract 6 – Rail Yard Operations (see Section 3.1.5 and Appendix 6).

The following subsections provide general overviews of work to be conducted under each contract. Refer to each corresponding Phase 1 Project Specifications and Contract Drawings appendix for additional detail.

3.1.1 Contract 1 – Facility Site Work Construction

As described in Appendix 1, the Facility Site Work Construction work will consist of activities to develop the Energy Park property to be used for the processing facility, including general civil work, wharf area construction, and river mooring installations. This contract will also govern work needed to develop the Work Support Marina that will be used to provide river access and staging for support vessels.

- **General Civil Work –** Prior to initiation of in-river dredging, the Energy Park property must be transformed from its current condition to a fully functional and secure sediment handling and processing facility. First, the contractor will perform initial site preparation activities including land clearing and grubbing, installation of site perimeter security fencing and control gates, and construction of an electrical substation to support the supply of power and the extension of primary utilities (water, sewer, telephone) from nearby main line locations. Earthwork activities will include cut and fill operations, installation of rail yard drainage layers, and installation of the stormwater collection and drainage systems. Site access roads, storage areas, and decontamination pads will be constructed and paved. Box culverts will be installed to allow construction of roads over Bond Creek and the Diversion Canal.

- **Wharf Area Construction –** The work wharf and unloading wharf along the Champlain Canal must be constructed so that barges moored to them will not interfere with the canal's existing navigation channel. Work will begin by performing earthwork including clearing, grubbing, and excavation. The Contractor will construct the wharves by installing pile, revetments, and rip-rap; building a structural steel superstructure and framework; and installing a concrete deck and rails. The unloading area will be paved with concrete, the decontamination areas constructed, and primary utilities brought to the area.

- **Work Support Marina Construction –** The NYS property immediately north of the NYSDEC boat launch property is proposed for river access during dredging operations by others. This property will be upgraded; work will include earthwork, grading and preparation of parking areas, and construction of access roads. Primary utilities will also be brought to the site, and a dock will be constructed.

- **River Mooring Installations –** To facilitate barge movement, control, and staging, river moorings will be installed near the downstream entrance of Lock 7, including one turning dolphin (i.e., snubbing post) and four mooring dolphins.

3.1.2 Contract 2 – Rail Yard Construction

As described in Appendix 2, the Rail Yard Construction work will consist of activities to develop the rail yard where dewatered sediments will be loaded onto rail cars for transport to the offsite disposal facility. Rail yard track and facilities will be constructed on both the Energy Park site and CPR properties. Rail yard operation services will be governed by a separate contract (see Section 3.1.6 and Appendix 6).

- **Rail Yard Construction on Energy Park Property –** Construction will be performed on the sub-grade or sub-ballast placed as part of the work performed under Contract 1, and will include installation of ballasted track and special work (e.g., crossings, other ancillary facilities and installations). Ties, rail, and other track material required to construct ballasted jointed or relay welded rail track and special work will be installed and top ballasted, aligned, and stabilized. Low density at-grade crossings will be constructed where site roadways cross tracks.

- **Rail Yard Construction on CPR Property –** For rail yard construction activities on CPR property, the Contractor will provide personnel and superintendence qualified under 49 CFR Part 214, Railroad Workplace Safety, and CPR rules. The Contractor will install ballast for all track and special work, and will install all ties, new rail, and other new track material required to construct ballasted welded rail track and special work. All track and special work will be top ballasted, aligned, and stabilized. Any closure welds required in track and special work will be provided.

- **Rail Yard Facilities Work –** On the Energy Park property, the Contractor will construct the rail support building, repair track facility, and weigh-in-motion scale. The Contractor will also construct a yard air system.

3.1.3 Contract 3 – Processing Facility Construction & Operations

As described in Appendix 3, the Processing Facility Construction & Operations work will consist of activities to supply and install the sediment processing equipment, including the construction and installation of foundations, equipment pads, enclosures, remaining pavement, and containment structures, along with procurement and installation of process equipment, piping, mechanical, electrical, and instrumentation. Also included under this contract will be activities for the processing facility start-up, commissioning and operation, including sediment offloading, dewatering, stockpiling, and loading processed sediments and debris into rail cars for transport to the landfill; collecting and treating residual water and stormwater; and performing general operation and maintenance activities. The work of this contract will be broken into two parts.

- **Processing Facility Construction –** After the Energy Park property is prepared under the Facility Site Work Construction contract, the Contractor will construct the processing facility, including the sediment unloading area and coarse material separation area, the thickening and filter press system, and the stormwater collection and treatment systems. Foundations and buildings will be constructed to house the filter presses and water treatment system.

- **Processing Facility Operations –** After the facilities are constructed and have been started up and commissioned, the Contractor will operate and maintain the processing facility system. Operations will include barge offloading, coarse material separation, sediment dewatering, water treatment (process and stormwater), stormwater management, staging area management and maintenance, and loadout of sediment into rail cars. In the off season or non-dredge period, the Contractor will winterize the processing facility and operate and maintain the stormwater collection and treatment system. To support dredging operations and maintain schedule, the Contractor must be prepared to maintain processing operation services 24 hours a day, 7 days a week.

3.1.4 Contract 4 – Dredging Operations

As described in Appendix 4, the Dredging Operations work will consist of activities related to the dredging and barge transport of materials on the river. These activities include resuspension containment system installation, debris removal and sediment dredging, barge operations, capping/backfilling, and where necessary, shoreline restoration. The dredging contractor will have personnel, equipment, and materials available 24 hours a day, 6 days a week, during the canal season to complete these activities with the seventh day reserved for equipment maintenance and additional dredging, if needed to make up for lost productivity during the prior 6 days.

- **Resuspension Containment System Installation and Removal –** To control resuspension of sediments, the dredging contractor will install and maintain resuspension containment systems on the east side of Rogers Island and in the East Griffin Island area. After dredging is complete, or as appropriate, the contractor will remove the resuspension containment systems.

- **Dredging –** Prior to sediment removal in dredge areas, the dredging contractor will remove debris from the riverbed and clear the shoreline of overhanging vegetation. The contractor will then perform systematic inventory and residuals dredging in accordance with a Dredging Plan developed by the contractor. Dredged material will be transported to the processing facility wharf. Also included in this contract is the operation and maintenance of the Work Support Marina.

- **Positioning and Vessel Traffic Control System –** To manage river traffic the dredging contractor will provide and operate a digital global positioning system (DGPS), fathometer, water level gages, and transponders. These services will be operated from a central dispatch to control all of the contractor's water traffic and river navigation. The contractor will coordinate vessel management around Lock 7 with the NYSCC.

- **Backfilling, Capping, and Shoreline Restoration –** After dredging is completed in an area, the contractor will procure, transport and place appropriate backfill, cap or shoreline restoration structures. The contractor will transport these materials from supply location(s) to each in-river placement area.

3.1.5 Contract 5 – Habitat Construction

As described in Appendix 5, the Habitat Construction work will consist of all activities related to planting and seeding vegetation. After riverbed and shoreline substrate is placed during capping/backfilling operations (under the Dredging Operations contract), the habitat construction contractor will supply and plant specified vegetation. Due to the limited growing season, vegetation planting activities may wait until the spring season following completion of Phase 1 dredging. The contractor will then monitor and replace vegetation to the extent described in the Phase 1 Project Specifications and Contract Drawings for Habitat Construction (Appendix 5).

3.1.6 Contract 6 – Rail Yard Operations

As described in Appendix 6, the Rail Yard Operations work will consist of activities required to set up outbound loaded trains and receive inbound empty trains. The railroad (CPR) will drop a set of empty rail cars on one of the R&D tracks. The Rail Yard Operator 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 operator will 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 a unit train of 81 cars, which will be set on the R&D track for pick-up by CPR.

The Rail Yard Operator will inspect, maintain, and operate both an onsite rail support building and a repair-in-place (RIP) track facility. The Rail Yard Operator will also inspect, operate, and maintain the rail yard and set rail cars for loading by the Processing Facility Operator. The Rail Yard Operator will be responsible for providing the necessary labor, equipment, and materials to support and coordinate these tasks to meet the requirements of the specifications. The rail yard hours of operations are not restricted. The Rail Yard Operator will perform the above services to meet a regular service agreement with the rail carriers.

3.2 Phase 1 Schedule

The schedule for Phase 1 construction activities is provided in Table 3-1, and presents important milestones for implementing Phase 1 RA activities. The milestones presented in the updated schedule include activities identified in Table 1 of the SOW and major interim construction and operation activities.

The updated schedule format is similar to that used in Table 1 of the SOW, and is organized as summarized below. The relationship between the three RA Work Plans and the six contracts described in Section 3.1 is also summarized below.

- RA Work Plans for Phase 1;
- Phase 1 Facility Site Work Construction – these activities are covered under the following contracts:
  - Contract 1 – Facility Site Work Construction; and
  - Contract 2 – Rail Yard Construction.
- Phase 1 Processing Equipment Installation and Remaining Site Work – these activities are covered under the following contract:
  - Contract 3 – Processing Facility Construction & Operations – only the construction activities associated with this contract.
- Phase 1 Dredging and Facility Operation Activities - these activities are covered under the following contracts:
  - Contract 3 – Processing Facility Construction & Operations – only the operations activities associated with this contract;
  - Contract 4 – Dredging Operations;
  - Contract 5 – Habitat Construction; and
  - Contract 6 – Rail Yard Operations.
- Operation Maintenance and Monitoring (OM&M); and
- Progress Meetings, Inspections, Completion Process, and Reports.

Two points should be noted, in particular, about the schedule provided in Table 3-1.

First, for each of the six contracts, the schedule includes a deadline for issuing a Notice to Proceed in accordance with the schedule in Table 1 of the SOW. This Notice to Proceed will authorize the selected contractor to begin work on a limited basis, including, but not limited to, preparing shop drawings for long lead time equipment and materials (see Table 3-2 below for a list of long lead time equipment and materials). In addition to the Notice to Proceed, following EPA approval of the relevant RA Work Plan, GE would issue to the selected contractor a second notice, referred to as the Notice to Mobilize, which would authorize the contractor to mobilize to the site to conduct the actual onsite work called for by the contract.

Second, several of the activities in the schedule (e.g., Items 9, 12-15, 17, 20, 23-24, 28-31, 35, 37, 40, 43, 46, 49, 55, and 58) specify estimated numbers of days for undertaking or completing a particular activity. These represent the current best estimate and have been provided in accordance with the requirement in the SOW that the Phase 1 FDR provide an "estimated duration" for such activities (SOW pages 2-1, 2-4). These estimated durations, however, are provided solely for the purpose of planning and soliciting proposals. As the SOW makes clear (on pages 2-3, 2-6, and 2-13), the actual proposed schedules for these activities will be provided in the RA Work Plans.

The schedule considers equipment and materials procurement lead times. Listed below in Table 3-2 are the major systems for which equipment and materials will be procured, with anticipated lead times.

Table 3-2 – Long Lead Equipment and Materials

System	Lead Times (Weeks)
Hydrocyclone System	24
Trommel Screen	24 to 30
Water Treatment Building	17
Filter Presses	48 to 52
Dewatering Building	17
Sheet Pile	6 to 36
Barges	16 to 24
Railroad Ties	17
Rail	19
F&D Turnouts	23
Signals	52
Near Field Buoys	26
Far Field Stations	52
Aquatic and Terrestrial Vegetation	12 to 52

Notes:
1. Dewatering system will consist of 12 filter presses. According to one manufacturer, the lead time for the filter presses is dependent on the time of year the order is placed. The first press is expected to arrive onsite 12 to 20 weeks after the order, with lag times for successive press deliveries.
2. Quoted lead times are for fabrication and delivery, and are after shop drawing approval.

4. Phase 1 Monitoring and Compliance with Performance Standards

This section summarizes the monitoring program to be conducted during Phase 1 to assess the performance of the remedial action against the EPS, QoLPS, and WQ requirements. This section then summarizes how Phase 1 has been designed to meet the numeric standards presented in the Hudson EPS and QoLPS. Compliance with the processing facility discharge limitations specified in the WQ requirements was discussed in detail in Section 3.6.4.2 of the Phase 1 IDR; the refinements to the water treatment components during the Phase 1 Final Design have not altered the conclusion that the effluent is expected to meet the WQ discharge limitations for suspended solids, PCBs, cadmium, chromium, copper, lead, and mercury.

4.1 Phase 1 Environmental Monitoring Plan

An environmental monitoring program will be carried out during Phase 1 to evaluate the project performance with respect to the EPS, QoLPS, and WQ requirements. The Phase 1 EMP (which is an updated version of the RA Monitoring Scope that was Attachment B to the SOW, with relatively minor changes to correct inconsistencies and editorial deficiencies, and to make the document consistent with the Phase 1 Final Design) is provided in Appendix 7 to this Phase 1 FDR. The Phase 1 EMP describes monitoring of surface water, fish, sediment residuals, air quality, odor, noise, lighting, and water discharge, as well as special studies that will be implemented.

The activities described in the Phase 1 EMP will be supplemented and supported by Phase 1 RAM QAPP, which will be developed in accordance with the SOW. The Phase 1 RAM QAPP will include specific sampling and analytical protocols, quality assurance/quality control (QA/QC) requirements, and other details necessary for the implementation of the Phase 1 environmental monitoring program.

4.2 Other Compliance-Related Documents

The Phase 1 RA CHASP included as Appendix 8 to this Phase 1 FDR describes the prevention, response, and mitigation measures and other activities that will be carried out to address potential hazards to the public and other impacts that may occur within the vicinity of the Upper Hudson Work Area (as defined in the CD) and are associated with the remedial action. The Phase 1 RA CHASP also presents the contingent and mitigative steps that, when warranted, will be taken during the remedial action to address the QoLPS.

In addition, a Phase 1 PSCP will be developed as part of the RA Work Plan for Phase 1 Dredging and Facility Operations. This plan will provide guidance on complying with the performance standards and associated requirements and will provide the basis for certain remedial action plans. It will be based on and consistent with the PSCP Scope that is Attachment C to the SOW.

4.3 Engineering Performance Standards

In 2003, EPA issued draft EPS for resuspension, PCB residuals, and productivity for the remedial action. A peer-review panel evaluated the draft standards, after which the final EPS for Phase 1 were issued in April 2004 (EPA, 2004a). One objective of Phase 1 is to test the effectiveness of the remedial design relative to the performance standards. Although considerable effort has gone into developing a remedial design capable of achieving the EPS, a number of assumptions had to be incorporated into the design. As a result, there is no guarantee that the performance standards can be met individually or in combination, and the actual experience in Phase 1 will provide valuable information on the feasibility of achieving the performance standards. Results and experience from Phase 1 will be evaluated prior to the start of Phase 2 by GE, EPA, and an independent peer-review panel; and based on these reviews, changes to the project, design, or performance standards may be necessary.

This Phase 1 FDR documents that the Hudson EPS have been incorporated into the basis of design for the remedial action. Specific activities that will be undertaken to address the Hudson EPS during Phase 1 are described throughout the Phase 1 IDR, this Phase 1 FDR, the Phase 1 EMP, the Phase 1 RA CHASP, and the PSCP Scope, and will be further described in the Phase 1 RAM QAPP and the Phase 1 PSCP. Where appropriate and informative, the following summaries provide specific reference to applicable design documents such as attachments and appendices to this Phase 1 FDR and the associated design documents listed above.

4.3.1 Project-Related Resuspension

As discussed in Section 2.3.4 above, the results of the updated resuspension modeling (Attachment F) using a %R of 0.35 indicate that suspended solids in the near and far field would be well below the numeric standards and that PCB concentrations in the surface water would be below the control level, with a total Phase 1 PCB load at TID well below the 65 kg criterion established by EPA for Phase 1. When a 0.70% resuspension loss rate is used, most of the results are below EPA's numeric standards, except for the following parameters:

- The 7-day average net PCB flux at TID is predicted to exceed the 600 g/day Control Level; and
- One brief incidence of exceedance of the 300 m near-field TSS standard is predicted.

The installation and operation of the resuspension control systems described in Section 2.3.4 above are predicted to result in an estimated annual PCB load below the Resuspension Performance Standard criterion (65 kg total for Phase 1), using both the 0.35 value and the 0.70 value for %R. The model results also indicate that with %R values of 0.35 and 0.70, the PCB concentration at TID will be below the Control Level of 350 nanograms per liter (ng/l). The model results show that there is no anticipated need for additional contingent controls other than those provided for in the west and east channels of Rogers Island, as shown on Figure 3-26 of the Phase 1 IDR, and described in the Phase 1 Project Specifications for Dredging Operations (see Appendix 4, Section 13805).

4.3.2 Dredging Residuals

The Residuals Performance Standard forms the basis of design primarily for dredging, backfilling, and capping. This standard describes how concentrations of Tri+ PCBs in surface sediment that remain after inventory dredging will determine when dredging is complete and when backfilling or capping may be implemented. The action levels will be applied on a CU basis; this process was described in Section 3.3.6 of the Phase 1 IDR. The influence of the Residuals Performance Standard on the development of the backfilling/capping element, including the selection of backfill materials and design of engineered cap types, was described in Section 2.3.7 of this Phase 1 FDR.

The final decision regarding the appropriate backfill or cap type that will be placed in each dredged area will be made after inventory and (if necessary) residuals dredging is complete and residuals concentrations are known. The primary consideration when selecting the type of backfill material to be placed will be water velocity, which controls the ability of the selected backfill material to provide a stable substrate to support the habitat reconstruction and replacement goals for the area. Backfill will not be placed in the navigation channel, if the finished grade after dredging results in a water depth of less than 15 feet, or in sections of the river where the resultant water depth (following remediation) is desired for habitat purposes. Backfill will not be placed in areas where post-dredged surficial Tri+ PCB concentrations are less than 0.25 mg/kg, unless necessary to meet specific habitat goals, as these areas would already meet the substantive requirements of the ROD and the EPS.

Specific areas to be capped will be determined in accordance with the procedures described in the PSCP Scope. Site-specific cap design is subject to EPA approval as part of the CU completion process. As discussed in Section 2.3.7.2, two cap types have been developed to act as physical barriers and provide both isolation and stabilization (see Section 3.9.2.2 of the Phase 1 IDR and the Phase 1 Contract Drawings in Appendix 4 for details). The two cap types are: 1) Isolation Cap Type A, to be placed in a CU where the average Tri+ PCB concentration after dredging is less than or equal to 6 mg/kg and capping is necessary; and 2) Isolation Cap Type B, to be placed in a CU where the average Tri+ PCB concentration is greater than 6 mg/kg after dredging, and after GE and EPA have determined that additional dredging is not required.

The final cap design and eventual application will be based on practical limitations and efficiency of the dredging and capping operations, and will account for factors such as cap placement success in previously capped CU areas, consolidation, and slope stability.

Selection of the appropriate cap type will be made in the field by the Construction Manager, in consultation with the Design Engineer, and subject to approval by EPA's field representative. Selection will be based on the particular river conditions (velocity, habitat, etc.) and the Tri+ PCB concentration in the areas targeted for capping. Caps will be placed over sampling nodes in the CU such that the arithmetic average Tri+ PCB concentration of the uncapped nodes is 1 mg/kg or less, and no individual uncapped node has a Tri+ PCB concentration at or above 15 mg/kg.

The Phase 1 EMP provides an overview of the routine monitoring, reporting requirements, and requirements for sediment sampling and analysis associated with this performance standard; and the Phase 1 PSCP will describe the other actions to implement the Residuals Performance Standard. The process for evaluating data, defining response actions, certifying closure of CUs, and reporting was presented in Section 3.3 of the Phase 1 IDR. CU checklists have been developed for dredging (inventory and residual), backfill, capping, and habitat construction. The checklists are provided in Attachment K.

4.3.3 Dredging Productivity

The Productivity Performance Standard forms the basis of design primarily for the dredging, dredged material transport, sediment processing and storage, and transportation and disposal elements of the remedial action. This standard specifies the annual minimum and target volumes of sediment (*in situ* volumes, excluding re-dredging volumes) to be removed, processed, and shipped offsite during Phase 1 (Hudson EPS, Volume 4, p. 27). The dredge schedule designed to meet the Productivity Performance Standard during Phase 1 is discussed in Section 2.3.2, and all subsequent elements of the Phase 1 Final Design were developed based on the rate of dredging necessary to achieve the Productivity Performance Standard. Certain contingency actions will be implemented if specific productivity monitoring thresholds are exceeded; these monitoring thresholds and contingency actions are described in the PSCP Scope and will be further developed in the Phase 1 PSCP.

4.4 Design Analyses of Attaining Quality of Life Performance Standards

The Final Design of Phase 1 has been developed with the objective of achieving the criteria set forth in the QoLPS for air quality, odor, noise, lighting and navigation. This subsection summarizes how Phase 1 has been designed to meet that objective. Detailed descriptions of the QoLPS criteria, associated monitoring, contingency actions, reporting requirements, and complaint management are provided in the Phase 1 EMP, the Phase 1 RA CHASP, and/or the PSCP Scope, and are therefore not repeated here. Where appropriate and informative, the following summaries provide specific reference to applicable design documents such as attachments and appendices to this Phase 1 FDR and the associated design documents listed above.

Additional design analyses (modeling) relating to attainment of the QoLPS for air quality and noise have been performed since submittal of the Phase 1 IDR, and are discussed below and in Attachments H and I, respectively. Analyses relating to attainment of the QoLPS for odor and lighting are based primarily on information presented in the Phase 1 IDR and are summarized below. Finally, a discussion is presented as to how the Final Design will comply with the QoLPS for navigation, taking into account the logistical modeling presented in Attachment D.

4.4.1 Air Quality

The QoLPS for air quality contains three components – relating to PCBs in ambient air, opacity, and the National Ambient Air Quality Standards (NAAQS). Each of these components is discussed below.

4.4.1.1 PCBs in Ambient Air

Although dredged sediments will be exposed to the atmosphere after their removal from the riverbed and thus could produce PCB emissions to the air, the Phase 1 Final Design has been developed to prevent or mitigate against unacceptable emissions of PCBs. The numerical criteria in the QoLPS that relate to PCBs consist of a Concern Level of 0.08 microgram per cubic meter ($\mu g/m^3$) and a Standard Level of 0.11 $\mu g/m^3$ (both as 24-hour average concentrations) in residential areas and a Concern Level 0.21 $\mu g/m^3$ and a Standard Level of 0.26 $\mu g/m^3$ (both as 24-hour average concentrations) in commercial/industrial areas. These criteria apply at the locations of residential or commercial/industrial receptors. To assess attainment of these criteria, air quality modeling has been conducted for project activities that could produce PCB emissions to the air. The details of this modeling, including input parameters, methodologies, and results, are provided in Attachment I. The results are summarized below (by specific project activities), along with a description of preventive and contingency measures included in the design to meet the PCB criteria for air. This modeling does not include the general site work and construction of the processing facility, because no PCB-containing materials will be used or encountered during that work and hence it is not expected that there will be PCB emissions to the air.

Dredging Operations

As discussed in Attachment I, air quality modeling was performed to assess the impacts from dredging operations, including emissions from the water column during dredging (with and without resuspension controls) and emissions from open barges filled with sediments at the dredging location. The water column emissions were modeled using the resuspension model that was presented in Appendix E of the Phase 1 IDR. The emissions from sediments in the barges were initially modeled using a very conservative emissions model (the Equilibrium Partitioning Model); and the ambient air concentrations were predicted using an EPA-approved dispersion model (the Industrial Source Complex [ISC] Model). If this model predicted PCB concentrations at assessment points to be less than or equal to the applicable control level, then no further modeling was done and the results were documented. If the Equilibrium Partitioning Model predicted an emission factor that, after running the ISC model, resulted in a PCB concentration (in air) above the applicable Control Level, then a more complex Transport Limited Model was run to develop a more representative (less conservative) emission factor. The Equilibrium Partitioning Model and Transport Limited Model are described in Attachment I.

Emissions from barges and the water column were predicted for the entire dredge schedule. The emission factors are a strong function of PCB concentration in the sediment and meteorological conditions. It was assumed that barges will be moored at the dredging location for 8 hours while the mechanical dredge loads the barge. The Equilibrium Partitioning Model predicted that emissions from dredging operations would result in exceedances of the applicable PCB Concern and Standard Levels at certain nearby residences and commercial establishments. The contribution of volatilization from the river itself caused by resuspension was negligible; the exceedances were driven by predicted emissions of PCBs from the open barges. Further, these exceedances were predicted to occur only when the open barges contain sediments with average PCB concentrations greater than 200 mg/kg (of which there are predicted to be about 33 during Phase 1) and only during sustained high-wind conditions, which would promote the volatilization of the PCBs in the sediments. It should also be noted that additional conservatism was introduced into the modeling by the assumption that the wind across the surface of the water containing the sediments in the barge would not be reduced by the freeboard of the barge when it is being filled, which in fact will serve as a wind screen.

The Transport Limited Model, which uses a more realistic representation of emission rates, was then applied to the barge emissions to further assess emissions rates under the worst-case conditions noted above. This model indicates that emission rates would be considerably lower than predicted by the Equilibrium Partitioning Model (less than ¼ in the later stages of filling a barge). Applying these results to the ambient air PCB concentrations predicted in the initial modeling indicates that the PCB concentrations would not exceed the applicable residential concern levels or standards at any residential or commercial assessment points.

Since validation of the input conditions and model predictions will not be possible until dredging operations begin, GE has included in the Final Design a contingency requirement to address the potential that PCB emissions from the open barges would produce an exceedance of an applicable Concern or Standard Level at an assessment point. Specifically, the specifications include a requirement that, if the air monitoring indicates such an exceedance, wind screens will be fitted on the barges that contain sediments with PCB concentrations equal to or greater than the sediment contained in the barge that was the source of the exceedance. The use of 5-foot wind screens around the perimeter of such barges would reduce wind speeds across the surface of the water in the barges by up to 70%; and even the conservative Equilibrium Partitioning Model predicts that, with such wind screens in place, there would be no exceedances of the Concern or Standard Level at any residential or commercial assessment point.

In these circumstances, the contractor will be directed to have such wind screens available at the work area and to use them on the barges if monitoring indicates an exceedance of a Control or Standard Level at an assessment point. The contractor will also be allowed to propose alternative engineering or operational controls if they can be shown to be effective to meet the QoLPS for PCBs in air.

Barging Operations at Lock 7 and at Sediment Processing Facility Wharf

The model was also run for PCB emissions from barges lined up at Lock 7 (up to three at a time) and from barges tied up at the sediment processing facility wharf (also up to three at a time). The modeling, using the Equilibrium Partitioning Model to estimate the emission factors for these cases, predicts no exceedances of either the residential or the commercial/industrial Concern or Standard Levels. As a result, no mitigation is necessary.

Processing Facility Operations

At the processing facility, including the waterfront unloading wharf, size separation staging areas, dewatering and thickening facilities, filter press facility, and material staging and rail yard load-out areas, PCB-containing materials will at times be exposed to the atmosphere and could therefore become a potential source of PCB emissions. For uncontrolled emissions from the processing facility operations, the model (assuming emission rates based on Equilibrium Partitioning Model) predicts exceedances of the applicable Concern and Standard Levels at both residential and commercial assessment points. A review of the contributing sources indicates that the two fine-sediment storage areas would be responsible for a large portion of the elevated emissions, with secondary contributions from the gravity thickener and process water recycle tank.

Several preventive measures have been integrated into the Phase 1 Final Design to control these sources of PCB emissions during processing operations. Specifically, the Phase 1 Final Design specifies enclosures and ventilation systems to capture and treat potential PCB emissions from the fine-sediments storage piles (i.e., filter cake) near the rail yard. The design provides for the ventilation system to control air flow and PCB emissions by creating negative air pressure within the enclosures to prevent uncontrolled loss of air from the enclosures. The system includes large fans designed to capture interior air and direct the air flow into GAC units that will remove PCBs before the air is discharged. This system will be used as needed based on monitoring results. The specifications also call for covers over the gravity thickener and recycle water storage tanks to reduce PCB emissions. The modeling presented in Attachment I indicates that, with these controls in place, there would be no predicted exceedances of the applicable PCB Concern or Standard Levels at either residential or commercial/industrial assessment points. Air quality monitoring as described in the Phase 1 EMP and PSCP Scope will be conducted during operations to confirm model predictions and, in the event of an exceedance of air quality Concern or Standard Levels, the contingency monitoring and applicable response actions described in the Phase 1 EMP and RA CHASP will be implemented.

4.4.1.2 Opacity

Opacity issues may result from vessel, vehicular, or equipment emissions. However, routine maintenance of diesel engines, generators, and other equipment is expected to achieve the QoLPS for opacity. The Contractors will maintain and operate vessels and vehicles properly to prevent opacity problems. As discussed in the Phase 1 EMP and Phase 1 RA CHASP, opacity will be monitored by a certified visual observer at the beginning of use of each piece of equipment or if an opacity complaint is received. If such monitoring shows an exceedance of the opacity standard, appropriate repairs or other measures will be taken to prevent further exceedances of that standard.

4.4.1.3 NAAQS

The QoLPS for air quality requires a modeling assessment, during design, of the project's ability to achieve the NAAQS for several pollutants subject to those standards (known as "criteria pollutants"). The pollutants for which such an assessment was required are: respirable particulate matter with a diameter less than 10 micrometers (PM_{10}), fine particulate matter with a diameter less than 2.5 micrometers ($PM_{2.5}$), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and ozone (O_3) (to be evaluated using its precursors, NO_x and volatile organic compounds [VOCs]). This assessment was required to consist of repeating the assessment conducted by EPA and reported in EPA's *White Paper – Air Quality Evaluation* (2002) (which was included in the Responsiveness Summary accompanying the ROD), using project-specific design data. If this assessment validates EPA's conclusions in that document that the project activities will not exceed the NAAQS, no additional monitoring or controls for these pollutants are required.

Such a modeling assessment has been conducted for the above-listed criteria pollutants. Such modeling has been conducted for emissions of these pollutants (as relevant) from: a) construction of the processing facility; b) dredging operations; and c) operation of the processing facility. The details of this modeling, including input parameters, methodologies, and results, are included in Attachment I to this Phase 1 FDR. The results of this modeling confirm that the emissions of the criteria pollutants from any of these activities are not predicted to cause exceedances of the NAAQS. As a result, no provisions for monitoring or contingency actions for the criteria pollutants are necessary during implementation of this project.

Nevertheless, preventive or contingency measures have been included in the specifications to prevent the generation of dust during construction of the processing facility. These measures include:

- The contractor must prepare and submit a *Site-Specific Dust Prevention and Control Plan* that details the methods to be used to prevent and control onsite dust generation and migration from the site during construction of the processing facility.
- During site construction, soil piles and open excavations will be wetted down with water, as needed to prevent dust generation.
- During site construction, haul roads will be wetted down, as needed, to minimize dust generation, and appropriate covers will be used on trucks hauling fine or dusty material.
- During operations, the contractor shall be required to prevent and mitigate spills of sediment on haul roads.
- The contractor must prepare and submit a *Start-up and Testing Plan* that describes how each major piece of equipment will be tested against applicable criteria before operations begin at the processing facility. The contractor must also prepare and submit an *Operations & Maintenance Plan* to describe how the facility will be operated and maintained within specifications.

4.4.2 Odor

River sediments may contain organic matter that, during decomposition, can emit offensive odors from the natural byproducts of decay, such as hydrogen sulfide (H_2S). Because thousands of cubic yards of Hudson River sediments and debris will be brought to the surface and transported on the waterway and managed at the processing facility, the QoLPS for odor has been developed to prevent or mitigate unreasonable odors that may affect community members or others on or near the river and project area. The quantitative QoLPS for odor is

0.01 part per million (ppm) (14 μg/m^3) of H_2S over a 1-hour period, and the qualitative standard is that complaints are to be investigated and, if appropriate, mitigated.

The Final Design presented in this Phase 1 FDR is expected to comply with the QoLPS for odor. As discussed in Section 3.11.2.2 of the Phase 1 IDR, sediment cores previously collected from the river for physical and chemical analyses and treatability studies generally did not have offensive odors. Nevertheless, to minimize odors and prevent complaints, debris from dredging operations, which may contain wood, vegetation, shellfish, and other types of organic material, will be screened out and temporarily staged in the size separation area. The monitoring and contingency requirements that will be implemented under the QoLPS for odor, as well as the procedures and criteria for responding to an odor compliant, are described in the Phase 1 RA CHASP.

4.4.3 Noise

Noise will inevitably be generated during construction and operation of the processing facility, and during dredging, backfilling/capping, and sediment transfer operations. The QoLPS for noise specify a number of numerical criteria, which vary depending on the type of receptor and whether the operations are occurring in the daytime or nighttime. They are as follows:

- Short-Term Criteria (applicable to facility construction, dredging, and backfilling activities):
  - *Residential Control Level* (maximum hourly average)
    Daytime = 75 decibels (dBA)
  - *Residential Standard* (maximum hourly average)
    Daytime = 80 dBA
    Nighttime (10:00 pm – 7:00 am) = 65 dBA
  - *Commercial/Industrial Standard* (maximum hourly average)
    Daytime and nighttime = 80 dBA
- Long-Term Criteria (applicable to sediment processing facility and transfer operations):
  - *Residential Standard* (24-hour average)
    Day-night average = 65 dBA (after addition of 10 dBA penalty to night levels from 10:00 p.m.. to 7:00 a.m.)

– *Commercial/Industrial Standard* (maximum hourly average)
  Daytime and nighttime = 72 dBA

Final design analyses and predictive modeling have been updated since submittal of the Phase 1 IDR. Initially, the noise modeling was conducted for various sources in the absence of any acoustic controls. The results for each short-term activity (i.e., facility construction, dredging operations, backfilling, resuspension control installation) and for long-term continuous activity (i.e., processing facility operations) are discussed below, along with preventive and/or contingency mitigation measures, where necessary. Details of the noise modeling analyses, including input parameters, methodologies, and results, are provided in Attachment J.

Processing Facility Site Work and Construction

Construction of the processing facility will involve general earthwork, access road construction, utility installation, wharf construction, rail yard development, and installation of processing facility equipment. Based on an assessment of the construction activities with the potential worst-case noise levels, five specific construction activities were modeled at representative areas: 1) general site construction at the fines staging area; 2) wharf construction; 3) pile driving to construct the turning and mooring dolphins downstream of Lock 7; 4) construction of the access road north of the processing facility; and 5) earthwork trucks transporting fill along the access road for processing facility construction. All of these activities are expected to occur only during the daytime. As discussed in Attachment J, the noise modeling predicts that noise levels resulting from all of these activities except one will be below the applicable control level (where applicable) and noise standard at all offsite assessment points. The one exception is the pile driving, using impact hammering, for installation of the dolphins downstream of Lock 7, which is expected to last approximately 2 weeks. For this activity, the model predicts that sound levels will exceed the daytime control level of 75 dBA at 11 residences, with four of those residences also exceeding the daytime residential standard of 80 dBA.

In these circumstances, no mitigation measures are expected to be necessary for noise generated by general site construction work, wharf construction, access road construction, or earthwork truck traffic on the access road. However, during construction, surplus general fill (if available) will be used to construct an earthen berm near the south end of the property, which will help reduce noise from the facility.

For the pile driving of the turning and mooring dolphins downstream of Lock 7, several control/mitigation options have been considered to reduce these noise levels. However, they all have limitations associated with their implementation and/or uncertainties regarding their effectiveness, as discussed in Attachment J and summarized below.

- Installation of a sound barrier wall (about 20+ feet high) between the pile driving and the residences should allow achievement of the applicable criteria, but the installation of that wall would: a) itself generate considerable noise; b) require design/implementation details to be developed; c) require property access agreements and easements; and d) may have secondary quality of life issues associated with the architecture of the wall. In these circumstances, installation of a 20+ foot high wall for temporary noise control for a 2-week period does not appear to be a practicable approach.
- Another possible option would be to use a temporary barge-mounted sound barrier along the shore. However, the height of this wall would need to be on the order of 40 feet, which is likely to be impractical due to structural requirements for wind forces. Again, this approach does not appear to be practicable
- Another potential mitigation option would be to use sound-dampening blankets around the pile-driving hammerhead. However, actual project data demonstrating the noise-reduction effectiveness of such blankets have not been identified, and hence it cannot be determined whether such blankets would be effective in reducing noise levels to achieve the standards.

Given the practical limitations and uncertainties of these options, the design team has not to date identified control or mitigation options that can practicably and reliably be implemented to reduce the noise levels from this short-term pile-driving activity to levels below the applicable daytime criteria. The design team is continuing to investigate potential means to reduce noise levels associated with the pile driving, and will also seek input from the selected contractor on additional potential techniques. GE will provide an update on this issue in the RA Work Plan for Phase 1 Facility Site Work Construction.

Dredging and Barging Operations

In-river dredging and barging operations (which include backfilling) require the use of engine-driven dredges, tugboats, and other equipment that unavoidably generate noise. As discussed in Attachment J, the model predicts that these operations would meet the daytime residential and commercial/industrial standards of 80dBA at a distance of approximately 35 feet or more, the daytime residential control level of 75 dBA at a distance of 60 feet or more, and the nighttime residential standard of 65 dBA at a distance of 200 feet or more. These model results, in conjunction with the locations of assessment points, indicate that noise from dredging and barging operations would produce predicted exceedances of the applicable noise criteria only when these operations are within 200 feet of residences and only at night.

As discussed in the Phase 1 EMP, a noise study will be conducted at the commencement of dredging to confirm the equipment sound levels and assumptions used in the modeling. If this study confirms the model predictions, the dredging contractor will be instructed to reduce noise levels if and when it is necessary to perform dredging within 200 feet of residences at night. There are a number of measures that the contractor could take to reduce the noise levels at night. These include use of temporary portable noise shrouds around pumps, use of smaller work boats instead of tugs to move barges, and/or other operational adjustments on a temporary and as needed basis.

Sheet Pile Installation

Sheet piling will be used as a resuspension control measure in the EGIA, as discussed in Section 2.3.4 above. Although sheet pile installation is not a sustained long-term process, driving sheeting with a vibratory hammer generates noise. Moreover, based on an evaluation of the geotechnical characteristics of the sediment in this area during Final Design, it has been determined that certain pile-based support structures (batter piles and king piles) will need to be driven into the bedrock below the sediments to provide a stable and safe sheet pile resuspension structure. While much of the sheet piling can be installed with a vibratory hammer, an impact hammer will be needed for driving king piles into the rock. Sheet pile installation will be conducted only in the daytime and would be expected to last approximately 1 to 2 weeks. It is estimated that this work will include vibratory hammering approximately 80% of the time and impact hammering for the remaining 20% of the time.

The noise model predicts that the noise levels resulting from vibratory hammering would exceed the daytime residential and commercial/industrial standard of 80 dBA at a distance of approximately 180 feet and would exceed the daytime residential control level of 75 dBA at a distance of approximately 325 feet. It also predicts that the noise levels from impact hammering would exceed the 80 dBA standard at a distance of approximately 325 feet and the 75 dBA residential control level at a distance of approximately 575 feet. If sheet piling is installed in a portion of EGIA01B as planned, the model predicts that: 1) the noise levels from vibratory hammering would exceed the daytime residential control level at three nearby residences and the daytime residential standard at one of those residences; and 2) the noise levels from impact hammering would exceed the daytime residential Control and Standard Level at the same three residences and the daytime commercial/industrial standard at one non-residential location.

Similar to measures to address the noise impacts of pile driving near Lock 7, several noise control/mitigation options have been considered for sheet piling in the EGIA, as discussed in Attachment J and summarized below.

- One potential option is the installation of a sound barrier wall along the shoreline between the sheet pile installation and the residences. However, this option does not appear to be a practical approach for short-term (1 to 2 weeks) noise control for the same reasons discussed for this option in connection with the dolphin installation downstream of Lock 7.
- Another possible option would be the use of a temporary barge-mounted sound barrier along the shore (estimated height of about 30 feet), but this option would not appear to be practical for the same reasons discussed above and, in any event, would not be feasible when driving sheets adjacent to the shoreline.
- A further potential option is the use of sound-dampening blankets around the pile-driving hammerhead. However, as noted above, project data demonstrating the noise-reduction effectiveness of such blankets have not been identified.

In light of these considerations, the design team has not to date identified control or mitigation options that can practicably and reliably be implemented to reduce the noise levels from the sheet pile installation to levels below the applicable daytime criteria. Here again, the design team is continuing to investigate potential noise control or mitigation options for this activity, and will seek input from the selected contractor. GE will provide an update on this issue in the RA Work Plan for Phase 1 Dredging and Facility Operations.

Processing Facility and Rail Yard Operations

The dewatering and handling of dredged sediments at the processing facility will generate noise as the material is unloaded at the wharf, processed through a variety of pumps and mechanical equipment, and then transported by truck to the stockpiles for loading and offsite transport/disposal. Rail yard operations also will generate noise as locomotives maneuver rail cars and unit trains on and off the property. As discussed in Attachment J, the noise modeling results indicate that the noise levels from processing facility operations would meet the applicable long-term noise standards at all commercial/industrial and residential locations around the facility, except one. The one exception is a residence located on the west side of East Street across the canal from the unloading wharf and size separation area, where the noise level may exceed the long-term day-night 24-hour average residential standard level of 65 dBA.

To address this predicted exceedance, the specifications require the facility operations contractor to select equipment that will meet the QoLPS for noise at that assessment point through use of appropriate sizing and best achievable control technology (BACT) for sound suppression (e.g., mufflers, shrouds, covers). For example, as explained in Attachment J, the top two sources of noise at the processing facility are the rotary trommel screen and unloading crane, both located near the waterfront. Trommel screens equipped with sound-dampening shrouds have been required in the equipment specifications. The contractor will also be required to furnish sediment unloading equipment rated for a maximum specification of 73 dB at a distance of 100 feet, and maintain all equipment and vehicles in good working order at all times. These measures should allow achievement of the noise criteria. Further, if needed based on monitoring, other equipment may be shrouded or insulated to reduce noise generation, and small sources of noise (e.g., pumps and motors) may be shielded by placement of small portable sound barriers or other objects to block or reduce sound propagation.

4.4.4 Lighting

To meet the EPA's Productivity Performance Standard, in-river dredging and onshore processing is expected to be performed 24 hours a day, 6 days a week, which will unavoidably require nighttime lighting of work areas to protect worker safety and sufficiently illuminate equipment, transport routes, and operational areas. Because safety is of paramount importance, lighting requirements for worker safety, navigational safety, and vehicular safety under the Occupational Safety and Health Administration (OSHA), U.S. Coast Guard (USCG), and other applicable regulations supersede the QoLPS for lighting. However, design analyses and predictive modeling indicate that the Final Design presented in this Phase 1 FDR is expected to meet the numerical criteria specified in the QoLPS for lighting – namely, 0.2 footcandle in rural and suburban residential areas, 0.5 footcandle in urban residential areas, and 1 footcandle in commercial/industrial areas.

Section 3.11.2.4 of the Phase 1 IDR presented a modeling analysis of lighting impacts from: 1) nighttime on-water operations (dredging, barge transport, etc.); and 2) nighttime processing facility operations. The modeling analysis was updated during Final Design to evaluate the potential impacts of light sources from the revised processing facility layout, and indicates that the design would attain the relevant lighting standards. The results of this modeling, as well as a description of relevant Phase 1 Project Specifications and Contract Drawings relating to lighting, are summarized below.

On-Water Operations (Dredging, Backfilling/Capping, and Barge Transport)

The modeling described in the Phase 1 IDR indicated that the area in which light from the dredging (or backfilling/capping) work areas, including the dredge deck and adjacent barge to be loaded, would be above 0.2 footcandle would extend to only about 50 feet from the edge of the lit dredge barge. Thus, there should be no exceedances of the residential standard of 0.2 footcandle for rural/suburban areas (or of the 0.5 footcandle residential standard for urban areas, or the 1 footcandle commercial/industrial standard). Note also that light may be further attenuated by vegetation and other obstructions along shorelines.

Although this modeling indicates that no light mitigation from on-water operations is needed, the applicable Phase 1 Project Specifications provide lighting requirements that the dredging contractor must follow to prevent, or mitigate if necessary, exceedances of lighting standards. The contractor must prepare and submit a *Lighting Control Plan* that details how lights will be used during on-water operations, including contingencies if monitoring indicates an exceedance. Further, the contractor is directed to meet applicable QoLPS criteria, comply with state and federal navigation lighting requirements, and reduce light impacts through use of proper positioning, shielding, and directing of lights toward work areas and away from potential receptors. If barge-mounted lighting is employed, such lights will be turned off during transport, although all required navigational lighting will remain on for safety purposes.

Processing Facility Operations

The nearest receptor potentially affected by nighttime lighting at the sediment processing facility is the golf course (a commercial facility) located across the Champlain Canal from the waterfront unloading wharf. The modeling analysis presented in the Phase 1 IDR indicated that the assumed lighting necessary to sufficiently (i.e., safely) illuminate the unloading wharf would be well below the commercial/industrial standard, and in fact achieves a level of 0.2 footcandle within the canal itself. In other areas of the processing facility, operations-specific lighting is to be directed towards specific work areas, equipment, and facilities.

Although these results indicate no need for light mitigation at the processing facility, the applicable Phase 1 Project Specifications provide lighting requirements that the processing facility operations contractor must follow to prevent, or mitigate if necessary, exceedance of lighting standards. The contractor must prepare and submit a *Lighting Control Plan* that details how lights will be used during facility operations, including contingencies if monitoring indicates an exceedance. Further, the contractor is directed to meet applicable

QoLPS criteria, comply with current OSHA standards to allow for safe working conditions, and reduce light impacts through use of proper positioning, shielding, and directing of lights toward work areas and away from potential receptors. In addition, the use of low-mast lights and shielding will be required to limit offsite glare.

Moreover, although not required to meet lighting standards, the Final Design optimizes onsite general lighting, without reducing safety or security, by specifying streetlights for all facility roadway intersections but not necessarily along all roadways. In addition, care has been taken during design to minimize the number of trees removed during facility construction, which will further help reduce overall light impacts to surrounding areas.

4.4.5 Navigation

The Upper Hudson River and Champlain Canal are navigable waterways used for recreation and commerce. To a varying degree by location, season, and time of day, these waterways will be affected during active periods of the Phase 1 dredging and barge transport activities within designated project areas of the river. Execution of the project will add marine traffic to the project area waterways in the form of sediment transport barges, tugboats, and several types of support vessels carrying out vital monitoring, oversight, safety, and other tasks. The QoLPS for navigation was developed to regulate project-related vessel movement on the river. It 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 designed to avoid unnecessary interference with non-project-related vessels while at the same time allowing efficient performance of the project. These requirements include: restricting access to work areas; providing safe access around those areas in the navigation channel to the extent practical; notifying the NYSCC of in-river project activities; providing information to the NYSCC and USCG to allow them to issue Notices to Mariners; providing the public with a schedule of anticipated project activities; scheduling project-related river traffic so that non-project-related traffic is not unnecessarily hindered while allowing efficient performance of the project; coordinating lock usage with the NYSCC and its lock operators; and establishing temporary aids to navigation, such as lighting, signs, and buoys, to maintain safe and efficient vessel movement.

The Phase 1 Final Design incorporates certain accommodations, preventive 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. Based on Final Design analyses and results of predictive logistical modeling conducted since submittal of the Phase 1 IDR (see Attachment D), the Final Design presented in this Phase 1 FDR, including Phase 1 Project Specifications and

Contract Drawings and applicable contingencies and mitigation measures, is expected to meet the QoLPS for navigation.

To meet the QoLPS for navigation, the Phase 1 Final Design includes the requirements outlined below (which will be specified as requirements in the contract documents where applicable). Additional discussion of the scope of navigation monitoring, notification, contingencies, mitigation, and complaint management is provided in Section 3.11.2.5 of the Phase 1 IDR, Section 6 of the Phase 1 PSCP Scope, and Section 4.6 of the Phase 1 RA CHASP.

- **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 navigable channels 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 NYSCC. For example, installation of the silt curtain in the east channel of Rogers Island will be coordinated with the NYSCC, public and mariner notification and signage will be utilized, and buffer zones will be established to allow safe passage of non-project-related traffic. Although access by non-project vessels to the Terminal Wall in Fort Edward via the east channel of Rogers Island will be restricted for safety reasons, the Final Design provides for two ½-hour periods each day – one between 7 am and 9 am, and another between 3 pm and 5 pm – in which local boat traffic will be allowed into and out of this area. This access, and the specific timing of the ½-hour window each day, will be at the sole discretion of the dredging contractor.
- **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 lock** – Use of Lock 7 on the Champlain Canal will be coordinated with the NYSCC 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.

- **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 NYSCC and USCG.

- **Routine notices –** The NYSCC 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 discussed in more detail in Sections 4.6.2 and 10.1.1.9 of the RA 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. A monthly navigation report will be submitted by GE to EPA and NYSCC, summarizing (in tabular format) navigation activities for the previous month, including daily records, as well as a log of navigation compliance and follow up actions. It will also identify any in-river project activities that may significantly affect navigation by commercial and recreational vessels and that were not previously identified.

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

4.5 Summary

As stated above in preceding parts of this section, Phase 1 of the remedial action has been designed to achieve the Hudson EPS, the WQ requirements, and (with the possible exception of the noise standard in two specific locations) the QoLPS. However, because each aspect of the design is based on modeling, assumptions, and best available information, actual monitoring will be needed during the Phase 1 test to determine the ability of the design to comply with the EPS and QoLPS. Moreover, as discussed in Section 3.11.3 of the Phase 1 IDR, there are interactions among the standards; certain aspects of compliance with the EPS could counteract efforts to comply with the QoLPS (or vice versa). For example (in addition to the examples given in the Phase 1 IDR), as discussed in Section 4.4.3 above, efforts to comply with the navigation standard by installing mooring dolphins and efforts to comply with the resuspension standard by installing sheet piling in the EGIA may impede the ability to achieve the noise standard for short periods of time.

Given these limitations and potential interactions, it is uncertain as to whether the project will be able to meet all the EPS and QoLPS simultaneously. During Phase 1, GE will conduct monitoring to determine whether the various performance standards are being met, and to what extent interactions among performance standards are causing conflicts and project disruptions or inefficiencies. During implementation of Phase 1, in the event that there is an exceedance of a performance standard, appropriate contingency actions will be implemented as set forth in the Phase 1 RA CHASP and other design documents, as well as the Phase 1 PSCP to be developed as part of the RA Work Plans. Such activities may include equipment repair, operational changes, equipment or process modifications, additions of equipment, or, in extreme cases, a temporary shutdown of certain operations – all depending on the circumstances.

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6. Acronyms

$\mu g/m^3$ = micrograms per cubic meter

AOC = Administrative Order on Consent

ARARs = applicable or relevant and appropriate requirements

BA = Biological Assessment

BACT = best achievable control technology

BBL = Blasland, Bouck & Lee, Inc.

BMP = Baseline Monitoring Program

BO = Biological Opinion

CARA = Cultural and Archaeological Resources Assessment

CD = Consent Decree

CDE = Critical Phase 1 Design Elements

CERCLA = Comprehensive Environmental Response, Compensation and Liability Act

cfs = cubic feet per second

CO = carbon monoxide

CPR = Canadian Pacific Railway

CPT = Cone Penetrometer Testing

CU = certification unit

cy = cubic yards

dBA = A-weighted decibels

DGPS = digital global positioning system

DO = Dissolved Oxygen

DoC = depth of contamination

DSR = *Data Summary Report*

E&E = Ecology and Environment, Inc.

EGIA = East Griffin Island Area

Energy Park = Energy Park/Longe/New York State Canal Corporation

EPA = United States Environmental Protection Agency

EPS = Engineering Performance Standards

FCI = Functional Capacity Index

FS = Feasibility Study

ft/s = feet per second

g/day = grams per day

g/m^2 = grams per square meter

GAC = granular-activated carbon

GE = General Electric Company

gpm = gallons per minute

H_2S = hydrogen sulfide

HD Report = *Habitat Delineation Report*

HDA = Habitat Delineation and Assessment

HDA Work Plan = *Habitat Delineation and Assessment Work Plan*

HDPE = high-density polyethylene

ISC = Industrial Source Complex

kg = kilogram

m = meter

mg/kg = milligrams per kilogram

MPA = mass per unit area

NAAQS = National Ambient Air Quality Standards

ng/L = nanograms per liter

NOAA = National Oceanic and Atmospheric Administration

NO_x = nitrogen oxides

NRHP = National Register of Historic Places

NTIP = Northern Thompson Island Pool

NYS = New York State

NYSCC = New York State Canal Corporation

NYSDEC = New York State Department of Environmental Conservation

O_3 = ozone

OM&M = Operation, Maintenance, and Monitoring

OSHA = Occupational Safety and Health Administration

PCBs = polychlorinated biphenyls

PDR = *Preliminary Design Report*

Phase 1 ARA Report = *Archaeological Resources Assessment Report for Phase 1 Dredge Areas*

Phase 1 DAD Report = *Phase 1 Dredge Area Delineation Report*

Phase 1 DSR = *Phase 1 Data Summary Report*

Phase 1 EMP = *Phase 1 Environmental Monitoring Plan*

Phase 1 FDR = *Phase 1 Final Design Report*

Phase 1 HA Report = *Habitat Assessment Report for Candidate Phase 1 Areas*

Phase 1 IDR = *Phase 1 Intermediate Design Report*

Phase 1 RA CHASP = *Phase 1 Remedial Action Community Health and Safety Plan*

Phase 1 RAM QAPP = *Phase 1 Intermediate Design Remedial Action Monitoring Quality Assurance Project Plan*

PM_{10} = particulate matter with a diameter less than 10 micrometers

$PM_{2.5}$ = particulate matter with a diameter less than 2.5 micrometers

ppm = part per million

processing facilities = sediment processing/transfer facilities

PSCP = *Performance Standards Compliance Plan*

psi = pounds per square inch

QA/QC = quality assurance/quality control

QEA = Quantitative Environmental Analysis, LLC

QoLPS = Quality of Life Performance Standards

R&D = receiving and departure

RA CHASP = *Remedial Action Community Health and Safety Plan*

RD AOC = Administrative Order on Consent for Hudson River Remedial Design and Cost Recovery

RD Work Plan = *Remedial Design Work Plan*

RIP = repair in place

RM = river mile

ROD = Record of Decision

RSSCTs = Rapid Small-Scale Column Tests

SAV = submerged aquatic vegetation

SEDC = Supplemental Engineering Data Collection

SEDC Work Plan = *Supplemental Engineering Data Collection Work Plan*

Sediment Sampling AOC = Administrative Order on Consent for Hudson River Sediment Sampling

SHAWP = *Supplemental Habitat Assessment Work Plan*

SHPO = State Historic Preservation Office

SO_2 = sulfur dioxide

SOW = Statement of Work

SSAP = Sediment Sampling and Analysis Program

TID = Thompson Island Dam

TOC = total organic carbon

TS Report = *Treatability Studies Report*

TS Work Plan = *Treatability Studies Work Plan*

TSCA = Toxic Substances Control Act

TSS = total suspended solids

URS = URS Corporation

USACE = United States Army Corps of Engineers

USCG = United States Coast Guard

USFWS = U.S. Fish and Wildlife Service

USGS = United States Geological Survey

VOC = volatile organic compound

Year 2 SEDC IDSR = *Year 2 SEDC Interim Data Summary Report*