2013 Western Dredging Association Environmental Excellence Award Nomination Application

Environmental Dredging and Aquatic Enhancement of Lake Beauclair, Lake County, Florida

Project Owner:
Lake County Water Authority

Nominated by:
Jahna Dredging and Taylor Engineering

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Environmental Dredging and Aquatic Enhancement of Lake Beauclair

Nominating Entities

Jahna Dredging, Inc.
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Project Role: Dredging and Dredge Material Management

Taylor Engineering, Inc.
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Project Owner

Lake County Water Authority (LCWA)
107 North Lake Avenue, Tavares, FL 32778
Contact: Ron Hart, Water Resource Program Manager, (352) 343-3777
Project Role: Project Owner and primary funding source

Project Team Members

St. Johns River Water Management District (SJRWMD)
4049 Reid St, Palatka, FL 32177, (386) 329-4500
Project Role: Dredged Material Management Area (DMMA) property owner

Florida Fish and Wildlife Conservation Commission (FFWCC)
Farris Bryant Building, 620 South Meridian Street, Tallahassee, FL 32399-1600, (850) 488-4676
Project Role: Secondary funding source

Award Category

While the Environmental Dredging and Aquatic Enhancement of Lake Beauclair included both navigation and environmental dredging, which the LCWA accomplished in an efficient manner while meeting environmental enhancement goals, we wish to submit this application under the environmental dredging award category.

Summary

The LCWA, in cooperation with the FFWCC, has recently completed a water quality and habitat restoration project in Lake Beauclair and four residential canals along the Apopka-Beauclair Canal by hydraulically dredging over 1,300,000 cubic yards (cy) of nutrient-rich, fine-grained, organic “muck” sediments.

These muck sediments have long compromised the quality of the aquatic habitat in Lake Beauclair and impeded navigation during low water conditions. Removal of the muck sediments to the lake’s natural sand bottom has improved the substrate to establish aquatic plants, improve fish habitat, and provide a superior surface for fish spawning. In addition to habitat degradation, this muck layer had also created water depths too shallow for boaters to navigate without disturbing the muck layer. Suspended muck sediments cause two undesirable consequences: the presence of malodorous and aesthetically displeasing black plumes of muck, and damage to boat motor cooling systems from muck entrained in outboard engines.

Lake Beauclair is a hypereutrophic water body encompassing an area of approximately 1,118 acres in Lake County, Florida. Situated as the first lake downstream of Lake Apopka, Lake Beauclair has received

significant amounts of nutrients and sediments from Lake Apopka via the Apopka-Beauclair Canal for many years. Historically, water, nutrients, and sediments from Lake Apopka flowed northward through the Apopka-Beauclair Canal Dam, into the Apopka-Beauclair Canal, then into Lake Beauclair, which led to the degradation of the aquatic plant community and the balance of fish and wildlife species that use Lake Beauclair.

The LCWA selected contractor Jahna Dredging, Inc. to remove muck sediments from an estimated 255.4 acres in the western portion of Lake Beauclair, and from an additional 6.3 acres of combined residential canal segments (Figure 1).

Figure 1: Jahna Dredging's Dredging Supply Company Barracuda Dredge

The sediment dewatering and disposal area is located within the SJRWMD's North Shore Restoration Area. Jahna hydraulically transported dredged material via pipeline from the dredging area along the Apopka-Beauclair Canal where the dredged materials were deposited into field units F and G of West Marsh Restoration Area, located just to the west of the Apopka-Beauclair Canal. The Lake Beauclair dredged material had about 4% solids and much lower pesticide concentrations relative to the in-situ soil at the disposal area. Therefore, the property owners, the SJRWMD, and the relevant regulatory agencies anticipate that depositing dredged material on top of West Marsh Restoration Area will contribute to reducing pesticides in the soil-water environment of Cell F and Cell G of the SJRWMD's North Shore Restoration Area.

Overall, the project team expects to significantly benefit fisheries and navigation, and contribute toward better water quality in one of Florida's largest lakes. Water quality improvements are expected not only in Lake Beauclair but also in the disposal area and should carry positive influence downstream, throughout the Harris Chain-of-Lakes and the Ocklawaha River.

The project team expects increased wetland acreage to offset some of the historic ecosystem losses in the region. The project also fits well with other watershed objectives concerning Lake Apopka wetland restoration and Harris Chain-of-Lakes Total Maximum Daily Load (TMDL) issues. Detailed analysis from the FFWCC, LCWA, and SJRWMD led to consensus that this project represents mutual gains for stakeholders looking to improve the ecology and economy of the region.

Historic Environmental Impacts

In 1893, the Apopka Canal Company constructed the Apopka-Beauclair Canal connecting Lake Apopka with Lake Beauclair downstream. The canal reduced Lake Apopka's water elevation by approximately three feet and enhanced the farming ventures on the northern shore of Lake Apopka.

The SJRWMD has traced the decline of Lake Apopka, and the subsequent decline of Lake Beauclair, to the decision, in the 1940s, to construct a system of levees along the north shore of the lake to drain over 20,000 acres of shallow marsh for vegetable farming. The discharge of water, rich in nutrients from agricultural and other sources, produced conditions that created a chronic algal bloom and resulted in loss of both lake's recreational value and game fish populations well into the 1990s.

Historically Lake Apopka, and subsequently Lake Beauclair, has received a tremendous amount of nutrients and sediments through the drainage of adjacent farms (mainly vegetables and citrus), sewage effluent discharge, and nitrogen and carbon biological fixation. Consequently, Lake Apopka shifted in 1947 from a clear water state dominated by rooted macrophytes to a turbid hypereutrophic state dominated by phytoplankton.

The first recorded lake-wide algal bloom in Lake Apopka occurred in 1947. Photographic evidence and historic accounts suggest that the increase in phytoplankton and decline in macrophytes occurred over a several-year period from 1947 to 1951. Since the 1950s, Lake Apopka has had high levels of phosphorous and nitrogen and high turbidity caused by algae and resuspended sediments.

These same impacts were seen in Lake Beauclair as water from Lake Apopka flowed northward through the Apopka-Beauclair Canal Dam, into the Apopka-Beauclair Canal, and then into Lakes Beauclair.

Environmental Benefits

The Environmental Dredging and Aquatic Enhancement of Lake Beauclair provided direct environmental benefits by removing the muck sediments from the lake and four residential canals. The LCWA analyzed the top five feet of sediments and determined these muck sediments to be recent deposits, resulting from farm discharges around Lake Apopka.

In many areas these muck sediments were inches below the current water level, elevation 61 feet National Geodetic Vertical Datum of 1929 (NGVD 29). Removal of the sediments to sand bottom or elevation 51.5 ft NGVD 29 improved the substrate to establish aquatic plants, improve fish habitat, and provide a superior surface for fish spawning. The removal also eliminated wave and boat re-suspension of muck sediments back into the water column where they cause additional water quality issues within the lake.

The sediments were pumped over 8 miles via high-density polyethylene pipe and a series of booster pumps to an area north of the Lake Apopka shore and deposited in a 1 – 1.5 foot layer on the floor of the ponds that had for decades been used as farmland. The SJRWMD and the state of Florida acquired the property, which is undergoing restoration back to wetlands. The bottom of the now-flooded farm fields are contaminated with pesticides, which through the natural food chain are passed from invertebrates through fish and eventually into the waterfowl. Deposition of the relatively pesticide-free lake sediments buffers the contaminated bottom allowing the invertebrates and fish to feed in the overlying uncontaminated sediments. This clean cover lowers the potential bioaccumulation of pesticides in the food chain.

Within the SJRWMD's North Shore Restoration Area, the sediment dewatering and disposal area, one unique environmental challenge was to prevent birds from feasting on both live and dead fish as the cleaner lake sediments capped the shallow (average of 4 ft deep) cells. This required development of a fish kill monitoring plan within an active dredged material management area.

Jahna Dredging installed floating dissolved oxygen meters in both Cell F and Cell G of the SJRWMD's North Shore Restoration Area. Solar panels powered the system. The dissolved oxygen meters transmitted their readings via electronic signal to a central data gathering point 1.5 miles away. Monitoring the dissolved oxygen in real-time data gave advanced warning of a potential for fish kills. In the event of a fish kill, all dead fish were to be netted, bagged, and disposed of at an area landfill where the remains were immediately buried to prevent ingestion by wildlife. Some of the dead fish were to be collected and tested for toxicity in the internal organs.

In order for the pesticide-free lake sediments to cap the contaminated bottom, uniform distribution of the dredged sediments on the bottom of the disposal cells was very important. In addition, Jahna Dredging was to keep the dredged sediments from accumulating to within 1 foot of the water surface to prevent creating habitat for wading birds to feed on the contaminated fish within Cell F and Cell G of the North Shore Restoration Area. Jahna Dredging was able to accomplish this by utilizing a unique Disposal Ring designed by Jahna Dredging staff (Figure 2 and 3). SurvTech Solutions, Inc., a subcontractor to Jahna Dredging, performed regular bathymetric surveys to ensure compliance with the required sediment levels.

Figure 2 and 3: Jahna Dredging Disposal Ring control Turbidity and Deposition Levels along with Aerating Discharge Water

To complicate matters further, the dredging site also had an active bald eagle nest within the perimeter. Jahna Dredging only dredged outside of nesting season within the nest's perimeter, thus eliminating any possible disturbances to the eagles (Figure 4).

Figure 4: Bald Eagle Perching on the Mast of the Anchor Barge

Innovation

How does this project show leadership and take steps beyond "traditional" environmental protection efforts?

This complex project resolved nutrient and phosphorous loading of a fresh water lake and eliminated a contaminated wetland environment. In addition to many other environmental requirements, the project

was not allowed to result in elevated phosphorus levels within the disposal area. To achieve this task, alum and polymers were added to the pipeline elutriate to bind and settle nutrients as they enter the wetland disposal area. The project also involved environmental dredging. In the areas of deeper muck deposits, sediment cores showed the top five feet were the result of anthropogenic sources, from the Apopka muck farms, and had phosphorus levels much higher than the older deeper deposits. These nutrient-rich sediments were removed by dredging, thus dramatically reducing the re-suspension and release of phosphorus to the water column of the lake.

Did the project "break new ground" in addressing the environmental challenges?
The project broke new ground with the use of floating dissolved oxygen monitors in a hostile environment of a dredged material management area and management of wildlife survival and prevention of the transmission of toxicity to wildlife. Design and use of equipment to distribute and oxygenate dredge discharge materials to prevent fish and wildlife mortality.

To ensure that the dredging did not cause environmental impacts downstream of the disposal site, the project constructed a treatment train prior to water reentering Lake Beauclair. The train involved injecting polymer and alum into the dredge pipeline prior to discharge in the disposal area. This water was allowed to settle within the disposal area. Excess water was decanted to a wetland clarification pond. Excess water from the wetland clarification pond was pumped to an alum treatment facility where it was again dosed with alum to remove particulate matter and phosphorus and then allowed to settle in two 9-acre ponds prior to discharge downstream.

What methods, technologies, or approaches (including partnerships) were used?
A Dredging Supply Company Barracuda dredge was outfitted with a sliding spud pontoon to allow dredging widths of over 150 feet and a special cutter-head designed by Dredging Supply Company to pull suspended solids into the suction bell mouth of the dredge (Figure 1).

The DREDGPACK system was installed on the dredge using the HYPACK Hydrographic Survey Software to efficiently navigate the dredge and ensure precise cutting elevations were maintained.

As discussed above, funding for the project was provided by the LCWA and a million-dollar grant from the FFWCC. The SJRWMD provided land for the disposal area.

What sustainable approaches were applied?
The project resulted in a sustainable solution by removing and treating the nutrient-rich sediments in Lake Beauclair. These treated sediments were utilized to cover contaminated sediments for perpetuity within the disposal area. This cover has eliminated the contact of benthic invertebrates to the contaminated sediments and the bioaccumulation within the fish and wildlife. In addition, any water discharged from the disposal area in the future will further travel through the Lake County Water Authority's Nutrient Reduction Facility and will be treated again with alum prior to the supernatant being released downstream to Lake Beauclair. The Nutrient Reduction Facility was designed to remove pollutants discharging downstream from Lake Apopka. Its operation will prevent and remove organics before they can accumulate downstream in Lake Beauclair.

Economic Benefits

Explain implementation of cost-effective methods, procedures, or practices in terms of environmental protection efforts. Were there project efficiencies? Were there any specific cost-saving components of the project?

Please see the discussion on methods, technologies, or approaches above. In addition, the project was scheduled for 36 months and was completed in 24 months due to the efficiency of the dredging plan and the strict adherence to project operational plans. Five booster pumps were utilized during the project. Two of the boosters were electric powered verses diesel powered adding to the efficiency of the project. The project employed numerous personnel including surveyors, engineers, and biologists over the 24-month period.

How does the project contribute to the economy?
Improved navigation in the lake and improved water quality providing greater habitat for fish, plants, and wildlife will enhance the recreational boating and fishing industry. The project also provided jobs to local residents and work or money for local businesses.

Transferability

Are the project characteristics and lessons learned transferable and can they be used by others addressing similar environmental issues?
The project characteristics and lessons learned are transferable and can be used by others addressing similar environmental issues. Furthermore, project equipment can be rearranged and used to meet the specific requirement of another project.

Outreach and Education

What education and/or outreach activities were undertaken?
The project team members held numerous public meetings to identify a project that eliminates the navigational hazard and improves water quality and habitat in Lake Beauclair. After all potential projects were vetted, the consensus among regional elected officials was to proceed with the dredging.

What mechanisms were used to involve the broad array of stakeholders?
All surrounding property owners were invited to public meetings in their neighborhood before dredging began and when the dredging was nearing their homes. Residents were informed of what to expect and what they could do to further improve their shorelines.

Other

What about this project makes it deserving of the WEDA Environmental Excellence Award?
This complex project resolved nutrient and phosphorous loading of a fresh water lake and eliminated a contaminated wetland environment (Figure 5).
The project also involved

- placing treated dredged material to cap a pesticide-contaminated wetland that used to be a muck farm
- removing phosphorus-rich muck that was readily re-suspended in the water column
- purifying any return water through the Lake County Water Authority Nutrient Reduction Facility utilizing alum and two 9-acre settling ponds prior to discharging water back to Lake Beauclair
- dosing of alum and polymer to ensure settling and removing nutrients when the water enters the disposal area
- ensuring sufficient oxygen levels within the disposal area to prevent impacts to fish and other wildlife
- providing additional clarification through an isolated wetland
- protecting an eagle nest
- eliminating a navigational hazard

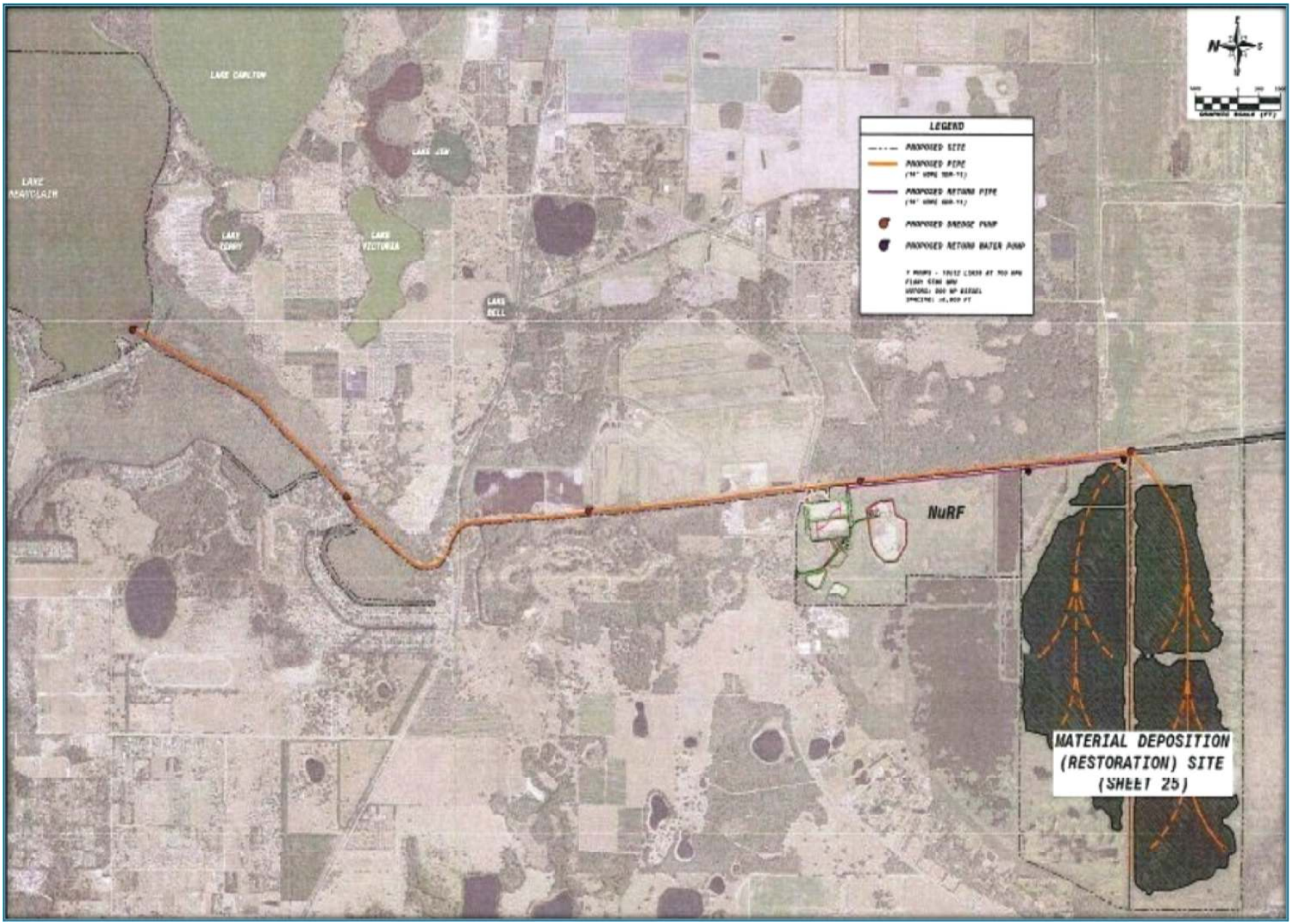

Figure 5: Site Plan Layout