APPENDIX K: SEDIMENT MANAGEMENT AND SUPERNATANT TREATMENT COST ESTIMATES

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SECTION K.1

DREDGING/SEDIMENT MANAGEMENT SYSTEMS

To evaluate various lake-wide remediation options, the feasibility study (FS) writers considered dredging and sediment management systems in a holistic approach. Four dredging and sediment management options were evaluated:

Option 1: Hydraulic Dredging and On-site Consolidation in an SCA

Option 2: Mechanical Dredging and Off-site Disposal

Option 3: Mechanical Dredging and On-site Consolidation in an SCA

Option 4: Hydraulic Dredging and Off-site Disposal

For options with hydraulic dredging, it is assumed that 14-inch hydraulic dredges would work 16 hours per day, five days per week. At a flow velocity of 10 feet per second (fps), a slurry solids content of 10 percent (weight of solids/weight of slurry), and a dredging efficiency of 70 percent, this would result in an average *in situ* removal rate of 150 cubic yards per hour (CY/hr), or 2,400 *in situ* CY per day, for each dredge. Table K.1 presents the geotechnical characteristics of the hydraulic slurry. The number of hydraulic dredges assumed for each on-site and off-site volume scenario is discussed in Subsections K.2.2 and K.3.2.

For options with mechanical dredging, it is assumed that one 6-CY clamshell bucket dredge would work 16 hrs per day, five days per week. Based on an average mid-range production rate of 130 CY/hr (see Appendix L, dredging issues), average daily production is an *in situ* dredged sediment volume of 2,100 CY. Off-site disposal is limited to this lower rate due to constraints on trucking and landfill acceptance. The feasibility and costs of each of the dredging and sediment management options are discussed in the following sections. A summary of the costs for on-site sediment management is made in Section K.2.5, and a summary of the costs for off-site sediment management is made in Section K.3.4.

SECTION K.2

ON-SITE SEDIMENT MANAGEMENT

On-site sediment management would involve transferring the sediments to a sediment consolidation area (SCA). For dredging/sediment management Option 1, the sediments would be pumped to the SCA, which would be used for solids separation as well as consolidation. For dredging/sediment management Option 3, the sediments would be trucked to the SCA after solidification, and no solids separation would be required. Although the method of transfer of sediments to the SCA would be different for Options 1 and 3, the SCA construction, closure, and long-term operation and maintenance are similar. The use of the SCA for solids separation during Option 1 (which would not be required for Option 3) would require an operation process. Because the extra volume needed for solids separation in Option 1 is small relative to the volume needed for solids consolidation, the size of the SCA is not substantially different between Options 1 and 3.

The design, operation, and management of the SCA for the Onondaga Lake work are described in Appendix L, dredging issues. The following sections describe the costs for the processes for on-site sediment management for Option 1 and Option 3. The relevant portions of on-site management for Options 1 and 3 are discussed in Section K.2.5, where the most appropriate on-site management option is selected.

The cost of on-site sediment management is grouped into the following major tasks:

- SCA construction
- Transfer of dredged material to the SCA and SCA operation
- SCA closure
- Long-term operation and maintenance

The basis of the costs for each of these major tasks is described below.

K.2.1 SCA CONSTRUCTION

For the FS, four sediment dredging volumes were evaluated: 100,000 CY, 500,000 CY, 1,000,000 CY, and 10,000,000 CY. Potential sites for the SCA were evaluated in Section 4.12 of the FS, and Wastebed 13 was selected for the on-site consolidation feasibility analysis.

The FS team prepared a conceptual design of the SCA based on the available data for evaluating the feasibility of on-site consolidation. The size and configuration of the SCA were designed by the steps described in *Engineering and Design – Confined Disposal of Dredged Material* (U.S. Army Corps of Engineers, 1987) to ensure successful operation and that the facility is protective of human health and the environment. Size of the SCA is determined by minimum area for settling, minimum water volume for settling, and storage for dredged sediments. A volume estimate for the SCA based on bulking of the dredged sediment as determined in settling tests (Harrington Engineering & Construction, Inc., 2003) is presented in Table K.2. Conceptual-level sizing and cost estimates for construction of SCAs sized for the noted dredging volumes are presented in Table K.3. It should be noted that the volume estimates and subsequent sizing calculations are based on limited data, specifically two data points from the Harrington study. The data used in developing Tables K.2 and K.3 are not assumed to be representative of all dredging areas, but are the best available site-specific information. Pre-design activities would include collecting samples representative of all dredging areas and settleability testing to develop information for the design of the SCA.

The available geotechnical data for the materials in the wastebeds indicate that some soil stabilization and/or pre-loading may have to be performed on the existing wastebed materials. The need for stabilization and/or pre-loading would be determined through pre-design geotechnical investigations. For the purpose of the FS, costs for preloading the entire consolidation area, i.e., the fill area, and stabilization through deep soil mixing under 25 percent of the dike area are assumed in the cost estimates. Pre-design activities would include geotechnical investigations and preparation of specific stabilization recommendations.

The SCA would be constructed on top of the existing wastebed material using 3:1 (horizontal to vertical) dikes with imported soil. Internal dikes may be needed in the SCA to lengthen the water flow path and reduce short-circuiting; two have been included in the cost estimates. For the three smaller sediment volumes, a dike height of 14 feet (ft) (4.3 meters [m]) is assumed. For the 10,000,000 CY sediment volume, the dikes are assumed to be 50 ft (15 m) high to accommodate the large volume of sediment in one area. The estimates do not consider excavation into the existing wastebed materials and regrading the excavated sediment into dikes.

The actual size and configuration, e.g., dike height v. footprint, of the SCA will be determined during design. The dike heights described above were selected based on the four comparative dredge volumes (100,000 CY, 500,000 CY, 1,000,000 CY and 10,000,000 CY) for development of cost information for use in comparing lake-wide remediation alternatives. The actual dike height and SCA footprint will be made to optimize the SCA design for the selected remedy and resulting anticipated dredge volume.

For the evaluation of lake-wide alternatives, a geomembrane layer was included in the conceptual SCA construction and attendant cost estimate; however, it is anticipated that the appropriate remedial design for the SCA would be determined as part of the pre-design investigation and design process. The decision would be based on a predesign geotechnical investigation of the wastebeds and use of U. S. Army Corps of Engineers (USACE) and U. S. Environmental Protection Agency (USEPA) guidance documents. The geotechnical investigation would include stability testing (bearing capacity) and permeability testing.

The cost estimate assumes that a 2-ft (0.6-m) thick sand drainage and leachate collection layer would be constructed on the bed of the SCA. Piping would be installed within the sand dewatering layer to provide drainage during sediment consolidation.

The cost estimates include all phases of engineering, design, and construction management required for design and construction of a SCA. The cost estimates also include oversight and quality assurance and quality control (QA/QC), in accordance with USEPA guidance and New York State regulations, and installation of monitoring wells spaced 200 ft apart around the perimeter of the SCA.

K.2.2 MATERIAL TRANSFER AND OPERATION OF THE SCA

K.2.2.1 Option 1 Material Transfer and Operation of the SCA

For Option 1 – Hydraulic Dredging and On-site Consolidation in an SCA, dredged sediments are hydraulically transferred to the SCA; this process requires piping, pumps, and labor to operate the pumps and inspect the pipelines. One booster pump, with an operator, is required approximately every mile of pipeline. In addition, a full-time crew to inspect the pipeline is anticipated.

During dredging, it is expected that the SCA would require 24-hour-per-day staffing with at least one person. It is expected that continuous air monitoring would also be required at the SCA. Operation of the SCA would consist of monitoring and directing the dredge slurry inflow, communicating with the dredge crew as necessary, and monitoring and controlling the outflow.

The thickness of the dredged material layer would increase with time until the dredging operation is completed. Operation of the SCA would continue after dredging while the settled solids consolidate. As deposition occurs in the early stages of SCA operation, the permeability of the material would rapidly decease, in essence forming a very low-permeability layer on the bottom of the SCA.

Costs for transfer of material and operation of the SCA depend on the duration of the dredging. The cost estimates assume that one dredge would be used for the 100,000 CY dredge volume, two dredges would be used for the 500,000 and 1,000,000 CY dredge volumes, and four dredges would be used for the 10,000,000 CY dredge volume. Assuming each dredge removes 150 CY/hr for a 16-hour work day, five-day work week, and a seven-month (30-week) dredging season results in the following dredging durations for each scenario:

Scenario	No. of Dredges	Duration (weeks)
100,000 CY	1	9
500,000 CY	2	21
1,000,000 CY	2	42
10,000,000 CY	4	209

Table K.4 presents estimated costs for the SCA operation. Water collected from the SCA would be pumped to the water treatment system for treatment and disposal. Water treatment costs are discussed in Section K.4 of this appendix.

K.2.2.2 Option 3 Material Transfer and Operation of the SCA

For Option 3 – Mechanical Dredging and On-site Consolidation in an SCA, dredged sediments are transferred to the SCA via trucking; this process is discussed in Subsection K.2.5.2.

K.2.3 SCA CLOSURE

The SCA would be capped when dredging is completed and the consolidation process has progressed far enough that the settled material has sufficient strength for cap construction. It is estimated that the SCA can be capped within one year of completion of dredging.

The SCA would be capped with the following, from bottom to top:

- A sloped sand layer to provide foundation and a gradient to the edges of the SCA
- 1.5-ft (0.5-m) thick soil layer
- 0.5-ft (.15-m) thick topsoil layer

The need for geomembrane and geocomposite layers in the cap would be evaluated after the geotechnical testing and during design of the SCA. The cost estimates do not include costs for installation of geomembrane and geocomposite drainage layers. Oversight and QA/QC, in accordance with USEPA guidance and New York State regulations, would be required during SCA cap construction.

Detailed estimates of SCA closure cap construction for each scenario are presented in Table K.5.

K.2.4 LONG-TERM OPERATION AND MAINTENANCE OF SCA

Post-closure operation and maintenance of the SCA is estimated for 30 years. Operation of the SCA would involve monthly inspections. Quarterly groundwater sampling is assumed for the first five years and biennial sampling from six to 30 years from closure. The cost of the operation and maintenance of the SCA depends on the size of the SCA and the number of monitoring wells around the perimeter. The average annual operation and maintenance costs of the SCA are presented in Table K.6.

K.2.5 SUMMARY OF ON-SITE SEDIMENT MANAGEMENT COSTS

K.2.5.1 Option 1 – Hydraulic Dredging and On-site Consolidation in an SCA

Table K.7 presents a summary of the on-site sediment management costs and dredging durations for each of the four volume scenarios (100,000 CY, 500,000 CY, 1,000,000 CY, and 10,000,000 CY) performed with Option 1. The on-site sediment management costs in Table K.7 are arranged by the five treatment options evaluated for the SCA supernatant. The assumptions and costs associated with supernatant treatment are discussed in Section K.4 of this appendix.

K.2.5.2 Option 3 – Mechanical Dredging and On-site Consolidation in an SCA

An evaluation of this dredging and sediment management combination can be made by an overview of the costs elements; a detailed cost comparison is not needed. Mechanical dredging with on-site consolidation would include all of the major cost elements in Option 1 plus an added cost for the more expensive mechanical dredging and additional cost elements, including solidification and trucking of the dredged sediments to the SCA.

Cost of Dredging

The unit cost for hydraulic dredging of the 13 lake-wide alternatives (which range in volume from 196,000 to 10,850,000 cubic yards) ranges from $8 to $10 per cubic yard of *in situ* sediment, as shown in (Appendix F) Tables F.2, F.4, F.6, and F.8. The cost of mechanical dredging is described here for comparison. Each shift of the mechanical dredging crew, described in Appendix L, consists of:

On dredge:
- 1 captain
- 2 clam operators
- 2 mates
- 2 deck hands

On support vessel (tug):
- 2 deck hands

At off-loading facility:
- 2 offload operators
- 2 offload deck hands
- 1 mechanical
- 1 supervisor

Daily equipment costs include the rental, operation, and supplies for the dredge, tug, containment barges, offload equipment, and transport equipment.

Also from Appendix L (dredging issues), the production rate of a 3-CY bucket mechanical dredge is between 50 to 80 CY/hr, and the production rate of a 6-CY bucket mechanical dredge is between 100 to 160 CY/hr. Using the crew described above and an average production rate of 130 CY/hr to reflect the use of a 6-CY dredge, the cost of mechanical dredging is calculated at $20 per CY versus $8 to $10 per CY for hydraulic. Therefore, mechanical dredging is estimated to cost more per cubic yard than hydraulic dredging.

Additional Cost Elements

Since the sediments would be mechanically dredged in this scenario, pumping the slurry to the SCA (as in the hydraulic dredge scenario, Option 1) is not possible. The sediments would have to be dewatered, solidified, and then trucked to the on-site SCA. These cost elements, not needed in Option 1, are considerably more expensive than pumping the slurry. Although Option 3 requires less water treatment than Option 1 (since mechanical dredging collects less water than hydraulic dredging), the costs for barge offloading, solidification, load-out, and trucking to the SCA are considerably more expensive than water treatment for the higher-volume scenarios. Per Table K.7 the costs for advanced water treatment for the four volume scenarios range from $28M to $105M. Per Table K.18, the costs for offloading barges, solidification, and load-out for the four volume scenarios range from $22M to $325M. The cost for offloading barges, solidification, and load-out becomes greater than advanced water treatment for scenarios with dredging volumes 500,000 cubic yards and larger.

K.2.5.3 On-site Consolidation Options Summary

Based on the above evaluation, Option 1 – Hydraulic Dredging and On-site Consolidation in an SCA represents the most cost effective dredging and sediment management system using on-site consolidation. Option 3 – Mechanical Dredging and On-site Consolidation in an SCA is more expensive than Option 1 because it uses a more expensive dredging method and incurs more costs for sediment management.

SECTION K.3

OFF-SITE SEDIMENT MANAGEMENT

Off-site sediment management would be associated with dredging/sediment management Option 2 – Mechanical Dredging and Off-site Disposal or Option 4 – Hydraulic Dredging and Off-site Disposal. Sediment management for each of these two options is discussed in the following sections.

K.3.1 OFF-SITE SEDIMENT MANAGEMENT FOR DREDGING/SEDIMENT MANAGEMENT OPTION 2

For dredging/sediment management Option 2 – Mechanical Dredging and Off-site Disposal, sediment from the mechanical dredge must be solidified prior to placement in trucks for transport off site. The off-site option assumes that one mechanical (6-CY clamshell bucket) dredge would be used for all sediment volume scenarios. The dredge production rate is assumed at 130 CY/hr. Solidification required for transportation and off-site disposal is assumed to require the addition of lime at a rate of 10 percent.

The following tasks are needed to implement this scenario:

- Construction of the bulkhead off-loading area
- Construction of the processing area, including cover system and water transfer system
- Off-loading dredged sediments and transfer to the processing area
- Solidification with lime (10 percent) and load-out of the stabilized sediment into trucks
- Transport to and disposal at off-site commercial non-hazardous waste landfill

The costs for major tasks in this process are described below.

K.3.1.1 Bulkhead and Process Area Construction

The bulkhead off-loading area was assumed to be a sheet pile retaining wall located southeast of the causeway, adjacent to Wastebed B. Dredged sediment transfer barges would carry sediment from the dredge to this area for off-loading with a clamshell bucket crane. The bulkhead off-loading area would have a haul road exiting to the process area located on Wastebed B. The cost to construct a 500-ft-long by 70-ft-deep sheet pile wall was included in the estimate.

The process area is assumed to be asphalt-lined, sloping from its center to the edges. The use of asphalt would create a durable and relatively impermeable layer for operation of process/solidification equipment. Other materials could be used in place of asphalt, but additional maintenance would be required. The process area would be constructed by grading and soil import for site preparation followed by finish grading and application of asphalt paving. An estimated 20-acre paved area is included in the cost estimate. Additionally, approximately five acres of the area would be covered to allow temporary storage and/or solidification of the sediment in inclement weather and to segregate non-contact runoff/stormwater from the contaminated material.

The handling of the sediment at the process area would generate a small amount of contaminated water. Flow is estimated to be 50 gallons per minute (gpm), and it is assumed this water would be treated in the Willis Avenue/Semet Ponds groundwater treatment plant. The water would be collected through catch basins and pipes around the perimeter of the covered area. Collected water would be conveyed to a transfer pump station and use the infrastructure constructed for the Harbor Brook/Wastebed B interim remediation measure (IRM), which will include a groundwater containment/collection and transfer system. Actual facility requirements, such as whether a separate transfer line would be used, would be determined during the design of the Harbor Brook/Wastebed B IRM. For this FS, it was assumed that a piping system and package pump station would be required, with an installed cost of $50,000.

For this FS, it was assumed that the incremental treatment operation and management (O&M) cost would be flow-proportional to the cost for advanced treatment as estimated for the on-site consolidation option, described in Section K.4 of this appendix. The incremental O&M cost is estimated at $130,000 per year, or $0.018 per gallon treated.

Non-contact runoff would be collected and diverted to the lake through a separate storm water collection system.

A detailed cost estimate for construction of the bulkhead and process area is presented in Table K.8.

K.3.1.2 Barge Offloading, Sediment Solidification, and Load-out

Offloading from sediment transport barges and truck transport to the process area is addressed as part of the offloading, solidification, and load-out costs in Table K.9. As described above, approximately 2,100 CY/day would be dredged and transferred to the process area. A crane equipped with a clamshell bucket would be staged at the bulkhead to remove the dredged sediment from the barges and place it in trucks.

The solidification activities were estimated based on the assumption that the fine-grained sediments could be solidified with addition and mixing of 10 percent lime by volume. It is estimated that solidification would increase the daily volume of the sediment from 2,100 CY to 2,400 CY. The solidification agent type and volume would be determined in the remedial design stage. Lime would be mixed into the sediments by two mixing crews. In addition, one front-end loader would be required to support both mixing crews by moving lime and other materials, and by assisting with loading solidified material out to trucks. Each mixing crew would consist of a bulldozer, a front-end loader, and a water truck. This crew would also load each day's mixed material into trucks for off-site disposal. It is assumed that these two crews combined can solidify the daily volume of sediments.

Management and quality control would consist of a full-time superintendent and two engineers (one field engineer and one laboratory engineer). It is assumed that the solidified material would only be tested for pass/fail of the paint filter liquid test. Table K.9 presents a detailed cost estimate for offloading, solidification, and load-out.

K.3.2 OFF-SITE SEDIMENT MANAGEMENT FOR DREDGING/SEDIMENT MANAGEMENT OPTION 4

For dredging/sediment Option 4 – Hydraulic Dredging and Off-site Disposal, sediment from the hydraulic dredge must be dewatered and solidified prior to placement in trucks for off-site disposal. As opposed to Option 1 – Hydraulic Dredging and On-site Consolidation in an SCA and as estimated for Option 3 – Mechanical Dredging and On-site Consolidation in an SCA, the number of hydraulic dredges is limited to one dredge for all volume scenarios, due to constraints on trucking and landfill acceptance.

The following tasks are needed to implement this scenario:

- Construction of the processing area, including cover system and water transfer system
- Construction of a mechanical dewatering system
- Operation of the mechanical dewatering system
- Solidification with lime (10 percent) and load-out of the stabilized sediment into trucks
- Transport to and disposal at off-site commercial non-hazardous waste landfill

The costs for major tasks in this process are described below.

K.3.2.1 Process Area Construction

The process area is the same as described for Option 2 in Subsection K.3.1.1, since approximately the same volume of sediment would require solidification. However, the bulkhead for barge unloading included in the costs for Option 2 is not included, since it is assumed that the hydraulically-dredged sediments can be transferred to the process area in this scenario at minimal cost. The process area is assumed to be an asphalt-lined area that slopes from its center to the edges. The use of asphalt over the process area would create a durable and relatively impermeable layer for operation of process/solidification equipment. Other materials could be used in place of asphalt, but additional maintenance would be required. The process area would be constructed by grading and soil import for site preparation followed by finish grading and application of asphalt paving. An estimated 20-acre paved area is included in the cost estimate. Additionally, approximately five acres of the area would be covered to allow temporary storage and/or solidification of the sediment in inclement weather and to segregate non-contact runoff/stormwater from the contaminated material.

A detailed cost estimate for construction of the process area is presented in Table K.10.

K.3.2.2 Mechanical Dewatering System Construction

As discussed in Appendix L, dredging issues, hydraulic dredging requires large volumes of water to dilute the *in situ* sediments to a hydraulically transportable density. For Option 4, a mechanical process removes that water from the sediments. A preliminary design of a mechanical dewatering system to operate at 4,500 gpm continuous flow for 24 hours a day discussed below.

The mechanical dewatering system consists of the following equipment:

Equalization Tanks: A seven-million-gallon tank with mixers would be constructed to provide for equalization capacity to accommodate surge flows from the dredging operation.

Hydrocyclone: The hydrocyclone would separate sand from the slurry. The hydrocyclone system would consist of the hydrocyclone, the classifier, a feed pump, and a slurry pump.

Primary Clarifier: The primary clarifier would remove fines from the slurry.

Belt Filter Press: The belt filter press would be used to remove water from the sludge separated by the primary clarifier. The system would be skid mounted and includes slurry feed pump, emulsion polymer feed system, air compressor, belt wash booster pump, and controls in the skid.

Additional tanks: Additional tanks would be required to store sludge and water from the belt filter press and decant water from the primary clarifier.

Additional equipment: Additional equipment would include pumps (solids transfer pumps and decant water pumps), piping and fittings, and electrical and instrumentation.

A detailed cost estimate for construction of the mechanical dewatering system is presented in Table K.11.

K.3.2.3 Mechanical Dewatering System Operation

Costs for mechanical dewatering system operation include polymer usage, electrical power, and labor. Costs, estimated at $0.00021 per gallon, are presented in Table K.12. Water collected from the mechanical separation system would be pumped to the water treatment system for treatment and disposal. Water treatment costs are discussed in Section K.4 of this appendix.

K.3.2.4 Sediment Solidification and Load-out

It is assumed that the hydraulically-dredged sediments can be transferred to the process area in this scenario at minimal cost. The solids portion of the sediments would be separated from water as described in Subsections K.3.2.2 and K.3.2.3; however, it is estimated that the sediments would require solidification to be suitable for off-site transportation and disposal. The solidification activities were estimated based on the assumption that the fine-grained sediments could be solidified with addition and mixing of 10 percent lime by volume. It is estimated that addition of lime would increase the daily volume of the sediment from 2,100 CY to 2,400 CY. The solidification agent type and volume would be determined in the remedial design stage. Lime would be mixed into the sediments by two mixing crews. In addition, one front-end loader would be required to support both mixing crews by moving lime and other materials and by assisting with moving solidified material to trucks. Each mixing crew would consist of a bulldozer, a front-end loader, and a water truck. This crew would also load each day's mixed material into trucks for off-site disposal. It is assumed that these two crews combined can solidify the daily volume of sediments.

Management and quality control would consist of a full-time superintendent and two engineers (one field engineer and one laboratory engineer). It is assumed that the solidified material would only be tested for pass/fail of the paint filter liquid test. Table K.13 presents a detailed cost estimate for solidification and load-out.

K.3.3 OFF-SITE TRANSPORTATION AND DISPOSAL

K.3.3.1 Off-site Transportation and Disposal Summary

Table K.14 presents five potential off-site disposal locations for sediment removed from Onondaga Lake. These locations were selected based on proximity to the site and available capacity. The table includes location information, transportation and disposal costs, and current capacities. Table K.15 provides the basis for the transportation costs in Table K.16.

Because of landfill capacity issues, the selected off-site disposal facility depends on the removal volume. In addition, because of permitted daily rates for off-site facilities, it is assumed herein that the dredge production rate would have an upper bound of 2,100 *in situ* cubic yards per day, which corresponds to approximately 2,400 CY (3,400 tons) of solidified sediment. It should be noted that the ability of a facility to accept sediment from Onondaga Lake in the future was based on current daily capacity, total available capacity (permitted and/or constructed), and current committed capacity (if available). In addition, the ability of a facility to commit a substantial portion of its capacity over extended periods was considered when evaluating how many facilities might be required for a given removal volume.

For sediment dredging volumes of 100,000 CY, 500,000 CY, and 1,000,000 CY, it is assumed that 50 percent of the sediment would go to High Acres Landfill and 50 percent would go to Niagara Falls / Pine Avenue Landfill. The use of these two landfills is based on current available daily capacity along with transportation and disposal costs for each landfill. The combined estimated cost for transportation and disposal for these volume scenarios is $63 per ton.

For dredging 10,000,000 CY of sediment, in-state landfills surveyed currently do not have sufficient capacity to accept the total volume of sediment anticipated under this scenario. Therefore, it is assumed that 50 percent of the sediment would be transported to American Landfill and 50 percent would go to Atlantic Waste Disposal. American Landfill in Waynesburg, Ohio, currently has 8,500,000 CY of total capacity; however, they have a permit pending for an additional 85,000,000 CY. Atlantic Waste Disposal in Waverly, Virginia, currently has total capacity of 104,000,000 CY. The average transportation and disposal cost for this scenario, based on a 50/50 split, is $98 per ton.

A summary of the total transportation and disposal costs for the four volume scenarios is provided in Table K.16. The estimate assumes truck transportation of sediment to the noted landfills. A detailed evaluation of trucking versus rail transportation is provided below. The evaluation concludes that trucking is a more economical transportation method. The actual transportation method would be selected by the dredging contractor, as transportation is very market-sensitive and the contractor may be able to develop a transportation concept that favors rail shipping at the time of implementation.

K.3.3.2 Detailed Evaluation of Transportation Options (Trucking versus Rail)

Access to Existing Rail Lines

There are several rail lines adjacent to or in the immediate area of Onondaga Lake. An active CSX rail line passes near the edge of Wastebed B; however, no spur is located in the area between the existing rail line and the lakeshore. Wastebed B was identified as the staging/solidification location for the off-site disposal option because of its proximity to the lakeshore. A construction estimate of approximately $60 to $100 per linear foot of spur was obtained from US Ecology, Inc.

There are several potential issues associated with the installation of a spur in this location that could impact its viability and cost. The geotechnical properties of Wastebed B are not fully known. However, given that the area is comprised mostly of Solvay waste, additional investigation of the area and/or structural considerations for the railroad spur would likely be necessary, potentially increasing the cost of installation considerably and decreasing the feasibility. In addition, the installation of a spur would need to be approved by CSX. Since the line near Wastebed B is an active line, any potential interruption of current rail traffic would need to be carefully coordinated with CSX to obtain a permit and their cooperation. Additionally, the spur would need to cross non-Honeywell property for connection to the main line. As a result, Honeywell would need to negotiate access rights and rights-of-way with all interested property owners. Costs for these activities were not included in the current cost estimate.

Rail spurs currently exist on the Matlow property, immediately adjacent to the Linden Chemicals and Plastics OU-1 Site, and at the Solvay Paper Company, located on Milton Avenue in Solvay, New York. A spur also exists, or previously existed, on the Willis Avenue Plant Site. A preliminary assessment of the feasibility of using these spurs indicated that it may be possible to negotiate their use. However, again, costs associated with negotiations and any fees involved were not included in this estimate.

Rail Infrastructure Requirements

To use rail for offsite disposal, the dredged material must be transported to a rail loading area. Since this area does not currently exist, one would need to be constructed, along with necessary infrastructure. The rail loading area would require sufficient area to allow the staging of rail cars, stockpiling of dredged materials, and loading of rail cars. A design would be required to determine the track length required to stage the rail cars for loading and the area required for containment and loading of stockpiled dredged material.

It was assumed that it would be difficult and costly to negotiate the access rights needed to construct a rail spur on Wastebed B and that it would be more economical to use one of the existing spurs. This would require the dredged material to be transported from the dredge site to a material handling facility, where it would be dried and loaded onto trucks for transport to the potential rail loading area. It was estimated that this double handling would increase the off-site disposal costs by an estimated $8 per CY.

The estimated cost associated with construction of a rail spur, loading facility, and decontamination area for the Hudson River PCBs Project was nearly $1,000,000. This cost was not estimated for Onondaga Lake, since even without the cost of this necessary rail infrastructure, trucking was determined to be more cost effective, as described below.

Transportation and Disposal Cost Evaluation

Several facilities across the United States were considered for off-site disposal of dredged materials. Primary selection was based on proximity to the site and available capacity, as described in Subsection 4.12.2 of the FS.

After primary selection, the cost of transportation and disposal by truck and by rail were calculated for each facility. Costs for transportation by rail were only calculated for those facilities that have the capability to accept rail loads in gondolas, as opposed to intermodal containers. A typical gondola rail car has a capacity of 100 tons, while a rail car carrying intermodal containers has a capacity of only 75 tons. Additionally, intermodal containers would have to be trucked to the disposal facility from a nearby rail yard. Costs for transportation by truck are presented in Table K.15 and costs for transportation by rail are presented in Table K.17.

The ability to accept waste by rail in this manner is a limiting factor for selection of potential landfills. Of the "local" landfills, only Pine Avenue Landfill in Niagara Falls indicated they could receive waste by rail. Further investigation of train availability indicated current potential service by one or two trains per week. Thus, to utilize this facility would require construction of a significant rail car demurrage facility at the loading point (as noted, assumed to be Wastebed B). For this FS, it was assumed that this is not a practical concept due to space limitations and uncertainty of the subsurface material stability. Accordingly, for the FS, it is assumed that no local facilities are available for rail transport of waste. It should be noted that it may be possible for a waste broker to arrange a more frequent rail service that could service the Pine Avenue Landfill and this transportation method can be revisited at the time of implementation bidding, if off-site disposal is ultimately selected as part of the lake-wide remedy. However, the uncertainties involved in the rail service and thus required demurrage facilities preclude assumed use of rail transport to a local landfill in the FS evaluations.

Disposal costs were obtained directly from the disposal facilities. Trucking costs were based on information provided by Tonawanda Tank Transport, Inc. In general, trucking costs were estimated at $3 per loaded mile, including a 10% fuel surcharge, and $50 linear charge per load. This equaled an average cost of transportation of approximately $0.18 per ton-mile.

Rail transportation costs are, in all cases, a negotiated price. There are several factors that can impact the negotiations, including volume of material hauled, hauling distance, loading and unloading facilities, and other factors (e.g., potential for hauling alternate materials on the return trip). Due to the uncertainties of these factors at this stage of the project, estimated rail costs are of limited accuracy until engaging in actual negotiations. In addition, many rail carriers that were contacted declined to provide any pricing at this time. One preliminary quote was obtained for rail transportation to Pine Avenue Landfill. Therefore, in the absence of quotes for other facilities, an estimated cost of $0.06 per ton-mile was obtained from similar projects using rail transportation. The resulting rail costs were comparable to the $55 per ton estimate provided in the Hudson River PCBs Reassessment RI/FS Phase 3 Report prepared by TAMS for the USEPA in December 2000. On a per mile transported cost basis (for long distances), rail is approximately 1/3 the cost of truck transport. However, the next step of the evaluation was to calculate the total transportation cost considering haul distance along with the cost of infrastructure and loading to compare costs on a common basis.

Table K.17 shows the estimated transportation and disposal costs for disposal facilities known to have direct rail offloading capabilities. The quoted cost for rail transport to Pine Avenue Landfill was higher than the estimated trucking cost. The estimated costs for transportation and disposal at the EQ-Wayne Disposal Inc. facility in Belleville, Michigan, and at the Lee County Landfill in Bishopville, South Carolina, are comparable to trucking and disposal to one of the three local facilities, and comparable to the Hudson River PCBs Project. However, the rail costs do not include the cost of the rail infrastructure requirements. With these additional costs, the two lowest overall cost transportation and disposal options remain trucking to two local facilities.

K.3.4 SUMMARY OF OFF-SITE SEDIMENT MANAGEMENT

Table K.18 presents a summary of the costs for off-site management via Option 2 – Mechanical Dredging and Off-site Disposal of the dredged sediments for the four volumes evaluated: 100,000 CY, 500,00 CY, 1,000,000 CY, and 10,000,000 CY. Dredging durations associated with these four volumes are also provided in the table.

Table K.19 presents a summary of the costs for off-site management via Option 4 – Hydraulic Dredging and Off-site Disposal of the dredged sediments for the four volumes evaluated: 100,000 CY, 500,00 CY, 1,000,000 CY, and 10,000,000 CY. Dredging durations associated with these four volumes are also provided in the table.

Table K.20 compares the total costs for sediment management for Option 2 versus Option 4. For the example volumes between 100,000 and 1,000,000 cubic yards, Option 2 is the most cost-effective dredging and sediment management combination for off-site disposal. Costs for Options 2 and 4 become closer on a percentage basis with increasing dredged volume.

SECTION K.4

SUPERNATANT TREATMENT FOR THE ON-SITE MANAGEMENT OPTION

This section describes the cost of treatment of supernatant resulting from on-site consolidation of sediments in a SCA. This evaluation considers five levels of treatment.

K.4.1 INFLUENT FLOW RATES

For the one-dredge scenario (100,000 CY, on-site SCA), the average dredge work day (16 hr) dredging rate is 150 CY per hour, based on a one-dredge crew. As presented in Table K.1, the amount of water in the slurry per CY of sediment dredged is estimated at 1,295 gallons per CY. Therefore, the one-dredge scenario generates approximately 3,109,000 gallons of water per day.

For the two-dredge scenarios (500,000 and 1,000,000 CY, on-site SCA), the average dredge work day (16 hr) dredging rate is 300 CY per hour, based on a two-dredge crew. As presented in Table K.1, the amount of water in the slurry per CY of sediment dredged is estimated at 1,295 gallons per CY. Therefore, the two-dredge scenario generates approximately 6,218,000 gallons of water per day.

For the four-dredge scenario (10,000,000 CY, on-site SCA), the average dredge work day (16 hr) dredging rate is 600 CY per hour, based on a four-dredge crew. As presented in Table K.1, the amount of water in the slurry per CY of sediment dredged is estimated at 1,295 gallons per CY. Therefore, the four-dredge scenario generates approximately 12,435,000 gallons of water per day.

The water treatment options discussed below were evaluated for a flow rate of 4,500 gpm to be treated on a 24-hour basis, or a daily capacity of 6,480,000 gallons. For the four-dredge (10,000,000 CY) scenario, the 4,500 gpm treatment systems presented in the estimates must be sized up by a factor of two to a 9,000 gpm system capable of treating 12,960,000 gallons per day. The six-tenths rule, a commonly-used industry standard that incorporates the efficiency of size, was used to calculate the cost of constructing this system. The rule applies an exponential six-tenths (0.60) to the multiple of increased flow, in this case 2.0, to yield a cost factor for the expanded system, in this case 1.52. This calculation is valid for the capital costs only.

K.4.2 SUPERNATANT WATER TREATMENT OPTIONS

The five considered treatment levels/options are described below. The actual treatment train will be based on information collected during pre-design sampling and treatability testing and established effluent limits.

Option A: Primary Treatment: This treatment consists of primary solids removal in a SCA. Details regarding a SCA are provided in Section K.2 of this appendix. Cost information is not included for this treatment option.

Option B: Enhanced Primary Treatment: This treatment train consists of primary treatment plus addition of flocculant and clarification for further suspended solids removal.

Option C: Enhanced Primary Treatment with Multimedia Filtration: This treatment train consists of enhanced primary treatment plus multimedia filtration for further suspended solids removal and partial volatile organic compounds (VOCs) removal.

Option D: Advanced Treatment: This treatment train consists of enhanced primary treatment with multimedia filtration plus air stripping and granular activated carbon (GAC) treatment for additional VOC removal. This option would include pH adjustment for chemical precipitation prior to the flocculation/clarification process to maximize mercury removal. Evaluation of an advanced treatment option in the pre-design treatability testing stage will include consideration of the sulfide precipitation method, as well as other mercury removal technologies.

Option E: Enhanced Primary Treatment Plus Organics Removal: This treatment option is focused on practical achievement of organics removal. The treatment train consists of enhanced primary treatment plus GAC treatment for additional VOC removal. Option E would provide a level of anticipated effluent quality between Options C and D. However, for clarity, this option is not shown between Options C and D as Options A through D build sequentially on a common treatment train.

The following subsections describe the process configuration and unit sizing and treatment efficiencies.

K.4.3 PROCESS CONFIGURATION AND UNIT SIZING

The supernatant water treatment system is designed to operate at 4,500 gpm continuous flow for 24 hours a day. Two treatment trains, each sized for 2,250 gpm, are proposed for all five options to treat this flow. Each of the proposed treatment steps are discussed below in more detail.

SCA (all options): SCA requirements are described in Section K.2 of this appendix. The SCA is designed with sufficient capacity to allow a detention time of 36 hours, which would allow heavier solids to settle out. The SCA would also act as an equalization basin.

Tanks and Pumps (all options): Several storage and pumping steps are envisioned, as provided in the process schematic. However, the actual number of these steps cannot be determined until a hydraulic profile is developed, which would depend on the topography of that area. In general, centrifugal pumps are assumed for the liquid service, and positive displacement type pumps (e.g., diaphragm pumps) are assumed for solids service.

Rapid Mix Tank/Flocculator (Options B, C, D, and E): A flocculation/clarification step following the initial solids removal would remove finer particulates and other insoluble particulates. The flocculation step is often accomplished in a secondary settling basin constructed within a SCA. This configuration would be evaluated during SCA design. However, for this evaluation and cost estimate, it is assumed that a coagulant and a flocculant would be added at the rapid mix/flocculator tank. The chemical addition is intended to flocculate colloidal solids and finer particulates in the secondary clarifier following rapid mixing and flocculation.

In the advanced treatment option (Option D), a pH adjustment step was included prior to rapid mixing to raise pH to the level where soluble metals (including mercury) would form an insoluble hydroxide that can be precipitated for additional removal.

Secondary Clarifier (Options B, C, D, and E): As noted above, secondary clarification may be performed in a secondary basin within the SCA. However for this cost estimate, flocs generated via the previous step would be settled using an inclined plate clarifier. The inclined plate clarifier would be sized between 0.25 gpm/ft^2 and 0.5 gpm/ft^2 hydraulic loading rates. Removed solids would be returned to the SCA.

Multimedia Filters (Options C and D): Filtration would be included to further remove particulates. Multimedia filters, which incorporate activated carbon, are recommended to facilitate removal of VOCs, total suspended solids (TSS), and mercury in a single step. Two units operating in parallel would allow continuous operation during backwashing. The multimedia filters would provide some adsorption of the organic compounds, although not to the degree provided by carbon absorption vessels.

Air Stripper (Option D): The effluent from the filters would be stripped for further removal of the VOCs. No information is available on the expected influent ammonia concentrations in the samples that were provided as representative samples. For this conceptual design, it is assumed that ammonia treatment would not be required, and also that treatment of the stripper off-gases would not be required. This is based on the assumption that the Syracuse area is not a non-attainment area for VOCs.

GAC Adsorption (Options D and E): These units are included for additional VOC and mercury removal. Two units would be operated in parallel to allow continuous operation during change out. Each unit would consist of two 10-ft diameter adsorbers, each containing approximately 10,000 pounds of GAC. It is expected that the media inside the units would need to be changed once a year.

Option E – Enhanced Primary Treatment plus Organics Removal may need a sand filter ahead of GAC adsorption. This filtration process is not included in the cost estimate for this process.

Final Effluent Discharge (All Options): Two final effluent holding tanks are provided. In case any off-specification water is produced, one of the two tanks can be used as a holding tank to recycle the water back to the front of the plant for further treatment. It is assumed that no pH adjustment of the final effluent would be needed, as the effluent pH is expected to be less than 9.

Site Preparation and Area Paving (All Options): It is assumed that the plant would be located at a field site, so the entire area would be paved. The process units would be skid mounted and would be above grade; hence the area paving would provide secondary containment by means of berms. It is assumed that no contamination would be encountered during site preparation and excavation that would require any special handling or disposal. Any required clearing or grubbing is assumed to be addressed in the construction of the SCA.

Electrical and Instrumentation (All Options): It is assumed that power would be available in the proposed plant area and that a new substation would not be required. The level of instrumentation could vary greatly, depending on client preference and the need to control the process. It is assumed that the instrumentation required would be consistent with a normal wastewater treatment facility, with a combination of field-mounted and locally controlled instruments and some remote capabilities.

K.4.4 SUPERNATANT WATER TREATMENT COSTS

Capital costs associated with construction of the supernatant water treatment systems are presented in Tables K.21 through 24**.** These costs were developed by scaling up 2,000 gpm systems to 4,500 gpm systems using the six-tenths rule (see Subsection K.4.1). In developing these costs, Parsons used vendor quotes for major equipment items, estimating guides, and professional judgment based on design and construction of similar systems for line items such as piping, electrical, and instrumentation. In addition to an internal review of the proposed treatment options and cost estimates, Parsons had O’Brien & Gere Engineers, Inc. of East Syracuse review the information.

The capital costs for the 9,000 gpm treatment system (for the 10,000,000 CY volume scenario) were estimated by applying the sixth-tenths rule to the 4,500 gpm system construction costs. Operating costs for the water treatment systems are provided in Table K.25.

A major cost element for the operation of the advanced treatment system is the caustic to raise the pH for metals precipitation. If metals removal to this level is not required, the operating cost for the advanced treatment system would be significantly reduced.

Table K.26 presents a summary of supernatant treatment costs, including construction and operating costs.

SECTION K.5

SEDIMENT MANAGEMENT COST SUMMARY

Table K.27 presents a summary of the estimated sediment management costs for options 1 (Hydraulic Dredging and On-site Consolidation in an SCA), 2 (Mechanical Dredging and Off-site Disposal), and 4 (Hydraulic Dredging and Off-site Disposal). Option 3 was demonstrated to be not cost effective in Section K2.5.2. Option 1 is the most cost-effective sediment management option.

SECTION K.6

REFERENCES

Harrington Engineering and Construction, Inc. 2003. *2002 Settling Study, Onondaga Lake*. Chesterton, Indiana.

U.S. Army Corps of Engineers. 1987. *Engineering and Design – Confined Disposal of Dredged Material*. Publication EM 1110-2-5027, CECW-EH-D.

APPENDIX K

TABLES

TABLE K.1
HYDRAULIC SLURRY CHARACTERISTICS
FOR ONE 14-INCH HYDRAULIC DREDGE

Parameter	Unit	Value	
Water Content *In Situ*		100.0%	Input from Settling Study
Gs of Solids		2.48	Input from Settling Study
Ps of Slurry (Ws / Wt)		10.0%	Assumed Input
Dredge Size	in	14	Assumed Input
Pumping Velocity	fps	10	Assumed Input
Efficiency of Dredging		70%	Assumed Input
Slurry Volume Rate	gpm	4,798	Unit Conversion
Slurry Volume Rate w/efficiency factor	gpm	3,358	Slurry Volume Rate * Efficiency
Slurry Volume Rate	cf/hr	38,485	Area * Velocity
Slurry Density	pcf	66.4	Function of Gs of solids and Ps of Slurry
Slurry Mass Rate	lb/hr	2,553,840	Flow Rate in CF/HR * Density
Solids Mass Rate	lb/hr	255,384	Slurry Mass Rate * Ps
Solids Volume Rate	cf/hr	1,650	Unit Conversion
Solids Volume Rate	ga/hr	12,344	Unit Conversion
Solids Volume Rate	gpm	206	Unit Conversion
Water Mass Rate	lb/hr	2,298,456	Slurry Mass Rate - Solids Mass Rate
Water Volume Rate	cf/hr	36,834	Unit Conversion
Water Volume Rate	ga/hr	275,520	Unit Conversion
Water Volume Rate	gpm	4,592	Unit Conversion
In Situ Total Mass Rate	lb/hr	510,768	Solid Mass Rate + Solids Mass Rate * Water Content of *In Situ*
In Situ Density	pcf	88.9	Function of Gs of Solids and Water Content of of *In Situ*
In Situ Volume Rate	cf/hr	5,743	*In Situ* Total Mass Rate/ Insitu Density
In Situ Removal	cy/hr	213	Unit Conversion
Water per CY *In Situ*	ga/cy	1,295	Water Mass Rate / *In Situ* Removal
Actual *In Situ* Removal Rate	cy/hr	149	Efficiency * *In Situ* Removal Rate

TABLE K.2
SCA VOLUME REQUIREMENTS

Property	***In Situ***	**SCA** [2]
Volume (CY)	100,000	127,675
Water Content (%) (Ww/Ws)	100% [1]	139%
Specific Gravity of Solids	2.48 [1]	2.48 [1]
Void Ratio	2.5	3.5 [1]
Unit Weight (PCF)	88.8	83.2
Total Weight (TN)	119,880	143,324
Water Weight (TN)	59,940	83,384
Water Volume (Mgal)	14,369	19,989
Solids Weight (TN)	59,940	59,940
Weight Percent Solids (%) (Ws/Wt)	50.0%	

Notes:
(1) from Settling Tests, Harrington Engineering & Construction, Inc., January 2003
(2) hydraulically-dredged bulked *in situ* sediment in SCA

TABLE K.3a
SCA CONSTRUCTION COSTS - 100,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Construct SCA	12	AC	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Dike Construction											
Project Manager	504	HR	134				67,536	0	0	0	67,536
Superintendent	1,008	HR	100				100,800	0	0	0	100,800
Operator	9,072	HR	40				359,523	0	0	0	359,523
Laborer	2,016	HR	28				56,146	0	0	0	56,146
Engineer	1,008	HR	68				68,544	0	0	0	68,544
Survey Crew	403	HR				126	0	0	0	50,630	50,630
D6 Bulldozer	2,016	HR		41			0	83,200	0	0	83,200
330 Excavator	2,016	HR		58			0	115,940	0	0	115,940
815 Compactor	2,016	HR		30			0	61,387	0	0	61,387
Dump Truck	2,016	HR		54			0	109,126	0	0	109,126
Water Truck	1,008	HR		16			0	15,684	0	0	15,684
Fuel	45,360	GA			1.5		0	0	68,040	0	68,040
Soil	125,138	CY			7.31		0	0	914,756	0	914,756
Per Diem	2,822	DY	109				307,642	0	0	0	307,642
Finish Grading											
Superintendent	97	HR	100				9,703	0	0	0	9,703
Operator	194	HR	40				7,691	0	0	0	7,691
Laborer	97	HR	28				2,702	0	0	0	2,702
815 Compactor	97	HR		30			0	2,955	0	0	2,955
140G Motor Grader	97	HR		41			0	3,959	0	0	3,959
Fuel	970	GA			1.5		0	0	1,455	0	1,455
Per Diem	68	DY	109				7,403	0	0	0	7,403

TABLE K.3a
SCA CONSTRUCTION COSTS - 100,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Construct SCA (continued)	1	AC	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Liner System, from bottom to top											
Geomembrane	0	SF				0.60	0	0	0	0	0
Superintendent	313	HR	100				31,309	0	0	0	31,309
Operator	626	HR	40				24,815	0	0	0	24,815
Laborer	313	HR	28				8,720	0	0	0	8,720
815 Compactor	313	HR		30			0	9,534	0	0	9,534
D6 Bulldozer	313	HR		41			0	12,921	0	0	12,921
Per Diem	219	DY	109				23,889	0	0	0	23,889
Sand	39,136	CY			7.31		0	0	286,084	0	286,084
HDPE Pipe	500	LF			13.81		0	0	6,905	0	6,905
Freight	1	LS			1,000.0		0	0	1,000	0	1,000
Gravel Road	2,995	LF			39.15		0	0	117,260	0	117,260
Monitoring Wells	15	EA				5135.38	0	0	0	77,031	77,031
TOTAL							1,076,423	414,706	1,395,501	127,661	3,014,290
Overhead	10%						107,642	41,471	139,550	12,766	301,429
G&A, Profit	8%						94,725	36,494	122,804	11,234	265,258
TOTAL							1,278,790	492,671	1,657,855	151,661	3,580,977

Remedial Design (4%)	143,239
Construction Management (4%)	143,239
Project Management (3%)	107,429
Contingency (25%)	993,721
Total	4,968,605

TABLE K.3a
SCA CONSTRUCTION COSTS - 100,000 CY DREDGE VOLUME

Basis of Estimate:

DIKE CONSTRUCTION

Location	perimeter (LF)	Volume (cy)	Source
office area:	na	2,000	plug
laydown yard:	na	2,000	plug
SCA:	2,995	80,758	
two interior dikes:	1,498	40,379	
	Total Volume:	125,138	cy

dike height: 14

area per lf of height shown above with 3:1 side slopes and 10' wide top: 728 cf/lf

Fill can be placed at 1000 CY per day

Therefore, duration is 126 DA = 1008 HR = 6 MO

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Project Manager	1	0.5	1,008	504
Superintendent	1	1	1,008	1,008
Operator	9	1	1,008	9,072
Laborer	2	1	1,008	2,016
Engineer	1	1	1,008	1,008
Surveyor	2	0.2	1,008	403
D6 Bulldozer	2	1	1,008	2,016
330 Excavator	2	1	1,008	2,016
815 Compactor	2	1	1,008	2,016
Dump Truck	2	1	1,008	2,016
Water Truck	1	1	1,008	1,008

Item	# people	w/e factor	Dur in DA	Total DA
per diem	16	1.4	126	2,822

FINISH GRADING

area:	528,336	SF
area:	12	AC
production per day:	1	AC
Number days:	12	DA
HRs per day:	8	HR
Total HR:	97	HR

CREW DEFINITION				
Item	Number	Usage	Duration HRs	Total HRs
Superintendent	1	1	97	97
Operator	2	1	97	194
Laborer	1	1	97	97
815 Compactor	1	1	97	97
140G Motor Grader	1	1	97	97

Item	# people	w/e factor	Dur in DA	Total DA
per diem	4	1.4	12	68

TABLE K.3a
SCA CONSTRUCTION COSTS - 100,000 CY DREDGE VOLUME

Basis of Estimate (continued):
LINER SYSTEM

Area from "Volume Sheet":	528,336	SF =	12	AC
Sand layer depth	2	FT		
Sand volume	39,136	CY		
Placement Rate:	1,000	CY/DA		
# days:	39	DA		
HR/DA:	8	HR		
Total HRs:	313	HR		

CREW DEFINITION				
Item	Number	Usage	Duration HRs	Total HRs
Superintendent	1	1	313	313
Operator	2	1	313	626
Laborer	1	1	313	313
815 Compactor	1	1	313	313
D6 Bulldozer	1	1	313	313

Item	# people	w/e factor	Dur in DA	Total DA
per diem	4	1.4	39	219

geosynthetics in liner? n
area of geosynthetics: 0

Assumed 500 LF of piping needed for leachate collection

MONITORING WELLS

Perimeter	2,995	LF
assume one Monitoring Well every	200	LF of perimeter
Therefore,	15	Monitoring Wells are needed

TABLE K.3a
SCA CONSTRUCTION COSTS - 100,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Preloading	1	LS	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Preloading											
Project Manager	49	HR	134				6,590	0	0	0	6,590
Superintendent	492	HR	100				49,177	0	0	0	49,177
Operator	984	HR	40				38,978	0	0	0	38,978
Laborer	492	HR	28				13,696	0	0	0	13,696
Engineer	492	HR	68				33,441	0	0	0	33,441
Survey Crew	49	HR				126	0	0	0	6,175	6,175
D6 Bulldozer	492	HR		41			0	20,295	0	0	20,295
Water Truck	492	HR		16			0	7,652	0	0	7,652
Fuel	4,918	GA			1.5		0	0	7,377	0	7,377
Per Diem	683	DY	109				74,469	0	0	0	74,469
Soil	122,943	CY			7.31		0	0	898,716	0	898,716
TOTAL							216,350	27,947	906,093	6,175	1,156,566
Overhead	10%						21,635	2,795	90,609	618	115,657
G&A, Profit	8%						19,039	2,459	79,736	543	101,778
TOTAL							257,024	33,202	1,076,438	7,336	1,374,000

Remedial Design (4%)	54,960
Construction Management (4%)	54,960
Project Management (3%)	41,220
Contingency (25%)	381,285
Total	1,906,425

Basis of Estimate:

Preloading

preload:	502,950	SF	
sediment depth:	7	FT	
Volume of Preload Soil:	122,943	CY	
Rate of Import:	2,000	CY/DA	based on practical limit of truck traffic
# Days of Import:	61	DA	
Hours of Import:	492	HR	

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Project Manager	1	0.1	492	49
Superintendent	1	1	492	492
Operator	2	1	492	984
Laborer	1	1	492	492
Engineer	1	1	492	492
Surveyor	2	0.05	492	49
D6 Bulldozer	1	1	492	492
Water Truck	1	1	492	492
	0	1	492	0
	0	1	492	0

Item	# people	w/e factor	Dur in DA	Total DA
per diem	8	1.4	61	683

TABLE K.3a
SCA CONSTRUCTION COSTS - 100,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Stabilization under Dikes	1.00	LS	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Dike Subgrade Stabilization											
Dry Soil Mixing	139,815	CY				27.06	0	0	0	3,783,381	3,783,381
TOTAL							0	0	0	3,783,381	3,783,381
Overhead	10%						0	0	0	378,338	378,338
G&A, Profit	8%						0	0	0	332,938	332,938
TOTAL							0	0	0	4,494,657	4,494,657

Remedial Design (4%)	179,786
Construction Management (4%)	179,786
Project Management (3%)	134,840
Contingency (25%)	1,247,267
Total	6,236,336

Basis of Estimate:

DIKE SUBGRADE STABILIZATION

dike bottom area:	301,999	SF, from SCA sizing calc
Percentage dry soil mixed:	25.0%	based on estimate from Hayward Baker
Depth of Mixing:	50	FT, based on approximate depth of materials in Wastebeds
Volume of Mixing:	139,815	CY

TABLE K.3b

SCA CONSTRUCTION COSTS - 500,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Construct SCA	40	AC	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Dike Construction											
Project Manager	896	HR	134				120,064	0	0	0	120,064
Superintendent	1,792	HR	100				179,200	0	0	0	179,200
Operator	16,128	HR	40				639,153	0	0	0	639,153
Laborer	3,584	HR	28				99,814	0	0	0	99,814
Engineer	1,792	HR	68				121,856	0	0	0	121,856
Survey Crew	717	HR				126	0	0	0	90,009	90,009
D6 Bulldozer	3,584	HR		41			0	147,912	0	0	147,912
330 Excavator	3,584	HR		58			0	206,116	0	0	206,116
815 Compactor	3,584	HR		30			0	109,133	0	0	109,133
Dump Truck	3,584	HR		54			0	194,002	0	0	194,002
Water Truck	1,792	HR		16			0	27,884	0	0	27,884
Fuel	80,640	GA			1.5		0	0	120,960	0	120,960
Soil	223,116	CY			7.31		0	0	1,630,976	0	1,630,976
Per Diem	5,018	DY	109				546,918	0	0	0	546,918
Finish Grading											
Superintendent	316	HR	100				31,621	0	0	0	31,621
Operator	632	HR	40				25,063	0	0	0	25,063
Laborer	316	HR	28				8,806	0	0	0	8,806
815 Compactor	316	HR		30			0	9,629	0	0	9,629
140G Motor Grader	316	HR		41			0	12,901	0	0	12,901
Fuel	3,162	GA			1.5		0	0	4,743	0	4,743
Per Diem	221	DY	109				24,127	0	0	0	24,127

TABLE K.3b
SCA CONSTRUCTION COSTS - 500,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Construct SCA (continued)	1	AC	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Liner System, from bottom to top											
Geomembrane	0	SF				0.60	0	0	0	0	0
Superintendent	1,020	HR	100				102,030	0	0	0	102,030
Operator	2,041	HR	40				80,869	0	0	0	80,869
Laborer	1,020	HR	28				28,415	0	0	0	28,415
815 Compactor	1,020	HR		30			0	31,068	0	0	31,068
D6 Bulldozer	1,020	HR		41			0	42,108	0	0	42,108
Per Diem	714	DY	109				77,849	0	0	0	77,849
Sand	127,537	CY			7.31		0	0	932,298	0	932,298
HDPE Pipe	500	LF			13.81		0	0	6,905	0	6,905
Freight	1	LS			1,000.0		0	0	1,000	0	1,000
Gravel Road	5,418	LF			39.15		0	0	212,103	0	212,103
Monitoring Wells	28	EA				5135.38	0	0	0	143,791	143,791
TOTAL							2,085,785	780,751	2,908,986	233,799	6,009,321
Overhead	10%						208,579	78,075	290,899	23,380	600,932
G&A, Profit	8%						183,549	68,706	255,991	20,574	528,820
TOTAL							2,477,913	927,533	3,455,875	277,753	7,139,074

Remedial Design (4%)	285,563
Construction Management (4%)	285,563
Project Management (3%)	214,172
Contingency (25%)	1,981,093
Total	9,905,465

TABLE K.3b
SCA CONSTRUCTION COSTS - 500,000 CY DREDGE VOLUME

Basis of Estimate:

DIKE CONSTRUCTION

Location	perimeter (LF)	Volume (cy)	Source
office area:	na	2,000	plug
laydown yard:	na	2,000	plug
SCA:	5,418	146,077	
two interior dikes:	2,709	73,039	
	Total Volume:	223,116	cy

dike height: 14

area per lf of height shown above with 3:1 side slopes and 10' wide top: 728 cf/lf

Fill can be placed at 1000 CY per day

Therefore, duration is 224 DA = 1792 HR = 11 MO

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Project Manager	1	0.5	1,792	896
Superintendent	1	1	1,792	1,792
Operator	9	1	1,792	16,128
Laborer	2	1	1,792	3,584
Engineer	1	1	1,792	1,792
Surveyor	2	0.2	1,792	717
D6 Bulldozer	2	1	1,792	3,584
330 Excavator	2	1	1,792	3,584
815 Compactor	2	1	1,792	3,584
Dump Truck	2	1	1,792	3,584
Water Truck	1	1	1,792	1,792

FINISH GRADING

area:	1,721,755	SF
area:	40	AC
production per day:	1	AC
Number days:	40	DA
HRs per day:	8	HR
Total HR:	316	HR

CREW DEFINITION				
Item	Number	Usage	Duration HRs	Total HRs
Superintendent	1	1	316	316
Operator	2	1	316	632
Laborer	1	1	316	316
815 Compactor	1	1	316	316
140G Motor Grader	1	1	316	316

Item	# people	w/e factor	Dur in DA	Total DA
per diem	4	1.4	40	221

TABLE K.3b

SCA CONSTRUCTION COSTS - 500,000 CY DREDGE VOLUME

Basis of Estimate (continued):

LINER SYSTEM

Area from "Volume Sheet":	1,721,755	SF =	40	AC
Sand layer depth	2	FT		
Sand volume	127,537	CY		
Placement Rate:	1,000	CY/DA		
# days:	128	DA		
HR/DA:	8	HR		
Total HRs:	1,020	HR		

CREW DEFINITION				
Item	Number	Usage	Duration HRs	Total HRs
Superintendent	1	1	1,020	1,020
Operator	2	1	1,020	2,041
Laborer	1	1	1,020	1,020
815 Compactor	1	1	1,020	1,020
D6 Bulldozer	1	1	1,020	1,020

Item	# people	w/e factor	Dur in DA	Total DA
per diem	4	1.4	128	714

geosynthetics in liner?	n	
area of geosynthetics:	0	
Assumed	500	LF of piping needed for leachate collection

MONITORING WELLS

Perimeter	5,418	LF
assume one Monitoring Well every	200	LF of perimeter
Therefore,	28	Monitoring Wells are needed

TABLE K.3b

SCA CONSTRUCTION COSTS - 500,000 CY DREDGE VOLUME

				Unit Prices				Cost				
Preloading		1	LS	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Preloading												
Project Manager		248	HR	134				33,262	0	0	0	33,262
Superintendent		2,482	HR	100				248,227	0	0	0	248,227
Operator		4,965	HR	40				196,745	0	0	0	196,745
Laborer		2,482	HR	28				69,131	0	0	0	69,131
Engineer		2,482	HR	68				168,795	0	0	0	168,795
Survey Crew		248	HR				126	0	0	0	31,170	31,170
D6 Bulldozer		2,482	HR		41			0	102,443	0	0	102,443
Water Truck		2,482	HR		16			0	38,624	0	0	38,624
Fuel		24,823	GA			1.5		0	0	37,234	0	37,234
Per Diem		3,472	DY	109				378,448	0	0	0	378,448
Soil		620,568	CY			7.31		0	0	4,536,355	0	4,536,355
TOTAL								1,094,609	141,068	4,573,589	31,170	5,840,435
Overhead	10%							109,461	14,107	457,359	3,117	584,043
G&A, Profit	8%							96,326	12,414	402,476	2,743	513,958
TOTAL								1,300,395	167,588	5,433,423	37,030	6,938,437

Basis of Estimate:

Remedial Design (4%)	277,537
Construction Management (4%)	277,537
Project Management (3%)	208,153
Contingency (25%)	1,925,416
Total	9,627,081

Preloading

preload:	1,675,535	SF	
sediment depth:	10	FT	
Volume of Preload Soil:	620,568	CY	
Rate of Import:	2,000	CY/DA	based on practical limit of truck traffic
# Days of Import:	310	DA	
Hours of Import:	2,482	HR	

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Project Manager	1	0.1	2,482	248
Superintendent	1	1	2,482	2,482
Operator	2	1	2,482	4,965
Laborer	1	1	2,482	2,482
Engineer	1	1	2,482	2,482
Surveyor	2	0.05	2,482	248
D6 Bulldozer	1	1	2,482	2,482
Water Truck	1	1	2,482	2,482
	0	1	2,482	0
	0	1	2,482	0

Item	# people	w/e factor	Dur in DA	Total DA
per diem	8	1.4	310	3,472

TABLE K.3b
SCA CONSTRUCTION COSTS - 500,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Stabilization under Dikes	1.00	LS	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Dike Subgrade Stabilization											
Dry Soil Mixing	241,689	CY				27.06	0	0	0	6,540,096	6,540,096
TOTAL							0	0	0	6,540,096	6,540,096
Overhead	10%						0	0	0	654,010	654,010
G&A, Profit	8%						0	0	0	575,528	575,528
TOTAL							0	0	0	7,769,634	7,769,634

Remedial Design (4%)	310,785
Construction Management (4%)	310,785
Project Management (3%)	233,089
Contingency (25%)	2,156,073
Total	10,780,367

Basis of Estimate:

DIKE SUBGRADE STABILIZATION

dike bottom area:	522,048	SF, from SCA sizing calc
Percentage dry soil mixed:	25.0%	based on estimate from Hayward Baker
Depth of Mixing:	50	FT, based on approximate depth of materials in Wastebeds
Volume of Mixing:	241,689	CY

TABLE K.3c
SCA CONSTRUCTION COSTS - 1,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Construct SCA	80	AC	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Dike Construction											
Project Manager	1,248	HR	134				167,232	0	0	0	167,232
Superintendent	2,496	HR	100				249,600	0	0	0	249,600
Operator	22,464	HR	40				890,248	0	0	0	890,248
Laborer	4,992	HR	28				139,027	0	0	0	139,027
Engineer	2,496	HR	68				169,728	0	0	0	169,728
Survey Crew	998	HR				126	0	0	0	125,369	125,369
D6 Bulldozer	4,992	HR		41			0	206,020	0	0	206,020
330 Excavator	4,992	HR		58			0	287,090	0	0	287,090
815 Compactor	4,992	HR		30			0	152,006	0	0	152,006
Dump Truck	4,992	HR		54			0	270,217	0	0	270,217
Water Truck	2,496	HR		16			0	38,838	0	0	38,838
Fuel	112,320	GA			1.5		0	0	168,480	0	168,480
Soil	311,905	CY			7.31		0	0	2,280,026	0	2,280,026
Per Diem	6,989	DY	109				761,779	0	0	0	761,779
Finish Grading											
Superintendent	636	HR	100				63,606	0	0	0	63,606
Operator	1,272	HR	40				50,414	0	0	0	50,414
Laborer	636	HR	28				17,714	0	0	0	17,714
815 Compactor	636	HR		30			0	19,368	0	0	19,368
140G Motor Grader	636	HR		41			0	25,951	0	0	25,951
Fuel	6,361	GA			1.5		0	0	9,541	0	9,541
Per Diem	445	DY	109				48,532	0	0	0	48,532

TABLE K.3c

SCA CONSTRUCTION COSTS - 1,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Construct SCA (continued)	1	AC	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Liner System, from bottom to top											
Geomembrane	0	SF				0.60	0	0	0	0	0
Superintendent	2,052	HR	100				205,236	0	0	0	205,236
Operator	4,105	HR	40				162,670	0	0	0	162,670
Laborer	2,052	HR	28				57,158	0	0	0	57,158
815 Compactor	2,052	HR		30			0	62,494	0	0	62,494
D6 Bulldozer	2,052	HR		41			0	84,701	0	0	84,701
Per Diem	1,437	DY	109				156,595	0	0	0	156,595
Sand	256,545	CY			7.31		0	0	1,875,347	0	1,875,347
HDPE Pipe	500	LF			13.81		0	0	6,905	0	6,905
Freight	1	LS			1,000.0		0	0	1,000	0	1,000
Gravel Road	7,613	LF			39.15		0	0	298,050	0	298,050
Monitoring Wells	39	EA				5135.38	0	0	0	200,280	200,280
TOTAL							3,139,542	1,146,686	4,639,349	325,649	9,251,226
Overhead	10%						313,954	114,669	463,935	32,565	925,123
G&A, Profit	8%						276,280	100,908	408,263	28,657	814,108
TOTAL							3,729,776	1,362,263	5,511,547	386,871	10,990,456

Remedial Design (4%)	439,618
Construction Management (4%)	439,618
Project Management (3%)	329,714
Contingency (25%)	3,049,852
Total	15,249,258

TABLE K.3c
SCA CONSTRUCTION COSTS - 1,000,000 CY DREDGE VOLUME

Basis of Estimate:
DIKE CONSTRUCTION

Location	perimeter (LF)	Volume (cy)	Source
office area:	na	2,000	plug
laydown yard:	na	2,000	plug
SCA:	7,613	205,270	
two interior dikes:	3,807	102,635	
	Total Volume:	311,905	cy

dike height: 14
area per lf of height shown above with 3:1 side slopes and 10' wide top: 728 cf/lf

Fill can be placed at 1000 CY per day
Therefore, duration is 312 DA = 2496 HR = 16 MO

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Project Manager	1	0.5	2,496	1,248
Superintendent	1	1	2,496	2,496
Operator	9	1	2,496	22,464
Laborer	2	1	2,496	4,992
Engineer	1	1	2,496	2,496
Surveyor	2	0.2	2,496	998
D6 Bulldozer	2	1	2,496	4,992
330 Excavator	2	1	2,496	4,992
815 Compactor	2	1	2,496	4,992
Dump Truck	2	1	2,496	4,992
Water Truck	1	1	2,496	2,496
	0	1	2,496	0
	0	1	2,496	0

FINISH GRADING

area:	3,463,363	SF
area:	80	AC
production per day:	1	AC
Number days:	80	DA
HRs per day:	8	HR
Total HR:	636	HR

CREW DEFINITION				
Item	Number	Usage	Duration HRs	Total HRs
Superintendent	1	1	636	636
Operator	2	1	636	1,272
Laborer	1	1	636	636
815 Compactor	1	1	636	636
140G Motor Grader	1	1	636	636

Item	# people	w/e factor	Dur in DA	Total DA
per diem	4	1.4	80	445

TABLE K.3c
SCA CONSTRUCTION COSTS - 1,000,000 CY DREDGE VOLUME

Basis of Estimate (continued):

LINER SYSTEM

Area from "Volume Sheet":	3,463,363	SF =	80	AC
Sand layer depth	2	FT		
Sand volume	256,545	CY		
Placement Rate:	1,000	CY/DA		
# days:	257	DA		
HR/DA:	8	HR		
Total HRs:	2,052	HR		

CREW DEFINITION				
Item	Number	Usage	Duration HRs	Total HRs
Superintendent	1	1	2,052	2,052
Operator	2	1	2,052	4,105
Laborer	1	1	2,052	2,052
815 Compactor	1	1	2,052	2,052
D6 Bulldozer	1	1	2,052	2,052

Item	# people	w/e factor	Dur in DA	Total DA
per diem	4	1.4	257	1,437

geosynthetics in liner?	n	
area of geosynthetics:	0	
Assumed	500	LF of piping needed for leachate collection

MONITORING WELLS

Perimeter	7,613	LF
assume one Monitoring Well every	200	LF of perimeter
Therefore,	39	Monitoring Wells are needed

TABLE K.3c
SCA CONSTRUCTION COSTS - 1,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Preloading	1	LS	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Preloading											
Project Manager	503	HR	134				67,449	0	0	0	67,449
Superintendent	5,033	HR	100				503,349	0	0	0	503,349
Operator	10,067	HR	40				398,954	0	0	0	398,954
Laborer	5,033	HR	28				140,183	0	0	0	140,183
Engineer	5,033	HR	68				342,277	0	0	0	342,277
Survey Crew	503	HR				126	0	0	0	63,206	63,206
D6 Bulldozer	5,033	HR		41			0	207,732	0	0	207,732
Water Truck	5,033	HR		16			0	78,321	0	0	78,321
Fuel	50,335	GA			1.5		0	0	75,502	0	75,502
Per Diem	7,045	DY	109				767,883	0	0	0	767,883
Soil	1,258,372	CY			7.31		0	0	9,198,699	0	9,198,699
TOTAL							2,220,095	286,053	9,274,202	63,206	11,843,555
Overhead	10%						222,009	28,605	927,420	6,321	1,184,356
G&A, Profit	8%						195,368	25,173	816,130	5,562	1,042,233
TOTAL							2,637,473	339,831	11,017,752	75,088	14,070,144

Remedial Design (4%)	562,806
Construction Management (4%)	562,806
Project Management (3%)	422,104
Contingency (25%)	3,904,465
Total	19,522,324

Basis of Estimate:

Preloading

preload:	3,397,604	SF	
sediment depth:	10	FT	
Volume of Preload Soil:	1,258,372	CY	
Rate of Import:	2,000	CY/DA	based on practical limit of truck traffic
# Days of Import:	629	DA	
Hours of Import:	5,033	HR	

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Project Manager	1	0.1	5,033	503
Superintendent	1	1	5,033	5,033
Operator	2	1	5,033	10,067
Laborer	1	1	5,033	5,033
Engineer	1	1	5,033	5,033
Surveyor	2	0.05	5,033	503
D6 Bulldozer	1	1	5,033	5,033
Water Truck	1	1	5,033	5,033
	0	1	5,033	0
	0	1	5,033	0

Item	# people	w/e factor	Dur in DA	Total DA

TABLE K.3c
SCA CONSTRUCTION COSTS - 1,000,000 CY DREDGE VOLUME

				Unit Prices				Cost				
Stabilization under Dikes		1.00	LS	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Dike Subgrade Stabilization												
Dry Soil Mixing		337,227	CY				27.06	0	0	0	9,125,352	9,125,352
TOTAL								0	0	0	9,125,352	9,125,352
Overhead	10%							0	0	0	912,535	912,535
G&A, Profit	8%							0	0	0	803,031	803,031
TOTAL								0	0	0	10,840,918	10,840,918

Remedial Design (4%)	433,637
Construction Management (4%)	433,637
Project Management (3%)	325,228
Contingency (25%)	3,008,355
Total	15,041,774

Basis of Estimate:

DIKE SUBGRADE STABILIZATION

stabilization under dikes?:	y	(y/n)
dike bottom area:	728,409	SF, from SCA sizing calc
Percentage dry soil mixed:	25.0%	based on estimate from Hayward Baker
Depth of Mixing:	50	FT, based on approximate depth of materials in Wastebeds
Volume of Mixing:	337,227	CY

Honeywell

TABLE K.3d
SCA CONSTRUCTION COSTS - 10,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Construct SCA	160	AC	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Dike Construction											
Project Manager	20,616	HR	134				2,762,544	0	0	0	2,762,544
Superintendent	41,232	HR	100				4,123,200	0	0	0	4,123,200
Operator	371,088	HR	40				14,706,217	0	0	0	14,706,217
Laborer	82,464	HR	28				2,296,622	0	0	0	2,296,622
Engineer	41,232	HR	68				2,803,776	0	0	0	2,803,776
Survey Crew	16,493	HR				126	0	0	0	2,071,001	2,071,001
D6 Bulldozer	82,464	HR		41			0	3,403,289	0	0	3,403,289
330 Excavator	82,464	HR		58			0	4,742,505	0	0	4,742,505
815 Compactor	82,464	HR		30			0	2,511,029	0	0	2,511,029
Dump Truck	82,464	HR		54			0	4,463,776	0	0	4,463,776
Water Truck	41,232	HR		16			0	641,570	0	0	641,570
Fuel	1,855,440	GA			1.5		0	0	2,783,160	0	2,783,160
Soil	5,154,000	CY			7.31		0	0	37,675,739	0	37,675,739
Per Diem	115,450	DY	109				12,584,006	0	0	0	12,584,006
Finish Grading											
Superintendent	1,279	HR	100				127,868	0	0	0	127,868
Operator	2,557	HR	40				101,348	0	0	0	101,348
Laborer	1,279	HR	28				35,611	0	0	0	35,611
815 Compactor	1,279	HR		30			0	38,936	0	0	38,936
140G Motor Grader	1,279	HR		41			0	52,170	0	0	52,170
Fuel	12,787	GA			1.5		0	0	19,180	0	19,180
Per Diem	895	DY	109				97,563	0	0	0	97,563

TABLE K.3d
SCA CONSTRUCTION COSTS - 10,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Construct SCA (continued)	1	AC	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Liner System, from bottom to top											
Geomembrane	0	SF				0.60	0	0	0	0	0
Superintendent	4,126	HR	100				412,588	0	0	0	412,588
Operator	8,252	HR	40				327,017	0	0	0	327,017
Laborer	4,126	HR	28				114,906	0	0	0	114,906
815 Compactor	4,126	HR		30			0	125,633	0	0	125,633
D6 Bulldozer	4,126	HR		41			0	170,275	0	0	170,275
Per Diem	2,888	DY	109				314,805	0	0	0	314,805
Sand	515,735	CY			7.31		0	0	3,770,025	0	3,770,025
HDPE Pipe	500	LF			13.81		0	0	6,905	0	6,905
Freight	1	LS			1,000.0		0	0	1,000	0	1,000
Gravel Road	11,587	LF			39.15		0	0	453,651	0	453,651
Monitoring Wells	58	EA				5135.38	0	0	0	297,852	297,852
TOTAL							40,808,074	16,149,183	44,709,660	2,368,853	104,035,771
Overhead	10%						4,080,807	1,614,918	4,470,966	236,885	10,403,577
G&A, Profit	8%						3,591,111	1,421,128	3,934,450	208,459	9,155,148
TOTAL							48,479,992	19,185,230	53,115,076	2,814,197	123,594,496

Remedial Design (4%)	4,943,780
Construction Management (4%)	4,943,780
Project Management (3%)	3,707,835
Contingency (25%)	34,297,473
Total	171,487,363

TABLE K.3d
SCA CONSTRUCTION COSTS - 10,000,000 CY DREDGE VOLUME

Basis of Estimate:

DIKE CONSTRUCTION

Location	perimeter (LF)	Volume (cy)	Source
office area:	na	2,000	plug
laydown yard:	na	2,000	plug
SCA:	11,587	3,433,333	
two interior dikes:	5,794	1,716,667	
	Total Volume:	5,154,000	cy

dike height: 50

area per lf of height shown above with 3:1 side slopes and 10' wide top: 8000 cf/lf

Fill can be placed at 1000 CY per day

Therefore, duration is 5154 DA = 41232 HR = 258 MO

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Project Manager	1	0.5	41,232	20,616
Superintendent	1	1	41,232	41,232
Operator	9	1	41,232	371,088
Laborer	2	1	41,232	82,464
Engineer	1	1	41,232	41,232
Surveyor	2	0.2	41,232	16,493
D6 Bulldozer	2	1	41,232	82,464
330 Excavator	2	1	41,232	82,464
815 Compactor	2	1	41,232	82,464
Dump Truck	2	1	41,232	82,464
Water Truck	1	1	41,232	41,232
	0	1	41,232	0
	0	1	41,232	0

FINISH GRADING

area:	6,962,427	SF
area:	160	AC
production per day:	1	AC
Number days:	160	DA
HRs per day:	8	HR
Total HR:	1,279	HR

CREW DEFINITION				
Item	Number	Usage	Duration HRs	Total HRs
Superintendent	1	1	1,279	1,279
Operator	2	1	1,279	2,557
Laborer	1	1	1,279	1,279
815 Compactor	1	1	1,279	1,279
140G Motor Grader	1	1	1,279	1,279

Item	# people	w/e factor	Dur in DA	Total DA
per diem	4	1.4	160	895

TABLE K.3d
SCA CONSTRUCTION COSTS - 10,000,000 CY DREDGE VOLUME

Basis of Estimate (continued):

LINER SYSTEM

Area from "Volume Sheet":	6,962,427	SF =	160	AC
Sand layer depth	2	FT		
Sand volume	515,735	CY		
Placement Rate:	1,000	CY/DA		
# days:	516	DA		
HR/DA:	8	HR		
Total HRs:	4,126	HR		

CREW DEFINITION				
Item	Number	Usage	Duration HRs	Total HRs
Superintendent	1	1	4,126	4,126
Operator	2	1	4,126	8,252
Laborer	1	1	4,126	4,126
815 Compactor	1	1	4,126	4,126
D6 Bulldozer	1	1	4,126	4,126

Item	# people	w/e factor	Dur in DA	Total DA
per diem	4	1.4	516	2,888

geosynthetics in liner?	n	
area of geosynthetics:	0	
Assumed	500	LF of piping needed for leachate collection

MONITORING WELLS

Perimeter	11,587	LF
assume one Monitoring Well every	200	LF of perimeter
Therefore,	58	Monitoring Wells are needed

TABLE K.3d
SCA CONSTRUCTION COSTS - 10,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Preloading	1	LS	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Preloading											
Project Manager	4,681	HR	134				627,266	0	0	0	627,266
Superintendent	46,811	HR	100				4,681,086	0	0	0	4,681,086
Operator	93,622	HR	40				3,710,229	0	0	0	3,710,229
Laborer	46,811	HR	28				1,303,683	0	0	0	1,303,683
Engineer	46,811	HR	68				3,183,139	0	0	0	3,183,139
Survey Crew	4,681	HR				126	0	0	0	587,804	587,804
D6 Bulldozer	46,811	HR		41			0	1,931,884	0	0	1,931,884
Water Truck	46,811	HR		16			0	728,377	0	0	728,377
Fuel	468,109	GA			1.5		0	0	702,163	0	702,163
Per Diem	65,531	DY	109				7,142,901	0	0	0	7,142,901
Soil	11,702,716	CY			7.31		0	0	85,546,852	0	85,546,852
TOTAL							20,648,303	2,660,261	86,249,015	587,804	110,145,383
Overhead	10%						2,064,830	266,026	8,624,901	58,780	11,014,538
G&A, Profit	8%						1,817,051	234,103	7,589,913	51,727	9,692,794
TOTAL							24,530,184	3,160,390	102,463,830	698,311	130,852,715

Remedial Design (4%)	5,234,109
Construction Management (4%)	5,234,109
Project Management (3%)	3,925,581
Contingency (25%)	36,311,628
Total	181,558,142

Basis of Estimate:

Preloading

preload:	6,868,985	SF	
sediment depth:	46	FT	
Volume of Preload Soil:	11,702,716	CY	
Rate of Import:	2,000	CY/DA	based on practical limit of truck traffic
# Days of Import:	5,851	DA	
Hours of Import:	46,811	HR	

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Project Manager	1	0.1	46,811	4,681
Superintendent	1	1	46,811	46,811
Operator	2	1	46,811	93,622
Laborer	1	1	46,811	46,811
Engineer	1	1	46,811	46,811
Surveyor	2	0.05	46,811	4,681
D6 Bulldozer	1	1	46,811	46,811
Water Truck	1	1	46,811	46,811
	0	1	46,811	0
	0	1	46,811	0

Item	# people	w/e factor	Dur in DA	Total DA

TABLE K.3d
SCA CONSTRUCTION COSTS - 10,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Stabilization under Dikes	1.00	LS	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Dike Subgrade Stabilization											
Dry Soil Mixing	1,682,539	CY				27.06	0	0	0	45,529,514	45,529,514
TOTAL							0	0	0	45,529,514	45,529,514
Overhead	10%						0	0	0	4,552,951	4,552,951
G&A, Profit	8%						0	0	0	4,006,597	4,006,597
TOTAL							0	0	0	54,089,062	54,089,062

Remedial Design (4%)	2,163,562
Construction Management (4%)	2,163,562
Project Management (3%)	1,622,672
Contingency (25%)	15,009,715
Total	75,048,574

Basis of Estimate:

DIKE SUBGRADE STABILIZATION

dike bottom area:	3,634,285	SF, from SCA sizing calc
Percentage dry soil mixed:	25.0%	based on estimate from Hayward Baker
Depth of Mixing:	50	FT, based on approximate depth of materials in Wastebeds
Volume of Mixing:	1,682,539	CY

TABLE K.4a
SCA OPERATION COSTS - 100,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Transfer to CDF	100,000	CY	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
							0	0	0	0	0
Pumping											
Booster Pump	2,233	HR		26			0	58,938	0	0	58,938
Fuel	11,167	GA			1		0	0	11,167	0	11,167
Operator	2,233	HR	41				91,902	0	0	0	91,902
Inspection of the pipeline											
Laborer	667	HR	30				20,227	0	0	0	20,227
Superintendent	167	HR	100				16,667	0	0	0	16,667
Pickup Truck	333	HR		5			0	1,667	0	0	1,667
Dive Team	667	HR	294				195,833	0	0	0	195,833
Skiff	333	HR		2			0	667	0	0	667
per diem	117	DY	109				12,753	0	0	0	12,753
TOTAL							337,381	61,271	11,167	0	409,819
Overhead	10%						33,738	6,127	1,117	0	40,982
G&A, Profit	8%						29,690	5,392	983	0	36,064
TOTAL							400,809	72,790	13,266	0	486,865

Remedial Design (4%)	19,475
Construction Management (4%)	19,475
Project Management (3%)	14,606
Contingency (25%)	135,105
Total	675,525

Basis of Estimate:

Booster Pumps

Longest length =	31,433	LF
Booster pump neede every	5,280	LF
Therefore,	5	booster pumps needed
	667	HR per booster pump
	0.7	use factor
	2,233	Total HR booster pumps

Pipeline Inspection

Volume to be dredged:	100,000	CY
Dredging production rate:	150	CY/HR
Duration	667	HR

Item	#	Factor	Duration	Total HRs
Laborer	2	0.5	667	667
Superintendent	0.5	0.5	667	167
Pickup Truck	1	0.5	667	333
Dive Team	2	0.5	667	667
Skiff	1	0.5	667	333

Item	# People	W/E Factor	Dur in DA	Total DA
Per Diem	2	1.4	42	117

TABLE K.4a
SCA OPERATION COSTS - 100,000 CY DREDGE VOLUME

				Unit Prices				Cost				
Operation of CDF		1	LS	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
								0	0	0	0	0
Booster Pump		667	HR		26			0	17,593	0	0	17,593
Fuel		3,334	GA			1		0	0	1,667	0	1,667
Operator		667	HR	41				27,433	0	0	0	27,433
Laborer		667	HR	30				20,227	0	0	0	20,227
Pickup Truck		667	HR		5			0	3,333	0	0	3,333
Hg Test - Air		250	EA				433	0	0	0	108,250	108,250
VOCs - Air		250	EA				142	0	0	0	35,453	35,453
TOTAL								47,660	20,927	1,667	143,703	213,956
Overhead	10%							4,766	2,093	167	14,370	21,396
G&A, Profit	8%							4,194	1,842	147	12,646	18,828
TOTAL								56,620	24,861	1,980	170,719	254,180

Basis of Estimate:

Volume to be dredged:	100,000	CY				
Dredging production rate:	150	CY/HR				
Duration	667	HR =	83	SHIFTS =	9	WEEKS
# Air tests per shift:	3					
Total # Air Samples:	250	EA				

Remedial Design (4%)	10,167
Construction Management (4%)	10,167
Project Management (3%)	7,625
Contingency (25%)	70,535
Total	352,674

TABLE K.4b
SCA OPERATION COSTS - 500,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Transfer to CDF	500,000	CY	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
							0	0	0	0	0
Pumping											
Booster Pump	5,583	HR		26			0	147,344	0	0	147,344
Fuel	27,917	GA			1		0	0	27,917	0	27,917
Operator	5,583	HR	41				229,754	0	0	0	229,754
Inspection of the pipeline											
Laborer	1,667	HR	30				50,567	0	0	0	50,567
Superintendent	417	HR	100				41,667	0	0	0	41,667
Pickup Truck	833	HR		5			0	4,167	0	0	4,167
Dive Team	1,667	HR	294				489,583	0	0	0	489,583
Skiff	833	HR		2			0	1,667	0	0	1,667
per diem	582	DY	109				63,482	0	0	0	63,482
TOTAL							875,052	153,178	27,917	0	1,056,147
Overhead	10%						87,505	15,318	2,792	0	105,615
G&A, Profit	8%						77,005	13,480	2,457	0	92,941
TOTAL							1,039,562	181,975	33,165	0	1,254,702

Remedial Design (4%)	50,188
Construction Management (4%)	50,188
Project Management (3%)	37,641
Contingency (25%)	348,180
Total	1,740,899

Basis of Estimate:

Booster Pumps

Longest length =	31,433	LF
Booster pump neede every	5,280	LF
Therefore,	5	booster pumps needed
	1,667	HR per booster pump
	0.7	use factor
	5,583	Total HR booster pumps

Pipeline Inspection

Volume to be dredged:	500,000	CY
Dredging production rate:	300	CY/HR
Duration	1,667	HR

Item	#	Factor	Duration	Total HRs
Laborer	2	0.5	1,667	1,667
Superintendent	0.5	0.5	1,667	417
Pickup Truck	1	0.5	1,667	833
Dive Team	2	0.5	1,667	1,667
Skiff	1	0.5	1,667	833

Item	# People	W/E Factor	Dur in DA	Total DA
Per Diem	2	1.4	208	582

TABLE K.4b
SCA OPERATION COSTS - 500,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Operation of CDF	1	LS	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
							0	0	0	0	0
Booster Pump	1,667	HR		26			0	43,983	0	0	43,983
Fuel	8,333	GA			1		0	0	8,333	0	8,333
Operator	1,667	HR	41				68,583	0	0	0	68,583
Laborer	1,667	HR	30				50,567	0	0	0	50,567
Pickup Truck	1,667	HR		5			0	8,333	0	0	8,333
Hg Test - Air	624	EA				433	0	0	0	270,192	270,192
VOCs - Air	624	EA				142	0	0	0	88,489	88,489
TOTAL							119,150	52,317	8,333	358,681	538,481
Overhead	10%						11,915	5,232	833	35,868	53,848
G&A, Profit	8%						10,485	4,604	733	31,564	47,386
TOTAL							141,550	62,152	9,900	426,114	639,716

Basis of Estimate:

Volume to be dredged:	500,000	CY				
Dredging production rate:	300	CY/HR				
Duration	1,667	HR =	208	SHIFTS =	21	WEEKS
# Air tests per shift:	3					
Total # Air Samples:	624	EA				

Remedial Design (4%)	25,589
Construction Management (4%)	25,589
Project Management (3%)	19,191
Contingency (25%)	177,521
Total	887,606

TABLE K.4c
SCA OPERATION COSTS - 1,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Transfer to CDF	1,000,000	CY	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
							0	0	0	0	0
Pumping											
Booster Pump	11,167	HR		26			0	294,688	0	0	294,688
Fuel	55,833	GA			1		0	0	55,833	0	55,833
Operator	11,167	HR	41				459,508	0	0	0	459,508
Inspection of the pipeline											
Laborer	3,333	HR	30				101,133	0	0	0	101,133
Superintendent	833	HR	100				83,333	0	0	0	83,333
Pickup Truck	1,667	HR		5			0	8,333	0	0	8,333
Dive Team	3,333	HR	294				979,167	0	0	0	979,167
Skiff	1,667	HR		2			0	3,333	0	0	3,333
per diem	1,168	DY	109				127,268	0	0	0	127,268
TOTAL							1,750,410	306,355	55,833	0	2,112,598
Overhead	10%						175,041	30,636	5,583	0	211,260
G&A, Profit	8%						154,036	26,959	4,913	0	185,909
TOTAL							2,079,487	363,950	66,330	0	2,509,767

Remedial Design (4%)	100,391
Construction Management (4%)	100,391
Project Management (3%)	75,293
Contingency (25%)	696,460
Total	3,482,302

Basis of Estimate:

Booster Pumps

Longest length =	31,433	LF
Booster pump neede every	5,280	LF
Therefore,	5	booster pumps needed
	3,333	HR per booster pump
	0.7	use factor
	11,167	Total HR booster pumps

Pipeline Inspection

Volume to be dredged:	1,000,000	CY
Dredging production rate:	300	CY/HR
Duration	3,333	HR

Item	#	Factor	Duration	Total HRs
Laborer	2	0.5	3,333	3,333
Superintendent	0.5	0.5	3,333	833
Pickup Truck	1	0.5	3,333	1,667
Dive Team	2	0.5	3,333	3,333
Skiff	1	0.5	3,333	1,667

Item	# People	W/E Factor	Dur in DA	Total DA
Per Diem	2	1.4	417	1,168

TABLE K.4c
SCA OPERATION COSTS - 1,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Operation of CDF	1	LS	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
							0	0	0	0	0
Booster Pump	3,333	HR		26			0	87,967	0	0	87,967
Fuel	16,667	GA			1		0	0	16,667	0	16,667
Operator	3,333	HR	41				137,167	0	0	0	137,167
Laborer	3,333	HR	30				101,133	0	0	0	101,133
Pickup Truck	3,333	HR		5			0	16,667	0	0	16,667
Hg Test - Air	1,251	EA				433	0	0	0	541,683	541,683
VOCs - Air	1,251	EA				142	0	0	0	177,404	177,404
TOTAL							238,300	104,633	16,667	719,087	1,078,687
Overhead	10%						23,830	10,463	1,667	71,909	107,869
G&A, Profit	8%						20,970	9,208	1,467	63,280	94,924
TOTAL							283,100	124,304	19,800	854,276	1,281,481

Basis of Estimate:

Volume to be dredged:	1,000,000	CY				
Dredging production rate:	300	CY/HR				
Duration	3,333	HR =	417	SHIFTS =	42	WEEKS
# Air tests per shift:	3					
Total # Air Samples:	1251	EA				

Remedial Design (4%)	51,259
Construction Management (4%)	51,259
Project Management (3%)	38,444
Contingency (25%)	355,611
Total	1,778,054

TABLE K.4d
SCA OPERATION COSTS - 10,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Transfer to CDF	10,000,000	CY	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
							0	0	0	0	0
Pumping											
Booster Pump	55,833	HR		26			0	1,473,442	0	0	1,473,442
Fuel	279,167	GA			1		0	0	279,167	0	279,167
Operator	55,833	HR	41				2,297,542	0	0	0	2,297,542
Inspection of the pipeline											
Laborer	16,667	HR	30				505,667	0	0	0	505,667
Superintendent	4,167	HR	100				416,667	0	0	0	416,667
Pickup Truck	8,333	HR		5			0	41,667	0	0	41,667
Dive Team	16,667	HR	294				4,895,833	0	0	0	4,895,833
Skiff	8,333	HR		2			0	16,667	0	0	16,667
Per Diem	2,918	DY	109				318,018	0	0	0	318,018
TOTAL							8,433,727	1,531,775	279,167	0	10,244,668
Overhead	10%						843,373	153,178	27,917	0	1,024,467
G&A, Profit	8%						742,168	134,796	24,567	0	901,531
TOTAL							10,019,267	1,819,749	331,650	0	12,170,666

Remedial Design (4%)	486,827
Construction Management (4%)	486,827
Project Management (3%)	365,120
Contingency (25%)	3,377,360
Total	16,886,799

Basis of Estimate:

Booster Pumps

Longest length =	31,433	LF
Booster pump needed every	5,280	LF
Therefore,	5	booster pumps needed
	16,667	HR per booster pump
	0.7	Use factor
	55,833	Total HR booster pumps

Pipeline Inspection

Volume to be dredged:	10,000,000	CY
Dredging production rate:	600	CY/HR
Duration	16,667	HR

Item	#	Factor	Duration	Total HRs
Laborer	2	0.5	16,667	16,667
Superintendent	0.5	0.5	16,667	4,167
Pickup Truck	1	0.5	16,667	8,333
Dive Team	2	0.5	16,667	16,667
Skiff	1	0.5	16,667	8,333

Item	# People	W/E Factor	Dur in DA	Total DA
Per Diem	2	1.4	1042	2,918

TABLE K.4d
SCA OPERATION COSTS - 10,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Operation of CDF	1	LS	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
							0	0	0	0	0
Booster Pump	16,667	HR		26			0	439,833	0	0	439,833
Fuel	83,333	GA			1		0	0	83,333	0	83,333
Operator	16,667	HR	41				685,833	0	0	0	685,833
Laborer	16,667	HR	30				505,667	0	0	0	505,667
Pickup Truck	16,667	HR		5			0	83,333	0	0	83,333
Hg Test - Air	6,250	EA				433	0	0	0	2,706,250	2,706,250
VOCs - Air	6,250	EA				142	0	0	0	886,313	886,313
TOTAL							1,191,500	523,167	83,333	3,592,563	5,390,563
Overhead	10%						119,150	52,317	8,333	359,256	539,056
G&A, Profit	8%						104,852	46,039	7,333	316,146	474,370
TOTAL							1,415,502	621,522	99,000	4,267,964	6,403,988

Basis of Estimate:

Volume to be dredged:	10,000,000	CY				
Dredging production rate:	600	CY/HR				
Duration	16,667	HR =	2,083	SHIFTS =	209	WEEKS
# Air tests per shift:	3					
Total # Air Samples:	6250	EA				

Remedial Design (4%)	256,160
Construction Management (4%)	256,160
Project Management (3%)	192,120
Contingency (25%)	1,777,107
Total	8,885,534

TABLE K.5a
SCA CAPPING COSTS - 100,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Construct Cap over SCA	12	AC	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
sand	48,920	CY			7		0	0	357,605	0	357,605
GCL	0	SF				0.65	0	0	0	0	0
geomembrane	0	SF				0.60	0	0	0	0	0
geocomposite	0	SF				0.49	0	0	0	0	0
soil	29,352	CY			7		0	0	214,563	0	214,563
topsoil	9,784	CY			22		0	0	214,563	0	214,563
D6 Bulldozer	360	HR		41			0	14,857	0	0	14,857
330 Excavator	360	HR		58			0	20,704	0	0	20,704
140G Motor Grader	18	HR		41			0	734	0	0	734
815 Compactor	360	HR		30			0	10,962	0	0	10,962
Water Truck	360	HR		16			0	5,602	0	0	5,602
Tractor and Disc	360	HR		13			0	4,500	0	0	4,500
Project Manager	36	HR	134				4,824				4,824
Superintendent	360	HR	100				36,000				36,000
Operator	1,440	HR	40				57,067				57,067
Per Diem	378	DY	109				41,202				41,202
Fuel	13,500	GA			1.5		0	0	20,250	0	20,250
TOTAL							139,093	57,359	806,982	0	1,003,434
Overhead	10%						13,909	5,736	80,698	0	100,343
G&A, Profit	8%						12,240	5,048	71,014	0	88,302
TOTAL							165,243	68,142	958,694	0	1,192,079

Remedial Design (4%)	47,683
Construction Management (4%)	47,683
Project Management (3%)	35,762
Contingency (25%)	330,802
Total	1,654,010

Basis of Estimate:

SCA surface area: 528,336 SF

		area (SF)	volume (CY)
SCA Cap consists of	2.5 foot thick foundation layer	528,336	48,920
	GCL	0	
	geomembrane	0	
	geocomposite	0	
	1.5 foot thick soil layer	528,336	29,352
	0.5 foot thick topsoil layer	528,336	9,784
	TOTAL		88,056

Crew can install 2000 cy per day

Duration = 45 DY = 360 HR

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Project Manager	1	0.1	360	36
Superintendent	1	1	360	360
Operator	4	1	360	1,440
D6 Bulldozer	1	1	360	360
330 Excavator	1	1	360	360
140G Motor Grader	1	0.05	360	18
815 Compactor	1	1	360	360
Water Truck	1	1	360	360
Tractor and Disc	1	1	360	360

Item	# people	w/e factor	Dur in DA	Total DA
per diem	6	1.4	45	378

Labor for geosynthetics is included in subcontract price

TABLE K.5b
SCA CAPPING COSTS - 500,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Construct Cap over SCA	40	AC	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
sand	159,422	CY			7		0	0	1,165,373	0	1,165,373
GCL	0	SF				0.65	0	0	0	0	0
geomembrane	0	SF				0.60	0	0	0	0	0
geocomposite	0	SF				0.49	0	0	0	0	0
soil	95,653	CY			7		0	0	699,224	0	699,224
topsoil	31,884	CY			22		0	0	699,224	0	699,224
D6 Bulldozer	1,152	HR		41			0	47,543	0	0	47,543
330 Excavator	1,152	HR		58			0	66,252	0	0	66,252
140G Motor Grader	58	HR		41			0	2,350	0	0	2,350
815 Compactor	1,152	HR		30			0	35,078	0	0	35,078
Water Truck	1,152	HR		16			0	17,925	0	0	17,925
Tractor and Disc	1,152	HR		13			0	14,400	0	0	14,400
Project Manager	115	HR	134				15,437				15,437
Superintendent	1,152	HR	100				115,200				115,200
Operator	4,608	HR	40				182,615				182,615
Per Diem	1,210	DY	109				131,846				131,846
Fuel	43,200	GA			1.5		0	0	64,800	0	64,800
TOTAL							445,098	183,548	2,628,621	0	3,257,267
Overhead	10%						44,510	18,355	262,862	0	325,727
G&A, Profit	8%						39,169	16,152	231,319	0	286,639
TOTAL							528,777	218,055	3,122,801	0	3,869,633

Remedial Design (4%)	154,785
Construction Management (4%)	154,785
Project Management (3%)	116,089
Contingency (25%)	1,073,823
Total	5,369,116

Basis of Estimate:

SCA surface area: 1,721,755 SF

			area (SF)	volume (CY)
SCA Cap consists of	2.5	foot thick foundation layer	1,721,755	159,422
		GCL	0	
		geomembrane	0	
		geocomposite	0	
	1.5	foot thick soil layer	1,721,755	95,653
	0.5	foot thick topsoil layer	1,721,755	31,884
		TOTAL		286,959

Crew can install 2000 cy per day
Duration = 144 DY = 1152 HR

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Project Manager	1	0.1	1,152	115
Superintendent	1	1	1,152	1,152
Operator	4	1	1,152	4,608
D6 Bulldozer	1	1	1,152	1,152
330 Excavator	1	1	1,152	1,152
140G Motor Grader	1	0.05	1,152	58
815 Compactor	1	1	1,152	1,152
Water Truck	1	1	1,152	1,152
Tractor and Disc	1	1	1,152	1,152

Item	# people	w/e factor	Dur in DA	Total DA
per diem	6	1.4	144	1,210

Labor for geosynthetics is included in subcontract price

TABLE K.5c
SCA CAPPING COSTS - 1,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Construct Cap over SCA	80	AC	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
sand	320,682	CY			7		0	0	2,344,184	0	2,344,184
GCL	0	SF				0.65	0	0	0	0	0
geomembrane	0	SF				0.60	0	0	0	0	0
geocomposite	0	SF				0.49	0	0	0	0	0
soil	192,409	CY			7		0	0	1,406,510	0	1,406,510
topsoil	64,136	CY			22		0	0	1,406,510	0	1,406,510
D6 Bulldozer	2,312	HR		41			0	95,416	0	0	95,416
330 Excavator	2,312	HR		58			0	132,963	0	0	132,963
140G Motor Grader	116	HR		41			0	4,716	0	0	4,716
815 Compactor	2,312	HR		30			0	70,400	0	0	70,400
Water Truck	2,312	HR		16			0	35,975	0	0	35,975
Tractor and Disc	2,312	HR		13			0	28,900	0	0	28,900
Project Manager	231	HR	134				30,981				30,981
Superintendent	2,312	HR	100				231,200				231,200
Operator	9,248	HR	40				366,498				366,498
Per Diem	2,428	DY	109				264,608				264,608
Fuel	86,700	GA			1.5		0	0	130,050	0	130,050
TOTAL							893,287	368,371	5,287,255	0	6,548,913
Overhead	10%						89,329	36,837	528,725	0	654,891
G&A, Profit	8%						78,609	32,417	465,278	0	576,304
TOTAL							1,061,225	437,625	6,281,258	0	7,780,109

Remedial Design (4%)	311,204
Construction Management (4%)	311,204
Project Management (3%)	233,403
Contingency (25%)	2,158,980
Total	10,794,901

Basis of Estimate:

SCA surface area: 3,463,363 SF

			area (SF)	volume (CY)
SCA Cap consists of	2.5	foot thick foundation layer	3,463,363	320,682
		GCL	0	
		geomembrane	0	
		geocomposite	0	
	1.5	foot thick soil layer	3,463,363	192,409
	0.5	foot thick topsoil layer	3,463,363	64,136
		TOTAL		577,227

Crew can install 2000 cy per day
Duration = 289 DY = 2312 HR

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Project Manager	1	0.1	2,312	231
Superintendent	1	1	2,312	2,312
Operator	4	1	2,312	9,248
D6 Bulldozer	1	1	2,312	2,312
330 Excavator	1	1	2,312	2,312
140G Motor Grader	1	0.05	2,312	116
815 Compactor	1	1	2,312	2,312
Water Truck	1	1	2,312	2,312
Tractor and Disc	1	1	2,312	2,312

Item	# people	w/e factor	Dur in DA	Total DA
per diem	6	1.4	289	2,428

Labor for geosynthetics is included in subcontract price

TABLE K.5d
SCA CAPPING COSTS - 10,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Construct Cap over SCA	160	AC	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
sand	644,669	CY			7		0	0	4,712,532	0	4,712,532
GCL	0	SF				0.65	0	0	0	0	0
geomembrane	0	SF				0.60	0	0	0	0	0
geocomposite	0	SF				0.49	0	0	0	0	0
soil	386,802	CY			7		0	0	2,827,519	0	2,827,519
topsoil	128,934	CY			22		0	0	2,827,519	0	2,827,519
D6 Bulldozer	4,648	HR		41			0	191,823	0	0	191,823
330 Excavator	4,648	HR		58			0	267,306	0	0	267,306
140G Motor Grader	232	HR		41			0	9,482	0	0	9,482
815 Compactor	4,648	HR		30			0	141,532	0	0	141,532
Water Truck	4,648	HR		16			0	72,323	0	0	72,323
Tractor and Disc	4,648	HR		13			0	58,100	0	0	58,100
Project Manager	465	HR	134				62,283				62,283
Superintendent	4,648	HR	100				464,800				464,800
Operator	18,592	HR	40				736,801				736,801
Per Diem	4,880	DY	109				531,964				531,964
Fuel	174,300	GA			1.5		0	0	261,450	0	261,450
TOTAL							1,795,848	740,566	10,629,020	0	13,165,434
Overhead	10%						179,585	74,057	1,062,902	0	1,316,543
G&A, Profit	8%						158,035	65,170	935,354	0	1,158,558
TOTAL							2,133,467	879,792	12,627,276	0	15,640,535

Remedial Design (4%)	625,621
Construction Management (4%)	625,621
Project Management (3%)	469,216
Contingency (25%)	4,340,248
Total	21,701,242

Basis of Estimate:

SCA surface area: 6,962,427 SF

			area (SF)	volume (CY)
SCA Cap consists of	2.5	foot thick foundation layer	6,962,427	644,669
		GCL	0	
		geomembrane	0	
		geocomposite	0	
	1.5	foot thick soil layer	6,962,427	386,802
	0.5	foot thick topsoil layer	6,962,427	128,934
		TOTAL		1,160,405

Crew can install 2000 cy per day
Duration = 581 DY = 4648 HR

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Project Manager	1	0.1	4,648	465
Superintendent	1	1	4,648	4,648
Operator	4	1	4,648	18,592
D6 Bulldozer	1	1	4,648	4,648
330 Excavator	1	1	4,648	4,648
140G Motor Grader	1	0.05	4,648	232
815 Compactor	1	1	4,648	4,648
Water Truck	1	1	4,648	4,648
Tractor and Disc	1	1	4,648	4,648

Item	# people	w/e factor	Dur in DA	Total DA
per diem	6	1.4	581	4,880

Labor for geosynthetics is included in subcontract price

TABLE K.6a
SCA LONG-TERM OPERATION AND MAINTENANCE COSTS - 100,000 CY DREDGE VOLUME

			Unit Prices				Cost				
O&M for SCA - 1st 5 years	1.00	YR	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Engineer	320	HR	68				21,760				21,760
Laborer	960	HR	30				29,126				29,126
Soil	400	CY			8		0	0	3,032	0	3,032
Pickup Truck	320	HR		5			0	4,800	0	0	4,800
Metals - water	72	EA				146.14	0	0	0	10,522	10,522
VOCs - Water	72	EA				64.95	0	0	0	4,676	4,676
Sulfides - Water	72	EA				11.91	0	0	0	858	858
											0
Sampling Supplies	4	WK			200		0	0	800	0	800
TOTAL							50,886	4,800	3,832	16,056	75,574
Overhead 10%							5,089	480	383	1,606	7,557
G&A, Profit 8%							4,478	422	337	1,413	6,651
TOTAL							60,453	5,702	4,552	19,075	89,782

Basis of Estimate:

Monthly sampling for	40	HR per person per event
	4	Events per YR
	15	Monitoring wells are to be constucted

Remedial Design (4%)	3,591
Construction Management (4%)	3,591
Project Management (3%)	2,693
Contingency (25%)	24,915
Total	124,573

Labor

Position	Number	HR per event	event/YR	HR per YR
Engineer	1	80	4	320
Laborer	3	80	4	960
Pickup Truck	2	40	4	320

Analytical

Item	Number Wells	QC factor	event/YR	Total
Metals - water	15	1.2	4	72
VOCs - Water	15	1.2	4	72
Sulfides - Water	15	1.2	4	72

Assume an area for cap repair:

Cap repair area:	0.5	AC
Cap repair depth:	0.5	FT
Cap repair volume:	400	CY

TABLE K.6a
SCA LONG-TERM OPERATION AND MAINTENANCE COSTS - 100,000 CY DREDGE VOLUME

			Unit Prices				Cost				
O&M for SCA - Remaining 25 years	1.00	YR	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
							0	0	0	0	0
Engineer	160	HR	68				10,880				10,880
Laborer	480	HR	30				14,563				14,563
Pickup Truck	160	HR		5			0	4,800	0	0	4,800
Metals - water	36	EA				146.14	0	0	0	5,261	5,261
VOCs - Water	36	EA				64.95	0	0	0	2,338	2,338
Sulfides - Water	36	EA				11.91	0	0	0	429	429
Sampling Supplies	2	WK			200		0	0	400	0	400
TOTAL							25,443	4,800	400	8,028	38,671
Overhead	10%						2,544	480	40	803	3,867
G&A, Profit	8%						2,239	422	35	706	3,403
TOTAL							30,227	5,702	475	9,537	45,941

Remedial Design (4%)	1,838
Construction Management (4%)	1,838
Project Management (3%)	1,378
Contingency (25%)	12,749
Total	63,744

Basis of Estimate:

Bi-annual sampling for	40	HR per person per event
	2	Events per YR
	15	Monitoring wells are to be constucted

Labor

Position	Number	HR per event	event/YR	HR per YR
Engineer	1	80	2	160
Laborer	3	80	2	480
Pickup Truck	2	40	2	160

Analytical

Item	Number Wells	QC factor	event/YR	Total
Metals - water	15	1.2	2	36
VOCs - Water	15	1.2	2	36
Sulfides - Water	15	1.2	2	36

TABLE K.6b
SCA LONG-TERM OPERATION AND MAINTENANCE COSTS - 500,000 CY DREDGE VOLUME

			Unit Prices				Cost				
O&M for SCA - 1st 5 years	1.00	YR	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Engineer	320	HR	68				21,760				21,760
Laborer	960	HR	30				29,126				29,126
Soil	400	CY			8		0	0	3,032	0	3,032
Pickup Truck	320	HR		5			0	4,800	0	0	4,800
Metals - water	135	EA				146.14	0	0	0	19,729	19,729
VOCs - Water	135	EA				64.95	0	0	0	8,768	8,768
Sulfides - Water	135	EA				11.91	0	0	0	1,608	1,608
											0
Sampling Supplies	4	WK			200		0	0	800	0	800
TOTAL							50,886	4,800	3,832	30,105	89,623
Overhead	10%						5,089	480	383	3,011	8,962
G&A, Profit	8%						4,478	422	337	2,649	7,887
TOTAL							60,453	5,702	4,552	35,765	106,473

Basis of Estimate:

Monthly sampling for	40	HR per person per event
	4	Events per YR
	28	Monitoring wells are to be constucted

Remedial Design (4%)	4,259
Construction Management (4%)	4,259
Project Management (3%)	3,194
Contingency (25%)	29,546
Total	147,731

Labor

Position	Number	HR per event	event/YR	HR per YR
Engineer	1	80	4	320
Laborer	3	80	4	960
Pickup Truck	2	40	4	320

Analytical

Item	Number Wells	QC factor	event/YR	Total
Metals - water	28	1.2	4	135
VOCs - Water	28	1.2	4	135
Sulfides - Water	28	1.2	4	135

Assume an area for cap repair:

Cap repair area:	0.5	AC
Cap repair depth:	0.5	FT
Cap repair volume:	400	CY

TABLE K.6b
SCA LONG-TERM OPERATION AND MAINTENANCE COSTS - 500,000 CY DREDGE VOLUME

			Unit Prices				Cost				
O&M for SCA - Remaining 25 years	1.00	YR	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
							0	0	0	0	0
Engineer	160	HR	68				10,880				10,880
Laborer	480	HR	30				14,563				14,563
Pickup Truck	160	HR		5			0	4,800	0	0	4,800
Metals - water	68	EA				146.14	0	0	0	9,938	9,938
VOCs - Water	68	EA				64.95	0	0	0	4,417	4,417
Sulfides - Water	68	EA				11.91	0	0	0	810	810
Sampling Supplies	2	WK			200		0	0	400	0	400
TOTAL							25,443	4,800	400	15,164	45,807
Overhead	10%						2,544	480	40	1,516	4,581
G&A, Profit	8%						2,239	422	35	1,334	4,031
TOTAL							30,227	5,702	475	18,015	54,419

Remedial Design (4%)	2,177
Construction Management (4%)	2,177
Project Management (3%)	1,633
Contingency (25%)	15,101
Total	75,506

Basis of Estimate:

Bi-annual sampling for	40	HR per person per event
	2	Events per YR
	28	Monitoring wells are to be constucted

Labor

Position	Number	HR per event	event/YR	HR per YR
Engineer	1	80	2	160
Laborer	3	80	2	480
Pickup Truck	2	40	2	160

Analytical

Item	Number Wells	QC factor	event/YR	Total
Metals - water	28	1.2	2	68
VOCs - Water	28	1.2	2	68
Sulfides - Water	28	1.2	2	68

TABLE K.6c
SCA LONG-TERM OPERATION AND MAINTENANCE COSTS - 1,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
O&M for SCA - 1st 5 years	1.00	YR	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Engineer	320	HR	68				21,760				21,760
Laborer	960	HR	30				29,126				29,126
Soil	400	CY			8		0	0	3,032	0	3,032
Pickup Truck	320	HR		5			0	4,800	0	0	4,800
Metals - water	188	EA				146.14	0	0	0	27,474	27,474
VOCs - Water	188	EA				64.95	0	0	0	12,211	12,211
Sulfides - Water	188	EA				11.91	0	0	0	2,239	2,239
											0
Sampling Supplies	4	WK			200		0	0	800	0	800
TOTAL							50,886	4,800	3,832	41,924	101,442
Overhead	10%						5,089	480	383	4,192	10,144
G&A, Profit	8%						4,478	422	337	3,689	8,927
TOTAL							60,453	5,702	4,552	49,806	120,514

Remedial Design (4%)	4,821
Construction Management (4%)	4,821
Project Management (3%)	3,615
Contingency (25%)	33,443
Total	167,213

Basis of Estimate:

Monthly Sampling for	40	HR per person per event
	4	Events per YR
	39	Monitoring wells are to be constucted

Position	Number	HR per event	event/YR	HR per YR
Engineer	1	80	4	320
Laborer	3	80	4	960
Pickup Truck	2	40	4	320

Analytical

Item	Number Wells	QC factor	event/YR	Total
Metals - water	39	1.2	4	188
VOCs - Water	39	1.2	4	188
Sulfides - Water	39	1.2	4	188

Assume an area for cap repair:

Cap repair area:	0.5	AC
Cap repair depth:	0.5	FT
Cap repair xolume:	400	CY

TABLE K.6c
SCA LONG-TERM OPERATION AND MAINTENANCE COSTS - 1,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
O&M for SCA - Remaining 25 years	1.00	YR	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
							0	0	0	0	0
Engineer	160	HR	68				10,880				10,880
Laborer	480	HR	30				14,563				14,563
Pickup Truck	160	HR		5			0	4,800	0	0	4,800
Metals - water	94	EA				146.14	0	0	0	13,737	13,737
VOCs - Water	94	EA				64.95	0	0	0	6,105	6,105
Sulfides - Water	94	EA				11.91	0	0	0	1,120	1,120
Sampling Supplies	2	WK			200		0	0	400	0	400
TOTAL							25,443	4,800	400	20,962	51,605
Overhead	10%						2,544	480	40	2,096	5,161
G&A, Profit	8%						2,239	422	35	1,845	4,541
TOTAL							30,227	5,702	475	24,903	61,307

Remedial Design (4%)	2,452
Construction Management (4%)	2,452
Project Management (3%)	1,839
Contingency (25%)	17,013
Total	85,063

Basis of Estimate:

Bi-annual sampling for	40	HR per person per event
	2	Events per YR
	39	Monitoring wells are to be constucted

Labor

Position	Number	HR per event	event/YR	HR per YR
Engineer	1	80	2	160
Laborer	3	80	2	480
Pickup Truck	2	40	2	160

Analytical

Item	Number Wells	QC factor	event/YR	Total
Metals - water	39	1.2	2	94
VOCs - Water	39	1.2	2	94
Sulfides - Water	39	1.2	2	94

TABLE K.6d
SCA LONG-TERM OPERATION AND MAINTENANCE COSTS - 10,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
O&M for SCA - 1st 5 years	1.00	YR	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Engineer	320	HR	68				21,760				21,760
Laborer	960	HR	30				29,126				29,126
Soil	400	CY			8		0	0	3,032	0	3,032
Pickup Truck	320	HR		5			0	4,800	0	0	4,800
Metals - water	279	EA				146.14	0	0	0	40,773	40,773
VOCs - Water	279	EA				64.95	0	0	0	18,121	18,121
Sulfides - Water	279	EA				11.91	0	0	0	3,323	3,323
											0
Sampling Supplies	4	WK			200		0	0	800	0	800
TOTAL							50,886	4,800	3,832	62,217	121,735
Overhead	10%						5,089	480	383	6,222	12,174
G&A, Profit	8%						4,478	422	337	5,475	10,713
TOTAL							60,453	5,702	4,552	73,914	144,622

Remedial Design (4%)	5,785
Construction Management (4%)	5,785
Project Management (3%)	4,339
Contingency (25%)	40,133
Total	200,663

Basis of Estimate:

Monthly Sampling for	40	HR per person per event
	4	Events per YR
	58	Monitoring wells are to be constucted

Position	Number	HR per event	event/YR	HR per YR
Engineer	1	80	4	320
Laborer	3	80	4	960
Pickup Truck	2	40	4	320

Analytical

Item	Number Wells	QC factor	event/YR	Total
Metals - water	58	1.2	4	279
VOCs - Water	58	1.2	4	279
Sulfides - Water	58	1.2	4	279

Assume an area for cap repair:

Cap repair area:	0.5	AC
Cap repair depth:	0.5	FT
Cap repair volume:	400	CY

TABLE K.6d
SCA LONG-TERM OPERATION AND MAINTENANCE COSTS - 10,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
O&M for SCA - Remaining 25 years	1.00	YR	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
							0	0	0	0	0
Engineer	160	HR	68				10,880				10,880
Laborer	480	HR	30				14,563				14,563
Pickup Truck	160	HR		5			0	4,800	0	0	4,800
Metals - water	140	EA				146.14	0	0	0	20,460	20,460
VOCs - Water	140	EA				64.95	0	0	0	9,093	9,093
Sulfides - Water	140	EA				11.91	0	0	0	1,667	1,667
Sampling Supplies	2	WK			200		0	0	400	0	400
TOTAL							25,443	4,800	400	31,220	61,863
Overhead	10%						2,544	480	40	3,122	6,186
G&A, Profit	8%						2,239	422	35	2,747	5,444
TOTAL							30,227	5,702	475	37,089	73,493

Remedial Design (4%)	2,940
Construction Management (4%)	2,940
Project Management (3%)	2,205
Contingency (25%)	20,394
Total	101,972

Basis of Estimate:

Bi-annual sampling for	40	HR per person per event
	2	Events per YR
	58	Monitoring wells are to be constucted

Labor

Position	Number	HR per event	event/YR	HR per YR
Engineer	1	80	2	160
Laborer	3	80	2	480
Pickup Truck	2	40	2	160

Analytical

Item	Number Wells	QC factor	event/YR	Total
Metals - water	58	1.2	2	140
VOCs - Water	58	1.2	2	140
Sulfides - Water	58	1.2	2	140

TABLE K.7a
ON-SITE SEDIMENT MANAGEMENT COST AND DURATION SUMMARY
PRIMARY WATER TREATMENT

	100,000 CY	500,000 CY	1,000,000 CY	10,000,000 CY
SCA Area (AC)	12	40	80	160
Capital Costs				
Construct SCA	13,111,366	30,312,913	49,813,356	428,094,078
SCA Operation	1,028,199	2,628,505	5,260,356	25,772,333
SCA Capping	1,654,010	5,369,116	10,794,901	21,701,242
Primary Water Treatment System	0	0	0	0
Water Treatment per 1,000 gallon	0.05	0.05	0.05	0.05
Total Gallons to be Treated (at 1,295 ga/cy)	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Water Treatment Costs	6,475	32,375	64,750	647,500
Dismantle Water Treatment System	0	0	0	0
Operating Costs				
Annual SCA Long-Term O&M (1st Five Years)	124,573	147,731	167,213	200,663
Discount Factor	4.100	4.100	4.100	4.100
Net Present Value	510,750	605,696	685,572	822,716
Annual SCA Long-Term O&M (Remaining 25 Years)	63,744	75,506	85,063	101,972
Discount Factor	8.309	8.309	8.309	8.309
Net Present Value	529,655	627,392	706,804	847,301
Total On-Site Sediment Management Costs	16,840,455	39,575,998	67,325,738	477,885,171
Costs per In Situ Cubic Yard	168	79	67	48
Duration				
Number of Dredge Crews	1	2	2	4
Dredge Rate (150 CY/HR Per Dredge Crew)	150	300	300	600
Duration (DA)	42	104	208	1,042
Duration (MO)	2	5	10	52
Duration (YR)	0.3	0.7	1.5	7.4

TABLE K.7b
ON-SITE SEDIMENT MANAGEMENT COST AND DURATION SUMMARY
ENHANCED PRIMARY WATER TREATMENT

	100,000 CY	500,000 CY	1,000,000 CY	10,000,000 CY
SCA Area (AC)	12	40	80	160
Capital Costs				
Construct SCA	13,111,366	30,312,913	49,813,356	428,094,078
SCA Operation	1,028,199	2,628,505	5,260,356	25,772,333
SCA Capping	1,654,010	5,369,116	10,794,901	21,701,242
Enhanced Primary Water Treatment System	7,732,538	7,732,538	7,732,538	11,720,335
Water Treatment per 1,000 gallon	0.40	0.40	0.40	0.40
Total Gallons to be Treated (at 1,295 ga/cy)	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Water Treatment Costs	51,800	259,000	518,000	5,180,000
Dismantle Water Treatment System	1,000,000	1,000,000	1,000,000	1,000,000
Operating Costs				
Annual SCA Long-Term O&M (1st Five Years)	124,573	147,731	167,213	200,663
Discount Factor	4.100	4.100	4.100	4.100
Net Present Value	510,750	605,696	685,572	822,716
Annual SCA Long-Term O&M (Remaining 25 Years)	63,744	75,506	85,063	101,972
Discount Factor	8.309	8.309	8.309	8.309
Net Present Value	529,655	627,392	706,804	847,301
Total On-Site Sediment Management Costs	25,618,318	48,535,160	76,511,525	495,138,006
Costs per In Situ Cubic Yard	256	97	77	50
Duration				
Number of Dredge Crews	1	2	2	4
Dredge Rate (150 CY/HR Per Dredge Crew)	150	300	300	600
Duration (DA)	42	104	208	1,042
Duration (MO)	2	5	10	52
Duration (YR)	0.3	0.7	1.5	7.4

TABLE K.7c
ON-SITE SEDIMENT MANAGEMENT COST AND DURATION SUMMARY
ENHANCED PRIMARY WATER TREATMENT WITH MULTIMEDIA FILTRATION

	100,000 CY	500,000 CY	1,000,000 CY	10,000,000 CY
SCA Area (AC)	12	40	80	160
Capital Costs				
Construct SCA	13,111,366	30,312,913	49,813,356	428,094,078
SCA Operation	1,028,199	2,628,505	5,260,356	25,772,333
SCA Capping	1,654,010	5,369,116	10,794,901	21,701,242
Enhanced Primary Water Treatment w/ MMF System	12,968,963	12,968,963	12,968,963	19,657,271
Water Treatment per 1,000 gallon	0.57	0.57	0.57	0.57
Total Gallons to be Treated (at 1,295 ga/cy)	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Water Treatment Costs	73,815	369,075	738,150	7,381,500
Dismantle Water Treatment System	1,000,000	1,000,000	1,000,000	1,000,000
Operating Costs				
Annual SCA Long-Term O&M (1st Five Years)	124,573	147,731	167,213	200,663
Discount Factor	4.100	4.100	4.100	4.100
Net Present Value	510,750	605,696	685,572	822,716
Annual SCA Long-Term O&M (Remaining 25 Years)	63,744	75,506	85,063	101,972
Discount Factor	8.309	8.309	8.309	8.309
Net Present Value	529,655	627,392	706,804	847,301
Total On-Site Sediment Management Costs	30,876,758	53,881,660	81,968,100	505,276,443
Costs per In Situ Cubic Yard	309	108	82	51
Duration				
Number of Dredge Crews	1	2	2	4
Dredge Rate (150 CY/HR Per Dredge Crew)	150	300	300	600
Duration (DA)	42	104	208	1,042
Duration (MO)	2	5	10	52
Duration (YR)	0.3	0.7	1.5	7.4

TABLE K.7d
ON-SITE SEDIMENT MANAGEMENT COST AND DURATION SUMMARY
ADVANCED WATER TREATMENT

	100,000 CY	500,000 CY	1,000,000 CY	10,000,000 CY
SCA Area (AC)	12	40	80	160
Capital Costs				
Construct SCA	13,111,366	30,312,913	49,813,356	428,094,078
SCA Operation	1,028,199	2,628,505	5,260,356	25,772,333
SCA Capping	1,654,010	5,369,116	10,794,901	21,701,242
Advanced Water Treatment System	26,237,625	26,237,625	26,237,625	39,768,803
Water Treatment per 1,000 gallon	4.98	4.98	4.98	4.98
Total Gallons to be Treated (at 1,295 ga/cy)	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Water Treatment Costs	644,910	3,224,550	6,449,100	64,491,000
Dismantle Water Treatment System	1,000,000	1,000,000	1,000,000	1,000,000
Operating Costs				
Annual SCA Long-Term O&M (1st Five Years)	124,573	147,731	167,213	200,663
Discount Factor	4.100	4.100	4.100	4.100
Net Present Value	510,750	605,696	685,572	822,716
Annual SCA Long-Term O&M (Remaining 25 Years)	63,744	75,506	85,063	101,972
Discount Factor	8.309	8.309	8.309	8.309
Net Present Value	529,655	627,392	706,804	847,301
Total On-Site Sediment Management Costs	44,716,515	70,005,798	100,947,713	582,497,474
Costs per In Situ Cubic Yard	447	140	101	58
Duration				
Number of Dredge Crews	1	2	2	4
Dredge Rate (150 CY/HR Per Dredge Crew)	150	300	300	600
Duration (DA)	42	104	208	1,042
Duration (MO)	2	5	10	52
Duration (YR)	0.3	0.7	1.5	7.4

TABLE K.7e
ON-SITE SEDIMENT MANAGEMENT COST AND DURATION SUMMARY
ENHANCED PRIMARY WITH ORGANICS REMOVAL

	100,000 CY	500,000 CY	1,000,000 CY	10,000,000 CY
SCA Area (AC)	12	40	80	160
Capital Costs				
Construct SCA	13,111,366	30,312,913	49,813,356	428,094,078
SCA Operation	1,028,199	2,628,505	5,260,356	25,772,333
SCA Capping	1,654,010	5,369,116	10,794,901	21,701,242
Enhanced Primary with Organics Removal	11,373,338	11,373,338	11,373,338	17,238,756
Water Treatment per 1,000 gallon	0.57	0.57	0.57	0.57
Total Gallons to be Treated (at 1,295 ga/cy)	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Water Treatment Costs	73,815	369,075	738,150	7,381,500
Dismantle Water Treatment System	1,000,000	1,000,000	1,000,000	1,000,000
Operating Costs				
Annual SCA Long-Term O&M (1st Five Years)	124,573	147,731	167,213	200,663
Discount Factor	4.100	4.100	4.100	4.100
Net Present Value	510,750	605,696	685,572	822,716
Annual SCA Long-Term O&M (Remaining 25 Years)	63,744	75,506	85,063	101,972
Discount Factor	8.309	8.309	8.309	8.309
Net Present Value	529,655	627,392	706,804	847,301
Total On-Site Sediment Management Costs	29,281,133	52,286,035	80,372,475	502,857,927
Costs per In Situ Cubic Yard	293	105	80	50
Duration				
Number of Dredge Crews	1	2	2	4
Dredge Rate (150 CY/HR Per Dredge Crew)	150	300	300	600
Duration (DA)	42	104	208	1,042
Duration (MO)	2	5	10	52
Duration (YR)	0.3	0.7	1.5	7.4

TABLE K.8
BULKHEAD AND PROCESS AREA CONSTRUCTION COSTS

			Unit Prices				Cost				
Construct Process Area and Bulkhead			Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Site Preparation for Process Area											
Project Manager	50	HR	134				6,700	0	0	0	6,700
Superintendent	100	HR	100				10,000	0	0	0	10,000
Operator	900	HR	41				37,035	0	0	0	37,035
Laborer	200	HR	30				6,068	0	0	0	6,068
Engineer	100	HR	68				6,800	0	0	0	6,800
Surveyor	40	HR	30				1,191	0	0	0	1,191
D6 Bulldozer	200	HR		39			0	7,706	0	0	7,706
330 Excavator	200	HR		49			0	9,742	0	0	9,742
815 Compactor	200	HR		30			0	6,000	0	0	6,000
Dump Truck	200	HR		51			0	10,148	0	0	10,148
Water Truck	100	HR		25			0	2,500	0	0	2,500
Fuel	4,500	GA			1		0	0	4,500	0	4,500
Per Diem	255	DY	109				27,773	0	0	0	27,773
Process Area Liner System, from bottom to top											
Finish Grading	871,200	SF				0.10	0	0	0	87,120	87,120
Asphalt Paving	871,200	SF				1.10	0	0	0	958,320	958,320
Process Area Cover											
Temporary Structure	217,800	SF			19		0	0	4,138,200	0	4,138,200
Structure Consultant	1,168	HR	100				116,800	0	0	0	116,800
Superintendent	1,168	HR	100				116,800	0	0	0	116,800
Operator	3,504	HR	41				144,190	0	0	0	144,190
Laborer	16,352	HR	30				496,120	0	0	0	496,120
Crane	1,168	HR	150				175,200	0	0	0	175,200
Manlift	3,504	HR	25				87,600	0	0	0	87,600
Scissors Lifts	1,168	HR	20				23,360	0	0	0	23,360
Per Diem	3,884	DA	109				423,312	0	0	0	423,312
Drainage Control System											
Drainge Control System	1	LS				50,000	0	0	0	50,000	50,000
Connection to Willis Ave GW System	1	LS				50,000	0	0	0	50,000	50,000
Bulkhead											
Sheetpiling	35,000	SF				41	0	0	0	1,435,000	1,435,000
Soil	1,852	CY			7.58		0	0	14,038	0	14,038
Front End Loader	80	HR		23			0	10,148	0	0	10,148
Dump Truck	80	HR		51			0	10,148	0	0	10,148
Operator	160	HR	41				37,035	0	0	0	37,035
Finish Grading	25,000	SF				0.10	0	0	0	2,500	2,500
Asphalt Paving	25,000	SF				1.10	0	0	0	27,500	27,500

TABLE K.8
PROCESS AREA CONSTRUCTION COST

			Unit Prices				Cost				
Construct Process Area and Bulkhead (cont.)			Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Approach Dredging											
Dredging	18,519	CY				25.00	0	0	0	462,975	462,975
Material Transport and Handling	18,519	CY				18.34	0	0	0	339,670	339,670
Offsite Transportation and Disposal	29,816	TN				63.00	0	0	0	1,878,382	1,878,382
TOTAL							1,715,984	56,392	4,156,738	5,291,467	11,220,581
Overhead	10%						171,598	5,639	415,674	529,147	1,122,058
G&A, Profit	8%						151,007	4,962	365,793	465,649	987,411
TOTAL							2,038,589	66,994	4,938,205	6,286,262	13,330,050

Remedial Design (4%)	533,202
Construction Management (4%)	533,202
Project Management (3%)	399,901
Contingency (25%)	3,699,089
Total	18,495,444

Basis of Estimate:

Area of Process Area is based on 10 cells, each of 1.5 acres uncovered and 0.50 acres covered,
for a total area of 20 acres = 871,200 sf
and a covered area of 5 acres = 217,800 sf

SITE PREPARATION
Estimated duration for clear and grub and rough grading is 100 HR

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Project Manager	1	0.5	100	50
Superintendent	1	1	100	100
Operator	9	1	100	900
Laborer	2	1	100	200
Engineer	1	1	100	100
Surveyor	2	0.2	100	40
D6 Bulldozer	2	1	100	200
330 Excavator	2	1	100	200
815 Compactor	2	1	100	200
Dump Truck	2	1	100	200
Water Truck	1	1	100	100
	0	1	100	0
	0	1	100	0

Item	# People	W/E Factor	Dur in DA	Total DA
Per Diem	14	1.4	13	255

TABLE K.8
PROCESS AREA CONSTRUCTION COST

Basis of Estimate (continued):

LINER SYSTEM

Area from "Volume Sheet": 653,400 SF

COVER CONSTRUCTION

Area to be	5	AC =	217,800	SF
Production	1500	SF/DA		
Duration:	146	DA =	1168	HR

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Structure Consultant	1	1	1,168	1,168
Superintendent	1	1	1,168	1,168
Operator	3	1	1,168	3,504
Laborer	14	1	1,168	16,352
Crane	1	1	1,168	1,168
Manlift	3	1	1,168	3,504
Scissors Lifts	1	1	1,168	1,168

Item	# People	W/E Factor	Dur in DA	Total DA
Per Diem	19	1.4	146	3,884

BULKHEAD CONSTRUCTION

Assume 500 LF of shoreline will have sheetpiling installed to a depth of 70 FT
for a total area of 35,000 SF

Assume a triangular cross section of 20 FT wide by 10 FT deep must be backfilled behind sheetpiling
for a cross sectional area of 100 SF
which results in a volume of 1,852 CY

Assume that a strip 50 FT wide must be paved behind bulkhead to provide footing for crane and trucks
Length: 500 LF
Area: 25,000 SF

APPROACH DREDGING

Assume an approach 500 FT long by 100 FT wide and 10 FT deep needs to be dredged
for a volume of 18,519 CY

Dredge unit cost is assumed to be 25 $/CY based on estimated included in Appendix F

Material handling and transport to the Process Area is 18.34 based on data in Table 9 of this appendix

Offsite Transporation and Disposal is $63 per Table 16 of this appendix

Dredged Volume =	18,519	CY	
Solidified Volume of	21,297	CY	per Table 9 of this appendix
At	1.4	TN/CY	per Table 15 of this appendix
The disposal weight is	29,816	TN/CY	

TABLE K.9a
OFFLOAD, SOLIDIFICATION, AND LOADOUT COSTS - 100,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Solidification	100,000	CY	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Offloading Barges											
Superintendent	769	HR	100				76,923				76,923
Operator	1,538	HR	41				63,308				63,308
Laborer	1,538	HR	30				46,677				46,677
Front End Loader	769	HR		23			0	17,954	0	0	17,954
Crane	769	HR		25			0	19,231	0	0	19,231
Pickup Truck	1,538	HR		5			0	7,692	0	0	7,692
Solidification											
Superintendent	769	HR	100				76,923				76,923
Engineer	1,538	HR	68				104,615				104,615
Operator	3,077	HR	41				126,615				126,615
Laborer	2,308	HR	30				70,015				70,015
Low-ground-pressure Dozer	1,538	HR		37			0	56,923	0	0	56,923
Front End Loader	3,077	HR		23			0	71,815	0	0	71,815
Water Truck	1,538	HR		25			0	38,462	0	0	38,462
Pickup Truck	1,538	HR		5			0	7,692	0	0	7,692
Booster Pump	1,538	HR		26			0	40,600	0	0	40,600
Lime	11,000	TN			70		0	0	773,960	0	773,960
Water Treatment at Willis GWTP	1,439,255	GA				0.018				25,907	25,907
Truck Loading for Offsite Disposal											
Superintendent	769	HR	100				76,923				76,923
Operator	769	HR	41				31,654				31,654
Laborer	1,538	HR	30				46,677				46,677
Front End Loader	3,077	HR		23			0	71,815	0	0	71,815
Pickup Truck	1,538	HR		5			0	7,692	0	0	7,692
TOTAL							720,331	339,877	773,960	25,907	1,860,074
Overhead	10%						72,033	33,988	77,396	2,591	186,007
G&A, Profit	8%						63,389	29,909	68,108	2,280	163,687
TOTAL							855,753	403,774	919,464	30,777	2,209,768

Remedial Design (4%)	88,391
Construction Management (4%)	88,391
Project Management (3%)	66,293
Contingency (25%)	613,211
Total	3,066,053

TABLE K.9a
OFFLOAD, SOLIDIFICATION, AND LOADOUT COSTS - 100,000 CY DREDGE VOLUME

Basis of Estimate:

OFFLOADING BARGES

Dredging production rate:	130	CY/HR		
Dredging duration:	769	HR or	96	Shifts
Volume dredged:	100,000	CY		

CREW DESCRIPTION				
Item	Number	Factor	HR per item	Total HR
Superintendent	1	1	769	769
Operator	2	1	769	1,538
Laborer	2	1	769	1,538
Front End Loader	1	1	769	769
Crane	1	1	769	769
Pickup Truck	2	1	769	1,538

SOLIDIFICATION

Dredging production rate:	130	CY/HR =				
Dredging duration:	769	HR or	96	Shifts		
Volume:	100,000	CY				
Lime addition rate:	10%	by volume				
Volume lime needed:	10,000	CY =	11,000	TN at	1.1	TN/CY

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	769	769	
Engineer	2	1	769	1,538	1 engineer for lab QC, one for field QC, and one for oversight
Operator	4	1	769	3,077	
Laborer	3	1	769	2,308	
Low-ground-pressure Dozer	2	1	769	1,538	1 dozer per mix crew
Front End Loader	4	1	769	3,077	1 front end loader per mix crew and 1 per loading crew
Water Truck	2	1	769	1,538	1 water truck per mix crew
Pickup Truck	2	1	769	1,538	booster pumps for control of rain water
Booster Pump	2	1	769	1,538	

Assume	10%	of the insitu water in the sediments is drained out and collected during solidification
Volume:	100,000	CY
Water Content:	100%	
Specific Gravity:	2.48	from Settling Tests
Water Volume	71,264	CY
Water Volume	1,439,255	GA

TABLE K.9a
OFFLOAD, SOLIDIFICATION, AND LOADOUT COSTS - 100,000 CY DREDGE VOLUME

Basis of Estimate (continued):

TRUCK LOADING FOR OFFSITE DISPOSAL

Offloading production rate:	150	CY/HR =	1500	CY/DA
Volume dredged:	100,000	CY		
Volume as solidified:	115,000			
Offloading duration:	769	HR or	96	Shifts

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	769	769	
Operator	1	1	769	769	
Laborer	2	1	769	1,538	2 laborers for traffic control
Front End Loader	4	1	769	3,077	
Pickup Truck	2	1	769	1,538	

TABLE K.9b
OFFLOAD, SOLIDIFICATION, AND LOADOUT COSTS - 500,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Solidification	500,000	CY	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Offloading Barges											
Superintendent	3,846	HR	100				384,615				384,615
Operator	7,692	HR	41				316,538				316,538
Laborer	7,692	HR	30				233,385				233,385
Front End Loader	3,846	HR		23			0	89,769	0	0	89,769
Crane	3,846	HR		25			0	96,154	0	0	96,154
Pickup Truck	7,692	HR		5			0	38,462	0	0	38,462
Solidification											
Superintendent	3,846	HR	100				384,615				384,615
Engineer	7,692	HR	68				523,077				523,077
Operator	15,385	HR	41				633,077				633,077
Laborer	11,538	HR	30				350,077				350,077
Low-ground-pressure Dozer	7,692	HR		37			0	284,615	0	0	284,615
Front End Loader	15,385	HR		23			0	359,077	0	0	359,077
Water Truck	7,692	HR		25			0	192,308	0	0	192,308
Pickup Truck	7,692	HR		5			0	38,462	0	0	38,462
Booster Pump	7,692	HR		26			0	203,000	0	0	203,000
Lime	55,000	TN			70		0	0	3,869,800	0	3,869,800
Water Treatment at Willis GWTP	7,196,276	GA				0.018				129,533	129,533
Truck Loading for Offsite Disposal											
Superintendent	3,846	HR	100				384,615				384,615
Operator	3,846	HR	41				158,269				158,269
Laborer	7,692	HR	30				233,385				233,385
Front End Loader	15,385	HR		23			0	359,077	0	0	359,077
Pickup Truck	7,692	HR		5			0	38,462	0	0	38,462
TOTAL							3,601,654	1,699,385	3,869,800	129,533	9,300,371
Overhead	10%						360,165	169,938	386,980	12,953	930,037
G&A, Profit	8%						316,946	149,546	340,542	11,399	818,433
TOTAL							4,278,765	2,018,869	4,597,322	153,885	11,048,841

Remedial Design (4%)	441,954
Construction Management (4%)	441,954
Project Management (3%)	331,465
Contingency (25%)	3,066,053
Total	15,330,267

TABLE K.9b
OFFLOAD, SOLIDIFICATION, AND LOADOUT COSTS - 500,000 CY DREDGE VOLUME

Basis of Estimate:

OFFLOADING BARGES

Dredging production rate:	130	CY/HR		
Dredging duration:	3,846	HR or	481	Shifts
Volume dredged:	500,000	CY		

CREW DESCRIPTION				
Item	Number	Factor	HR per item	Total HR
Superintendent	1	1	3,846	3,846
Operator	2	1	3,846	7,692
Laborer	2	1	3,846	7,692
Front End Loader	1	1	3,846	3,846
Crane	1	1	3,846	3,846
Pickup Truck	2	1	3,846	7,692

SOLIDIFICATION

Dredging production rate:	130	CY/HR =				
Dredging duration:	3,846	HR or	481	Shifts		
Volume:	500,000	CY				
Lime addition rate:	10%	by volume				
Volume lime needed:	50,000	CY =	55,000	TN at	1.1	TN/CY

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	3,846	3,846	
Engineer	2	1	3,846	7,692	1 engineer for lab QC, one for field QC, and one for oversight
Operator	4	1	3,846	15,385	
Laborer	3	1	3,846	11,538	
Low-ground-pressure Dozer	2	1	3,846	7,692	1 dozer per mix crew
Front End Loader	4	1	3,846	15,385	1 front end loader per mix crew and 1 per loading crew
Water Truck	2	1	3,846	7,692	1 water truck per mix crew
Pickup Truck	2	1	3,846	7,692	booster pumps for control of rain water
Booster Pump	2	1	3,846	7,692	

Assume	10%	of the insitu water in the sediments is drained out and collected during solidification
Volume:	500,000	CY
Water Content:	100%	
Specific Gravity:	2.48	from Settling Tests
Water Volume	356,322	CY
Water Volume	7,196,276	GA

TABLE K.9b
OFFLOAD, SOLIDIFICATION, AND LOADOUT COSTS - 500,000 CY DREDGE VOLUME

Basis of Estimate (continued):

TRUCK LOADING FOR OFFSITE DISPOSAL

Offloading production rate:	150	CY/HR =	1500	CY/DA
Volume dredged:	500,000			
Volume as solidified:	575,000			
Offloading duration:	3,846	HR or	481	Shifts

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	3,846	3,846	
Operator	1	1	3,846	3,846	
Laborer	2	1	3,846	7,692	2 laborers for traffic control
Front End Loader	4	1	3,846	15,385	
Pickup Truck	2	1	3,846	7,692	

TABLE K.9c
OFFLOAD, SOLIDIFICATION, AND LOADOUT COSTS - 1,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Solidification	1,000,000	CY	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Offloading Barges											
Superintendent	7,692	HR	100				769,231				769,231
Operator	15,385	HR	41				633,077				633,077
Laborer	15,385	HR	30				466,769				466,769
Front End Loader	7,692	HR		23			0	179,538	0	0	179,538
Crane	7,692	HR		25			0	192,308	0	0	192,308
Pickup Truck	15,385	HR		5			0	76,923	0	0	76,923
Solidification											
Superintendent	7,692	HR	100				769,231				769,231
Engineer	15,385	HR	68				1,046,154				1,046,154
Operator	30,769	HR	41				1,266,154				1,266,154
Laborer	23,077	HR	30				700,154				700,154
Low-ground-pressure Dozer	15,385	HR		37			0	569,231	0	0	569,231
Front End Loader	30,769	HR		23			0	718,154	0	0	718,154
Water Truck	15,385	HR		25			0	384,615	0	0	384,615
Pickup Truck	15,385	HR		5			0	76,923	0	0	76,923
Booster Pump	15,385	HR		26			0	406,000	0	0	406,000
Lime	110,000	TN			70		0	0	7,739,600	0	7,739,600
Water Treatment at Willis GWTP	14,392,552	GA				0.018				259,066	259,066
Truck Loading for Offsite Disposal											
Superintendent	7,692	HR	100				769,231				769,231
Operator	7,692	HR	41				316,538				316,538
Laborer	15,385	HR	30				466,769				466,769
Front End Loader	30,769	HR		23			0	718,154	0	0	718,154
Pickup Truck	15,385	HR		5			0	76,923	0	0	76,923
TOTAL							7,203,308	3,398,769	7,739,600	259,066	18,600,743
Overhead	10%						720,331	339,877	773,960	25,907	1,860,074
G&A, Profit	8%						633,891	299,092	681,085	22,798	1,636,865
TOTAL							8,557,530	4,037,738	9,194,645	307,770	22,097,683

Remedial Design (4%)	883,907
Construction Management (4%)	883,907
Project Management (3%)	662,930
Contingency (25%)	6,132,107
Total	30,660,534

TABLE K.9c
OFFLOAD, SOLIDIFICATION, AND LOADOUT COSTS - 1,000,000 CY DREDGE VOLUME

Basis of Estimate:

OFFLOADING BARGES

Dredging production rate:	130	CY/HR		
Dredging duration:	7,692	HR or	962	Shifts
Volume dredged:	1,000,000	CY		

CREW DESCRIPTION				
Item	Number	Factor	HR per item	Total HR
Superintendent	1	1	7,692	7,692
Operator	2	1	7,692	15,385
Laborer	2	1	7,692	15,385
Front End Loader	1	1	7,692	7,692
Crane	1	1	7,692	7,692
Pickup Truck	2	1	7,692	15,385

SOLIDIFICATION

Dredging production rate:	130	CY/HR =				
Dredging duration:	7,692	HR or	962	Shifts		
Volume:	1,000,000	CY				
Lime addition rate:	10%	by volume				
Volume lime needed:	100,000	CY =	110,000	TN at	1.1	TN/CY

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	7,692	7,692	
Engineer	2	1	7,692	15,385	1 engineer for lab QC, one for field QC, and one for oversight
Operator	4	1	7,692	30,769	
Laborer	3	1	7,692	23,077	
Low-ground-pressure Dozer	2	1	7,692	15,385	1 dozer per mix crew
Front End Loader	4	1	7,692	30,769	1 front end loader per mix crew and 1 per loading crew
Water Truck	2	1	7,692	15,385	1 water truck per mix crew
Pickup Truck	2	1	7,692	15,385	booster pumps for control of rain water
Booster Pump	2	1	7,692	15,385	

Assume	10%	of the insitu water in the sediments is drained out and collected during solidification
Volume:	1,000,000	CY
Water Content:	100%	
Specific Gravity:	2.48	from Settling Tests
Water Volume	712,644	CY
Water Volume	14,392,552	GA

TABLE K.9c
OFFLOAD, SOLIDIFICATION, AND LOADOUT COSTS - 1,000,000 CY DREDGE VOLUME

Basis of Estimate (continued):

TRUCK LOADING FOR OFFSITE DISPOSAL

Offloading production rate:	150	CY/HR =	1500	CY/DA
Volume dredged:	1,000,000			
Volume as solidified:	1,150,000			
Offloading duration:	7,692	HR or	962	Shifts

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	7,692	7,692	
Operator	1	1	7,692	7,692	
Laborer	2	1	7,692	15,385	2 laborers for traffic control
Front End Loader	4	1	7,692	30,769	
Pickup Truck	2	1	7,692	15,385	

TABLE K.9d
OFFLOAD, SOLIDIFICATION, AND LOADOUT COSTS - 10,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Solidification	10,000,000	CY	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Offloading Barges											
Superintendent	76,923	HR	100				7,692,308				7,692,308
Operator	153,846	HR	41				6,330,769				6,330,769
Laborer	153,846	HR	30				4,667,692				4,667,692
Front End Loader	76,923	HR		23			0	1,795,385	0	0	1,795,385
Crane	76,923	HR		25			0	1,923,077	0	0	1,923,077
Pickup Truck	153,846	HR		5			0	769,231	0	0	769,231
Solidification											
Superintendent	76,923	HR	100				7,692,308				7,692,308
Engineer	153,846	HR	68				10,461,538				10,461,538
Operator	307,692	HR	41				12,661,538				12,661,538
Laborer	230,769	HR	30				7,001,538				7,001,538
Low-ground-pressure Dozer	153,846	HR		37			0	5,692,308	0	0	5,692,308
Front End Loader	307,692	HR		23			0	7,181,538	0	0	7,181,538
Water Truck	153,846	HR		25			0	3,846,154	0	0	3,846,154
Pickup Truck	153,846	HR		5			0	769,231	0	0	769,231
Booster Pump	153,846	HR		26			0	4,060,000	0	0	4,060,000
Lime	1,100,000	TN			70		0	0	77,396,000	0	77,396,000
Water Treatment at Willis GWTP	143,925,517	GA				0.018				2,590,659	2,590,659
Truck Loading for Offsite Disposal											
Superintendent	76,923	HR	100				7,692,308				7,692,308
Operator	76,923	HR	41				3,165,385				3,165,385
Laborer	153,846	HR	30				4,667,692				4,667,692
Front End Loader	307,692	HR		23			0	7,181,538	0	0	7,181,538
Pickup Truck	153,846	HR		5			0	769,231	0	0	769,231
TOTAL							72,033,077	33,987,692	77,396,000	2,590,659	186,007,429
Overhead	10%						7,203,308	3,398,769	7,739,600	259,066	18,600,743
G&A, Profit	8%						6,338,911	2,990,917	6,810,848	227,978	16,368,654
TOTAL							85,575,295	40,377,378	91,946,448	3,077,703	220,976,825

Remedial Design (4%)	8,839,073
Construction Management (4%)	8,839,073
Project Management (3%)	6,629,305
Contingency (25%)	61,321,069
Total	306,605,345

TABLE K.9d
OFFLOAD, SOLIDIFICATION, AND LOADOUT COSTS - 10,000,000 CY DREDGE VOLUME

Basis of Estimate:

OFFLOADING BARGES

Dredging production rate:	130	CY/HR		
Dredging duration:	76,923	HR or	9,615	Shifts
Volume dredged:	10,000,000	CY		

CREW DESCRIPTION				
Item	Number	Factor	HR per item	Total HR
Superintendent	1	1	76,923	76,923
Operator	2	1	76,923	153,846
Laborer	2	1	76,923	153,846
Front End Loader	1	1	76,923	76,923
Crane	1	1	76,923	76,923
Pickup Truck	2	1	76,923	153,846

SOLIDIFICATION

Dredging production rate:	130	CY/HR =				
Dredging duration:	76,923	HR or	9,615	Shifts		
Volume:	10,000,000	CY				
Lime addition rate:	10%	by volume				
Volume lime needed:	1,000,000	CY =	1,100,000	TN at	1.1	TN/CY

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	76,923	76,923	
Engineer	2	1	76,923	153,846	1 engineer for lab QC, one for field QC, and one for oversight
Operator	4	1	76,923	307,692	
Laborer	3	1	76,923	230,769	
Low-ground-pressure Dozer	2	1	76,923	153,846	1 dozer per mix crew
Front End Loader	4	1	76,923	307,692	1 front end loader per mix crew and 1 per loading crew
Water Truck	2	1	76,923	153,846	1 water truck per mix crew
Pickup Truck	2	1	76,923	153,846	booster pumps for control of rain water
Booster Pump	2	1	76,923	153,846	

Assume	10%	of the insitu water in the sediments is drained out and collected during solidification
Volume:	10,000,000	CY
Water Content:	100%	
Specific Gravity:	2.48	from Settling Tests
Water Volume	7,126,437	CY
Water Volume	143,925,517	GA

TABLE K.9d
OFFLOAD, SOLIDIFICATION, AND LOADOUT COSTS - 10,000,000 CY DREDGE VOLUME

Basis of Estimate (continued):

TRUCK LOADING FOR OFFSITE DISPOSAL

Offloading production rate:	150	CY/HR =	1500	CY/DA
Volume dredged:	10,000,000			
Volume as solidified:	11,500,000			
Offloading duration:	76,923	HR or	9,615	Shifts

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	76,923	76,923	
Operator	1	1	76,923	76,923	
Laborer	2	1	76,923	153,846	2 laborers for traffic control
Front End Loader	4	1	76,923	307,692	
Pickup Truck	2	1	76,923	153,846	

TABLE K.10
PROCESS AREA CONSTRUCTION COSTS

			Unit Prices				Cost				
Construct Process Area and Bulkhead			Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Site Preparation for Process Area											
Project Manager	50	HR	134				6,700	0	0	0	6,700
Superintendent	100	HR	100				10,000	0	0	0	10,000
Operator	900	HR	41				37,035	0	0	0	37,035
Laborer	200	HR	30				6,068	0	0	0	6,068
Engineer	100	HR	68				6,800	0	0	0	6,800
Surveyor	40	HR	30				1,191	0	0	0	1,191
D6 Bulldozer	200	HR		39			0	7,706	0	0	7,706
330 Excavator	200	HR		49			0	9,742	0	0	9,742
815 Compactor	200	HR		30			0	6,000	0	0	6,000
Dump Truck	200	HR		51			0	10,148	0	0	10,148
Water Truck	100	HR		25			0	2,500	0	0	2,500
Fuel	4,500	GA			1		0	0	4,500	0	4,500
Per Diem	255	DY	109				27,773	0	0	0	27,773
Process Area Liner System, from bottom to top											
Finish Grading	871,200	SF				0.10	0	0	0	87,120	87,120
Asphalt Paving	871,200	SF				1.10	0	0	0	958,320	958,320
Process Area Cover											
Temporary Structure	217,800	SF			19		0	0	4,138,200	0	4,138,200
Structure Consultant	1,168	HR	100				116,800	0	0	0	116,800
Superintendent	1,168	HR	100				116,800	0	0	0	116,800
Operator	3,504	HR	41				144,190	0	0	0	144,190
Laborer	16,352	HR	30				496,120	0	0	0	496,120
Crane	1,168	HR	150				175,200	0	0	0	175,200
Manlift	3,504	HR	25				87,600	0	0	0	87,600
Scissors Lifts	1,168	HR	20				23,360	0	0	0	23,360
Per Diem	3,884	DA	109				423,312	0	0	0	423,312
Drainage Control System											
Drainge Control System	1	LS				50,000	0	0	0	50,000	50,000
Connection to Willis Ave GW System	1	LS				50,000	0	0	0	50,000	50,000
TOTAL							1,678,949	36,096	4,142,700	1,145,440	7,003,185
Overhead	10%						167,895	3,610	414,270	114,544	700,318
G&A, Profit	8%						147,748	3,176	364,558	100,799	616,280
TOTAL							1,994,591	42,882	4,921,528	1,360,783	8,319,784

Remedial Design (4%)	332,791
Construction Management (4%)	332,791
Project Management (3%)	249,594
Contingency (25%)	2,308,740
Total	11,543,700

TABLE K.10
PROCESS AREA CONSTRUCTION COST

Basis of Estimate:

Area of Process Area is based on 10 cells, each of 1.5 acres uncovered and 0.50 acres covered,
for a total area of 20 acres = 871,200 sf
and a covered area of 5 acres = 217,800 sf

SITE PREPARATION
Estimated duration for clear and grub and rough grading is 100 HR

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Project Manager	1	0.5	100	50
Superintendent	1	1	100	100
Operator	9	1	100	900
Laborer	2	1	100	200
Engineer	1	1	100	100
Surveyor	2	0.2	100	40
D6 Bulldozer	2	1	100	200
330 Excavator	2	1	100	200
815 Compactor	2	1	100	200
Dump Truck	2	1	100	200
Water Truck	1	1	100	100
	0	1	100	0
	0	1	100	0

Item	# People	W/E Factor	Dur in DA	Total DA
Per Diem	14	1.4	13	255

TABLE K.10
PROCESS AREA CONSTRUCTION COST

Basis of Estimate (continued):

LINER SYSTEM

Area from "Volume Sheet": 653,400 SF

COVER CONSTRUCTION

Area to be covered:	5	AC =	217,800	SF
Production Rate:	1500	SF/DA		
Duration:	146	DA =	1168	HR

CREW DEFINITION				
Item	Number	Usage	Duration	Total HRs
Structure Consultant	1	1	1,168	1,168
Superintendent	1	1	1,168	1,168
Operator	3	1	1,168	3,504
Laborer	14	1	1,168	16,352
Crane	1	1	1,168	1,168
Manlift	3	1	1,168	3,504
Scissors Lifts	1	1	1,168	1,168

Item	# People	W/E Factor	Dur in DA	Total DA
Per Diem	19	1.4	146	3,884

TABLE K.11
MECHANICAL SEPARATION SYSTEM CONSTRUCTION COST

Process Unit / Item	Quantity	Units	Unit Costs ($) Material / Equipment	Labor / Installation	Total	Total Costs ($)
Equalization Tank (7 MM Gallons) w/mixers	1	each	1,180,000	118,000	1,298,000	**$ 1,298,000**
Hydrocyclone						
Cyclone System	4	each	115,000	11,500	126,500	**$ 506,000**
(Hydrocyclone, Classifier, Feed Pump, Slurry Pump)						
Primary Clarifier	2	each	135,000	20,250	155,250	**$ 310,500**
Tanks						
Sludge Holding Tank (w/mixer)	2	each	113,870	17,080	130,950	$ 261,900
Decant Water Holding Tank	2	each	32,534	4,880	37,414	$ 74,800
					Subtotal	**$ 336,700**
Belt Filter Press (WX-3.0G)	8	each	265,000	26,500	291,500	**$ 2,332,000**
(skid mounted and includes slurry feed pump, emulsion polymer feed system, air compressor, belt wash booster pump and controls in the skid)						
Pumps						
Solids Transfer Pump	4	each	32,534	800	33,334	$ 133,337
Decant Water Pump	12	each	24,000	800	24,800	$ 297,600
					Subtotal	**$ 430,900**
Piping						
Carbon Steel Piping(lined, insulated and heat traced)	500	LF	-	-	488	$ 244,000
Misc. Yard Piping (20% of piping)	1	each				$ 49,000
					Subtotal	**$ 293,000**
Fittings and Tie-ins (25% of subtotal piping)		each				$ 73,000
Valves (30% of Subtotal piping)		each				$ 88,000
					Subtotal	**$ 161,000**
Meters						
Flowmeters	2	each	7,000	500	7,500	$ 15,000
					Subtotal	**$ 15,000**
Platforms, Ladders, Supports, etc.	1	each			50,000	**$ 50,000**
					Grand SubTotal	**5,730,000**
Electrical Costs (Lump Sum)						$ 350,000
Instrumentation (15% of Grand SubTotal)						$ 859,500
Cost for Two-2,250 GPM Trains						**$ 6,939,500**

Remedial Design (4%)	$	277,580.00
Construction Management (3%)	$	277,580.00
Project Management (4%)	$	208,185.00
Contingency (25%)	$	1,925,711.3
Total	$	9,628,556

TABLE K.12

MECHANICAL SEPARATION SYSTEM OPERATION COST

Chemical usage			
Polymer		$	15,000.00
	Chemical Usage Costs Per Year	***$***	***15,000***

Electrical

cost per kWhr	$	0.06
cost per hP	$	0.000594

	hP	Number	Cost/hr	cost/day	cost/yr
Equalization Tank Mixers	10	1	$ 0.01	$ 0.14	$ 52.03
Hydrocyclone	50	4	$ 0.12	$ 2.85	$ 1,040.69
Clarifier Mechanism	40	2	$ 0.05	$ 1.14	$ 416.28
Pumps	15	8	$ 0.07	$ 1.71	$ 624.41
Solids Transfer Pump	20	4	$ 0.05	$ 1.14	$ 416.28
Decant Water Pumps	15	8	$ 0.07	$ 1.71	$ 624.41
Other electrical requirements (25% of total)					$ 793.52

Electrical Costs Per Year	***$***	***4,000***

Labor

		High
Incremental number of Personnel (Administrative, Operations, Maintenance (Mech. & Elec))		3
Average Annual Pay (includes benefits) per person	$	75,000
Total Labor	***$***	***225,000***

Total Operating Costs per year	**$**	**244,000**

Flow rate:	gpm	4500
This Operating cost is based on 12 hrs per day, 365 days per year:	min	262800
cost per gallon:	$	0.00021

Notes:

1.The labor costs includes only the incremental number of personnel required to operate the CDF replacement equipment.

2. Electrical estimates are based on the hP and a conversion provided in literature by Gorman Rupp Pumps

TABLE K.13a
SOLIDIFICATION AND LOADOUT COSTS - 100,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Solidification	100,000	CY	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Solidification											
Superintendent	769	HR	100				76,923				76,923
Engineer	1,538	HR	68				104,615				104,615
Operator	3,077	HR	41				126,615				126,615
Laborer	2,308	HR	30				70,015				70,015
Low-ground-pressure Dozer	1,538	HR		37			0	56,923	0	0	56,923
Front End Loader	3,077	HR		23			0	71,815	0	0	71,815
Water Truck	1,538	HR		25			0	38,462	0	0	38,462
Pickup Truck	1,538	HR		5			0	7,692	0	0	7,692
Booster Pump	1,538	HR		26			0	40,600	0	0	40,600
Lime	11,000	TN			70		0	0	773,960	0	773,960
Truck Loading for Offsite Disposal											
Superintendent	769	HR	100				76,923				76,923
Operator	769	HR	41				31,654				31,654
Laborer	1,538	HR	30				46,677				46,677
Front End Loader	3,077	HR		23			0	71,815	0	0	71,815
Pickup Truck	1,538	HR		5			0	7,692	0	0	7,692
TOTAL							533,423	295,000	773,960	0	1,602,383
Overhead	10%						53,342	29,500	77,396	0	160,238
G&A, Profit	8%						46,941	25,960	68,108	0	141,010
TOTAL							633,707	350,460	919,464	0	1,903,631

Remedial Design (4%)	76,145
Construction Management (4%)	76,145
Project Management (3%)	57,109
Contingency (25%)	528,258
Total	2,641,288

TABLE K.13a
SOLIDIFICATION AND LOADOUT COSTS - 100,000 CY DREDGE VOLUME

Basis of Estimate:

OFFLOADING BARGES

Dredging production rate:	130	CY/HR		
Dredging duration:	769	HR or	96	Shifts
Volume dredged:	100,000	CY		

CREW DESCRIPTION				
Item	Number	Factor	HR per item	Total HR
Superintendent	1	1	769	769
Operator	2	1	769	1,538
Laborer	2	1	769	1,538
Front End Loader	1	1	769	769
Crane	1	1	769	769
Pickup Truck	2	1	769	1,538

SOLIDIFICATION

Dredging production rate:	130	CY/HR =				
Dredging duration:	769	HR or	96	Shifts		
Volume:	100,000	CY				
Lime addition rate:	10%	by volume				
Volume lime needed:	10,000	CY =	11,000	TN at	1.1	TN/CY

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	769	769	
Engineer	2	1	769	1,538	1 engineer for lab QC, one for field QC, and one for oversight
Operator	4	1	769	3,077	
Laborer	3	1	769	2,308	
Low-ground-pressure Dozer	2	1	769	1,538	1 dozer per mix crew
Front End Loader	4	1	769	3,077	1 front end loader per mix crew and 1 per loading crew
Water Truck	2	1	769	1,538	1 water truck per mix crew
Pickup Truck	2	1	769	1,538	booster pumps for control of rain water
Booster Pump	2	1	769	1,538	

TABLE K.13a
SOLIDIFICATION AND LOADOUT COSTS - 100,000 CY DREDGE VOLUME

Basis of Estimate (continued):

TRUCK LOADING FOR OFFSITE DISPOSAL

Offloading production rate:	150	CY/HR =	1500	CY/DA
Volume dredged:	100,000	CY		
Volume as solidified:	115,000			
Offloading duration:	769	HR or	96	Shifts

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	769	769	
Operator	1	1	769	769	
Laborer	2	1	769	1,538	2 laborers for traffic control
Front End Loader	4	1	769	3,077	
Pickup Truck	2	1	769	1,538	

TABLE K.13b
SOLIDIFICATION AND LOADOUT COSTS - 500,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Solidification	500,000	CY	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Solidification											
Superintendent	3,846	HR	100				384,615				384,615
Engineer	7,692	HR	68				523,077				523,077
Operator	15,385	HR	41				633,077				633,077
Laborer	11,538	HR	30				350,077				350,077
Low-ground-pressure Dozer	7,692	HR		37			0	284,615	0	0	284,615
Front End Loader	15,385	HR		23			0	359,077	0	0	359,077
Water Truck	7,692	HR		25			0	192,308	0	0	192,308
Pickup Truck	7,692	HR		5			0	38,462	0	0	38,462
Booster Pump	7,692	HR		26			0	203,000	0	0	203,000
Lime	55,000	TN			70		0	0	3,869,800	0	3,869,800
Truck Loading for Offsite Disposal											
Superintendent	3,846	HR	100				384,615				384,615
Operator	3,846	HR	41				158,269				158,269
Laborer	7,692	HR	30				233,385				233,385
Front End Loader	15,385	HR		23			0	359,077	0	0	359,077
Pickup Truck	7,692	HR		5			0	38,462	0	0	38,462
TOTAL							2,667,115	1,475,000	3,869,800	0	8,011,915
Overhead	10%						266,712	147,500	386,980	0	801,192
G&A, Profit	8%						234,706	129,800	340,542	0	705,049
TOTAL							3,168,533	1,752,300	4,597,322	0	9,518,155

Remedial Design (4%)	380,726
Construction Management (4%)	380,726
Project Management (3%)	285,545
Contingency (25%)	2,641,288
Total	13,206,441

TABLE K.13b
SOLIDIFICATION AND LOADOUT COSTS - 500,000 CY DREDGE VOLUME

Basis of Estimate:

OFFLOADING BARGES

Dredging production rate:	130	CY/HR		
Dredging duration:	3,846	HR or	481	Shifts
Volume dredged:	500,000	CY		

CREW DESCRIPTION				
Item	Number	Factor	HR per item	Total HR
Superintendent	1	1	3,846	3,846
Operator	2	1	3,846	7,692
Laborer	2	1	3,846	7,692
Front End Loader	1	1	3,846	3,846
Crane	1	1	3,846	3,846
Pickup Truck	2	1	3,846	7,692

SOLIDIFICATION

Dredging production rate:	130	CY/HR =				
Dredging duration:	3,846	HR or	481	Shifts		
Volume:	500,000	CY				
Lime addition rate:	10%	by volume				
Volume lime needed:	50,000	CY =	55,000	TN at	1.1	TN/CY

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	3,846	3,846	
Engineer	2	1	3,846	7,692	1 engineer for lab QC, one for field QC, and one for oversight
Operator	4	1	3,846	15,385	
Laborer	3	1	3,846	11,538	
Low-ground-pressure Dozer	2	1	3,846	7,692	1 dozer per mix crew
Front End Loader	4	1	3,846	15,385	1 front end loader per mix crew and 1 per loading crew
Water Truck	2	1	3,846	7,692	1 water truck per mix crew
Pickup Truck	2	1	3,846	7,692	booster pumps for control of rain water
Booster Pump	2	1	3,846	7,692	

TABLE K.13b
SOLIDIFICATION AND LOADOUT COSTS - 500,000 CY DREDGE VOLUME

Basis of Estimate (continued):

TRUCK LOADING FOR OFFSITE DISPOSAL

Offloading production rate:	150	CY/HR =	1500	CY/DA
Volume dredged:	500,000			
Volume as solidified:	575,000			
Offloading duration:	3,846	HR or	481	Shifts

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	3,846	3,846	
Operator	1	1	3,846	3,846	
Laborer	2	1	3,846	7,692	2 laborers for traffic control
Front End Loader	4	1	3,846	15,385	
Pickup Truck	2	1	3,846	7,692	

TABLE K.13c
SOLIDIFICATION AND LOADOUT COSTS - 1,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Solidification	1,000,000	CY	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Solidification											
Superintendent	7,692	HR	100				769,231				769,231
Engineer	15,385	HR	68				1,046,154				1,046,154
Operator	30,769	HR	41				1,266,154				1,266,154
Laborer	23,077	HR	30				700,154				700,154
Low-ground-pressure Dozer	15,385	HR		37			0	569,231	0	0	569,231
Front End Loader	30,769	HR		23			0	718,154	0	0	718,154
Water Truck	15,385	HR		25			0	384,615	0	0	384,615
Pickup Truck	15,385	HR		5			0	76,923	0	0	76,923
Booster Pump	15,385	HR		26			0	406,000	0	0	406,000
Lime	110,000	TN			70		0	0	7,739,600	0	7,739,600
Truck Loading for Offsite Disposal											
Superintendent	7,692	HR	100				769,231				769,231
Operator	7,692	HR	41				316,538				316,538
Laborer	15,385	HR	30				466,769				466,769
Front End Loader	30,769	HR		23			0	718,154	0	0	718,154
Pickup Truck	15,385	HR		5			0	76,923	0	0	76,923
TOTAL							5,334,231	2,950,000	7,739,600	0	16,023,831
Overhead	10%						533,423	295,000	773,960	0	1,602,383
G&A, Profit	8%						469,412	259,600	681,085	0	1,410,097
TOTAL							6,337,066	3,504,600	9,194,645	0	19,036,311

Remedial Design (4%)	761,452
Construction Management (4%)	761,452
Project Management (3%)	571,089
Contingency (25%)	5,282,576
Total	26,412,881

Honeywell

TABLE K.13c
SOLIDIFICATION AND LOADOUT COSTS - 1,000,000 CY DREDGE VOLUME

Basis of Estimate:

OFFLOADING BARGES

Dredging production rate:	130	CY/HR		
Dredging duration:	7,692	HR or	962	Shifts
Volume dredged:	1,000,000	CY		

CREW DESCRIPTION				
Item	Number	Factor	HR per item	Total HR
Superintendent	1	1	7,692	7,692
Operator	2	1	7,692	15,385
Laborer	2	1	7,692	15,385
Front End Loader	1	1	7,692	7,692
Crane	1	1	7,692	7,692
Pickup Truck	2	1	7,692	15,385

SOLIDIFICATION

Dredging production rate:	130	CY/HR =				
Dredging duration:	7,692	HR or	962	Shifts		
Volume:	1,000,000	CY				
Lime addition rate:	10%	by volume				
Volume lime needed:	100,000	CY =	110,000	TN at	1.1	TN/CY

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	7,692	7,692	
Engineer	2	1	7,692	15,385	1 engineer for lab QC, one for field QC, and one for oversight
Operator	4	1	7,692	30,769	
Laborer	3	1	7,692	23,077	
Low-ground-pressure Dozer	2	1	7,692	15,385	1 dozer per mix crew
Front End Loader	4	1	7,692	30,769	1 front end loader per mix crew and 1 per loading crew
Water Truck	2	1	7,692	15,385	1 water truck per mix crew
Pickup Truck	2	1	7,692	15,385	booster pumps for control of rain water
Booster Pump	2	1	7,692	15,385	

TABLE K.13c
SOLIDIFICATION AND LOADOUT COSTS - 1,000,000 CY DREDGE VOLUME

Basis of Estimate (continued):

TRUCK LOADING FOR OFFSITE DISPOSAL

Offloading production rate:	150	CY/HR =	1500	CY/DA
Volume dredged:	1,000,000			
Volume as solidified:	1,150,000			
Offloading duration:	7,692	HR or	962	Shifts

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	7,692	7,692	
Operator	1	1	7,692	7,692	
Laborer	2	1	7,692	15,385	2 laborers for traffic control
Front End Loader	4	1	7,692	30,769	
Pickup Truck	2	1	7,692	15,385	

TABLE K.13d
SOLIDIFICATION AND LOADOUT COSTS - 10,000,000 CY DREDGE VOLUME

			Unit Prices				Cost				
Solidification	10,000,000	CY	Labor	Equipment	Materials	Subcont	Labor	Equipment	Materials	Subcont	TOTAL
Solidification											
Superintendent	76,923	HR	100				7,692,308				7,692,308
Engineer	153,846	HR	68				10,461,538				10,461,538
Operator	307,692	HR	41				12,661,538				12,661,538
Laborer	230,769	HR	30				7,001,538				7,001,538
Low-ground-pressure Dozer	153,846	HR		37			0	5,692,308	0	0	5,692,308
Front End Loader	307,692	HR		23			0	7,181,538	0	0	7,181,538
Water Truck	153,846	HR		25			0	3,846,154	0	0	3,846,154
Pickup Truck	153,846	HR		5			0	769,231	0	0	769,231
Booster Pump	153,846	HR		26			0	4,060,000	0	0	4,060,000
Lime	1,100,000	TN			70		0	0	77,396,000	0	77,396,000
Truck Loading for Offsite Disposal											
Superintendent	76,923	HR	100				7,692,308				7,692,308
Operator	76,923	HR	41				3,165,385				3,165,385
Laborer	153,846	HR	30				4,667,692				4,667,692
Front End Loader	307,692	HR		23			0	7,181,538	0	0	7,181,538
Pickup Truck	153,846	HR		5			0	769,231	0	0	769,231
TOTAL							53,342,308	29,500,000	77,396,000	0	160,238,308
Overhead	10%						5,334,231	2,950,000	7,739,600	0	16,023,831
G&A, Profit	8%						4,694,123	2,596,000	6,810,848	0	14,100,971
TOTAL							63,370,662	35,046,000	91,946,448	0	190,363,110

Remedial Design (4%)	7,614,524
Construction Management (4%)	7,614,524
Project Management (3%)	5,710,893
Contingency (25%)	52,825,763
Total	264,128,814

TABLE K.13d
SOLIDIFICATION AND LOADOUT COSTS - 10,000,000 CY DREDGE VOLUME

Basis of Estimate:

OFFLOADING BARGES

Dredging production rate:	130	CY/HR		
Dredging duration:	76,923	HR or	9,615	Shifts
Volume dredged:	10,000,000	CY		

CREW DESCRIPTION				
Item	Number	Factor	HR per item	Total HR
Superintendent	1	1	76,923	76,923
Operator	2	1	76,923	153,846
Laborer	2	1	76,923	153,846
Front End Loader	1	1	76,923	76,923
Crane	1	1	76,923	76,923
Pickup Truck	2	1	76,923	153,846

SOLIDIFICATION

Dredging production rate:	130	CY/HR =				
Dredging duration:	76,923	HR or	9,615	Shifts		
Volume:	10,000,000	CY				
Lime addition rate:	10%	by volume				
Volume lime needed:	1,000,000	CY =	1,100,000	TN at	1.1	TN/CY

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	76,923	76,923	
Engineer	2	1	76,923	153,846	1 engineer for lab QC, one for field QC, and one for oversight
Operator	4	1	76,923	307,692	
Laborer	3	1	76,923	230,769	
Low-ground-pressure Dozer	2	1	76,923	153,846	1 dozer per mix crew
Front End Loader	4	1	76,923	307,692	1 front end loader per mix crew and 1 per loading crew
Water Truck	2	1	76,923	153,846	1 water truck per mix crew
Pickup Truck	2	1	76,923	153,846	booster pumps for control of rain water
Booster Pump	2	1	76,923	153,846	

TABLE K.13d
SOLIDIFICATION AND LOADOUT COSTS - 10,000,000 CY DREDGE VOLUME

Basis of Estimate (continued):

TRUCK LOADING FOR OFFSITE DISPOSAL

Offloading production rate:	150	CY/HR =	1500	CY/DA
Volume dredged:	10,000,000			
Volume as solidified:	11,500,000			
Offloading duration:	76,923	HR or	9,615	Shifts

Item	Number	Factor	HR per item	Total HR	
Superintendent	1	1	76,923	76,923	
Operator	1	1	76,923	76,923	
Laborer	2	1	76,923	153,846	2 laborers for traffic control
Front End Loader	4	1	76,923	307,692	
Pickup Truck	2	1	76,923	153,846	

TABLE K.14
OFF-SITE TRUCKING TRANSPORTATION AND DISPOSAL COSTS

Disposal Facility	Owner	Location	Distance (miles)	Transportation (Truck) ($/ton)	Disposal Nonhazardous ($/ton)	Transportation and Disposal ($/ton)	Daily Capacity (tons/day)	Total Capacity
High Acres Landfill	Waste Management	Fairport, NY	80	$16	$50	$66	3,500 (2,700 committed capacity)	1.9 million CY constructed
Niagara Falls/Pine Avenue	Allied Waste	Niagara Falls, NY	165	$30	$30	$60	2,200 (1,700 committed capacity)	500,000 CY permitted; 1.8 million CY pending approval
CWM Chemical Services	Waste Management	Model City, NY	170	$31	$50	$81	4,400 (1,000 committed capacity)	1.2 million CY constructed
American Landfill	Waste Management	Waynesburg, OH	390	$67	$18	$85	15,000	8.5 million CY currently permitted; 85 million CY pending approval
Atlantic Waste Disposal	Waste Management	Waverly, VA	525	$89	$22	$111	15,000 (3,750 committed capacity)	104 million CY permitted capacity

Notes:
1. Transportation costs (i.e., trucking) are based on information provided by Tonawanda Tank Transport, Inc.
2. Transportation costs (i.e., trucking) assume 1 hour demurrage fee ($65 per hour) would be required for approximately 10% of the loads.
3. Disposal costs based on vendor quotes from Waste Management and Allied Waste.
4. Committed capacity is based on current amounts of waste material being received by the facility

TABLE K.15
TRUCKING TRANSPORTATION COST ANALYSIS

Company	Facility Location	Distance	Rate @ $3.00/ Loaded Mile	Per Load	Fuel Surcharge @ 10%	Liner Charge @ $50 per Load	Total per Load ($/Load)	Demurrage Cost[1] ($/Load)	Cost/Ton	Cost/Yard
High Acres Landfill	Fairport, NY	80	$3.00	$240.00	$24.00	$50.00	$314.00	$6.50	$16	$22
Niagara Falls/Pine Avenue	Niagara Falls, NY	165	$3.00	$495.00	$49.50	$50.00	$594.50	$6.50	$30	$42
Waste Management	Model City, NY	170	$3.00	$510.00	$51.00	$50.00	$611.00	$6.50	$31	$43
American Landfill	Waynesburg, OH	390	$3.00	$1,170.00	$117.00	$50.00	$1,337.00	$6.50	$67	$94
Atlantic Waste Disposal	Waverly, VA	525	$3.00	$1,575.00	$157.50	$50.00	$1,782.50	$6.50	$89	$125

Notes:
1. Demurrage cost assumes 1 hour demurrage fee ($65 per hour) would be required for approximately 10% of the loads (i.e., $6.50 per load).
2. Transportation costs (i.e., trucking) are based on information provided by Tonawanda Tank Transport, Inc. (Fall 2003).
3. 20 tons/load is assumed.
4. A unit weight of 1.4 tons/cubic yard is assumed.

TABLE K.16
OFF-SITE TRUCKING TRANSPORTATION AND DISPOSAL COSTS BY VOLUME

Disposal Volume (*In Situ*) (cubic yards)	Disposal Volume (Dewatered/Solidified) (cubic yards)	Disposal Tons	Disposal Facilities and Percentage Used	Average Distance/Load (miles)	Average Transportation & Disposal Cost ($/ton)	Total Transportation & Disposal Cost
100,000	115,000	161,000	High Acres Landfill 50% Niagara Falls/Pine Avenue 50%	123	$63	$10,122,875
500,000	575,000	805,000	High Acres Landfill 50% Niagara Falls/Pine Avenue 50%	123	$63	$50,614,375
1,000,000	1,150,000	1,610,000	High Acres Landfill 50% Niagara Falls/Pine Avenue 50%	123	$63	$101,228,750
10,000,000	11,500,000	16,100,000	American Landfill 50% Atlantic Waste Disposal 50%	458	$98	$1,577,598,750

Notes:
1. Transportation costs (i.e., trucking) are based on information provided by Tonawanda Tank Transport, Inc.
2. Transportation costs (i.e., trucking) assume 1 hour demurrage fee ($65 per hour) would be required for approximately 10% of the loads.
3. Disposal costs based on vendor quotes from Waste Management and Allied Waste.
4. Assume density of 1.4 tons/cubic yard

TABLE K.17
OFF-SITE RAIL TRANSPORTATION AND DISPOSAL COSTS

Disposal Facility	Owner	Location	Distance (miles)	Transportation (Rail) ($/ton)	Disposal Nonhazardous ($/ton)	Transportation and Disposal ($/ton)
Taylor	Allied Waste	Mauk, GA	1100	$66	$30	$96
Lee County	Allied Waste	Bishopville, SC	800	$48	$30	$78
EQ-Wayne Disposal Inc.	EQ Holdings, Inc.	Belleville, MI	450	$27	$33	$60
Columbia Ridge Landfill	Waste Management	Arlington, OR	2660	$160	$50	$210

Notes:
1. Transportation costs (i.e., rail) are based on estimated cost of $0.06 per ton-mile or vendor quotes.
2. Disposal costs based on vendor quotes from Waste Management and Allied Waste.

TABLE K.18
OPTION 2
OFF-SITE SEDIMENT MANAGEMENT COST AND DURATION SUMMARY

	100,000 CY	500,000 CY	1,000,000 CY	10,000,000 CY
Capital Costs				
Construct Process Area and Bulkhead	18,495,444	18,495,444	18,495,444	18,495,444
Offload Barges, Solidification, and Load Out	3,066,053	15,330,267	30,660,534	306,605,345
T&D	10,122,875	50,614,375	101,228,750	1,577,598,750
Operating Costs				
none				
Total Off-Site Sediment Management	31,684,373	84,440,087	150,384,729	1,902,699,539
Costs per In Situ Cubic Yard	317	169	150	190
Duration				
Number of Dredge Crews	1	1	1	1
Dredge Rate (Per Dredge Crew)	130	130	130	130
Duration (DA)	48	240	481	4,808
Duration (MO)	2	12	24	240
Duration (YR)	0.3	1.7	3.4	34.3

TABLE K.19
OPTION 4
OFF-SITE SEDIMENT MANAGEMENT COST AND DURATION SUMMARY

	100,000 CY	500,000 CY	1,000,000 CY	10,000,000 CY
Capital Costs				
Construct Process Area	11,543,700	11,543,700	11,543,700	11,543,700
Construct Mechanical Dewatering System	9,628,556	9,628,556	9,628,556	9,628,556
Mechanical Dewatering per 1,000 gallon	0.21	0.21	0.21	0.21
Total Gallons to be Treated (at 1,295 (	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Mechanical Dewatering Costs	27,195	135,975	271,950	27,195
Advanced Water Treatment System	26,237,625	26,237,625	26,237,625	39,768,803
Water Treatment per 1,000 gallon	4.98	4.98	4.98	4.98
Total Gallons to be Treated (at 1,295 (	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Water Treatment Costs	644,910	3,224,550	6,449,100	64,491,000
Dismantle Water Treatment System	1,000,000	1,000,000	1,000,000	1,000,000
Solidification and Load Out	2,641,288	13,206,441	26,412,881	264,128,814
T&D	10,122,875	50,614,375	101,228,750	1,577,598,750
Operating Costs				
none				
Total Off-Site Sediment Management	61,846,149	115,591,222	182,772,563	1,968,186,818
Costs per In Situ Cubic Yard	618	231	183	197
Duration				
Number of Dredge Crews	1	1	1	1
Dredge Rate (Per Dredge Crew)	150	150	150	150
Duration (DA)	42	208	417	4,167
Duration (MO)	2	10	21	208
Duration (YR)	0.3	1.5	3.0	29.8

TABLE K.20
OPTION 2 VERSUS OPTION 4
OFF-SITE SEDIMENT MANAGEMENT COST SUMMARY

	100,000 CY	500,000 CY	1,000,000 CY	10,000,000 CY
Option 2				
Total Off-Site Sediment Management	31,684,373	84,440,087	150,384,729	1,902,699,539
Costs per In Situ Cubic Yard	317	169	150	190
Option 4				
Total Off-Site Sediment Management	61,846,149	115,591,222	182,772,563	1,968,186,818
Costs per In Situ Cubic Yard	618	231	183	197

TABLE K.21
CONSTRUCTION COST ESTIMATE FOR ENHANCED PRIMARY TREATMENT
(4,500 GPM @ 24-HRS/DAY)

Process Unit / Item	Quantity	Units	Unit Costs ($) Material / Equipment	Labor / Installation	Total	Total Costs
Flocculator	2	each	75,000	11,250	86,250	**$ 172,500**
Inclined Plate (Secondary) Clarifier	2	each	150,000	22,500	172,500	**$ 345,000**
Chemical Feed System						
Polymer Feed System	2	each			20,000	$ 40,000
Alum Feed System	2	each			20,000	$ 40,000
						$ 80,000
Tanks						
Effluent Holding Tank	2	each	100,000	15,000	115,000	**$ 230,000**
Pumps						
Pump from CDF to Rapid Mix Chamber	4	each	26,000	1,000	27,000	$ 108,000
Clarifier Sludge Transfer Pump	3	each	20,000	800	20,800	$ 62,400
						$ 170,400
Piping						
Carbon Steel Piping(lined, insulated and heat traced)	2,000	LF			250	$ 500,000
Misc. Yard Piping (20% of piping)	1	each				$ 100,000
						$ 600,000
Fittings and Tie-ins (25% of subtotal piping)		each				$ 150,000
Valves (30% of subtotal piping)		each				$ 180,000
						$ 330,000
Meters						
pH Meters	2	each	1,000	500	1,500	$ 3,000
Flowmeters	2	each	7,000	500	7,500	$ 15,000
						$ 18,000
Site Preparation & Development						
Site Clearance + Grubbing	0	each	(Lump Sum)		40,000	$ -
Area Paving & Foundations	1.5	acre			125,000	$ 187,500
						$ 187,500
Platforms, Ladders, Supports, etc.	1	each			100,000	**$ 100,000**
				Grand SubTotal		**2,230,000**
Electrical Costs (lump sum)						$ 750,000
Instrumentation (20% of grand subtotal)						$ 446,000
Cost for Two-1,000 GPM Trains						**$ 3,426,000**
Scale-Up to Two-2,250 GPM trains				**Total**		**$ 5,573,000**

Remedial Design (4%)	$ 222,920
Construction Management (3%)	$ 222,920
Project Management (4%)	$ 167,190
Contingency (25%)	$ 1,546,508
Total	$ 7,732,538

Note:
1. Cost for 1,000 GPM train, scaled to 2,250 GPM.
2. Estimate does not include providing for utilities, e.g. fire water system, air, nitrogen, power, etc. in a new area.
3. Estimate does not include costs for relocation, if any, of underground and aboveground utilities, demolition, closure, or remediation.
4. SCA cost is not included but is part of the treatment train.

TABLE K.22
CONSTRUCTION COST ESTIMATE FOR ENHANCED PRIMARY TREATMENT WITH MULTI-MEDIA FILTRATION (4,500 GPM @ 24-hrs./day)

Process Unit / Item	Quantity	Units	Unit Costs ($) Material / Equipment	Labor / Installation	Total	Total Costs
Flocculator	2	each	75,000	11,250	86,250	**$ 172,500**
Inclined Plate (Secondary) Clarifier	2	each	150,000	22,500	172,500	**$ 345,000**
Multi-Media Filter (includes b/w pumps)	2	each	145,000	21,750	166,750	**$ 333,500**
Tanks						
Filter Feed Tank	2	each	70,000	10,500	80,500	$ 161,000
Filter Effluent Tank	2	each	70,000	10,500	80,500	$ 161,000
Effluent Holding Tank	2	each	100,000	15,000	115,000	$ 230,000
						$ 552,000
Chemical Feed System						
Polymer Feed System (Secondary Clarifier)	2	each			20,000	$ 40,000
Alum Feed System (Secondary Clarifier)	2	each			20,000	$ 40,000
						$ 80,000
Pumps						
Pump from CDF to Flocculator	4	each	26,000	1,000	27,000	$ 108,000
Clarifier Sludge Transfer Pump	3	each	20,000	800	20,800	$ 62,400
Pump from Filter Fd Tk to MMF	4	each	26,200	1,000	27,200	$ 108,800
Final Effluent Pump	4	each	26,200	800	27,000	$ 108,000
						$ 496,000
Piping						
Carbon Steel Piping(lined, insulated and heat traced)	3,500	LF			250	$ 875,000
Misc. Yard Piping (20% of piping)	1	each				$ 175,000
						$ 1,050,000
Fittings and Tie-ins (25% of subtotal piping)		each				$ 262,500
Valves (30% of subtotal piping)		each				$ 315,000
						$ 577,500
Meters						
pH Meters	4	each	1,000	500	1500	$ 6,000
Flowmeters	4	each	7,000	500	7,500	$ 30,000
						$ 36,000
Site Preparation & Development						
Site Clearance + Grubbing	0	each	(Lump Sum)		40,000	$ -
Area Paving & Foundations	2.50	acre			125,000	$ 312,500
						$ 312,500
Platforms, Ladders, Supports, etc.	1	each			125,000	**$ 125,000**
					Grand SubTotal	**4,080,000**
Electrical Costs (lump sum)						$ 850,000
Instrumentation (20% of grand subtotal)						$ 816,000
Cost for Two-1,000 GPM Train						**$ 5,746,000**
Scale-Up to Two-2,250 GPM trains						**$ 9,347,000**

Remedial Design (4%)	$ 373,880
Construction Management (3%)	$ 373,880
Project Management (4%)	$ 280,410
Contingency (25%)	$ 2,593,793
Total	$ 12,968,963

Note:
1. Cost and line sizing for 1,000 GPM train, scaled to 2,250 GPM.
2. Estimate does not include providing for utilities, e.g. fire water system, air, nitrogen, power, etc. in a new area.
3. Estimate does not include costs for relocation, if any, of underground and aboveground utilities, demolition, closure, or remediation.
4. SCA cost is not included but is part of the treatment train.

TABLE K.23
CONSTRUCTION COST ESTIMATE FOR ADVANCED TREATMENT
(4,500 GPM @ 24-HRS/DAY)

Process Unit / Item	Quantity	Units	Unit Costs ($) Material / Equipment	Labor / Installation	Total	Total Costs
Flocculator	2	each	75,000	11,250	86,250	**$ 172,500**
Inclined Plate (Secondary) Clarifier	2	each	150,000	22,500	172,500	**$ 345,000**
Multi-Media Filter (includes backwash pumps)	2	each	145,000	21,750	166,750	**$ 333,500**
Air Stripper system (includes blowers)	2	each	400,000	40,000	440,000	**$ 880,000**
GAC Filter Systems	6	each	135,000	13,500	148,500	**$ 891,000**
Tanks						
Filter Feed Tank	2	each	140,000	21,000	161,000	$ 322,000
Filter Effluent Tank	2	each	70,000	10,500	80,500	$ 161,000
Air Stripper Effluent Tank	2	each	70,000	10,500	80,500	$ 161,000
GAC Effluent Tank	2	each	70,000	10,500	80,500	$ 161,000
Effluent Holding Tank	2	each	100,000	15,000	115,000	$ 230,000
						$ 1,035,000
Chemical Feed System						
pH Adjustment System	4	each			100,000	$ 400,000
Polymer Feed System (Secondary Clarifier)	2	each			20,000	$ 40,000
Polymer Feed System (Filter Press)	2	each			20,000	$ 40,000
Alum Feed System (Secondary Clarifier)	2	each			20,000	$ 40,000
						$ 520,000
Pumps						
Pump from Filter Fd Tk to MMF	4	each	26,200	1,000	27,200	$ 108,800
Pump from MMF to Air Stripper	4	each	26,400	800	27,200	$ 108,800
GAC Influent Pump	4	each	35,000	800	35,800	$ 143,200
Final Effluent Pump	4	each	26,200	800	27,000	$ 108,000
Solids Pump	3	each	20,000	800	20,800	$ 62,400
						$ 531,200
Piping						
Carbon Steel Piping(lined, insulated and heat traced)	8,000	LF			250	$ 2,000,000
Misc. Yard Piping (20% of piping)	1	each				$ 400,000
						$ 2,400,000
Fittings and Tie-ins (25% of subtotal piping)		each				$ 600,000
Valves (30% of subtotal piping)		each				$ 720,000
						$ 1,320,000
Meters						
pH Meters	4	each	1,000	500	1,500	$ 6,000
Flowmeters	4	each	7,000	500	7,500	$ 30,000
						$ 36,000
Site Preparation & Development						
Site Clearance + Grubbing	0	each	(Lump Sum)		40,000	$ -
Area Paving & Foundations	4	acre			125,000	$ 500,000
						$ 500,000
Platforms, Ladders, Supports, etc.	1	each			175,000	**$ 175,000**
				Grand SubTotal		**9,140,000**
Electrical Costs (lump sum)						$ 1,000,000
Instrumentation (20% of grand subtotal)						$ 1,828,000
Cost for Two-1,000 GPM Trains						**$ 11,968,000**
Scale-Up to Two-2,250 GPM trains						**$ 18,910,000**

Remedial Design (4%)	$ 756,400
Construction Management (3%)	$ 756,400
Project Management (4%)	$ 567,300
Contingency (25%)	$ 5,247,525
Total	$ 26,237,625

Note:
1. Cost and line sizing for 1,000 GPM train, scaled to 2,250 GPM.
2. Estimate does not include providing for utilities, e.g. fire water system, air, nitrogen, power, etc. in a new area.
3. Estimate does not include costs for relocation, if any, of underground and aboveground utilities, demolition, closure, or remediation.
4. SCA cost is not included but is part of the treatment train.

TABLE K.24
CONSTRUCTION COST ESTIMATE FOR ENHANCED PRIMARY TREATMENT PLUS ORGANICS REMOVAL (4,500 GPM @ 24-HRS/DAY)

Process Unit / Item	Quantity	Units	Unit Costs ($) Material / Equipment	Labor / Installation	Total	Total Costs ($)
Flocculator	2	each	75,000	11,250	86,250	**$ 172,500**
Inclined Plate (Secondary) Clarifier	2	each	150,000	22,500	172,500	**$ 345,000**
GAC Filter Systems	6	each	135,000	13,500	148,500	**$ 891,000**
Tanks						
GAC Feed Tank	2	each	70,000	10,500	80,500	$ 161,000
Effluent Holding Tank	2	each	100,000	15,000	115,000	$ 230,000
				Subtotal		**$ 391,000**
Chemical Feed System						
Polymer Feed System (Inclined Plate Clarifier)	2	each			20,000	$ 40,000
Alum Feed System (Inclined Plate Clarifier)	2	each			20,000	$ 40,000
Polymer Feed System (Filter Press)	0	each			20,000	$ -
				Subtotal		**$ 80,000**
Pumps						
Pump from CDF to Flocculator	4	each	26,200	1,000	27,200	$ 108,800
GAC Influent Pump	4	each	35,000	800	35,800	$ 143,200
Final Effluent Pump	4	each	26,200	800	27,000	$ 108,000
				Subtotal		**$ 360,000**
Piping						
Carbon Steel Piping(lined, insulated and heat traced)	2,500	LF			250	$ 625,000
Misc. Yard Piping (20% of piping)	1	each				$ 125,000
				Subtotal		**$ 750,000**
Fittings and Tie-ins (25% of subtotal piping)		each				$ 188,000
Valves (30% of Subtotal piping)		each				$ 225,000
				Subtotal		**$ 413,000**
Meters						
pH Meters	4	each	1,000	500	1,500	$ 6,000
Flowmeters	4	each	7,000	500	7,500	$ 30,000
				Subtotal		**$ 36,000**
Site Preparation & Development						
Site Clearance + Grubbing	0	each	(Lump Sum)		40,000	$ -
Area Paving & Foundations	2	acre			125,000	$ 250,000
						$ 250,000
Platforms, Ladders, Supports, etc.	1	each			175,000	**$ 175,000**
				Grand SubTotal		**3,860,000**
Electrical Costs (Lump Sum)						$ 750,000
Instrumentation (20% of Grand SubTotal)						$ 772,000
Cost for One-1,000 GPM Trains						**$ 5,382,000**
Scale-Up to Two-2,250 GPM trains						**$ 8,197,000**

Remedial Design (4%)	$ 327,880
Construction Management (3%)	$ 327,880
Project Management (4%)	$ 245,910
Contingency (25%)	$ 2,274,668
Total	$ 11,373,338

Note:
1. Cost and line sizing for 1,000 GPM train, scaled to 2,250 GPM.
2. Estimate does not include providing for utilities, e.g. fire water system, air, nitrogen, power, etc. in a new area.
3. Estimate does not include costs for relocation, if any, of underground and aboveground utilities, demolition, closure, or remediation.
4. SCA cost is not included but is part of the treatment train.

TABLE K.25
OPERATIONS & MAINTENANCE COST ESTIMATE
(4,500 GPM @ 24-HRS/DAY)

Chemical usage

			Advanced						Enhanced + MMF and Organics	Enhanced	Primary
			Caustic		Anionic Polymer	Cationic Polymer	Alum		Polymer & Alum Cost	Polymer & Alum Cost	Polymer & Alum Cost
			0.54		0.125	2.5	50	mg/L			
Flow	*4,500*	gpm	24.30	gpm	3.07	61.32	1226	kg/day			
	17,034	L/min	12,772,080	gpy	6.75	134.91	2698	lb/day			
	24,529,470	L/day			2462	49243	984858	lb/yr			
			0.72	$/gal	1.8	1.35	0.16	$/lb			
			$9,195,898		4,432	66,478	157,577	$/yr	$ 230,000	$ 230,000	$ -
			Chemical Usage Costs Per Year				***$ 9,424,385***		***$ 230,000***	***$ 230,000***	***$ -***

Electrical

cost per kWh	$	0.06
cost per hP	$	0.000594

Pump	hP	Number	Cost/hr	cost/day	cost/yr	Enhanced + MMF	Enhanced	Primary
Pump from Cyclone to Pri. Clarifier	20	2	$ 0.02	$ 0.57	$ 208.14			
Pump from Filter Fd Tk to MMF	25	2	$ 0.03	$ 0.71	$ 260.17			
Pump from MMF to Air Stripper	30	2	$ 0.04	$ 0.86	$ 312.21			
GAC Influent Pump	35	2	$ 0.04	$ 1.00	$ 364.24			
Effluent Pump	25	2	$ 0.03	$ 0.71	$ 260.17			
Decant Water Pumps for Solids Tank	15	4	$ 0.04	$ 0.86	$ 312.21			
Solids Transfer Pump	3	4	$ 0.01	$ 0.17	$ 62.44			
Solids Pump	3	2	$ 0.00	$ 0.09	$ 31.22			
Decant Water Pump	15	2	$ 0.02	$ 0.43	$ 156.10			
Other electrical requirements (25% of total)					$ 491.73			
Electrical Costs Per Year					***$ 2,459***	***$ 1,800***	***$ 1,200***	***$ -***

			Advanced	Enhanced + MMF	Enhanced	Primary
GAC Filters						
Exchange out 3 beds of carbon every 30 days		(per month)	$ 30,000	$ -	$ -	$ -
	GCA FiltrationCosts Per Year		***$ 1,080,000***	***$ -***	***$ -***	***$ -***
Multi-Media Filter (MMF)		(per month)	$ 6,750			
	MMF FiltrationCosts Per Year		***$ 243,000***	***$ 243,000***	***$ -***	***$ -***

Labor

	Advanced	Enhanced + MMF	Enhanced	Primary
Total number of personnel (administrative, operations, maintenance (mech. & elec.))	12	10	8	0
Average annual pay (includes benefits) per person	$ 75,000	$ 75,000	$ 75,000	$ -
Total labor	***$ 900,000***	***$ 750,000***	***$ 600,000***	***$ -***

Analytical

	Number/year	Cost/test	Advanced	Enhanced + MMF	Enhanced	Primary
Metals - Water (total) (10 per week with QC)	624	157.48	$ 98,270	$ 98,270	$ 98,270	$ 98,270
Sulfides - Water (10 per week with QC)	624	15.75	$ 9,829	$ 9,829	$ 9,829	$ 9,829
TSS (10 per week with QC)	624	8.60	$ 5,364	$ 5,364	$ 5,364	$ 5,364
Turbidity - Water (10 per week with QC)	624	8.60	$ 5,364	$ 5,364	$ 5,364	$ 5,364
Total Analytical			***$ 118,826***	***$ 118,826***	**$ 118,826**	**$ 118,826**
Total Operating Costs per year			**$ 11,769,000**	**$ 1,344,000**	**$ 950,000**	**$ 119,000**
Treatment Rate			4,500	4,500	4,500	4,500
Gallon per Year			2,365,200,000	2,365,200,000	2,365,200,000	2,365,200,000
Total Operating Costs per 1,000 Gallons			**4.98**	**0.57**	**0.40**	**0.05**

Notes:
1.Caustic usage is based on the treatability report prepared by O'Brien & Gere for the Willis Avenue/Semet Tar beds IRM (groundwater).
This said that 0.54 percent of 50% caustic solution was required to adjust the pH to 8.5 for solids precipitation.
2. Electrical estimates are based on the hP and a conversion provided in literature by Gorman Rupp Pumps
3. Carbon usage rate provided by GAC supplier.

TABLE K.26a
SUPERNATANT TREATMENT COST SUMMARY
PRIMARY WATER TREATMENT

	100,000 CY	500,000 CY	1,000,000 CY	10,000,000 CY
Capital Costs				
Construct Water Treatment System	0	0	0	0
Operation Water Treatment System per 1,000 Gallon	0.05	0.05	0.05	0.05
Gallons of Water per *In Situ* Cubic Yard (see Table K.1)	1,295	1,295	1,295	1,295
Total Gallons	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Total Operation Water Treatment System	6,475	32,375	64,750	647,500
Dismantle Water Treatment System	0	0	0	0
Operating Costs				
none				
Total Supernatant Treatment Costs	6,475	32,375	64,750	647,500
Gallons of Water per *In Situ* Cubic Yard (see Table K.1)	1,295	1,295	1,295	1,295
Total Gallons	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Costs per 1,000 Gallon	0.05	0.05	0.05	0.05

TABLE K.26b
SUPERNATANT TREATMENT COST SUMMARY
ENHANCED PRIMARY WATER TREATMENT

	100,000 CY	500,000 CY	1,000,000 CY	10,000,000 CY
Capital Costs				
Construct Water Treatment System	7,732,538	7,732,538	7,732,538	11,720,335
Operation Water Treatment System per 1,000 Gallon	0.40	0.40	0.40	0.40
Gallons of Water per *In Situ* Cubic Yard (see Table K.1)	1,295	1,295	1,295	1,295
Total Gallons	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Total Operation Water Treatment System	51,800	259,000	518,000	5,180,000
Dismantle Water Treatment System	1,000,000	1,000,000	1,000,000	1,000,000
Operating Costs				
none				
Total Supernatant Treatment Costs	8,784,338	8,991,538	9,250,538	17,900,335
Gallons of Water per *In Situ* Cubic Yard (see Table K.1)	1,295	1,295	1,295	1,295
Total Gallons	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Costs per 1,000 Gallon	67.83	13.89	7.14	1.38

TABLE K.26c
SUPERNATANT TREATMENT COST SUMMARY
ENHANCED PRIMARY TREATMENT WITH MULTI-MEDIA FILTRATION

	100,000 CY	500,000 CY	1,000,000 CY	10,000,000 CY
Capital Costs				
Construct Water Treatment System	12,968,963	12,968,963	12,968,963	19,657,271
Operation Water Treatment System per 1,000 Gallon	0.57	0.57	0.57	0.57
Gallons of Water per *In Situ* Cubic Yard (see Table K.1)	1,295	1,295	1,295	1,295
Total Gallons	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Total Operation Water Treatment System	73,815	369,075	738,150	7,381,500
Dismantle Water Treatment System	1,000,000	1,000,000	1,000,000	1,000,000
Operating Costs				
none				
Total Supernatant Treatment Costs	14,042,778	14,338,038	14,707,113	28,038,771
Gallons of Water per *In Situ* Cubic Yard (see Table K.1)	1,295	1,295	1,295	1,295
Total Gallons	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Costs per 1,000 Gallon	108.44	22.14	11.36	2.17

TABLE K.26d
SUPERNATANT TREATMENT COST SUMMARY
ADVANCED WATER TREATMENT

	100,000 CY	500,000 CY	1,000,000 CY	10,000,000 CY
Capital Costs				
Construct Water Treatment System	26,237,625	26,237,625	26,237,625	39,768,803
Operation Water Treatment System per 1,000 Gallon	4.98	4.98	4.98	4.98
Gallons of Water per *In Situ* Cubic Yard (see Table K.1)	1,295	1,295	1,295	1,295
Total Gallons	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Total Operation Water Treatment System	644,910	3,224,550	6,449,100	64,491,000
Dismantle Water Treatment System	1,000,000	1,000,000	1,000,000	1,000,000
Operating Costs				
none				
Total Supernatant Treatment Costs	27,882,535	30,462,175	33,686,725	105,259,803
Gallons of Water per *In Situ* Cubic Yard (see Table K.1)	1,295	1,295	1,295	1,295
Total Gallons	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Costs per 1,000 Gallon	215.31	47.05	26.01	8.13

TABLE K.26e
SUPERNATANT TREATMENT COST SUMMARY
ENHANCED PRIMARY TREATMENT PLUS ORGANICS REMOVAL

	100,000 CY	500,000 CY	1,000,000 CY	10,000,000 CY
Capital Costs				
Construct Water Treatment System	11,373,338	11,373,338	11,373,338	17,238,756
Operation Water Treatment System per 1,000 Gallon	0.57	0.57	0.57	0.57
Gallons of Water per *In Situ* Cubic Yard (see Table K.1)	1,295	1,295	1,295	1,295
Total Gallons	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Total Operation Water Treatment System	73,815	369,075	738,150	7,381,500
Dismantle Water Treatment System	1,000,000	1,000,000	1,000,000	1,000,000
Operating Costs				
none				
Total Supernatant Treatment Costs	12,447,153	12,742,413	13,111,488	25,620,256
Gallons of Water per *In Situ* Cubic Yard (see Table K.1)	1,295	1,295	1,295	1,295
Total Gallons	129,500,000	647,500,000	1,295,000,000	12,950,000,000
Costs per 1,000 Gallon	96.12	19.68	10.12	1.98

TABLE K.27
SUMMARY OF SEDIMENT MANAGEMENT COSTS

	100,000 CY	500,000 CY	1,000,000 CY	10,000,000 CY
On-Site Option 1				
Primary	16,840,455	39,575,998	67,325,738	477,885,171
Enhanced Primary	25,618,318	48,535,160	76,511,525	495,138,006
Enhanced Primary w/MMF	30,876,758	53,881,660	81,968,100	505,276,443
Advanced	44,716,515	70,005,798	100,947,713	582,497,474
Enhanced Primary w/OR	29,281,133	52,286,035	80,372,475	502,857,927
Off-Site Option 2	31,684,373	84,440,087	150,384,729	1,902,699,539
Off-Site Option 4	61,846,149	115,591,222	182,772,563	1,968,186,818