Supplemental Engineering Data Collection Work Plan Hudson River PCBs Superfund Site

General Electric Company
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1. Introduction

This *Supplemental Engineering Data Collection Work Plan* (SEDC Work Plan) has been prepared on behalf of the General Electric Company (GE) and presents a technical approach for collecting additional engineering data to assist in the design of the remedy selected by the United States Environmental Protection Agency (USEPA) to address polychlorinated biphenyls (PCBs) in sediments of the Upper Hudson River, located in New York State. This SEDC Work Plan provides the framework for field activities to be conducted by GE during the Year 2 Supplemental Engineering Data Collection Program (Year 2 SEDC Program) to support the development of the remedial design (RD), as described in the *Remedial Design Work Plan* (RD Work Plan) dated August 2003 (Blasland, Bouck & Lee, Inc. [BBL], 2003a). The activities described in the RD Work Plan are being conducted under 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) (USEPA/GE, 2003). It is important to note that, because dredge area delineation (DAD) efforts are still under development or currently underway as of the date of this SEDC Work Plan, this document may require an addendum to address modifications to the proposed sampling program that may be warranted once actual target dredge areas have been established in the *Phase 1 Dredge Area Delineation Report* (Phase 1 DAD Report), which is scheduled to be submitted in early 2004.

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 USEPA issued a Superfund Record of Decision (ROD) on February 1, 2002, calling for, among other things, the removal and disposal of approximately 2.65 million cubic yards (cy) of PCB-contaminated sediments from the Upper Hudson River (USEPA, 2002). A summary of the remedial action (RA) can be found in sub-section 1.2 of the RD Work Plan (BBL, 2003a).

The USEPA divided the Upper Hudson River into three sections (River Section 1, River Section 2, and River Section 3) (hereafter referred to as the "Upper Hudson River") for the sediment remediation activities outlined in its 2002 ROD. The location of each section is described below:

- **River Section 1:** Former location of Fort Edward Dam to Thompson Island Dam (approximately 6.3 miles);
- **River Section 2:** Thompson Island Dam to Northumberland Dam (approximately 5.1 miles); and

- **River Section 3:** Northumberland Dam to the Federal Dam at Troy (approximately 29.5 miles).

1.2 Sediment Sampling and Analysis Program (SSAP) Overview

The objective of the SSAP is to provide sediment data for the design of the remedy set forth in the ROD (USEPA, 2002). The scope of the SSAP is provided in the *Sediment Sampling and Analysis Program – Field Sampling Plan* (SSAP-FSP) (Quantitative Environmental Analysis, LLC [QEA], 2002), *Supplemental Field Sampling Plan* (Supplemental FSP) (QEA, 2003a), and *Sediment Sampling and Analysis Program – Quality Assurance Project Plan* (SSAP-QAPP) (QEA and Environmental Standards, Inc. [ESI], 2002). The SSAP activities are being conducted under the AOC for the SSAP (hereafter referred to as the Sediment Sampling AOC), effective July 26, 2002 (Index No. CERCLA-02-2002-2023) (USEPA/GE, 2002). The SSAP data will be used in delineating the locations (areal extent and depth) of sediment to be removed. The SSAP data also will provide measurements of certain chemical and physical properties of the sediment to be removed that are important for the design of dredging, transport, treatment, and disposal.

1.3 SEDC Program Overview

As described in the RD AOC (USEPA/GE, 2003) and RD Work Plan (BBL, 2003a), additional engineering data collection and analysis activities are necessary to supplement the information obtained from the SSAP activities conducted under the Sediment Sampling AOC (USEPA/GE, 2002). The first step in developing the SEDC Work Plan was to review the dataset collected under the SSAP for sampling locations in the three candidate Phase 1 areas (see discussion below on the candidate Phase 1 areas). This evaluation included a detailed review of the core log information, field information, visual classification, and a review of the geotechnical testing that was conducted under the SSAP, including approximately 1,100 core samples. This review indicated that most of the samples (over 75%) were either fine sand or silt. Likewise, the extensive side-scan sonar (SSS) information and visual classifications from the database support the classifications indicated above (i.e., the majority of sediment deposits consisting of sand and silt).

Based on the review of the geotechnical testing program results, the Year 2 SEDC Program was developed to augment the information available for specific elements necessary for design (e.g., data on sediment and sub-bottom strength in candidate Phase 1 areas of the river). The three candidate Phase 1 areas were described in sub-section 2.4 of the RD Work Plan (BBL, 2003a) and consist of the upper portion of River Section 1, the portion of River Section 1 in the vicinity of Griffin Island, and the areas of River Section 2 in the vicinity of Hot Spots 33 through 35. Note that the actual dredge areas within the candidate Phase 1 areas will be presented in the Phase 1 DAD Report based on the criteria outlined in sub-section 2.7 of the RD Work Plan (BBL, 2003a).

The SEDC activities described herein were developed to be part of a flexible program to accommodate issues that may not be known as of the writing of this SEDC Work Plan. For example, as described above, although the three candidate Phase 1 areas are generally known, the specific dredge areas within each general area will not be defined until the Phase 1 DAD Report is issued and approved. As such, the SEDC activities will be conducted in areas likely to be affected by remedial activities (i.e., in areas where available SSAP data indicate PCB Tri+ mass per unit area (MPA) above thresholds established in the ROD [USEPA, 2002]). It should be recognized that additional SEDC data may need to be collected in these areas based on the final dredge areas specified in the Phase 1 DAD Report. An overview of the SEDC Program objectives, activities, and associated deliverables is presented herein.

1.3.1 Objectives

The primary objective of the SEDC Program is to gather the field data needed to develop the RD. The SSAP fulfilled many of these data needs and the SEDC Program is designed to complete the required dataset. The data needs currently identified include information regarding the physical characteristics of the riverbed (including sub-strata) in the areas to be dredged. The specific objectives of these activities are the following:

- Identify the presence and characteristics of structures/debris (i.e., boulders, man-made obstructions, and debris) present in sediments targeted for removal;
- Identify equipment access issues;
- Determine the suitability of available backfill materials; and
- Collect additional data regarding engineering properties of sediments and underlying strata to support the RD, including:
  - Geotechnical properties of in-river sediments and underlying strata;
  - Dredgeability of sediments to be removed;
  - Slope stability adjacent to dredge areas during and following dredging; and

– Other river characteristics (velocity and discharge, stage, waves).

Additional waste characterization activities for disposal will be handled during the treatability study phase.

1.3.2 Year 2 SEDC Program Tasks

To collect the necessary engineering data, the Year 2 SEDC Program will include the following tasks:

- Task 1 – Infrastructure Documentation;
- Task 2 – Debris and Obstruction Survey;
- Task 3 – Geotechnical Drilling Program;
- Task 4 – Backfill Source Material Identification and Characterization; and
- Task 5 – River Hydraulics and Hydrography Data Collection.

A more detailed description of each task to be conducted during the Year 2 SEDC Program is provided in Section 3, along with a description of the SEDC process and data quality objectives (DQOs) for the project.

1.4 SEDC Work Plan Organization

This SEDC Work Plan is organized into the sections shown in Table 1, below.

Table 1 – SEDC Work Plan Organization

Section	Description
1 – Introduction	Presents background information and overall project objectives.
2 – SEDC Process and Rationale	Describes the process, DQOs, and data needs for the Year 2 SEDC Program.
3 – Year 2 SEDC Program Tasks	Provides details on the five tasks that comprise the Year 2 SEDC Program.
4 – Project Management	Describes the project management roles for the SEDC Program, organized according to project/task organization and project execution.
5 – SEDC Documentation, Reporting, and Schedule	Describes the information that will be included in the *Supplemental Engineering Data Collection Report for Year 2* (SEDC Report for Year

Section	Description
	2), along with the schedule components for the SEDC activities.
6 – References	Presents references used to prepare this SEDC Work Plan.
Tables	Provides tables that are referenced in this SEDC Work Plan.
Figures	Provides figures that are referenced in this SEDC Work Plan.
Appendices	Appendix A provides American Society for Testing and Materials (ASTM) Standards, Appendix B provides Standard Operating Procedures (SOPs), Appendix C presents the sample handling and custody requirements, and Appendix D contains the Backfill Source Log.

This SEDC Work Plan is supplemented by the following documents, which have been previously prepared by GE and its consultants and submitted to, and/or approved by, the USEPA under the Sediment Sampling AOC (USEPA/GE, 2002):

- SSAP–FSP (QEA, 2002) and Supplemental FSP (QEA, 2003a) describe the SSAP activities. The SSAP-FSP was approved by the USEPA as part of the Sediment Sampling AOC (USEPA/GE, 2002). The USEPA has not formally approved the Supplemental FSP; however, the USEPA requested that GE move forward with the sampling program and collect samples at the locations proposed in the Supplemental FSP. The sampling specified in the SSAP-FSP and Supplemental FSP is currently being implemented.

- SSAP-QAPP (QEA and ESI, 2002) presents the quality assurance/quality control (QA/QC) protocols to be followed during sediment sampling and laboratory analytical efforts. This SSAP-QAPP was submitted to the USEPA in connection with the Sediment Sampling AOC (USEPA/GE, 2002) and approved by the USEPA on October 1, 2002.

- *Sediment Sampling and Analysis Program – Year 1 – Data Summary Report* (Year 1 DSR) (QEA, 2003b) presents the data summary for the Year 1 SSAP. The Draft Final Year 1 DSR was submitted to the USEPA in May 2003 in connection with the Sediment Sampling AOC (USEPA/GE, 2002).

Further, a *Revised Community Health and Safety Plan* (Revised CHASP) (BBL, 2003b) has been approved by the USEPA and is appended to the RD AOC (USEPA/GE, 2003) as Appendix 2. The Revised CHASP presents protocols addressing aspects of the field investigation activities to be performed as part of the RD Work Plan and correspondingly this SEDC Work Plan.

Also, a *Revised Health and Safety Plan* (Revised HASP) (BBL, 2003c) has been submitted under the RD AOC (USEPA/GE, 2003). The Revised HASP presents the occupational safety and health program for the additional field activities to be performed under the RD Work Plan (BBL, 2003a) and correspondingly this SEDC Work Plan.

2. SEDC Process and Rationale

2.1 SEDC Process Overview

This section describes the steps used to arrive at the recommended SEDC field program. The SEDC process began with the identification of relevant DQOs (identified in Table 2). These DQOs provided a basis to establish a data needs matrix (contained in Table 3). The data collected under the SSAP for the candidate Phase 1 areas (as presented in the Year 1 DSR [QEA, 2003b] and subsequent data from Year 2 SSAP work efforts) were evaluated with regard to the data needs. Engineering data gaps identified from this evaluation defined the scope of the Year 2 SEDC Program.

Subsequently, the SEDC sampling and testing plan (as contained in this SEDC Work Plan) was derived based on two process flow charts:

- Geotechnical Field Sampling Flow Diagram (Figure 1), which explains the logic behind development of geotechnical field sampling program; and
- Geotechnical Testing and Analysis Flow Diagram (Figure 2), which explains the logic behind the decisions regarding which samples will be submitted for laboratory analysis of various engineering parameters.

The following sub-sections discuss the DQOs, data needs, and sample handling and custody requirements.

2.2 Data Quality Objectives

Table 2 provides the complete listing of DQOs (including the primary and detailed DQOs) in tabular summary format. The primary DQOs (Level 1) include the following:

- Delineate dredge areas and depths;
- Determine the impact of site conditions on dredging operations, dredged material transport, equipment, and the ability of such equipment to access targeted sediments;
- Determine the impact of site conditions on resuspension control systems installation and operation;

- Determine resuspension effects during dredging;
- Determine the impact of site conditions on the design of sediment processing and water treatment systems;
- Identify the potential effects of dredging operations on neighboring areas/properties; and
- Identify material requirements for the habitat replacement and reconstruction design.

Detailed DQOs (Levels 2 and 3) developed to satisfy the Level 1 DQOs are listed below (headings for Section 2.2.1 through 2.2.7 represent the Level 1 DQOs) and summarized in Table 2. Note that DQOs 8 through 10 (in Table 2) will be more fully addressed in the *Treatability Studies Work Plan* (currently under development), although some data collected under the SEDC Program will help satisfy these DQOs.

2.2.1 Delineate Dredge Areas and Depths

Supporting information addressing this Level 1 DQO is presented elsewhere, including SSAP-QAPP (QEA and ESI, 2002) Section A7.1.1, the *Cultural and Archaeological Resources Assessment Work Plan* (CARA Work Plan) (URS, 2003), *Habitat Delineation and Assessment Work Plan* (HDA Work Plan) (BBL, 2003d), and RD Work Plan (BBL, 2003a) and are not repeated herein. The following additional Level 2 DQO is identified for SEDC activities:

1. Identify areas with physical conditions that may affect the dredging activities.

2.2.2 Determine the Impact of Site Conditions on Dredging Operations, Dredged Material Transport, Equipment, and the Ability of Such Equipment to Access Targeted Sediments

The CARA Work Plan (URS, 2003) and HDA Work Plan (BBL, 2003d) indirectly address this Level 1 objective. Other activities associated with this DQO include a review of previous investigations and reports. Any additional information uncovered as part of the background information review (e.g., New York State [NYS] Canal Corporation and DOT file reviews) will also be included in the assessment. Six additional objectives are identified for SEDC activities, including the following Level 2 DQOs:

1. Determine the impacts of river hydraulics on dredging and dredged material transport equipment access and/or operation.

2. Determine the impact of wave action (generated by wind and vessel wake) on anchor systems.
3. Determine the effect of structures (e.g., dams, locks, bulkheads, utilities, bridges, docks, piers, seawalls, marinas, water intakes/outfalls, river traffic, vegetation, roads/highways, houses) and debris on dredging and dredged material transport equipment access and/or operations.
4. Identify the effect of the geotechnical properties of site sediments on the selection of dredge equipment and design of dredged material transport.
5. Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the design of dredging and anchoring systems.
6. Determine the effect of climatic and weather conditions (wind speed and direction, temperature, relative humidity, precipitation, storm/extreme event frequency, and high-flow events) on safety of operations and dredging schedules, operations, and productivity.

2.2.3 Determine the Impact of Site Conditions on Resuspension Control Systems Installation and Operations

The CARA Work Plan (URS, 2003) and HDA Work Plan (BBL, 2003d) indirectly address this Level 1 objective. Four additional objectives are identified for SEDC activities, including the following Level 2 DQOs:

1. Determine the impacts of river hydraulics (including water depths, river flow, seasonal and other changes in water level to determine relative changes in flow and velocity on resuspension control systems. An assessment of the river hydraulics allows for a determination of hydraulic forces to which the silt curtains or sheetpiling would be subject, and a determination of the rise and fall of the river versus time provides a benchmark for the containment system design. Note that daily recorded information available from existing staff gauges at the hydropower facilities will be utilized in this assessment.
2. Determine the impact of wave action (generated by wind and vessel wake) on anchor systems.
3. Determine the effect of structures (e.g., dams, locks, bulkheads, utilities, bridges, docks, piers, seawalls, marinas, water intakes/outfalls, river traffic, vegetation, roads/highways, houses, etc.) on the installation and operation of resuspension control systems.
4. Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the installation and operation of resuspension control systems in dredge areas.

2.2.4 Determine Resuspension Effects during Dredging

The SSAP-QAPP (QEA and ESI, 2002) and the *Baseline Monitoring Quality Assurance Project Plan* (Baseline Monitoring QAPP) (to be developed) contain DQOs addressing this Level 1 objective. In addition, the Draft Engineering Performance Standards Peer Review Copy (pending revisions/peer review comments) addresses resuspension effects during dredging and was considered in developing Level 2 DQOs. Two additional objectives are identified for SEDC activities, including the following Level 2 DQOs:

1. Identify the geotechnical properties of site sediments that may be resuspended.
2. Determine the river hydraulics (including water depths, river flow, and seasonal and other changes in water level) to estimate transport of resuspended sediment.

2.2.5 Determine the Impact of Site Conditions on the Design of Sediment Processing and Water Treatment Systems

One Level 2 DQO is identified for this objective:

1. Determine the river elevation to assess the pumping head required for pipeline transport of dredged material.

2.2.6 Identify the Potential Affects of Dredging Operations on Neighboring Areas/Properties

One Level 2 DQO is identified for this objective:

1. Determine existing shoreline/land use adjacent to removal areas and at processing facility sites to limit impacts to property features (docks, bulkheads, piers, houses, utilities, roads/highways, seawalls, marinas, water intakes/outfalls, etc.).

2.2.7 Identify Material Requirements for the Habitat Replacement and Reconstruction Design

Two Level 2 DQOs were identified for this objective:

1. Identify backfill material sources, determine material availability, and characterize the physical properties of the material to develop strategies and specifications for obtaining appropriate backfill material (e.g., direct, blending) and establish material transport requirements.

2. Determine shoreline restoration requirements necessary to protect shoreline material from long-term erosion due to potential erosive forces (e.g., wave action generated by wind and vessel wake, storm events, and ice scour).

2.3 Data Needs

Using the Data and Measurement column in Table 2, a matrix was developed to summarize the data need to complete the RD. The matrix (Table 3) summarizes which test/data and measurement satisfy particular DQOs, thereby demonstrating the need for the particular data and measurement. Each of these data needs is described below in more detail. To provide additional clarification of data needs, both Level 2 and Level 3 DQOs are included under each activity in Section 2.3.

2.3.1 Physical Characterization Activities

Physical characterization activities will define the makeup and integrity of the sediment and sub-grade conditions as they relate to dredging, anchoring, spud setting, and the installation of other structures (e.g., sheetpiling) that may be deemed necessary for the remediation activities. Performing borings, in-situ testing, and laboratory testing will provide the geotechnical data for the river sediments targeted for dredging, transport, treatment, and disposal. The geotechnical data will also provide information for the analysis of subsurface strata (i.e., those materials underlying the sediments targeted for removal).

Various types of physical data are needed for the engineering design work. To understand the rationale for choosing the appropriate test procedures to satisfy the engineering data needs, a brief overview of the physical characterization elements is provided below, along with a general description of the activities selected for the Year 2 SEDC Program (which is subsequently described in detail in Section 3). Note that the physical characterization activities and testing described in the following sections will be performed in accordance with ASTM standards, where applicable. The relevant ASTM standards are provided in Appendix A.

2.3.1.1 Blow Counts

Standard Penetration Test (SPT) N-values will be useful in establishing density/consistency profiles versus depth, and transitions from unconsolidated soil materials to cobble/boulder deposits and from unconsolidated soils to bedrock. The SPT is used to determine the stratification, consistency, and approximate density and strength of the sediment/sub-bottom at a given location. The SPT consists of driving a split-barrel sampler into the ground using a 140-pound hammer dropped from a height of 30 inches, as described in ASTM D1586 (ASTM standards are provided in Appendix A). The data obtained from the test are the number of blows required for each 6-inch sampler penetration, and the N-value (i.e., the blow count that is representative of the penetration resistance) is calculated as the number of blows required to drive the sampler over the depth interval of 6 to 18 inches. In addition, the material collected in the split-spoon sampler is used to identify the sediment type.

The numerous correlations that have been developed between N-values and relative density (Fang, 1991) serve as a guide for identifying the consistency and density of materials with depth, on a location by location basis. The estimates of relative density are used to evaluate the appropriate dredge type based on the penetration resistance. By estimating sediment/sub-bottom strength based on these correlations, the stability of shorelines and areas adjacent to dredge prisms can also be estimated. In addition, the resistance expected during installation of resuspension control systems and dredging activities can be estimated (e.g., sheetpiling that may be used for resuspension control, or spuds to anchor dredges). Based on the strength parameters estimated from the N-values, appropriate design for dredging and resuspension control systems can be developed, thus satisfying the Level 1 DQOs for impacts on site conditions. Specifically, this information will be used to address these DQOs:

- Determine the geotechnical properties of sediments in the dredge areas to identify conditions that might limit the effectiveness of various dredges to penetrate and remove the sediment;
- Determine the geotechnical properties of strata underlying the sediments in dredge areas to identify conditions that might limit the dredgeability at the interface between areas to be dredged and underlying sediments;
- Determine the stability of river bottom sediments and shoreline areas to determine stable side-slope requirements for dredge areas and to identify areas with sloughing potential and slope stability issues for shoreline areas;

- Identify the effect of the geotechnical properties of site sediments on the selection of dredge equipment and design of dredged material transport;
- Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the design of dredging and anchoring systems;
- Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the installation and operation of resuspension control systems in dredge areas; and
- Identify the geotechnical properties of site sediments that may be resuspended.

The basis for the 60 locations included professional judgment that was informed by the extensive data available from the SSAP program, the current understanding of where higher PCB levels have been observed (and, as such, would represent potential dredge areas), and recognition that this effort would provide an overall assessment of geotechnical properties. The SSAP program was a significant investigative effort that included core sample collection and a probing program, along with geophysical data collection (e.g., side-scan sonar and bathymetry). Approximately 5% of all samples collected during the SSAP (more than 1,100 samples) were subjected to geotechnical analysis, including grain size, Atterberg limits, and water content. The proposed SEDC sampling locations were established considering areas within the candidate Phase 1 areas where higher PCB levels were observed, while considering the data need being addressed (e.g., resuspension containment, dredge equipment) and the available geotechnical data. This selection process resulted in 60 locations. The boring locations were distributed to provide a general understanding of conditions within the candidate Phase 1 areas as a whole.

As such, based on the review of existing SSAP information, SPT tests have been located within candidate Phase 1 areas to evaluate a broad range of conditions that may be encountered during the dredging program. Specifically, for the Year 2 SEDC Program, 60 boring locations have been selected based on engineering judgment, in conjunction with Figure 1, and are identified on Figures 3 through 11. SPT measurements will be performed at each boring location.

Additional engineering data collection may be warranted based on the results of this initial effort. If variability in measured parameters occurs to the extent that it affects decision making, then additional data may be needed to better understand the spatial variability. It may be possible to combine the additional data collection (if needed) with the Supplemental Engineering Data Collection for Year 3.

2.3.1.2 Grain Size Distribution

Sediments and sub-bottom materials are composed of various particle sizes. The distribution of these particle sizes determines the material type and provides an indication of potential behavior of these materials under various conditions (e.g., during dredging, installation of anchoring systems, dewatering). Using a mechanical sieve (ASTM D422; standard included in Appendix A), the coarse fraction (i.e., sands and gravels) and fine fraction (i.e., silts and clays) can be identified by the portion retained on or passing through the U.S. No. 200 (<0.074 millimeter [mm]) sieve, respectively. If greater than 50% of the sample is retained on the No. 200 sieve, the material is classified as coarse grained; whereas, if less than 50% is retained, the material is classified as fine grained. The hydrometer (ASTM D422/D1140; standard included in Appendix A) is used to further differentiate the finer fraction into silts and clays. Using the data provided from the mechanical sieve and the hydrometer, a full grain size distribution curve can be developed.

For a coarse grained material, the grain size distribution curve can also be used to estimate additional parameters such as the coefficient of uniformity and coefficient of curvature. The coefficient of uniformity is particularly useful in identifying whether the material is well or poorly graded. Since a well graded material typically has greater strength than a poorly graded material, this parameter provides valuable strength information for design (i.e., shoreline stability, use of spuds to anchor dredges, and sloughing of sediment at the dredge area perimeter). For the finer grained material, establishing the percentage of silt and clay provides the required data to establish the resuspension characteristics of the sediment and to evaluate the appropriate resuspension control system. For example, the presence of more clay than silt may require design measures to account for additional time to allow resuspended particles to settle following dredging (i.e., settling velocity). The settling velocity for the fine-grained particle classes is dependent on grain size and particle density; therefore, it is important to know whether the fines in a given sediment type are predominantly silts (5 -75 microns [µm] in size) or clays (<5 µm). Even within the silt range, there is a significant difference in settling velocities, and it is important to understand the fraction of sediment type that is susceptible/available for resuspension and the potential degree of transport for that fraction. Higher clay contents also affect the design of sediment processing (e.g., dewatering) systems (e.g., estimating settling times, predicting filter press efficiencies, etc.).

The grain size information (both coarse and fine) satisfies several of the Level 1 DQOs related to site condition impacts presented in sub-section 2.2 by providing a design basis for evaluating potential resuspension control systems, spuds for anchoring dredges, shoreline stability, sloughing of sediment at the dredge area perimeter, and potential transport systems for dredged materials (i.e., pipeline transport of dredge slurry). In addition, the grain size distribution of the existing sediment will be used when developing the backfill specifications for habitat replacement and restoration following dredging, which is also a Level 1 DQO. The Level 1 DQOs are further satisfied by combining the grain size information with SPT (Section 2.3.1.1), specific gravity (Section 2.3.1.3), Atterberg limits (Section 2.3.1.4), and strength data (Section 2.3.1.6) to further classify the material and evaluate engineering properties.

Specifically, this information will be used to address these DQOs:

- Determine the geotechnical properties of sediments in the dredge areas to identify conditions that might limit the effectiveness of various dredges to penetrate and remove the sediment;
- Determine the geotechnical properties of strata underlying the sediments in dredge areas to identify conditions that might limit the dredgeability at the interface between areas to be dredged and underlying sediments;
- Determine the stability of river bottom sediments and shoreline areas to determine stable side-slope requirements for dredge areas and to identify areas with sloughing potential and slope stability issues for shoreline areas;
- Identify the effect of the geotechnical properties of site sediments on the selection of dredge equipment and design of dredged material transport;
- Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the design of dredging and anchoring systems;
- Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the installation and operation of resuspension control systems in dredge areas;
- Identify the geotechnical properties of site sediments that may be resuspended to determine the potential for various sediment types to generate suspended sediment during the dredging process;
- Identify the effect of in-situ geotechnical properties of site sediments on the design of sediment handling, transport, dewatering, and treatment systems;
- Identify the effect of in-situ geotechnical properties of site sediments on the dredged material handling, transportation, and disposal requirements;
- Develop strategies and specifications for obtaining appropriate backfill material (e.g., direct, blending of material, etc.); and
- Establish material transport requirements (i.e., by rail, truck barge, etc.).

Based on the existing dataset from the SSAP, the SEDC Program focused on sampling areas that encompass the candidate Phase 1 areas and will likely contain a broad range of materials for testing. Based on the total number of samples to be collected (Table 4), approximately 25% of the samples obtained from the borings will be analyzed for geotechnical parameters, including grain size (e.g., 95 samples will be tested out of the approximately 395 to be collected from Sampling Area 1 [Upper Thompson Island Pool]). Based on the current understanding of the river and available data, 25% of the samples collected as part of the Year 2 SEDC work, in combination with the already collected and analyzed 5% of the SSAP samples, are expected to provide an adequate number of physical laboratory tests to complete the design. Therefore, as part of the Year 2 SEDC Program, it is anticipated that up to 135 samples will undergo grain size analysis.

Based on information from the previous geotechnical testing work performed during the SSAP, up to 75% of the samples tested were classified as fine sand. Material classifying as fine sand can contain less than 10% by weight finer than a No. 200 sieve and still be classified as a fine sand. Recognizing the potential influence of fines in dredging operations, the grain size analysis will include hydrometer testing on all samples submitted for grain-size analysis.

Note that the samples submitted for grain size analysis will be analyzed concurrently with samples for other geotechnical parameters (i.e., samples tested for water content will be tested for Atterberg Limits and grain size). No unmatched geotechnical sampling will be performed.

2.3.1.3 Specific Gravity

Specific gravity is a dimensionless parameter that relates particle density to the density of water and is measured as described in ASTM D854 (standard provided in Appendix A). Specific gravity, which is indicative of material type, can be correlated with results from grain size analyses and SPT sample descriptions to establish typical material characteristics. In addition, specific gravity is required for various dredging-related calculations. For instance, specific gravity in combination with water content (Section 2.3.1.5) can be used to estimate the void ratio and porosity of sediment, which are required parameters for performing sediment transport and processing design (e.g., for determining the nature of slurry requiring transport, selection of dewatering processes, etc). Thus, obtaining specific gravity data addresses the Level 1 DQO related to sediment transport and processing operations.

Specifically, this information will be used to address these DQOs:

- Determine the geotechnical properties of sediments in the dredge areas to identify conditions that might limit the effectiveness of various dredges to penetrate and remove the sediment;
- Determine the geotechnical properties of strata underlying the sediments in dredge areas to identify conditions that might limit the dredgeability at the interface between areas to be dredged and underlying sediments;
- Determine the stability of river bottom sediments and shoreline areas to determine stable side-slope requirements for dredge areas and to identify areas with sloughing potential and slope stability issues for shoreline areas;
- Identify the effect of the geotechnical properties of site sediments on the selection of dredge equipment and design of dredged material transport;
- Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the design of dredging and anchoring systems;
- Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the installation and operation of resuspension control systems in dredge areas;
- Identify the geotechnical properties of site sediments that may be resuspended to determine the potential for various sediment types to generate suspended sediment during the dredging process;
- Identify the effect of in-situ geotechnical properties of site sediments on the design of sediment handling, transport, dewatering, and treatment systems; and
- Identify the effect of in-situ geotechnical properties of site sediments on the dredged material handling, transportation, and disposal requirements.

Based on the existing dataset from the SSAP, the SEDC Program focuses on sampling areas that encompass the candidate Phase 1 areas and will likely provide a broad range of materials for testing. As described in Section 2.3.1.2, approximately 25% of the samples to be collected will be analyzed for geotechnical parameters. Therefore, it is anticipated that up to 135 samples will undergo specific gravity testing. The number of samples collected and analyzed as part of the Year 2 SEDC Program, in combination with the samples collected/analyzed from the SSAP, will provide adequate physical laboratory testing to perform the intermediate design program. Based on the total number of samples to be collected (Table 4), approximately 25% of the samples obtained from the borings will be analyzed for geotechnical parameters, including grain size (e.g., 95 samples will be tested out of the approximately 395 to be collected from Sampling Area 1 [Upper Thompson Island Pool]). Based on current understanding of the river and available data, 25% of the samples collected as part of the Year 2 SEDC work, in combination with the already collected and analyzed 5% of the SSAP samples, will provide an adequate number of physical laboratory tests to complete the intermediate design. Therefore, as part of the Year 2 SEDC Program, it is anticipated that up to 135 samples will undergo grain size analysis. Since the program is engineering-based, the samples to be submitted for specific gravity analysis will be selected based on the visual observations made in the field by the field engineer/geologist (in consultation with senior design engineers in the office). Based on the existing geotechnical information from the SSAP, an estimated number of samples were chosen within this document. It is important to note that, because DAD efforts are still under development or currently underway as of the date of this SEDC Work Plan, this document may require an addendum to address modifications to the proposed sampling program that may be warranted once actual target dredge areas have been established in the *Phase 1 Dredge Area Delineation Report* (Phase 1 DAD Report), which is scheduled to be submitted in early 2004.

2.3.1.4 Atterberg Limits

Atterberg limits are water contents at which the engineering behavior of a soil changes, (i.e., the soil behaves differently from its original form), and they are determined using the material retained on the U.S. No. 40 sieve (<0.425 mm), as described in ASTM D4318 (standard provided in Appendix A). Specifically, the liquid limit is defined as the water content at the lower limit of viscous flow, and the plastic limit is defined as the water content at the lower limit of the plastic state. In addition, the plasticity index is defined as the range over which the soil behaves as a plastic and is equal to the difference between the liquid and plastic limits.

In general, Atterberg limits, in combination with grain size information, are used to classify fine grained materials or the fines portion of a coarse grained material, but they can also be correlated with typical engineering properties/behavior based on natural water content (sub-section 2.3.1.5). For example, the liquidity index can be calculated as follows:

$$LI = \frac{w_n - PL}{PI}$$

where LI is the liquidity index, w_n is the natural water content, PL is the plastic limit, and PI is the plasticity index. If the LI is less than zero, the soil will behave like a brittle material when sheared; if the LI is between zero and one, the soil will behave like a plastic when sheared; and if the LI is greater than one, the soil will behave like a viscous liquid when sheared. Therefore, based on a combination of natural water content and

Atterberg limits data, the potential engineering behavior of fine-grained soils under various loading/unloading conditions (such as those caused by transport and disposal process) can be evaluated.

The soil plasticity determined using Atterberg limits can also provide an indication of potential resuspension behavior during dredging, dewatering, and sediment processing based on whether the fines are determined to be a silt, a lean clay (i.e., low plasticity index and low liquid limit), or a fat clay (i.e., high plasticity index and high liquid limit).

Based on the correlations described above, obtaining Atterberg limits data addresses the Level 1 DQOs related to the potential effects of sediment characteristics on resuspension issues (i.e., system installation, system operation, and dredging effects), dredging operations on the stability of adjacent areas (e.g., neighboring areas/properties), and sediment transport and processing. In addition, determining the plasticity of the native materials provides the required information for developing backfill material specifications. Specifically, this information will be used to address the following DQOs:

- Determine the geotechnical properties of sediments in the dredge areas to identify conditions that might limit the effectiveness of various dredges to penetrate and remove the sediment;
- Determine the geotechnical properties of strata underlying the sediments in dredge areas to identify conditions that might limit the dredgeability at the interface between areas to be dredged and underlying sediments;
- Determine the stability of river bottom sediments and shoreline areas to determine stable side-slope requirements for dredge areas and to identify areas with sloughing potential and slope stability issues for shoreline areas;
- Identify the effect of the geotechnical properties of site sediments on the selection of dredge equipment and design of dredged material transport;
- Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the design of dredging and anchoring systems;
- Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the installation and operation of resuspension control systems in dredge areas;
- Identify the geotechnical properties of site sediments that may be resuspended to determine the potential for various sediment types to generate suspended sediment during the dredging process;
- Identify the effect of in-situ geotechnical properties of site sediments on the design of sediment handling, transport, dewatering, and treatment systems; and

- Identify the effect of in-situ geotechnical properties of site sediments on the dredged material handling, transportation, and disposal requirements.

Based on the existing dataset from the SSAP, the SEDC Program focuses on sampling areas that encompass the candidate Phase 1 areas and will likely contain a broad range of materials for testing. According to the SSAP data, the majority of the material observed and/or collected during the program was fine sand. As described in Section 2.3.1.2, it is anticipated that 25% of the samples (total of up to 135 samples) to be collected will be analyzed for geotechnical parameters. However, samples with less than 10% fines will not be tested; therefore, it is likely that less than 25% of the total samples (135 samples) will undergo Atterberg limits testing. Since the program is engineering-based, samples will be selected for testing based on field observations by the field engineer/geologist and on engineering judgment through consultation with senior design engineers in the office (and in conjunction with Figure 2) to obtain a full range of material types. The number of samples collected and analyzed as part of the Year 2 SEDC Program, in combination with the samples collected/analyzed from the SSAP, will provide an adequate amount of physical laboratory tests.

An estimated number of samples were chosen based on the existing information from the SSAP. However, depending on the findings during implementation of the field work, the actual number of samples sent to the geotechnical laboratory for analysis may change.

2.3.1.5 Water Content

The water content is the water weight to dry soil weight ratio that is typically expressed as a percentage and is measured in accordance with ASTM D2216 (standard provided in Appendix A). As discussed previously, potential engineering behavior can be determined using natural water content and Atterberg limits data. In addition, the water content data, combined with the grain size data, provide the information necessary to determine the appropriate dredge material process systems (e.g., filter presses) and to estimate dredge material dewatering rates (i.e., system efficiency), which are both Level 1 DQOs.

Specifically, this information will be used to address these DQOs:

- Determine the geotechnical properties of sediments in the dredge areas to identify conditions that might limit the effectiveness of various dredges to penetrate and remove the sediment;

- Determine the geotechnical properties of strata underlying the sediments in dredge areas to identify conditions that might limit the dredgeability at the interface between areas to be dredged and underlying sediments;
- Determine the stability of river bottom sediments and shoreline areas to determine stable side-slope requirements for dredge areas and to identify areas with sloughing potential and slope stability issues for shoreline areas;
- Identify the effect of the geotechnical properties of site sediments on the selection of dredge equipment and design of dredged material transport;
- Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the design of dredging and anchoring systems;
- Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the installation and operation of resuspension control systems in dredge areas;
- Identify the geotechnical properties of site sediments that may be resuspended to determine the potential for various sediment types to generate suspended sediment during the dredging process;
- Identify the effect of in-situ geotechnical properties of site sediments on the design of sediment handling, transport, dewatering, and treatment systems; and
- Identify the effect of in-situ geotechnical properties of site sediments on the dredged material handling, transportation, and disposal requirements.

Based on the existing dataset from the SSAP, the SEDC Program is focused on sampling areas that will likely provide a broad range of materials and, thus, a broad range of water contents. As described in Section 2.3.1.2, it is anticipated that 25% of the samples to be collected (total of 135 samples) will be analyzed for geotechnical parameters. Since the program is engineering-based, samples will be selected for water content testing based on field observations by the field engineer/geologist (in combination with engineering judgment by consultation with senior design engineers in the office), considering the locations of those samples submitted for Atterberg limit analysis. Based on the existing information from the SSAP, it is anticipated that up to 135 samples will undergo water content testing; however depending on the findings during implementation of the field work, additional samples may be sent to the geotechnical laboratory for analysis.

2.3.1.6 Shear Strength

The two types of shear strength testing that will be performed in the SEDC Program will be in-situ vane shear testing (ASTM D2573 [standard provided in Appendix A]) and laboratory unconsolidated-undrained (UU) testing (ASTM D2850 [standard provided in Appendix A]). Undrained strength testing was selected because short-term loading is typically the worst case scenario that should be considered during design of resuspension control systems. In addition, the laboratory UU testing may be used to confirm the results of the in-situ vane shear testing.

The vane shear test consists of inserting a four-bladed vane into a borehole and then pushing the vane into the undisturbed deposit located at the bottom of the borehole. It should be noted that, at the locations for the in-situ vane-shear testing (from which there is no sample recovery), attempts will be made to obtain good sample recovery immediately above and below the in-situ vane shear test locations. Torque is applied to the vane via the rods, and the maximum torque required to shear the soil is measured and recorded. Then, the soil is remolded by rotating the vane rapidly through a minimum of five to ten revolutions, and the torque required to shear the remolded soil is applied and measured. From the dimensions of the vane and the peak (or remolded) torque, the peak (or remolded) undrained shear strength of the material can be estimated.

The UU test is used to determine the undrained shear strength of a soil specimen by placing an undisturbed cylindrical soil sample (collected in accordance with ASTM D1587 [standard provided in Appendix A]) into a rubber membrane and then subjecting the specimen to a confining pressure without allowing any drainage. The specimen is then sheared by increasing the vertical stress on the specimen until failure occurs.

The undrained strength results (both peak and remolded) will be used to evaluate the stability of shoreline areas (e.g., areas/properties adjacent to dredging locations) and sloughing of sediment at the dredge area perimeter. In addition, the undrained shear strength data can be used to determine whether the sediment has adequate strength to support various resuspension control anchoring systems (e.g., sheetpile and silt curtains). Therefore, obtaining shear strength data satisfies the Level 1 DQOs related to stability issues.

Specifically, this information will be used to address these DQOs:

- Determine the stability of river bottom sediments and shoreline areas to determine stable side-slope requirements for dredge areas and to identify areas with sloughing potential and slope stability issues for shoreline areas;

- Identify the effect of the geotechnical properties of site sediments on the selection of dredge equipment and design of dredged material transport;
- Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the design of dredging and anchoring systems; and
- Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the installation and operation of resuspension control systems in dredge areas.

Since understanding shear strength development with depth is essential to evaluating shoreline and dredge prism stability, and strength testing was not performed during the SSAP, it is anticipated that three in-situ vane shear tests will be performed at each boring location, for a total of 180 tests at 60 locations. Based on previous vane shear testing in sediments, sampling in the upper 1 foot usually results in little to no response (i.e., due to the soft/loose condition of the surficial sediments). As such, vane shear testing will initially be performed at depths of 3, 5, and 8 feet; however, these depths may be adjusted by the field engineer/geologist (in consultation with senior design engineers in the office) based on actual field conditions. In addition, 14 Shelby tube (i.e., thin-walled tube) samples will be collected for UU testing. The locations and depths of these samples will be selected by the field engineer/geologist based on engineering judgment (in consultation with senior design engineers in the office); however, they will be representative of the top 0 to 8 feet of sediment/sub-bottom material. Note that the testing intervals may be adjusted to shallower depths based on information provided in the Phase 1 DAD Report.

2.3.1.7 River Velocity

River velocity measurements will be performed to better understand the flow of the river and how it relates to velocity within different sections of the river and within candidate Phase 1 dredge areas. An acoustic Doppler current profiler (ADCP) or another traditional velocity survey device will be used for the sampling process. The ADCP will provide two types of current velocity data: 1) vertical profile; and 2) depth-averaged value.

This information will provide information relating to the velocity distribution in the river during multiple flow conditions and will be used to address the following DQOs:

- Properly select and size dredging and dredged material transport equipment;
- Design proper anchoring systems;

- Identify seasonal and other constraints to access;
- Identify river conditions that pose a potential health and safety risk to specify proper safety measures to be implemented during operations;
- Determine hydraulic forces on control structures (e.g., silt curtain, sheetpiling, etc.); and
- Determine the river hydraulics (including water depths, river flow, and seasonal and other changes in water level) to estimate transport of resuspended sediment.

River velocity data will be collected along seven transects; five transects in River Section 1 (Thompson Island Pool) and two transects in River Section 2 (near Northumberland Dam). The locations of these transects were selected based on their proximity to areas that are likely to be dredged and the objective of sampling from a range of hydrographic conditions. Data will be collected when Fort Edward discharge is within the following ranges: 1) lower flow, 1,000 to 3,000 cubic feet per second (cfs); 2) moderate flow, 3,000 to 7,000 cfs; and 3) higher flow, 7,000 to 10,000 cfs. One set of data will be obtained for each discharge range. Figure 12 shows the location of the proposed transects.

2.3.2 Other Information Retrieval

Various data needs were considered for the purpose of performing the information retrieval activities, which will provide an array of information related to developing the design for dredging, anchoring, dredge material transport equipment access/operations, and resuspension control systems. Data needs include information/data for vertical clearance, physical measurement of riverbed debris, in-river and shoreline infrastructure (e.g., houses/structures, roads/highways, bridge, locks, docks, piers, water intake/outfall), weather characteristic data collection, literature review of engineering records, determination of owner/access issues, determination of river bank slopes, determination of land use category, shoreline vegetation cover, photo and video documentation, inventory of backfill sources, and hydrography. To understand the rationale for choosing these procedures to satisfy the engineering data needs, a brief overview of these information retrieval elements, including general methodology for collection of the data, is provided in Sections 2.3.2.1 through 2.3.2.12.

2.3.2.1 Vertical Clearance

Vertical clearance is the distance between the lowest points of a structure that spans across the project area and the water surface. Available navigation mapping from the National Oceanic and Atmospheric Administration (NOAA), as well as NYS Canal Corporation and NYS Department of Transportation (DOT) records, will be reviewed to identify information on vertical clearances in the project area. Where data do not exist or are insufficient, physical measurements will be performed using a measuring tape or survey rod to confirm or identify the distance between the structure and the water surface at a particular time and river stage (water surface elevation). Data obtained from this measurement include the distance in feet and inches in correlation with the time and river stage. This information will be recorded and inventoried. By documenting the water elevation (to the vertical datum indicated herein) during the vertical clearance measurement activities, in concert with the obtaining daily elevation information provided by the hydropower facilities, the influence of the hydropower facilities on daily river stage will be incorporated into the design.

Using the measurements of the structure in relation to water surface elevation, a range of vertical clearances can be established for each structure that crosses the project area. The vertical clearances will be presented relative to North American Vertical Datum (NAVD) of 1988. Based on these estimates, the vertical clearance can be used to address these DQOs:

- Properly select and size dredging and dredged material transport equipment;
- Determine localized constraints on equipment movement and access to dredge areas;
- Identify navigation constraints on dredging and dredged material transport; and
- Identify constraints on the installation and operation of resuspension control systems in dredge areas.

Vertical clearance will be measured or identified on all overhead structures that span the river in the project area.

2.3.2.2 Physical Measurement of Riverbed Debris

Physical measurement of riverbed debris consists of confirmation and identification of debris location and dimensions. First, an extensive review of the Year 1 DSR side-scan survey will be used to identify areas in the river where debris has been identified. In addition, results from the CARA efforts will be reviewed to identify potential areas of debris or other archaeological structures. If additional, more detailed investigation of debris in areas targeted for removal is warranted based on this review, the specific scope will be established at that time. If it is deemed appropriate, based on the review of the existing information, the scope will include use of additional geophysical techniques (e.g., marine magnetometer, submerged video camera work) and/or diver surveys to physically measure the extent of debris. The intention is to focus the use of divers in dredge areas known or suspected to contain debris and where information from other data sources (e.g., side-scan sonar, sub bottom profiling, probing, marine magnetometer, submerged video camera work) is either inconclusive or warrants ground truthing. In those areas, divers will be used to verify the actual extent and characteristics of the debris.

Should a detailed underwater survey using divers be recommended, the divers will confirm the presence of debris, measure debris dimensions in feet and inches, measure water depth in feet at each debris location, measure the water surface elevation with time, and identify the location using a Real-Time Kinematics (RTK) Differential Global Positioning System (DGPS) unit located on the vessel. This information will be identified on plan drawing sheets.

Physical measurement of river bed debris can be used to address the following DQOs:

- Determine localized constraints on equipment movement and access to dredged areas;
- Identify navigational constraints on dredging and dredged material transport; and
- Identify constraints on the installation and operation of resuspension control systems in the dredge area.

Given the relatively extensive nature of resources required to complete this activity, efforts will be focused in actual dredge areas (as will be defined in the Phase 1 DAD Report) where additional debris characterization is warranted. The details of this activity cannot be specified at this time but will be presented in an addendum to this SEDC Work Plan after the Phase 1 DAD Report has been approved, and sub-bottom profiling test data have been collected, reviewed, and analyzed.

2.3.2.3 In-River and Shoreline Infrastructure

Physical measurement of in-river (e.g., bridge abutment, piers, water intake/outfalls, docks, locks dams, etc.) and shoreline (e.g., roads/highways, houses/structures, trees/landscaping, sea walls, etc.) infrastructure consists of locating and measuring physical dimensions and identifying location of the infrastructure locations within the candidate Phase 1 areas. NYS Canal Corporation and NYS DOT records will be collected and reviewed to identify information on in-river and shoreline infrastructure in the project area. This task will also include identifying the location and providing a description of available information on underwater pipelines and cable crossings of the river.

If existing information is insufficient, physical measurements of infrastructure will be performed by measuring dimensions using a measuring tape or survey rod and locating infrastructure using an RTK DGPS unit. This information will be recorded and inventoried.

Physical measurement of infrastructure can be used to address these DQOs:

- Identify potential impacts that dredging may have (either directly or indirectly) on those structures and whether adjustment of the dredge area boundaries is required to appropriately minimize these impacts;
- Properly select and size dredging and dredged material transport equipment, and determine localized constraints on equipment movement and access to dredge areas (in water or along the shoreline);
- Identify navigational constraints on dredging and dredged material transport;
- Identify existing conditions of shoreline features to determine limits on maneuvering equipment along shorelines; and
- Identify constraints on the installation and operation of resuspension control systems in dredge areas.

Physical measurement of in-river and shoreline infrastructure will be performed in areas where available information is insufficient adjacent to candidate Phase 1 areas, proposed processing facility locations, and access points to the river.

2.3.2.4 Weather Characteristic Data Collection

A review of all available historical data on wind speed, air and water temperature, relative humidity, average monthly rainfall, and river stage will be performed. . However, any quantitative statistics performed with weather-related datasets should use the most reliable and relevant information. The datasets from the last 20 to 25 years are believed to be the most appropriate. Prior to that time, data are generally based on physical data acquisition and hand-recording and may skew any statistics that use these data. Weather and climatic historical data will be obtained from local weather stations, including the weather station set up and operated at Site 10 adjacent to the Thompson Island Pool for approximately 3 years in the late 1980s (if such data are available and usable). River stage information will be obtained from the NYS Canal Corporation, Hudson River GIS Database, and Fort Edward gauging station.

Weather characteristics can be used to address these DQOs:

- Determine the effects of climatic and weather conditions on safety of operations, dredging schedule, routine operations and productivity;
- Determine extreme event frequency that is derived from historical records of rainfall, river stage, and river flow;
- Derive wave height (measured in feet) and wave period (measured in seconds) from wind speed and direction;
- Determine the impacts of wave action on anchoring systems for dredging operations and installation and operation of resuspension control systems;
- Determine the impacts of river hydraulics on resuspension systems;
- Determine river stage versus time relationships to benchmark and design dredging and resuspension systems; and
- Determine the impacts of river stage on vertical clearance and in-river and shoreline infrastructure as it pertains to dredging and dredged material transport.

Weather information will be obtained, assembled, and analyzed for the Hudson River project area.

2.3.2.5 Literature Review of Engineering Records

A literature review of engineering records will be conducted from sources such as the NYS Canal Corporation, local townships, villages, NYS Department of Environmental Conservation (NYSDEC), and NYS DOT records. Results from this literature review will be used to develop a historical database and aid in the design. Information gathered from these sources will include: detailed drawings; specifications (i.e., length and width) on locks, canals, and dams; historic physical records of river flow, river stage, operation of locks, vessel traffic, etc; and detailed drawings of bridges, abutments, and roads adjacent to the river. The literature review will also include construction and soil investigation information available from NYS DOT, county, and township records for areas adjacent to the river. In addition, this effort will include the collection and review of the original canal construction drawings prepared in the early 1900s, if available. These drawings are expected to show the river bed profile prior to building the dams and include soil borings along the canal centerline. Furthermore, comparison of recent bathymetry to the original profile (if available) will provide data on the extent of infilling behind dams since their construction in the early 1900s and the depth of sediment over bedrock where it was exposed in the original bed.

The literature review can be used to address these DQOs:

- Properly select and size dredging and dredged material transport equipment;
- Determine localized constraints on equipment movement and access to dredge areas;
- Identify navigation constraints on dredging and dredged material transport;
- Identify constraints on the installation and operation of resuspension control systems in dredge areas; and
- Determine the effects of non-dredging related physical disturbances (e.g., debris removal, boat traffic) on resuspension, as necessary, to estimate resuspension.

Existing records will be obtained, assembled, and analyzed for the Hudson River project area.

2.3.2.6 Determination of Owner/Access Issues

A review of the parcels that are adjacent to dredge areas and potential access points/processing facility locations will be conducted by examining the property ownership data within the Hudson River GIS Database, as well as by conducting field verification/observation of property boundaries. The importance of this task is to have data/information readily available to determine what agreements may be required to gain access rights to the property, as well as to identify the contact person (owner). Access to the river may be needed at several locations other than the access at the Sediment Processing Facilities for a variety of reasons, including but not limited to supplemental access to the river for labor and equipment, access to the land-locked section of the river for sediment removal and transport, emergency access, access for shoreline rehabilitation, and access to perform necessary maintenance. Proper planning and scheduling for such access will be considered in the design.

The owner/access information can be used to address these DQOs:

- Identify the potential affects of dredging operations on neighboring areas/properties; and
- Identify potential access points along the Hudson River.

This analysis will be conducted adjacent to candidate Phase 1 areas, and other potential access points to the river. No field activity will be performed under this effort.

2.3.2.7 Determination of River Bank Slopes

River bank slopes will be examined in areas adjacent to dredge areas, potential access points, and processing facility locations. Slope stability assessments will be conducted based on data collected during HDA activities (not yet defined), as well as from review of topographic surveys available in the Hudson River GIS Database. The collected data will also include the identification of areas with riprap, timber bulkheads, and other armoring. Information on shoreline topography is important so that effects of the dredging program on the shoreline can be estimated, and appropriate protective (or restoration) measures can be specified in the design.

This information will be used to address these DQOs:

- Identify possible slope stability issues in relationship to dredging design (e.g., side slopes of deep dredging areas that may intersect a steep shoreline causing a localized slope failure);
- Identify potential access points along the Hudson River; and
- Determine the impact of site conditions on the design of sediment processing and water treatment systems.

This analysis will be conducted adjacent to candidate Phase 1 areas, final candidate site (FCS) locations (areas selected by the USEPA for processing facilities), and access points to the river. No field activity will be performed under this effort.

2.3.2.8 Determination of Land Use Category

A review will be conducted of the parcels that are adjacent to dredge areas and potential access points/processing facility locations by examining the data within the Hudson River GIS database, as well as using field verification/observations. The importance of this task is to have data/information readily available to determine what actions may need to take place if dredging-/construction-related activities may occur in the vicinity of the parcel. This information will be used to address these DQOs:

- Identify the potential affects of dredging operations on neighboring areas/properties;
- Determine the impact of site conditions on the design of sediment processing and water treatment systems; and
- Determine existing shoreline/land use adjacent to removal areas and at processing facility sites to limit or mitigate impacts to property features.

This analysis will be conducted adjacent to candidate Phase 1 areas, FCS locations, and access points to the river. No field activity is currently planned under this effort. Information obtained from implementation of this task is to be collected and evaluated from existing database information. Depending on findings, field activities may be recommended for future SEDC activities.

2.3.2.9 Shoreline Vegetation Cover

A vegetation assessment will be conducted by using data collected during HDA activities and by reviewing aerial photos available in the Hudson River GIS Database.

This information will be collected to document the current extent of vegetation and will be used to address this DQO:

- Determine existing shoreline/land use adjacent to removal areas and at processing facility sites to limit or mitigate impacts to property features.

This analysis will be conducted adjacent to candidate Phase 1 areas, FCS locations, and access points to the river. No additional field activity beyond current HDA efforts will be performed under this effort.

2.3.2.10 Photo and Video Documentation

Photo and video documentation collected during HDA activities (combined with the results from the infrastructure documentation task) will be used to assess the integrity of structures/shoreline features before and after construction-related activities. This information will be used to address this DQO:

- Determine existing shoreline/land use adjacent to removal areas and at processing facility sites to limit or mitigate impacts to property features.

Photo and video documentation will be conducted for the entire project area.

2.3.2.11 Inventory of Backfill Sources

Site visits/interviews will be conducted with quarries (actual quarries will be identified at a later date) during Preliminary Design. This information will be used to address these DQOs:

- Develop strategies and specifications for obtaining appropriate backfill material (e.g., direct, blending of material, etc.); and

- Establish material transport requirements.

This information is needed to understand the availability (i.e., amount of material available and location of sources) and transport options (e.g., rail, barge, etc.) for backfill material that will be required for areas to be dredged.

2.3.2.12 Hydrography

The candidate Phase 1 area-specific hydrographic surveys will provide a detailed surface of the river bottom to better understand the discontinuities in the river bottom (e.g., troughs, scour points, etc.). Knowledge of these features allows for better dredging operational control and accuracy, as well as generation of dredging volumes during the design phases. The data that will be collected will be soundings (water depths measured in feet), which will be correlated to a horizontal position (northing and easting). The data will be used to generate a river bottom elevation based on the data collected. The data will also be used to create accurate contour maps of the candidate Phase 1 areas.

First, an extensive review of existing bathymetric information will be used to identify data gaps, if any, along the final target dredge areas for Phase 1. Based on this review, if additional more detailed bathymetric investigations are warranted in areas targeted for removal, the specific scope will be established at that time. The scope may include use of additional geophysical techniques and/or finer resolution surveys.
This information will be used to address these DQOs:

- Properly select and size dredging and dredged material transport equipment;
- Design proper anchoring systems;
- Identify seasonal and other constraints to access;
- Determine localized constraints on equipment movement and access to dredge areas;
- Identify navigation constraints on dredging and dredged material transport; and
- Identify the location of riverbed debris to identify constraints on the installation and operation of resuspension control systems in dredge areas.

The type of surveys and the total number of survey lines (and length of survey lines) will be determined upon USEPA approval of the Phase 1 DAD Report and provided as an addendum to this SEDC Work Plan.

2.4 Sample Handling and Custody Requirements

The sample handling and custody requirements are provided in Appendix C to this SEDC Work Plan. In general, sample handling and custody procedures are consistent with those procedures developed for the SSAP. However, since the SEDC sampling program focuses on engineering parameters and physical characteristics, there are some special sampling and handling protocols (e.g., use of dedicated logging forms that are familiar to field personnel). Geotechnical samples will be collected and containerized in the field, and then transferred to a central location for storage in accordance with the field activities sample custody protocols specified in Appendix C of this SEDC Work Plan. The samples will be stored following the protocols specified in Appendix C, with the following modifications. Decisions regarding storage or disposal of samples will be made by the field and design team based on the potential future utility of such samples and the availability of sufficient storage space. If samples are scheduled for disposal, the USEPA will be provided the opportunity to take custody of the samples.

Select samples will be submitted for geotechnical analysis under the custody protocols specified in Appendix C.

3. Year 2 SEDC Program Tasks

Because the precise locations and boundaries of the candidate Phase 1 areas are as yet unknown, the SEDC Program may need to be modified based on the actual delineation of dredge areas in the Phase I DAD. As such, the SEDC activities will be conducted in areas likely to be affected by sediment removal activities, based on available SSAP data. Additional and/or different design elements may be completed on a separate timeline, and these are noted in the appropriate tasks.

The Year 2 SEDC Program will include the following tasks:

- Task 1 – Infrastructure Documentation;
- Task 2 – Debris and Obstruction Survey;
- Task 3 – Geotechnical Drilling Program;
- Task 4 – Backfill Source Material Identification and Characterization; and
- Task 5 – River Hydraulics and Hydrography Data Collection.

A more detailed description of each task is provided in the sub-sections below. Each task includes a subset of activities designed to fill the data needs described in sub-section 2.3. Additional ASTM standards and SOPs that are not included in the SSAP-QAPP (QEA and ESI, 2002), but will be followed during performance of SEDC activities, are included in Appendices A and B, respectively.

3.1 Task 1 – Infrastructure Documentation

Infrastructure documentation will be conducted to obtain additional information that will help evaluate the logistics of the dredging program and associated field data collection needs. Under this task, the locations and dimensions of structures within and adjacent to the Upper Hudson River in the seven navigable reaches between Fort Edward and Troy (RM 195 to 154) will be documented. In addition, a review of limited infrastructure (i.e., mainly river navigational clearances) will be performed between Troy and Albany to evaluate potential constraints on barge transport issues. Reconnaissance survey activities will identify areas with physical conditions that may impact dredging operations, dredge material transportation, installation and operation of resuspension control systems, and potential requirements for operations on neighboring areas/properties.

The infrastructure documentation task will cover candidate Phase 1 areas, as well as the rest of the Upper Hudson River, since structures throughout this section of the river are of interest as they may affect transport of equipment or dredged sediment within the river. This task will also be conducted to help better evaluate the logistics of the dredging program (e.g., access to potential dredging areas near structures, etc.) and associated field data collection needs (e.g., measurements of clearances, etc.). The infrastructure documentation task will include candidate Phase 1 areas, as well as the rest of the river, since structures throughout this section of the river are of interest as they may affect or limit transport of equipment or sediment This task will also be conducted to help better evaluate the logistics of the dredging program and associated field data collection needs.

Specific activities to be completed under this task are described in the subsections below.

3.1.1 Vertical and Horizontal Clearances

Vertical and horizontal clearances of potential obstacles (e.g., bridge spans, overhead utilities) will be collected from an inventory of documented clearance information and physical field measurements. Vertical clearance is the distance between the lowest point of a structure that spans across the project area and the water surface. Horizontal clearance is the distance between bridge abutments or other structures. Available navigation mapping from NOAA, as well as NYS Canal Corporation and NYS DOT records, will be reviewed to identify information on vertical clearances in the project area. Where data do not exist or are insufficient, physical measurements will be performed using a measuring tape or survey rod to confirm or identify the distance between the structure and the water surface at a particular time and river stage. Data obtained from this measurement include the distance in feet and inches in correlation with the time and river stage. This information will be recorded and inventoried. Vertical clearance measurements will incorporate the influence of hydropower facilities on daily stage of the river.

Using the measurements of the structure in relation to water surface elevation, a range of vertical clearances can be established for each structure that crosses the project area. The vertical clearances will be presented relative to NAVD of 1988. Data will also be collected on span clearance. If information on horizontal clearance is not available, it will be measured by using a hand-held RTK DGPS. All data collected will be referenced to horizontal datum North American Datum (NAD) 1983 New York (NY) East Zone and referenced to the vertical datum NAVD 1988. Appendix B contains SOP No. 4, which specifies the protocols to be followed to determine vertical and horizontal clearances. An example of an Infrastructure Documentation Log is provided as Attachment 4-1 to SOP No. 4 (Appendix B).

3.1.2 Shoreline and In-River Infrastructure

Information on the physical characteristics of the shoreline, in-river infrastructure, and dimensions of river bank property will be collected. Information will be obtained from available resources (e.g., NYS Canal Corporation and NYS DOT records, etc.) along with some field verifications. The physical condition of the above-referenced items will be photo-documented, and physical measurements will be recorded. If available, elevation and general layout of foundations of in-river structures will be obtained; however, no surveying or intrusive investigation is currently planned. At this time, it is premature to consider any intrusive investigative work, as final dredge prisms have not been developed.

3.2 Task 2 – Debris and Obstruction Survey

Measurements will be made using RTK DGPS units. All data collected will be referenced to horizontal datum NAD 1983 NY East Zone and vertical datum NAVD 1988. Information on land ownership and land use will be obtained from existing information in the Hudson River GIS database. Appendix B contains SOP No. 4, which specifies the protocols to be followed during shoreline and in-river infrastructure surveys. An example of the Infrastructure Documentation Log is provided as Attachment 4-1 to SOP No. 4 (Appendix B). Only the recent datasets (2001 and 2003) will be reviewed, as these datasets reflect contemporary river conditions and are based on known, high-confidence GPS control monuments.

At this time, the debris and obstruction survey activities will consist of a desktop review of the available side-scan data (i.e., identification of obstructions/debris) performed by Ocean Surveys, Inc. (OSI) in 2002 and presented in the Year 1 DSR (QEA, 2003b). The SSAP SSS work effort achieved bank-to-bank coverage, but a more extensive review of the available data is necessary to determine whether potential anomalies exist. A review of the overall SSS work, along with the sub-bottom profiling work (yet to be completed), will provide design engineering personnel the opportunity to correlate the effectiveness of geophysical methodologies/techniques for surficial debris mapping and profiling. The SSS data will also be compared with the original riverbed data shown on canal construction drawings and with soil borings along the canal centerline (if such data are available).

Activities specified in the *Sediment Sampling and Analysis Program - Sub-Bottom Profiling Test Work Plan* (SBPT Work Plan) (QEA, 2003c) may also provide additional data on obstruction locations (below the river bottom surface/mudline) within the areas to be surveyed.

Based on this review, it may be determined that an additional side-scan survey on a smaller transect spacing may be warranted in specific candidate Phase 1 areas. If the results of the SBPT indicate that particular sub-bottom profiling techniques may be effective at delineating subsurface debris and obstructions in the Upper Hudson River, additional sub-bottom profiling surveys may be performed. Specific processes and methodologies regarding further remote-sensing investigative efforts, if needed, will be presented in an addendum to this SEDC Work Plan.

3.3 Task 3 – Geotechnical Drilling Program

The geotechnical drilling program is composed of two subtasks aimed at obtaining the characterization of sediments, shoreline, and sub-bottom conditions, as described herein. These activities will include collecting additional sediment and sub-bottom samples and submitting the samples for analysis of geotechnical parameters (e.g., grain size, Atterberg limits, specific gravity, water content, and Unified Soil Classification System [USCS]) soil classification (i.e., the preferred system used by engineers and contractors for geotechnical descriptions). The activities will also include vane shear strength testing and/or other geotechnical tests.

Several of these design elements have been partially addressed by existing data sources, including the SSS and SSAP results presented in the draft Year 1 DSR (QEA, 2003b). In addition, activities specified in the SBPT Work Plan (QEA, 2003c) may provide additional data correlation/material identification with the boring/drilling program. Field and laboratory analysis activities under this task are described below.

3.3.1 Field Work

The following field activities will be conducted to complete the geotechnical characterization of sediments and shorelines:

- Barge location setup (SOP No. 2 [Appendix B]);
- Measurement of blow counts in blows per foot (ASTM D1586 [Appendix A]);

- Visual observations during sample collection (ASTM D2488 [Appendix A]);
- Shelby tube sampling of soils for geotechnical purposes (ASTM D1587 [Appendix A]);
- HDA observations (e.g., video mapping, vegetation delineation, etc.) (as specified in the SOPs contained in the HDA Work Plan [BBL, 2003d]); and
- Shear strength measured in pounds per square foot (psf) (from Vane Shear Tests, ASTM D2573 [Appendix A]).

The proposed SEDC sampling locations were established considering areas within the candidate Phase 1 areas where higher PCB levels were observed, while considering the data need being addressed (e.g., resuspension containment, dredge equipment) and the available geotechnical data. As such, 60 borings will be advanced by a drilling rig, and samples will be collected continuously at 2-foot intervals (as specified in Table 4) to depths of 10 to 25 feet below the existing mudline or to the point of refusal. Figures 3 through 11 provide the location and anticipated depth of each proposed boring. These boring depths vary depending on the specific need for the subsurface data. In areas adjacent to land-based structures or roadways and in areas considered to be potentially unstable during the dredging program, boring depths have been set at 25 feet in an effort to understand the material characteristics with depth. Where the geotechnical information is to be collected only for purposes of dredging and barge spudding, boring depths have been set at 10 feet.

With the understanding that, during geotechnical investigations, cobbles, boulders, debris, and obstructions can suggest "bedrock refusal" for SPT methods, it will be important to avoid obtaining data that suggest premature refusal. In order to prevent premature test boring refusal, the field crew will be made aware of those areas suspected of containing potential boulders or debris (based on available information) that could cause premature test boring refusal. If it is suspected that a significant boulder deposit or obstruction (within the soft sediments requiring dredging) is causing refusal, the test boring location will be moved within a 20-foot radius of the original location, and the boring will be reattempted. Following four unsuccessful boring attempts, the location will be abandoned. The test boring refusal criteria as described herein (i.e., four unsuccessful attempts) provides valuable geotechnical information on the area in and of itself; however, if a decision is made to pursue additional data gathering in this area, a Work Plan addendum will be prepared and submitted to the USEPA for review and approval prior to implementing any proposed investigative activities.

A specific color coding system is provided on Figures 3 through 11 that indicates the rationale for the boring location (e.g., slope stability issue, spudding/sheeting/dredge prism stability issue, or FCS riverfront analysis).

All subsurface samples will be visually examined and logged by the field geologist/engineer. The boring log will include observations of the type of material, including color, grain size, and textural features; depths of observed changes in subsurface stratigraphy; thicknesses of stratigraphic units; and other appropriate information (e.g., presence of wood chips, evidence of weathering, staining, or odors detected in the sample). All boring log information will be entered into the electronic database maintained on the field vessel. An example of the boring log is provided as an attachment in Appendix B. As a backup, the boring logs will also be recorded in indelible ink in a bound field notebook.

The barge-mounted borings performed in the river will be advanced inside a steel casing. Formation samples for geologic logging will be collected continuously from the mudline to the bottom of the borings using 2-foot split-spoon be driven in advance of the steel casing, according to ASTM D1586 (standard included in Appendix A). Blow counts will be recorded for each 2-foot sample interval. It is anticipated that all materials collected in the split-spoon sampler will be placed in jars and sealed. Decisions regarding storage or disposal of samples will be made by the field and design team based on the potential future utility of such samples and the availability of sufficient storage space. If samples are scheduled for disposal, the USEPA will be provided the opportunity to take custody of the samples. The planned drilling methodology is a wash boring technique with driven casing and a collection tub on the vessel to collect wash water and soil particles as the casing and drilling tools are advanced. The wash water will be used to maintain adequate head over the water levels within the borehole per ASTM D-1586. The water collected in the tub will be decanted and recirculated, while soil particles will collect on the bottom of the tub. Approximately 36 25' borings and 24 10' borings are proposed in the work plan. Based on discussions with prospective drillers, generally about three casing volumes of water are generated per boring. As such, a conservative estimate of potential IDW would be about 100 gallons of water for every 3 borings, which equates to 2,000 gallons of water for the total SEDC drilling program. The spoils estimate is approximately 3 cubic yards for the entire planned SEDC drilling program. Due to the inherent flexibility of the SEDC program, some of the materials collected as potential IDW may be sent off for geotechnical testing following processing depending on observations made in the field during the drilling program. Water and soil particles collected as potential IDW during the SEDC drilling program will be transferred to 55 gallon drums on shore and transported to Ft. Edward for processing and appropriate disposal. Representative samples (as identified by the field engineer/geologist [in consultation with senior design engineers in the office]) will be recovered and placed in glass jars as identified in SOP No. 1 (Appendix B). The samples will also be visually classified in the field in accordance with ASTM D2488 (standard included in Appendix A). To allow for the potential of additional testing and/or visual review of collected sediments and sub-bottom materials, all split-spoon and tube samples will be stored indefinitely until the samples are deemed no longer required as part of the design process. An adequately sized, cool dry storage facility will be determined as part of the field work initiation phase (i.e., the contracting/ procurement/mobilization phase). Note that refrigeration of samples is not necessary as chemical analysis will not be performed on the samples collected. Select samples will be sent out for geotechnical laboratory analysis as directed by the engineer upon review of the samples at the storage facility.

Based on the extensive database of geotechnical information collected during the SSAP work efforts (i.e. more than 1,100 samples were tested for physical characteristics, including grain size, Atterberg Limits, and water content), it is expected that a maximum of 25% of the SEDC samples collected will be used for laboratory/geotechnical analysis (as specified by the field engineer/geologist). It is believed that the 25% testing frequency will provide an adequate informational database for the development of the design. However, based on field engineer observations (in consultation with senior design engineering personnel) during the sample collection, additional samples may be sent off for geotechnical testing.

Additional stored samples may be used at a later date and sent to the laboratory for further analysis. More specific information on laboratory analysis is provided below in sub-section 3.3.2.

In addition, undisturbed Shelby tube samples will be collected as part of the engineering evaluation. The field engineer/geologist (in consultation with senior design engineers in the office) present during the drilling operations will determine from which location Shelby tube samples will be collected.

3.3.2 Laboratory Analysis

The following laboratory analyses will be required to complete the geotechnical characterization of sediments:

- Shear strength measured in psf (from UU Triaxial Tests, ASTM D2850 [Appendix A]);
- Grain size distribution/sieve analysis (from Sieve Analysis, ASTM D422 [Appendix A]);
- Grain size distribution for finer fraction (from Hydrometer Analysis, ASTM D1140 [Appendix A]);
- Specific gravity (ASTM D854 [Appendix A]);
- Classification by USCS method (ASTM D2487 [Appendix A]);
- Atterberg limits measured in % (ASTM D4318 [Appendix A]); and

Water content measured in % (ASTM D2216 [Appendix A]).

3.4 Task 4 – Backfill Source Material Identification and Characterization

Backfill source material identification and characterization activities will be conducted to support the development of the backfill design, which is associated with both dredging design and the habitat replacement and reconstruction program. As part of the RD, it will be necessary to understand the potential sources of backfill as this information will affect items such as transportation and implementation logistics for the project. In the Preliminary Design stage, potential available borrow sources will be identified. Once identified, materials from sources will be sampled and analyzed. The actual sample location will be determined based on the Preliminary Design. Associated testing of potential backfill sources will be performed as part of the SEDC work, but may need to be implemented on a separate timeline due to the timing of the Preliminary Design. As such, data collected from potential backfill sources may need to be submitted separate from the SEDC data, such as part of the *Phase 1 Intermediate Design Report*, depending on the timing of data collection and receipt.

The identification of backfill material sources specified in this SEDC Work Plan are designed to provide the additional detail necessary to more fully address DQO 7a (Table 2). Activities under this task include:

- Identification of available borrow material in cy (to be reported as part of *Preliminary Design Report*);
- Inventory of local quarries (and other borrow sources) and collection of existing testing information) (to be reported as part of *Preliminary Design Report*);
- Grain size distribution (of representative samples) measured in mm (from Sieve Analysis, ASTM D422 (standard included in Appendix A); and
- Grain size distribution (of representative samples) for finer fraction in mm (from Hydrometer Analysis, ASTM D1140 [standard included in Appendix A]).

Since the actual need for backfill is several years away, performing any chemical analysis and screening as part of the SEDC will not necessarily be representative of conditions in the future. As part of the backfill specifications, there will be a requirement to certify that such materials are “clean,” along with a protocol for sampling, analysis, and material acceptance criteria. However, if information and analytical data are available from prior sampling performed by others, the data will be obtained, and contaminant screening will be performed. No additional sampling and analysis of borrow sources is planned as part of the SEDC.

This SEDC task will include site visits and interviews with quarry representatives regarding the availability of material (both by size [sieve] and quantity [cy]). It should be noted that the term "quarries" not restrictive, but refers in this document to all borrow sources. This task is focused on areas where it is known that materials can be obtained. Existing information from previous data gathering efforts (i.e., relative to potential capping source areas) will be included in the task. Documentation of discussions with quarry personnel concerning available backfill materials will be prepared, samples of potential backfill materials will be obtained for laboratory testing, and the information will be placed in the Hudson River GIS Database for ease of use. An example of a potential Backfill Source Log is provided in Appendix D.

3.5 Task 5 – River Hydraulics and Hydrography Data Collection

3.5.1 River Hydraulics Investigation

As discussed in Section 2.12 of the Remedial Design Work Plan, GE's hydrodynamic model will be used to predict river velocities under a range of flow conditions to support RD. The velocity measurements conducted under the SEDC will provide an additional dataset for model calibration/validation. The approach will be to use the model to simulate the flow conditions at the transect locations where the data are collected, and then compare model-predicted and measured velocities. The model's calibration parameters may then be refined so as to provide the best possible agreement between simulated and observed velocities. This recalibration may be necessary because the scale at which velocity predictions will be needed for RD will likely be finer than that at which the model was originally developed to simulate.

River hydraulics data will be collected to better understand the dynamics of the river and how changes in river velocity may affect the RD. The purpose of this task is to identify areas with physical conditions of the river flow system that may impact dredging operations, dredge material transportation, equipment access, installation and operations of resuspension control systems, and potential requirements for operations on neighboring areas/properties. To better understand the dynamics of the river system over time (as the project will be implemented over several months throughout the year), this task will be performed on a separate timeline and track. Specific flow ranges (discharge in cfs based on the U.S. Geological Survey [USGS] Fort Edward gauging station) will be targeted to determine how the flow affects the river velocities at different locations during the dredging season (May through November). River velocity information (based on the targeted flow events) will be collected along seven transects: five transects in River Section 1 (Thompson Island Pool) and two transects in River Section 2 (near Northumberland Dam). As such, the complete dataset from this evaluation will not likely be submitted as part of the SEDC Report for Year 2; however, it is anticipated that the majority of the information collected relative to river hydraulics (during SEDC activities) will be reported in the *Intermediate Design Report.*

Specific activities under the river hydraulics investigation are described below.

3.5.1.1 Weather Conditions

Weather conditions, including wind speed and direction, air and water temperature, relative humidity, and average monthly rainfall, will be obtained from local weather stations. Extreme event frequency is derived from analyzing historic records of rainfall, river stage, and river velocity.

3.5.1.2 Measurement of River Velocity

River velocity data will be collected along seven transects; five transects in River Section 1 (Thompson Island Pool) and two transects in River Section 2 (near Northumberland Dam). The locations of these transects were selected based on their proximity to areas that are likely to be dredged and the objective of sampling from a range of hydrographic conditions. Brief descriptions of these transect locations follow.

- Transect 1: in the vicinity of Rogers Island (approximately at RM 194), in the east and west channels of the river. The east channel transect will sample a steeply sloped cross-section with narrow nearshore shallows and a deep channel. The west channel transect will sample just downstream of a mid-channel island that may induce secondary circulations important to the design of resuspension controls. Data at the Rogers Island transect will help to quantify the relative split of total river flow rate between the two channels.
- Transect 2: approximately at RM 193.0. This transect is located where the river contains an extensive shoal on the west side and a narrow shoal on the east side. The navigational channel sediments in this area are likely to be dredged.

- Transect 3: approximately at RM 192.7. This transect is located at the apex of a river bend and a location where bank-to-bank dredging may be needed.

- Transect 4: approximately at RM 191.9, near the islands upstream of Snook Kill. This transect is located where islands isolate the eastern portion of the river.

- Transect 5: approximately at RM 190.1, near Griffin Island. This transect is located where the river narrows significantly.

- Transect 6: upstream of Northumberland Dam, approximately at RM 183.9. This transect is located in a relatively wide section of the river.

- Transect 7: downstream of Northumberland Dam, approximately at RM 183.6. This transect is located at a point where the river has narrowed significantly.

The monthly average flow rate at Fort Edward during the dredging period (i.e., May through November) ranges from approximately 2,900 cubic feet per second (cfs) in July to approximately 7,600 cfs in May. River velocity data will be collected during lower, moderate, and higher discharge relative to the range of flows expected to occur during the May through November period. Data will be collected at the seven transects when Fort Edward discharge is within the following ranges: 1) lower flow, 1,000 to 3,000 cfs; 2) moderate flow, 3,000 to 7,000 cfs; and 3) higher flow, 7,000 to 10,000 cfs. One set of data will be obtained for each discharge range.

Along each transect, river velocity measurements will be made using an ADCP or equivalent device. For water depths greater than 5 feet, an ADCP will be used. The ADCP will provide two types of current velocity data: 1) vertical profile; and 2) depth-averaged value. ADCP data will be collected along each transect in water depths greater than 5 feet. The frequency of sampling will be such that a velocity measurement will be obtained approximately every 20 feet along a transect (i.e., approximately 30 to 40 samples per transect). Survey in shallow water will use the following procedure: for water depths less than 1 to 1.5 meters, a self-floating ADCP will be deployed using shallow water mode. This device would be towed from the last boat position on each transect to shore. The floating ADCP we intend to use will have the exact same capabilities as the one used in deeper water (GPS navigation, continuous vertical profile, continuous data collection, etc.). The floating ADCP will be towed from the boat to the shore using a pulley system (similar to a clothesline) operated by a person stationed on shore. A data cable will be attached to the floating ADCP to relay the readings back to the computer on the boat. Two passes will be performed - to the shore and then back again. We will get as close to the shore as possible with the boat (typically 2 - 3' water depth) before using the floating ADCP. Realistically, the floating ADCP is only going to be used in an area that receives a tiny fraction of the overall discharge across each transect - as such this data is unlikely to significantly affect the results. In shallow water mode, which allows for smaller velocity bin sizes (on the order of a few centimeters vertical resolution), the floating ADCP should be able to track the bottom and record velocity measurements in water as shallow as 0.25 to 0.5 meters.

3.5.2 River Hydrography

The purpose of this task is to identify areas with physical conditions of the river bottom surface that may impact dredging operations, dredge material transportation, equipment access, installation and operations of resuspension control systems, and potential requirements for operations on neighboring areas/properties. As with the remote sensing issues described in the debris and obstruction survey task (sub-section 3.2), an existing hydrographic survey was conducted as part of the SSAP work. The initial work under this task will be to perform a detailed desktop review of the available bathymetry data (i.e., identification of river bottom surface) performed by OSI in 2002 and presented in the Year 1 DSR (QEA, 2003b). A review of the overall bathymetry work, along with the physical field measurements made at the time of the survey work, will provide design engineering personnel the opportunity to evaluate any potential anomalies in the existing dataset.
Based on the review, it may be determined that an additional bathymetry work on a smaller transect spacing may be warranted in specific candidate removal areas. Should additional bathymetry work be deemed necessary, survey data coverage will be collected at an appropriate interval to provide a detailed surface of the river bottom in the candidate Phase 1 areas. Survey line spacing will depend on dredge area locations, SSAP core sample locations, as well as water depth in the vicinity of the candidate Phase 1 areas. Any additional hydrographic survey work would be conducted in accordance with the United States Army Corps of Engineers (USACE) manual titled *Engineering and Design - Hydrographic Surveying* (EM 1110-2-1003) (USACE, 2002). Specific processes and methodologies regarding further remote-sensing investigative efforts to be performed would be presented in a subsequent *Engineering Data Collection Phase Work Plan*. As with the debris survey, any additional remote-sensing surveys will not be conducted until the Phase 1 DAD Report has been issued and approved.

The data collection will focus on the most recent and technologically accurate information (the 2001 and 2003 datasets, which reflect contemporary river conditions and are based on known, high-confidence GPS control monuments).

4. Project Management

This section describes the project management roles for the SEDC Program, organized into the following sub-sections:

- Project/task organization; and
- Project execution.

4.1 Project/Task Organization

GE will have overall technical responsibility for conducting the SEDC Program. It is anticipated that BBL will be responsible for management of the data collection efforts under the SEDC Program; QEA will provide database management, sample storage, and river hydraulic measurement support; and ESI will provide data processing and QA support. Specific project roles and responsibilities for project personnel for the SEDC Program are described below.

Overall Project Managers
John Haggard/Bob Gibson, GE

Responsibilities of the Overall Project Managers include:

- Defining project objectives and establishing project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
- Reviewing and analyzing overall task performance with respect to planned requirements and authorizations;
- Approving reports prior to their submission to the USEPA; and
- Representing GE at public meetings.

Project Manager
Ram Mohan, Ph.D., P.E., BBL

The Project Manager is directly responsible for project activities performed by their respective personnel and subcontractors. Responsibilities of the Project Manager include:

- Providing overall direction and management of activities performed as part of the SEDC Program;
- Providing QA management of all aspects of the project;
- Providing final review of all documents; and
- Representing the project team at public meetings.

QA Program Manager

David Blye, Environmental Standards, Inc.

The QA Program Manager will oversee all quality assurance aspects of the project. Specific tasks include:

- Overseeing data verification;
- Coordinating analytical laboratories' schedules; and
- Reviewing DQOs, reviewing set assessment criteria, and conducting assessments to determine compliance.

Field Sampling Manager

Steve Montagna, P.E., BBL

The Field Sampling Manager will oversee all field activities performed. Note that the SEDC Field Sampling Manager is the former Engineering Data Coordinator (as specified in the SSAP-QAPP [QEA and ESI, 2002]), and, as such, will retain the Engineering Data Coordinator responsibilities, including:

- Reviewing routine progress reports, including a summary of field activities and field audit results; and
- Recommending program modifications needed to maximize data usability for design.

In addition, during SEDC activities, the Field Sampling Manager will be responsible for:

- Managing field staff;
- Supervising Site Coordinators;
- Coordinating sample collection and field laboratory schedules;
- Overseeing ordering and delivery of supplies;
- Coordinating and managing BBL subcontractors;

- Monitoring program progress relative to schedule and determining corrective actions necessary to maintain schedule;
- Reviewing/approving the type of field equipment used and verifying that procedures are followed to achieve the DQOs;
- Reviewing field notebooks/logs with respect to completeness, consistency, and accuracy; and
- Preparing progress reports, including a summary of field activities and field audit results.

Site Coordinators
Todd Merrell, BBL
Mark LaRue, QEA
Christopher Yates, QEA
Sean McNamara, QEA

The Site Coordinators are responsible for day-to-day supervision of all site activities conducted as part of the SEDC Program. The BBL Site Coordinator will be responsible for:

- Primary contact with the agency oversight team during SEDC activities;
- Overseeing all SEDC field activities;
- Overseeing all activities in the field laboratory, including field data log-in, chain-of-custody (COC) generation, sample labeling, cooler packing, etc.;
- Coordinating sample collection and field laboratory schedules; and
- Reporting any deviations from protocol to the Field Sampling Manager.

The QEA Site Coordinators will be responsible for:

- Supporting river hydraulic measurement collection;
- Storing samples; and
- Developing and managing the database.

Site Health and Safety Coordinator (Site HSC)

Kip Score, Saratoga Safety, Inc.

The Site HSC is responsible for enforcement of the Occupational Safety and Health Administration (OSHA) standards (29 CFR 1910.120) regarding health and safety concerns. Specific responsibilities include:

- Verifying compliance with all Revised HASP (BBL, 2003c) procedures during performance of field work activities; and
- Reporting any deviations from the Revised HASP to the Site Coordinator.

Project QA/QC Officer

Tom Roberts, Environmental Standards, Inc.

The Project QA/QC Officer has the following responsibilities:

- Receiving data packages from laboratories;
- Reviewing laboratory data packages;
- Coordinating field QA/QC activities with the Field Sampling Manager;
- Reviewing field reports;
- Reviewing audit reports;
- Preparing interim Quality Assurance Reviews; and
- Preparing final Quality Assurance Reviews.

4.2 Project Execution

This sub-section presents the project execution roles for the SEDC Program.

Infrastructure Documentation

BBL

BBL will be responsible for completing the following activities under the infrastructure documentation task:

- Locating in-river and shoreline infrastructure;
- Identifying vertical and horizontal points of infrastructure using RTK unit;
- Measuring dimensions of infrastructure;

- Measuring minimum distance under each span; and
- Recording all infrastructure information in field book (e.g., date, time, water surface elevation, river mile, sketch of infrastructure, etc.).

<u>Debris and Obstruction Survey</u>
BBL

BBL will review the existing SSS data as previously gathered by OSI.

<u>Geotechnical Drilling Program</u>
BBL
Drilling Subcontractor (TBD)

BBL will be responsible for:

- Providing oversight of the drilling subcontractor;
- Overseeing positioning/maneuvering of barge into position;
- Documenting all field activities during boring extraction;
- Preparing and entering field notes into the electronic database;
- Preparing samples for transport/storage for future analysis; and
- Determining visual soil classification.

In the event that a different subcontractor (from those approved for SSAP) is proposed for the SEDC geotechnical drilling program activities, the USEPA will be notified in accordance with Paragraph 27 of the RD AOC (USEPA/GE, 2003) and the contractor's *Quality Management Plan* will be submitted to the USEPA as required to comply with Paragraph 28 of the RD AOC (USEPA/GE 2003).

Responsibilities of the drilling subcontractor include:

- Operating drilling equipment and barges;
- Driving and pulling split-spoon and Shelby tube samplers; and
- Decontaminating drilling equipment.

Backfill Source Material Identification and Characterization

BBL

QEA

BBL will be responsible for:

- Identifying backfill sources to be sampled based on the RD.

QEA will be responsible for:

- Collecting backfill material samples and submitting the samples for laboratory analysis.

River Hydraulics and Hydrography Data Collection

QEA

OSI

QEA will provide oversight of OSI during the river hydraulics and hydrography data collection efforts.

OSI will be responsible for:

- Performing ADCP activities;
- Performing additional bathymetry surveys, if necessary;
- Processing/interpreting collected data; and
- Providing tabular results and bathymetry and velocity profiles for all survey transects.

Sample Management and Storage

BBL

QEA

BBL will provide oversight responsible for:

- Preparing sample containers for shipping; and
- Maintaining COC documentation.

QEA will be responsible for:

- Developing and maintaining the database;
- Preparing database reports; and

- Storing material samples.

Analytical Measurements on Sediment Samples

STL Burlington (Burlington, Vermont)

Laboratory Subcontractor (TBD)

It is anticipated that STL Burlington, a laboratory approved for the SSAP, will conduct a majority of the SEDC geotechnical testing. Additional laboratory subcontractors may be selected for other specific geotechnical testing (e.g., unconsolidated-undrained [UU] testing) for SEDC activities. If additional laboratories are proposed for SEDC activities, the USEPA will be notified in accordance with Paragraph 27 of the RD AOC (USEPA/GE, 2003) and the laboratory's *Quality Management Plan* will be submitted to the USEPA as required to comply with Paragraph 28 of the RD AOC (USEPA/GE 2003).

Responsibilities and duties of the analytical laboratories include:

- Performing analytical testing;
- Reporting the data to the database manager in the required format and within required turnaround times;
- Strictly adhering to all protocols in this SEDC Work Plan; and
- Contacting the QA Program Manager in advance of any protocol deviations.

Coordination of Analytical Laboratories

Environmental Standards, Inc.

Responsibilities include:

- Communicating daily with the analytical laboratories;
- Verifying that laboratories can meet their time commitments; otherwise, direct samples to another laboratory; and
- Resolving laboratories' questions/concerns about SOP details.

Data Production and Database Development and Maintenance

QEA

Responsibilities include:

- Performing electronic QA checks on data packages;

- Conducting electronic data verification;
- Populating the project database;
- Performing QA checks on database; and
- Distributing the database

5. SEDC Documentation, Reporting, and Schedule

5.1 Documentation and Records

A centralized filing system will be established for documents (i.e., new forms/logs that have been generated for this SEDC Work Plan) that document the sampling and analysis activities described in this SEDC Work Plan. GE and its various consultants/contractors are custodians of and will maintain the contents of centralized files for the SEDC activities, including all relevant records, correspondence, reports, logs, data, field reports, field logs, pictures, video, subcontractor reports, analytical data, and data reviews. GE will make all information available to the USEPA and will provide information upon request.

5.2 Addenda to SEDC Work Plan

If the need for supplemental investigation work is identified (based on review of existing or ongoing investigations), such activities will be proposed as addenda to this SEDC Work Plan. Such addenda may include additional data collection work for debris identification and hydrographic work.

5.3 SEDC Report

The results of the Year 2 SEDC Program will be presented in the SEDC Report for Year 2. The report will present the results of the activities described in this SEDC Work Plan, which will be utilized during design as described in the RD Work Plan (BBL, 2003a).

5.4 Schedule for SEDC Activities

The schedule for deliverables outlined in this SEDC Work Plan is specified in Table 5, below.

Table 5 – Schedule for Deliverables/Approvals Related to the SEDC Work Plan

Activity	Date/Deadline
Submission of SEDC Work Plan for Year 2 to the USEPA	Submit to the USEPA on 9/17/03.
Initiate Field Work	Field work to start 45 days after approval of SEDC Work Plan (includes 30 days for contractor procurement and contracting and 15 days for mobilization) or as weather and seasonal constraints permit.
Complete Field Work [3]	45 days from initiation of field work (estimate). Actual schedule will depend on weather, seasonal constraints, field equipment availability, and sample collection productivity.[1]
Submit SEDC Report for Year 2 [3]	90 days after field work is completed [2].

Notes:

1. 2003 sampling season to close in early November (due to canal operations and weather constraints). As such, field investigation activities not completed in 2003 will start in May 2004. However, review of documentation will start as soon as this SEDC Work Plan is approved.
2. Information/data collected under the SEDC Program pertaining to backfill, hydraulics, and debris surveys will not be collected during the same time frame as in-river field work and infrastructure documentation (as identified by the schedule above). If available, information collected relative to backfill material (during SEDC activities) will be reported in the SEDC Report for Year 2. If not available at that time, the data will be reported in the next design report.
3. This does not include addenda to the SEDC Work Plan. If the need for supplemental investigation work is identified (based on review of existing or ongoing investigations), such activities will be proposed as addenda to this SEDC Work Plan and a separate schedule would be proposed. Depending on the timing of such activities, results would be reported as part of the SEDC Report, or as addenda to SEDC Report.

6. References

BBL. 2003a. *Remedial Design Work Plan* (RD Work Plan). Hudson River PCBs Superfund Site. Prepared for General Electric Company, Albany, NY.

BBL. 2003b. *Revised Community Health and Safety Plan* (Revised CHASP). Hudson River PCBs Superfund Site. Prepared for General Electric Company, Albany, NY.

BBL. 2003c. *Revised Health and Safety Plan* (Revised HASP). Hudson River PCBs Superfund Site. Prepared for General Electric Company, Albany, NY.

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Fang, Hsai-Yang. 1991. *Foundation Engineering Handbook*. Boston: Kluwer Academic Publishers.

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QEA. 2003b. *Sediment Sampling and Analysis Program – Year 1 – Data Summary Report* (Year 1 DSR). Hudson River PCBs Superfund Site. Prepared for General Electric Company, Albany, NY.

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USEPA. 2002. *Hudson River PCBs Site - Record of Decision and Responsiveness Summary* (ROD). New York, NY.

USEPA/GE. 2003. Administrative Order on Consent for Hudson River Remedial Design and Cost Recovery (Index No. CERCLA-02-2003-2027) (RD AOC). Effective Date August 18, 2003.

USEPA/GE. 2002. Administrative Order on Consent for Hudson River Sediment Sampling (Index No. CERCLA-02-2002-2023) (Sediment Sampling AOC). Effective Date July 26, 2002.

Tables

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engineers & scientists

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
1. Delineate dredge areas and depths.	1a. Identify dredge areas and depths based on the ROD requirements.		• Dredge areas in acres; and • Dredge depths in feet.	• DAD Reports
	1b. Identify areas with physical conditions that may affect the dredging activities.	1b. (1) Determine the geotechnical properties of sediments in the dredge areas to identify conditions that might limit the effectiveness of various dredges to penetrate and remove the sediment.	• Blow counts in blows per foot (from SPT, ASTM D1586); • Grain size distribution measured in mm (from Sieve Analysis, ASTM D422); • Grain size distribution for finer fraction in mm (from Hydrometer Analysis, ASTM D1140); • Specific gravity (ASTM D854); • Atterberg limits measured in % (ASTM D4318); • Water content measured in % (ASTM D2216); and • Visual observations during sample collection.	• SEDC activities
		1b. (2) Determine the geotechnical properties of strata underlying the sediments in dredge areas to identify conditions that might limit the dredgeability at the interface between areas to be dredged and underlying sediments.	• Blow counts in blows per foot (from SPT, ASTM D1586); • Grain size distribution measured in mm (from Sieve Analysis, ASTM D422); • Grain size distribution for finer fraction in mm (from Hydrometer Analysis, ASTM D1140); • Specific gravity (ASTM D854); • Atterberg limits measured in % (ASTM D4318); • Water content measured in % (ASTM D2216); • Visual observations during sample collection; • Delineation of stratigraphy; and • Assessment of the ability of sub-bottom profiling techniques to provide supplemental geotechnical information (Objective D in SBPT Work Plan).	• SSAP sub-bottom profiling • SEDC activities

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
		1b. (3) Determine the stability of river-bottom sediments and shoreline areas to determine stable side-slope requirements for dredge areas and to identify areas with sloughing potential and slope stability issues for shoreline areas.	• Shear strength measured in psf (from Vane Shear Tests, ASTM D2573); • Shear strength measured in psf (from UU Triaxial Tests, ASTM D2850); • Blow counts in blows per foot (from SPT, ASTM D1586); • Grain size distribution measured in mm (from Sieve Analysis, ASTM D422); • Grain size distribution for finer fraction in mm (from Hydrometer Analysis, ASTM D1140); • Specific gravity (ASTM D854); • Atterberg limits measured in % (ASTM D4318); • Water content measured in % (ASTM D2216); • Visual observations during sample collection; and • HDA observations (video mapping, vegetation delineation, etc.).	• SEDC/HDA activities
		1b. (4) Identify fixed structures (e.g., bridges, utilities, roads/highways, houses/structures, trees/landscaping, dams, locks, docks, piers, seawalls, marinas, and water intakes/outfalls) located within dredge areas and on adjacent shore areas that may be encroached during dredging. This information will be used to identify potential impacts that dredging may have (either directly or indirectly) on those structures and to determine whether adjustment of the dredge area boundaries is required to appropriately minimize these impacts.	• Infrastructure dimensions measured in feet (from inventory of physical condition information and physical measurements [tape or rule] to confirm); • Documentation of any administrative encroachment limitations that may be imposed by owners of structures; and • Locations in northing/easting (NAD 1983 NY East Zone) and elevations (NAVD 1988) measured in feet.	• SEDC activities

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
	1c. Identify the in-river and shoreline areas containing sensitive ecological features to determine whether adjustment of the dredge area boundaries is required to appropriately minimize impacts to these areas.		• Delineation of vegetation beds and shoreline vegetation in acres by vegetation type and location, including measurement of aerial crown density, root mass, vertical thickness, and qualitative description.	• HDA activities
	1d. Identify the in-river and shoreline areas containing cultural and archaeological resources to determine whether adjustment of the dredge area boundaries is required to appropriately minimize impacts to these areas.		• Delineation of archaeologically or culturally sensitive areas.	• CARA activities
2. Determine the impact of site conditions on dredging operation, and dredged material transport, equipment, and the ability of such equipment to access targeted sediments.	2a. Determine the impacts of river hydraulics and hydrology on dredging and dredged material transport equipment access and/or operation.	2a. (1) Determine water depths, river flow and river velocity, and seasonal and other changes in water level in dredge areas to: • Properly select and size dredging and dredged material transport equipment; • Design proper anchoring systems; and • Identify seasonal and other constraints to access.	• Hydrography data measured in feet (combination of single-beam, multi-beam, and lead-line surveys); • River velocity measured in fps; • Flow measured in cfs; and • River stage (i.e., water surface elevation for seasonal averages, as well as for extreme flow events) measured in feet at various pools.	• *Data Summary Reports* • Baseline monitoring activities • GE Hudson River GIS Database • SEDC activities
		2a. (2) Determine water depths in the vicinity of land-based facility to determine potential dredging requirements for access.	• Hydrography data measured in feet.	• *Data Summary Reports* • GE Hudson River GIS Database
		2a. (3) Identify river conditions that pose a potential health and safety risk to specify proper safety measures to be implemented during operations.	• River stage (time varied fluctuation and average water surface elevation) measured in feet; • Discharge measured in cfs (staff gauges at water surface in relation to river flow and associated velocities and time related to change in elevation); and • River velocity measured in fps.	• *Data Summary Reports* • GE Hudson River GIS Database • SEDC/baseline monitoring activities

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
	2b. Determine the impact of wave action (generated by wind and vessel wake) on anchor systems.		• Wind speed measured in mph; • Wind direction; and • River traffic information (i.e., vessel type and size).	• Local weather stations • GE Hudson River GIS Database • NYS Canal Corporation
	2c. Determine the effect of structures (e.g., dams, locks, bulkheads, utilities, bridges, docks, piers, seawalls, marinas, water intakes/outfalls, river traffic, vegetation, roads/highways, houses, etc.) and debris on dredging and dredged material transport equipment access and/or operations.	2c. (1) Identify the location, dimension, and vertical clearance (e.g., dams, locks, bulkheads, utility clearances, bridges, overhead structures) of all in-river structures within the project area to: • Properly select and size dredging and dredged material transport equipment; • Determine localized constraints on equipment movement and access to dredge areas; and • Identify navigation constraints on dredging and dredged material transport.	• Infrastructure dimensions measured in feet (inventory of physical condition information); • Vertical clearance dimensions measured in feet; • Physical measurements (tape or rule) to confirm; • River stage (time varied fluctuation and average water surface elevation) measured in feet (inventory of clearance information and physical measurements [tape or rule] to confirm); • Documentation of any administrative encroachment limitations that may be imposed by owners of structures; and • Locations in northing/easting (NAD 1983 NY East Zone) and elevations (NAVD 1988) measured in feet.	• SEDC/HDA activities
		2c. (2) Identify the existing condition of shoreline features (e.g., roadways, houses, and structures) to determine limits on maneuvering equipment along the shoreline.	• Infrastructure dimensions measured in feet (inventory of physical conditions information); • Physical measurements (tape or rule) to confirm; • Documentation of any administrative encroachment limitations that may be imposed by owners of structures; and • Locations in northing/easting (NAD 1983 NY East Zone) and elevations (NAVD 1988) measured in feet.	• SEDC/HDA activities
		2c. (3) Identify the extent and type of vegetation in the river and on the shoreline (bank areas) to understand navigability issues for vessels.	• Delineation of vegetation beds and shoreline vegetation in acres by vegetation type and location, including measurement of aerial crown density, root mass, vertical thickness, and qualitative description.	• HDA activities

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
		2c. (4) Determine expected river traffic (not related to site activities) to identify navigation constraints on dredging and dredged material transport.	• Vessel traffic information.	• NYS Canal Corporation
		2c. (5) Identify the location of riverbed debris to: • Determine localized constraints on equipment movement and access to dredge areas; and • Identify navigation constraints on dredging and dredged material transport.	• Hydrography measured in feet (combination of single-beam, multi-beam, and lead-line surveys); • River stage (time varied fluctuation and average water surface elevation) measured in feet (inventory of clearance information and physical measurements [tape or rule] to confirm); • Physical measurements of riverbed structures; and • Locations in northing/easting (NAD 1983 NY East Zone) and elevations (NAVD 1988) measured in feet.	• *Data Summary Report* • SEDC/HDA activities • SSAP sub-bottom profiling test activities
	2d. Identify the effect of the geotechnical properties of site sediments on the selection of dredge equipment and design of dredged material transport.		• Blow counts in blows per foot (from SPT ASTM D1586); • Shear strength measured in psf (from Vane Shear Tests, ASTM D2573); • Shear strength measured in psf (from UU Triaxial Tests, ASTM D2850); • Grain size distribution measured in mm (from Sieve Analysis, ASTM D422); • Grain size distribution for finer fraction in mm (from Hydrometer Analysis, ASTM D1140); • Specific gravity (ASTM D854); • Atterberg limits measured in % (ASTM D4318); • Water content measured in % (ASTM D2216); and • Visual observations during sample collection.	• SEDC activities

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
	2e. Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the design of dredging and anchoring systems.		• Blow counts in blows per foot (from SPT, ASTM D1586); • Shear strength measured in psf (from Vane Shear Tests, ASTM D2573); • Shear strength measured in psf (from UU Triaxial Tests, ASTM D2850); • Grain size distribution measured in mm (from Sieve Analysis, ASTM D422); • Grain size distribution for finer fraction in mm (from Hydrometer Analysis, ASTM D1140); • Specific gravity (ASTM D854); • Atterberg limits measured in % (ASTM D4318); • Water content measured in % (ASTM D2216); • Visual observations during sample collection; and • Assessment of the ability of sub-bottom profiling techniques to provide supplemental geotechnical information.	• SEDC activities • SSAP sub-bottom profiling test results
	2f. Determine the effect of climatic and weather conditions (wind speed and direction, temperature, relative humidity, precipitation, storm/extreme event frequency, and high-flow events) on: • Safety of operations; and • Dredging schedules, operations, and productivity.		• Wind speed measured in mph; • Wind direction; • Temperature measured in °F; • Relative humidity in %; • Precipitation in inches; and • Extreme event frequency.	• Local weather stations
	2g. Identify the in-river and shoreline areas containing sensitive ecological features to determine localized constraints on dredging equipment movement and access to dredge areas.	.	• Delineation of vegetation beds and shoreline vegetation in acres by vegetation type and location, including measurement of aerial crown density, root mass, vertical thickness, and qualitative description.	• HDA activities

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
	2h. Identify the in-river and shoreline areas containing cultural and archaeological resources to determine localized constraints on equipment movement and access to dredge areas.		• Delineation of archaeologically or culturally sensitive areas.	• CARA activities
3. Determine the impact of site conditions on resuspension control systems installation and operation.	3a. Determine the impacts of river hydraulics and hydrology (including water depths, river flow, and seasonal and other changes in water level) on resuspension control systems to: • Determine hydraulic forces on control structures (e.g., silt curtain, sheet piling, etc.); and • Determine the rise and fall of the river versus time to benchmark and design control systems.		• River velocity measured in fps; • Direction (placement of velocity meters at water surface and river bottom); • River stage (time varied fluctuation and average water surface elevation) measured in feet; and • Discharge measured in cfs.	• Baseline monitoring activities • SEDC activities • GE Hudson River GIS Database • NYS Canal Corporation
	3b. Determine the impact of wave action (generated by wind and vessel wake) on anchor systems.		• Wind speed measured in mph; • Wind direction; and • River traffic information (i.e., vessel type and size).	• Local weather stations • GE Hudson River GIS Database • NYS Canal Corporation

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
	3c. Determine the effect of structures (e.g., dams, locks, bulkheads, utilities, bridges, docks, piers, seawalls, marinas, water intakes/outfalls, river traffic, vegetation, roads/highways, houses, etc.) on the installation and operation of resuspension control systems.	3c. (1) Identify the locations, dimensions, and vertical clearance of all in-river structures within the project area to identify constraints on the installation and operation of resuspension control systems in dredge areas.	• Infrastructure dimensions measured in feet (inventory of physical condition information); • Vertical clearance dimensions measured in feet; • Physical measurements (tape or rule) to confirm; • River stage (time varied fluctuation and average water surface elevation) measured in feet (inventory of clearance information and physical measurements [tape or rule] to confirm); • Documentation of any administrative encroachment limitations that may be imposed by owners of structures; and • Locations in northing/easting (NAD 1983 NY East Zone) and elevations (NAVD 1988) measured in feet.	• SEDC/HDA activities
		3c. (2) Identify the existing condition of shoreline features (e.g., roadways, houses, and structures) to identify constraints on the installation and operation of resuspension control systems in dredge areas.	• Infrastructure dimensions measured in feet (inventory of physical conditions information); • Physical measurements (tape or rule) to confirm; • Documentation of any administrative encroachment limitations that may be imposed by owners of structures; and • Locations in northing/easting (NAD 1983 NY East Zone) and elevations (NAVD 1988) measured in feet.	• SEDC/HDA activities
		3c. (3) Identify the extent of areas containing cultural and archaeological resources in the river and on the shoreline (bank areas) to identify constraints on the installation and operation of resuspension control systems in dredge areas.	• Delineation of archaeologically or culturally sensitive areas.	• CARA activities
		3c. (4) Determine expected river traffic (not related to site activities) to identify constraints on the installation and operation of resuspension control systems in dredge areas.	• Vessel traffic information.	• NYS Canal Corporation

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
		3c. (5) Identify the location of riverbed debris to identify constraints on the installation and operation of resuspension control systems in dredge areas.	• Hydrography measured in feet (combination of single-beam, multi-beam, and lead-line surveys); • River stage (time varied fluctuation and average water surface elevation) measured in feet (inventory of clearance information and physical measurements [tape or rule] to confirm); • Physical measurements of riverbed structures; and • Locations in northing/easting (NAD 1983 NY East Zone) and elevations (NAVD 1988) measured in feet.	• *Data Summary Reports* • SEDC/HDA activities • SSAP sub-bottom profiling test activities
	3d. Identify the effect of geotechnical properties of strata underlying the sediments (e.g., location of bedrock or other hard strata) on the installation and operation of resuspension control systems in dredge areas.		• Blow counts in blows per foot (from SPT, ASTM D1586); • Shear strength measured in psf (from Vane Shear Tests, ASTM D2573); • Shear strength measured in psf (from UU Triaxial Tests, ASTM D2850); • Grain size distribution measured in mm (from Sieve Analysis, ASTM D422); • Grain size distribution for finer fraction in mm (from Hydrometer Analysis, ASTM D1140); • Specific gravity (ASTM D854); • Atterberg limits measured in % (ASTM D4318); • Water content measured in % (ASTM D2216); • Visual observations during sample collection; and • Assess the ability of sub-bottom profiling techniques to provide supplemental geotechnical information.	• SEDC activities • SSAP sub-bottom profiling test results
	3e. Identify the in-river and shoreline areas containing sensitive ecological features to determine localized constraints on the installation and operation of resuspension control systems in dredge areas.	.	• Delineation of vegetation beds and shoreline vegetation in acres by vegetation type and location, including measurement of aerial crown density, root mass, vertical thickness, and qualitative description.	• HDA activities

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
	3f. Identify the in-river and shoreline areas containing cultural and archaeological resources to determine localized constraints on the installation and operation of resuspension control systems in dredge areas.		• Delineation of archaeologically or culturally sensitive areas.	• CARA activities
4. Determine resuspension effects during dredging.	4a. Identify the chemical characteristics of sediments (concentration of COCs [e.g., metals, dioxins, furans]) that may be resuspended during dredging.		• COC concentrations measured in ppm.	• *Data Summary Reports*
	4b. Identify the geotechnical properties of site sediments that may be resuspended.		• Grain size distribution measured in mm (from Sieve Analysis, ASTM D422); and • Grain size distribution for finer fraction in mm (from Hydrometer Analysis, ASTM D1140).	• SEDC activities
	4c. Determine the river hydraulics (including water depths, river flow, and seasonal and other changes in water level) to estimate transport of resuspended sediment.		• River velocity measured in fps; • Direction (placement of flow meters at water surface and river bottom); • River stage (seasonal average and extreme event water surface elevation) measured in feet; and • Discharge measured in cfs.	• Baseline monitoring activities • SEDC activities • GE Hudson River GIS Database
	4d. Determine the resuspension characteristics of dredge type and transportation methods.	4d. (1) Identify: • Feasible dredge types, locations where they may be employed, resuspension data, and operating conditions; and • Dredged material transport methods.	• Dredge type; • Production rate; • Dredge material transport method; and • Suspended solids and/or chemical data from other dredging projects.	• Preliminary Design • MCSS database • Vendor performance data
		4d. (2) Identify water quality impacts of dredge types through laboratory testing to determine potential resuspension control requirements.	• TSS; • Turbidity; and • PCB concentrations.	• Treatability studies

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
		4d. (3) Determine the effects of non-dredging-related physical disturbances (e.g., debris removal, boat traffic, etc.) on resuspension as necessary to estimate resuspension.	• Literature search; • Suspended solids and/or chemical data from other dredging projects; and • TSS, turbidity, and chemical concentration from other projects.	• MCSS database • Other literature source • Vendor performance data
	4e. Determine the baseline correlation between turbidity and TSS.		• Turbidity testing; and • Collection of water samples for TSS analysis.	• Baseline monitoring activities
5. Determine the impact of site conditions on the design of sediment processing and water treatment systems.	5a. Determine the river elevation to assess the pumping head required for pipeline transport of dredged material.		• River stage time varied fluctuation and average water surface elevation) measured in feet (staff gauges at surface in relation to areas of potential dredging and land-based facilities); and • Review existing topographic surveys.	• Baseline monitoring activities • SEDC activities • GE Hudson River GIS Database
	5b. Identify the effect of in-situ geotechnical properties of site sediments on: • Design of sediment handling, transport, dewatering, and treatment systems; and • Dredged material handling, transportation, and disposal requirements.		• Grain size distribution measured in mm (from Sieve Analysis, ASTM D422); • Grain size distribution for finer fraction in mm (from Hydrometer Analysis, ASTM D1140); • Specific gravity (ASTM D854); • Atterberg limits measured in % (ASTM D4318); • Water content measured in % (ASTM D2216); and • Visual observations during sample collection.	• *Data Summary Reports* • SEDC activities • Treatability studies

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
6. Identify the potential affects of dredging operations on neighboring areas/properties.	6a. Determine existing shoreline/land use adjacent to removal areas and at processing facility sites to limit impacts to property features (docks, bulkheads, piers, houses, utilities, roads/highways, seawalls, marinas, water intakes/outfalls, etc.).		• Delineation of areas in acres; • Owner of property; • Dimensions of property in feet; • Angle of slope in degrees from horizontal; • Land use category (residential/commercial); • Vegetation cover (type and acreage); • Number and type of structures (condition and construction); • Additional data from photo and video documentation; • Documentation of any administrative encroachment limitations that may be imposed by owners of structures; and • Locations in northing/easting (NAD 1983 NY East Zone) and elevations (NAVD 1988) measured in feet.	• HDA/SEDC activities • GE Hudson River GIS Database
7. Identify material requirements for the habitat replacement and reconstruction design.	7a. Identify backfill material sources, determine material availability, and characterize the physical properties of the material to: • Develop strategies and specifications for obtaining appropriate backfill material (e.g., direct, blending, etc.); and • Establish material transport requirements.		• Available borrow material in cy; • Location (inventory local quarries and obtain existing testing information); • Grain size distribution measured in mm (from Sieve Analysis, ASTM D422); and • Grain size distribution for finer fraction in mm (from Hydrometer Analysis, ASTM D1140).	• HDA/SEDC activities

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
	7b. Determine shoreline restoration requirements necessary to protect shoreline material from long-term erosion from wave action (generated by wind and vessel wake).		• Wind speed measured in mph; • Wind direction; and • River traffic information (i.e., vessel type and size).	• Local weather stations • GE Hudson River GIS Database • NYS Canal Corporation
	7c. Identify whether backfill blending and placement techniques will meet design specification.	7c. (1) Perform laboratory simulations of cap material blending and placement techniques, measuring water column impacts and geotechnical properties of post-placement cap/backfill layer.	• Column settling test.	• Preliminary Design • Intermediate Design • Treatability studies
8. Collect data to select, size, and combine dewatering unit processes, which will allow off-site disposal of sediments.	8a. Identify dewatering necessary for acceptance of dredged material by disposal sites (require clear understanding of the final disposal site requirements).	8a. (1) Identify landfill acceptance criteria to establish specific measurement endpoints for processed dredged material.	• Solids content measured in %; • Water content measured in % (ASTM D2216); • Unconfined compressive strength; • Paint filter test; and • Chemical criteria.	• Preliminary Design
		8a. (2) Identify railroad handling acceptance criteria to establish specific measurement endpoints for processed dredged material.	• Solids content in %; • Unconfined compressive strength; • Paint filter test; and • Chemical criteria.	• Preliminary Design
	8b. Identify the in-situ sediment chemical and physical properties (that determine how the material will dewater) to predict dredged material properties throughout the system.	8b. (1) Determine the particle size distribution, plasticity, and moisture content of in-situ sediment since these properties are the best predictors of dewatering behavior that can be used throughout the processing system.	• Grain size distribution measured in mm (from Sieve Analysis, ASTM D422); • Grain size distribution for finer fraction in mm (from Hydrometer Analysis, ASTM D1140); • Specific gravity (ASTM D854); • Atterberg limits measured in % (ASTM D4318); and • Water content measured in % (ASTM D2216).	• SEDC activities • Treatability studies

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
		8b. (2) Determine the concentrations and types of chemicals (of regulatory importance) in in-situ sediments to establish regulatory classification of materials to be sent for final disposal.	• Chemical characteristics (metals and PCBs) in ppm; and • Chemical characteristics (metals and PCBs) based on size fractionation in ppm (TCLP, TAL Metals, SW-846 Method 8082 [PCBs]).	• SSAP activities • Treatability studies
	8c. Determine chemical and physical properties (that determine how the material will dewater) of dredged material to relate to measured in-situ sediment properties throughout the system.	8c. (1) Determine the physical and chemical properties of mechanically dredged and dewatered material, as simulated through laboratory tests, to select and optimize specific dewatering unit processes.	• Laboratory testing to be defined in Treatability Study Program; and • Physical and chemical analysis of end products.	• Treatability studies
		8c. (2) Determine the physical and chemical properties of hydraulically dredged and dewatered material, as simulated through laboratory tests, to select and optimize specific dewatering unit processes.	• Laboratory testing to be defined in Treatability Study Program; • Grain size distribution measured in mm (from Sieve Analysis, ASTM D422); and • Grain size distribution for finer fraction in mm (from Hydrometer Analysis, ASTM D1140).	• Treatability studies
	8d. Determine target dredged material processing rates to select dewatering equipment and material handling components.	8d. (1) Determine dredge type, production rates, and transportation method to predict rate of dredged material input to the dewatering system select dewatering units and material handling components.	• Dredge type; • Production rate; • Schedule; and • Transportation method.	• Preliminary Design
9. Determine water discharge requirements to select, size, and combine water treatment unit processes.	9a. Determine permitting limits for treated water discharge to select, size, and combine specific water treatment unit processes.	9a. (1) Determine allowable limits of all parameters for discharge to the Hudson River and to local municipal wastewater treatment facilities to select, size, and combine specific water treatment unit processes.	• Physical and chemical water quality standards for relevant receiving waters.	• Data to be obtained from literature review • NYSDEC Regulations
	9b. Determine the volume and flow rate of water to be treated to establish overall system capacity.	9b. (1) Determine dredge type and production rate required to predict quantity of water to be handled by the water treatment facilities.	• Dredge type; • Production rate; • Schedule; and • Transportation method.	• Preliminary Design

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
		9b. (2) Estimate water removal efficiencies of dewatering techniques to predict volumes and flow rates that will be handled by water treatment facilities.	• Laboratory simulations of various dewatering techniques (water removal efficiencies), as will be specified in Treatability Study Program.	• Treatability studies
		9b. (3) Develop dredged material processing trains to predict total quantity, rate, and quality of water to be handled by water treatment facilities.	• Potential dredged material processing units assembled as full treatment trains.	• Intermediate Design • Treatability studies
	9c. Determine physical and chemical characteristics of water to be treated to select and size specific water treatment unit processes.	9c. (1) Determine how the dredging process and the individual dewatering unit processes impact quality of water removed both from mechanically and hydraulically dredged material to select and size specific water treatment unit processes.	• Laboratory testing to be defined in Treatability Study Program; and • Physical and chemical analyses of the water.	• Treatability studies
		9c. (2) Determine performance of individual water treatment unit processes, as applied to water removed by dewatering processes, to select and size specific water treatment unit processes.	• Laboratory testing to be defined in Treatability Study Program; and • Physical and chemical analyses of the water.	• Treatability studies
10. Determine other processing requirements beyond dewatering which may be needed to meet disposal site requirements.	10a. Determine requirements to add stabilizing agents to reduce moisture content to make dewatered material acceptable for transport and final disposal.	10a. (1) Determine amount and type of additives necessary to allow transportation and landfill disposal of dewatered dredged material if raw dewatered materials do not meet landfill requirements.	• Perform treatability tests; and • Measure chemical and physical parameters in treated material.	• Treatability studies
	10b. Determine potential for beneficial reuse of dredged material.	10b. (1) Determine if sediment treatment facilities are available, whether they can receive dredged material from the site, and their acceptance criteria to establish viability of cost-saving alternatives to landfill disposal.	• Determine location and interest from sediment treatment facilities.	• Treatability studies • Preliminary Design

Table 2 – EDC Data Quality Objectives (DQOs)

Collect Engineering Data to Design the Dredging Remedy (Level 1 DQO)	Level 2 DQO	Level 3 DQO	Data and Measurement	Data Source
		10b. (2) Determine if beneficial reuse opportunities exist and their acceptance criteria to establish viability of cost-saving alternatives to landfill disposal.	• Determine beneficial reuse of end products and processing requirements (end product markets, regulatory criteria) to convert dredged material from site into acceptable product.	• Treatability studies • Preliminary Design
	10c. Establish performance of treatment processes on dredged material from the site to develop magnitude of cost savings.	10c. (1) Determine the effectiveness of specific treatment processes on dredged material from the site, end product market, and logistical impacts to materials handling.	• Provide sediment and/or dredged material samples to technology vendors or to laboratories simulating beneficial reuse processes.	• Treatability studies

Table 2 – EDC Data Quality Objectives (DQOs)

Notes:

1. Acronyms:

   ASTM = American Society for Testing and Materials
   CARA = cultural and archaeological resources assessment
   cfs = cubic feet per second
   cy = cubic yards
   COC = constituent of concern
   DAD Reports = *Dredge Area Delineation Reports*
   °F = degrees Fahrenheit
   fps = feet per second
   GE = General Electric Company
   GIS = geographic information system
   HDA = habitat delineation and assessment
   MCSS = Major Contaminated Sediment Sites
   mm = millimeter
   mph = miles per hour
   NAD = North American Datum
   NAVD = North American Vertical Datum
   NYS = New York State
   NYSDEC = New York State Department of Environmental Conservation
   PCB = polychlorinated biphenyl
   ppm = parts per million
   psf = pounds per square foot
   ROD = Record of Decision
   SBPT Work Plan = *Sub-Bottom Profiling Test Work Plan* (QEA, 2003c)
   SEDC = supplemental engineering data collection
   SPT = Standard Penetration Test
   SSAP = Sediment Sampling and Analysis Program
   TAL= target analyte list
   TCLP = Toxicity Characteristic Leaching Procedure
   TSS = total suspended solids
   USEPA = United States Environmental Protection Agency
   UU = unconsolidated-undrained
   WRDA = Water Resources Development Act

2. Shading indicates DQOs that will be primarily addressed by treatability study activities.

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Table 3 – SEDC Data Needs Matrix

Data and Measurement Needs	SEDC DQOs Note 2
1. Blow counts in blows per foot (from SPT, ASTM D1586).	1b. (1), 1b. (2), 1b. (3), 2d., 2e., 3d., 4b.
2. Grain size distribution measured in mm (from Sieve Analysis, ASTM D422).	1b. (1), 1b. (2), 1b. (3), 2d., 2e., 3d., 4b., 5b., 7a.
3. Grain size distribution for finer fraction in mm (from Hydrometer Analysis, ASTM D1140).	1b. (1), 1b. (2), 1b. (3), 2d., 2e., 3d., 4b., 5b., 7a.
4. Specific gravity (ASTM D854).	1b. (1), 1b. (2), 1b. (3), 2d., 2e., 3d., 4b., 5b.
5. Atterberg limits measured in % (ASTM D4318).	1b. (1), 1b. (2), 1b. (3), 2d., 2e., 3d., 4b., 5b.
6. Water content measured in % (ASTM D2216).	1b. (1), 1b. (2), 1b. (3), 2d., 2e., 3d., 4b., 5b.
7. Visual observations during sample collection.	1b. (1), 1b. (2), 1b. (3), 2d., 2e., 3d., 4b., 5b.
8. Shear strength measured in psf (from Vane Shear Tests, ASTM D2573 and Unconsolidated-Undrained Triaxial Tests, ASTM D2850).	1b. (3), 2d., 2e., 3d., 4b.
9. Vertical clearance dimensions measured in feet of all structures within dredge areas (from inventory of clearance information and physical measurements [tape or rule] to confirm).	2c. (1), 3c. (1)
10. Physical measurement to confirm location and size of riverbed debris.	2c. (5), 3c. (5)
11. River stage (time varied fluctuation and average water surface elevation) measured in feet. Notes 3 & 5	2a. (1), 2a. (3), 2c. (1), 2c. (5), 3a., 3c. (1), 3c. (5), 4c., 5a.
12. In-river infrastructure dimensions measured in feet (from inventory of physical condition information and physical measurements [tape or rule] to confirm).	1b. (4), 2c. (1), 3c. (1)
13. Shoreline infrastructure dimensions measured in feet (from inventory of physical conditions information and physical measurements [tape or rule] to confirm).	1b. (4), 2c. (2), 3c. (2)
14. Documentation of any administrative encroachment limitations that may be imposed by owners of structures.	1b. (4), 2c. (1), 2c. (2), 3c. (1), 3c. (2), 6a.
15. Locations in northing/easting (NAD 1983 NY East Zone) and elevations (NAVD 1988) of existing fixed structures along shoreline and in-river debris, structures, and other potential obstacles.	1b. (4), 2c. (1), 2c. (2), 2c. (5), 3c. (1), 3c. (2), 3c. (5), 6a.
16. River velocity measured in fps and direction. Note 3	2a. (1), 2a. (3), 3a., 4c.
17. Wind speed measured in mph and direction obtained from local weather station database. Note 4	2b., 2f., 3b., 7b.
18. Air and water temperature measured in °F and relative humidity in %.	2f.

Table 3 – SEDC Data Needs Matrix

Data and Measurement Needs	SEDC DQOs [Note 2]
19. Average monthly rainfall measured in inches obtained from local weather station database. [Note 5]	2f.
20. Literature search to determine the effects of non-dredging related physical disturbances.	4d. (3)
21. Delineation of dredge areas in acres to determine land adjacent to removal areas and at processing facilities.	6a.
22. Determination of owner and dimensions of river bank property adjacent to dredge areas in feet.	6a.
23. Angle of river bank slopes adjacent to dredge areas in degrees from horizontal.	6a.
24. Land use category adjacent to dredge areas (residential/commercial).	6a.
25. Shoreline vegetation cover adjacent to dredge areas (type and acreage).	6a.
26. Number and type of in-river structures along the project.	6a.
27. Photo and video documentation of shoreline along the project.	6a.
28. Inventory local quarries, existing testing information, and available borrow material measured in cy.	7a.
29. Hydrography data measured in feet (combination of single-beam, multi-beam, and lead-line surveys).	2a. (1), 2c. (5), 3c. (5)

Notes:

1. Acronyms:

   ASTM = American Society for Testing and Materials
   cfs = cubic feet per second
   cy = cubic yards
   DQOs = Data Quality Objectives
   °F = degrees Fahrenheit
   fps = feet per second
   mm = millimeter
   mph = miles per hour
   NAD = North American Datum
   NAVD = North American Vertical Datum
   psf = pounds per square foot
   SEDC Work Plan = *Supplemental Engineering Data Collection Work Plan*
   SPT = Standard Penetration Test
   TSS = total suspended solids
   USEPA = United States Environmental Protection Agency

2. SEDC DQOs refer to Table 2 – EDC Data Quality Objectives (DQOs).

Table 3 – SEDC Data Needs Matrix

3. River flow (measured in cfs) is derived from river velocity, river stage, and river cross-section.

4. Wave height (measured in feet) and wave period (measured in seconds) are derived from wind speed and direction.

5. Extreme event frequency is derived from historic records of rainfall, river stage, and river flow.

6. DQOs 8 through 10 are addressed in Treatability Study Program.

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Table 4 - Sediment Sampling and Testing Plan Summary Table

Area/Description	Maximum Number of Field Samples Note 1			Maximum Number of Laboratory Analysis			
	# Boring Samples	# Grab Samples	# Shelby Tube Samples	Geotechnical Note 2 and 5	Atterberg Limits Note 3 and 5	Shear Strength Note 4 and 5	
						UU Tests	Vane Shear
Sampling Area 1 – Upper Thompson Island Pool A minimum of 40 soil borings will be installed within the area, with continuous split-spoon sampling and standard penetrometer testing at 2-foot intervals. The borings will be installed to depths of 10 to 25 feet below mudline (or refusal), depending on the specific purpose of the boring, as shown on Figures 3 through 11.	395	-	15	95	95	10	120
Sampling Area 2 – Griffin Island A minimum of 11 soil borings will be installed within the area, with continuous split-spoon sampling and standard penetrometer testing at 2-foot intervals. The borings will be installed to depths of 10 to 25 feet below mudline (or refusal), depending on the specific purpose of the boring, as shown on Figures 3 through 11.	85	-	5	20	20	2	33
Sampling Area 3 – Northumberland Dam A minimum of nine soil borings will be installed within the area, with continuous split-spoon sampling and standard penetrometer testing at 2-foot intervals. The borings will be installed to depths of 10 to 25 feet below mudline (or refusal), depending on the specific purpose of the boring, as shown on Figures 3 through 11.	90	-	5	20	20	2	27
Backfill Sampling Backfill samples will be collected from a minimum of four sources. A minimum of two samples will be collected from each source.	-	8	-	8	-	-	-

Notes:

1. The number of boring samples indicates the maximum number of samples to be collected from soil borings advanced in the area. Refer to the area/description for the minimum number of borings to be advanced in the area.
2. Geotechnical tests include laboratory analysis for moisture content, specific gravity, grain size distribution, and Unified Soil Classification System (USCS) classification.
3. Atterberg limits analysis will be performed only on samples containing a significant amount of fine-grained material (based on the results of grain size distribution analysis).
4. Shear strength tests include unconsolidated-undrained triaxial (UU) tests and vane shear testing.
5. Based on the extensive existing geotechnical dataset from the SSAP sampling efforts, the SEDC testing program has been created with inherent flexibility to allow the design professionals the opportunity to select the appropriate samples for geotechnical testing. As such, the number indicated is considered the likely maximum number of samples to be tested.