

**LAKE SEMINOLE RESTORATION PROJECT
SUPPORTING DOCUMENTATION REPORT**

Prepared for



PINELLAS COUNTY

Clearwater, FL

Prepared by

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AMEC Project No. 19147

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DRAFT

1.0 INTRODUCTION

1.1 Background

Lake Seminole is a moderately large (684 acre), shallow (average depths between 4.1 and 5.5 feet) fresh water body located in west-central Pinellas County (SWFWMD 1992) (**Figure 1.1**). It has an hourglass shape, with distinct northern and southern lobes that are connected by a narrow channel known locally as the “Narrows”. The lake’s approximately 3,500 acre watershed is comprised primarily poorly-drained sandy soils. The area is highly urbanized, with commercial and residential land uses comprising most of the land surface. The western lake shoreline is entirely urban, consisting of mobile home parks, apartment complexes, and single family dwellings. Seawalls and docks are common and residential canal networks branch off the lake in various locations. The eastern shoreline consists of many residences along the north lobe and through the “narrows”. The southeast shoreline has been restored to a native plant community through restoration projects undertaken in 2004 and 2006 and also includes a large county park that provides public access to the lake. The soils and land use maps are included as **Figures 1.2 and 1.3**, respectively. Aerial photographs of the area are included as **Maps 5 and 6** located in the back of this report. Map 7 is the USGS quadrangle map.

Prior to the mid-1940s Lake Seminole was an estuarine water body, the northern portion of the Long Bayou embayment of Boca Ciega Bay (**Figure 1.4**). It was converted to a freshwater system by the construction of a roadway (Park Boulevard) which acts as an uncontrolled dam/weir. This downstream weir is the only water control structure in the Lake Seminole basin area. In addition to altering the lake’s salinity regime from brackish to fresh, the construction of the road and several additional hydrologic modifications in the watershed have substantially reduced its flushing rate and increased its hydraulic residence time (SWFWMD 1992). The weir’s normal operation will not be affected by the restoration project activities.

Although concerted efforts have been made to improve stormwater treatment levels in recent years, a large proportion of the watershed was developed prior to the adoption of modern stormwater treatment requirements. As a result, the lake has received discharges of untreated or minimally treated stormwater runoff from a variety of urban land uses for many decades. Prior to 1971 it also received discharges of nutrient-rich treated effluent from the City of Largo municipal wastewater treatment plant (SWFWMD 1992).

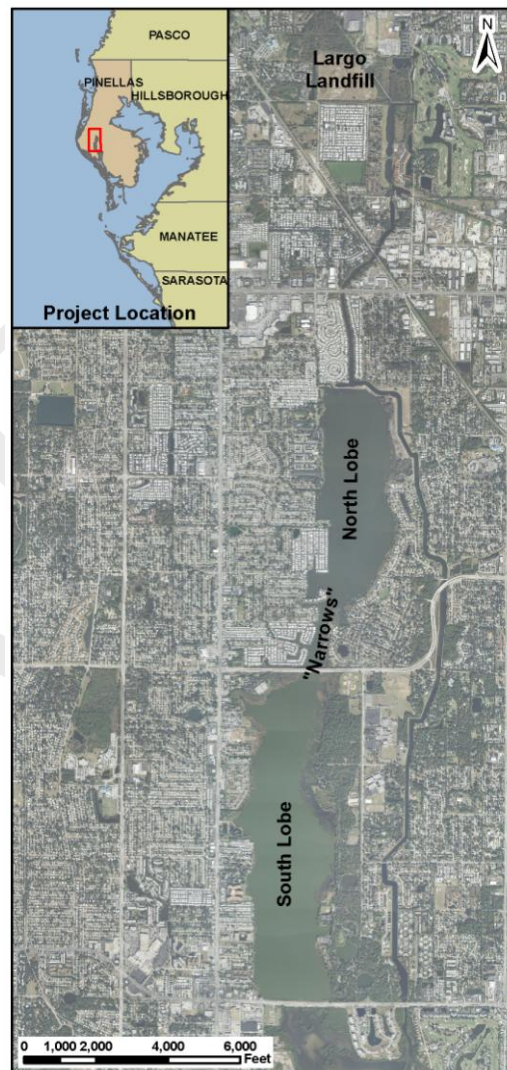
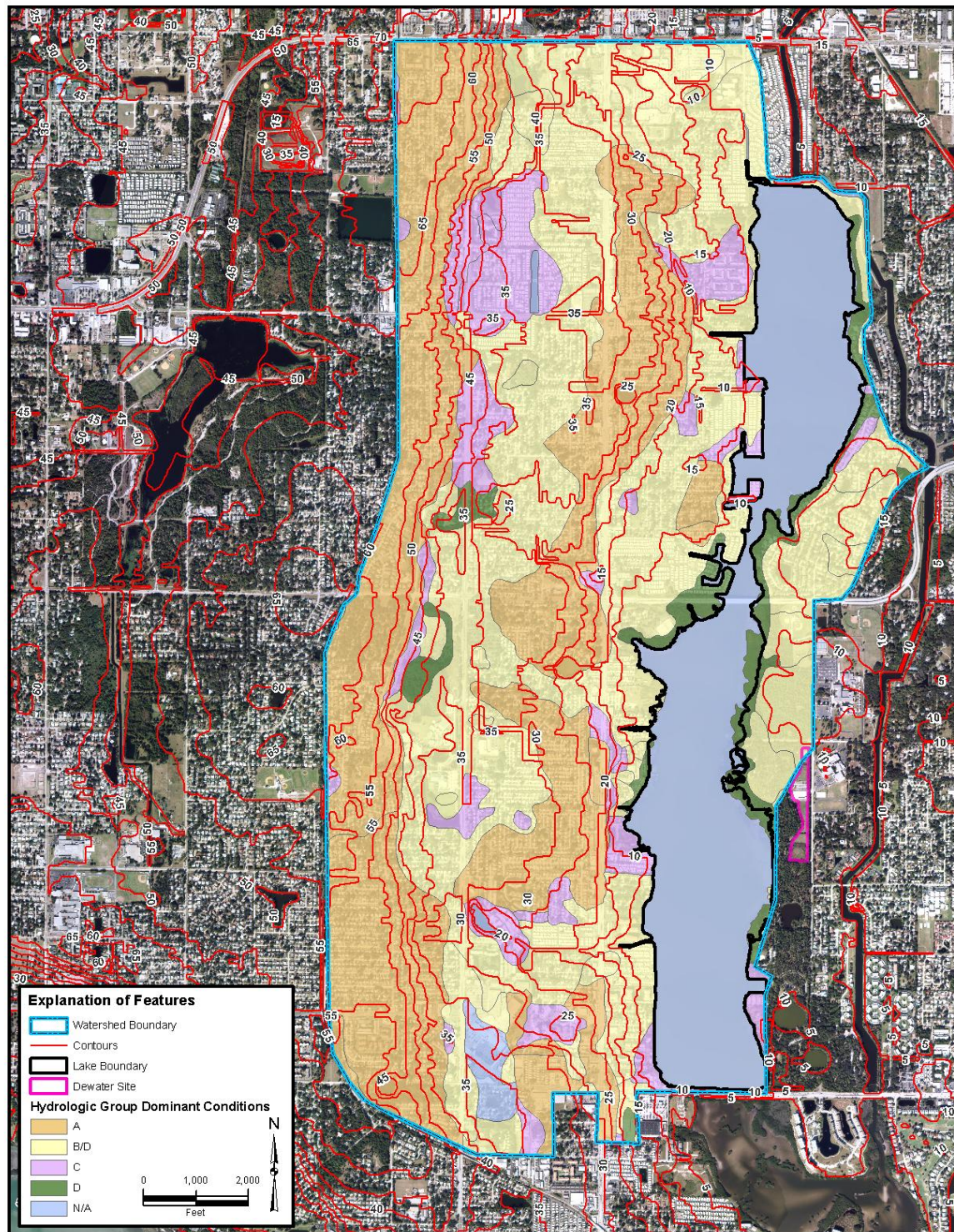


Figure 1.1
Project Location & Site Features

Figure 1.2
Soils Map by Hydrologic Soil Group



**Figure 1.3
Land Use Map**

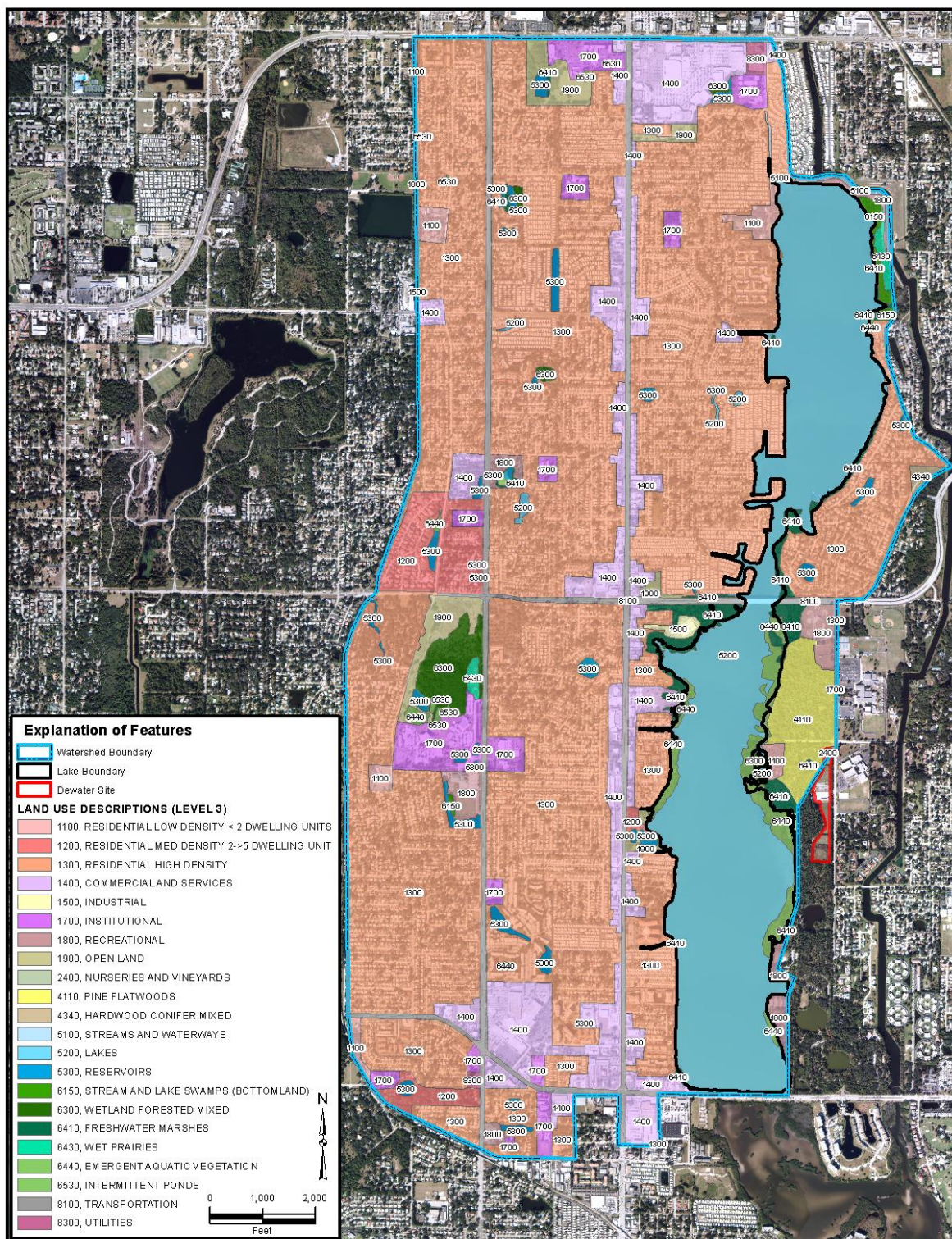
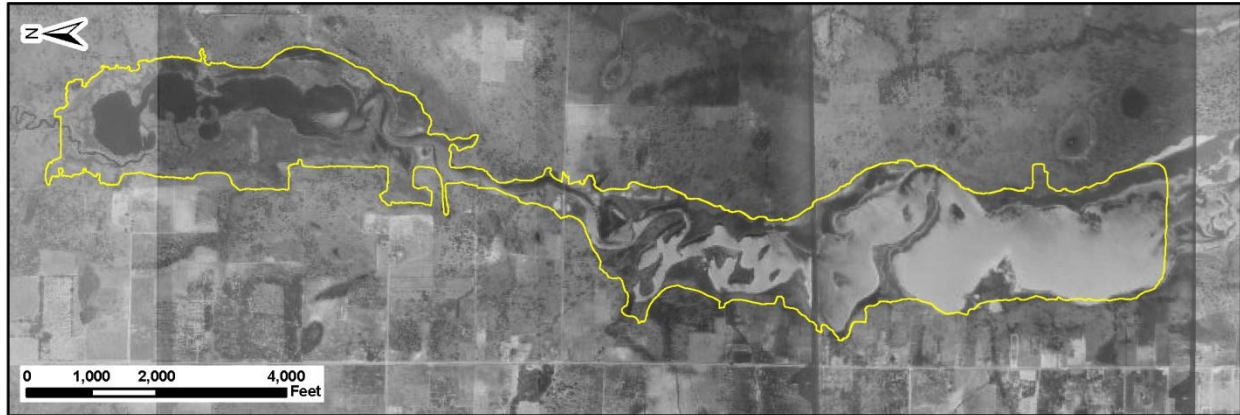


Figure 1.4
Historic Aerial of Lake Seminole (1942)



Note: The approximate extent of the modern lake's shoreline is indicated in yellow.

1.2 Objectives

Lake Seminole is a highly eutrophic lake that is currently listed by the Florida Department of Environmental Protection (FDEP) and the U.S. Environmental Protection Agency (USEPA) as an impaired waterbody pursuant to Section 303(d) of the federal Clean Water Act. The pollutants linked to the impairment are nutrients (phosphorus and nitrogen) that are present at elevated levels in the lake's water column.

In accordance with USEPA reporting guidelines, impaired waters can be classified as either Category 4 or Category 5 waters. Category 5 waters are those for which at least one designated use (DU) is not being supported or is threatened and a Total Maximum Daily Load (TMDL) is needed. Category 4 waters are those for which at least one designated use (DU) is not being supported or is threatened, but a TMDL is not needed. Waters can be classified in Category 4 with approval of USEPA if they fall into one of five subcategories; Category 4a through 4e. Category 4b includes those waters for which a TMDL is not needed because planned pollution control requirements are expected to result in the attainment of an applicable water quality standard (WQS) in a reasonable period of time.

On a state level, the Florida Watershed Restoration Act (Section 403.067(4)) explicitly allows FDEP to list impaired waters in Category 4 rather than Category 5. Lake Seminole's listing as a Category 4b water has been approved by both the USEPA and FDEP based on the Lake Seminole Reasonable Assurance Plan (RAP) (2007) and supporting documents, which provides a framework for addressing the Lake Seminole impairment. The Lake Seminole Restoration Project is an important element of the Lake Seminole RAP. The primary purpose of the project is to remove nutrient rich sediments present within the lake that have been linked to its nutrient-related impairment (e.g., SWFWMD 1992).

AMEC was selected by Pinellas County to provide professional services associated with the design, permitting, and implementation of the Lake Seminole Restoration Project. This report describes the project design and implementation features, as needed to support project permitting by the Florida Department of Environmental Protection (FDEP).

1.3 Previous Studies and Efforts

Previous studies have been conducted concerning Lake Seminole's water quality, trophic status, bathymetry, sediment distribution, and sediment quality, culminating with the Lake Seminole Sediment Removal Feasibility Study (PBS&J 2006), which provided the technical basis for moving forward with design and implementation of the Lake Seminole Restoration Project. A summary of the various studies reviewed and utilized by AMEC in the preparation of this report follows.

- Lake Seminole Sediment Characterization and Analysis (Schelske 1991)
- Lake Seminole Diagnostic Feasibility Study (SWFWMD 1992)
- Lake Seminole Sediment Characterization Study (BCI 1997)
- Lake Seminole Watershed Management Plan (PBS&J 2001)
- Lake Seminole Sediment Removal Feasibility Study (PBS&J 2006)
- Lake Seminole Reasonable Assurance Plan (PBS&J 2007)
- Largo Landfill Reports (various)

Relevant information from the above sources was used as appropriate to supplement information collected / developed by AMEC and is incorporated throughout various portions of this report.

1.4 Contents of the Report

In addition to the introductory chapter, this report includes the following:

- Lake water quality
- Sediment quantity assessment
- Sediment quality assessment
- Proposed dredging plan
- Environmental Impact Assessment
- Right-of-way issues and sovereign lands

1.5 Agency Meetings

Prior to initiating this study, input was sought from permitting and technical support staff from the FDEP. In addition to several previous coordination meetings, a pre-application meeting was held at the FDEP Temple Terrace office on February 19, 2013. The meeting included a project overview as well as an informal discussion on permitting issues. FDEP staff provided advice on items necessary to meet permitting requirements.

Following are descriptions of each of the removal activities:

5.2 Removal of In-Situ Sediment

A goal of the project during development of the engineering plans was to optimize the sediment removal activities by minimizing overcut and avoiding dredging in areas of thin sediment accumulation (up to 12 inches) and where the sediments include a low amount of organic material. It was considered that those areas do not represent significant sources of nutrients into the water column. The plans show the existing top of the sediment layer, the estimated location of the lake sandy bottom, and the extent of the planned sediment removal. As mentioned previously, the estimated volume of in-situ sediment to be removed from Lake Seminole amounts to one million CY.

Both mechanical and hydraulic dredges were considered for this type of application. However, because mechanical dredging has several disadvantages such as imprecise control of depth excavated, incomplete removal between bucket excavations, loss of fine-grained material during bucket withdrawal, disturbance of shoreline, and potential spillage from barge landing and unloading operations, hydraulic dredging was selected as the preferred option.

In general, the hydraulic dredging equipment consists of a hydraulic dredge that excavates and pumps material from within a lake through a temporary pipeline (typically high-density polyethylene) to an offsite location. The dredge functions as a floating vacuum cleaner that can remove lake-bottom sediments with reasonable precision. Control of dredging depth and sediment disturbance occur by various configurations of the suction head, ranging from a rotating cutter or auger to a shielded intake port. Hydraulic dredging is an unobtrusive method that requires no disturbance of the shoreline and it is the preferred method for this application.

The hydraulic dredge anticipated for this project uses a non-rotating “suction head” in place of a more conventional cutter head. This is an important consideration for excavating muck and fine sand. The dredged slurry will be pumped through a pipeline, using a barge-mounted booster pump and land-based sled-mounted diesel-powered booster pump, to the sediment dewatering area.

The barge-mounted dredge will consist of a “ladder” assembly supporting the suction head and discharge pipe, a pump that will move the material from the dredge to the dewatering area, and an operator responsible for maintaining suction head contact with the sediment while minimizing overcut volume. The ladder is raised and lowered by a pulley system suspended from an “A”-frame. Diesel engine driven pumps are recommended for the dredge and slurry transport system.

Dredge movement will consist of side-to-side sweeping motions as dredging advances through the sediment. The dredge will move in parallel paths for a pre-determined distance as shown on the plans. Each “cut-line” will be offset the width of the sweep from the previous line to maximize sediment removal. A suction head hydraulic dredge has proved effective for other lake dredging projects managed by AMEC and is expected to perform as well in Lake Seminole.

The dredging rate, measured in terms of in-situ volume, will be approximately between 1,400 CY/day. As shown in **Table 4.2**, the sediment in-situ solids content by weight averages 45 percent. The corresponding solids content by volume is 25 percent at a solids bulk SPG of 2.51. The solids content of the dredged slurry to be pumped to the dewatering facility is expected to be 5 percent. The daily volume of dredged slurry pumped from the lake has been estimated at about 7,000 CY. The dredged lake area is 270 acres.

The dredge material will be pumped from the dredge to the dewatering facility through a 12-inch internal diameter HDPE flexible pipe. The portion of pipe from the lake shore to the dewatering facility will be approximately 500 ft long and will be installed along the corridor shown on the plans. The pipe will be kept in place by cement collars located at each end of the pipe segment and at significant turns. A steel pipe sleeve will be installed at the location where the pipe crosses the public access paths to minimize disruption of recreational use of the park and to act as secondary containment. The stationary HDPE pipe will be fusion-welded to the pipe connected to the dredge at the lake shore. The dredging pumping rate will be about 3,000 gallons per minute (gpm). It is expected that the work will be completed in 24 months.

5.3 Sediment Dewatering

The dewatering facility for the project will be constructed at a site located along the eastern shore of the southern lobe of the lake. The site is owned by Pinellas County and was formerly utilized as a plant nursery. A portion of the site houses office, garage, and ancillary storage facilities utilized by county parks maintenance crews. This portion of the site will be excluded from activities associated with the project.

Several types of dewatering and disposal schemes were considered for the project ranging from confined upland disposal with no dewatering to high rate mechanical dewatering with subsequent beneficial utilization of the dewatered sediments. Ultimately high rate mechanical dewatering was chosen as the preferred technology based on a number of factors including:

- The relatively small land area available for dewatering;
- Ease of handling of dewatered sediments with respect to beneficial use needs; and
- Demonstrated success of the process at other projects such as the Sawgrass Lake Project in Pinellas County.

As shown on **Figure 5.1**, the dewatering system for the project will consist of three primary steps; (1) screening of dredge inflow to remove large trash and debris, (2) removal of sand size material from the process flow stream remaining after step 1, and (3) mechanical dewatering of the remaining high organic content / fine sediments with the aid of polymers. Dewatered sediments from the third step in the process will be stored on-site for a nominal period of 7 days to undergo additional evaporative drying to enhance material handling characteristics and to reduce transportation and disposal costs. General performance specifications for the dewatering facility are as follow:

- | | |
|--|--|
| • Daily in-situ sediment processing capacity: | 1,000 to 3,000 yd ³ per day |
| • Nominal dredge flow capacity @ 10% solids by weight: | 3,000 gpm |
| • Sand processing capacity (dry tons basis): | 35 to 65 tons/hour |
| • Fine sediment processing capacity (dry tons basis): | 15 to 45 tons/hour |
| • Dewatered fine sediment percent solids by weight: | 35% |
| • Fine sediment percent solids by weight at 7 days: | 44% |

As previously discussed, the first processing step will be to screen the incoming dredge flows to remove any large debris and trash prior to desanding and dewatering. Several types of screening equipment could be utilized for this step in the process including flat deck systems and rotating trommel type screens. Oversized material from this process will be collected and

disposed off as a separate waste stream. This material is not expected to suitable for any beneficial uses. It is planned to be disposed of at the County's landfill.

Following the initial screening step, the remaining dredge material will be processed through a de-sanding unit with the intent of removing sand size materials from the process flow stream. The de-sanding unit should generally consist of dewatering through hydrocyclones to remove water, fine materials, and organics followed by subsequent dewatering of the hydrocyclone underflow to further dewater the material. The screen overflow will generally consist of clean sandy material that can be immediately removed for off-site final disposal / beneficial use.

The hydrocyclone overflow and screen underflow from the de-sanding unit will be combined for subsequent polymer treatment, screening, and passive dewatering. Polymer dose studies were completed by for sediments collected within four areas of the lake as show on **Figure 5.2**. The results of the study are presented in **Table 5.1** (full test details are included in **Appendix A**). Following polymer dosage, the process stream will be passed across stationary screens to facilitate flocculation of sediments and initial dewatering. The overflow of the screens will consist of a fairly high solids content which will undergo additional dewatering in a process similar to that used at the Sawgrass Lake project. The equipment utilized at Sawgrass Lake is manufactured and operated by Genesis Water.

As previously discussed, **Figure 5.1** shows the general process flow schematic for the project based on average sediment parameter values. In reviewing the sediment characterization data presented in **Section 4**, it is apparent that sediment characteristics vary across the lake but can be generally grouped into three general types characterized as follows:

- **Group 1** – this group consists exclusively of the sediments within the Area 1 sediment distribution area depicted in **Figure 3.1**. These sediments generally contain a higher percentage of fines than other areas in the lake and have the lowest overall in-situ solids content.
- **Group 2** - this group consists of the sediments within the Area 2, 3, and 4 sediment distribution areas depicted in **Figure 3.1**. These sediments generally contain a higher percentage of sand size sediments than other areas in the lake and have the highest overall in-situ solids content.
- **Group 3** - this group consists of the sediments within the Area 5, 6, and 7 sediment distribution areas depicted in **Figure 3.1**. These sediments generally fall somewhere in between the group 1 and 2 sediments in terms of particle size distribution and in-situ solid content.

Process flow schematics for each of the above groups of sediments are present in **Figures 5.2, 5.3, and 5.4**, which follow:

Figure 5.2
Group 1 Sediment Parameters – Process Schematic

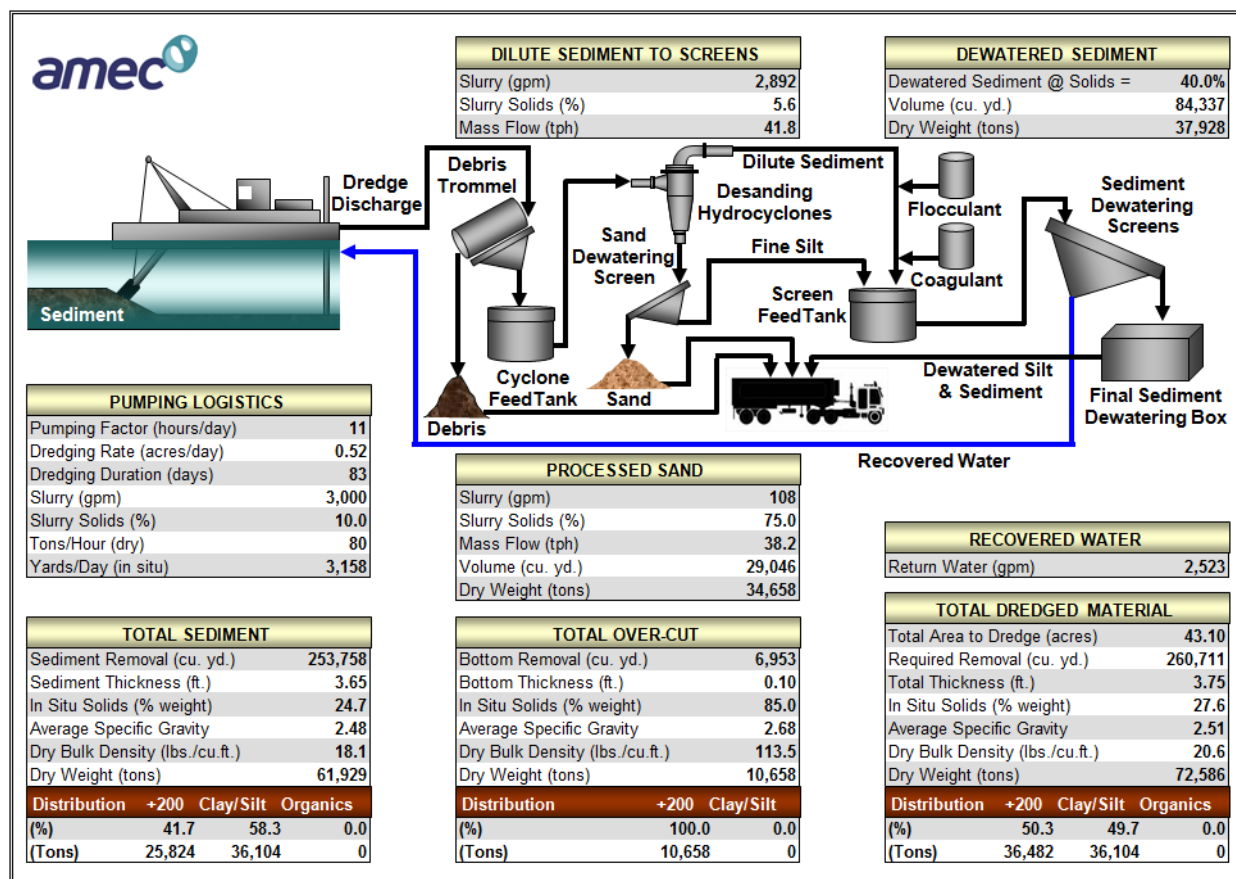
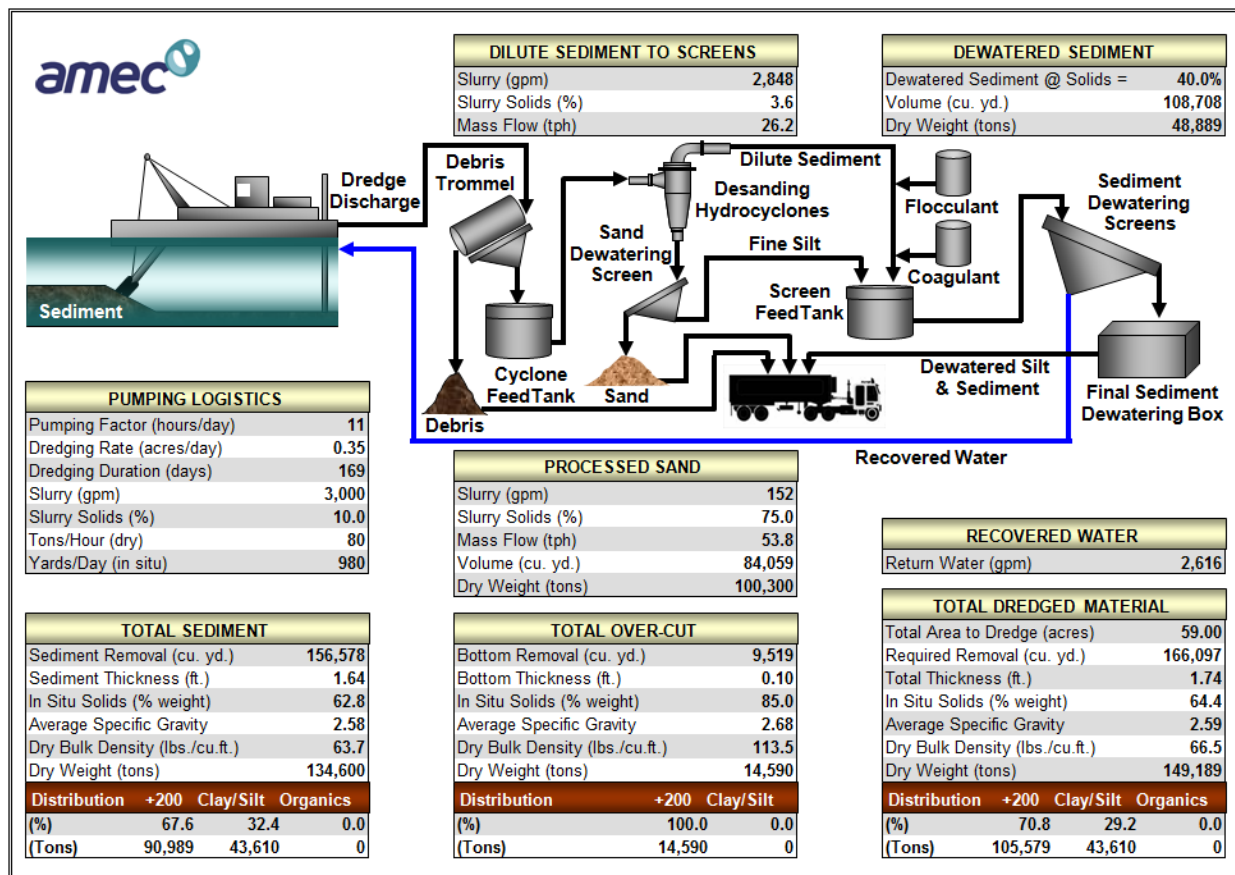
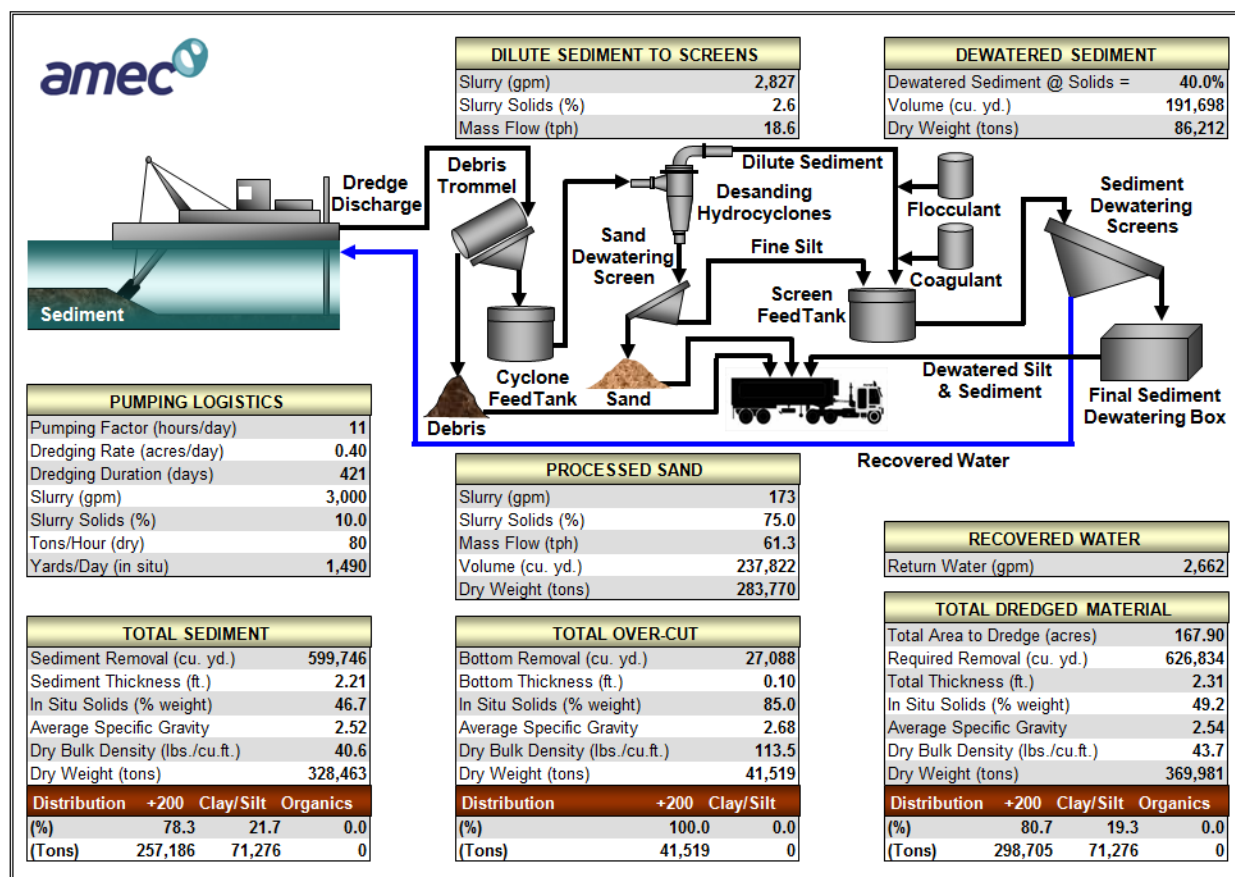


Figure 5.3
Group 2 Sediment Parameters – Process Schematic



**Figure 5.4
Group 3 Sediment Parameters – Process Schematic**



Excess Water

As described previously, the dredged material from the lake is expected to have a solids concentration of 5 percent by volume. The solids content in the dewatered material will be about 20 percent solids. The excess water will be pumped back to the lake once it is subject to treatment per the stormwater pollution prevention plan (SWPPP) requirements. A 150-ft mixing zone has been considered around the discharge point in the lake.

Treatment of excess water will occur at a 0.5-acre SWPPP detention pond. The pond volume will be about 1.5 acre-ft, which far exceeds the SWPPP volume requirement of 25,000 cf (3,600 ft³ of storage at the approximate 7-acre site). As shown on the plans, the pond will be built adjacent to the production / dewatering area. This facility will also receive inflows from the storage and drying areas described later in the section. Water elevations in the pond will be controlled by on/off switches located at the pond's wet well. One foot of freeboard will be provided. During dry weather, the pond will be able to hold a volume equivalent to 3 hrs of the dewatering facility operation in case discharges to the lake must be stopped for maintenance or regulatory compliance purposes.

The excess water will be pumped back to the lake through a 12-inch HDPE pipe that will be installed along the same corridor as the pipe transporting the dredged material to the dewatering units. The outfall location in the lake is ideal for discharge given the straight shore line and the absence of vegetation, which will eliminate areas of in-lake storage. The pipe will be protruding from the shore to a depth of 2 ft and will be installed with the nozzle pointing upwards at 45 degrees towards the center of the lake to minimize sediment re-suspension.

Excavated material from pond construction will be used for a) placement in areas to be used for sediment storage to even the terrain and establish process flow gradients towards the water quality treatment pond, and b) build slightly elevated perimeter roads to establish positive drainage to the interior of the site and pond areas.

The parameters of concern in the returned water are solids, nutrients (nitrogen and phosphorus), unionized ammonia and lead. Following is a description of the issues associated with these parameters.

- The solids concentration in the excess water is very small and less than the mg/L TSS concentration in the lake water. Discharge of solids to the lake will be controlled by placement of erosion mats around all the production and sediment process units.
- Based on the average TN and TP concentration in both the lake water (TN=2.95 and TP=0.11 mg/L) and the sediment elutriate (TN=14.3 and TP=1.79 mg/L), as well as the average soils content of the sediment by volume (25%) and the dredged material soils content by volume (5%), it was determined that the concentration of TN and TP in the excess water discharge will be 5.2 and 0.4 mg/L, respectively. Those concentrations, although higher than the background lake water, will be temporary and will not cause an imbalance in the lake's natural populations of aquatic flora or fauna.
- The water quality standard threshold for unionized ammonia is 0.02 mg/L. The standard is substantially exceeded in the lake itself given the average lake water pH of 8.85. Assuming that the measured average TKN concentration of 2.95 mg/L is all ammonia, the unionized ammonia concentration in the lake water at 20 C is 0.66 mg/L (background conditions). Based on the elutriate and lake water concentrations, it is expected that the excess water discharge will have an ammonia concentration of 5.2 mg/L, which results in an unionized ammonia concentration of 1.16 mg/L at 20 C and at the lake's pH. Both background and the discharge substantially exceed the standard. Given that the dilution ratio necessary to meet background is less than 2, it is anticipated that background concentrations will be met just a few outfall pipe diameters away from the discharge and well within the edge of the mixing zone, as discussed in Section 6. An aeration system will be installed in the SWPPP pond to facilitate nitrification. However, it is recognized that the detention time in the pond is not adequate to allow for significant nitrification processes to take place.
- Given the reported average alkalinity of 87 mg/L as CO₃Ca in the lake, the applicable lead water quality standard is 0.98 ug/L. This chemical was found in the sediment elutriate at an average concentration of 8.48 ug/L, which represents a concentration of 1.7 ug/L in the excess water assuming no lead in the background. Similar to unionized ammonia, the dilution factor to meet standards is less than 2 and will be met at the edge of the mixing zone.

Drainage and Stormwater Runoff

Existing drainage patterns will be maintained. Stormwater runoff occurring inside the dewatering and sediment storage areas will be conducted to the treatment pond, which has a capacity to store at least one inch of runoff over a 7-acre drainage area, in addition to approximately one hour of operation of the dewatering facility. Erosion protection and turbidity control measures will be provided at all work areas. Those measures will be maintained through the duration of project activities. Once dredging operations are completed, all disturbed lands will be returned to the original pre-project condition.

Dewatered Soils

The output from the dewatering system is expected to have a soil concentration by volume of about 15 percent. The coarse material will be transported directly to the disposal site, whereas the fine material will be transported to a 1.0-acre site initial sediment stacking area for storage and additional dewatering. Subsequently the fines will be moved to a second and final stacking 1-acre site area prior to being transported to the disposal site. Excess water at the stacking sites will be collected in a perimeter drainage system and pumped to the SWPPP pond. The estimated dewater flow is 70 gpm. The material will be collected from this site for final disposal at the County's Bridgeway Acres landfill.

5.4 Disposal Method

The dredged and dewatered sediment will be transported from the site to the County's Bridgeway Acres (BWA) facility located on 118th Avenue North in Pinellas County. The material will be used for either daily cover. The sediment may also be used to fill-in three sediment basins and/or for regaining side slopes during landfill closure. Use of the material will be on as as-needed-basis. It is anticipated that it may be stored up to year. Storage will occur inside the landfill slurry wall. The daily volume of transported dredged material has been estimated at approximate 750 CY. The total volume of sediment transported will be about 550 thousand CY.

6.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS

Lake Seminole is the flooded basin of a relict embayment, an arm of Long Bayou. The lake was formed when the Park Boulevard causeway was constructed and a large concrete weir structure was installed. Aerial photographs of the original bayou are presented in **Maps 1 -4**. Currently the lake is surrounded by dense urban residential development with approximately 25% of the shoreline abutting a county park. Nearly all of the shoreline abutting residential properties is armored by seawalls. Sediment cores taken throughout the lake, along with bathymetric data, indicate that the deep water sections of the old bayou have in-filled with organic and nutrient laden sediment ranging from fines to peat layers adding to the existing peat and sediment that had accumulated prior to inundation. Deeper holes not consistent with the native topography are likely dredged holes used to provide fill for adjacent upland development prior to the development of modern environmental protection rules. The specifics of the organic and nutrient content sediment have been thoroughly discussed above. The ecological benefits of the removal of this organic debris are many and far outweigh the temporary ecological impacts of the proposed dredging operation.

6.1 Ecological Impacts

This evaluation of the environmental impacts of the proposed dredging and dewatering operation follows the criteria set forth in the SWFWMD Basis of Review Chapter 3 - Environmental. The project will result in minor temporary impacts to the surface water and wetland habitat adjacent to the dewatering site. Only minimal permanent impacts are expected as a result of the project. The extent of the impacts quantified is the conversion of 0.04 acres of emergent vegetation to open water as a result of increased water depth. This is necessary to improve water flushing within a small bay on the east side of the narrows area.

6.1.1 Elimination or Reduction of Impacts

There are only minimal permanent impacts associated with this project and it is intended to provide long term environmental benefits. Temporary impacts have been reduced the greatest extent practicable. The limits of dredging have been reduced where possible and practical, while still achieving the desired environmental benefits. Careful consideration of the cost-benefit analysis has been used to eliminate areas where only minimal sediment accumulation has occurred. This includes some shoreline areas where emergent vegetation is present. Further reductions in the dredge scope would significantly reduce the environmental benefits of the project.

The dewatering site has been chosen to minimize impacts to wetlands and other habitats within the area. The site is a County owned plant nursery site on the east side of the lake. While the shape of the site is not ideal from a logistical working area, it does provide benefits in terms of impact reductions. The location of the site is in close proximity to the lake. This will reduce the temporary impact of the piping corridor to and from the dewatering ponds. This corridor will be less than 300 feet through existing park property. The pipe alignment can be accomplished with little to no impacts to large tree species and represents the shortest possible distance through shoreline wetlands. The lake bank in this area is rimmed by a raised dyke used as an access road by park maintenance vehicles. This dyke may be used as a pipe layout area to minimize any impacts to the adjacent wetlands from the construction phase of the project. Additionally