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General Electric Company
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Phase 2
Intermediate Design Report

Hudson River PCBs Superfund Site

May 2008

ARCADIS

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Intermediate Design Report

Hudson River PCBs
Superfund Site

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Executive Summary

This Phase 2 Intermediate Design Report (Phase 2 IDR) presents the current state of design for Phase 2 of the Hudson River dredging project. The U.S. Environmental Protection Agency (EPA) issued a Superfund Record of Decision (ROD) on February 1, 2002 (EPA 2002) calling for the dredging and disposal of certain sediments from the Upper Hudson River containing polychlorinated biphenyls (PCBs). The ROD states that dredging will occur in two distinct phases. Phase 1 is defined as the first year of dredging and will be a test of the design and operation plans. Phase 1 dredge areas are located in River Section 1 and include 265,000 cubic yards (cy) of sediment targeted for removal. Phase 2 consists of the remainder of the dredging project, from river mile (RM) 193 (just upstream of Snook Kill) to the Federal Dam at Troy (RM 153.9).

The basis of design for Phase 2 has been developed with many of the same assumptions as the Phase 1 Design. Many of the plans presented in this Phase 2 IDR are consistent with those developed in the Phase 1 Final Design Report (Phase 1 FDR), which was approved by EPA on January 25, 2008. This report adapts the basis of design from Phase 1 to the conditions that are unique to Phase 2. During the Phase 1 operations, equipment and systems will be examined, production and processing rates will be assessed, and safety measures will be evaluated and enhanced, considering the data collected in accordance with the Phase 1 Remedial Action Work Plan for Dredging and Facility Operations (RAWP #3) and the Phase 1 Remedial Action Monitoring Quality Assurance Project Plan (Phase 1 RAM QAPP; both of which are currently being prepared and will be approved by EPA prior to Phase 1).

Under the Remedial Action Consent Decree for the Hudson River PCBs Superfund Site (RA CD; EPA/GE 2005), following the completion of Phase 1 and a subsequent peer review proceeding, EPA will notify GE of its decision regarding changes to the performance standards or scope of Phase 2. GE will then notify EPA as to whether GE will implement Phase 2 pursuant to the Consent Decree. At this point, the Phase 2 Design plans may be modified, particularly if there are changes to the performance standards or the scope of Phase 2.

This design document was prepared pursuant to the Administrative Order on Consent for Hudson River Remedial Design and Cost Recovery (RD AOC; EPA/GE 2003) and in accordance with the RA CD. GE's preparation and submittal of this report is not, and should not be interpreted as, an indication of whether GE will or will not elect to implement Phase 2 of the remedy. That determination will not be made until the time required by the Consent Decree.

Basis of the Design

The ROD provided an estimate of the amount of material to be dredged during Phase 2 from the Upper Hudson River, but recognized that additional data were required to determine locations where sediments met the criteria for dredging. The Phase 2 dredge areas are identified in the Phase 2 Dredge Area Delineation Report (Phase 2 DAD Report; QEA 2007a), which was approved by EPA on November 16, 2007.

GE is designing the remedy to address a number of specific requirements developed by EPA for this project. In addition to the specifications in the ROD, there are three other key sets of standards that guide the overall basis of design of the remedy. The Hudson River Engineering Performance Standards (Hudson EPS; EPA 2004a) specify the amounts of sediments targeted to be dredged and processed in each year of the project (productivity), limits for resuspension of PCBs and sediments during dredging (resuspension), and the targets for the concentration of PCBs remaining on the river bottom after dredging (residuals). The Hudson River Quality of Life Performance Standards (QoLPS; EPA 2004b) address potential community impacts caused by the remedy, including impacts on air quality, odor, noise, lighting and navigation. Substantive water quality requirements, which were developed by New York State and issued by EPA (EPA 2005), include limitations on releases of treated water and stormwater from the sediment processing facility (Processing Facility) and limits on concentrations of metals and other parameters allowed in the river during dredging. This report presents an analysis of the actions to be taken to meet these standards and requirements.

In addition to the requirements summarized above, the project is being developed based on findings generated from a variety of design support activities undertaken to document site conditions that affect the design. These activities included, but were not limited to, geotechnical characterization of sediments and sub-bottom (the river bed below the sediments to be dredged); assessing habitat and cultural and archaeological resources; debris and obstruction mapping; determining clearances for bridges, dams and other structures; assessing shoreline conditions; and evaluating the water velocity and depths in the Phase 2 areas.

Summary of the Phase 2 Intermediate Design

As in the Phase 1 Design, the plan is to remove the sediments in the Phase 2 areas with mechanical dredges and load the dredged material into barges. The barges, moved by tugs, will navigate through the Champlain Canal to the Processing Facility, located between Locks 7 and 8. The dredged material will be offloaded from the barges, mechanically classified (as debris, coarse and fine materials) and dewatered. The processed materials will be staged and then loaded into rail cars. The rail cars will be assembled into 81-car unit trains within the onsite rail yard and the materials containing PCBs will be transported to a licensed landfill in Andrews, Texas for disposal. Backfill (or caps, if required by the Residuals Performance Standard) will be placed and habitat constructed within the dredged areas.

The scope of the Phase 2 Design is summarized, as follows:

- The plan for Phase 2 assumes a 5-year duration. Based on the EPA Productivity Performance Standard, the minimum and target annual production rates are 319,000 and 340,000 cy, respectively. This design has been based on an annual sediment removal target of 340,000 cy.

- The first two full years of Phase 2 dredging are planned in River Section 1. Dredging of River Section 2 areas is planned in Year 3. In River Section 3, dredging is planned between the Northumberland and Stillwater Dams in Year 4 and the Stillwater and Federal Dams in Year 5.

- Dredging will begin in May and continue into October. Backfilling and some habitat construction activities will continue through mid-November. Habitat construction will continue in the following season. This seasonal schedule is dependent on weather conditions and the operating season for the Champlain Canal.

- To achieve EPA's Productivity Performance Standard, dredging and processing will occur 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 satisfy the Productivity Performance Standard.

- Mechanical dredges will be used for all dredging activities. Multiple dredges may be operating at any one time to complete the inventory and residuals dredging (as necessary, in areas where PCB residual targets are not met).

- Residual PCB concentrations will be evaluated within each of a number of certification units (CUs), which are identified in this report. Each CU is approximately 5 acres and there are a total of 82 CUs for Phase 2.

- Resuspension control has been specified, based on model results, in several small areas in River Section 1 and one area downstream of the Fort Miller Dam in River Section 2.

- Several barges and tug boats will be needed to transport dredged sediment and debris via the Champlain Canal to the Processing Facility and to carry backfill and capping materials to CUs after dredging.

- To limit other project-related traffic through Lock 7, the Work Support Marina (constructed for Phase 1) will be used for supporting and monitoring dredging operations in River Section 1. Dredged sediments will not be transported to or processed at this site. Commercial marinas will be considered as a support base for dredging operations in River Sections 2 and 3.

- The mooring posts to be installed downstream of Lock 7 during Phase 1 will be used in Phase 2. Additional mooring posts are proposed at RM 176.8.

- Approximately 670,000 cy of backfill or capping materials will be placed in the river after dredging. This volume includes a minimum of 1 foot of such material to be placed over the dredged areas and 97,000 cy of additional backfill for the creation of submerged aquatic vegetation (SAV) beds (Additional 15 Percent Backfill). In addition, approximately 68,000 cy of backfill material will be placed to restore grades necessary in certain areas for wetland restoration. Potential sources of backfill materials were identified in the Phase 1 Design documents. However, this source evaluation was specific to the Phase 1 scope. The capability of these sources to meet the material types and quantities for Phase 2 and routes of delivery will continue to be evaluated and finalized in the Remedial Action Work Plan (RAWP) for Phase 2 Dredging and Facility Operations (or addenda).

- Approximately 29 acres of wetlands will be restored and 26 acres of SAV will be planted. Natural colonization of an additional 52 acres of SAV will be monitored.

- Plans to set back from large trees located on the riverbanks have been proposed to protect shoreline habitats.

- The Processing Facility and rail yard construction and operation plans and specifications were approved by EPA as part of the Phase 1 FDR. These facilities are currently under construction and will be used for Phase 2. No expansion of these facilities or operational changes are expected for Phase 2.

West Griffin Island Area

The narrow channel to the west of Griffin Island presents several unique challenges. This channel encompasses 26 acres of shallow backwater. Nearly 85,000 cy of sediment have been delineated for removal in this channel. Dredging as deep as 3 feet is planned in some areas, but removal of less than 2 feet is planned for the majority of the channel. Access to this channel from the river is available only from the south where there is a narrow channel of open water. Generally, water is shallow in this channel during summer flow conditions. The upstream end of the channel is connected to the main stem of the river by a culvert, which affects flow in this channel. Runoff from lands to the west enters this channel via a culvert under West River Road. Based on the habitat delineation, the channel has 13.4 acres of water chestnut (an invasive species), 7.81 acres of backwater wetlands and 1.23 acres of riverine fringing wetlands. There is a small area of water chestnut that will not be dredged. This channel has also been identified as a spawning area for largemouth bass.

Because of these conditions, dredging in this channel is planned at a lower productivity rate and will be stretched over two seasons (the first 2 years of Phase 2). Resuspension/hydraulic controls have been proposed due to the sediment type and PCB concentrations, but the specific approach will be reviewed during Final Design after additional hydraulic information is collected.

The design includes invasive species control for this area. Because of the persistence of water chestnut in this area, planting of SAV is not recommended. However, the wetland areas where water chestnut is not currently present will be reconstructed and planted with native wetland vegetation. Coarse/gravely backfill, which is suitable for largemouth bass spawning and resists recolonization of water chestnut, will be placed in other areas. Type 2 backfill is being considered for this purpose; however, final determination of the backfill type for this area will be identified in the Phase 2 FDR.

Land-Locked Area

The area located between Thompson Island and Fort Miller Dams is referred to as the “land-locked area” (i.e., not directly accessible by water from the navigable channel of the Hudson River and Champlain Canal system). Approximately 108,000 cy of sediment has been targeted for removal from this area. Because the navigation channel is located in a land cut, adjacent to the river, equipment cannot access the land-locked area by water and dredged sediments cannot be barged directly to the Processing Facility. Therefore, a sediment transfer operation is proposed to move material from small barges in the land-locked area to other, larger barges staged in the land-cut section of the Champlain Canal.

From there, the barges will be pushed by tugs through Lock 7 to the Processing Facility. The transfer area is proposed to be located on a narrow strip of land to the south of Thompson Island Dam-East (near dredge area LL_05_NK). The barge containing dredged sediment will be docked on the west side of the transfer area and a receiving barge will be docked on the east side of the transfer area. Aids to navigation will be implemented in the canal to permit safe transit of recreational boaters and other vessels around this operation. Sediment will be transferred across the island with a crane-mounted clamshell bucket or mechanical conveyor system. The operations are expected to take one season (planned for Year 3 of Phase 2) at a reduced daily productivity.

Next Steps

There is more work planned to advance the Phase 2 Design, including: additional sample collection and analysis, information gathering, and discussions with EPA on certain details of this design. Since dredging in River Section 2 and River Section 3 is still several years in the future, engineering data collection, such as multi-beam bathymetry, will be scheduled accordingly.

After EPA approves this Phase 2 IDR and the additional information gathering is completed, the Phase 2 Final Design Report will be prepared and submitted for EPA review and approval.

1. Introduction

This Phase 2 Intermediate Design Report (Phase 2 IDR) has been prepared on behalf of the General Electric Company (GE) and presents the Intermediate Design for Phase 2 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 report 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). Additionally, this Phase 2 IDR has been prepared in accordance with the Remedial Design Work Plan (RD Work Plan; Blasland, Bouck & Lee, Inc. [BBL] 2003a), which is an attachment to the RD AOC, except for those items described in Section 1.5; and it builds upon GE's Preliminary Design Report (PDR; BBL 2004a). Finally, this report has been developed in accordance with the Remedial Action Consent Decree between GE and the United States (Civil Action No. 1:05-CV-1270) for the Hudson River PCBs Superfund Site (RA CD; EPA/GE 2005), entered on November 2, 2006, including the Statement of Work for Remedial Action and Operations, Maintenance and Monitoring (SOW; Appendix B to the RA CD) and the attachments thereto.

1.1 Project Setting

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

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

- **River Section 1:** Former location of 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).

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

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

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

The remedy selected by EPA is described in the ROD, and additional descriptions of the remedial action can be found in the RD Work Plan, the PDR and the RA CD, including its attachments.

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

- In River Section 1, removal of sediments based primarily on a mass-per-unit-area (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, removal of sediments based primarily on an MPA of 10 g/m^2 Tri+ PCBs or greater.

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

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

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 determined 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) and the RD AOC (EPA/GE 2003), have been performed in all three river sections. The data have been used to delineate dredge areas and volumes for Phase 2 dredging, as described in the revised Phase 2 Dredge Area Delineation Report (Phase 2 DAD Report; QEA 2007a), which was approved by EPA on November 16, 2007 (EPA 2007).

The ROD calls for the dredging to be undertaken in two distinct phases. The Final Design for Phase 1 of the project was described in the Phase 1 Final Design Report (Phase 1 FDR; BBL 2006a), which was approved by EPA on January 25, 2008 (EPA 2008), after resolution of EPA's comments and incorporation of numerous design addenda. The Phase 1 Design includes the following contract documents: Facility Site Work Construction (Contract 1), Rail Yard Construction (Contract 2), Processing Facility Construction (Contract 3A), Processing Facility Operations (Contract 3B), Dredging Operations (Contract 4), Habitat Construction (Contract 5) and Rail Yard Operations (Contract 6). Phase 1 dredge areas are located in River Section 1 and include 265,000 cubic yards (cy) of sediment targeted for removal. The Phase 1 FDR includes a 1-month period where the targeted sediment removal would be at a rate equal to the Phase 2 production rate anticipated at the time the Phase 1 FDR was developed (i.e., 89,000 cy per month), which exceeds the average monthly Phase 2 target presented in this design report. Phase 1 dredging has not been initiated.

EPA has developed performance standards for both the engineering aspects of the project and quality of life considerations. The Hudson River Engineering Performance Standards (EPS or 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 (QoLPS or Hudson QoLPS) address project-related impacts on air quality, odor, noise, lighting and river navigation for Phase 1 (EPA 2004b). In addition, EPA has issued substantive water quality requirements (WQ requirements), which include limitations on releases of treated water and stormwater from the sediment processing facility (Processing Facility) and limits on concentrations of metals and other parameters allowed in the river during dredging (EPA 2005).

The Hudson EPS, QoLPS and the WQ requirements (sometimes collectively referred to herein as performance standards) are discussed as elements of the basis of design presented in Section 2 of this Phase 2 IDR, although they are subject to change by EPA following the completion of Phase 1. Section 5 assesses the Phase 2 Design with respect to these performance standards.

Section 4 summarizes the process for evaluating results from Phase 1 and transitioning to Phase 2. In brief, GE and EPA will each prepare a Phase 1 Evaluation Report, which will include respective evaluations of the Phase 1 dredging operations with regard to the Phase 1 EPS. The evaluation reports will also set forth proposed changes to those EPS, and, in general, evaluate the experience gained from Phase 1 as relevant to certain key issues. A peer review will evaluate both Phase 1 Evaluation Reports and, at a minimum, address the issues raised by the following questions:

1. Does the experience in Phase 1 show that each of the Phase 1 EPS can consistently be met individually and simultaneously?

2. If not, and if EPA and/or GE has proposed modified EPS, does the experience in Phase 1 and any other evidence before the [peer review] panel show that it will be practicable to consistently and simultaneously meet the EPS that are being proposed for Phase 2?

3. If the experience in Phase 1 and other evidence before the [peer review] panel does not show that it will be practicable to consistently and simultaneously meet the EPS that are being proposed for Phase 2, can the Phase 1 EPS be modified so that they could consistently be met in Phase 2, and, if so, how?

4. If EPA and/or GE has proposed modifications to the monitoring and sampling program for Phase 2, are the proposed modifications adequate and practicable for determining whether the Phase 2 EPS will be met?

The RA CD provides that, following Phase 1, EPA will provide GE with an opportunity to discuss changes to the EPS, QoLPS, SOW and scope of Phase 2. It provides further that, after these discussions and the peer review, EPA and will notify GE of its decision regarding changes (if any) to the EPS, the QoLPS, the SOW and the scope of Phase 2. GE is then required to notify EPA as to whether GE will implement Phase 2 pursuant to the RA CD. In addition, if GE elects to implement Phase 2, GE and EPA will work together to attempt to identify and select a discrete area(s) where Phase 2 dredging could begin in the remainder of the year immediately following Phase 1, subject to certain conditions set forth in the RA CD. The remainder of that year is referred to in this Phase 2 IDR as the "Phase 2, Initial Short Year."

1.3 Remedial Design Objectives

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 remedy selected by EPA and defined in the ROD, consistent with the goal of achieving the performance standards. Activities to accomplish the remedial design objectives are described in the PDR and RD Work Plan and updated in this report, including the following:

- Develop remedial design deliverables to allow timely execution of the Phase 2 dredging programs (this Phase 2 IDR is a component of this ongoing activity).

- Collect and analyze data necessary to support the remedial design for the Upper Hudson River. This includes sediment sampling, geophysical investigations, bathymetric surveys and other tasks (this is an ongoing effort – see Sections 2.2.1 and 2.2.4).

- Develop engineering and design specifications to support EPA efforts in identifying and evaluating land-based sites that are necessary for project implementation including the processing facilities (this activity was completed as part of Phase 1 – see the Phase 1 Intermediate Design Report [Phase 1 IDR; BBL 2005a]).

- Design facilities to handle and process dredged sediment and prepare the sediment for transport and disposal (this Phase 2 IDR includes an evaluation of the capabilities of the Processing Facility being constructed as part of Phase 1 to process the sediment to be dredged as part of Phase 2 – see Section 3.3).

- 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 (this Phase 2 IDR has been developed with this objective as a basis of design – see Section 2.1.2.3).

- Develop engineering and design information to support the identification and selection of the areas where sediment will be removed during the Phase 2 dredging program (this activity is ongoing for Phase 2 – see Section 2.2).

- Delineate sediment to be removed from the Upper Hudson River consistent with the criteria in the ROD and the RD Work Plan (this activity is primarily complete for Phase 2 – see Section 2.3.1.1).

- Develop design documents for the Phase 1 and Phase 2 dredging programs with the goal of achieving the performance standards established by EPA (this Phase 2 IDR has been developed with this objective as a basis of design – see Section 2.1).

- 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 (development of a baseline monitoring program is ongoing and a remedial action monitoring program for Phase 1 is currently under review by EPA).

- 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 Facility to the disposal facility(ies); and 2) the backfill/cap material will be transported by rail and/or barge to the Upper Hudson River prior to placement in the river (this Phase 2 IDR describes the status of this ongoing activity).

The objectives of this Phase 2 IDR are consistent with those remedial design objectives that apply to Phase 2 of the project.

1.4 Completion of Phase 2 Design

This Phase 2 IDR presents the Intermediate Design for Phase 2, which includes dredging, sediment processing, transportation and offsite disposal of processed sediment and habitat construction. Phase 2 will be conducted in the following areas:

- The remainder of River Section 1 not addressed during Phase 1, which includes the southern portion of the Thompson Island Pool (TIP) from approximately 0.5 mile south of Lock 7 to TID and excluding the area of the river east of Griffin Island between RM 190.4 and RM 189.9 that was included in Phase 1.

- River Section 2 between TID and Northumberland Dam (i.e., the area from RM 188.5 to RM 183.4).

- River Section 3 between Northumberland Dam and the Federal Dam at Troy (i.e., the area from RM 183.4 to RM 153.9).

Following EPA approval of this Phase 2 IDR, the Phase 2 Final Design Report (Phase 2 FDR) will be prepared to include data and information that become available after the Phase 2 IDR is completed, and to address EPA comments regarding the Phase 2 IDR. The Phase 2 FDR will include the final Phase 2 Drawings and Specifications for dredging, backfilling/capping and habitat construction for River Section 1, and will integrate available data and information from design support activities, including the Phase 2 cultural and archaeological resources assessment (CARA), habitat assessment, dredge area delineation data gaps, and supplemental engineering data collection (SEDC) activities that are implemented between submittal of this Phase 2 IDR and development of the Phase 2 FDR.

Data collection and design support activities for River Sections 2 and 3 will be undertaken on a parallel schedule with the development of the Phase 2 Final Design for River Section 1. The objective of this approach is to ensure that data collected for River Sections 2 and 3 will be more current relative to the actual implementation of dredging for those two river sections. Following data collection and design support activities for River Sections 2 and 3, dredge prisms will be finalized and an addendum to the Phase 2 FDR will be issued to present the Final Design for River Sections 2 and 3, which will fully integrate the Phase 2 CARA, habitat assessment and SEDC activities for these river sections. Additional information related to the development of dredge prisms for River Sections 2 and 3 is presented in Sections 2.3.1.1 and 3.1.1. Furthermore, GE may, in accordance with the RD Work Plan (pp. 4-11), submit an addendum to the Phase 2 FDR to incorporate proposed design changes, based on the Phase 1 dredging experience and the peer review.

1.5 Phase 2 Intermediate Design Report – Exceptions to RD Work Plan

This Phase 2 IDR has been prepared in accordance with the RD Work Plan, with the exception of the following elements not provided in this Phase 2 IDR. The rationale for not including these elements is provided below.

- **Dredge Prisms – River Sections 2 and 3:** The RD Work Plan indicates that the Phase 2 IDR would include "Removal areas, depths and volumes for the relevant phase, utilizing the dredge areas from pertinent Dredge Area Delineation Report(s), as may be modified for practicability considerations to generate dredge prisms and cut lines (subject to further adjustments based on the results of the HDA and CARA activities during the Final Design phase)." To complete the dredge prisms, multi-beam sonar bathymetry needs to be collected in areas to be dredged. These data have been collected for all of River Section 1 (TIP), and this Phase 2 IDR contains detailed dredge prisms for River Section 1 (see Drawings D-2101 through D-2139 in Appendix 1). According to the dredge plan presented in this report, this represents the first 2 years of Phase 2 dredging. If bathymetric data were collected now (in 2008) for River Sections 2 and 3, it would be several years out of date by the time dredging actually begins in these areas. Therefore, bathymetric data will be collected in River Sections 2 and 3 during the year following Phase 1, enabling development of final dredge prisms for these river sections early in the first full year of Phase 2 dredging. As described in

Section 1.4, this information would be provided to EPA as an addendum to the Phase 2 FDR.

- **Environmental Monitoring Plan (EMP):** The RD Work Plan indicates that the Phase 2 IDR would include "An outline of the Environmental Monitoring Plan, including recommendations, if necessary, for testing of potential field monitoring techniques." The EMP, submitted with the Phase 1 FDR, has since been superseded by the Phase 1 Remedial Action Monitoring Quality Assurance Protection Plan (Phase 1 RAM QAPP; QEA 2006 [under review by EPA]), which is described in Section 2.3.2.1 of the SOW. The Data Quality Objectives (DQOs) may evolve during Phase 1 and as the project transitions from Phase 1 to Phase 2. The plan for sample collection, analysis and data handling should be informed by Phase 1 and updated for Phase 2. Therefore, it is proposed that a revised EMP will not be included in the Phase 2 Design reports. Instead, the Phase 1 RAM QAPP will be revised as part of the RAWP for the Phase 2, Initial Short Year (see Section 3.1.1.1 of the SOW), if submitted, and as part of the RAWPs for the remainder of Phase 2 (see Section 3.2.1.1 of the SOW).

- **Value Engineering (VE) Study:** The RD Work Plan indicates that "the Intermediate Design Report will include or be accompanied by a discussion of the results of the VE Study and any consequent recommendations for modifications to the design (to be incorporated into the Final Design)." The aspects of the design to be reviewed during the VE Study are listed in Section 3.2 of the RD Work Plan. Most of these aspects will be tested in Phase 1. Therefore, the VE Study will be deferred until Phase 1 has been completed, and may not be necessary. If this VE Study is ultimately completed, the results will be included in revisions or addenda to the Phase 2 Final Design documents.

1.6 Phase 2 Intermediate Design Report Organization

The Phase 2 IDR is organized into the sections shown in Table 1-1, below.

Table 1-1
Phase 2 IDR Organization

Section	Description
1 – Introduction	Summarizes the proposed remedial action selected by EPA, a description of the project setting, the purpose and scope of this Phase 2 IDR and completion of Phase 2 Design.
2 – Phase 2 Basis of Design and Supporting Information	Provides the basis of design for Phase 2. Also summarizes information from design support activities to document the project conditions and physical conditions under which the remedial action will occur.
3 – Phase 2 Project Description	Summarizes the overall dredging project, including transporting dredged material, resuspension controls, sediment and water processing, transportation and disposal of processed sediment, backfilling/capping and habitat construction.
4 – Phase 2 Construction and Implementation Schedule	Summarizes the projected schedule for Phase 2 of the remedial action.
5 – Phase 2 Monitoring and Compliance with Performance Standards	Presents an evaluation of the design for Phase 2 of the remedial action against the numerical criteria in the performance standards.
6 – References	Provides the references cited in this Phase 2 IDR.
7 – Acronyms and Abbreviations	Provides the definitions of acronyms that are used in this Phase 2 IDR.
Tables	Provides the tables referenced in this Phase 2 IDR.
Figures	Provides the figures referenced in this Phase 2 IDR.
Attachments	Provides the attachments referenced in this Phase 2 IDR.
Appendices	Provides the draft drawings and specifications referenced in this Phase 2 IDR.

Draft Drawings (Appendix 1) and Specifications (Appendix 2) are appended to this report for Phase 2 areas in River Section 1. The plans for backfill, capping and vegetation planting are shown in the figures (these plans will be converted to Drawings for River Section 1 in the Final Design). The specifications are provided as revisions to the approved Phase 1 specifications to highlight the changes proposed for Phase 2.

2. Phase 2 Basis of Design and Supporting Information

This section summarizes the basis of design for the Phase 2 IDR including the Phase 2 performance requirements, design support activities (e.g., engineering data) and a summary of the basis of design for the Phase 2 Design.

2.1 Phase 2 Performance Requirements

Performance requirements guide the design presented in this Phase 2 IDR and provide a foundation for the basis of design. The performance requirements discussed in this section are updated from or in addition to those presented in the Phase 1 FDR and include elements from the ROD, the Hudson EPS, QoLPS and water quality requirements (WQ requirements) for the Hudson River (EPA 2005) and stormwater discharge to Bond Creek (EPA 2006a).

2.1.1 Record of Decision Requirements

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

- Removal of sediments based primarily on a MPA of 3 g/m^2 Tri+ PCBs or greater from River Section 1
- Removal of sediments based primarily on an MPA of 10 g/m^2 Tri+ PCBs or greater from River Section 2
- Removal of selected sediments with high concentrations of PCBs and high erosional potential (NYSDEC Hot Spots 36, 37 and the southern portion of 39) from River Section 3
- Dredging of the navigation channel, as necessary, to implement the remedy and to avoid hindering canal traffic during implementation
- Removal of all PCB-containing sediments within areas targeted for remediation, with an anticipated residuals of approximately 1 milligram per kilogram (mg/kg) Tri+ PCBs (prior to backfilling)
- Design to achieve the EPS and QoLPS developed by EPA

- Performance of the dredging in two phases whereby remedial dredging will occur at a reduced rate during the first year of dredging (Phase 1), and Phase 2 will be the remainder of the dredging operation, which will be conducted at full-scale

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

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

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

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

In addition to these requirements, EPA's July 2004 decision in the dispute resolution proceeding on GE's initial Phase 1 DAD Report (EPA 2004c) specified sediment removal criteria based on surface sediment Tri+ PCB concentrations of 10 mg/kg in River Section 1 and 30 mg/kg in River Sections 2 and 3.

Further, in the ROD, EPA identified a number of federal and state environmental laws and regulations as Applicable or Relevant and Appropriate Requirements (ARARs) (see Tables 14-1 through 14-3 of the ROD; EPA 2002). These ARARs, which apply to onsite activities, fall into three broad categories – chemical-specific, location-specific and action-specific requirements) – based on the manner in which they are applied at a site. The Phase 1 IDR and FDR provided information on how potentially applicable regulatory requirements were incorporated into the Phase 1 Design. Similarly, Section 2.1.5 of this Phase 2 IDR describes how the substantive requirements of applicable statutory and regulatory provisions will be incorporated into the Phase 2 Intermediate Design.

2.1.2 Engineering Performance Standards

In 2003, EPA released the draft Hudson EPS. These EPS cover three aspects of the dredging: resuspension of sediments, post-dredging residuals PCB levels and productivity for the remedy (EPA 2003). A peer review panel evaluated the draft EPS, and in 2004 the final EPS for Phase 1 of the remedial action were issued in a five-volume report (EPA 2004a).

Because Phase 1 has not been implemented as of the date of this Phase 2 IDR, the final EPS were used as a basis for developing the Phase 2 Intermediate Design. Following Phase 1 dredging, EPA and GE will each produce Phase 1 Evaluation Reports to propose changes to Phase 2 Design (see the RA CD Paragraph 13.b). EPA may modify the final EPS for Phase 2, based on information gathered during Phase 1. Specific activities that will be undertaken to address the Hudson EPS during Phase 1 will be described in the Phase 1 RAM QAPP and Phase 1 Performance Standards Compliance Plan (PSCP), which are currently being developed in accordance with the SOW and its attachments.

Summaries of the Hudson EPS as they apply to the Phase 2 Design are discussed in the following sections.

2.1.2.1 Project-Related Resuspension

The Resuspension Performance Standard provides a basis of design for dredging, backfilling, capping and resuspension controls. This standard specifies three action levels – Evaluation, Control and Standard. Action levels set for Phase 1 activities apply to PCBs and/or total suspended solids (TSS) in surface water at either near-field stations (located within 300 meters of the dredging activities) or far-field stations (located more than 1 mile downstream of dredging activities). As described below, these action levels will be used to trigger additional monitoring or contingency actions.

Evaluation Level

Under the EPS (EPA 2004a, Volume 2, Section 4.1.1, pp. 87-92), the Evaluation Level would be exceeded if any of the following conditions occur:

- “The net increase in Total PCB mass transport due to dredging-related activities at any downstream far-field monitoring station exceeds 300 g/day for a seven-day running average.”

- “The net increase in Tri+ PCB mass transport due to dredging-related activities at any downstream far-field monitoring station exceeds 100 g/day for a seven-day running average.”

- “The sustained suspended solids concentration above ambient conditions at a far-field station exceeds 12 mg/L. To exceed this criterion, this condition must exist on average for 6 hours or a period corresponding to the daily dredging period (whichever is shorter). Suspended solids are measured continuously by turbidity (or an alternate surrogate) or every 3 hours by discrete samples."

- "The sustained suspended solids concentration above ambient conditions at a location 300 m downstream (i.e., near-field monitoring) of the dredging operation or 150 m downstream from any suspended solids control measure (e.g., silt curtain) exceeds 100 mg/L for River Sections 1 and 3 and 60 mg/L for River Section 2. To exceed this criterion, this condition must exist on average for 6 hours or for the daily dredging period (whichever is shorter). Suspended solids are measured continuously by surrogate or every 3 hours by discrete samples."

- "The sustained suspended solids concentration above ambient conditions at the near-field side channel station or the 100 m downstream station exceeds 700 mg/L. To exceed this criterion, this condition must exist for more than 3 hours on average measured continuously or a confirmed occurrence of a concentration greater than 700 mg/L when suspended solids are measured every 3 hours by discrete samples."

Control Level

Under the EPS (EPA 2004a, Volume 2, Section 4.1.2, pp. 93-95), the Control Level would be exceeded if any of the following conditions occur:

- "The Total PCB concentration during dredging-related activities at any downstream far-field monitoring station exceeds 350 ng/L for a seven-day running average."

- "The net increase in Total PCB mass transport due to dredging-related activities at any downstream far-field monitoring station exceeds 600 g/day on average over a seven-day period." (The EPS document notes that this daily load criterion "is equivalent to 650 kg load over the entire remediation and 65 kg/yr in Phase 1 assuming half the targeted production rate will be achieved" [EPA 2004a, Volume 2, p. 57]).

- "The net increase in Tri+ PCB mass transport due to dredging-related activities at any downstream far-field monitoring station exceeds 200 g/day on average over a seven-day period."

- "The sustained suspended solids concentration above ambient conditions at a far-field station exceeds 24 mg/L. To exceed this criterion, this condition must exist for a period corresponding to the daily dredging period (6 hours or longer) or 24 hours if the operation runs continuously (whichever is shorter) on average. Suspended solids are measured continuously by surrogate or every 3 hours by discrete samples."

- "The sustained suspended solids concentration above ambient conditions at a location 300 meters downstream (i.e., near-field monitoring) of the dredging operation or 150 meters downstream from any suspended solids control measure (e.g., silt curtain) exceeds 100 mg/L for River Sections 1 and 3 and 60 mg/L for River Section 2. To exceed this criterion, this condition must exist for a period corresponding to the daily dredging period (6 hours or longer) or 24 hours if the operation runs continuously (whichever is shorter) on average. Suspended solids are measured continuously by surrogate or every 3 hours by discrete samples."

- "The net increase in PCB mass transport due to dredging-related activities measured at the downstream far-field monitoring stations exceeds 65 kg/year Total PCBs or 22 kg/year Tri+ PCBs."

Standard Level

Under the EPS (EPA 2004a, Volume 2, Section 4.1.3, p. 98), the Standard Level is "a confirmed occurrence of 500 ng/L Total PCBs, measured at any main stem far-field station. To exceed the standard threshold, an initial result greater than or equal to 500 ng/L Total PCBs must be confirmed by the average concentration of four samples collected within 48 hours of the first sample. The standard threshold does not apply to far-field station measurements if the station is within 1 mile of the remediation."

Adjustments of PCB Load Criteria

The Resuspension Performance Standard (EPA 2004a, Volume 2, Section 4.1.2.7, pp. 97-98) also specifies that adjustments can be made to the allowable mass loss of PCBs as expressed by load at the far-field station based on the results of the following:

- "The production rate will be reviewed on a weekly basis. The allowable Total PCB load loss for the season will be adjusted if this target rate is not met…."

- "The allowable seven-day Total PCB load loss thresholds will be revised if the production rate varies from the anticipated value or the operation schedule differs from that assumed for this report. The revision is to be calculated once per dredge season (i.e., the 7-day running average criterion is set once per season)."

The Performance Standards Compliance Plan Scope (PSCP Scope), which is Attachment C to the SOW, indicates that EPA will review the total project PCB mass loss (currently set at 650 kg, as described above) after the dredge area delineation for Phase 2 is complete, and, if appropriate, will increase or decrease this total allowable project mass proportionally to the difference between the final and ROD estimates of total project mass targeted for removal. As summarized in the approved Phase 2 DAD Report (QEA 2007a), the Total PCB mass targeted for the project has been revised from 70,000 kg to 113,100 kg. Accordingly, the total allowable project mass loss could be proportionally increased to 1,050 kg.

Special Studies to Support the Resuspension Standard

GE has conducted or will conduct several special studies related to PCB resuspension and monitoring (specified in the Resuspension EPS and the PSCP Scope), which provide or will provide additional information to support the Phase 2 Design. These special studies are summarized below:

- Development of a semi-quantitative relationship between TSS and a surrogate real-time measurement for the near- and far-field stations (bench-scale and full-scale)
- Alternate Phase 2 Monitoring Plan – a special study to evaluate the feasibility of using automated samplers for the Near- and Far-Field Monitoring programs during Phase 1 (QEA 2008a)
- Near-Field PCB Release Mechanism Study (dissolved vs. particulate)
- Non-Target, Downstream Area Contamination Study

The bench-scale special study to develop a semi-quantitative relationship between TSS and a surrogate parameter has been completed. The results of this study are presented in the Phase 1 RAM QAPP and include a relationship between suspended solids concentrations and real-time turbidity measurements. This information will be used as a starting point during Phase 1 for assessing compliance with the near- and far-field suspended solids criteria specified in the Hudson EPS. This relationship will be updated as appropriate based on data collected during a full-scale special study conducted during Phase 1 in accordance with the Phase 1 RAM QAPP.

Additionally, GE has performed a special study to evaluate the feasibility of using automated samplers to conduct portions of the monitoring program. Essentially, this special study was the program described in the Hudson EPS for the Alternate Phase 2 Monitoring Plan; however, it was accelerated to facilitate the use of automated sampling equipment during Phase 1. The results of this study, presented in the Far-Field and Near-Field Pilot Study Data Summary Report (QEA 2008b), are the basis for the design of the water monitoring program specified in the Phase 1 RAM QAPP.

The remaining special studies (Near-Field PCB Release Mechanism and Non-Target, Downstream Area Contamination) will be performed during Phase 1 in accordance with the procedures specified in the Phase 1 RAM QAPP. The results of these special studies will be evaluated to confirm sediment resuspension and transport predictions that were developed during the Phase 1 Design, and will also be compared to the results of the modeling performed for the Phase 2 Design. If the results of these special studies (in conjunction with other monitoring performed to assess compliance with the EPS) suggest that sediment resuspension and downstream transport vary significantly from predicted levels, the Phase 2 modeling will be updated as appropriate, and the resuspension controls specified in the Phase 2 Design will be modified accordingly.

In the design analysis for the resuspension control element presented in Section 3.2, the concentration and flux predicted at the far-field station are compared with the Evaluation, Control and Standard action levels. The near-field suspended solids and far-field suspended solids action levels presented in the EPS (and summarized above) may be adjusted, based on the relationship observed during Phase 1 between suspended solids and PCBs (EPA 2004a, Volume 1, p. 94). The elements that form the basis of design for resuspension control and the results of the resuspension design analysis are discussed further in Sections 2.3.2 and 3.2, respectively. The design analyses performed to date to assess achievement of the numerical criteria in the Resuspension Performance Standard, together with the activities included in the design to date to meet that standard, are summarized in Section 5.2.1.

2.1.2.2 Dredging Residuals

The Residuals Performance Standard provides a basis of design for additional dredging after the inventory sediments have been removed (termed residuals dredging) as well as for backfilling and capping. This standard describes action levels for Tri+ PCBs as the trigger for additional dredging and the post-removal conditions when backfill and caps can be placed. The action levels will be applied on a Certification Unit (CU) basis. CUs are described in Section 3.1, and are identified on Drawings D-2101 through D-2139 included in Appendix 1 and on Figures DA-01 through DA-39. The action levels in the Residuals Performance Standard are summarized in Table 2-1 below.

Table 2-1
Summary of the Performance Standard for Dredging Residuals

Case	Certification Unit Arithmetic Average (mg/kg Tri+ PCBs)	Number of Sample Results ≥ 15 mg/kg Tri+ PCBs and < 27 mg/kg Tri+ PCBs	Number of Sample Results ≥ 27 mg/kg Tri+ PCBs	Number of Dredging Attempts Conducted	Required Action (when all conditions are met) *
A	Avg. ≤ 1	≤ 1	0	N/A	Backfill CU (where appropriate); no testing of backfill required.
B	N/A	≥ 2	N/A	< 2	Re-dredge sampling nodes and re-sample.
C	N/A	N/A	1 or more	< 2	Re-dredge sampling node(s) and re-sample.
D	1 < avg. ≤ 3	≤ 1	0	N/A	Evaluate 20-acre area-weighted average concentration ≤ 1 mg/kg Tri+ PCBs, place and sample backfill. **If 20-acre area-weighted average concentration > 1 mg/kg, follow actions for Case E below.
E	3 < avg. ≤ 6	≤ 1	0	< 2	Construct sub-aqueous cap immediately OR re-dredge. Construct cap so that arithmetic avg. of uncapped nodes is ≤ 1 mg/kg Tri+ PCBs, no nodes > 27 mg/kg Tri+ PCBs, and not more than one node > 15 mg/kg Tri+ PCBs.

Case	Certification Unit Arithmetic Average (mg/kg Tri+ PCBs)	Number of Sample Results ≥ 15 mg/kg Tri+ PCBs and < 27 mg/kg Tri+ PCBs	Number of Sample Results ≥ 27 mg/kg Tri+ PCBs	Number of Dredging Attempts Conducted	Required Action (when all conditions are met) *
F	avg. > 6	N/A	N/A	0	Collect additional sediment samples to re-characterize vertical extent of contamination and re-dredge. If CU median > 6 mg/kg Tri+ PCBs, entire CU must be sampled for vertical extent. If CU median ≤ 6 mg/kg Tri+ PCBs, additional sampling required only in portions of CU contributing to elevated mean concentration.
G	avg. > 6	N/A	N/A	1	Re-dredge. ***
H	avg. > 1 (20-acre avg. > 1)	≥ 2	≥ 1	2	Construct sub-aqueous cap (if any of these arithmetic average/sample result conditions are true) as described in Case E and two re-dredging attempts have been conducted OR choose to continue to re-dredge.

Notes:

Source: PSCP Scope (Attachment C to the SOW)

* Except for Case H, where any of the listed conditions will require cap construction.

** Following placement of backfill, sampling of 0- to 6-inch backfill surface must demonstrate average concentration ≤ 0.25 mg/kg Tri+ PCBs. If backfill surface average concentrations ≥ 0.25 mg/kg, backfill must be dredged and replaced or otherwise remediated with input from EPA.

*** Isolation Cap Type B will not be installed without receiving EPA approval to cease redredging attempts, except for CUs where the average concentration in the CU is less than 6 mg/kg Tri+ PCBs and the only non-compliant areas are due to exceedances of the prediction limits.

The activities to be performed to meet the Residuals Performance Standard are summarized in Section 5.2.2.

2.1.2.3 Dredging Productivity

The Productivity Performance Standard provides a basis of design for the dredging, dredged material transport, sediment processing, transportation and disposal elements of the remedial design. This standard specifies annual minimum and target volumes of sediment (inventory sediment volumes, excluding residuals dredging volumes) to be removed, processed and shipped offsite during Phase 1 and 2 activities (EPA 2004a, Volume 4, p. 27). The total volume assumed in the EPS was 2.65 million cy, which was used to calculate the annual productivity objectives for both Phases 1 and 2 of the project. However, as recognized in the EPS, it was expected that this estimate would be revised during remedial design based on additional sampling data and the resulting dredge area delineation. A provision was built into the Productivity Performance Standard (EPA 2004a, Volume 4, Section 1.2) to allow for changes in the annual productivity objectives if the sediment removal volume differs from the EPA estimate by 10 percent or more.

The revised volume of sediment targeted for removal during both Phase 1 and Phase 2 is 1,795,000 cy, as presented in the Phase 2 DAD Report. Even with an allowance for dredge prism engineering considerations, the revised removal volume for the overall project differs from the EPS estimate by more than 10 percent. Consequently, the Phase 2 production rates have been re-calculated using the formulae from Section 4.2 of the PSCP Scope. These calculations yield a minimum annual removal volume of 319,000 cy and target annual removal volumes of 340,000 cy for the first 4 years of Phase 2 and 170,000 cy for the fifth year. The calculated Productivity Performance Standard minimum and target cumulative volumes for the project are summarized in Table 2-2 below.

Table 2-2
Minimum and Target Volumes Based on the Productivity Performance Standard

Dredge season	Minimum Cumulative Volume (cy)	Target Cumulative Volume (cy) [1]
Phase 1	200,000	265,000
Phase 2, Year 1	519,000	605,000
Phase 2, Year 2	838,000	945,000
Phase 2, Year 3	1,157,000	1,285,000
Phase 2, Year 4	1,476,000	1,625,000
Phase 2, Year 5	1,795,000	1,795,000

Note:

1. Target annual production volumes are subject to annual adjustment based on production achieved in prior years. These volumes may be adjusted if removal occurs in the Phase 2, Initial Short Year.

Figures 2-1, 2-2 and 2-3 show the approximate Phase 2 areas currently targeted to be dredged each year over the five Phase 2 construction seasons for River Sections 1, 2 and 3, respectively. The breakout by year is based on the Target Annual Production Volume for Phase 2, Years 1 through 4 (340,000 cy/year) and Phase 2, Year 5 (170,000 cy) and has been adjusted based on physical markers (i.e., dams) along the river.

Monitoring and contingency actions (if productivity monitoring indicates that productivity is behind schedule) will be described in the Phase 2 PSCP that will be submitted following completion of Phase 1 and prior to implementation of Phase 2.

The design analyses performed to date to assess achievement of the Productivity Performance Standard, as well as the factors affecting achievement of that standard, are summarized in Section 5.2.3.

2.1.3 Quality of Life Performance Standards

In May 2004, EPA issued QoLPS, which address air quality, odor, noise, lighting and river navigation during implementation of the remedial action (EPA 2004b). These standards provide a basis of design for all design elements except offsite transportation and disposal.

2.1.3.1 Air Quality Performance Standard

The standards for Total PCB concentrations in ambient air are 24-hour average concentrations of 0.11 microgram per cubic meter (μg/m^3) in residential areas and 0.26 μg/m^3 in commercial/industrial areas, with "Concern Levels" at 80 percent of those values (0.08 μg/m^3 in residential areas and 0.21 μg/m^3 in commercial/industrial areas; EPA 2004b). The Phase 2 Design will be developed to prevent or mitigate unacceptable emissions of PCBs. To assess attainment of the air quality PCB standard, air quality modeling has been conducted for project activities that could produce PCB emissions to the air. The results of the air modeling are summarized in Section 5.3.1, along with a description of preventive and contingency measures included in the design to meet the PCB Air Performance Standard.

The Air Performance Standard for opacity, based on New York State regulations (6 NYCRR 211.3), is that opacity during project operations must be less than 20 percent as a 6-minute average, except that there can be one 6-minute period per hour of not more than 57 percent (EPA 2004b). The actions to be taken to meet the QoLPS for opacity are summarized in Section 5.3.1.

In addition, the Air Performance Standard requires a modeling assessment, during design, of the project's ability to achieve the National Ambient Air Quality Standards (NAAQS) for several pollutants subject to those standards (known as "criteria pollutants"). The pollutants for which such an assessment is 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]).

The modeling assessment was conducted for Phase 1, addressing the above-listed criteria pollutants. (see Phase 1 FDR, BBL 2006a, Attachment I). The modeling was conducted for emissions of these pollutants (as relevant) from the dredging operations and operation of the Processing Facility. The results of this modeling confirmed that the emissions of the criteria pollutants are not predicted to cause exceedances of the NAAQS. These results also apply to Phase 2, since the operations (including equipment to be employed) during Phase 2 are expected to be similar to those used in Phase 1. As a result, no provisions for monitoring or contingency actions for the criteria pollutants are necessary during implementation of this project.

2.1.3.2 Odor Performance Standard

The QoLPS for odor has two components. The first is a standard for hydrogen sulfide (H_2S) of 14 μg/m^3 (0.01 ppm), expressed as a 1-hour average, which applies if an odor identified as H_2S is detected by workers or the public. The second component is that odor complaints will be investigated and mitigated, as appropriate (EPA 2004b). The Odor Performance Standard has been incorporated into the Intermediate Design for Phase 2. The actions to be performed to meet the QoLPS for odor are summarized in Section 5.3.2.

2.1.3.3 Noise Performance Standard

The QoLPS for noise are summarized in Tables 2-3 and 2-4 below.

Table 2-3
Summary of Noise Performance Standards - Short-term Criteria (applicable to facility construction, dredging and backfilling)

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

Table 2-4
Summary of Noise Performance Standards - Long-term Criteria (applicable to the Processing Facility and transfer operations)

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

The control levels and standards listed above have been incorporated into the basis of design for Phase 2. The design analyses performed to date to assess achievement of the numerical criteria in the Noise Performance Standard are summarized in Section 5.3.3.

2.1.3.4 Lighting Performance Standard

The numerical lighting standards for light emissions attributable to the project are as follows (EPA 2004b):

- Rural and suburban residential areas: 0.2 footcandle
- Urban residential areas: 0.5 footcandle
- Commercial/Industrial areas: 1 footcandle

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

The standards listed above have been incorporated into the basis of design for Phase 2. The design analyses performed to date to assess achievement of the numerical criteria in the Lighting Performance Standard, together with the activities included in the design to date to meet that standard, are summarized in Section 5.3.4.

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

- 33 Code of Federal Regulations (CFR) § 154.570, which requires adequate fixed lighting for bulk transfer facilities at nighttime and states that lighting will be located or shielded so as not to mislead or otherwise interfere with navigation

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

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

2.1.3.5 Navigation Performance Standard

The Navigation Performance Standard (EPA 2004a) was modified in the PSCP Scope (Attachment C to the SOW) to be consistent with the revisions to the navigational regulations of the New York State Canal Corporation (NYS Canal Corporation; 21 NYCRR Part 151), which were identified after release of the QoLPS. The following requirements are identified in the PSCP Scope to satisfy the Navigation Performance Standard requirements:

- **Obstructions:** To the extent practical consistent with meeting the goals of the project and complying with the other performance standards, comply with 33 USC Ch. 9 § 409, which prohibits tying up or anchoring vessels or other craft in navigable channels in such a manner as to prevent or obstruct the passage of other vessels or craft.

- **Lighting on vessels:** Comply with the following requirements relating to the type, size, location, color and use of lighting on all ships:

  - 33 CFR §§ 84-88, Annex I – requirements for positioning and spacing of lights; location of direction-indicating lights for dredges; and screens, color, shape and intensity of lights

  - 33 CFR §§ 84-88, Annex V – additional requirements for lighting of moored barges and dredge pipelines

  - NYS Canal Corporation regulations at 21 NYCRR 151.11 – lighting requirements for moored floats

- **Signals on vessels:** Comply with the following requirements relating to the type, intensity and use of lighting and sound for signaling on all ships:

  - 33 CFR § 86, Annex III – requirements for technical details of sound signals

  - 33 CFR § 87, Annex IV – requirements for distress signals

  - NYS Canal Corporation regulations at 21 NYCRR 151.6 (draft marking on floats), 151.15 (buoys and lights displaced), 151.23 (warning signals approaching bends) and 151.26 (aids to navigation)

- **Piloting:** Comply with the following requirements regarding the piloting and movement of vessels:

  - 33 CFR § 88, Annex V – requirements for public safety activities, obtaining copies of rules and law enforcement vessels

  - NYS Canal Corporation regulations at 21 NYCRR 151.7, 151.8, 151.9, 151.17, 151.18, 151.19, 151.20, 151.21 and 151.24 – piloting requirements

In addition to the above, the Navigation Performance Standard requires the following:

- **Restricting access:** Restrict access to work areas undergoing remediation where necessary in coordination with the New York State Canal Corporation. Where access is restricted, take necessary steps, to the extent practical, to provide an adequate buffer zone for safe passage of commercial and recreational vessels in the navigation channel. In any event, channel encroachment requirements will be established in consultation with the NYS Canal Corporation.

- **Scheduling activities and use of locks:** Control and schedule project-related river traffic so that interference with non-project-related vessels is not unnecessarily hindered, while at the same time allowing efficient performance of the project. Where locks are used, remedial operations shall be coordinated with the NYS Canal Corporation and its lock operators. Project-related vessels shall be considered commercial vessels for purposes of navigation.

- **Temporary aids to navigation:** Temporary aids to navigation (e.g., lighting, signs, buoys) in areas of active work may be necessary and will consist of items specified by the NYS Canal Corporation or U.S. Coast Guard (USCG).

The Navigation Performance Standard includes two action levels – Concern and Exceedance Levels, as described below.

- The Concern Level occurs if there is a deviation from the requirements described above and the deviation can be easily mitigated, or if a project-related navigation complaint is received from the public.

- The Exceedance Level occurs if remedial activities unnecessarily hinder overall non-project related vessel movement and create project-related navigation interferences or if there are frequent recurrent complaints from the public that project activities are unnecessarily hindering non-project vessel movement.

Actions included in the Phase 2 Design to meet the Navigation Performance Standard are summarized in Section 5.3.5.

2.1.3.6 Monitoring and Reporting

Routine monitoring, reporting requirements, and action levels for additional monitoring under the QoLPS for air quality, odor, noise and lighting will be summarized in a Phase 2 RAM QAPP to be prepared prior to implementation of Phase 2. Specific actions that will be taken to address the QoLPS will be discussed in the Phase 2 PSCP to be prepared prior to implementation of Phase 2.

2.1.4 Water Quality Requirements

In addition to the EPS and QoLPS, EPA has issued certain water quality (WQ) requirements developed by the NYSDEC. WQ requirements contain numerical standards, limitations and monitoring requirements for: 1) in-water releases of constituents not subject to the EPS, as set forth in Substantive Requirements Applicable to Releases of Constituents not Subject to Performance Standards (notably, metals and physical parameters); 2) substantive requirements for discharges to the Hudson River and Champlain Canal, as set forth in Substantive Requirements of State Pollutant Discharge Elimination System (SPDES) Permit for Potential Discharges to Champlain Canal (land cut above Lock 7); and 3) Substantive Requirements of State Pollutant Discharge Elimination System Permit for Potential Discharges to the Hudson River. These three sets of requirements are contained in a single document (EPA 2005) in the form of a letter to GE with enclosures that EPA issued on January 7, 2005 and their requirements were included in the PSCP Scope (Attachment C to the SOW).

In addition, EPA issued Substantive Requirements of State Pollutant Discharge Elimination System Permit for Potential Discharges to Bond Creek along with comments on the Phase 1 FDR. A copy of these requirements is included in Attachment A. The actions to be taken in Phase 2 to meet the WQ requirements are summarized in Section 5.4.

2.1.5 Permit Equivalency

The remedy for the Upper Hudson River is being performed pursuant to CERCLA. As a result, no federal, state, or local permit is required for work being performed “onsite” [42 under 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 “onsite,” 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 (RA CD, Paragraph 8.a). For purposes of this permit exemption, onsite activities include the following: 1) all on-river operations, including dredging, sediment transport, backfilling/capping, monitoring and habitat construction; and 2) all near-river operations, including any modifications to and operation of the Work Support Marina in the Town of Moreau for supporting dredging and river monitoring operations, and the Processing Facility in the Town and Village of Fort Edward for barge unloading, sediment processing, and the rail yard operations, as well as any additional development needed for operations of these facilities. These land-based facilities are currently under construction, as they are needed to support the Phase 1 operations. Additional related facilities that are considered “onsite” include land-based backfill loading facilities, the land-based facility that is proposed for transferring dredged sediment from the land-locked area (i.e., not directly accessible by water from the navigable channel of the Hudson River and Champlain Canal system), as described in Section 3.7.2, and any mooring or dock facilities proposed in this and future submittals. 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 project design documents from the use of that term for purposes of the onsite permit exemption.

Due to this onsite permit exemption, 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) for activities conducted onsite (as described above).

Notwithstanding the permit exemption, remedial action under CERCLA must comply with the substantive requirements of federal and state 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 and state laws is also referred to as “permit equivalency.”

In addition, certain activities being conducted as part of the remedial design, such as the Habitat Delineation and Assessment (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), the Hudson QoLPS (EPA 2004b) and the substantive WQ requirements (EPA 2005 and Attachment A). 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 the EPS, QoLPS, or substantive WQ requirements will satisfy the relevant substantive requirements of federal or state laws and regulations that those standards/requirements 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) and Phase 1 FDR (Section 2.2.7) described, in narrative form, how the substantive requirements of applicable statutory and regulatory provisions would be incorporated into the design. To the extent identified, those substantive requirements have been considered in the draft Phase 2 Specifications and Drawings. 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 the Phase 2 Facility Demobilization and Restoration Plan, to be provided in accordance with the SOW.

Offsite activities will remain subject to all applicable statutory and regulatory requirements, including permit 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. Similarly, the transport and disposal of the dredged and processed sediments will be conducted in accordance with the applicable requirements of EPA's regulations under the Toxic Substances Control Act (TSCA).

2.2 Summary of Phase 2 Design Support Activities

This section summarizes design support activities (e.g., design studies, design analyses, modeling) that were conducted to support the Phase 2 remedial design. Certain design support activities were performed to support the Phase 1 remedial design and are also relevant to the Phase 2 Design. The results of design support activities that were implemented during the Phase 1 Design are presented in the Phase 1 IDR and FDR, and therefore are not repeated in this document.

While certain design support activities for Phase 2 are complete, some are ongoing or dependent upon the outcome of Phase 1 activities. This section summarizes the Phase 2 Design support activities and references appropriate reports or attachments where additional details and results are provided.

2.2.1 Sediment Sampling and Analysis Program and Dredge Area Delineation

The Sediment Sampling and Analysis Program (SSAP) was initiated in October 2002, pursuant to the Sediment Sampling AOC (EPA/GE 2002). The objective of the SSAP was to provide sediment data for the design of the site remedy set forth in the ROD. Additional sediment sampling for dredge area delineation was performed under the RD AOC. These data were used to delineate the aerial extent and depth of sediments to be removed and provide measurements of certain chemical and physical properties in those sediments. The SSAP results and related geophysical survey data have also been used to develop information for determining the potential presence of cultural resources.

The results of the sampling activities were used in development of the Phase 2 DAD Report, and the physical and chemical characteristics of the river sediment identified in the SSAP and SEDC Programs will be used in the Phase 2 Design. The results of the sampling activities performed under the SSAP are included in a database provided to EPA with the Phase 1 DAD Report and Phase 2 DAD Report (QEA 2005a), and are updated as additional data become available.

The Phase 2 DAD Report identified the Phase 2 dredge areas and quantified the volume and PCB mass to be targeted for removal. The delineation was based on criteria set by EPA for each river section. Table 2-5 summarizes the sediment volume, sediment area and PCB mass targeted for removal in each river section for both Phase 1 and Phase 2.

Table 2-5
Sediment Volume, Area and PCB Mass Targeted for Removal

River Section	Volume (cy)	Area (acres)	Mass of PCBs (kg)
River Section 1 - Phase 1	265,000	90	20,300
River Section 1 - Phase 2	675,000	218	40,300
River Section 1 - Total	*940,000*	*308*	*60,600*
River Section 2	344,000	84	28,500
River Section 3	511,000	98	24,000
Phase 2 Total	**1,530,000**	**400**	**92,800**
Project Total	**1,795,000**	**490**	**113,100**

Notes:

Source: Phase 1 DAD Report (QEA 2005a) and Phase 2 DAD Report (QEA 2007).

1. Quantities are approximate and based on the Phase 1 and Phase 2 DAD Reports. The Phase 1 FDR assumed that 94 acres would be dredged in Phase 1 to reach the productivity goal; however, the actual amount dredged in Phase 1 will be determined during the Phase 1 remedial action. Areas in the Phase 1 FDR scope, but not dredged in Phase 1, will be dredged in Phase 2.

The Phase 2 DAD Report identified a relatively small number of data gaps for additional sediment sampling or probing. As described in the approved Phase 2 DAD Report, additional sampling to address these data gaps will be conducted for River Sections 1, 2 and 3. The results of this additional sampling will be incorporated into the Phase 2 FDR and subsequent addenda.

2.2.2 Processing Facility Site Selection

EPA conducted a study to select the site for construction of the Processing Facility and associated waterfront and rail support facilities (EPA 2004d). An approximate 110-acre parcel just east of the Village of Fort Edward and adjacent to the Champlain Canal above Lock 7 was selected (the Energy Park/Longe/NYS Canal Corporation site). The Processing Facility is currently under construction and will be used during Phase 1 and Phase 2 to process dredged sediment and load the processed sediment in rail cars for shipment to an out-of-state landfill.

The portion of River Section 2 from the Thompson Island Dam to the Fort Miller Dam is land-locked. Access to this area by land will be necessary to mobilize equipment and transfer sediments to the canal. As described in Section 3.7.2, the Phase 2 Design evaluates the need for access to shoreline properties to support the dredging, backfill/capping and habitat construction activities in this portion of the river.

2.2.3 Treatability Studies

Treatability studies were conducted as part of the design process to provide data needed to:

- Assess the impact of dredging on river water quality
- Design the sediment dewatering system so that processed sediment will meet anticipated landfill acceptance requirements
- Design the water treatment system
- Determine the effects of transport on the characteristics of processed sediment relative to anticipated landfill acceptance requirements

Treatability studies were conducted in 2004 and 2005, and results were included in the Phase 1 IDR and FDR. No additional treatability studies have been performed or are anticipated to be needed to support the Phase 2 Design effort.

2.2.4 Supplemental Engineering Data Collection Program

The Phase 2 SEDC Program was developed to gather the engineering field data to support development of the remedial design as described in the Phase 2 Supplemental Engineering Data Collection Work Plan (SEDC Work Plan; BBL 2004b). The objectives of the SEDC Program are to fill engineering data gaps identified during evaluation of the SSAP data and Year 2 SEDC geotechnical and geophysical testing. These data gaps indicated a need for detailed multi-beam bathymetry in the Phase 2 dredge areas and in the navigation channel, and a need for an assessment of sub-bottom conditions to support design of potential rigid resuspension control systems and evaluate shoreline stability in deep dredge areas adjacent to structures or steep shore areas. The Year 2 SEDC work included a geotechnical drilling program that was designed to supplement the SSAP data and support the engineering assessment of dredging and resuspension controls. One conclusion from that effort was that the SSAP data were sufficient to address the issues of sediment dredgeability and spudding (i.e., anchoring) of barges. Additional SEDC activities, such as infrastructure documentation, debris/obstruction surveys and select geophysical (e.g., magnetometer, multi-beam bathymetry, acoustic doppler [river velocity]) and geotechnical studies (e.g., test borings, cone penetrometer), were performed in areas identified in the draft Phase 2 DAD Report. The extent of the Phase 2 areas prompted the development of a phased implementation plan for SEDC activities in River Sections 2 and 3 dredge areas that would provide for collection of data closer to the actual dredging time frame. This will provide more up-to-date information while preparing for the actual dredging work. As such, although the Phase 2 SEDC information included herein covers River Sections 1, 2 and 3, additional SEDC data will be needed as design activities move forward.

A summary of the SEDC activities performed and the findings of these activities to support the Phase 1 Design are summarized in the following documents:

- Year 2 SEDC Interim Data Summary Report (Year 2 IDSR; BBL 2005b)
- Supplemental Engineering Data Collection Work Plan Addendum No. 1 (SEDC Work Plan Addendum No. 1; BBL 2005c)
- Supplemental Engineering Data Collection Work Plan Addendum No. 2 (SEDC Work Plan Addendum No. 2; BBL 2005d)

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

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

- Supplemental Engineering Data Collection Work Plan for 2005 Data Gap Sampling (QEA 2005b)

- Supplemental Engineering Data Collection Data Gap Sampling Program Data Summary Report for 2005 (QEA/ES 2006)

The results for SEDC activities performed to support the Phase 1 Design are referenced in the Phase 1 IDR and FDR and are not repeated in this document. Data and information collected in Dredge Areas NTIP02H, SK_01_NK, SK_01_KA, SK_02, GI_05_KA and GI_06_NK (former Phase 1 candidate areas that are now in Phase 2) will be incorporated into the Phase 2 Design, where appropriate.

Additional SEDC activities have been performed to specifically support the Phase 2 Design. A summary of the SEDC activities performed and the findings of these activities to support the Phase 2 Design are summarized in the following documents:

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

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

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

- Phase 2 Supplemental Engineering Data Collection Data Summary Report Addendum (Attachment B to this Phase 2 IDR)

Additional SEDC activities will be conducted to support Phase 2 Final Design, including, but not necessarily limited to, the following:

- Geotechnical evaluations in select locations where piles or sheeting are specified. These locations will be compared with the existing data set to identify data gaps.

- Geotechnical evaluations at locations proposed for vessel mooring.
- Geotechnical investigation and survey of the proposed land-locked area sediment transfer facility (Transfer Facility) property.
- Multi-beam bathymetry surveys for River Sections 2 and 3 to support the development of dredge prisms in these sections of the river.
- Shoreline stability assessment and the identification of shoreline structures for River Sections 2 and 3.
- Hydraulic assessment of the west channel of Griffin Island.

Phase 2 SEDC Work Plan Addendum No. 2, will be separately submitted to EPA and will describe additional field work proposed for 2008 to support the development of the Phase 2 Final Design.

2.2.5 Phase 2 Habitat Delineation and Habitat Assessment

Habitat delineation and habitat assessment activities were conducted in support of the project design to document the nature and distribution of habitats potentially affected by remediation, and to identify reference habitat locations that represent the distribution of existing conditions and that are not likely to be affected by remediation. The habitat delineation and habitat assessment information relating to Phase 2 areas was presented in the Habitat Delineation Report (HD Report; BBL & Exponent 2006) and the Habitat Assessment Report for Phase 2 Areas (Phase 2 HA Report; QEA 2007b), respectively. Based on discussions with EPA, revised versions of these reports will be submitted to EPA in the near future.

For the Phase 2 Design, the Upper Hudson River was delineated into four different habitat types – unconsolidated river bottom, aquatic vegetation bed, shoreline and riverine fringing wetlands, as described in the Habitat Delineation and Assessment Work Plan (HDA Work Plan; BBL 2003b), which is an attachment to the RD AOC. Data were collected in Phase 2 areas from all four habitat types and used in developing the habitat construction design. Detailed habitat maps are included in the HD Report.

The results of the detailed habitat assessment of Phase 2 areas are presented and discussed in the Phase 2 HA Report.

Evaluation of habitat considerations will continue in the Phase 2 Final Design.

2.2.6 Phase 2 Biological Assessment and Concurrence by Resource Agencies

In January 2006, Ecology and Environment, Inc. (E&E) completed the Final Biological Assessment (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 and the shortnose sturgeon – and where deemed appropriate, to specify conservation measures designed to minimize impacts on those species. The overall conclusion of the Final BA was that the project "may affect, but is not likely to adversely affect," the bald eagle and the shortnose sturgeon.

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

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

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

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

- Operation of the Processing Facility and in-river dredging-related work will be implemented during periods least likely to affect the bald eagle. The majority of construction activities, including any tree clearing, also will be 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.

- 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 bald eagle was removed from the federal list of threatened and endangered species on August 9, 2007. Even though they are delisted, bald eagles are still protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, and 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 one of the final two sites considered for the Processing Facility (the OG Real Estate site). However, the Processing Facility is currently being constructed at the Energy Park site in Fort Edward, New York, and is expected to be suitable for Phase 2. As a result, the Phase 2 project is not expected to have any impact on the shortnose sturgeon.

2.2.7 Phase 2 Cultural and Archaeological Resources Assessment Program

Cultural resources, such as archaeological sites, may be situated within and immediately adjacent to the river in locations that could be affected by future dredging operations. Archaeological resource assessments are being completed to document the existence of cultural and archaeological resources that could be affected by implementing the site remedy. The Archaeological Resources Assessment Report for Phase 2 Dredge Areas (Phase 2 ARA Report; URS 2008) included maps that identify zones with potential for containing archaeological resources within the Phase 2 Areas. The potential effects of dredging, backfilling/capping and habitat construction on these resources have been, and are continuing to be, evaluated during the remedial design.

2.2.7.1 Terrestrial Resources

Fifty-three unprotected river bank areas have been identified as having known potentially significant cultural resources or, due to results of the initial field reconnaissance, the potential for significant sites to exist. Ten unprotected river bank areas with known resources have been identified. The remaining 43 areas have been classified as "high potential" based on environmental features or historical map data, but no cultural resources have yet been verified and the integrity of these areas has not been assessed.

These river bank areas will be examined to evaluate existing shoreline slope stability and the feasibility of implementing shoreline protective measures during dredging. Protective measures to be considered during design are described in Section 2.3.1.6 and include: 1) a prohibition of root ball disturbance during shoreline tree removal; 2) vertical dredging sediment cuts of no more than 2 feet deep where dredge areas abut the shoreline; 3) a prohibition of placing backfill and capping materials on the river bank above the mean high water line; and 4) a prohibition of sheet piling installation along the shoreline. Archaeological investigation of these "high potential" river bank areas will only be completed if the areas cannot be protected using the measures described above. A preliminary assessment of the stability of these river bank areas and typical protective measures is presented in Section 3.6.1.3.

2.2.7.2 Underwater Resources

Twenty-four in-river areas have been identified as having "high potential" for containing culturally or archaeologically significant resources, due to either historical background information or features identified through review of existing remote sensing data or the initial site reconnaissance. Small dredge areas with relatively low PCB inventory located in these "high potential" areas were identified in the Phase 2 ARA Report, which is currently under review by EPA. Table 3-3 in Section 3.1.1.1 identifies nine dredge areas that have been proposed for exclusion from the Phase 2 dredging program. These dredge areas are small, totaling 2.2 acres, and represent less than 0.4 percent of the PCB mass to be removed as part of Phase 2. Exclusion of these dredge areas will avoid adverse impacts to these potentially significant river bottom areas without compromising the effectiveness of the Phase 2 dredging program. Additional evaluation of potential dredge prism modifications will be completed based on cultural resource factors, as well as habitat and engineering considerations, as the Phase 2 Design progresses.

2.2.8 Phase 2 Logistics Modeling

Similar to the Phase 1 Design (see Attachment D to the Phase 1 FDR), a logistics model was developed for the Phase 2 Design to simulate the movement of sediment removed from dredge areas to the Processing Facility as well as simulation of restoration activities (backfill and capping) following dredging. While the logistics model is ultimately designed to simulate sediment processing, rail yard operation and rail car movement to the disposal facility, the model presented at this Intermediate Design stage has only been used to simulate and predict dredging, dredged material transport and restoration. This model allowed for a variety of conditions and constraints to be simulated to assess potential bottlenecks in the dredging, dredged material transport and restoration activities. This allows the computer-assisted numerical model to help with testing and optimizing systems for efficient movement of equipment (e.g., barges) and dredged material on the river. An overview of the model, how it was constructed and used, and the results and applicability of simulations are provided in Section 3.8 and Attachment C.

2.2.9 Phase 2 River Hydrodynamic Analysis

Similar to the hydrodynamic analyses performed as part of the Phase 1 Design (Attachment E of the Phase 1 IDR), analyses have been conducted to characterize river hydrodynamics within the Phase 2 dredge areas. The specific purpose of these analyses was to define the likely range of in-river conditions that would be encountered in the project area so these conditions could be considered in the design. River flow characterization (both velocity and flow volume) was used in the design of dredging, resuspension controls, backfilling/capping and habitat construction.

Hydrodynamic analyses were conducted using a two-dimensional, vertically averaged hydrodynamic model, which accounts for spatial variations in bathymetry and river velocity, as well as temporal changes in flow rate. The model applied in this analysis is

Environmental Fluid Dynamics Computer Code, which has been used by EPA and others to study other riverine systems and is the same model used during Phase 1. This model, its calibration, and its validation are summarized in Attachment D. The validated model was applied during Phase 2 Intermediate Design to: estimate water depths to evaluate equipment accessibility to dredge areas, provide a basis for the habitat design, define the shoreline elevations in each reach, assess resuspension and provide a basis for backfill and cap design. The bathymetric data used in the hydrodynamic model was modified to reflect post-dredging/capping bathymetry for all Phase 2 areas. Specifically, the bathymetry was changed to reflect dredging to the depth of contamination (DoC) and placing 1 foot of backfill/cap material at each Phase 2 dredge location. For River Section 1, the existing bathymetry is based on multi-beam bathymetric survey data. For River Sections 2 and 3, the existing bathymetry is based on single-beam bathymetric survey data. Figures WD-01 through WD-43 illustrate the water depths for River Sections 1, 2 and 3 based on low pool elevations defined in Section 2.3.1.2.

High-flow events with return frequency of 2, 5, 10, 20, 50 and 100 years were simulated using the estimated bathymetry after backfill placement. In general, current speed (and hence bottom shear stress) decreased under post-backfill conditions compared to pre-dredge conditions due to the increased cross-section area. Figures showing comparisons of estimated water velocities for Phase 2 under various flow events are presented in Attachment D.

2.2.10 Baseline Monitoring Program

The Baseline Monitoring Program (BMP) is described in the Baseline Monitoring Program Quality Assurance Project Plan (QEA 2004). The water column monitoring that is part of the BMP is an ongoing program intended to establish baseline conditions for river water quality to which future remedial action monitoring results can be compared.

To estimate the PCB mass flux passing the far-field station due to project activities, it is necessary to subtract the baseline mass flux from the total flux. The BMP has been designed to provide the baseline mass flux estimates for each month of the dredge season.

2.3 Basis of Design Summary

This section presents the technical basis of design for the Phase 2 operations. Specific basis of design information for the Phase 2 Design is summarized in Tables 2-6 through 2-10, and a brief narrative summary of the basis of design information is provided in the following sections. The Critical Phase 1 Design Elements (CDE; Attachment A to the SOW) summarizes key decisions affecting the critical design elements that are to be included in the Intermediate and Final Design reports for Phase 1 and Phase 2. The CDE is included for reference in Attachment E to this Phase 2 IDR. Specific critical design elements are discussed in the following sections as appropriate.

2.3.1 Dredging and Dredged Material Transport

Dredging is the first step of the sediment removal and disposal process. The dredging production rate and characteristics of the dredged material will affect subsequent project elements, including the need for and degree of resuspension control, the amount of solids and water requiring transport to the Processing Facility, sediment processing, water treatment, sediment transport and disposal throughput rates and the rate at which dredged areas can be backfilled or capped.

2.3.1.1 Phase 2 Dredge Area Delineation and Prism Development

The basis of the dredging design process begins with the delineation of dredge areas. Dredge area delineation is a multi-step process and includes the identification of both the horizontal and vertical extents of dredging.

The Phase 2 DAD Report, which was completed in December 2007, identified those sediments within the Phase 2 areas that meet EPA's established criteria for removal. There were 158 dredge areas delineated for Phase 2 (QEA 2007a). The Phase 2 DAD Report also included 10 dredge areas that were initially identified in the Phase 1 DAD Report, but were ultimately not included in the Phase 1 project design.

Dredge prisms were developed for the Phase 2 IDR by a process that is detailed in Section 2.4 of the CDE (Attachment E). In summary, the following analyses were conducted to develop dredge prisms for the Phase 2 areas in River Section 1:

- All data that were available in the January 17, 2006 version of the SSAP database were integrated into the development of the depth of contamination (DoC) analysis using the 1 mg/kg interpolation at depth (QEA 2007a).

- The DoC surface was combined with the elevation of Glacial Lake Albany Clay and it was determined where the clay layer is used to define the depth of dredging. This procedure and the results are described in Attachment F.

- 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 in River Section 1 by approximately 200 cy. Details of this process are provided in Attachment F. The "pop-through" procedure incorporated all PCB concentration information that was available based on the March 6, 2006 version of the SSAP database and includes some minor adjustment to some cores' data treatment to address comments received from EPA on the March 29, 2006 Draft Phase 2 DAD Report, as well as agreements reached during discussions with EPA and GE in spring 2007. Consequently, any data gap cores that were entered into the database between the January 17, 2006 and March 6, 2006 versions of the database were included in the pop-through analysis and the surface was adjusted for these cores, in accordance with the rules presented in Attachment F.

- Jagged edges of the dredge area perimeters presented in Phase 2 DAD were straightened with no net change in the dredge area.

As identified in the Phase 2 DAD Report, additional data will be collected from River Sections 1, 2 and 3 in 2008. The results of this data collection will be reviewed and incorporated into revised dredge prisms as necessary in the Phase 2 FDR (or addenda).

For the areas in River Sections 2 and 3, the dredge prisms will be completed in the Phase 2 FDR (or addenda) after multi-beam bathymetry, Phase 2 DAD data gaps and other engineering data are collected. The application of archaeological and habitat data will also be finalized in the Phase 2 FDR or addenda.

Additional discussion of the dredge prisms completed for River Section 1 is presented in Section 3.1.1.

2.3.1.2 Shoreline Definition

The elevation of the shoreline in River Section 1 was based on aerial photos taken in the spring of 2002 and represents a flow of approximately 5,000 cubic feet per second (cfs) at Fort Edward, which corresponds to an elevation of about 119 feet. The exact flow varies depending on the date and time photos were taken in different parts of the river. Shoreline elevations downstream were estimated using the hydrodynamic model at the flow predicted when the flow at Fort Edward is 5,000 cfs (Attachment D).

EPA, as part of its review of the Phase 1 Design (EPA 2006b), selected the "in-river" boundary for the restoration of near-shore bathymetry. For Phase 1 areas, which are all in Reach 8, this "in-river" boundary was defined as 117.5 feet (NAVD 1988). An elevation of 117.5 feet corresponds approximately to the flow event that occurs once every 3 years (1Q3; flow of 1,100 cfs at Fort Edward). EPA also recommended that the 1Q3 flow event values be used in Phase 2 regions downstream of Reach 8 if bathymetric data are not available to identify natural breaks in slope in the shoreline areas or if a natural break is not generally found in a given pool (Malcolm Pirnie, Inc. 2006). Because bathymetric data are not sufficient to identify natural breaks in slopes, the 1Q3 flow event was used as the design basis for River Sections 2 and 3.

For Phase 2, the 119-foot (design pool) and 117.5-foot (low pool) elevations were applied to all of Reach 8, and the Upper Hudson River hydrodynamic model (Attachment D) was used to estimate the corresponding elevations in Reaches 7 through 1 based on flows of 5,000 and 1,100 cfs at the Fort Edward gage for the design pool and low pool, respectively.

The model rating curve was used to estimate that a flow of 1,100 cfs at the USGS gage at Fort Edward corresponds to a water surface elevation of 117.6 at the downstream end of Reach 8. In Reaches 7 through 1, the hydrodynamic model was run for flows of 5,000 cfs (design pool) and 1,100 cfs (low pool) at Fort Edward to estimate the corresponding water surface elevations in each model grid cell. Elevations were assigned to the shoreline based on the nearest model grid cell elevation. Table 2-11 below shows these water surface elevations for the most upstream and downstream dredge area in each Reach.

Table 2-11
Design and Low Pool Elevations (NAVD88) in Reaches 7 through 1

Reach	Dredge Area ID (Upstream / Downstream)	Design Pool Elevation (5,000 cfs at Fort Edward)		Low Pool Elevation (1,100 cfs at Fort Edward)	
		at Most Upstream Dredge Area	at Most Downstream Dredge Area	at Most Upstream Dredge Area	at Most Downstream Dredge Area
7	LL_01_NK / LL_19_NK	115	114.8	114.2	114.2
6	FMD_01 / NDCA_01_NK	102.1	102.1	100.3	100.3
5	NDCA_02_NK / CSD_36_NK	84	83.4	82.5	82.5

Reach	Dredge Area ID (Upstream / Downstream)	Design Pool Elevation (5,000 cfs at Fort Edward)		Low Pool Elevation (1,100 cfs at Fort Edward)	
		at Most Upstream Dredge Area	at Most Downstream Dredge Area	at Most Upstream Dredge Area	at Most Downstream Dredge Area
4	UPM_01_NK / UPM_09_NK	70	70	68.9	68.9
3	UPM_10_NK / LMD_07_NK	47.8	47.7	45.8	45.8
2	LMD_08_NK / WD_05_NK	29.7	29.6	28	28
1	WD_06_NK / TD_01_NK	15.4	15.2	13.5	13.5

Note:
Source: Dredge Area IDs are from Phase 2 DAD Report (QEA 2007a).

2.3.1.3 Dredge Equipment

Consistent with Phase 1, dredging for Phase 2 of this project will be conducted using backhoe-mounted, hydraulically closing environmental clamshell bucket mechanical dredges. Selection of mechanical dredges for the project was presented in the Phase 1 IDR. As stated in the CDE (Attachment E), after Phase 1, the dredge type may be reassessed.

Due to the challenges of operating in the channel to the west of Griffin Island and the land-locked area, the removal methods for these areas are being evaluated as part of the Phase 2 Design. Both the dredging equipment and operating parameters for dredging in this area have been assessed, as discussed further in Section 3.7.

2.3.1.4 Dredged Material Transport

The basis of design for Phase 2 dredging and dredged material transport is summarized in Table 2-6 and includes the use of scows for transporting materials to the Processing Facility. The dredged material from River Sections 1, 2 and 3 will be transported to the Processing Facility, which is located on the Champlain Canal between Lock 7 and Lock 8. Therefore, dredged material will be transported through as many as seven locks. Additionally, NYS Canal Corporation operational data indicate that the maximum time for one-way lockage is approximately 40 minutes, which includes the time needed to stage and position the vessels, drain or fill the lock and exit the lock. For the purposes of the Phase 2 Design, it is assumed that both dredged material transport and the locks will be operating 24 hours per day, 6 days per week for approximately 28 weeks (from early May through late November). A contingency for material transport using the Champlain Canal on days reserved for equipment maintenance has been assumed, as a potential response in the case that the productivity levels are not being achieved.

Based on NYS Canal Corporation design records, maximum lock length available for vessels is 300 feet. The project vessels used in material transport include both tug boats and barges. The barge sizes that are expected to be used for this project range from 195 by 35 feet to 100 by 30 feet, while tug boats are approximately 60 feet long. In special areas, such as the channel to the west of Griffin Island and the land-locked area, the use of smaller capacity barges will be considered in the Phase 2 FDR. Approximate travel speeds for tug boats and barges range from 6 to 7 mph. Push boats will be used to move barges and other equipment shorter distances than tug boats, and differ primarily from tug boats in their lack of overnight crew quarters. Push boats are approximately 25 to 35 feet long, 12 to 14 feet wide, draft approximately 4 feet and require 400 to 600 horsepower engines.

2.3.1.5 Dredge season

The duration of the dredge season for inventory removal has been assumed to be 120 dredge days (20 weeks, 6 days/week) and is constrained by the NYS Canal Corporation lock system opening in early May, closing of the locks in November, and the need to conduct post-removal sampling and backfilling (as well as the potential for residuals dredging and/or capping) after inventory dredging is completed.

2.3.1.6 Archaeological Site Protection Measures

The following archaeological site protection measures will be taken to ensure that the shoreline remains stable during dredging and restoration in archaeologically sensitive zones:

- Tree removal will be performed by hand using chainsaws. The root balls will be left in place to assist with bank stabilization.

- Using barge-mounted dredge equipment, a vertical cut no more than 2 feet deep will be made on the shoreline for dredge areas that come into contact with the shoreline (no dredge equipment will be operated from the shore).

- The final dredge prism will include a setback and stable slope for shorelines and underwater areas that are determined to be archaeologically sensitive, and avoidance is the mitigation. The set back from the Mechanicville Hydroelectric Plant will be proposed in the Phase 2 FDR. Final dredge prism adjustments will be provided in the Phase 2 FDR.

- No backfill will be placed on the river bank above the shoreline adjacent to archaeological sites. Dredge areas that are off-shore from, but adjacent to, sensitive shorelines will be backfilled to provide stability.

- Sheet piling is not planned to be installed along the shoreline of archaeologically sensitive areas.

Underwater archaeological resource protection measures include delineating "off-limit" sensitive resource locations where no impacts are allowed. These areas will be marked with distinctive buoys and any other appropriate visual markers. This means that no debris removal, dredging, or mooring or anchoring of project vessels will be permitted in these areas. Also, sediment removal will be prohibited within a setback from the known edge of these resources.

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

2.3.2 Resuspension Control

Resuspension controls have been established for this project based on the results of the resuspension model (Attachment G). The specific basis of design for Phase 2 resuspension control is summarized in Table 2-7.

Because exceedance of the Control Level requires the consideration and implementation of engineering controls, the 7-day running average Total PCB concentration Control Level (350 ng/L measured at any downstream far-field monitoring station) and the PCB mass transport equivalent to the Control Level (currently calculated for Phase 2 as 585 kg, based on subtracting the 65 kg allotted to Phase 1 from the total project mass load of 650 kg set by EPA) were selected as a basis of design. Additionally, the Standard Level of 500 ng/L Total PCB concentration (24-hour average, measured at any downstream far-field monitoring station) was selected as a basis of design.

The resuspension control basis of design will be reviewed after Phase 1 is completed and revisions to the basis of design may be made, if necessary, based on the conditions encountered during Phase 1.

2.3.3 Sediment and Water Processing

The sediment and water Processing Facility infrastructure and equipment are being constructed in accordance with the Specifications and Drawings appended to the Phase 1 FDR (BBL 2006a) and the addenda issued after the Phase 1 FDR. The specific basis of design for the Phase 2 sediment and water processing facilities is presented in Table 2-8. Section 2.5 of the CDE (Attachment E) provides a summary of the critical elements of the basis of design for the Processing Facility.

The sizing of the sediment and water processing facilities takes into account the need to handle a range of sediment types from coarse and sandy materials to fine-grained materials. Four Sediment Types were developed by pooling the sediment data from Years 1 and 2 of the SSAP into four equal quartiles when sorted by Percent Fines (<74 microns). This resulted in the following definition of Sediment Types: S1 indicates sediments containing less than 9.3 percent fines; S2 indicates sediments containing from 9.3 percent to 37.3 percent fines; S3 indicates sediments containing from 37.3 percent to 65.3 percent fines; and S4 indicates sediments containing more than 65.3 percent fines.

The Processing Facility has been designed to process a peak daily rate of 5,100 cy of S2 or S3 type sediment. Once installed, the Processing Facility will have the ability to process 3,500 cy/day of S1 type sediment and 3,700 cy/day of S4 type sediment.

For the Phase 2 dredge areas, it is estimated that approximately 65 percent of the dredge volume will be composed of S2 / S3 type sediment and 35 percent will be composed of S4 type sediment.

As a result of the target annual productivity of 340,000 cy and an assumed 120-day dredge period, the estimated daily average dredging rate required to be processed is 3,500 cy/day, which is based on an average inventory dredging rate of approximately 2,900 cy/day and 600 cy/day of residuals dredging. Based on these dredge rates, the performance of each unit process will be assessed, as discussed further in Section 3.3.

After completion of Phase 1, the performance of the Processing Facility equipment and unit process operations will be evaluated. Changes to the facility design may then be initiated to improve the facility's performance, operational ease and reliability during the Phase 2 dredge seasons.

2.3.4 Processed Sediment Transportation and Disposal

The mode of transportation (rail) and the landfill destination (Waste Control Specialists [WCS] in Andrews, Texas) have been selected for Phase 1. This transport mode and disposal facility are used as the basis for the Phase 2 Design. This Phase 2 IDR reviews the methods for loading processed material into rail cars, the procedure for handling debris to be transported to the disposal facility, the delivery requirements specified by WCS and the plans for rail transportation and landfill waste receipt to reflect the anticipated Phase 2 volumes.

During loading at the Processing Facility, each empty rail car will be lined with a disposable liner prior to the placement of processed material in the car. The liners will be disposed of at the destination landfill along with the processed material. Debris will be loaded into rail cars at either the front or rear of each 81-car unit train to facilitate their separate handling at the landfill destination. For the purposes of disposal, debris is defined as any single piece of material larger than 1 cy, greater than 5 feet in any dimension, or heavier than 1 ton.

As explained in the Phase 1 FDR, 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 simpler design for storage, loading and rail car management. This basis will be reviewed during the implementation of the project and, if available, a more efficient process for transport and disposal may be proposed.

The specific basis for the transportation element design is summarized in Table 2-9.

2.3.5 Backfill/Capping and Habitat Construction

The specific basis of design for Phase 2 backfill/capping design is presented in Table 2-10 and described below.

2.3.5.1 Backfill/Cap Footprint

The Phase 2 acreage assumptions for backfill/cap start with consideration of the total area to be dredged (400 acres). Ultimately, the total and relative acreage of areas to be capped or backfilled will depend on the results of the residuals sampling. In areas where a dredge prism falls within the navigation channel, no backfill material will be placed when the post-dredging water depth is predicted to be less than 15 feet. For the River Section 1 areas to be dredged in Phase 2 of the project, approximately 58 acres of Phase 2 dredge areas are within the navigation channel and within this area approximately 46 acres are predicted to have a post-dredging water depth less than 15 feet based on the dredge prisms as they are presented in Drawings D-2101 through D-2139 included in Appendix 1. For purposes of the Phase 2 IDR, the breakout of areas that may be backfilled or capped was performed for five different potential scenarios: 1) 100 percent of the area backfilled; 2) 75 percent of the area backfilled and 25 percent capped; 3) 50 percent backfill, 50 percent cap; 4) 25 percent backfill, 75 percent cap; and 5) 100 percent cap. These assumptions do not predict the actual amount of backfilling or capping that will take place during implementation of the Phase 2 activities. These assumptions have simply been used as a basis of design in this Phase 2 IDR so that ranges for material volumes can be estimated and the feasibility of placing the material within each construction season can be determined. The use of five scenarios allows for the full range of potential backfill and capping acreages to be considered.

2.3.5.2 Backfill Design

There are three components of backfill in the Phase 2 Design: 1) the One-Foot Backfill Layer; 2) Near-shore Backfill and 3) Additional 15 Percent Backfill. The Near-shore Backfill has been included in the project design, based on the EPA's Regional Administrator's Final Decision dated November 9, 2006 (EPA 2006c). The Near-shore Backfill returns the area where the dredge prisms touch the shoreline to the pre-dredge bathymetry for a given distance out into the river. For Phase 1, the bathymetry was returned to the post-dredge surface from the shoreline (elevation 119.0) laterally into the channel to an approximate bed elevation of 117.5. For the Phase 2 Design, the post-dredge surface will be returned to pre-dredge bathymetry from the point where the dredge prisms intersect the shoreline laterally into the channel to where the bed elevation equals:

- An elevation of 117.5 in River Section 1.

- The elevation corresponding to the 1Q3 flow event in River Sections 2 and 3. These elevations will vary per river reach and are presented in Table 2-11.

No backfill material will be placed in the navigation channel with post-dredging water depths less than 15 feet.

The use of the Additional 15 Percent Backfill stems from the requirement in the CDE (Attachment E) that, in addition to the backfill estimated to be placed over all dredge areas to a depth of 1 foot, additional backfill up to 15 percent of that volume will be used for the creation of aquatic vegetation beds in dredged areas that would no longer support such beds. The basis for determining the locations for placement of the Additional 15 Percent Backfill is presented in Attachment H. The approximate volumes of backfill materials for the One-Foot Backfill Layer and Additional 15 Percent Backfill are 570,000 and 97,000 cy, respectively. The volume for the Additional 15 Percent Backfill was based directly on the requirements of the CDE (Attachment E).

Certain locations in Phase 2 dredge areas that currently contain aquatic vegetation beds, excluding water chestnut (*Trapa natans*), will be returned to elevations equivalent to water depths of 4 to 8 feet (at the design flow of 5,000 cfs), based on the flowchart shown in Figure H-2 of Attachment H. Areas shallower than 4 feet deep post-dredging will have 1 foot of backfill material applied and positively sloped toward shore. In the event that the estimated 15 percent additional backfill volume is insufficient to meet the elevation specifications for all of the targeted areas for a dredge year, the material will be applied according to the following priorities:

- In CUs from north to south
- To areas that currently support large linear beds adjacent to shoreline areas, before placement in areas below islands or in mid-channel

2.3.5.3 Capping

The placement of an engineered cap is an engineering contingency to be used if the post-dredging residuals concentrations do not meet the goals for backfill and residuals dredging is not required. The basis of design is provided in Section 2.6 of the CDE (Attachment E). When and where capping is required will be decided on the basis of the Residuals Performance Standard, as defined in the PSCP Scope (Attachment C to the SOW).

2.3.5.4 Habitat Construction

Based on the requirements in the CDE and the 400-acre area of the Phase 2 dredge areas, up to 97,000 cy of backfill materials are available for the Additional 15 Percent Backfill. Location and elevations for placement of the Additional 15 Percent Backfill and planting areas for the SAV are presented in Attachment H.

The riverine fringing wetland, aquatic vegetation and shoreline species that will be planted were selected based on the results of the habitat assessment activities (see Section 2.2.5). The same species and planting intervals specified in the Phase 1 FDR will be used for Phase 2 areas in River Section 1. The final species list for the other river sections will be based on the habitat assessments completed in those river sections and described in Phase 2 FDR or FDR addenda. The specific basis of design for Phase 2 habitat construction is presented in Table 2-10.

2.4 Basis of Design – Adjustments Phase 2 Design

This Phase 2 IDR presents the design for the Phase 2 remedial action at the intermediate stage. Several activities will be performed to advance the Phase 2 Design, including additional sediment sample collection and analysis, information gathering and discussions with EPA on certain details of the Phase 2 Design. The basis of design presented above may be adjusted during development of the Phase 2 Final Design as additional data and information are gathered. In addition, the basis of design may require modification based on data gathered or experience during Phase 1 and/or following evaluation and peer review of the results of Phase 1 to determine whether any modifications to the performance standards, design, or scope of Phase 2 are warranted.

3. Phase 2 Project Description

As described in the PDR (BBL 2004a), the remedial action can be broken into eight key components or project "elements." Each of these elements is briefly described below.

- ***Dredging:*** Dredging is the first of several linked and mutually dependent project elements. As the initial project element, the rate and process of dredging affect the design of all subsequent project elements, including resuspension controls, sediment processing and water treatment, transportation and disposal, and the rate at which dredged areas can be backfilled or capped.

- ***Dredged Material Transport:*** Once material is dredged from the river, it will be transported to the land-based Processing Facility. The dredged material transport project element includes the barging of mechanically dredged material.

- ***Resuspension Control:*** Resuspension control involves methods to reduce the transport of sediment and PCBs that will be resuspended during dredging activities. Modeling the potential for resuspension and transport of PCBs during dredging has been incorporated in the design.

- ***Sediment and Water Processing:*** At the Processing Facility, water will be separated from the dredged material and then treated to meet discharge requirements. The dewatered sediment will be transported for disposal. Debris and vegetation removed as part of the dredging activities will also be handled and transported for offsite disposal. The capacity of the Processing Facility, which is currently under construction, was reviewed based on the Phase 2 dredging plans.

- ***Transportation for Disposal:*** After the dredged sediments are processed, the dewatered sediment (as well as debris and vegetation removed during dredging activities) will be transported to disposal facilities. The ROD requires processed material be transported out of the project area by rail or barge.

- ***Disposal:*** The disposal element involves the unloading and placing for final disposal of processed material at one or more disposal facilities, in accordance with each disposal facility's relevant permit conditions.

- ***Backfilling/Capping:*** Following removal of targeted sediment from the river, the areas that have been dredged will be backfilled or capped, as appropriate, to isolate residual sediments and support habitat construction.

- ***Habitat Construction:*** The habitat construction program is intended to replace the functions of Upper Hudson River habitats, through the use of both active replacement and reconstruction techniques and natural processes, to within the range of functions found in similar physical settings (referred to as reference areas in habitat assessment reports) in the Upper Hudson River.

The remainder of this section describes each of these project elements for the Phase 2 remedial action at the Intermediate Design stage. A summary of the general approach for each element is presented in Sections 3.1 through 3.6. However, conditions associated with certain sections of the river require special consideration and design approaches in order to maintain productivity and/or control resuspension. These "special" river sections include the area west of Griffin Island (the West Griffin Island Area [WGIA]), the land-locked area between Thompson Island and Fort Miller Dams and areas in close proximity to dams, locks and associated hydropower structures. The proposed design approach for dredging, dredged material transport and habitat construction for these areas is described in Section 3.7.

3.1 Dredging and Dredged Material Transport

The factors that affect the ability to achieve the project requirements and meet the performance standards were analyzed extensively during the Phase 1 Design. This analysis estimated how many dredges would be necessary, where each would be placed, the timing and duration of their operations and what issues may affect schedule and dredge operations. In addition, the transport of dredged material was planned so that the number of barges and material handling rates at the Processing Facility could be estimated for design purposes. As mentioned previously, the Phase 2 Design relies and builds upon the Phase 1 analyses to develop the approach that will be implemented for the rest of the project.

During Phase 2, 1,530,000 cy of sediment are targeted for removal over five construction seasons in River Sections 1, 2 and 3. The minimum and target volumes determined in accordance with EPA's Productivity Performance Standard for each construction season in Phase 2 are provided in Table 2-2. The areas targeted for dredging cover approximately 400 acres of the river. These areas are shown on Figures 1-1, 2-1, 2-2 and 2-3. Phase 2 dredge areas are also presented on Drawings D-2101 through D-2139 (included in Appendix 1) and Figures DA-01 through DA-39.

Considering the design basis for achieving the target volumes under EPA's Productivity Performance Standard, the design includes multiple dredges operating at any one time to complete the initial “inventory” dredging and re-dredging (the “residual” dredging) necessary in areas where PCB levels in residual sediment do not meet the Residuals Performance Standard after the initial inventory removal. The criteria that will be used for deciding when dredging is complete are discussed in Section 3.1.4. Operations are planned for 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.

As part of dredging and dredged material transport operations, anchoring be restricted within areas where caps have been completed or submerged aquatic vegetation (SAV) has been planted. In addition, no anchoring of work-related vessels will be permitted in the navigation channel without prior approvals. Restricted areas are shown on Drawings D-4001 through D-4017 (River Section 1; included in Appendix 1) and Figures ANC-01 through ANC-35 (River Sections 2 and 3).

During Phase 1 of the project, a Work Support Marina will be constructed in River Section 1 to provide an area for support vessels to dock and load or unload passengers and equipment. The facility will be used by a wide variety of vessels during Phase 1, including bathymetry survey boats, sediment sampling boats, water quality monitoring boats and oversight boats. In addition, the Work Support Marina will be used by dredging crew boats to help with the efficient movement of crews and equipment to and from the dredges located in River Section 1. Dredged sediments will not be staged or processed at the Work Support Marina. During Phase 2 of the project, the Work Support Marina will continue to be utilized, but the travel times from the Work Support Marina to the dredge areas in River Sections 2 and 3 will increase as distances from the facility increase. The movement of dredging crews by water to and from the active dredges will become less efficient as these travel times increase. Overland transport of personnel, sampling equipment and collected samples is considerably quicker and more efficient than water-based movement. During the Phase 2 Final Design, existing commercial marinas in River Sections 2 and 3 that have available docking facilities will be identified, and their ability to provide support equivalent to that being provided by the Work Support Marina will be evaluated. By locating available facilities within River Sections 2 and 3, the travel times will be reduced and efficiencies increased. When evaluating existing facilities, priority will be placed on their ability to first accommodate the transfer of dredge crews, followed by the sediment sampling boats and the other types of support vessels.

3.1.1 Dredge Prism Development

The dredging design process begins with the delineation of dredge areas. Dredge area delineation is a multi-step process that includes the identification of both the horizontal and vertical extents of dredging. The Phase 2 DAD Report, which was approved by EPA in November 2007, was prepared to identify those sediments within the Phase 2 areas that meet EPA's established criteria for removal.

The process by which dredge prisms were developed for the Phase 2 IDR, based on the delineated dredge areas, is detailed in the CDE (Attachment E). The analyses conducted to develop dredge prisms for Phase 2 are listed and described in Section 2.3.1.1.

For this Phase 2 IDR, dredge prisms were developed for the remainder of River Section 1 (i.e., areas not already specified in the Phase 1 FDR), which will encompass the first 2 full years of Phase 2 dredging. These dredge prisms will be finalized in the Phase 2 FDR. Following additional data collection and design support activities, dredge prisms for River Sections 2 and 3 will be developed and included in an addendum to the Phase 2 FDR.

During development of the dredge prisms for River Section 1, the dredge prism boundaries were developed using the "married grid" (Steps 1 through 4 of the dredge prism process specified in the CDE). The "married grid" also reflected the pop-through analysis conducted under Step 8 of that process. The results of Steps 1 through 4 and 8 are described in Attachment F.

The dredge prism (Step 6) was built around the "married grid" and included straightening the 2-D outline of the dredge area per Step 5. The next step (Step 7) was the identification and evaluation of exclusion areas, which is discussed in Section 3.1.1.1. The proposed exclusion areas are not shown in the Phase 2 IDR dredge prisms, but are described in Section 3.1.1.1 and shown on Figures EXC-01 through EXC-12, AD-01 and AD-07, and will be integrated into the Drawings in the Phase 2 FDR (or addenda).

Under Steps 9 and 10, shoreline areas with depth of contamination (DoC) greater than 24 inches were evaluated relative to the slope of the existing bathymetry moving away from the shoreline. The approach for these locations was to place a 2-foot vertical cut at the shoreline (i.e., elevation 119.0 for River Section 1) and apply a 3-to-1 (horizontal-to-vertical) slope until it intersected the "married grid." This rule was applied to locations where the slope of the existing bathymetry at the shoreline was 3-to-1 or less. For those locations where the slope of the existing bathymetry was steeper than 3-to-1 and DoC was greater than 24 inches at the shoreline, existing bathymetric slopes were used to develop that portion of the dredge prism, unless:

- The steeper slope was less than 30 linear feet along the shore, in which case the typical 3-to-1 side slope was used to develop that portion of the dredge prism, or

- The steeper slope results from localized features (within the first few feet of the shoreline) and the remainder of the slope is flatter than 3-to-1, then the 3-to-1 slope was used to develop that portion of the dredge prism. These locations and select cross sections showing the near-shore slopes are presented in Attachment M.

The dredge prisms also included 3-to-1 slopes at their upstream and downstream ends, consistent with the Phase 1 Design.

The resulting dredge prisms (in plan view) with final cut-line design elevations are shown on Drawings D-2101 through D-2139 included in Appendix 1. An electronic file containing three-dimensional point information for the dredge prisms within River Section 1 are being transmitted to EPA with this Phase 2 IDR.

3.1.1.1 Exclusion Areas

As described in the CDE (Attachment E), the dredge areas were further reviewed and certain areas are recommended for exclusion using a two-step process that involves:

1. An engineering practicality assessment resulting in the identification of candidate exclusion areas.

2. An evaluation of these candidate exclusion areas to assess whether excluding them would have a measurable impact on remedy benefits.

The operational characteristics of the dredging equipment and the presence of permanent structures or obstructions that could potentially interfere with sediment removal play a central role in determining whether dredging is impracticable in an area. In areas where the dredge cannot remove the material due to obstructions, appropriate alternate methods will be evaluated to allow removal of such material to the maximum extent reasonably practicable.

The rationale for excluding particular dredge areas (or portions of dredge areas) has been developed considering quantification of sediment volumes, mass of PCBs in sediment and surface sediment concentrations. EPA will evaluate this proposal on an area-by-area basis and will also consider the areas collectively and determine whether such areas should be excluded.

Areas that were isolated as part of the Hudson River Floodplain Short-Term Response Action Documentation Report (ARCADIS 2007) will be assessed as candidate exclusion areas during Phase 2 Final Design (or addenda). Some limited areas of the floodplain isolation covers extend below the river shoreline, as shown in the G-Series Drawings included in Appendix 1.

Identification of Candidate Exclusion Areas Based on Unsafe Work Conditions or Inefficient Operations

The candidates for exclusion include portions of dredge prisms that present unsafe work conditions or would result in very inefficient operations. Factors that may contribute to identification of such exclusion areas include (but are not limited to) the following:

- Thin sediment layer
- Presence of rocks and cobbles
- Shallow water
- In-river and shoreline structures and buried utilities

These factors have been considered alone and in combination to identify candidate areas and to evaluate potential project inefficiencies (e.g., low productivity) and risk (e.g., to schedule, structural integrity or safety).

To evaluate whether the interpolated dredge areas include materials that will be difficult to dredge or otherwise create inefficiencies and risk to dredging operations, the dredge areas were initially evaluated to identify areas with a thin sediment layer and areas of rocks and cobbles. The first step in this process was to identify coring locations where refusal was encountered and sediment cores could not be collected. In some locations, surface grab samples provided surface PCB data. The initial review included identification of those locations identified as confidence level 2H, 2I, 2J 2K and 2L sampling locations in the Phase 2 DAD (QEA 2007a). These locations were reviewed in detail along with the dredge area interpolations, available probing, coring and chemistry data from nearby locations and the side-scan sonar data. In areas where the refusals appear to be associated with hard materials near the shoreline or with other evidence of rocks or cobbles, or with materials mapped as Type III or V, adjustments to the dredge areas are proposed.

If adjustments to the dredge areas were determined to be appropriate, the new boundaries proposed are based on data from surrounding points. Where the refusal locations are bounded by points that are below the DAD criteria, the dredge boundary was adjusted to these points. Where refusal locations are bounded by locations that exceed the DAD criteria, the dredge boundary was modified to be either the refusal point itself or the mid-point between the refusal and the point that exceeds criteria, depending on the surrounding data.

A review of abandoned core information identified 106 such locations in River Section 1, 39 locations in River Section 2 and 12 locations in River Section 3. Of these, many appear to be associated with areas surrounded by locations that exceed the criteria or that have relatively thicker depths of contamination. Although actual dredging may determine that these isolated points represent areas that are impractical to dredge, no adjustments to the dredge areas are recommended at this stage in the design process. Refusals at locations that appear to be associated with materials that would be difficult or impractical to dredge are recommended as the basis for areas to be excluded from the dredge areas. The rationale for excluding these areas and how the dredge boundaries were revised are summarized in Table 3-1.

Table 3-1
Summary of Recommended Exclusion Areas Based on Abandoned Core Information

Dredge Area	Core ID	Description and Rationale of Dredge Area Modification
SK_01_KX	RS1-9392-WT242, RS1-9392-WT249	The proposed exclusion area (SK_01_KX_A) is shown on Figure EXC-01 and includes two cores that encountered refusals along the western shoreline with a third core between them that is less than the criteria. The refusals near the shoreline are likely associated with shoreline riprap or other debris that will be difficult to dredge. These core locations are surrounded to the east by points that exceed the criteria. The western bound of the dredge area was modified to be the mid-point between the core locations that exceed criteria and the refusals.
SK_01_KX	RS1-9392-WT261, RS1-9392-WT266, RS1-9392-PR002	The proposed exclusion area (SK_01_KX_B) is shown on Figure EXC-01 and includes three cores that encountered refusal near a small "finger" of dredge area, surrounded by other refusals and core locations that are less than the criteria. The small finger area is mapped as Type II sediments bounded to the north and south by Type V materials. Based on these refusals, it appears that the harder Type V material is also underneath this small area. This small finger shaped area was excluded from the dredge area.

Dredge Area	Core ID	Description and Rationale of Dredge Area Modification
SK_01_KX	RS1-9392-WS653, RS1-9392-WT293, RS1-9392-WS294, RS1-9392-CT289	Two proposed exclusion areas (SK_01_KX_C and SK_01_KX_D) are shown on Figure EXC-02 and include four abandoned cores that were encountered along the break between two dredge areas. Several other samples in this area were reported as having shallow recovery and surface concentrations that only slightly exceed the criteria. The area is mapped as Type IV sediment to the south and along both shorelines to the north, with Type V materials directly north. These refusals and shallow recovery grab samples indicate that the rocky, gravelly Type V material extends into the dredge area and will likely be a difficult area to dredge. The dredge area was modified to exclude the rocky, gravelly materials and cores that are less than the criteria.
GI_02_NK	RS1-9190-PR046	The proposed exclusion area (GI_02_NK_A) is shown on Figure EXC-03. This location includes a single refusal in an area mapped as Type III sediment and the remainder of the dredge area is mapped as Type II sediment. Based on this data, this refusal appears to be associated with the harder Type III materials and will likely be difficult to dredge. The dredge area was modified to exclude this small area of Type III material.
EGIA01B_2	RS1-9089-ET055	The proposed exclusion area (EGIA01B_02_A) is shown on Figure EXC-04. The figure shows that the southern end of dredge area is surrounded on the west by cores that are less than removal criteria, to the south by another poor recovery (Level 2L) and to the east by the shoreline. The refusal is in an area mapped as Type III material, bounded immediately to the south by Type V material. Based on these refusals and this mapped material types, this area is expected to be difficult to dredge. The southern bound of the dredge area was modified to be the boundary between Type II sediments to the north and the Type III material to the south.
GI_01_KX	RS1-9089-WT185	The proposed exclusion area (GI_01_KX_A) is shown on Figure EXC-05. The figure shows that refusal was encountered along the western shoreline, likely associated with shoreline riprap or other shoreline debris and the area is bounded to the east by two cores that are less than criteria and to the north and south by points that exceed the criteria. The western bound of the dredge area was modified along the shoreline to exclude the refusal.

Dredge Area	Core ID	Description and Rationale of Dredge Area Modification
LL_04_NK	RS2-8988-IN022	The proposed exclusion area (LL_04_NK_A) is shown on Figure EXC-06 and includes the narrow section of dredge area in between areas mapped as Type III and Type V materials. Based on the refusal data, it appears that the harder Type III or Type V materials extend into this narrow area. This is further supported by the data for the point to the south, where elevated concentrations were reported, but the DOC is only 12 inches. This rocky, gravelly material will be difficult to dredge. The dredge area was modified to exclude the refusal area defined as the refusal to the south and the midway point between the refusal and the point to the north that exceeds the criteria.
FMD_01	RS2-8685-WT067	The proposed exclusion area (FMD_01_A) is shown on Figure EXC-07. This is a small piece of area extending north from the main dredge area and includes a single point where refusal was encountered. This small area is bounded to the north, east and west by points that are less than criteria and to the west by Type IV materials. This refusal is likely associated with gravelly and rocky material and will be difficult to dredge. The dredge area was modified to exclude this small area and extend to the mid-way point between the point that exceeds the criteria and the refusal.
FMD_01	RS2-8685-EP157 RS2-8685-EP158 RS2-8685-WT102 RS2-8685-AR216	The proposed exclusion area (FMD_01_B) is shown on Figure EXC-07 and includes four cores that encountered refusal along the western edge of the dredge area. The area is bounded to the west by other refusals and cores that are less than the criteria. These multiple refusals in the same area indicate that if surface sediments are present, they are shallow and that this material will be difficult to dredge. The exclusion area includes revision of the western bound of the dredge area in this section to be midway between the points that exceed the criteria and the refusals along the western edge. Note that point RS2-8685-WT087 is located east of the exclusion area and has a DoC of 1 inch. Because the surface concentration exceeded criteria (MPA Tri+ PCBs of 4 g/m^2 and maximum surface PCB concentration of 85 mg/kg), this point is left in the dredge area, but actual field work may determine that the shallow refusals and difficult to dredge region extends into this area.

Dredge Area	Core ID	Description and Rationale of Dredge Area Modification
FMD_03_NK	RS2-8584-CL001 RS2-8584-CL002 RS2-8584-CL003	The proposed exclusion area (FMD_03_NK_A) is shown on Figure EXC-08 and includes three refusal locations in an area mapped as Type IV materials bounded to the east by an area mapped as Type I sediment and points that exceed the criteria. The refusals appear to be associated with material type and will also be difficult to dredge. The dredge area was modified to exclude the Type IV material at this location.
FMD_05_NK	RS2-8584-PR002	The proposed exclusion area (FMD_05_NK_A) is shown on Figure EXC-08 and includes a single refusal located in a thin strip of Type III material on the eastern side of the dredge area. The dredge area was modified to exclude this thin strip of Type III material.
FMD_08_NK	RS2-8584-CL020 RS2-8584-CL021 RS2-8584-AR036	The proposed exclusion area (FMD_08_NK_A) is shown on Figure EXC-09 and includes three cores that encountered refusal located in a narrow portion of the dredge area bounded to the west by an area mapped as Type IV material. Other nearby points to the east and west are less than the criteria. Based on the refusals, it appears that the Type IV materials may extend further into the western side of the dredge area than mapped. The dredge area was modified to exclude the area of refusals. The northern bound of the exclusion area is the northernmost refusal and the southern bound is the midway point between the southernmost refusal and the point to the south that exceeds the criteria. The western bound of the dredge area in this section was modified to coincide with the mapped boundary of the Type IV material.
FMD_11_NK	RS2-8483-CT077	The proposed exclusion area (FMD_11_NK-A) is shown on Figure EXC-10 and includes a small, isolated piece of area with only a single grab sample. Although this location had a surface concentration of 43 mg/kg, the DoC is only 1 inch, making it impractical to dredge. The area is mapped as Type IV material surrounded by Type III material and points that are less than criteria or where shallow refusals were met. The dredge area was modified to exclude this small area of Type IV material.

Dredge Area	Core ID	Description and Rationale of Dredge Area Modification
UPM_10_NK	RS3-6665-PR049	The proposed exclusion area (UPM_10_NK_A) is shown on Figure EXC-11 and includes a small extension of the dredge area to the east at the northern end of the dredge area. The area includes a single core that encountered refusal in an area mapped as Type II material and is surrounded by other refusals and points that are less than the criteria, with the single exception of the nearest point to the west that only slightly exceeds criteria (MPA Tri+ PCBs of 10.8 g/m^2). The eastern bound of the dredge area was modified to be midway between the exceedence and the nearest refusal to the northeast and to the refusal point to the south.
UPM_10_NK	RS3-6665-PR051	The proposed exclusion area (UPM_10_NK_B) is shown on Figure EXC-11 and includes a single core that encountered refusal located in a small piece of dredge area mapped as Type III material and that will likely be difficult to dredge. The dredge area was modified to exclude this Type III material.
WD_06_NK	RS3-6059-PR059	The proposed exclusion area (WD_06_NK_A) is shown on Figure EXC-12 and includes a single core that encountered refusal located in a small piece of dredge area mapped as Type III material. The core sample to the south is less than the criteria. The dredge area was modified to exclude this Type III material.

Table 3-2 summarizes the area (acres), the estimated sediment volume (cy) and PCB mass (kg) in each exclusion area. Note that the depth of removal, volume and PCB mass included in Table 3-2 are based on the interpolated surface described in the Phase 2 DAD Report. Because the sampling in these areas provided mostly refusal data, the DoC and PCB concentrations are based on interpolated results from nearby locations. Actual dredging of these areas would probably yield significantly less material and less PCB mass than predicated by the interpolated results. In each case, the rationale for excluding these areas is the low removal productivity that would be encountered in trying to remove these materials and the relatively small amount of PCBs present.

Dredge areas were also reviewed for shallow water depths where additional non-target dredging would be needed to access the dredge areas (“access dredging”). A number of these access dredging locations are also wetland and were evaluated from the perspective of the adverse impacts of the additional access dredging. This evaluation resulted in the recommended exclusion of wetland areas originally targeted for dredging in dredge areas

NTIP02H and FMD_04. These proposed exclusion areas are shown on Figures AD-01 and AD-07. The acres, estimated sediment volume and PCB mass associated with these areas is given in Table 3-2.

Dredge areas in the vicinity of dams, locks and existing hydroelectric generating facilities were also reviewed to assess the ability to safely operate dredging equipment within close proximity to these structures. Dredge areas GI_13_NK, UPM_09_NK, LMD_05_NK and LMD_07_NK were identified as requiring special consideration based on their proximity to these structures. A brief summary of these dredge areas and their proximity to these structures is presented in Section 3.7.3. Portions of these dredge areas that are within 200 feet of the structures are proposed for exclusion from Phase 2. The areas proposed for exclusion are shown on Figures DA-05, DA-27 and DA-30 and will result in revisions to the dredge prisms in these areas in the Phase 2 FDR. The areas, estimated sediment volume and PCB mass associated with these proposed exclusion areas are presented in Table 3-2.

Table 3-2
Summary of Estimated Acreage, Volume and PCB Mass for Recommended Exclusion Areas

Recommended Exclusion Area	Area (acres)	Volume (cy)	Total PCB Mass (kg)
River Section 1			
NTIP02H_A	0.22	1,213	165
SK_01_KX_A	0.49	132	3.3
SK_01_KX_B	0.43	276	2.2
SK_01_KX _C	0.60	387	3.8
SK_01_KX_B	0.65	446	0.7
GI_02_NK_A	0.1	154	5.4
EGIA01B_2_A	0.16	254	56
GI_01_KX_A	0.15	489	0.5
River Section 2			
LL_04_NK_A	0.1	406	22
FMD_01_A	0.06	148	0.3
FMD_01_B	0.35	808	48
FMD_03_NK_A	0.1	342	27
FMD-04_A	0.76	2,227	16

Recommended Exclusion Area	Area (acres)	Volume (cy)	Total PCB Mass (kg)
FMD_05_NK_A	0.08	132	22
FMD_08_NK_A	0.22	380	43
FMD_11_NK_A	0.25	395	16
River Section 3			
UPM-09-NK_A	0.73	3,395	273
UPM_10_NK_A	0.11	837	7
UPM_10_NK_B	0.09	368	7.9
LMD-07-NK_A	0.14	880	58
WD_06_NK_A	0.11	520	16
GI-13-NK_A	0.41	783	76
LMD-05-NK_A	0.81	4,493	75

Identification of Candidate Exclusion Areas Based on Archaeological Concerns

The Phase 2 ARA Report recommended that specific areas be excluded from dredging based on the "high potential" that these areas would contain culturally sensitive material. As discussed in Section 2.2.7, 24 in-river areas have been identified as having such "high potential" due to either historical background information or features identified through review of existing remote sensing data or the initial site reconnaissance. Small dredge areas with relatively low PCB mass located in these "high potential" areas were identified in the Phase 2 ARA Report. Table 3-3 identifies nine dredge areas that are proposed for exclusion from the Phase 2 dredging due to the "high potential" that these areas would contain culturally sensitive material.

Table 3-3
Phase 2 Dredge Areas Proposed for Exclusion Based on Cultural Resource Potential

Dredge Area	CARA Investigation Area	River Section	Area (acres)	Volume (cy)	Total PCB Mass (kg)
FMD_06_NK	FMD-d2	2	0.4	783	23
CSD_03_NK	CSD-e	3	0.2	617	68
CSD_04_NK	CSD-f	3	0.2	576	26
CSD_05_NK	CSD-h	3	0.2	800	55
CSD_08_NK	CSD-j2	3	0.3	1,177	32
CSD_10_NK	CSD-j4	3	0.2	903	30
CSD_11_NK	CSD-k2	3	0.2	940	55
CSD_13_NK	CSD-l	3	0.4	1,357	29
CSD_04_KA	CSD-o	3	0.1	746	25
Totals			**2.2**	**7,898**	**342**

Additional evaluation of potential dredge prism modifications will be completed based on cultural resource factors, as well as habitat and engineering considerations, in the Phase 2 FDR (or addenda).

3.1.1.2 Development of Certification Units (CUs)

During development of the dredge prisms, CUs were defined in accordance with the Residuals Performance Standard. Specific requirements detailed in the Residuals Performance Standard and the RA Monitoring Scope (Attachment B to the SOW, Section 3.2) are summarized below:

- Isolated dredge areas smaller than 5 acres in size are to be designated as single CUs.
- Noncontiguous dredge areas smaller than 5 acres in size and within 0.5 mile of one another can be included as a single CU. The sum of the grouped dredge areas must be less than 7.5 acres.
- Dredge areas up to 7.5 acres in size can be considered a single CU.

- Dredge areas that range in size from 7.5 to 10 acres will be divided into two CUs of equivalent area.

- Dredge areas larger than 10 acres in size are to be divided into equally sized, approximate 5-acre CUs (as outlined in the Residuals Performance Standard).

Based on the aforementioned requirements, several dredge areas could be incorporated into a single CU, and this was done in many instances. The dredge areas that were incorporated into the individual CUs are summarized in Table 3-4, which also includes CU areas. CU numbering continues sequentially from Phase 1, thus Phase 2 removal activities will begin in CU 19. A total of 82 CUs have been developed for the Phase 2 removal activities, for a total of 100 CUs for both Phases 1 and 2. The CUs are shown on Figures DA-01 through DA-39 and Drawings D-2101 through D-2139 (for River Section 1; included in Appendix 1).

3.1.2 Debris Removal

Prior to inventory dredging, debris removal activities will occur and proceed in the sequence outlined below for inventory dredging. Debris removal will consist of the removal and clearing of objects and obstructions from the riverbed and shoreline (e.g., large boulders, overhanging vegetation, etc.).

A debris and obstruction survey was performed to identify the presence and determine the characteristics of structures, boulders, obstructions and debris in Phase 2 dredge areas. The survey was conducted by Ocean Surveys, Inc. (OSI) and included the use of available bathymetry survey data (multi-beam and single-beam bathymetry surveys), side-scan sonar data and magnetometer survey data to identify potential concern areas that will be targeted for debris removal activities. A summary of the methods and techniques utilized in this debris and obstruction survey evaluation (including debris survey figures) is summarized in the Phase 2 SEDC Data Summary Report Addendum, included in Attachment B of this Phase 2 IDR. The presence of shoreline debris will be determined through visual inspection prior to dredging.

Large items identified during survey and visual inspections will be removed in advance of inventory dredging. Smaller debris will be removed by dredging equipment during dredging operations. Following the removal of debris from the riverbed and/or shoreline, debris will be placed on a barge and transported to the Processing Facility where it will be offloaded and managed.

3.1.3 Inventory Dredging

The approach for Phase 2 inventory dredging is based on the following assumptions, in addition to those presented in Section 2:

- Dredging will begin in Dredge Area NTIP02H (CU 19), and work will generally proceed upstream to downstream. Exceptions to this approach may be necessary when addressing the area upstream and across from the mouth of Snook Kill (CU 35), the area west of Griffin Island (CUs 50 to 54), the land-locked area between Thompson Island and Fort Miller Dams (CUs 61 through 66) and areas in close proximity to dams, locks and associated hydropower structures (CUs 60, 78, 91, 93 and 96).

- Inventory dredging will be carried out using multiple mechanical dredges equipped with an environmental clamshell bucket. The dredges will likely include a range of sizes to accommodate the range of available water depths. The final number of dredges and size of buckets will be proposed by the contractor and presented in the RAWP(s) for Phase 2 Dredging and Facility Operations.

- Target combined removal rates for inventory sediment dredges is 2,900 cy/day on average.

The "design elevations" are shown on Drawings D-2101 through D-2139 included in Appendix 1. The acceptable tolerances for the cut lines relative to the design elevations are given in the Specifications (see Specification Section 13801 in Appendix 2). This specification includes the use of multi-beam bathymetry to assess the post-dredge elevations, and removal of inventory sediment will not be considered complete unless and until: (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, the elevation of no individual grid cell is more than 3 inches higher than the target elevation for that given cell.

As described above, Phase 2 of the project will be conducted over five construction seasons. A summary of the proposed dredging sequencing for Phase 2 is presented below. In this Phase 2 IDR, "Phase 2, Year 1" refers to the first full year of Phase 2 dredging (not the Phase 2, Initial Short Year).

- Phase 2, Year 1 (CUs 19 through 37, and CUs 52, 53 and 54):

  - CUs 19 through 31 will be dredged proceeding from upstream to downstream.

  - Dredging in CU 35 will be completed in parallel with dredging in CUs 20 through 24, and is to be completed prior to beginning dredging in CU 36.
  - Dredging operations will commence in CU 54 (WGIA) approximately 6 weeks after Year 1 dredging commences. Then dredging will proceed northward in this channel to CUs 53 and 52. These areas will be dredged in parallel with the CUs listed above.
- Phase 2, Year 2 (CUs 38 through 51, and CUs 55 through 60):
  - Dredging in Year 2 will commence in CU 38 and proceed upstream to downstream to CU 49 and then from CUs 55 through 60.
  - Dredging operations will commence in CU 51 (WGIA; approximately 2 weeks after Year 2 dredging commences) and proceed northward to CU 50. Residuals dredging, if required, in WGIA will commence after inventory dredging is completed in CU 50 and work southward to CU 54. These areas will be dredged in parallel with the CUs listed above.
  - Year 2 dredging activities will conclude in CU 60, which is the final CU located in River Section 1.
- Phase 2, Year 3 (CUs 61 through 77):
  - Dredging in Year 3 will commence in CU 61 and will generally proceed upstream to downstream to CU 66 within the land-locked area.
  - Dredging in CUs 67 through 77 will be completed in parallel with dredging operations in CUs 61 through 66, proceeding upstream to downstream.
- Phase 2, Year 4 (CUs 78 through 91):
  - Dredging in Year 4 will commence in CU 78 and will generally proceed upstream to downstream to CU 91. Given the distance between dredge areas, dredging in downstream CUs will be permitted provided that residuals samples are not collected prior to the completion of upstream inventory dredging.

- Phase 2, Year 5 (CUs 92 through 100):
  - Dredging in Year 5 will commence in CU 92 and will generally proceed upstream to downstream to CU 100. Given the distance between dredge areas, dredging in downstream CUs will be permitted provided that residuals samples are not collected prior to the completion of upstream inventory dredging.

The above listing of the CUs to be dredged in each year has been developed for design purposes; the actual number and identity of CUs that will be dredged in each year of Phase 2 will depend on project and field conditions and the actual progress of the dredging.

3.1.4 Residuals Dredging

After the initial inventory dredging is completed in a CU (i.e., target elevations verified through bathymetric survey), the process for sampling residuals, re-dredging (if necessary), and backfilling/capping (depending on the results of the residuals sampling) will be implemented. Mechanical dredges, similar to those used for inventory dredging, will also be used to remove residual sediment if re-dredging is necessary. The plan for residuals dredging is based on the following assumptions (in addition to those presented in Section 2):

- Residuals dredging in a CU will begin approximately 6 days after the completion of inventory dredging in that CU.
- Residuals dredging will be carried out using multiple mechanical dredges in each CU. The dredges will likely be different sizes and equipped with environmental clamshell buckets. The final number of dredges and size of buckets will be proposed by the contractor.
- Target residual sediment removal thickness is 6 inches.
- For planning purposes, it has been assumed that one re-dredging pass will be conducted over the entire Phase 2 area. The accuracy of this assumption is unknown and final determination of the extent of residuals dredging will be determined after inventory dredging is completed.
- To assist in designing the Processing Facility, a combined average residuals dredging rate of 600 cy/day was assumed.

The residuals dredging productivity assumptions have been incorporated into the logistics model (Attachment C), including delay times due to confirmatory bathymetric surveys and sediment sampling of approximately 6 days after the completion of inventory dredging in that CU. Based on the residuals dredging assets (dredges, barges and tugs) and the assumed scope and dredge rate for the residuals program, the logistics model predicts that the residuals will be able to be dredged to meet the construction timeline and schedule in the majority of Phase 2 dredge areas. As described in Section 3.8, additional modeling evaluations will be performed during Phase 2 Final Design.

The Residuals Performance Standard provides a basis of design for residuals dredging as well as for backfilling and capping. This standard describes Tri+ PCBs action levels as the trigger for additional dredging and the post-removal conditions when backfill and caps can be placed. The action levels will be applied on a CU basis. Following completion of inventory dredging within a given CU, residuals sampling will be performed to determine PCB concentrations in residual sediment after dredging. The Phase 2 RAM QAPP will specify the routine monitoring, reporting and sediment sampling and analysis protocols; and the Phase 2 PSCP will describe the data evaluation procedures and actions associated with the results for each CU. Both of these plans will be developed prior to Phase 2 dredging.

The action levels and required actions are discussed in Section 2.1.2.2. The Phase 1 PSCP Scope (Attachment C to the SOW) provides additional details on how data will be evaluated. A checklist will be used to certify completion of dredging (see Attachment I).

3.1.5 Access to Dredge Areas

In some areas of the site, dredging of non-target material may be necessary to provide access to certain shallow-water dredge areas. Primarily, this involves deepening (dredging below the DoC) within the footprint of the established dredge areas. The mechanical dredge equipment selected for the inventory and residuals dredging will also be used for any dredging of non-target sediment to access dredge areas. Locations where access dredging may be needed include those areas that, under low-flow conditions, are expected to generally have 3 feet or less of water available for the dredging equipment, including the dredge platform and dredged material barge. Sediment removed during remedial operations was also considered as many of the dredge areas with shallow water will have sufficient water depth once targeted sediments are removed. However, there are some dredge areas with little to no water depth available under low-flow conditions and the 1 to 2 feet of sediment targeted for removal is not sufficient to provide equipment access. The areas where access is of concern are shown in Figures AD-01 through AD-16. The need for access dredging will be made in the field based on flow conditions and actual equipment used at that time.

Access dredging may or may not be needed depending on water flows during a given year and the specific equipment that the contractor uses. In Final Design, consideration will be given for deviating from the general upstream to downstream sequence in order to dredge these areas early in the season when water levels tend to be higher. The low-flow conditions used to identify the potential access dredging locations are based on existing bathymetric data and a return period of 1Q3. This analysis will be updated for River Sections 2 and 3 once multi-beam bathymetric data are available for these portions of the river. Riverine fringing wetland areas are shown on Figures AD-01 through AD-16 as many of the access dredging locations coincide with the presence of wetland areas, as noted in Section 3.1.1.1.

3.1.6 Dredged Material Transport

Phase 2 dredged material transport encompasses the activities that involve movement of the dredged material from the point of origin located in River Sections 1, 2 and 3 through to the final delivery at the Processing Facility, located along the Champlain Canal between Locks 7 and 8. These activities incorporate the in-water transport of inventory and residual sediment and debris. The type of material, transport operations and frequency of delivery and unloading at the Processing Facility are critical to the efficiency of dredging and Processing Facility operations. Key factors include the quantity, character and amount of debris, sediment and water brought to the facility, as well as the timing of the movement of these transported materials. These activities must occur at a rate sufficient to maintain the specified dredging production. In order to reduce the number of trips and increase productivity, removal and treatment of the water layer in scows after the sediment settles, at or near the point of dredging, will be considered in Final Design.

In-water transport of inventory and residual sediment will occur through the use of scows (barges), in conjunction with tugs, to deliver material to the Processing Facility. The barge sizes that are expected to be used for this project range from 195 by 35 feet to 60 by 30 feet, while tug boats are approximately 60 feet in length. Travel speeds for tug boats, either pushing barges or moving without a load, range from 6 to 7 mph.

Prior to dredging, large debris items will be removed by a backhoe staged on a deck barge and equipped with a hydraulic grappling hook. The removed material will be placed on a deck barge and transported to the Processing Facility for handling and shipment for disposal. Tree limbs and other materials removed during the shoreline preparation process may be handled in a similar manner, but utilizing separate barges for the transportation of the material to the Processing Facility or to alternate locations in River Sections 2 and 3 to be identified by the contractor. The contractor may choose to employ deck barges dedicated to the transportation of debris or tree limbs, so as to allow the debris removal backhoe barge to remain in the active work area.

Material transport will occur through up to seven locks, with the potential for an additional two locks, Locks 8 and 9, to be utilized for the transport of backfill and cap material. Operational and design records for those locks were obtained from the NYS Canal Corporation. These records indicate a typical lock length of 300 feet and a maximum time for one-way lockage of approximately 40 minutes, which includes the time needed to stage and position the vessel(s), drain or fill the lock and exit the lock.

Prior to Phase 1 dredging operations, a turning dolphin will be installed approximately 60 feet south of Lock 7 to facilitate vessel movement and ensure safe turning of vessels. Additionally, a series of mooring dolphins will be installed just south of Lock 7 for the temporary staging of project vessels. The Phase 2 dredged material transport will utilize these structures and one additional in-river barge mooring location in River Section 3. This new mooring area will be similar to the one to be located just south of Lock 7. The proposed location of these barge mooring dolphins are shown on Figure BM-01. This area will be utilized to regulate the flow of material transport through River Sections 2 and 3, including corresponding Locks 1 through 6, and, when available, to provide short-term mooring areas for equipment not being actively used on the river.

A maximum travel distance for material transport during Phase 2 will be approximately 41 miles and is anticipated to occur during Year 5 of Phase 2. The trip will include transit through seven locks. Distances between locks range from a maximum distance of 14 miles (between Locks 4 and 5) and a minimum distance of 2 miles (between Locks 3 and 4). For the purposes of the Phase 2 dredged material transport design, it is assumed that locks and lift bridges will be operating 24 hours per day, 6 days per week for approximately 26 to 28 weeks, weather permitting (from early May through late November). A seventh day of activities each week will depend on dredging production and will be utilized on a contingency basis, as needed.

The pool above the Upper Mechanicville Dam is subject to variations in elevation based on operation of the flow control structures at the dam. These pool elevation fluctuations may cause difficulties in navigating beneath low clearance bridges in this area of the project.

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

3.2 Resuspension Control

Sediments may be suspended at levels above baseline conditions during the following in-river activities: dredging, debris removal, propeller wash (associated with in-river transport and the anchoring of barges and work boats) and pile-driving (associated with in-river mooring area construction or installation of resuspension control systems). Once suspended, larger particles (i.e., coarse and medium sands) descend through the water column back to the river bed relatively close to their point of origin, whereas smaller particles (i.e., fine sands, silt and clay) remain suspended for longer periods of time and may migrate further downstream (away from their point of origin). While suspended, a fraction of PCBs (if present in sediment) has the ability to desorb and enter the water column in a dissolved phase. This desorption is a function of several factors, including, but not limited to, the type of sediment and associated PCB concentration, the rate of resuspension and surface water flow conditions, including additional factors specified in Table 2-9. Resuspension modeling, as presented in Attachment G, was utilized to develop a screening level estimate of PCB concentrations and mass loads at the nearest far-field station to the dredging operation. Only the release from the dredge bucket has been included in the model, as the release rate from other sources cannot be reliably estimated. There is also uncertainty in the release rate, assumed to be 0.35 percent, from the dredge bucket. Due to the uncertainties of the actual release rate from the bucket and other sources, a rate of two times the estimated release rate has been used as a design basis for contingent controls. In addition, applying the rate of 0.70 percent loss provides a sensitivity analysis of the model results. Resuspension controls have been evaluated in areas that, according to the model, contribute enough PCBs to be above the Control Level and/or the Standard Level at the far-field station, as described in Section 2.1.2.1.

The following section describes those findings.

3.2.1 Summary of Resuspension Modeling

The transport of sediment and associated PCBs resuspended during the dredging operation was modeled to assess the impacts of dredging. The results of the resuspension modeling are provided in Attachment G and summarized below.

Overall, this screening analysis predicts that the cumulative resuspended Total PCB load at the end of Phase 2 dredging (not including Phase 1 dredging) is 237 kg at the 0.35 percent resuspension loss rate and 475 kg at the 0.70 percent loss rate. Both of these values are below the Control Level calculated for Phase 2 of 585 kg. The screening analysis also predicts the estimated PCB mass transported to far-field stations as a result of dredging individual areas without resuspension controls.

The resuspension model summarized in Attachment G used an assumption of two dredges, for simplicity, operating at a dredge rate of 1,450 cy/d for each dredge (half the average target removal rate of 2,900 cy/day for inventory sediment) and an assumption that dredging operations would occur 24 hours per day, 6 days per week. Based on these assumptions, individual areas that are predicted to generate instantaneous far-field concentrations greater than a screening level of 225 ng/L (half of the daily concentration allowance above baseline) are identified. A screening level of 225 ng/L assumes a baseline far-field PCB concentration of 50 ng/L subtracted from the Standard Level of 500 ng/L, divided by two dredges operating simultaneously. It is likely that more than two dredges will be working simultaneously, however, the effects of multiple smaller dredges working in close proximity can be modeled as one larger operation. As discussed in Attachment G, the actual baseline PCB concentration will change as dredging proceeds from upstream to downstream and the far-field station moves from Thompson Island Dam to Schuylerville, Stillwater and then to Waterford. Average baseline PCB concentrations at these stations range from approximately 35 to 45 ng/L. Thus, use of an assumed baseline concentration of 50 ng/L is conservative. This provides a conservative estimate of areas that might contribute to concentrations above the standard. While there are sporadic small areas throughout the TIP that are estimated to exceed the 225 ng/L far-field PCB concentration, only sub-areas with two or more adjacent model grid cells that result in over 225 ng/L averaged over a 24-hour period are identified. These areas for Phase 2 are:

- **NTIP02H:** The sub-area within dredge area NTIP02H is approximately 1.9 acres and is located in the vicinity of RM 193. The approximate volume specified for removal is 9,300 cy, situated in CU 19, in which the majority of sediment is classified as S3 and Type I (Attachment B). As shown in Drawing G-2111 (included in Appendix 1), there is an overhead power cable above this sub-area that may hinder or inhibit the implementation of sheet pile-based resuspension controls. Geotechnical borings collected in this sub-area indicate silty sand materials in the top 6 feet (BBL 2005b). Debris and obstruction surveys identified several targets in the sub-area that may hinder or inhibit the implementation of resuspension controls (Figure 1, Attachment B). The cut required near the shoreline for this dredge area and shallow water depth will result in a reduced rate of dredging and an associated reduced rate of loss by resuspension being predicted by the model.

- **SK_01_NK:** The sub-area within dredge area SK_01_NK is approximately 5.2 acres and is located in the vicinity of RM 191.9. The approximate volume specified for removal is 20,900 cy, situated in the immediate vicinity of CUs 31 through 35, in which the majority of sediment is classified as S3 and Type I (Attachment B). Site conditions and constraints that may hinder or inhibit the implementation of resuspension controls include wooden docks and shoreline rip-rap extending into the removal area as shown in Drawings G-2114 and G-2115 (included in Appendix 1) and numerous debris targets as shown on Figure 3 of Attachment B. In addition, the islands present in this area, known as the "Three Sisters," will limit the maneuverability of dredges and barges in the areas between the islands and the shoreline, resulting in lower removal rates. If hard structure resuspension control measures are necessary, the physical barriers presented by the islands can be incorporated into such control measures by installing sheet piles between the islands.

- **SK_01:** The sub-area within dredge area SK_01 is approximately 4.2 acres and is located in the vicinity of RM 191.4. The approximate volume specified for removal is 13,300 cy located in the immediate vicinity of CUs 38 and 39, in which the majority of sediment is classified as S2 and Type IV (Figure 4 in Attachment B). Site conditions and constraints that may hinder or inhibit the implementation of resuspension controls include wooden docks and shoreline rip-rap extending into the dredge removal area as shown in Drawing G-2118 (included in Appendix 1) and numerous debris targets as shown on Figure 4 in Attachment B.

- **SK_03_KA:** The sub-areas within dredge area SK_03_KA are approximately 2.7 acres and are located in the vicinity of RM 190.9. The approximate volume specified for removal is 12,200 cy. located along the western shoreline in the immediate vicinity of CUs 44 and 45, and in the center of the channel in CU 46, in which the majority of sediment is classified as S2 and Types II and IV (Figures 5 and 6 in Attachment B). Site conditions or constraints that may hinder or inhibit the implementation of resuspension controls include numerous debris targets, as shown on Figures 5 and 6 in Attachment B.

- **GI_05_NK/GI_06_NK:** The sub-area within dredge area GI_05_NK is approximately 1.3 acres and the adjacent dredge area GI_06_NK is approximately 1.6 acres and is located in the vicinity of RM 189.3. The approximate volume specified for removal from these two areas is 11,300 cy located in the immediate vicinity of CUs 55 and 56, in which the majority of sediment is classified as S4 and S3 and Type I (Figure 8 in Attachment B), respectively. Site conditions are shown in Drawing G-2112 (included in Appendix 1), and geotechnical data collected during the SEDC indicate depths to bedrock of 5 to 10 feet near this area, presenting difficulties for the installation of hard structure resuspension controls. The Moses Kill discharges to the river in this area, further complicating the ability to install structures that could impede water flow. Numerous debris targets were also identified in this area, as shown on Figure 8 in Attachment B.

- **FMD_01:** The sub-area within dredge area FMD_01 is approximately 16.3 acres and is located in the vicinity of RM 185.9. The approximate volume specified for removal is 75,600 cy located in the immediate vicinity of CUs 67 through 70, in which the majority of sediment is classified as S3 and Type I (Figure 17 in Attachment B). Site conditions are shown in Drawings G-2132 and G-2133 (included in Appendix 1), and indicate the presence of the navigation channel, a potential hindrance to the installation of hard structure resuspension controls. In addition, data collected during the Phase 2 SEDC indicated depths to bedrock in this area of 8 feet, presenting additional difficulties in the installation of hard resuspension control structures. Numerous debris targets were also identified in this sub-area, as shown on Figure 17 in Attachment B. The shallow water depths in this area will also require dredging from the center of the channel towards the shoreline to provide sufficient access for the dredges and barges to remove sediments along the shore. The slow rate of dredging associated with these shallow water operations are consistent with the rates predicted by the model as being necessary to work within the resuspension requirements.

As described in Section 3.7.1, the resuspension model did not assess resuspension in the WGIA. Due to the prevalence of soft aqueous silty (Type 1) sediment and high PCB mass in the WGIA, resuspension controls may be needed at its south end. For the purpose of this Intermediate Design, it has been assumed that a rigid control structure (sheet pile system) would be installed in this area to support sediment removal operations in the channel west of Griffin Island. The Phase 2 Final Design will evaluate the need, for type, of and extent of resuspension controls actually required in this area after additional hydraulic information is collected within this channel. The Phase 2 FDR will also include a detailed design and layout for the control structure, as necessary.

3.2.2 Resuspension Control

The methodology utilized in the selection of appropriate resuspension controls is discussed at length in the Phase 1 IDR. As such, the following briefly revisits and describes the process of selecting appropriate resuspension controls.

- **Step 1 - Resuspension Modeling:** The modeling of the transport of sediment and associated PCBs resuspended by the dredging operation is conducted to assess various dredge scenarios in terms of compliance with the far-field Control and Standard Levels for PCBs. This modeling has considered variations and limitations on the rate of sediment removal as a factor that controls resuspension.

- **Step 2 - Selection of Control Systems:** The location and type of resuspension controls are based on an evaluation of the modeling results, and identifying those areas of the river where controls may be needed. The following factors also influence the location and type of controls: riverbed geotechnical characteristics, river hydraulics, dredged material transport, water depth, density of debris, quality of life considerations and navigational requirements. Following the identification of locations where resuspension controls will be required, the decision is made to utilize reductions in sediment removal rates or the implementation of containment systems (i.e., silt curtains or rigid control systems) as the method of resuspension control.

  Lessons learned from the implementation of resuspension controls from Phase 1 will be reviewed and considered as a design basis in the Phase 2 Final Design addendum. Specifically, the test period and resulting resuspension controls utilized in the East Griffin Island Area (EGIA) to test and evaluate the effectiveness, reliability and operation of different resuspension control structures may be used to refine the design for resuspension controls for Phase 2.

- **Step 3 - Development of Drawings and Specifications:** This step translates the results of the design process into design Drawings and Specifications that will provide guidance to the contractor, whose responsibility it will be to properly design, install and operate the resuspension control structures or plan for reduced dredging rates and/or restrictions on areas that can be dredged simultaneously.

Based on the results of the resuspension modeling described in Attachment G and summarized in Section 3.2.1, it will be necessary to control resuspension in several areas. The obstacles and sub-bottom geotechnical properties identified in these sub-areas inhibit the ability to install rigid-type control structures. Therefore, the ability to limit the rate of sediment removal from these areas was assessed. These areas are shown on Figures RC-01 through RC-07. When the resuspension modeling was completed using a design loss rate (%R) of 0.35, two areas were identified. A reduced rate of removal in these two areas results in PCB concentrations below the screening level at far-field locations:

- **Dredge Area SK 01; CU 39:** Sediment removal from a sub-section of this area will be limited to a maximum of 1,100 cy/day.

- **Dredge Area GI 05 NK and GI 06 NK; CU 55 and 56:** Sediment removal from sub-sections of these areas will be limited to a maximum of 1,000 cy/day.

As described in Section 3.2.1, the resuspension modeling was also completed using a %R of 0.70, to identify areas where resuspension control or containment systems will be specified in the design as contingencies to be available for such areas on an as-needed basis. This modeling effort identified six areas where limits on the rate of removal will be available as a contingent control (shown on Figures RC-03 through RC-07):

- **Dredge Area NTIP02H; CU 19:** Sediment removal from a sub-section of this area would be limited to a maximum of 1,100 cy/day.

- **Dredge Area SK_01_NK; CU 35: and 36** Sediment removal from a sub-section of this area would be limited to a maximum of 550 cy/day.

- **Dredge Area SK_01; CU 38-39:** Sediment removal from a sub-section of this area would be limited to a maximum of 950 cy/day in the northern portion of the sub-section, and 430 cy/day in the southern portion of the sub-section.

- **Dredge Area SK 03 KA; CU 44 and 46:** Sediment removal from two sub-sections of this area would be limited to a maximum of 1,000 cy/day.

- **Dredge Area GI 05 NK and GI 06 NK; CU 55 and 56:** Sediment removal from sub-sections of these areas will be limited to a maximum of 430 cy/day in the northern portion of the sub-section, and 550 cy/day in the southern portion of the sub-section.

- **Dredge Area FMD 01; CU 67-69:** Sediment removal from a sub-section of this area would be limited to a maximum of 2,200 cy/day.

The Phase 2 FDR or addendum will present Drawings that direct the contractor to limit sediment removal in the two sub-areas shown on Figures RC-01 and RC-02. The

Drawings will also further limit removal rates in the sub-areas shown on Figures RC-03 through RC-07 if these areas are identified as the source of exceedances of the Resuspension Performance Standard.

3.3 Sediment and Water Processing

This section presents a summary of the estimated quantities and type of sediment expected to be encountered during Phase 2. It also discusses whether the Processing Facility that is currently being constructed for Phase 1 is capable to support the Phase 2 dredging program. A description of the Phase 2 Processing Facility operations is also described here.

The Processing Facility unit processes will be operated during Phase 2 as described in the Phase 1 FDR and subsequent addenda. Sediment and water processing will follow dredged material transport, and involves the unloading and preparation of dredged sediments for transportation and offsite disposal. The facility will receive barges and unload dredged sediment from the barges at the waterfront. Debris and other large objects will be separated from the sediment at this location and then the sediment will be classified according to particle size into fine and coarse fractions. The fine fraction of the sediment will be thickened and dewatered and stockpiled for subsequent loading into rail cars. The same unit processes and equipment designed and constructed for Phase 1 will be utilized during Phase 2. The separated coarse fraction will also be stockpiled for subsequent loading into rail cars and transportation for disposal. Water from the unloading, screening and dewatering operations, along with stormwater collected from process areas of the site, will be treated and discharged to the Champlain Canal.

3.3.1 Estimated Quantities of Sediment To Be Processed

The following discussion describes the methods for calculating the estimated quantities of sediment (by type) and the results of those calculations. The Phase 2 Dredging Rates discussed in Sections 3.1.3 through 3.1.4 were used as inputs, including an average target inventory dredging rate of 2,900 cy/day and residuals dredging rate of 600 cy/day for a total target dredging rate of 3,500 cy/day. The maximum or peak inventory dredging rate is assumed to be 4,360 cy/day with a residuals dredging rate of 630 cy/day, for a total maximum dredging rate of 5,000 cy/day (rounded), which is below the nominal capacity of the plant for S2/S3 type sediment.

The Phase 1 IDR presented an assessment of Hudson River sediment data using analytical results from Years 1 and 2 of the SSAP. Attachment G, Exhibit G-1.1 of the Phase 1 IDR detailed this assessment. Four sediment types were developed by pooling the Years 1 and 2 SSAP sediment data into four equal quartiles when sorted by Percent Fines (< 74 um). This resulted in the following definition of Sediment Types:

- S1 indicates sediments containing less than 9.3 percent fines (<74 microns)
- S2 indicates sediments containing from 9.3 to 37.3 percent fines (<74 microns)
- S3 indicates sediments containing from 37.3 to 65.3 percent fines (<74 microns)
- S4 indicates sediments containing more than 65.3 percent fines (<74 microns)

Table 3-5 presents the major properties associated with each of the Sediment Quartiles from the Years 1 & 2 SSAP data. Additional sediment data were acquired for the Phase 2 dredge areas. The Phase 2 sediment data are presented on Table 3-6 for comparison to the Years 1 and 2 SSAP data.

The Phase 2 data were pooled by the same percent fines ranges developed from the SSAP data (i.e., splits at 9.3, 37.3 and 65.3 percent fines). In general, the Phase 2 and SSAP data averages are similar for the properties of dry bulk density, solids specific gravity, fines (<74µm) and percent solids within each of the sediment types. However, the average PCB concentrations within the SSAP data are different from the Phase 2 data sets. In general, the Phase 2 sediments contain comparable or lower PCB concentrations than the SSAP samples (lower for S3 and S4 sediment types).

3.3.2 Evaluation of the Processing Facility

The sediment and water Processing Facility infrastructure and equipment that is being constructed for Phase 1 is expected to be used for Phase 2. The design of the facility was presented in the Phase 1 FDR and addenda issued during procurement and construction. The specific basis of design for the Phase 2 sediment and water processing facilities (Processing Facility) is presented in Table 2-8 of Section 2. For the Phase 2 dredge areas, it is estimated that approximately 65 percent of the dredge volume will be composed of S2/S3 type sediment and 35 percent of the material will be composed of S4 type sediment. The Processing Facility has been designed to process a peak rate of 5,100 cy/day of S2/S3 type sediment. Once installed, the Processing Facility will have the ability to process 3,500 cy/day of S1 type sediment and 3,700 cy/day of S4 type sediment.

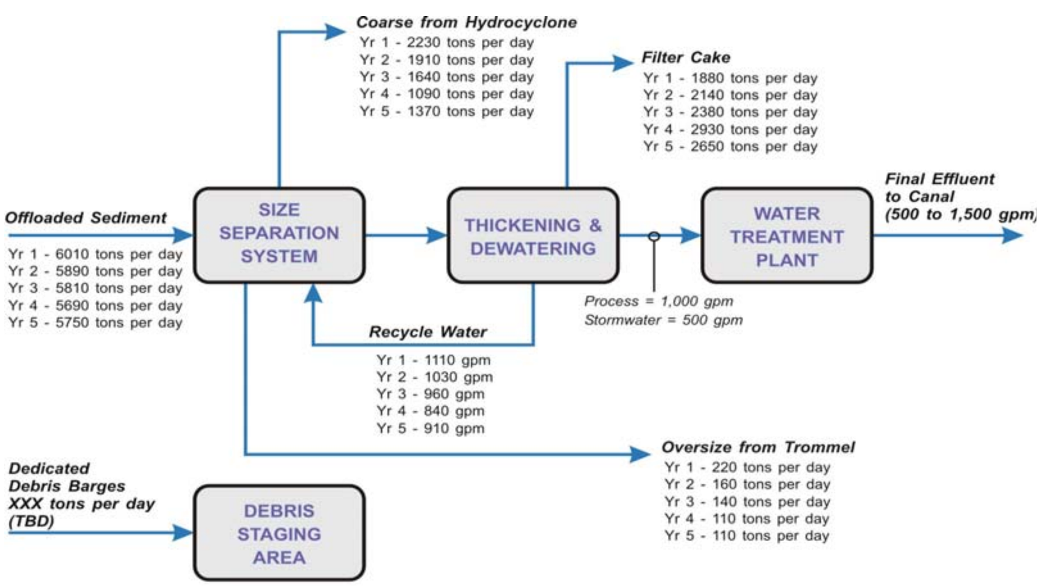
To determine if additional equipment and processing capacity was required at the Processing Facility during Phase 2, METSIM™ model runs have been developed utilizing the Phase 2 dredge area data. METSIM™ is a process simulation tool designed to aid in the generation of mass and energy balances for complex processes process optimization, flow sheet generation and equipment sizing. For this project, the METSIM™ model was used to generate a material balance around the varies unit processes at the Process Facility to assess whether the equipment being installed for Phase 1 is capable of meeting the Phase 2 process and capacity requirements. The METSIM™ model output data are presented in Attachment L of this report and a summary of the results is described below.

The Processing Facility is divided into four process areas:

- Size Separation
- Thickening and Dewatering
- Water Treatment
- Storage and Rail Car Loading

A simplified mass balance diagram for each process is presented below.

Figure 3-1
Simplified Mass Balance Diagram



Notes:
1. All noted values of "Tons per Day" are shown as "Wet Tons."
2. Actual flow rates will vary and depend on actual sediment properties and unloading rates of the dredged material.
3. Proportional flow rates will be assumed for lower production rates.
4. Yearly rates are the anticipated annual averages that are expressed per operating day.
5. Offloaded sediment consists of 2,900 cubic yards per day of inventory dredging, plus 600 cubic yards per day residual dredging, plus associated dredge uptake water.
6. Additional mass balance information is included in Attachment L to the Phase 2 Intermediate Design Report.
7. gpm = gallons per minute
8. Yr = year

A description of each process area is presented below:

3.3.2.1 Size Separation

The size separation process area is located at the waterfront (adjacent to the canal). The primary objective of the size separation system is to separate the coarse sediment from fine sediment, and reduce the amount of material to be dewatered mechanically. The size separation area consists of the following:

- Sediment offloading
- Trommel
- Hydrocyclone system

The size separation system currently has a design capacity of 5,100 cy/day of S2/S3 type sediment. Based on the results of the Phase 2 METSIM™ model runs, the current processing capacity of the size separation area will not be exceeded during Phase 2. As a result, no additional design or process modifications are proposed for this area of the Processing Facility at this time.

3.3.2.2 Thickening and Dewatering

The primary objective of the thickening and dewatering system is to concentrate and dewater the fine particulate slurry from the size separation system to the desired dry solids concentration prior to final disposal. The basis of design for the dewatered sediment slurry is a minimum dry solids concentration of 55 percent. Two of the key Thickening and Dewatering system components are the gravity thickener and the filter press system. Each is described below:

Gravity Thickener

Based on the Phase 1 Design, a gravity thickener will be provided to separate and concentrate the fine sediments from the water fraction of the sediment slurry following size separation. The gravity thickener consists of an above-grade steel thickener tank with a conical bottom to concentrate the slurry to approximately a concentration of 15 percent.

The gravity thickener was designed to handle a total design flow of 2,290 gallons per minute (gpm) and a total mass loading of 1,550 dry tons per day. Based on the results of the METSIM™ material balance estimates (Attachment L, Table 1) the gravity thickener provided under Phase 1 has sufficient capacity to handle the anticipated Phase 2 flows and mass loading. As a result, no additional design or process modifications are proposed for the gravity thickener for Phase 2 at this time.

Filter Press System

Twelve (12) 2-meter by 2-meter plate and frame filter presses will be installed based on the Phase 1 Design. Assuming that each filter press will have a 3-hour cycle time and operate 24-hours per day, the filter press system has the capacity to process up to 5,100 cy/day of S2/S3 type sediment or 3,700 cy/day of S4 type sediment. Since S4 type sediment contains a much higher percentage of fine grain solids, the fine solids flow to the gravity thickener is going to be higher than the fines solids flow from S2/S3 sediment. As a result, the capacity of the filter press system will be reduced from 5,100 cy/d to 3,700 cy/d for S4 sediment.

METSIM™ model runs were developed for each Phase 2 dredge year (1 to 5) based on an assumed inventory dredge rate of 2,900 cy/day for a 120-day inventory dredge season. The METSIM™ output results were used to determine the total number of filter presses required to process inventory sediment for each Phase 2 dredge year. The results of the filter press evaluation are presented in Attachment L – Processing Facility Evaluation. The results indicated that the filter press system as currently being constructed under Phase 1 will have the capacity to meet the required Phase 2 dredge inventory sediment processing rates if operated 6 days per week for the assumed 120 dredge days. Based on this evaluation, the average number of filter presses required for each dredge year was determined to be between 6.6 and 10.2 units, depending on the type of sediment for each year. The average number of filter presses required for Phase 2 was determined to be 7.8 units. Since the quantity, characteristics and schedule for residuals dredging are currently uncertain, residuals dredging was not included in the filter press capacity evaluation. Residuals dredging will be handled with the spare filter press capacity. Also, since the filter press evaluation assumes that all inventory dredging will be completed in 120 days of dredging, additional time following inventory dredging and all 12 filter presses will be available for additional residuals dredged material processing, if required.

Water Treatment System

The water treatment system is designed to treat water generated from the site stormwater runoff and the Processing Facility operations. The water treatment facility is designed to remove suspended solids and PCBs, as required to achieve the discharge effluent limits. The primary objectives of the stormwater and process water treatment facilities are to collect and treat stormwater and facility process water and to provide process water for reuse in the facility. The Phase 1 water treatment system is designed with a capacity of 1,500 gpm.

Based on the results of the METSIM™ model estimates, the water treatment system provided under Phase 1 has sufficient capacity to handle the anticipated Phase 2 flows. As a result, no additional design or process modifications are proposed for this area of the Processing Facility at this time.

Staging and Rail Car Loading

Staging facilities are provided during Phase 1 for onsite temporary storage of debris, coarse material and filter cake. The filter cake storage areas are covered and provided with vapor phase activated carbon systems. No process modifications are proposed for this area of the Processing Facility at this time. However, should Phase 1 show that additional staging is needed, additional space is available at the Processing Facility to expand all three storage areas. In this event, additional staging areas can be constructed for Phase 2 Operations. Since the rail yard operation is scheduled for daylight hours in Phase 1, there is available capacity for loading more rail cars per day in Phase 2 by working additional hours.

3.4 Processed Sediment Transportation and Disposal

The processed sediment transportation and disposal element of the project involves the transportation of processed sediment and other project waste material (such as oversized debris) to an approved landfill for final disposal. The process employed to identify, evaluate and select the mode of transportation and the landfill destination was explained in Sections 3.7 and 3.8 of the Phase 1 IDR.

Transportation of processed sediment and other project waste material will be by rail using "unit trains" comprising 81 gondola rail cars (a "unit train" consists entirely of rail cars traveling from an origin to a single destination, instead of small groups of rail cars that are included in trains carrying other commodities to different destinations). The selected landfill destination for Phase 1 is the Waste Control Specialists, Inc. (WCS) TSCA-authorized landfill facility in Andrews, Texas. 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 material storage, sampling and loading. It also simplifies the logistics of rail car management. The Phase 2 logistics model has assumed that WCS landfill facility in Andrews, Texas will be the destination for Phase 2 processed materials in order to evaluate rail logistics. However, the final decision on the landfill for Phase 2 will be determined after Phase 1.

Rail cars will be equipped with a sift-proof packaging system in accordance with New York State Department of Transportation (NYSDOT) requirements. Each rail car will be weighed before leaving the Processing Facility rail yard to verify that the load meets the weight restrictions of the commercial carriers. Once a unit train of 81 cars is filled with processed sediment and other project waste material, it will be picked up by the commercial rail carrier.

It is anticipated that when a unit train of full cars is dropped off at the landfill, the locomotives will be connected to a waiting group of 81 empty cars for the return trip; conversely, when a unit train of empty cars reaches the Processing Facility rail yard, the locomotives will be connected to a set of 81 full cars to start the trip to the landfill.

A fleet of rail cars (including an allowance for spare cars to accommodate routine and unexpected maintenance needs) will be dedicated to the project. On average, one unit train will depart from (and one unit train of empty cars will arrive at) the rail yard at the Processing Facility every 2 to 3 days during Phase 2, although the actual frequency of train movements will be controlled by the rail carriers.

Upon arrival at the landfill, the cars will be unloaded and 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. Before being used for any other purpose (e.g., at the end of the project), rail cars will be decontaminated in accordance with applicable regulations.

3.5 Backfilling/Capping and Habitat Construction

Once inventory and residuals dredging are complete in a given portion of each 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 I. The decision to place backfill or cap will be based on the post-dredging distribution of PCB concentrations in accordance with the Phase 2 PSCP. The backfill design balances habitat and stability considerations.

3.5.1 Backfill and Cap Types

Ultimately, the total and relative acreage of areas to be capped or backfilled will depend on the results of the residuals sampling. The assumptions described below are used as a basis of design in the Phase 2 IDR so that material volumes can be estimated and the feasibility of placing the material within each construction season can be determined utilizing the logistics model described in Section 3.8. These assumptions do not predict the actual amount of backfilling or capping that will take place during implementation of the Phase 2 activities, but have been developed to allow assessment of transport and placement logistics.

3.5.1.1 Backfill Types

As described in Section 2.3.5.2, there are three components of backfill in the Phase 2 Design – the One-Foot Backfill Layer, Near-shore Backfill and Additional 15 Percent Backfill. The elevations for defining the location of Near-shore Backfill are presented in Table 2-11 for each reach. No backfill material will be placed in the navigation channel where post-dredging water depths are less than 15 feet.

The basis for the location of the Additional 15 Percent Backfill is presented in Attachment H. The approximate volumes of backfill materials for the One-Foot Backfill Layer and Additional 15 Percent Backfill are 570,000 and 97,000 cy, respectively. The volume for the Additional 15 Percent Backfill was based on the requirements of the CDE, as described in Section 2.3.5.2.

For the Phase 2 IDR, the backfill design is presented on Figures BCK-01 through BCK-39. Details and cross sections for River Section 1 are shown on the B-Series Drawings included in Appendix 1. The design for River Section 1 will be incorporated into Drawings to be included in the Phase 2 FDR, but the Drawings for River Sections 2 and 3 will be submitted with the Dredge Prism Drawings, in an addendum to the Phase 2 FDR, after the multi-beam bathymetric data are collected in River Sections 2 and 3.

Backfill specifications are taken from the Phase 1 Design and include Type 1 backfill for areas with lower surface water velocities and Type 2 backfill for areas with higher surface water velocities. Type 1 backfill will be used in locations with estimated surface water velocities of 1.5 feet per second (ft/s) or less during a 2-year flow event, and Type 2 backfill will be used in areas with estimated surface water velocities above 1.5 ft/s under the same 2-year flow event. Run-of-bank materials are specified for Phase 2, as described below and presented in the Specifications (Appendix 2).

Approximately 68,000 cy of backfill material will be placed to restore grades necessary in certain areas for wetland restoration. Type 3 backfill will be specified for wetland restoration with a thickness of 12 inches, or approximately 46,000 cy. If more than 12 inches of backfill thickness is required in areas targeted for wetland restoration, the design includes Type 1 or Type 2 material under the Type 3 material. The selection of Type 1 or Type 2 backfill will depend on the backfill being placed in the general vicinity of the wetland area.

Potential sources of backfill materials were identified in the Phase 1 Design documents. However, this source evaluation was specific to the Phase 1 scope. The capability of these sources to meet the material types and quantities for Phase 2 and routes of delivery will continue to be evaluated and finalized in the RAWP for Phase 2 Dredging and Facility Operations (or addenda).

3.5.1.2 Cap Types

The placement of an engineered cap is a contingency to be used if the post-dredging Residuals Performance Standard is not achieved by dredging. The primary function of a residuals cap is to act as a physical barrier that both isolates and stabilizes. Placement of the cap will sequester residual sediment from direct interaction with the overlying water column or benthos. An armor layer (if needed) will provide additional protection of the isolation layer through resistance to erosion due to currents, vessel wakes and waves, propeller wash and ice. The specific design objectives of the engineered caps are described in Section 2.6 of the CDE (Attachment E), and the conditions and locations for placement of caps, based on the results of the residuals sampling, are set forth in the PSCP Scope (Attachment C to the SOW).

Cap design is based on several factors including residual PCB concentration in sediment, hydraulic forces expected to act at the particular CU, proximity to shoreline and proximity to the navigation channel. As in Phase 1, two types of caps (Isolation Cap Type A and Isolation Cap Type B) have been designed to account for various conditions in the river. Details and cross sections for the cap design are shown on the C-Series Drawings included in Appendix 1. Figures CAP-01 through CAP-39 show the potential locations of Isolation Caps Type A, and Figures CAP-40 through CAP-78 show the potential locations of Isolation Cap Type B. These potential locations are based on the relative distribution of the 10- and 100-year flow return frequencies for Isolation Cap Types A and B, respectively.

3.5.2 Backfill and Cap Material Sources, Handling and Staging

In July 2007, a Backfill Sourcing Report (ARCADIS 2007) was prepared to evaluate the potential availability of backfill and capping materials for Phase 1 in the vicinity of the project site based on information provided by various pit owners and government agencies. The evaluation focused on the following three factors:

- Target grain size distribution
- Type of geological deposit
- Method of mining and processing

Primarily, run-of-bank material from sand and gravel pits was analyzed, although some beneficial use materials (mine tailings, stone dust and dredge spoils) were also considered. Some of the commercial materials evaluated were processed (screened, crushed and/or washed). The results of the study identified natural run-of-bank materials comparable to the target Type 1 and Type 2 backfill specifications, and minor adjustments were made to the grain size distribution in finalizing the Phase 1 Design to accommodate the available information.

During the Phase 1 contracting process, additional information provided by backfill material suppliers indicated that, due to its natural variability, run-of-bank materials contained in any Upper Hudson River Valley deposit would not consistently comply with the grain size distribution requirements for Type 2 backfill materials, as presented in the Phase 1 Specifications. Based on input from suppliers, it was expected there would have been insufficient material meeting the coarse gradations (greater than the No. 10 sieve) required for the Type 2 backfill, and that a significant portion of parent material would be screened out (i.e., retained on the 3-inch sieve) as oversize during the processing. To meet the specified gradation more consistently, the suppliers proposed the addition of a limited amount of crushed oversize run-of-bank material in the production of Type 2 backfill. The crushed materials would be screened and reintroduced into the production of Type 2 backfill material. Use of crushed materials in this manner would provide additional consistency to the mined run-of-bank material. The Phase 2 Backfill and Capping Material specification (Section 02206) accounts for this additional information obtained from the backfill suppliers. The crushed material would be used to augment the coarser portion of the backfill mixture and would only be inserted at the No. 10 or larger sieve sizes (100 percent of the Type 2 backfill would still pass the 3-inch sieve). The Phase 1 specification for Type 2 backfill still includes the requirement for 100 percent run-of-bank materials, but now allows for a maximum percentage of crushed oversize material of 30 percent by dry weight, and includes a requirement that such crushed run-of-bank materials would only be used above the No. 10 sieve.

3.5.2.1 Source Selection Criteria

Several studies have been completed to identify local sources of materials to satisfy project requirements. Such studies were documented in the Phase 1 PDR and IDR, the Year 2 SEDC Program and the Backfill Sourcing Report. Throughout these studies, evaluation criteria were developed based on several factors including, but not limited to, waterfront access, material types and volumes, location of possible staging areas, transport distance and the availability of existing facilities related to the Phase 1 project. These factors will be further evaluated for the Phase 2 project in the RAWP for Phase 2 Dredging and Facility Operations (or addenda).

3.5.2.2 Material Quantities

An estimate of quantities of backfill and cap materials is necessary to accurately estimate transport time and placement production, ultimately affecting the overall construction schedule. For purposes of the Phase 2 IDR, the breakout of areas that may be backfilled or capped was performed for five different scenarios: 1) 100 percent of the area backfilled; 2) 75 percent of the area backfilled, 25 percent capped; 3) 50 percent backfill, 50 percent cap; 4) 25 percent backfill, 75 percent cap; and 5) 100 percent cap. These assumptions do not predict the actual amount of backfilling or capping that will take place during implementation of the Phase 2 activities. Rather, these assumptions have been used as a basis of design in the Phase 2 IDR so that material volumes can be estimated and the feasibility of placing the material within each construction season can be determined. The use of five scenarios allows for the full range of potential backfill and capping acreages to be considered. Estimated material quantities for these scenarios are given in Table 3-7. These volumes will be used as part of the backfill and cap material sourcing evaluation to be included in the RAWP process.

3.5.3 Placement Techniques and Equipment

During the Phase 1 Design process, several backfilling/capping techniques were evaluated based on their applicability to materials to be placed, anticipated environmental conditions (e.g. river velocities, water depths) and estimated accuracy in the field. Placement with a clamshell bucket operated from a barge was selected. The bucket would be attached to either a backhoe or crane that is staged on a floating platform such as a deck barge or sectional barge.

This method is applicable to the Phase 2 backfill and capping operations due both to the accuracy of the placement of materials and to the range of materials and conditions under which the system can operate. Backfill and cap material placement will be performed by clamshell bucket equipped with Real-Time Kinematic Differential GPS (RTK DGPS) or equivalent method. The placement of materials will occur in lifts of no greater than 12 inches and will be accomplished such that material forms a uniform layer of required thickness within the specified tolerances (see Specification Section 13720 in Appendix 2).

3.6 Habitat Construction

3.6.1 Conceptual Habitat Construction Design

The approach for habitat construction in Phase 2 areas is consistent with the habitat construction design presented in the Phase 1 FDR. 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. The model evaluates whether conditions are suitable for development of aquatic vegetation habitat and is further described in Attachment H.

A major difference between Phase 1 and Phase 2 is the amount of invasive species located within and adjacent to dredge areas. The Phase 1 Adaptive Management Plan and the Invasive Species Management Plan attached thereto discuss limiting invasive species in habitat construction areas following remediation and restoration. That approach was developed because there are a limited number of invasive species in wetlands adjacent to Phase 1 dredge areas and no invasive species in aquatic vegetation beds in or adjacent to Phase 1 dredge areas.

However, for Phase 2, there are multiple locations where invasive species are located within and adjacent to dredge areas. Specifically, there are several dredge areas in River Section 3 with water chestnut (*Trapa natans*) beds. In addition, significantly more wetlands are located within Phase 2 dredge areas, some of which have invasive species. For Phase 2, it will be necessary to limit the potential for invasive species to be spread during dredging and also reduce the potential for invasive species to colonize dredged areas. In areas where water chestnut occurs, this may include physical removal or chemical treatment (with 2,4-D, or equivalent) to remove the entire bed of water chestnut. Due to the large size of the water chestnut beds in some areas, application of an appropriate herbicide prior to dredging may be the most practical approach. For wetlands, this may include physical removal or chemical treatment of the vegetation from within the dredge area and a buffer around the dredge area prior to dredging. Removal of the vegetation could occur immediately prior to the area being dredged. Additional information on invasive species management prior to and after remediation will be provided in the Phase 2 FDR. It should be noted, however, that because invasive species are present in the Upper Hudson River, there is a chance that invasive species may colonize Phase 2 areas. While monitoring and response actions will be implemented to minimize the potential for establishment of invasive species, elimination of invasive species from Phase 2 areas is not an ultimate project goal and is not a requirement for determining the success of the habitat construction.

3.6.1.1 Unconsolidated River Bottom

Unconsolidated river bottom (UCB) habitat will be reconstructed through the placement of Type 1 or Type 2 backfill. The locations where Types 1 and 2 backfill would be applied are shown on Figures BCK-01 through BCK-39. There are approximately 273 acres of UCB in the Phase 2 plans.

3.6.1.2 Aquatic Vegetation Beds

Aquatic vegetation beds (sometimes referred to as SAV beds) will be constructed through both planting and natural recolonization. In certain locations, a portion of the Additional 15 Percent Backfill will be allocated for creation of SAV beds in dredged areas where such additional backfill is necessary to support SAV. The process used to identify the locations where the 15 percent additional backfill material will be placed is described in Attachment H. Planting areas were then selected based on the presence of vegetation prior to dredging, the SAV model scores, location of the Additional 15 Percent Backfill material and water depth. The process used to select the planting locations, contingency areas (i.e., areas that would be planted if a planting area is determined to be unsuitable), and natural recolonization areas is discussed in Attachment H. The planting, contingency and natural recolonization areas are shown on Figures H-5 and H-6. Representative aquatic vegetation bed Drawings for Phase 2 areas in River Section 1 are provided in Appendix 1. Specifications for aquatic vegetation bed construction are provided in Appendix 2. There are approximately 26 acres of planting areas (over 283,140 plants) and approximately 60 areas of natural recolonization areas (including contingent planting areas) in Phase 2 areas. SAV planting, contingency and natural recolonization areas for River Sections 2 and 3 will be determined following collection of multi-beam bathymetry and development of the dredge prisms and will be presented in an addendum to the Phase 2 FDR.

3.6.1.3 Shorelines

Shoreline construction is separated into two components: shoreline areas above the normal pool elevation (e.g., 119 feet elevation in River Section 1); and shoreline areas below the normal pool elevation. The Dredging Contractor will be responsible for repairing shoreline areas above the normal pool water surface elevation, which is the defined shoreward extent of dredging.

Areas above the normal pool water surface elevation will be constructed as moderate or low energy shorelines based on surface water velocity profiles (above and below 1.5 ft/s, respectively). Shoreline construction will consist of seeding (low energy), or seeding and live staking (moderate energy). Typical shoreline construction details for the areas above the normal pool elevation in River Section 1 are presented in Appendix 1. For the areas below the normal pool water surface elevation, a shoreline construction framework will be applied to minimize hardening of the shoreline. The framework was initially developed for and used in Phase 1 areas and is based on:

- The presence of shoreline structures including sheet piling, retaining walls, bridge abutments, boat launches and outfalls

- The presence of maintained shoreline, including riprap, armor stone and gabion baskets

- Thickness of dredge cut along the shoreline (shoreline areas with dredge cuts equal to or greater than 9 inches and shoreline areas with dredge cuts less than 9 inches)

- Property ownership along the shoreline, including whether the property is owned by the State of New York

- Proximity of the shoreline to the navigation channel

The framework was applied to the existing shoreline conditions identified on the G-Series Drawings in Appendix 1 to identify the lengths of shoreline that will receive one of three shoreline treatments: (1) Near-shore Backfill alone; (2) a combination of Near-shore Backfill and biologs; or (3) Type P armor stone. Representative shoreline construction details for Phase 2 areas in River Section 1 are provided on Drawings B-2201 and B-2202 included in Appendix 1. Specifications for shoreline construction are provided in Appendix 2. The lengths of the shoreline treatment segments in River Section 1 are based on the existing conditions determined during habitat assessment and SEDC data collection activities. In many instances, the treatment is still under consideration and more than one option is listed. The existing shoreline conditions and appropriateness of the reconstruction approach for Phase 2 areas in River Section 1 will be verified by field inspection during summer low flow conditions prior to submittal of the Phase 2 FDR. The shoreline treatments in River Sections 2 and 3 will be verified following additional SEDC data collection and development of the dredge prisms and will be presented in an addendum to the Phase 2 FDR.

Shoreline construction in areas that were isolated as part of the Hudson River Floodplains Short-Term Response Action Documentation Report will be assessed in the Phase 2 FDR.

3.6.1.4 Riverine Fringing Wetlands

Riverine fringing wetlands affected by the remediation will be replaced at their current locations, to the extent practicable. Where it is not practicable to replace the wetland in its original location, mitigation will be conducted in other areas with post-dredging conditions appropriate for construction of riverine fringing wetlands. The locations for riverine fringing wetlands in all Phase 2 areas are shown on Figures HC-01 through HC-32. This Phase 2 IDR assumes that it will be feasible to reconstruct the riverine fringing wetlands at their current locations with the exception of a small wetland at the northern tip of Griffin Island (see Section 3.7.1). This will be verified and a formal delineation of these wetland boundaries will be conducted in subsequent field seasons and the revised boundaries included in the Phase 2 FDR (or an addendum).

Wetlands will be constructed by returning the area to pre-dredging elevations, with Type 3 backfill material as the surface sediments to provide a planting substrate. Type 3 backfill comprises a combination of Type 1 backfill and topsoil, resulting in a pre-placement total organic carbon content of 2 percent. Wetland areas will be planted and seeded using species native to the Upper Hudson River. Representative wetland construction details for Phase 2 areas in River Section 1 are shown on the H-Series Drawings included in Appendix 1. Specifications for wetland construction are provided in Appendix 2. Wetland Drawings for River Sections 2 and 3 will be developed following formal delineation of the wetlands in those River Sections and development of the dredge prisms and will be presented in an addendum to the Phase 2 FDR.

3.6.2 Threatened and Endangered Species Considerations

As discussed in Section 2.2.6, wintering eagles from the northern segment of the Hudson River bald eagle population use the Phase 2 area, although two new nesting pairs (identified in 2005) are located near Lock 1 and the Green Island area. The conservation measures listed in Section 2.2.6 will be followed to minimize disturbances to bald eagles.

3.7 Special Areas

Certain sections of the river require special consideration due to the existing conditions present at or around these dredge sites. These special river sections include the WGIA, the land-locked area between Thompson Island and Fort Miller Dams and areas in close proximity to dams, locks and associated hydropower structures. The proposed design approach for dredging, dredged material transport and habitat construction for these areas is described below.

3.7.1 West Griffin Island

During Phase 2, approximately 86,400 cy of sediment have been targeted for removal in the WGIA. The WGIA is located within River Section 1 between RM 189.4 and RM 190.5 and occupies 26.4 acres. The targeted removal areas comprise five CUs (CUs 50 through 54). This area is shown on Figure 3-2 and on Figures DA-03 and DA-04. The dredge prisms (in plan view) with final cut-line design elevations for the WGIA are provided on Drawings D-2125 through D-2130 included in Appendix 1.

The WGIA has conditions that will cause inefficiencies in the dredging operations, such as the high density of vegetation, shallow water depths and resuspension concerns due to soft and silty sediment characteristics and elevated PCB concentrations (as compared to other areas targeted for Phase 2 removal). Sediment characteristics, PCB concentrations and additional information regarding the WGIA are provided in the Phase 2 DAD Report. These factors have the potential to negatively impact dredging productivity and resuspension, as well as other key design considerations, including control of invasive species, Processing Facility capacity and largemouth bass habitat. As such, a unique design approach has been taken for addressing the WGIA.

Dredging Approach/Sequence

Dredging in the WGIA will be split between Years 1 and 2 of Phase 2. The proposed approach for sediment removal includes inventory dredging from south to north, starting within CU 54 and progressing to CU 50. During Year 1, inventory dredging will begin approximately 6 weeks following mobilization and be completed in CUs 54, 53 and 52 while dredging is performed concurrently in other Year 1 areas. During Year 2, sediment removal activities will be conducted in CUs 51 and 50 while dredging is performed concurrently in other Year 2 areas. For the WGIA (CUs 50 through 54), residuals sampling, and consequently residuals dredging and backfilling/capping, will not commence in any of the CUs until Year 2 of Phase 2, after inventory dredging is completed in CUs 50 through 54. Once inventory dredging is completed in the entire WGIA, residuals sampling (and residuals dredging, backfilling and capping) will be implemented and sequenced from CUs 50 to 54 (upstream to downstream) in accordance with the procedures described in Section 3.1.4.

Dredging in the WGIA will be performed utilizing equipment similar to that used throughout the rest of project (i.e., mechanical dredges equipped with clamshell buckets). However, smaller scows will be utilized to transport the dredged sediment within the WGIA to the southern portion of the WGIA where the dredged sediment will be transferred to a large barge located on the opposite side of the resuspension/hydraulic control structure (described below). When full, the large barge will be moved to the Processing Facility.

It is estimated that dredging productivity within the WGIA will be approximately 400 cy/day. This dredging will occur in parallel with dredging in other portions of the river at rates ranging from approximately 760 and 2,730 cy/day. Parallel dredging in the WGIA and other portions of River Section 1 is necessary to achieve the dredging productivity requirements for the project. In the southern end of the WGIA, dredging to remove non-target material may be necessary in the vicinity of the resuspension/hydraulic control structure (described below) to facilitate access and dredged material transport in this area. The anticipated extent of non-target dredging is shown on Figures 3-2 and AD-04 and is estimated to total approximately 15,000 to 20,000 cy. The actual extent of non-target dredging in this area will be determined in the field and will be dependent on field conditions encountered. Due to these challenges, alternate means of sediment removal may be considered in Final Design.

In Year 2, after inventory dredging is completed for all five CUs (i.e., target elevations verified through bathymetric survey), residuals sampling will be performed in CUs 50 through 54. Sampling for residuals, re-dredging (if necessary) and backfilling/capping depending on the results of the residuals sampling will be implemented in accordance with the procedures described in Section 3.1.4. Residuals dredging, if needed, will be conducted using mechanical dredges to remove residual sediment. Residuals dredging will be sequenced upstream to downstream (CUs 50 through 54).

Resuspension and Hydraulic Control

As described in Attachment G, the resuspension model did not assess resuspension in the WGIA, because hydraulic data is not available. Due to the prevalence of soft aqueous silty (Type 1) sediment and high PCB mass in the WGIA, resuspension controls have been incorporated. In addition to resuspension control, hydraulic control of the WGIA is included in the design approach to maintain sufficient water levels in the area to access and remove the targeted sediment. The Phase 2 Final Design will evaluate the need, type and extent of resuspension and hydraulic controls required in this area after additional hydraulic information and geotechnical data are collected within this channel.

As shown on Figure 3-2, a control structure is proposed at the south end of the WGIA between Griffin Island and the western bank of the Hudson River. The control structure would be installed prior to dredging in the WGIA. An assessment of potential noise impacts associated with the installation of this structure is described in Attachment K and summarized in Section 5.3.3. The detailed design and layout of the control structure will be performed as part of the Phase 2 FDR following the collection of additional hydraulic and geotechnical information in the area. The assessment will include determination of the range of flows into the channel from the upstream culvert. There is also a culvert under West River Road that hydraulically connects an upland wetland (west of the road) with this channel. The impact of the proposed design on this upland wetland will be assessed in the Final Design.

Vegetation Management

There are more than 13 acres of water chestnut (*Trapa natans*), an invasive species, that will need to be removed from the WGIA to facilitate dredge access and sediment removal. The riverine fringing wetland vegetation will be removed with the sediments during dredging and is not expected to impede access. The water chestnut will be removed through the application of an appropriate herbicide (2,4-D, or equal). The treatment would occur prior to dredging to prevent the plants from producing seeds. Immediately prior to dredging, limited hand removal may be required to remove any water chestnut that emerges that season.

Fish Management

The WGIA has been identified as an active spawning and nursery area for largemouth bass and other species. The proposed dredging sequence would limit the major impacts on spawning fish to one season. During Year 1, dredging would not begin until mid to late June (approximately 6 weeks following mobilization for Year 1) allowing time for spawning and rearing of juvenile fish. Prior to dredging, the mouth of the backwater area would be blocked to reduce fish access and potential mortality during active dredging. In addition, the culverts at the north end of the backwater will be blocked so that water levels can be maintained for dredging. This also will limit fish movement into the area during dredging. Once the area is blocked and prior to dredging, fish will be captured and relocated to the main stem of the river. Mortality due to shocking is anticipated to be minimal. During Year 2 of dredging, there will not be access to the WGIA for spawning bass due to the control structure. The loss of 1 spawning year should not significantly adversely impact the overall bass population. Many factors contribute to bass reproductive success and recruitment can be highly variable year to year. In addition, other areas within Thompson Island Pool will be available to largemouth bass for spawning during the season that the WGIA is unavailable.

Restoration Activities

The habitat construction approach for the WGIA is designed to provide suitable fish spawning and nursery habitat, and also reduce the potential for re-invasion of water chestnut. Based on data collected during the habitat delineation and SSAP programs, water chestnut is found predominately in silty substrate. Coarse/gravely backfill, which is suitable for largemouth bass spawning and resists recolonization of water chestnut (Stuber 1982), will be placed in this area, except where wetlands will be constructed. Type 2 backfill is being considered for this purpose; however, final determination of the backfill type for this area will be identified in the Phase 2 FDR. Placement of woody debris or other cover within the Type 2 areas in this channel is being evaluated and the approach to habitat construction in areas currently dominated by water chestnut will be provided in the Phase 2 FDR. Locations currently delineated as wetlands will receive Type 3 backfill material as a surface treatment (12-inch layer) and planted with native vegetation consistent with the wetland plantings specified in Phase 1 (see H-Series Drawings included in Appendix 1). There is one wetland area just north of the culvert at the top of the WGIA channel. This area will be restored as a channel area to provide deeper water during low flow periods and improve water movement through the WGIA channel. Hydrodynamic evaluation of this area will be completed and described in the Phase 2 FDR. The wetland acreage in this area will be combined into the larger wetland complex that will be constructed along the Griffin Island shoreline (see Figure HC-03).

Backfilling and cap construction for the WGIA will be performed, as described in Section 3.5, and as shown on Figures BCK-03 and BCK-04, and CAP-03 and CAP-04, respectively.

3.7.2 Land-Locked Area

The land-locked area of the river is located between RM 189 and RM 186. As shown in Figure 3-3, this section of river is land-locked to the north by the Thompson Island Dam (East and West) and to the south by the Fort Miller Dam. As such, this area is not directly accessible by water from the navigable channel of the Hudson River and Champlain Canal system. The mobilization of dredging and material transport equipment, dredging personnel, backfill equipment and material, habitat construction materials, sampling/monitoring personnel, and construction oversight personnel will require special consideration at this location. Approximately 108,000 cy of sediment are designated to be dredged from the land-locked area. The dredge areas within this section total approximately 28 acres and are shown on Figures DA-05 to DA-07. To facilitate dredged material transport from the land-locked area to the Processing Facility, access and development of an adjacent upland site is required to provide for the transfer of labor, equipment and backfill/cap materials into and labor equipment and dredged materials out of the land-locked area.

Site Selection

As part of the Intermediate Design process, an evaluation was performed to identify a potential transfer location for the land-locked area. This evaluation included a review of aerial photographs and parcel maps, followed by a reconnaissance of the land-locked area in January 2008. Based on the results of this evaluation, a parcel of property was selected for the proposed transfer location. The property under consideration for this Transfer Facility is shown on Figure 3-3 and is currently owned by the NYS Canal Corporation. This property was selected based on the considerations listed below.

- Shoreline access to the land-locked area and a navigable portion of the river for the transfer of sediment and backfill or cap materials to barges

- The feasibility of property development and construction of a facility to transfer the materials to and from the land-locked area

- Property and river access for mobilizing personnel, equipment and materials to and from the land-locked area for dredging and backfill/capping operations, habitat construction, project monitoring/sampling and construction oversight

- Existing river water depths and velocities

- Size and topography of the property

Property Access

Property access will be needed to develop and operate within the selected parcel for the Transfer Facility. In addition, access agreements will be required for adjacent properties in order to access the Transfer Facility from public roadways and set up administrative and parking areas.

Transfer Facility Conceptual Design

The proposed Transfer Facility is located approximately 2,500 feet south of the Thompson Island Dam - East. The conceptual site layout for the Transfer Facility is shown on Figure 3-4. The Transfer Facility will be utilized for loading and unloading sediment from the land-locked area to the canal and unloading backfill/cap barges from the canal to the land-locked area. Additionally, this facility will be used for mobilizing dredging and oversight personnel and equipment. Depending on the size of the barges proposed by the contractor for utilization in this area, a secondary location may be required for accessing the land-locked area. The need for this secondary location will be further evaluated in the Phase 2 FDR. In addition, the relatively narrow width of the Champlain Canal in this area will require close coordination with the NYS Canal Corporation during barge loading and unloading activities.

The Transfer Facility will be designed to move approximately 1,000 cy of sediment per day from small barges (100 to 200 cy in capacity) located in the land-locked area to a standard 1,000 cy barge staged in the Champlain Canal land cut. The loaded barges in the canal will then transport the dredged sediment to the Processing Facility where it will be offloaded and processed.

The major components of the conceptual design for the Transfer Facility are described below.

Access Road, Administration Area and Site Security

- Construction and operation access to the Transfer Facility will be gained by constructing a new access road from the end of Senecal Road. The access road will consist of two 10-foot wide lanes with 2-foot wide shoulders, for a total width of 24 feet. The new access road will be constructed of crushed stone and gravel due to the limited use, low traffic volume and low anticipated traffic loading. To provide sufficient clearances for the construction of the access road and the Transfer Facility, an existing garage will need to be relocated, with the permission of the property owner.

- An administration area will be constructed at the south end of the site. The administration area will have space for a contractor trailer and parking for up to approximately 40 vehicles. A floating boat dock will be provided adjacent to the parking lot, which will be used to dock sampling boats and other small craft required for the completion of the work in this area. The boat dock will also be utilized as the personnel entrance point for the dredging and habitat construction contractors into the land-locked area.

- Chain-link security fencing will be installed around the perimeter of the Transfer Facility. Additional fencing on the interior of the area will also be used to control access to the dredged material transfer area.

- A decontamination station will be provided to decontaminate equipment, vehicles and personnel that have entered into the exclusion zone of the Transfer Facility. Decontamination water will be combined with stormwater in the storage tanks.

Stormwater Collection

- Stormwater generated at this facility will be managed differently during construction and remedial operations. During construction operations, best management practices will be applied to limit erosion. Standard best management practices options, such as silt fences, check dams and outlet protection, will be utilized during this period. Since the site is small and assumed to be clean, no additional stormwater treatment prior to discharge is anticipated. Appropriate site characterization will be performed prior to construction to confirm these assumptions and/or to adjust the design appropriately.

- During sediment transfer operations, stormwater will be classified into three types based on the activities in the areas where the stormwater is generated. As with the Processing Facility, three types of stormwater will be generated at the Transfer Facility that will need to be managed. A summary of each stormwater type and the proposed treatment method is presented below:

  - *Type I Stormwater:* Type I stormwater is stormwater that will come in contact with PCB-containing material. All Type 1 stormwater generated at the site will be collected and treated. Type 1 stormwater will be generated in the exclusion zone (see shaded area of Figure 3-4) of the Transfer Facility. Stormwater from this area will be captured by a collection system consisting of curbing, catch basins and storm sewer piping. A liner will be installed under this portion of the site. The exclusion area will be graded to allow the Type I stormwater in the area to collect and flow to a wet-well. From the wet-well, the stormwater will be pumped to two 20,000-gallon, above-ground storage tanks located within the transfer area. Instrumentation will be provided to monitor the stormwater level in the storage tanks. The Type I stormwater collection system will be designed to contain runoff from storm events up to and including the 100-year, 24-hour storm event. A curb will be provided around the exclusion zone to increase the storage capacity within the Type I stormwater area (the same approach is currently being utilized for the Processing Facility). The volume of stormwater from the 100-year, 24-hour storm event (5.5 inches) is estimated to be approximately 60,000 gallons. Following a large rain event or series of smaller events, the stormwater collected and stored in the above-ground storage tanks will be pumped from the above-ground storage tanks to a transfer barge located in the Champlain Canal. Should multiple storms occur and the storage capacity of the facility be exceeded, the stormwater pump station will have the ability to pump stormwater directly to a transfer barge located in the canal. The transfer barge will transport the stormwater up-river to the Processing Facility, where it will be offloaded and treated in the water treatment plant prior to discharge to the Champlain Canal. In the event of an emergency, 5,000-gallon water transportation trucks could be utilized to transport stormwater from the Transfer Facility to the Processing Facility. Under this scenario, truck access to North River Road (and the Transfer Facility) could only occur from the bridge near Lock 6, since the other bridges in the area are load limited and would not have the capacity for trucks of this size. Since the water trucks may need to access the exclusion zone to complete this operation, a decontamination station will be provided at the point where the interior access road leaves the dredged material transfer area. Onsite treatment of stormwater followed by discharge to the Hudson River will be evaluated in Phase 2 FDR along with the applicable substantive discharge requirements. The onsite stormwater treatment system will also be evaluated for the treatment of excess scow water prior to sediment transport to the Processing Facility.

- *Type II Stormwater:* Type II stormwater consists of runoff from impervious non-contact areas of the site (i.e., paved areas of the facility outside of the exclusion zone) where dredged materials are not being handled. Type II stormwater also includes runoff from trailer rooftops and any gravel-covered areas of the site. Stormwater from these areas will be treated with standard best management practices options, such as silt fences, check dams and outlet protection, prior to discharge to the Champlain

Canal. The details of the stormwater system will be consistent with NYSDEC requirements for stormwater pollution prevention plans.

- *Type III Stormwater:* Type III stormwater consists of runoff from pervious non-contact areas and undisturbed areas of the site. Runoff from these areas will be diverted, as needed, to existing or newly constructed drainage features and will ultimately drain to the Champlain Canal or the river.

Waterfront and Transfer Facilities

- The conceptual design for the Transfer Facility includes design and construction of a barge docking area. The docking area is estimated to be approximately 270 feet long. As shown in Figure 3-4, the conceptual design for the docking area has the capacity to service one 200-foot barge (maximum length) in the canal land cut and a smaller barge in the land-locked area. Due to the limited amount of space within the land cut, staging of a second sediment transfer barge or backfill barge may need to be located either in the Thompson Island Pool or below Lock 6. The surface of the docking area will be sloped away from the canal and the Hudson River to collect runoff and any material spills that might occur during transfer operations. Mooring posts will be installed along the edge of the docking area. Stormwater runoff from the docking area will be drained into the stormwater collection system for storage (described above).

- Drip plates will be extended over the edge of the docking area and the combing of the barges. The drip plate will be designed to direct spillage from the bucket when the barge is being unloaded onto the docking area or back into the barge.

- It is anticipated that a single 90-ton crane will be able to perform all the required transfer operations with as much of the activity as possible focused during daytime hours. Due to weight limitations on the local bridges providing access into this area, the transfer crane will likely need to be assembled at the Transfer Facility. To accomplish this, a smaller crane will be “walked” off a barge from the canal land-cut side to the docking area. The small crane will be used to offload pieces of the 90-ton crane from a barge staged in the land cut and construct the 90-ton crane at the Transfer Facility. The design of the docking area will take into account this anticipated method of mobilization. Transfer operations are currently anticipated to occur with 2-cy offloading buckets. The bucket size for offloading operations is driven by the small size of the barges that will be used to move the sediment from the dredge sites to the facility for offloading. Separate buckets will be used for the transfer of dredged sediment and for the transfer of clean backfill material. Alternative transfer methods such as conveyors will continue to be evaluated during development of the Phase 2 FDR

- Once in place, the crane will also be used to lift the smaller sample boats and observation boats from the canal land cut into the land-locked area of the river. It is also anticipated that the crane may be capable of assisting with the mobilization of small barges into the land-locked area. If mobilization of the contractor-selected barges into the land-locked area by this method is not possible, a secondary equipment mobilization access point into the land-locked area may be required. The anticipated size and weight of the contractor's scows for this area is currently being evaluated to determine if the proposed 90-ton crane can safely mobilize the required equipment into the land-locked area. The results of the evaluation will be presented in the Phase 2 FDR.

Dredging and Dredged Material Transfer Operations

- Dredging in the land-locked area will be performed utilizing equipment similar to that used throughout the rest of project. Due to the need for placing the dredged material transport barges into the land-locked area by crane, and shallow water depths in the land-locked area**,** the use of full size (1,000 cy) barges will be precluded. Smaller scows will be utilized unless the crane mobilization issues discussed above preclude the placement of even smaller scows into the land-locked area. In that instance, smaller barges will be mobilized into the land-locked area and containers will be placed on the barges to serve as the dredged material transport vessels. The determination of any crane mobilization limits and associated influence on the barge sizes will be further assessed in the Phase 2 FDR.

- Due to the limited area within the canal land cut when either a sediment transfer barge is being loaded or a backfill barge is being unloaded, additional control and safety of non-project vessels must be assessed. Vessel control requirements during loading and unloading operations will be developed and presented in the Phase 2 FDR. At a minimum, it is anticipated that the requirements will include local notices of operation activities, additional signage in the area, the installation of safety buoys (see Figure 3-4), communications with the lock tender and the installation of safety lighting. It is currently anticipated that the safety lighting system provided for this area will be similar to the sheet pile wall lighting system described in the Phase 1 FDR. During periods of operation, one-way traffic control may be required in this area and thus the focus will be on the movement of large barges into and out of the land cut during periods when Lock 6 is closed to non-project vessel movement. This will limit temporary shut down of the canal when docking and undocking barges with the tug. Docking and undocking activities will be coordinated with the lock tender to minimize delays, to the extent possible, to non-project vessels.

- The Phase 2 CHASP will detail emergency response requirements associated with the construction and operation of the Transfer Facility.

3.7.3 Other Special Areas

The Phase 2 dredge areas are shown on Figures DA-01 through DA-39. Several of the dredge areas currently designated for removal are located either in close proximity to dams on the river or within the Champlain Canal. In particular, eight dredge areas have been identified that will require special consideration. These eight dredge areas are presented below and fall into two categories, which include: 1) dredge areas within close proximity to structures; and 2) dredge areas that may impact navigation.

Dredge Areas in Close Proximity to Structures

The Phase 2 dredge areas targeted for sediment removal stretch from RM 193 (just upstream of Snook Kill) to the Federal Dam (RM 153.9). Eight dams are located within this portion of the river. Hydroelectric generating facilities are located adjacent to some of the dams. A summary of dams located within this stretch of river is presented in Table 3-8.

Table 3-8
Summary of Dams within Phase 2 Dredge Limits

Dam	Owner	Year Constructed	NID Downstream Hazard Potential
Thompson Island Dam	NYS Canal Corporation	1910	Low
Fort Miller Dam	Fort Miller Pulp & Paper Co.	1984	Low
Northumberland Dam	NYSTA	1870	Significant
Stillwater Dam	National Grid	1955	Significant
Upper Mechanicville Dam	NYS DOT	1882	High
Lower Mechanicville Dam	NYS DOT	1900	Significant
Waterford Dam	NYS DOT	1912	Significant
Troy Dam	CENAN	1915	High

Notes:

1. Information based on National Inventory of Dams (NID) published by United States Army Corps of Engineers (USACE).
2. The NID Downstream Hazard Potential is defined as follows:
   - Low Hazard Potential - Dams where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses.
   - Significant Hazard Potential - Dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities or impact other concerns
   - High Hazard Potential - Dams where failure or misoperation will probably cause loss of human life.

A brief summary of dredge areas currently identified for special consideration in close proximity to these structures and associated locks is presented below:

- The southern end of Dredge Area GI_13_NK is located approximately 100 feet from the East Thompson Island Dam. The Thompson Island Dam is currently owned by NYS Canal Corporation and was constructed in 1910.

- The southern end of Dredge Area UPM_09_NK is located approximately 25 feet from the Upper Mechanicville Dam. The Upper Mechanicville Dam contains a hydro-electric power generating station and the dredge area is located in close proximity to the hydro-electric turbine water intake structure. As a result, variable water depth and velocities may occur in this area during hydro-electric power station operations. Dredges equipped with longer spuds will likely need to be provided for this area. Additional safety training will be necessary to increase awareness when working in this area.

- Dredge Area LMD_05_NK and LMD_07_NK are located adjacent to several Lock 2 structures.

As discussed in Section 3.1.1.1, portions of these dredge areas are proposed for exclusion from Phase 2 to provide sufficient clearance from these structures. The areas proposed for exclusion are shown on DA-05, DA-27 and DA-30 and are based on a setback distance of 200 feet from the structures. These proposed setbacks will result in revisions to the dredge prisms in these areas, which will be presented in the Phase 2 FDR.

The ability to safely operate dredging equipment within close proximity to these structures relies on understanding the construction of the facilities, their current condition and any clearance requirements. During Phase 2 Final Design, an evaluation of dredging in these areas will be performed to confirm the proposed setback distance discussed above. The evaluation of dredging in the vicinity of the dams and other structures may include: a desktop evaluation of all high and significant downstream hazard potential; a visual inspection of all dams in the Phase 2 dredge area; meeting with dam operators and/or owners; and recommendations for additional data collection needs (if necessary).

Dredge Areas That May Impact Navigation

A brief summary of dredge areas currently identified for special consideration that may impact navigation and a summary of measures that would be implemented to mitigate potential impact to navigation are presented below:

- Dredge Area GI_08_NK and the eastern portion of Dredge Area GI_06_NK are located just north of the land cut above Lock 6. Work in these areas will be focused on time periods that the locks are closed for non-project vessels. A local notice to mariners would be prepared for the project and updated on a regular basis. This notice would describe planned activities, including the nature of the work, hours of operation and buoys/lighting.

- Dredge Area NDCA_01_NK is located within 100 feet of Lock 5 and within the land cut for the navigation channel at Lock 5. Since a portion of this dredge area is near the upstream exit of Lock 5, coordination will be conducted with the NYS Canal Corporation. For those areas closest to the lock structure (within 250 feet), project operations would be focused on time periods when the lock was closed to non-project vessels. In addition, a local notice to mariners would be prepared for the project and updated on a regular basis. This notice would describe the planned activities, including the nature of the work, hours of operation and buoys/lighting. For those portions of the dredge area outside of the 250-foot area, operations would be conducted on a 24-hour basis and as described in the local notice to mariners.

- Dredge Area CSD_36_NK is located within the Lock 4 navigation channel. Sediment removal and backfill/cap transport operations occurring in this dredge area will be focused on times when the locks are closed to non-project vessels. A local notice to mariners will also be issued describing the nature of the work at this location, the planned hours of operation and buoys/lighting.

- Dredge Area LMD_05_NK is near the upstream exit of Lock 2 and the eastern portion of this dredge area project operations will be focused on times when the locks are closed to non-project vessel traffic. A local notice to mariners will also be issued that describes the nature of the work at this location, the planned hours of operation and buoys/lighting.

3.8 Design Optimization

Similar to Phase 1, a logistics model has been developed for Phase 2 to simulate the movement of sediment from the dredge areas to the disposal facility under a variety of project conditions and constraints to predict project operations and identify potential bottlenecks in the system. The Phase 2 logistics model has been developed using advanced simulation technology to provide a framework to evaluate and examine the logistics associated with the removal, processing and disposal of dredged sediment. The model was built using AnyLogic (Version 5.5) simulation software from XJ Technologies Company and utilizes Microsoft® Excel for input and output. The Phase 2 logistics model has been built by GE's Global Research Center and input has been provided by ARCADIS. Ultimately, the model has been developed to allow for sensitivity analyses by making adjustments to the proposed design based on an expected range of specific project variables. A description of the Phase 2 logistics model and the key inputs to the model are presented in Attachment C.

While the logistics model is ultimately designed to simulate sediment processing, rail yard operations and rail car movement to the disposal facility, the model presented at this Intermediate Design stage has only been used to simulate and predict dredging and dredged material transport operations. The logistics model will continue to be developed during Final Design to refine the inputs and scenarios related to dredging and dredged material transport for each of the five construction seasons and also incorporate simulation of sediment processing, rail yard operations and rail car movement.

3.8.1 Logistics Process Simulation Model

The Phase 1 logistics model (described in Attachment D of the Phase 1 FDR) was developed to evaluate Phase 1 dredging, barging, capping and backfill operations 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 Phase 2 logistics model expands on the Phase 1 model and utilizes a structured, object-oriented architecture to simplify the coding required to handle the increased complexity of the Phase 2 project, which includes dredging and dredged material transport through a series of pools and locks along the Champlain Canal between the Federal Dam in Troy to the Processing Facility north of Lock 7. In addition, the model evaluates potential backfill material transfer scenarios above Lock 9.

The data presented in the scenarios and the input values described herein are provided for demonstration purposes only, and do not represent specifications that will be used for contracting. The actual number of dredges, barges, tugs, etc., that are necessary to meet the project requirements will be specified in the RAWP for Phase 2 dredging and operations.

Input Parameters

The model has a user interface to enter input data, such as: the number of inventory and residual dredges in the system; dredge locations and sequencing; and volume of material to be dredged. The input data is provided by the project design team based on the dredge plan, assumptions for residuals dredging and other key variables. Various scenarios can be modeled by adjusting the model inputs to simulate different assumptions to evaluate how changes to these assumptions affect the predicted outcome of the overall design. The model requires various data for the following input categories to define the project-specific parameters and constraints:

- Dredge Area Definitions
- Dredging Parameters
- Dredge Plan
- Sediment Removal Precedence Relationships
- Backfill and Capping Parameters
- Processing Parameters
- Lock Parameters
- Rail Yard Parameters
- Dredging Resources
- Recreational Boaters
- Season Dates
- Work Schedule

Attachment C includes descriptions of these categories and inputs for each category.

Simulation Logic

The model was designed to emulate the planned operations of the project and facilitate an understanding of logistical constraints. The Phase 2 logistics model, like the dredging activities, is subdivided into several processes and components, including dredging processes (inventory dredging and residuals dredging), restoration processes (backfilling and capping), barge and tug movement processes (movement through locks and their interaction with recreational boaters); sediment processing (including material unloading, processing and staging); and rail yard operations (loading of material to train cars, train locomotive arrivals and the movement of loaded cars to the disposal facility).

The model provides a framework to evaluate various design scenarios. For example, the model can evaluate scenarios such as the effect of adding or removing dredges, barges, or tugs, on the overall flow of the project from dredging through landfill disposal of processed materials. While it is not intended to evaluate major changes in project design concepts, the tool can be used for sensitivity analyses over an expected range of specific project variables. The ultimate goal is to evaluate the design and understand the impact certain decisions have on productivity.

Modeling of West Griffin Island and Land-Locked Area Operations

Some of the unique aspects of the activities in the WGIA and land-locked areas, as described in Section 3.7, are not reflected in the model. Instead, the model has been simplified to simulate more global logistical aspects of operating in these areas.

For example, the model does not account for the dedicated dredging and backfilling resources (i.e. assets) that will be required for these areas. Instead, the current model allows for “shared” resources between these areas and other dredge areas that would be dredged concurrently, thereby resulting in a decrease in the predicted productivity for these areas.

In addition, the transfer operation at the land-locked area is being simulated, but the dynamic between inventory dredging and residuals dredging is still being developed for this portion of the river, which is isolated from the main navigation channel. For this area, the model predicts the overall durations for inventory dredging, residuals dredging and backfilling or capping; however, it assumes that all inventory dredging must be completed prior to any residuals dredging commencing in the area. As described in Section 3.7.2, the land-locked area is separated into six CUs (CUs 61 through 66). Under actual operations in the land-locked area, residuals dredging (if necessary) would be implemented in a CU when inventory dredging is completed and while inventory dredging is performed concurrently in other CUs. Therefore, the output data generated by the model has been transformed to present the results in a manner that is representative of the dredging sequence for this area.

As described in Section 3.7, the details of the approach for these areas are still under development and will be finalized as part of the Phase 2 FDR. As such, the logistics model inputs and logic will be reviewed and refined as part of the Phase 2 FDR along with the Final Design approach for these areas.

3.8.2 Model Results

The objective of the initial model runs was to examine whether the target volumes established under the Productivity Performance Standard can be removed while completing inventory dredging, residuals dredging and restoration activities within the available construction season. As described in Section 2.3.1.5, the construction season is determined by the operation of the NYS Canal Corporation lock system, which opens in early May and closes in early to mid-November for a total season of approximately 26 to 28 weeks. This basis of design for Phase 2 assumes that inventory dredging must be completed within 20 weeks (120 dredge days, 6 days/week) to allow sufficient time to complete residuals dredging and backfill/cap construction activities before the canal system closes for the season. Based on these assumptions, residuals dredging and backfill/cap construction activities must be completed within the 6 to 8 week window at the end of the construction season.

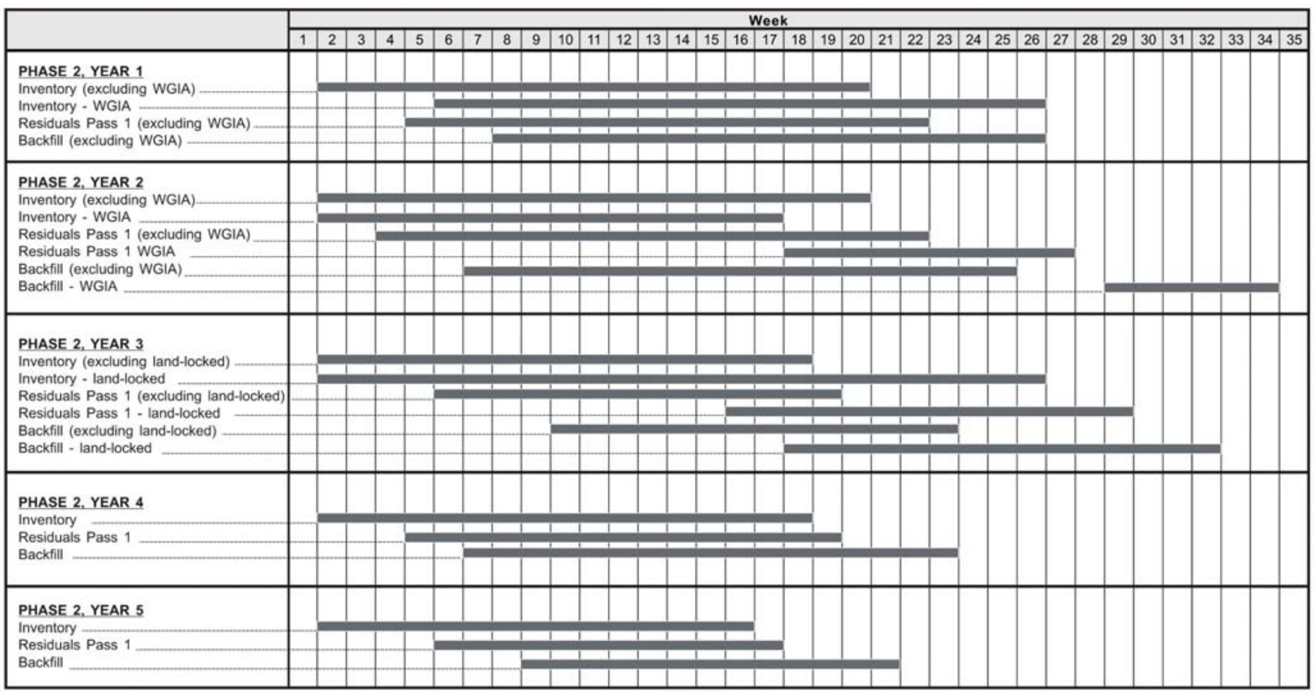
Base-Case Simulation

Initial model simulations were performed to establish a base case representative of the dredging plan and resuspension control measures described in Sections 3.1 and 3.2, respectively. The base case simulation assumes that the Champlain Canal System will remain open 24 hours per day and that one residuals dredging pass will be conducted over all Phase 2 dredge areas (the accuracy of this assumption is unknown and final determination of the extent of residuals dredging will be determined after inventory dredging is completed).

Model results have been generated for this base case scenario for each of the five Phase 2 construction seasons. Analysis of the model outputs indicate that the base case simulation is generally representative of the dredge plan described in Section 3.1 and that dredging and backfilling operations can be completed within the canal operating season for all CUs in Years 1 through 5, with the exception of the WGIA and the land-locked area, as discussed above.

Figure 3-5 presents a graphical depiction of the base case model prediction of the initiation and duration of inventory dredging, residuals dredging and backfill operations during each year and distinguishes the predicted results the WGIA and land-locked area.

Figure 3-5
Base-Case Simulation Output for Years 1 through 5 (One Residuals Dredging Pass in All Areas)



Note:
1. The model output data for residuals dredging and backfill operations in the land-locked area in Year 3 have been transformed to better represent actual sequencing of these activities.

As described in Section 3.7.1, inventory dredging in WGIA begins in Week 6 of Year 1 and continues to the end of the first season. The residuals dredging and backfilling/capping for this area are deferred to Year 2. However, the model predicts that backfilling this area will not be completed within the Year 2 season (the activity is not completed before Week 28). Similarly, the backfill operations in the land-locked area are predicted to extend past the end of the Year 3 season. Since the model output shows that the these areas are not completed within the operating season, both the plan and model for this area will be reviewed and refined in the Final Design. It is possible that one residuals dredging pass everywhere in these areas would cause a productivity shortfall.

<u>Sensitivity Analysis Simulations</u>

Sensitivity analyses allow for variations in the dredge plan, assumptions for residuals dredging and other key variables to see how changes in these assumptions affect the overall design. As a result, modification to the design can be made to address reasonable variations in key project parameters. For Intermediate Design, the assumption for residuals dredging was varied.

<u>Adjusted Residuals Dredging, Backfilling and Capping Assumptions</u>

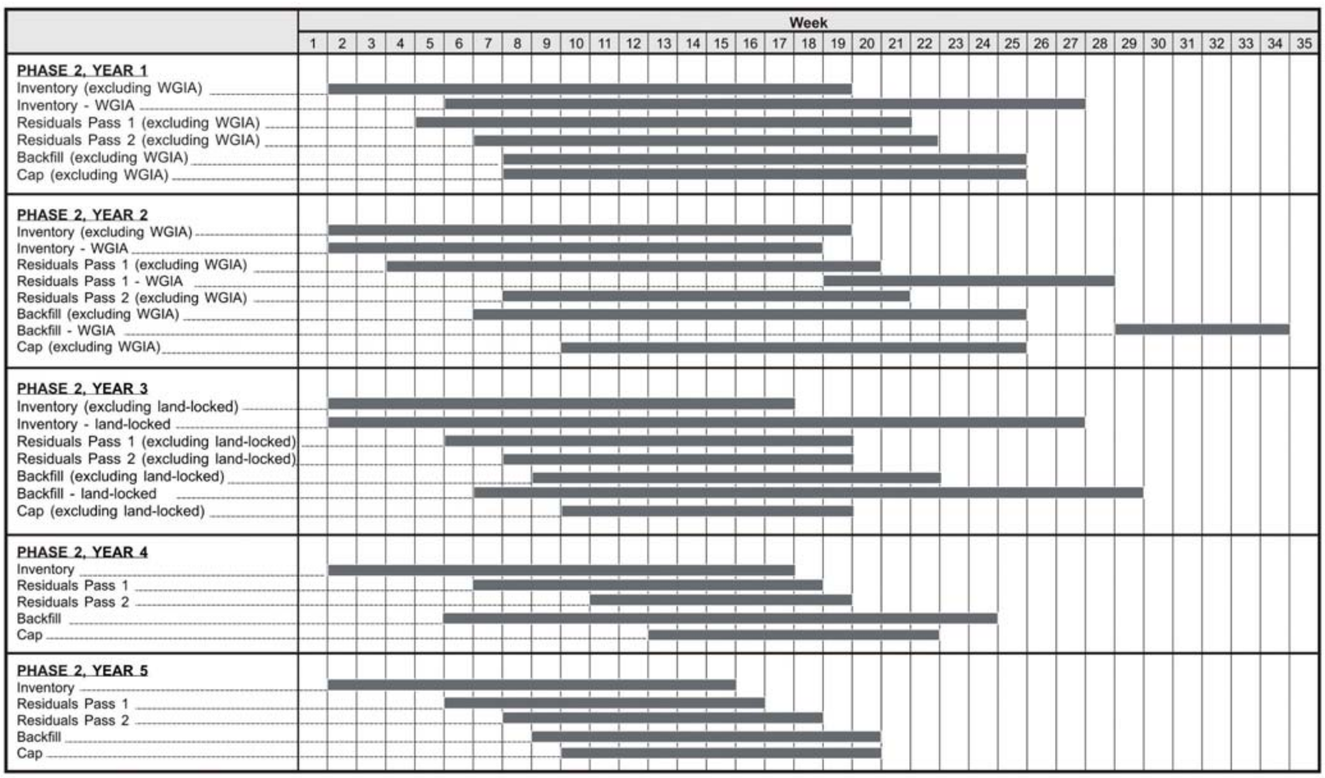
The amount of residuals dredging and capping that will be performed is a sensitive input assumption for this model. As described above, the base case simulation assumes that one re-dredging pass of 6 inches of material will be conducted over the entire Phase 2 area and that the entire Phase 2 area will be backfilled with 1 foot of material. To test the sensitivity of these assumptions, a scenario was simulated using the base case inputs with adjustments to the following assumptions:

- 50 percent of the Phase 2 dredge areas require no residuals dredging
- 25 percent of the Phase 2 dredge areas require one residuals dredging pass of 6 inches
- 25 percent of the Phase 2 dredge areas require two residuals dredging passes of 6 inches each
- 75 percent of the Phase 2 dredge areas require backfill, and the remaining 25 percent requires a cap

The model simulation results indicate that the overall durations are similar to the base case scenario. Overall completion dates for each year (which includes inventory dredging, residuals dredging and backfilling) are decreased or increased by 2 weeks for all construction seasons, and all operations can be completed within 26 weeks for all CUs in Years 1 through 5, again with the exception of the WGIA and the land-locked area. Figure 3-6 presents a graphical depiction of this scenario.

Figure 3-6

Sensitivity Analysis –Adjusted Residuals Dredging and Capping Assumptions



Note:
1. The model output data for residuals dredging and backfill operations in the land-locked area in Year 3 have been transformed to be representative of actual sequencing of these activities.

The input and output files for these simulations are included on an attached CD that is enclosed with this report.

4. Phase 2 Construction and Implementation Schedule

This section describes the construction-related tasks, the sequencing of these tasks and the process for implementing design changes that would be completed as Phase 2 progresses. Because the schedule for Phase 2 implementation would depend on the completion and review of Phase 1 activities, this schedule discussion is preliminary and subject to change. As outlined in the RA CD, there are several activities that will occur after Phase 1 is completed and before Phase 2 implementation can begin; the major activities include:

- Completion of Phase 1 Data Compilation Report and Phase 1 Evaluation Reports developed by GE and EPA.
- Completion of Peer Review of Phase 1 activities.
- EPA's determination of changes, if any, to the performance standards, SOW and/or scope of Phase 2.
- GE's decision on whether it will implement Phase 2 activities under the RA CD
- If GE decides to implement Phase 2 activities under the RA CD, the Phase 2 Design will be modified, if necessary, to reflect EPA's decision on changes to the performance standards, SOW and/or scope of Phase 2, as well as any other design changes on which the parties agree for Phase 2.
- Contracting for Phase 2 construction and operation services.

The RA CD contemplates the potential for the activities listed above to be completed in the calendar year following Phase 1, in sufficient time to allow for the completion of some dredging in the remainder of that year. In this Phase 2 IDR, as noted in Section 1.2, the remainder of that year, which is referred to as "Phase 2, Year 1" in the SOW, is referred to as the "Phase 2, Initial Short Year." Similar to Phase 1, RAWPs would be developed prior to implementing Phase 2 operations. Phase 2 will involve multiple years of dredging, processing and disposal. As described in Section 2.1, Phase 2 is being designed for completion in 5 years, as specified in EPA's Productivity Performance Standard. Implementation of the Phase 2 project elements would be completed in accordance with the construction schedules proposed in the Phase 2 RAWPs.

The remainder of this section describes the general types of construction activities that would be performed during Phase 2, along with a summary of the schedule for completion of RAWPs for Phase 2 and implementation of Phase 2 operations. Note that this section assumes that GE decides to implement Phase 2 under the RA CD. However, this determination has not been made and will not be made until Phase 1 is completed and EPA has determined the changes, if any, to the performance standards, SOW and/or scope of Phase 2, as described in the RA CD.

4.1 Phase 2 Construction Activities

The Phase 2 construction activities are listed below. Note that the contracting approach for Phase 2 (i.e., how the construction services will be organized into individual contracts) has not been established. As such, the description of activities below does not necessarily reflect how contracts will be established.

- Site work would be performed to construct the access and Transfer Facility in the land-locked area of River Section 2. This facility was described in Section 3.7.2 and would need to be constructed prior to dredging in that river section. This includes obtaining agreements to access necessary properties. As described in Section 3.3, the Phase 2 Design does not include any modifications to the Processing Facility being constructed for Phase 1 operations. If such modifications are appropriate after review of Phase 1, they would be specified in a Phase 2 Design addendum (described below).

- Dredging operations would be conducted, including sediment removal, resuspension control and transport of sediment to the Processing Facility. These operations would also include operation and maintenance of the Work Support Marina constructed in Phase 1. The general sequencing and preliminary annual scope for dredging were described in Section 3.1. Inventory dredging is planned for 120 work days, which leaves time in the season for residuals management (dredging, capping and/or backfill placement).

- Operations at the Processing Facility would continue in a similar manner for Phase 2. These operations would include offloading of sediment from barges, processing of sediment, treatment of water (from both removed sediment and stormwater from processing areas), staging of processed sediment, loading of rail cars, operation of the rail yard and maintenance of facilities. Operation and maintenance of the access and Transfer Facility for the land-locked area of River Section 2 also would be necessary to support dredging in that reach of the river.

- Transportation and disposal of processed sediments would include rail transport of sediment from the Processing Facility to the selected licensed disposal facility, as described in Section 3.4. The project has been designed so that all of the material dredged and processed in each season is shipped by the end of the calendar year.

- Backfilling and capping operations would include procurement of backfill and cap materials, transport of those materials to the dredge areas via barge and placement in accordance with the design for each CU. The backfilling and capping operations would be scheduled in the same season as dredging, with the exception of the WGIA (as explained in Section 3.7.1)

- Habitat construction activities would be performed following completion of dredging and backfilling/capping in a given CU. These activities would include planting of SAV and wetlands, as appropriate. This would be planned during the season after dredging operations and backfilling/capping are completed.

4.2 Phase 2 Remedial Action Activities

The Phase 2 RA activities described below are summarized from the descriptions provided in the SOW, which is attached to the RA CD. Some details from the SOW have been omitted for readability; however, this is not meant to modify any obligations specified in the SOW.

4.2.1 Phase 2, Initial Short Year

As described above, the Phase 2, Initial Short Year refers to the remainder of the year in which GE notifies EPA as to whether it will perform Phase 2 under the RA CD, in the event that GE and EPA reach agreement to conduct dredging in a discrete area(s) in that year. This would be less than a full construction season of dredging. If GE and EPA agree that dredging will be implemented during the Phase 2, Initial Short Year, the areas to be dredged would be selected while GE decides whether it will implement Phase 2.

4.2.1.1 Work Plans and Associated Submittals for Phase 2, Initial Short Year

RAWP and Revisions to Design Documents for Phase 2, Initial Short Year Dredging

GE will submit a RAWP for Phase 2, Initial Short Year Dredging and Facility Operations and revisions and/or addenda to the applicable approved design documents that are needed for or applicable to the Phase 2, Initial Short Year. These documents will be submitted within 30 days after EPA's final decision regarding changes, if any, to the Phase 1 EPS and QoLPS and the scope of Phase 2 (or within another timeframe agreed upon by EPA and

GE) – unless the parties have previously agreed that there will be no dredging in the Phase 2, Initial Short Year. In the latter event, GE will need only to submit, by that date, a schedule for submitting Phase 2 Design revisions and/or addenda to the approved Phase 2 Design documents. In addition, the Phase 2 RAWP would be submitted, as described in Section 4.2.2 below.

Due to the tight schedule, significant changes from Phase 1 operations will not be practical for the Phase 2, Initial Short Year. The RAWP for Phase 2, Initial Short Year Dredging and Facility Operations, if submitted, will propose a scope of dredging that is consistent with the time available to complete the work and the parties' agreement on the discrete area(s) for such work. This work plan may consist of revisions and/or addenda to the RAWP for Phase 1 Dredging and Facility Operations. In addition, the RAWP for Phase 2, Initial Short Year and the revisions and/or addenda to the applicable approved design documents may specify certain changes to the design of Phase 2 that would be implemented in subsequent years of Phase 2. Such changes are referred to as Deferred Phase 2 Design Changes. The RAWP for Phase 2, Initial Short Year will contain a schedule for submitting the Phase 2 Design revisions and/or addenda to the approved Phase 2 Design documents that are needed for the remainder of Phase 2.

Simultaneously, with submission of the RAWP for Phase 2, Initial Short Year Dredging and Facility Operations, GE will submit revisions and/or addenda to the Phase 1 RAM QAPP that may be needed to address monitoring during the Phase 2, Initial Short Year.

Update to RA Health and Safety Plan (HASP)

To the extent necessary, the RA HASP will be revised to address the Phase 2, Initial Short Year. Such revisions will be submitted concurrently with the RAWP for Phase 2, Initial Short Year Dredging and Facility Operations.

4.2.1.2 Implementation of Phase 2, Initial Short Year Dredging Activities

If GE and EPA agree that dredging will be implemented in the Phase 2, Initial Short Year, dredging and facility operations during that time period would be implemented in accordance with the approved RAWP for Phase 2, Initial Short Year Dredging and Facility Operations.

4.2.2 Remainder of Phase 2 of Remedial Action

4.2.2.1 Work Plans and Associated Submittals for Phase 2

For the work to be performed in each construction year following the Phase 2, Initial Short Year, or if no dredging was performed in the Phase 2, Initial Short Year; a RAWP for Phase 2 Dredging and Facility Operations would be submitted by February 15 of each such year (or by an alternate date agreed upon by GE and EPA) along with any necessary revisions and/or addenda to the applicable approved design documents for Phase 2. For any year after the first full year of Phase 2, any necessary revisions and/or addenda to a previously approved RAWP for Phase 2 Dredging and Facility Operations may be submitted in lieu of resubmitting the entire RAWP. These submittals may include any previously proposed changes to the Phase 2 Design or remedial action, including the Deferred Phase 2 Design Changes described above.

RAWPs and Revisions to Design Documents for Phase 2 Dredging

Any revisions and/or addenda to the applicable approved Phase 2 Design documents would, as appropriate, address, but not be limited to, the following project elements:

- Construction specifications
- Processing Facility design and operation
- Dredging design
- Resuspension control
- Dredged material transport to the Processing Facility
- Sediment and water processing
- Transportation for disposal or beneficial use
- Disposal or beneficial use
- Backfilling/capping
- Habitat construction

The RAWP for Phase 2 Dredging and Facility Operations (or addenda) would include a Phase 2 Dredging Construction Quality Assurance Plan, a Phase 2 PSCP, a Phase 2 Property Access Plan, a Phase 2 Transportation and Disposal Plan, a Phase 2 Facility Operations and Maintenance Plan (FOMP) and a Phase 2 Community Health and Safety Plan (CHASP) – all of which may include updates to the comparable Phase 1 plans. In addition, a Phase 2 RAM QAPP (or revisions or addenda to a previously approved RAM QAPP) would be submitted, as necessary, along with each RAWP for Phase 2 Dredging and Facility Operations.

RAWP for Phase 2 Facility Construction

A RAWP for Phase 2 Facility Construction would be submitted concurrently with the RAWP for Phase 2 Dredging and Facility Operations (or RAWP revisions or addenda), in a timeframe that allows for the review and approval of the RAWP, and construction of the facility in advance of its use to support the project. One of the facility operations includes construction of the access and Transfer Facility for the land-locked area, described in Section 3.7.2. If Phase 2 would include the use of additional sediment processing/transfer facility(ies), the construction of such facility(ies) would also be covered in this RAWP. The RAWP for Phase 2 Facility Construction would be developed consistent with the similar RAWPs developed for Phase 1. Additionally, the RAWP for Phase 2 Facility Construction will state the year of Phase 2 in which such facility(ies) would be required and will include a schedule for construction of such facility(ies). The schedule would allow sufficient time for facility construction and startup prior to the facility being required for use.

Update to RA HASP

To the extent necessary, the RA HASP would be revised to address Phase 2 of the RA, and such revisions will be submitted concurrently with the RAWP for Phase 2 Dredging and Facility Operations (or RAWP revisions or addenda) for the year to which those revisions apply.

Phase 2 Facility Demobilization and Restoration Plan

In addition to the above plans, for any year of Phase 2 in which demobilization and/or restoration activities are scheduled for any sediment processing/transfer facility(ies) or other ancillary and/or support facilities, a Phase 2 Facility Demobilization and Restoration Plan would be included with the RAWP for that year. That Phase 2 Facility Demobilization and Restoration Plan would address demobilization and restoration of such sediment processing/transfer facility(ies) and ancillary and support facilities.

4.2.2.2 Phase 2 Dredging Activities

Phase 2 Dredging and Facility Operations would be implemented in accordance with the RA CD; the SOW; the approved Phase 2 FDR and any revisions and/or addenda thereto; and the approved RAWP for Phase 2 Dredging and Facility Operations (or addenda), including its associated plans.

5. Phase 2 Monitoring and Compliance with Performance Standards

This section summarizes how Phase 2 remedial activities have been designed to meet the criteria (particularly the numerical criteria) presented in the Hudson EPS, QoLPS and substantive WQ requirements. For purposes of this design analysis, it has been assumed that those performance standards will be the same for Phase 2 as the existing standards adopted for Phase 1. However, as noted previously, following the evaluation and peer review of the Phase 1 experience and results, EPA may decide that changes are needed to the EPS, QoLPS and/or WQ requirements for Phase 2. In that case, revisions and/or addenda to the Phase 2 Design documents would be developed to reflect those changes.

Other documents to be prepared prior to Phase 2 that relate to the activities to be taken to implement the performance standards include the following:

- A Phase 2 PSCP (or an update to the Phase 1 PSCP) will describe the actions to be taken during Phase 2 operations to implement the performance standards and associated requirements.

- A Phase 2 RAM QAPP (or an update to the Phase 1 RAM QAPP) will describe sample collection, analysis and data handling activities for the various monitoring programs to be implemented during Phase 2, including the water monitoring program (i.e., far-field monitoring, near-field monitoring, off-season monitoring, public water supply monitoring, Processing Facility discharge monitoring, stormwater monitoring), the fish monitoring program, the sediment residuals monitoring program and the monitoring programs for air, odor, noise and lighting.

- A Phase 2 RA Community Health and Safety Plan (CHASP; or an update to the Phase 1 RA CHASP) will describe the prevention, response and mitigation measures that will be used to address potential hazards to the public and other impacts that may occur within the vicinity of the Phase 2 remedial activities. The Phase 2 RA CHASP will include a description of the contingency and response actions that, when warranted, would be taken to address impacts on the public that may result when performance standard criteria are exceeded.

5.1 Phase 2 Environmental Monitoring

An environmental monitoring program would be implemented during Phase 2 to evaluate the project performance with respect to the EPS, QoLPS and WQ requirements. As previously discussed, if dredging is conducted during the Phase 2, Initial Short Year, the monitoring program for that period would be set forth in revisions and/or addenda to the Phase 1 RAM QAPP, to be submitted with the RAWP for the Phase 2, Initial Short Year. The environmental monitoring program for the remainder of Phase 2 will be described in the Phase 2 RAM QAPP (or revisions or addenda to a previously approved RAM QAPP), to be submitted, as necessary, with each RAWP for Phase 2 Dredging and Facility Operations.

5.2 Analyses of and Actions for Attaining Engineering Performance Standards

The Hudson EPS regulate three aspects of dredging activities: resuspension of sediments, post-dredging residual PCB concentrations and dredging productivity. One objective of the Phase 1 project is to test the effectiveness of the remedial design relative to these EPS. Although considerable effort has gone into developing a remedial design capable of achieving the EPS in Phase 1, a number of assumptions had to be incorporated into the Phase 1 Design. As a result, the actual experience and monitoring in Phase 1 will provide important information as to whether and to what extent the numerical criteria in these EPS can be achieved, individually and in combination. Following the completion of Phase 1, EPA will make a decision regarding changes, if any, to the EPS for Phase 2, and any such changes would be incorporated in revisions to the Phase 2 Design documents and in the Phase 2 RAWPs.

At this stage of the Phase 2 Design, the analyses of attainment of the numerical criteria in the EPS have been based on the Phase 1 EPS. Summaries of those EPS as they apply to the Phase 2 Design are discussed in Section 2.1.2, and the analyses performed as part of the Phase 2 Intermediate Design to assess attainment of those criteria, as well as the actions included in the Phase 2 Design to meet those criteria, are summarized in the following sections.

5.2.1 Project-Related Resuspension

The transport of sediments (and associated PCBs) resuspended during the dredging operation was modeled to assess the impacts of dredging on attainment of the far-field PCB criteria in the Resuspension Performance Standard. The results of the resuspension modeling are provided in Attachment G and summarized here.

The PCB concentration and flux predicted at the far-field stations have been compared with the Control and Standard Levels in the Resuspension Performance Standard. The Total PCB concentration and flux at the far-field monitoring stations are the controlling factors for predicting conditions that may require resuspension controls, while the near-field TSS limits exert less influence on predicted outcomes (which was verified by analyses in the Phase 1 Design reports).

The model simulations predicted that the cumulative resuspended Total PCB load at the end of Phase 2 dredging (not considering Phase 1 dredging) would be approximately 237 kg and 475 kg at the assumed resuspension loss rates of 0.35 and 0.70 percent, respectively. As discussed in Section 2.1.2.1, GE proposes the total allowable project mass loss be proportionally increased to 1,050 kg, since the PCB mass to be removed is greater than the estimate that EPA used in developing the standard.

As described in Section 3.2.1, the resuspension model summarized in Attachment G assumed that two dredges would be operating at a dredge rate of 1,450 cy/d for each dredge (half the average target removal rate of 2,900 cy/day for inventory sediment), and that dredging operations would occur 24 hours per day, 6 days per week. Based on these assumptions, the predicted far-field PCB concentrations calculated for individual areas have been compared with a screening level of 225 ng/L. This screening level of 225 ng/L assumes a baseline far-field PCB concentration of 50 ng/L subtracted from the Standard Level of 500 ng/L and divided by two to account for the two dredges operating simultaneously. This procedure provides a conservative estimate of areas that might contribute to an exceedance of the daily average concentration standard.

Initial resuspension modeling was conducted assuming no resuspension controls and loss rates of 0.35 percent and 0.70 percent. The results of this initial modeling indicate that the surface water PCB concentration screening level may be exceeded in portions of three dredge areas (SK_01, GI_05_NK and GI_06_NK) at a loss rate of 0.35 percent, suggesting that resuspension controls would need to be incorporated into the design in areas that contribute to these potential exceedances. In addition, the results of this initial modeling indicate that the surface water PCB concentration screening level may be exceeded in four additional dredge areas (NTIP02H, SK_01_NK, SK_03_KA and FMD_01) at a loss rate of 0.70 percent, suggesting that resuspension controls would need to be available as contingencies in areas that contribute to these potential exceedances.

The model results indicate that reducing the daily maximum dredging rate in the areas targeted for resuspension controls would decrease PCB concentrations at the far-field monitoring stations to below the Control and Standard Levels. Therefore, reduced dredging rates will be specified for the areas requiring resuspension controls (i.e., those where the screening level was predicted to be exceeded when modeled with a release rate of 0.35 percent, as shown on Figures RC-01 and RC-02) and in the areas where resuspension controls would need to be available as contingencies (i.e., those where the screening level was predicted to be exceeded when modeled with a release rate of 0.70 percent, as shown on Figures RC-03 through RC-07).

As described in Section 3.7.1, the resuspension model did not assess resuspension in the WGIA. Due to the prevalence of soft aqueous silty (Type 1) sediment and high PCB mass in the WGIA, resuspension controls have been included in this Intermediate Design at the south end of the WGIA between Griffin Island and the western bank of the Hudson River. For the purpose of this Intermediate Design, it has been assumed that a control structure would be installed in this area. The Phase 2 Final Design will evaluate the need for, type of, and extent of resuspension controls required in this area after additional hydraulic information is collected within this channel. The Phase 2 FDR will also include a detailed design and layout for the control structure, as necessary.

5.2.2 Dredging Residuals

The current Residuals Performance Standard was described in Section 2.1.2.2. It is assumed that compliance with the Residuals Performance Standard in Phase 2 will be based on the criteria and actions in Table 2-1. Since the frequency of the various cases in Table 2-1 cannot be predicted, the productivity impacts are uncertain. The logistics model tests certain cases at an assumed frequency (see Section 3.8).

A CU checklist (Attachment I) has been developed to document the process for dredging (inventory and residual), backfill, capping and habitat construction for each CU.

5.2.3 Dredging Productivity

The annual minimum and target removal volumes calculated for Phase 2 based on the Productivity Performance Standard and the revised overall Phase 2 removal volume presented in the Phase 2 DAD Report were presented in Section 2.1.2.3. These volumes consist of *insitu* sediment volumes to be removed, processed and shipped offsite during each year of Phase 2. The ability to achieve these annual removal volumes is a function of the dredge removal rate, number and logistical organization of dredges, dredged material transport, sediment processing and storage and offsite transportation and disposal elements of the remedial design. The dredging approach designed to remove these volumes is discussed in Section 3.1 This section summarizes the factors affecting productivity, the modeling and other design activities used to predict attainment of the target removal volumes. The Phase 2 dredging approach described herein has been designed to achieve the target removal volumes during Phase 2. The logistics model was used to predict the ability of the Phase 2 Design to achieve these targets and is based on assumptions regarding the number, type and size of dredging, transport, backfill and capping equipment. The logistics model indicates that, under certain scenarios, the target removal volumes established under the Productivity Performance Standard can be achieved.

However, as discussed in Section 3.8, it is not possible to reliably predict the frequency of backfilling versus capping, so sensitivity of the model outputs to this frequency was tested. The model predicts the necessary assets (e.g. dredges, barges, tugs) to meet the annual productivity target, assuming residuals dredging in all CUs (conservative base case) and a mixture of residual cases over the 82 Phase 2 CUs. Other factors that could affect the ability to achieve these removal volumes include: timely and consistent completion of CU certification; inclement weather conditions; elevated river flows during the dredge season; slower dredging rates necessary to control resuspension; lock operations; longer tug and barge transit times than those assumed; backfill loading locations; barge mooring locations; the number of residuals sampling events necessary; and processing and/or rail delays. As discussed in Section 3.8, additional analysis will be performed in the Phase 2 FDR to further assess achievement of the Productivity Performance Standard.

5.3 Analyses of and Actions for Attaining Quality of Life Performance Standards

This Phase 2 Intermediate Design has been developed with the objective of achieving the numerical criteria set forth in the QoLPS for air quality, odor, noise, lighting and navigation. The QoLPS criteria are described in Section 2.1.3. As with the EPS, Phase 1 will constitute a test of the ability to achieve these QoLPS criteria. Following the completion of Phase 1 and evaluation of the Phase 1 results, EPA will then make a decision regarding changes, if any, to the QoLPS for Phase 2, and any such changes will be incorporated in revisions to the Phase 2 Design documents and in the Phase 2 RAWPs and associated documents.

At this stage of the Phase 2 Design, the analyses of attainment of the criteria in the QoLPS have been based on the current (Phase 1) QoLPS. Design analyses, including modeling, relating to attainment of the QoLPS criteria for PCBs in air and for noise and lighting have been performed. Analyses relating to attainment of the QoLPS criteria for other air pollutants and odor, are also discussed below, based on information presented in the Phase 1 FDR. Finally, this section discusses the actions included in the Phase 2 Design to meet the QoLPS for navigation, taking into account the logistical modeling presented in Attachment C.

5.3.1 Air Quality

The QoLPS document provides standards for PCBs in ambient air and for opacity, and requires an analysis of achievement of the National Ambient Air Quality Standards (NAAQS) for several pollutants. The Air Performance Standard is described in Section 2.1.3.1. Each component of that standard is discussed below.

5.3.1.1 NAAQS

A modeling assessment conducted for Phase 1 and presented in the Phase 1 FDR addressed the project’s ability to achieve the NAAQS for the criteria pollutants for which the Air Performance Standard requires such an assessment (these pollutants are identified in Section 2.1.3.1). The modeling was conducted for emissions of these pollutants (as relevant) from the dredging operations and operation of the Processing Facility. The results of this modeling confirmed that the emissions of the criteria pollutants are not predicted to cause exceedances of the NAAQS. As described in Section 3, the operations (including equipment to be employed) during Phase 2 are expected to be similar to those used in Phase 1. As a result, no provisions for monitoring or contingency actions for the criteria pollutants are necessary during implementation of this project.

5.3.1.2 Opacity

Unacceptable opacity may result from vessel, vehicular, or equipment emissions. However, routine maintenance of diesel engines, generators and other equipment is expected to prevent exceedances of the Air Performance Standard for opacity. The contract specifications will direct contractors to maintain and operate vessels and vehicles properly to prevent opacity problems. Similar to Phase 1, opacity would 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.

Equipment that only temporarily serves the operations (e.g., delivery trucks) will not be subject to this standard. In addition, the locomotives used by the main-line rail carriers will not be subject to this standard, since they are regulated by EPA’s national standards governing opacity (40 CFR Part 92). An engineering assessment of opacity will not be performed, as the opacity limits will be included in the Phase 2 FDR contract specifications.

5.3.1.3 PCBs in Ambient Air

Dredged sediments are exposed to the atmosphere after removal from the riverbed and thus could produce PCB emissions to the air. This Phase 2 Design includes measures to prevent or mitigate unacceptable emissions of PCBs. The numerical criteria in the QoLPS that relate to PCBs consist of a Concern Level of 0.08 $\mu g/m^3$ 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, several project activities that could produce PCB emissions to the air have been considered, as summarized below.

Dredging Operations

The Phase 1 FDR included a detailed modeling analysis of potential PCB air emissions during dredging operations and their impact on the numerical criteria in the QoLPS for PCBs in ambient air. That modeling considered 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 results of that modeling demonstrated that the contribution of air emissions directly from the water column was very low relative to the criteria in the air quality QoLPS. For this reason, modeling of dredging operations for this Phase 2 Intermediate Design has focused only on the emissions from open barges.

A detailed description of the air modeling conducted for Phase 2 dredging operations, including input parameters, methodologies and results, are provided in Attachment J. As discussed in that attachment, the base-case modeling indicates that barging operations under average wind conditions, with no controls, would result in the following:

- Residential receptors: concentrations above the Concern Level at 2 to 4 percent of Phase 2 dredge locations and concentrations above the Standard Level at 1 to 3 percent of dredge locations.

- Commercial receptors: concentrations above the Concern Level at 0.3 to 0.6 percent of dredge locations and concentrations above the Standard Level at 0.2 to 0.5 percent of dredge locations.

The maximum impact on PCB air quality for the base-case conditions are shown on Figure J-3-1 (residential) and Figure J-3-2 (commercial). This screening model assumes the nearest receptor is downwind for an entire 24-averaging period while dredging is occurring in the adjacent dredge area. The areas that cause predicted concentrations greater than the standard levels tend to be near shore and very close to the nearest receptor.

The modeling also shows that implementation of mitigation measures in these specific areas can substantially reduce the percentage of areas with predicted concentrations above the applicable criteria. These measures include:

(a) Mooring the large barges containing PCBs in deeper water near the navigation channel (creating a greater distance between the barge and receptors)

(b) Using barges of reduced surface area (200 m^2), which reduces the emissions of PCBs to the air

(c) Creating a thicker layer of river water to cover sediments in barges (a depth of 50 centimeters [cm] was modeled compared with 5 cm, which was assumed for the base case.

In fact, as discussed in Attachment J, the modeling analysis indicates that a combination of using smaller barges and covering the sediments in those barges with additional water would virtually eliminate any predicted exceedances of the PCB air quality criteria. The impact of these potential mitigation measures on productivity will be reviewed in the Phase 2 Final Design.

Additionally, the model developed in the Phase 1 FDR indicated that the use of 5-foot wind screens around the perimeter of barges would reduce air velocity across the surface of the water in the barges and thus reduce the emission rate of PCBs for maximum wind speed conditions. For Phase 2, wind screens will be considered if Phase 1 monitoring determines that mitigation for maximum wind conditions is required. In general, the effectiveness of control measures implemented in Phase 1 would be reviewed and the control strategies proposed above will be adapted in an addendum to the Phase 2 FDR.

Barge Mooring Areas

PCB emissions and ambient concentrations arising from barges moored at Lock 7 (up to three at a time) and from barges tied up at the Processing Facility wharf (up to three at a time) were modeled in the Phase 1 FDR. The modeling predicted no exceedances of either the residential or the commercial/industrial Concern Level. As a result, no contingency or mitigation measures were needed at these locations. The modeling was not repeated in Phase 2 because the average PCB concentrations are generally less in Phase 2 dredge areas and the plan for mooring barges in these areas is consistent with the Phase 1 Design.

An additional mooring location is proposed near RM 176.6 (see Figure BM-01) for Phase 2. Modeling has not been not performed in this area because the distances to the nearest receptor are much further than that for the Lock 7 mooring area, and PCB concentrations in air at the closest receptor would therefore be lower.

Processing Facility Operations

The Processing Facility includes the offloading wharf, size separation area, dewatering and thickening facilities, material staging areas and the rail yard. During facility operations, PCB-containing materials from these areas will be exposed to the atmosphere and could therefore become a potential source of PCB emissions. The potential emissions of PCBs from sources at the Processing Facility were evaluated through modeling in the Phase 1 FDR. That modeling demonstrated that, with the controls assumed in the facility design, emissions from the Processing Facility were not predicted to result in exceedances of the Concern or Standard Levels at either residential or commercial receptors. Since the Processing Facility is going to remain in the same configuration for Phase 2, the modeling results from Phase 1 will also apply to Phase 2, provided the PCB concentration in the dredged material are the same. The SEDC data for Phase 2 areas were analyzed to determine if the concentration of PCBs in the feed material was similar to Phase 1. The predicted Phase 1 and Phase 2 *insitu* sediment PCB concentrations by dredge year are presented in Table 5-1. As shown, the predicted *insitu* PCB concentrations for Phase 2, are 22 to 66 percent lower than the predicted *insitu* PCB concentration used for modeling conditions during Phase 1 Processing Facility operations.

Table 5-1
Average *Insitu* Sediment PCB Concentration - Phase 1 vs. Phase 2 Dredge Years

Average *Insitu* Sediment PCB Concentrations (mg/kg)					
Phase 1	Phase 2, Year 1	Phase 2, Year 2	Phase 2, Year 3	Phase 2, Year 4	Phase 2, Year 5
77.0	59.3	42.8	35.3	25.1	26.4

The mitigation measures designed in Phase 1 to control the PCB emissions from Processing Facility sources would be maintained for Phase 2, pending review of monitoring data collected during Phase 1. These measures include:

- Enclosures and vapor-phase activated carbon systems to capture and treat potential PCB emissions from the fine material (filter cake) staging areas
- Solid covers over the gravity thickener and recycle water storage tanks

The data collected during Phase 1 will be used to assess if other mitigation measures will be required for Phase 2 or if the level of mitigation planned can be reduced (e.g. adjustments to the operation of the air handling units for the filter cake enclosures).

5.3.2 Odor

River sediments may contain organic matter that, during decomposition, can emit unpleasant odors from the natural byproducts of decay, such as hydrogen sulfide (H_2S). Because thousands of cubic yards of Hudson River sediments and debris would be brought to the surface and transported on the waterway to be managed at the Processing Facility, the QoLPS for odor is intended to prevent or mitigate unreasonable odors that may affect the public. The QoLPS for odor is described in Section 2.1.3.2.

Sediment cores previously collected from the river for physical and chemical analyses and treatability studies generally did not have offensive odors. Nevertheless, debris from dredging operations, which may contain wood, vegetation, shellfish and other types of organic material, will be screened out and moved to a staging area in the center of the site. Covering the debris would also be available as a contingency measure if odors become a problem during operations. Phase 1 will likely provide additional information regarding the extent, if any, of odor concerns.

5.3.3 Noise

Noise would be generated during the operation of the Processing Facility and during dredging, backfilling/capping and sediment transfer operations. The QoLPS for noise specifies numerical criteria, which vary depending on the type of receptor (commercial or residential) and whether the operations are occurring in the daytime or nighttime. These noise criteria are summarized in Section 2.1.3.3.

A noise impact assessment was performed as part of Phase 1 Final Design to predict sound levels estimated for the Phase 1 dredging and material processing operations. The noise impact assessment was revised during the Phase 2 Intermediate Design based on updated design assumptions to estimate the potential impact associated with the Phase 2 operations. The Phase 2 noise impact assessment included predictive screening-level modeling for each short-term activity (i.e., dredging operations, backfilling, resuspension control installation) and for long-term activity (i.e., operation of the Transfer Facility). Details of the noise modeling analyses, including input parameters, methodologies, updates since the Phase 1 model was developed and results, are provided in Attachment K. The results of the predictive modeling for each activity are summarized below, along with preventive, contingency, or mitigation measures, where necessary.

5.3.3.1 Dredging and Barging Operations

Similar to Phase 1, 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 K, the model predicts that these operations would meet the daytime residential and commercial/industrial standards of 80 dBA at a distance of approximately 30 feet or more, the daytime residential control level of 75 dBA at a distance of 50 feet or more, and the nighttime residential standard of 65 dBA at a distance of 150 feet or more. These model results, in conjunction with the locations of assessment points, indicate that dredging and tug noise may exceed the nighttime residential standard, the daytime control level and the daytime standard at several potential receptors.

Figures QOL-01 through QOL-39 show contours around each Phase 2 dredge area at distances that correspond with the daytime residential and commercial/industrial standards of 80 dBA (i.e., at a distance of approximately 30 feet or more), the daytime residential control level of 75 dBA (i.e., at a distance of 50 feet or more) and the nighttime residential standard of 65 dBA (i.e., at a distance of 150 feet or more), and identify the potential receptors within these contours.

A noise study will be conducted at the commencement of Phase 1 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 150 feet of residences during nighttime operations and in areas where dredging operations are within 30 feet of potential receptors during daytime. There are various noise control/prevention or contingency measures that the contractor could utilize to reduce noise levels in these areas, including use of smaller work boats instead of tugs to move barges, or other operational adjustments on a temporary and as-needed basis.

5.3.3.2 Sheet Pile Installation

Sheet piling may be used to support sediment removal operations in the channel west of Griffin Island (near RM 190), as discussed in Section 3.2. Although sheet pile installation is not a sustained long-term process, driving sheeting with a vibratory hammer generates noise. The design for resuspension controls will be developed as part of the Phase 2 FDR. Certain pile-based support structures (i.e., batter piles and king piles) may need to be driven into the bedrock below the sediments to provide a stable and safe resuspension structure. While much of the sheet piling can be installed with a vibratory hammer, an impact hammer would be needed for driving king piles into bedrock. Sheet pile installation will be conducted only in the daytime, and may include both vibratory and impact hammering.

As described in Section 4.2 of Attachment K, there were no changes to the model assumptions for any potential sheet piling installation. As such, the model predictions for Phase 2 are the same as the noise levels predicted for Phase 1. 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.

The model predicts that the noise from impact hammering (the worst-case installation method for noise generation) near dredge area GI_01_KX would exceed the daytime residential and commercial standard (80 dBA), at certain receptors, as shown on Figure QOL-04. The exact number of potentially impacted receptors will not be known until the geotechnical investigations are complete to determine whether vibratory or impact methods are necessary, and until the needs for sheet piling at dredge area GI_01_KX are determined.

Potential noise control or mitigation measures will be evaluated as part of the Phase 2 FDR. Several potential noise control or mitigation options have been considered for sheet pile installation, as discussed in Attachment K. Sound-dampening blankets were identified in the Phase 1 FDR as a potential mitigation option, although data demonstrating their noise-reduction effectiveness have not been found. During the implementation of Phase 1, the contractor will have the ability to implement sound-dampening blankets and may propose other mitigation measures. Discussions will be held with local property owners predicted to be impacted by an exceedance of the Noise Performance Standard to determine if the unmitigated activity could be performed under a mutually agreeable arrangement. The results of these Phase 1 efforts will be considered in the development of the appropriate mitigation measures for Phase 2. As such, final mitigation measures will be described in an addendum to the Phase 2 FDR.

5.3.3.3 Barge Mooring Dolphins

It is currently anticipated that pile driving would be required to install several dolphins to provide mooring locations for barges. These mooring dolphin locations were described in Section 3.1.6 and will be situated at RM 176-177. It was assumed for purposes of this Phase 2 Intermediate Design that these dolphins would be installed in the same way as those being installed as part of Phase 1 (i.e., through impact hammering, since vibratory installation was not considered effective for this installation from an engineering perspective). However, this will be reassessed during Phase 2 Final Design once actual locations are refined and geotechnical data are available. It was also assumed that the impact hammer would drive the piles to the design depth in 30 minutes, and that the remainder of a given hour would be used to reposition equipment and set the next pile in place. Therefore, a usage factor of 0.5 (30 minutes/60 minutes) was assumed. Expected sound levels from the impact pile driving at various distances are presented in Attachment K. Pile-driving is expected to be a daytime-only activity.

The impact pile driving to install the dolphins is expected to produce sound levels of 80 dBA at a distance of approximately 400 feet and 75 dBA at a distance of approximately 700 feet. These distances are slightly different from the noise predictions from impact pile driving for the potential resuspension control sheet pile installation due to the slightly different usage factors. No residences are expected to be within either the 80 dBA contour or the 75 dBA contour for the dolphins at RM 176-177.

5.3.3.4 Processing Facility and Rail Yard Operations

The dewatering and handling of dredged sediments at the Processing Facility would generate noise as the material is unloaded at the wharf, processed through a variety of pumps and mechanical equipment (e.g., the trommel) and then transported by truck to the stockpiles for loading and offsite transport/disposal. Rail yard operations would also generate noise as locomotives maneuver rail cars and unit trains on and off the property. As discussed in Attachment K, 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 perimeter of the facility, with two exceptions. These exceptions are a Par-3 golf course building between the Processing Facility property and East Road (considered residential for purposes of the QoLPS for noise) and a residence on the west side of East Road across the canal from the unloading wharf and size separation area. At these locations, the noise level is predicted to exceed the long-term, day-night, 24-hour average residential standard level of 65 dBA.

The Phase 1 contract specifications require the Processing Facility Construction Contractor to select equipment that will meet the QoLPS for noise at these assessment points through the use of appropriate sizing and best achievable control technology for sound suppression (e.g., mufflers, shrouds, covers). The Processing Facility construction is currently underway, including equipment procurement and installation. Evaluation of the achievement of the noise QoLPS at the Processing Facility will be performed as part of Phase 1 activities. Since no additional process equipment or operation is proposed in this Phase 2 IDR for the Processing Facility, control measures that may be implemented for Phase 1 are expected to be effective to control noise during Phase 2 activities.

5.3.3.5 Land-Locked Area Sediment Transfer Facility

As described in Section 3.7.2, a portion of the Phase 2 dredge areas are in the land-locked area of the river (approximately RM 189 to RM 186). The proposed approach for transferring the dredged sediment out of this area for transportation to the Processing Facility is to construct a transfer operation near RM 188 just east of Thompson Island and to transfer sediment from the land-locked area to barges located within the navigable Champlain Canal. Sound level impacts of this operation were evaluated assuming dredged material would arrive from the Hudson River via a small barge pushed by a tug. A clamshell crane would transfer the material to a large barge on the Champlain Canal section to the east. The large barge would then be taken via tug north to the Processing Facility. Based on productivity requirements, it is expected that two small barges (roughly 500 cy each) and one large barge (roughly 1,000 cy) would be needed each day.

Construction of the Transfer Facility in the land-locked area would be a daytime-only activity. Since construction would be relatively brief and occur only during the daytime, no quantitative sound level analysis was conducted. The Construction Contractor would be required to submit a Noise Control Plan, which would describe how the Noise Performance Standard would be achieved.

Noise generation during operations was predicted for 24-hour operations at receptor locations within approximately 2,000 feet of the Transfer Facility location. As described in

Attachment K, all modeling results were well below the noise criteria in the QoLPS. These results indicate that no additional noise prevention or mitigation measures are expected to be necessary for transfer operations from the land-locked area.

5.3.4 Lighting

To meet EPA's Productivity Performance Standard, in-river dredging and onshore processing are 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. As described in Section 2.1.3.4, the numerical lighting criteria set forth in the QoLPS are 0.2 footcandle in rural and suburban residential areas, 0.5 footcandle in urban residential areas, and 1 footcandle in commercial/industrial areas. Due to the paramount issue of safety, lighting requirements for worker safety, navigational safety and vehicular safety under the Occupational Safety and Health Administration (OSHA), USCG and other applicable regulations will supersede the QoLPS for lighting.

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

The Phase 1 IDR included a modeling analysis of lighting impacts from nighttime on-water operations (e.g., dredging, barge transport). That modeling 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 about 50 feet from the edge of the dredge barge. Thus, the residential standard of 0.2 footcandle for rural/suburban areas would be met at a distance of 50 feet or more from the edge of the dredge deck. Potential receptors that are located within approximately 50 feet of the Phase 2 dredge areas are shown on Figures QOL-01 through QOL-39.

There are some receptors within 50 feet of the work area. The Phase 2 FDR contract specifications would therefore include lighting requirements that the Dredging Contractor must follow to prevent, or mitigate if necessary, exceedances of the Lighting Performance Standard. The contractor would be required to 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 would be directed to meet applicable QoLPS criteria, comply with 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 would be turned off during transport, although all required navigational lighting would remain on for safety purposes.

5.3.4.2 Processing Facility and Work Support Marina

The Phase 1 IDR also included a modeling analysis of lighting impacts from nighttime Processing Facility operations. However, a revised lighting modeling analysis was performed as part of this Phase 2 Intermediate Design to evaluate the potential impacts of light sources from the updated Processing Facility layout. The lighting layouts for the Processing Facility and Work Support Marina currently under construction as part of Phase 1 were evaluated using software titled “Visual – Professional Edition” (version 2.06). The calculation zones were extended beyond the actual property lines and into the Champlain Canal to verify lighting conditions at the site borders. The calculated model results for the Processing Facility and the Work Support Marina are shown on Figures 5-1 and 5-2, respectively. The results of the modeling analysis indicate that the design would attain the relevant lighting standards. Since no additional process equipment or operation is proposed in this Phase 2 IDR for the Processing Facility, these results indicate that Processing Facility operations during Phase 2 would be expected to meet these lighting standards.

Although these results indicate no need for light mitigation at the Processing Facility, the applicable Phase 2 contract specifications would include lighting requirements that the Processing Facility Operations Contractor must follow to prevent, or mitigate if necessary, exceedances of the Lighting Performance Standard. The contractor would be required to 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 would be 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.

5.3.5 Navigation

The Upper Hudson River and Champlain Canal are navigable waterways used for recreation and commerce. To varying degrees by location, season and time of day, these waterways would be affected during active periods of the Phase 2 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 and safety operations, as well as additional project activities. The QoLPS for navigation was developed to regulate project-related vessel movement on the river, as summarized in Section 2.1.3.5. 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 NYS Canal Corporation of in-river project activities
- Providing information to the NYS Canal Corporation 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 NYS Canal Corporation and its lock operators
- Establishing temporary aids to navigation, such as lighting, signs and buoys, to maintain safe and efficient vessel movement

The Phase 2 Intermediate 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 Phase 1 Design analyses and results of predictive logistical modeling conducted for Phase 2 (see Sections 2.2.8 and 3.8), as well as the draft specifications, the Phase 2 activities are expected to meet the QoLPS for navigation. Specifically, the Phase 2 Design includes the following general requirements relating to navigation:

- **Prohibition on obstructing navigation –** To the extent practicable and consistent with meeting other goals and performance standards, project-related vessels would 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 would comply with applicable federal and state regulations regarding proper lighting and signaling for safe and orderly navigation, day and night.

- **Piloting –** Project-related vessels would 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 would be restricted in coordination with the NYS Canal Corporation.

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

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

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

- **Routine notices –** The NYS Canal Corporation and USCG would be provided verbal and written routine notices regarding project schedules, which would allow those agencies to issue Notices to Mariners regarding anticipated access restrictions, project vessel scheduling, lock scheduling, contingencies, or other information. The general public would also be provided a schedule of anticipated project activities that may affect navigation, as will be discussed in more detail in the Phase 2 RA CHASP.

- **Monitoring, notifications and reporting –** Marine traffic would be routinely monitored after dredging operations begin. This routine monitoring would 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. Issues would be discussed at the remedial action process meetings described in the RA CD SOW.

- **Deviations from navigation requirements and complaint management –** If on-river operations deviate from applicable navigation regulations or from the design plans relating to navigation, the procedures to be specified in the Phase 2 PSCP and Phase 2 RA CHASP for reporting and taking contingency actions would be followed. Complaints from the public relating to navigation would be handled, as described in the Phase 2 RA CHASP.

In addition to these general requirements, the Phase 2 Intermediate Design includes specific provisions to address navigation adjacent to the land-locked area and in certain other specific locations.

To support the transport of sediment dredged from within the land-locked area to the Processing Facility and the import of backfill/capping materials, up to two large barges with approximate capacities of 1,000 tons each would be staged along the western shore of the land cut just upstream of Lock 6. Each barge would be approximately 195 feet long and 35 feet wide; one would be used for dredged sediments and the second would be used to bring backfill/cap materials to the land-locked area. While sufficient room would remain in the land cut for non-project vessels to pass by these two barges, lighted buoys will be stationed upstream and downstream of the barge mooring area. Mooring and movement of barges would be described in the local Notice to Mariners filed for the project and would be updated if project operations in this location change. Finally, movement of the barges into and out of the land cut would be focused on hours of the day when the lock is closed to non-project vessel traffic. Since operation of Lock 6 is not needed to support the movement of barges between this Transfer Facility and the Processing Facility, focusing this activity to periods when the lock is closed to non-project vessel movement would minimize the potential for conflict between project and non-project vessels.

Similar measures would be required for project operations slated to occur just upstream of Lock 2 (Dredge Area LMD_05_NK), in the land cut upstream of Lock 4 (Dredge Area CSD_36_NK), within the land cut in the navigation channel for Lock 5 (Dredge Area NDCA_01_NK) and just north of the land cut above Lock 6 (Dredge Areas GI_06_NK and GI_NK_08). Sediment removal and backfill/cap transport operations occurring in these dredge areas would be focused on times when the locks are closed to non-project vessels. The Notice to Mariners would also describe operations at these locations to the extent they are scheduled to occur during times when the locks are open to non-project vessel traffic or in the event that equipment would be staged in these areas.

Additional information regarding the scope of navigation monitoring, notification, contingencies, mitigation and complaint management would be provided in the Phase 2 PSCP and the Phase 2 RA CHASP.

5.4 Actions to Meet Substantive Water Quality Requirements

In addition to the above-described performance standards, EPA has issued other WQ requirements, as described in Section 2.1.4. These include substantive requirements for discharges from the Processing Facility to the Champlain Canal (EPA 2005) and to Bond Creek (Attachment A) and substantive requirements applicable to in-river releases of constituents not subject to the Resuspension Performance Standard (notably, metals and physical parameters; EPA 2005). This section describes the actions anticipated to be taken in Phase 2 to implement those requirements as they currently exist. However, as with the other performance standards, these WQ requirements may be revised following evaluation of the Phase 1 data and experience. Any such changes would be incorporated, as necessary, in revisions to the Phase 2 Design documents and in the Phase 2 RAWPs and associated documents – e.g., Phase 2 RAM QAPP and Phase 2 PSCP.

Process water and Type 1 stormwater generated at the Processing Facility and the Transfer Facility would be captured, treated at the water treatment plant and discharged in accordance with the discharge limitations established in the WQ requirements issued by EPA (EPA 2005). The Processing Facility water treatment plant has been designed to meet the Phase 1 WQ requirements included in the Phase 1 FDR. The effluent limits and associated requirements and the actions that would be taken to meet them are set forth in the PSCP Scope (Attachment C to SOW). Details regarding the monitoring of these discharges during Phase 1 are specified in the Phase 1 RAM QAPP. Discharge monitoring requirements for Phase 2, as well as actions to be taken in the event of an exceedance of a discharge limit, would be updated, if necessary, following completion of Phase 1 and would be included in the Phase 2 RAM QAPP and Phase 2 PSCP.

Type 2 (non-contact) stormwater at the Processing Facility includes stormwater from active areas of the facility other than those operational areas where sediments will be unloaded, moved, dewatered, stored or loaded. These non-contact areas include parking lots, non-contact rail yard areas and administrative buildings. Type 2 stormwater would be captured and diverted to basins to allow solids to settle, but not treated at the water treatment plant,. The two basins overflow to Bond Creek. Non-contact stormwater discharges to Bond Creek would be managed and discharged in conformance with the Substantive Requirements of State Pollutant Discharge Elimination System Permit for Potential Discharges to Bond Creek issued by EPA (Attachment A). Again, these requirements for

Phase 2 would be updated, if necessary, following completion of Phase 1, and will be included in the Phase 2 RAM QAPP and Phase 2 PSCP. If water is to be treated at the Transfer Facility, it would be discharged in accordance with Substantive Requirements of SPDES Permit for Potential Discharges to the Hudson River.

The WQ requirements for in-river releases of constituents not subject to the Resuspension Performance Standard are divided into acute water quality standards to be met at near-field stations and health-based standards to be met at far-field stations. They also include requirements for responses to observations of distressed or dying fish. The actions to be taken to implement these standards and requirements are described in the PSCP Scope (Attachment C to SOW). Details regarding the monitoring of these constituents subject to these requirements during Phase 1 are specified in the Phase 1 RAM QAPP. Monitoring requirements for Phase 2, as well as actions to be taken in the event of an exceedance of these WQ requirements (or observations of distressed or dying fish), would be updated, if necessary, following completion of Phase 1 and will be included in the Phase 2 RAM QAPP and Phase 2 PSCP.

In addition, for Phase 1, EPA directed GE to incorporate the substantive requirements of 6 NYCRR Part 608, which include a requirement that dredging operations not cause an increase in turbidity that results in a substantial visible contrast to natural conditions beyond the dredge site monitoring location. Meeting this requirement is addressed through the specifications (Section 13805), which include a provision for the contractor to define the operational areas in a resuspension control plan. For Phase 2, this plan would be further described in the RAWP for Phase 2 Dredging and Facility Operations and would preclude the use of sheet piling or silt curtains within the contractor-defined work area to meet the visual plume requirement of the specifications. For Phase 1, EPA will deem the remedial action to meet the turbidity requirement so long as the near- and far-field resuspension criteria and the WQ requirements for in-river releases of constituents not subject to the performance standards are met. EPA will use the results of Phase 1 to determine if this approach to compliance with the narrative standard for turbidity requires modification for Phase 2.

5.5 Summary and Conclusions

The effectiveness of the remedial design related to achievement of the performance standards will be evaluated during Phase 1. However, because Phase 1 has not been implemented as of the date of this Phase 2 IDR, the current Hudson EPS (EPA 2004a) and QoLPS (EPA 2004b) have been used as a basis for developing the Phase 2 Intermediate

Design. Given the basis of design presented in Section 2, this Phase 2 IDR concludes the following about the ability to meet the performance standards:

- Based on predictive modeling, the dredging operations, with reduced dredge rates in the areas requiring resuspension controls (as described in Sections 3.2 and 5.2.1), are predicted to achieve the Control and Standard Level criteria in the Resuspension Performance Standard.

- Since the Residuals Performance Standard allows capping after two residuals dredging passes, that standard can be satisfied. However, a high frequency of residuals dredging will negatively impact productivity. The frequency of residuals dredging passes and ratio of backfilled to capped areas cannot be reliably predicted; therefore there is uncertainty in the ability to meet both the Residuals Performance Standard requirements and the Productivity Performance Standard objectives simultaneously.

- The logistics model indicates that, under certain scenarios, the target removal volumes established under the Productivity Performance Standard can be achieved. However, the ability to achieve those target volumes depends on numerous factors, including, but is not limited to, the following:

  - The quantity of residuals dredging and/or capping required and the number of residuals sampling events necessary

  - Timely and consistent completion of CU certification

  - Inclement weather conditions

  - Ability to move sediment or backfill and cap material barges through the Canal system in a timely manner

  - Available backfill loading and barge mooring locations

  - River flows and water levels during the dredge season

  - Slowing dredging rates to control resuspension beyond those controls presented in Figures RC-01 through RC-07

  - Restrictions on nighttime dredging or backfilling operations due to QoLPS limitations beyond those presented in Section 3.1 and 3.5

- Canal season and lock operations (24 hours per day, predictable cycle times and mechanical reliability)

- Processing and/or rail delays

- The air quality model for PCBs predicts that barge operations during dredging would result in PCB concentrations greater than the Concern and Standard Level at several riverside receptors. As discussed in Section 5.3.1.3, the modeling indicates that the following mitigation measures applied in specific locations where uncontrolled operations are predicted (or shown by monitoring) to cause concentrations above the Concern Level would substantially reduce the potential for exceedances and may reduce levels to below the Concern Level:

  - Wind screens (during high wind conditions)

  - Anchoring the barge in deeper water (further from the shoreline) while dredging near the shore to create more distance between the source and receptor

  - Using smaller barges, especially for near-shore areas

  - Covering the sediment in the barges with a thicker layer of river water

- Practices specified for handling and staging of debris are assumed to be sufficient to satisfy the Odor Performance Standard.

- The numerical criteria in the Lighting Performance Standard are expected to be met, unless nighttime dredging is conducted near the shore within any dredge area where the adjacent receptor is within 50 feet of the operations (31 cases predicted in Phase 2). If monitoring data confirm these predictions, the exceedances can be mitigated by prescribing daytime dredging in these areas.

- The numerical criteria in the Noise Performance Standard are expected to be met assuming that:

  - Mitigation measures as discussed in Section 5.3.3.1 are effective for receptors that are within 30 feet of daytime dredging operations and for receptors that are within 150 feet of the dredging operations during the night.

- As discussed in Section 5.3.3.2, effective mitigation measures are developed for the relatively few receptors that are within the range of the pile driving operations where the model predicts exceedances of those criteria.

- The Navigation Standard is expected to be met. The NYS Canal Corporation will be consulted regarding the design of the mooring area for the Transfer Facility, the location of proposed mooring posts and the schedule for dredge areas adjacent to lock structures.

As previously discussed, although considerable effort has gone into developing a remedial design capable of achieving the performance standards, a number of assumptions have been incorporated into this Phase 2 Intermediate Design, as they were for the Phase 1 Design. The actual experience and monitoring in Phase 1 will provide valuable information on the feasibility of achieving the performance standards, both individually and in combination.

Following the completion of Phase 1, EPA and GE will evaluate the Phase 1 experience and monitoring data with regard to achievement of the performance standards, and EPA may modify those standards for Phase 2. Any such changes would be incorporated in revisions and/or addenda to the Phase 2 Design documents and in the Phase 2 RAWPs and associated documents (e.g., Phase 2 RAM QAPP, Phase 2 PSCP and Phase 2 RA CHASP).

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7. Acronyms and Abbreviations

1Q3	once every 3 years
AOC	Administrative Order on Consent
ARA	archaeological resources assessment
ARARs	applicable or relevant and appropriate requirements
BA	biological assessment
BBL	Blasland, Bouck & Lee, Inc.
BMP	Baseline Monitoring Program
CARA	cultural and archaeological resources assessment
CD	Consent Decree
CDE	Critical Phase 1 Design Elements
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
cm	centimeter
CO	carbon monoxide
CSD	Coveville to Stillwater Dam area
CU	certification unit
cy	cubic yards

cy/day	cubic yards per day
cy/year	cubic yards per year
DAD	dredge area delineation
dBA	A-weighted decibels
DoC	depth of contamination
DQO	data quality objective
DSR	Data Summary Report
%R	design loss rate
E&E	Ecology and Environment, Inc.
EGIA	East Griffin Island Area
EMP	Environmental Monitoring Plan
EPA	U.S. Environmental Protection Agency
EPS	Engineering Performance Standards
ESA	Endangered Species Act
ft/s	feet per second
Final BA	Final Biological Assessment
FDR	Final Design Report
FMD	Fort Miller Dam
FOMP	Facility Operations and Maintenance Plan
FS	feasibility study

g/day	grams per day
g/m^2	grams per square meter
GE	General Electric Company
GI	Griffin Island
g/mL	grams per milliliter
gpm	gallons per minute
gpm/sf	gallons per minute per square feet
HA Report	Habitat Assessment Report
HD Report	Habitat Delineation Report
HDA	habitat delineation and assessment
HDA Work Plan	Habitat Delineation and Assessment Work Plan
Hudson EPS	Hudson Engineering Performance Standards
Hudson QoLPS	Hudson Quality of Life Performance Standards
H_2S	hydrogen sulfide
IDR	Intermediate Design Report
IDSR	Interim Data Summary Report
KA	kriged area
kg	kilogram
kg/year	kilogram/year
KX	not kriged, but sufficient data exists to perform kriging

lbs	pounds
LL	land-locked area
LMD	lower Mechanicville Dam area
m	meter
m^2	square meter
$\mu g/m^3$	microgram per cubic meter
µm	micrometer
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MPA	mass per unit area
mph	miles per hour
ng/L	nanograms per liter
NAAQS	National Ambient Air Quality Standards
NDCA	Northumberland Dam to Coveville area
NID	National Inventory of Dams
NK	non-kriging – insufficient data to perform kriging
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NSPS	New Source Performance Standards
NSR	New Source Review

NTIP	North Thompson Island Pool area
NYCRR	New York Code of Rules and Regulations
NYS	New York State
NYS Canal Corporation	New York State Canal Corporation
NYSDEC	New York State Department of Environmental Conservation
NYSDOT	New York State Department of Transportation
OSHA	Occupational Safety and Health Administration
OSI	Ocean Surveys, Inc.
O_3	ozone
ppm	parts per million
PCBs	polychlorinated biphenyls
PDR	Preliminary Design Report
Phase 1 DAD Report	Phase 1 Dredge Area Delineation Report
Phase 1 EMP	Phase 1 Environmental Monitoring Plan
Phase 1 FDR	Phase 1 Final Design Report
Phase 1 IDR	Phase 1 Intermediate Design Report
Phase 1 RAM QAPP	Phase 1 Intermediate Design Remedial Action Monitoring Quality Assurance Project Plan
Phase 2 ARA Report	Archaeological Resources Assessment Report for Phase 2 Dredge Areas
Phase 2 DAD Report	Phase 2 Dredge Area Delineation Report

Phase 2 FDR	Phase 2 Final Design Report
Phase 2 HA Report	Habitat Assessment Report for Phase 2 Areas
Phase 2 IDR	Phase 2 Intermediate Design Report
Phase 2 SEDC DSR	Phase 2 Supplemental Engineering Data Collection Data Summary Report
PM	particulate matter
$PM_{2.5}$	fine particulate matter with a diameter less than 2.5 micrometers
PM_{10}	respirable particulate matter with a diameter less than 10 micrometers
PSCP	Performance Standards Compliance Plan
psi	pounds per inch
QAPP	Quality Assurance Project Plan
QEA	Quantitative Environmental Analysis, LLC
QoLPS	Quality of Life Performance Standards
RA CD	Remedial Action Consent Decree
RAM	remedial action monitoring
RAM QAPP	Remedial Action Monitoring Quality Assurance Project Plan
RAWP	Remedial Action Work Plan
RAWP #3	Phase 1 Remedial Action Work Plan for Dredging and Facility Operations
RCRA	Resource Conservation and Recovery Act

RD AOC	Administrative Order on Consent for Hudson River Remedial Design and Cost Recovery
RD Work Plan	Remedial Design Work Plan
RM	river mile
ROD	Record of Decision
RTK DGPS	Real-Time Kinematic Differential Global Positioning System
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
SIP	State Implementation Plan
SK	Snook Kill area
SO_2	sulfur dioxide
SOW	Statement of Work for Remedial Action and Operations, Maintenance and Monitoring
SPDES	State Pollutant Discharge Elimination System
SSAP	Sediment Sampling and Analysis Program
TCLP	Toxic Characteristic Leaching Procedure
TD	Troy Dam area
TID	Thompson Island Dam

TIP	Thompson Island Pool
TOC	total organic carbon
Tri+ PCBs	PCBs with three or more chlorine atoms
TSCA	Toxic Substances Control Act
TSS	total suspended solids
UCB	unconsolidated river bottom
UP	Union Pacific Railroad
UPM	Upper Mechanicville Dam area
URS	URS Corporation
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Society
VE	value engineering
VOCs	volatile organic compounds
w/w	weight by weight
WCS	Waste Control Specialists
WD	Waterford Dam area
WLL	west land-locked area

WLMD	West Lower Mechanicville Dam area
WNDCA	West Northumberland Dam to Coveville area
WQ requirements	water quality requirements
WRI	West Rogers Island
wtons/hr	wet tons per hour
Year 2 IDSR	Year 2 Supplemental Engineering Data Collection Interim Data Summary Report