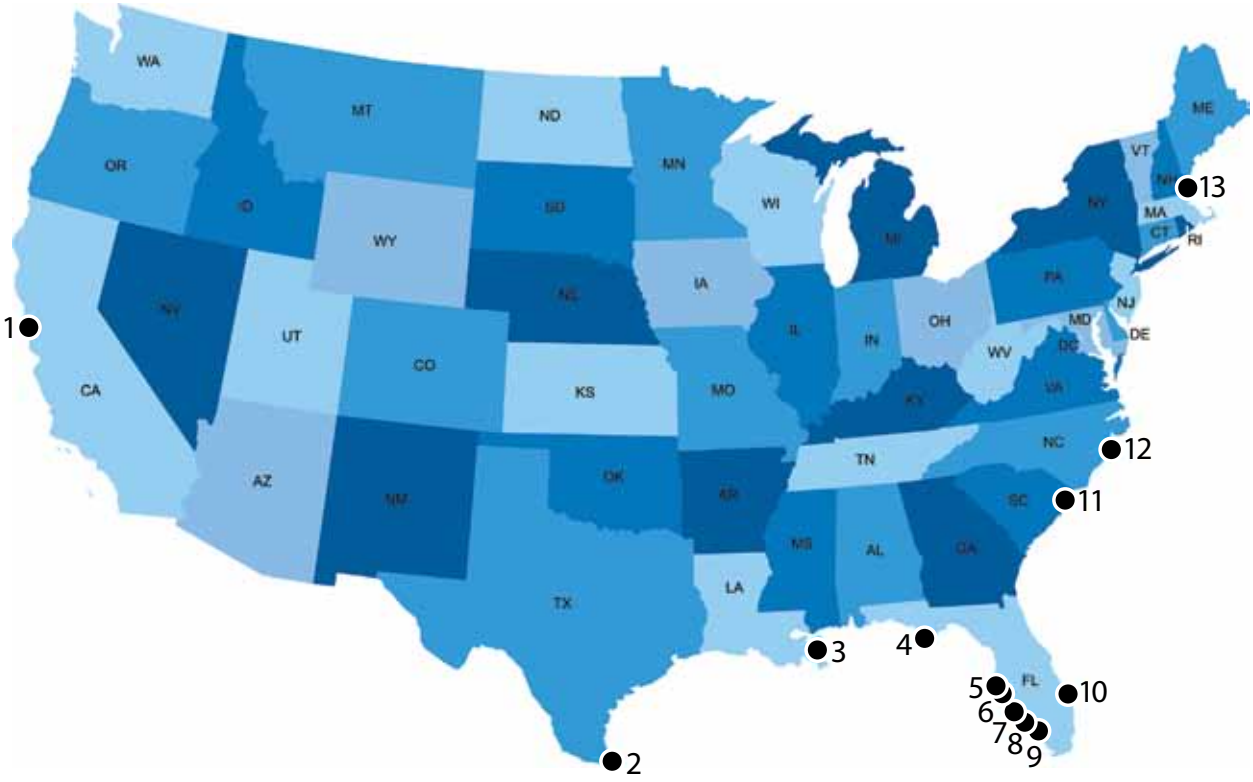
Project Portfolios



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Providing tidal hydrology restoration project examples, with supporting documentation, from the Southeastern United States and beyond.

Eden Landing Salt Pond Restoration Project

Hayward, Alameda County, CA

Dikes and levees built in the mid-1800s for the purposes of commercial salt production are breached to allow for the restoration of tidal marsh.

Photo Credit: NOAA

Background

Beginning in the mid-1800s, the tidal marshes and mudflats of the San Francisco Estuary were filled, diked, or drained for transportation, development, and farming. The bay lands in the South Bay were diked primarily for commercial salt production, and by the 1930s almost half of the South Bay's historical tidal marshes had been converted into salt ponds. The Eden Landing Ecological Reserve (ELER) Restoration Project is located on the eastern shore of San Francisco Bay in the California Department of Fish and Game's ELER. This multi-phase, 835-acre restoration project includes over 700 acres of tidal salt marsh restoration and 125 acres of managed ponds. The ELER Restoration Project was implemented within the context of the 15,100-acre South Bay Salt Ponds Restoration Project (SBSPRP). The ELER includes an additional 5,500 acres to be restored as part of that project. This case study focuses on the final phase of the original ELER Restoration Project, accomplished by breaching the last remaining Mt. Eden Creek levee, removing invasive species, and planting native species.

Outcomes / Status

By June 2006, restoration planning, design, and previous phases of construction were completed. Initial site monitoring was also completed, including pre-project pictures, vegetation transect surveys, and topographic and GPS mapping. In 2008, the project breached one final levee to open approximately 350 acres to tidal influence and restore 10,000 linear feet of emergent wetland. At the same time, two culverts were replaced to improve pond management, invasive species were removed, and native species were planted. Since 2006, the project's partnership with Save the Bay has included community-based restoration activities with corporate, school, and other groups conducting habitat enhancements along a broad levee to provide wetland-upland transition habitat and jump-start plant establishment. From 2006 to 2009, over 5,000 seedlings were planted to establish native marsh vegetation, seedling growth and sibling groups were studied in native plant nurseries, and invasive plant removal and site mapping continued. Beginning in April 2007, post-project monitoring and vegetation surveys were underway, and site partner meetings were being held to assess success and next steps.

Lessons Learned

- Tidal restoration of former salt ponds to tidal salt marsh is projected within 5 to 10 years where elevation is suitable for plant establishment; habitat structure and functional development will require longer periods for channel development and sediment accretion.
- Partnerships with local agencies and organizations to fund and implement restoration actions are valuable and increase success.
- Focusing on a suite of species and on creating habitat diversity, rather than focusing on a single species, can improve site management.

Project Contact

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Eden Landing Ecological Reserve
CA Department of Fish and Game
415-454-8050

Additional information on this effort can be found online at Save the Bay's Eden Landing project page at http://www.savesfbay.org/eden-landing.

Eden Landing Salt Pond Restoration Project Details

Project Identification, Feasibility, and Planning

Project Start / Completion Dates

February 2001 to October 2008

Historic Tidal Modification (reason)

Dikes and levees were built in the mid-1800s to create commercial salt ponds in areas historically occupied by tidal marsh and tidal flats.

Impacts of Historic Tidal Modification

Most of the site was historically tidal marsh, with broad, well-developed channels, and large tidal marsh pans, including some backshore pans. Seaward of the tidal marsh were large areas of tidal mud flat. The upland boundaries of the marshes were grasslands, including a limited amount of moist grassland capable of supporting seasonal ponds. Historically, Alameda Creek provided a significant zone of brackish tidal marsh. This creek also supported well-developed riparian habitat and a steelhead trout run. Most of the tidal marsh was converted to salt ponds when a majority of the area was diked.

Project Partners

Lead: California Department of Fish and Game, East Bay Regional Park District
Others: Save the Bay, USFWS, NOAA

Funding Sources

Wildlife Conservation Board; NOAA Community-based Restoration Program; CA Department of Fish and Game; CA Coastal Conservancy, East Bay Regional Park District; Caltrans; Cities of San Jose, Milpitas, and Fremont; San Francisco Bay Conservation and Development Commission, Association of Bay Area Governments/Bay Trail

Goals and Objectives

Goals and Objectives

Goals: Restore and enhance wetland habitat structure and function for migratory birds and threatened and endangered species through native salt marsh vegetation reestablishment and invasive species control, provide for flood management, and provide public access and recreation opportunities

Objectives: Re-establish native salt marsh vegetation diversity with at least four species by 2007. Reduce flowering and seeding of *Lepidium latifolium* to at least 30 percent of population by 2008.

Project Design

Design Techniques

Multiple levee breaches (four primary breaches restored full tidal action; two breaches restored tidal action to major sloughs along their historic alignment, two breaches restored tidal action to the 2, 350-acre tidal basins within the former salt ponds) slope stabilization; invasive species removal and native planting; trail development and operations; flood protection.

Design Narrative

This multi-phased project restored approximately 835 acres of existing salt ponds to both tidal and seasonal wetlands. The first phase included tidal channel reconstruction at the site (the first breach occurred in April 2005 to restore tides to North Creek from Old Alameda Creek, the second breach restored tidal action from North Creek into the tidal basin). The second phase involved levee breaching at the bayfront to reconnect Mt. Eden Creek to the bay, and the final breach upstream which restored full tidal action from Mt. Eden Creek to the tidal basin; the two tidal basins combined are over 700 acres in size. The project also included removal and control of Lepidium latifolium and other invasive species, and planting of native marsh species. The final phase included levee construction (for flood protection and a service road along the Bay Trail), installation of additional drainage structures and slope stabilization measures, and several breaches that ultimately connect tidal waters from the Bay to salt ponds that had been isolated from tidal influences for many years.

Permitting

Permits

USACE San Francisco District Section 404 permit; Section 7 consultations with USFWS and NOAA for ESA; California Environmental Quality Act review; Bay Conservation and Development Commission permit; San Francisco Regional Water Quality Control Board Section 401 certification. Specific concerns related to fish and wildlife habitat included: habitat for two federal and state listed endangered species (California clapper rail, salt marsh harvest mouse), the federally listed threatened western snowy plover, and the state listed threatened black rail; nursery and foraging habitat for many species of fish including steelhead trout, starry flounder, and Pacific herring; mudflat habitat used as a source of invertebrate prey by shorebirds; and seasonal wetlands utilized in winter by migrating waterfowl, such as the northern shoveler.

Construction and Maintenance

Total Budget

$3,595,400 for restoration of 835 acres

Construction Narrative

Constructed channels follow historic channel alignments wherever possible. Culverts were installed as necessary to allow for water passage at the levees to managed ponds and to provide management as needed to address infrastructure constraints. Community volunteers established native vegetation along two miles of Bay Trail with a 10:1 slope along the perimeter bench of the tidal restoration area. This included planting with a native tidal marsh seed mix; installation of vegetated coir mats to reduce erosion and rapidly establish natives; blacktarping specific problem areas to reduce weed infestations through solarization; and planting over 5,000 site-specific native seedlings, 20 percent propagated by volunteers and 80 percent by contract with local nurseries.

Scientific Evaluation and Monitoring

Scientific Evaluation

This project has a reference site located in North Bay at China Camp, part of the San Francisco Bay National Estuarine Research Reserve. The restoration parameters to be evaluated include acreage of habitat types, vegetation species composition, percent cover of herbaceous vascular plants, interspersion of habitat types, and seedling survival.

The target value for invasive vegetation is less than or equal to 50 percent cover. The target value for native salt marsh vegetation species composition is four species. The reference values from China Camp State Park include 20 percent invasive species cover and 12 native salt marsh species.

Additional California Department of Fish and Game monitoring activities include Annual Monitoring Reports for 10 years of: waterbird distribution, habitat use, composition, abundance; snowy plover nesting activities (monitor similarly to past/current effort led by USFWS); clapper rail, salt marsh harvest mouse colonization/distribution within restored areas; tidal marsh vegetation establishment; sedimentation rates; tidal channel evolution/development; and tidal prism, extent of tidal inundation

Community Involvement

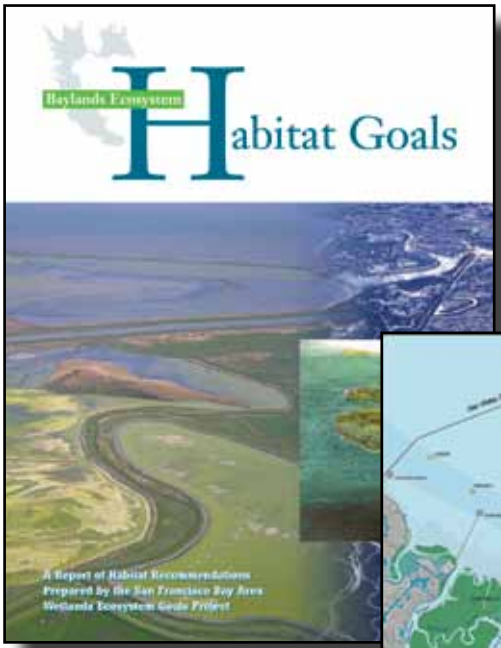
Volunteer Components

Save the Bay provided most of the volunteer opportunities for this project, including invasive species and trash removal pre-breach, and planting native vegetation along the perimeter of the newly restored tidal fringe.

Stakeholder Engagement and Community Outreach

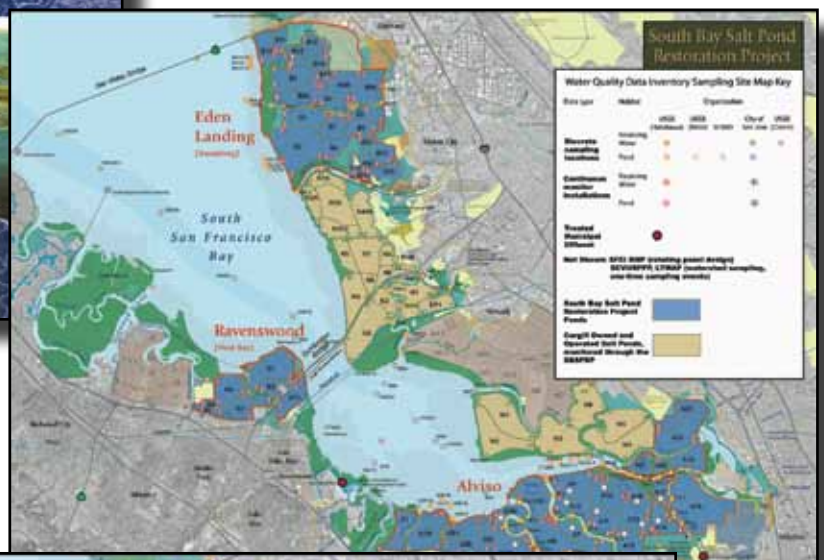
Outreach for the overall South Bay Salt Ponds Restoration Project is extensive. Stakeholders have been able to participate in many workshops and meetings. For Eden Landing, Save the Bay plans to lead 25 individual volunteer projects with local students and community residents to educate and provide volunteer opportunities.

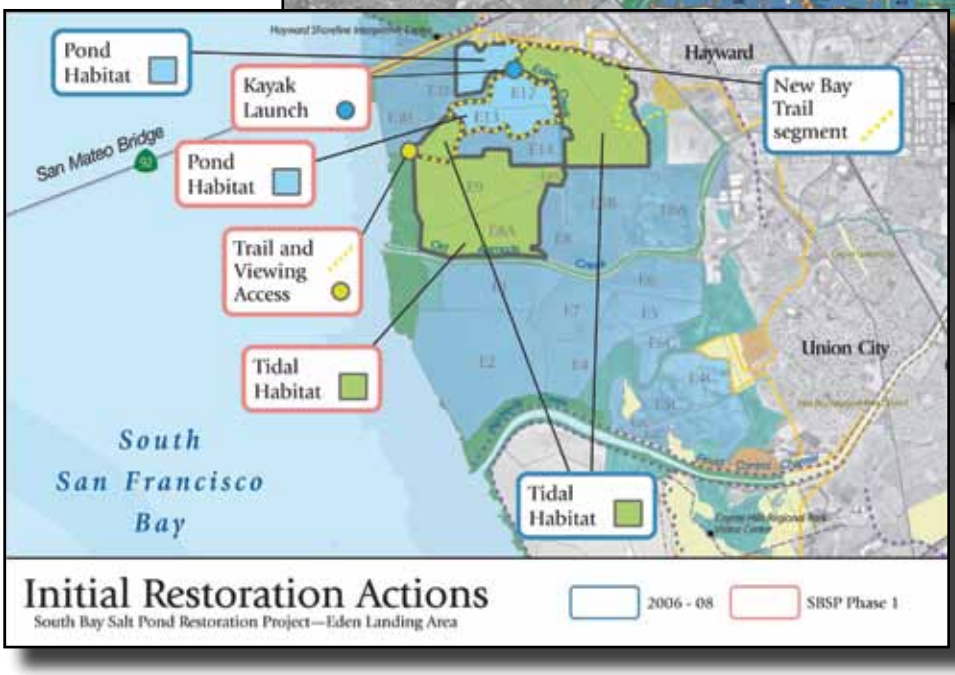
Additional Eden Landing Restoration Documents Available Online



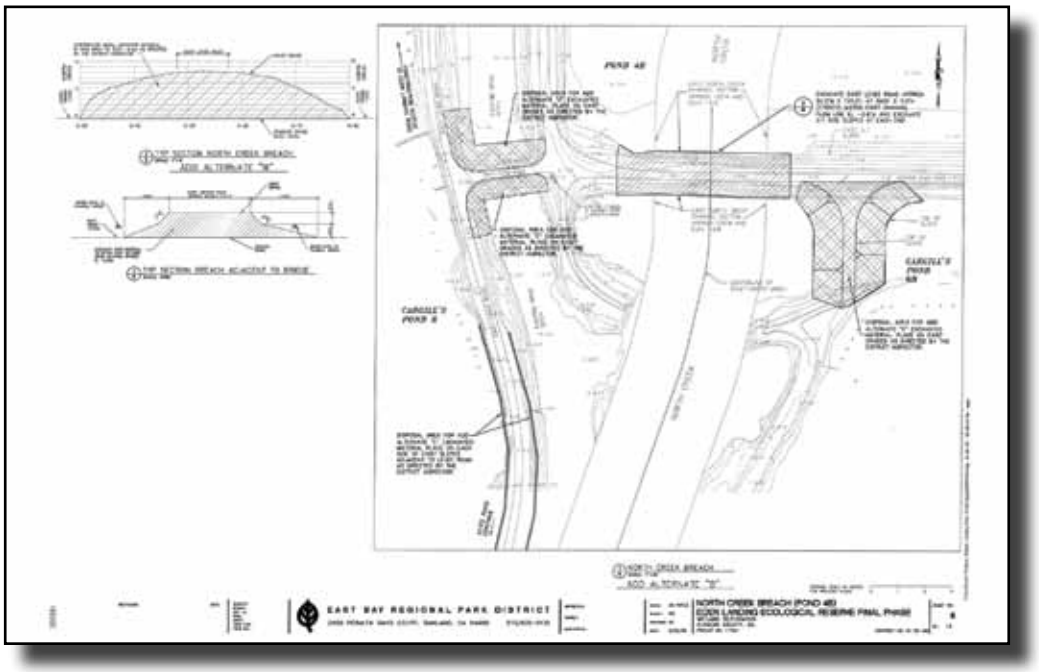
1 Baylands Ecosystem Habitat Goals

2 South San Francisco Bay
Salt Pond Restoration Overview Map





3 South San Francisco Bay Salt Pond Restoration
Map of Initial Restoration Actions in the Eden Landing Area



4 Eden Landing Design Plans

These Eden Landing case study materials can be found online at http://www.habitat.noaa.gov/partners/toolkits/tidal_hydro/portfolio_resources/tidalhydro-edenlanding.zip.

Bahia Grande Tidal Hydrology Restoration Project

Bahia Grande, Cameron County, TX

Background

The Bahia Grande is an 11,000-acre complex consisting of three basins between Brownsville and Port Isabel in Cameron County, TX. Originally a highly productive shallow estuarine water system, tidal flow was cut off in the 1930s by massive spoil banks left over from the dredging of the Brownsville ship channel. The basins dried up, converted to salty sand flats, and its drifting sands caused numerous health and industrial problems for nearby communities.

Outcomes / Status

In 2005 restoration of the Bahia Grande system began with the construction of a 2,400-foot-long, 60-foot-wide pilot channel that returned tidal flow after a 70-year absence. Future plans call for widening this channel to 210 feet. In addition to this main channel, other channels were constructed to connect Bahia Grande to both the Laguna Larga basin and the Little Laguna Madre basin. Ultimately, over 11,000 acres of estuarine habitat will be restored, making this one of the largest wetland restoration projects in U.S. history.

Lessons Learned

- An environmental assessment was used to translate the outcomes of different design scenarios determined by the hydrologic modeling.
- Other channels have been proposed, but due to budgetary limitations and permitting challenges, they have not been constructed to date.
- The satisfaction of community objectives relating to impacts from windblown sand provided tremendous support and enabled the project to be implemented in a short time frame.

For more information, visit the Bahia Grande project website at http://www.fws.gov/southwest/refuges/texas/STRC/laguna/Bahia%20Grande_Laguna.html.

Project Contact

Refuge Manager
Laguna Atascosa Wildlife Refuge
956-748-3607

In 2005, a pilot channel was opened between the Brownsville Ship Channel and the Bahia Grande, reconnecting permanent tidal flow to the area for the first time in 70 years.

Photo Credit: NOAA

Bahia Grande Tidal Hydrology Restoration Project Details

Project Identification, Feasibility, and Planning

Project Start / Completion Dates	January 2003 to July 2005
Historic Tidal Modification (reason)	Spoils banks were deposited from the dredging of the Brownsville Shipping channel. These banks impounded Bahia Grande, cutting off tidal flow.
Impacts of Historic Tidal Modification	11,000 acres of tidally influenced estuary were lost as the area converted to a dry basin. The biological productivity of this system drastically declined as wildlife, including abundant wildfowl and floral assemblages were lost.
Project Partners	U.S. Fish and Wildlife Service, National Fisheries Institute, The Ocean Trust, NOAA's Community-based Restoration Program, Gulf of Mexico Foundation
Funding Sources	National Fisheries Institute, The Ocean Trust, NOAA, Gulf of Mexico Foundation, U.S. Fish and Wildlife Service

Goals and Objectives

Goals	Reintroduce tidal flow throughout the system, reestablish salt marsh vegetation, allow fisheries access, and reduce windblown sediments.

Project Design

Design Techniques	Channel construction, mangrove and salt marsh revegetation
Design Narrative	To help create the most efficient design, a hydrologic modeling study was conducted that examined the effects of channel design and wind effects on water flow, circulation, and the mixing needed to achieve biological productivity goals. Individual and multiple breaches and channels at different locations were analyzed. The final design involved construction of a 2,400-foot-long main channel connecting Bahia Grande to the source of tidal waters, and construction of three additional channels, one to connect Bahia Grande to Laguna Larga basin (1,669 acres) and Little Laguna Madre basin (1,411 acres) and a 5,000-foot-long channel to enhance circulation between the two basins. The main channel was designed so that prevailing winds from the southeast facilitate maximum tidal inundation of the basin.

Permitting

Permits	U.S. Army Corps of Engineers Nationwide Permit 27. There were no ESA or NEPA delays, although the project required an individual Environmental Assessment due to archaeological issues.

PConstruction and Maintenance

Total Budget	$1,700,000
Construction Narrative	Construction was fairly simplistic. Large excavators and bulldozers were used to remove dredge spoils and cut the channel. Coordination with ongoing road work in the vicinity resulted in significant cost savings; the excavated material from the channel was used as fill material to grade the new road bed, resulting in significant savings.
As-built Monitoring	Channel depth and width.

Scientific Evaluation and Monitoring

Scientific Evaluation

Extensive evaluation and monitoring are being undertaken by a consortium of investigators from universities throughout south Texas. Monitored parameters include sediment geology and chemistry, water quality, bird communities. Estuarine monitoring includes benthic, epi-benthic, and nekton communities.

Community Involvement

Volunteer Components

Cultivation and planting of vegetation by volunteers was a large aspect of this project. Significant funding was generated to build extensive native plant nurseries.

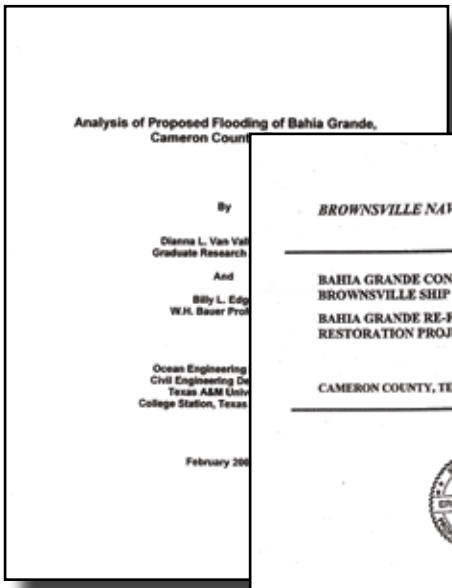
Stakeholder Engagement and Community Outreach

With the need to control the health and infrastructural impacts caused by wind blown sand from the Bahia Grande, a multitude of community groups joined with natural resource interests to offer strong support of the project. In all, a coalition of over 60 participating entities (county government, port, university, local landowners, etc.) came together to make the project a reality. Without this significant backing, the project would not have progressed as rapidly as it did.

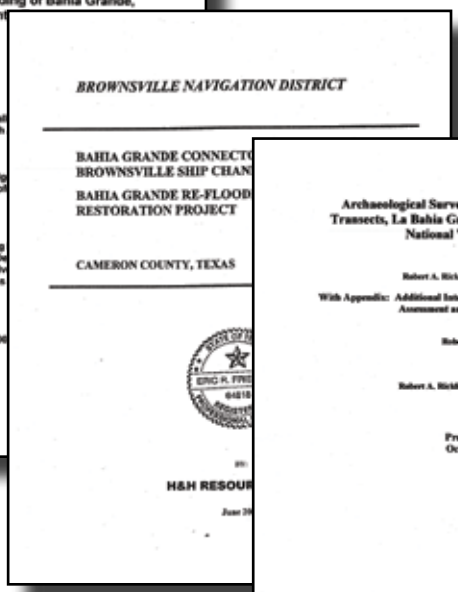
The reintroduction of tidal flow to the Bahia Grande enabled the restoration of an 11,000-acre estuary and alleviated the negative effects of windblown sands on the local community.

Photo Credit: NOAA

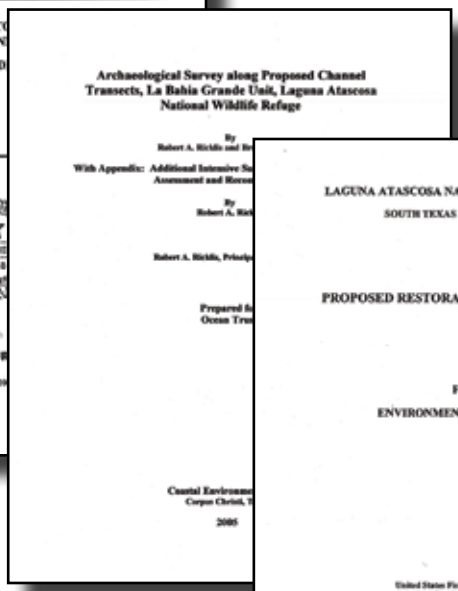
Additional Bahia Grande Restoration Documents Available Online



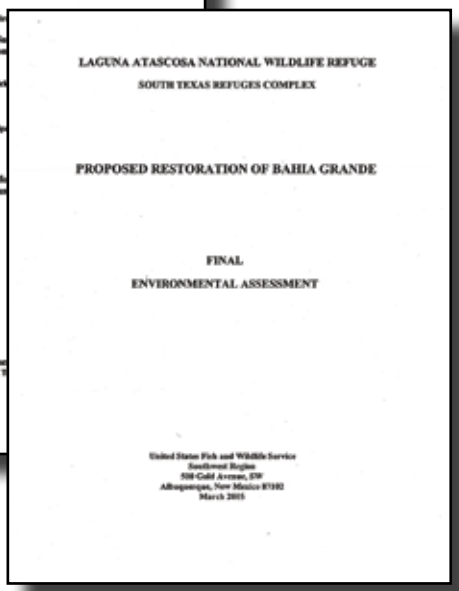
1 Analysis of Proposed Flooding of Bahia Grande



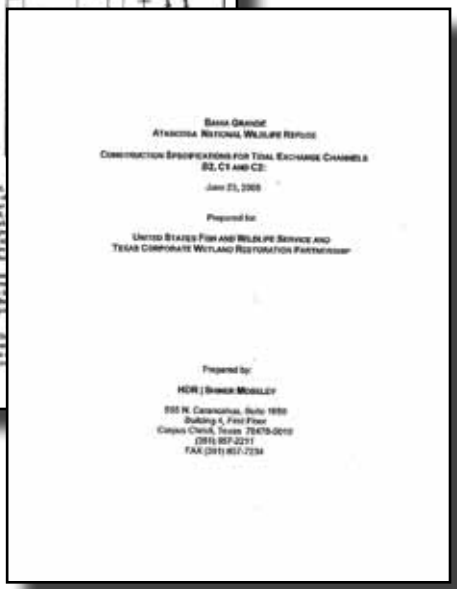
2 Bahia Grande Restoration Hydraulic Analysis



3 Archaeological Survey

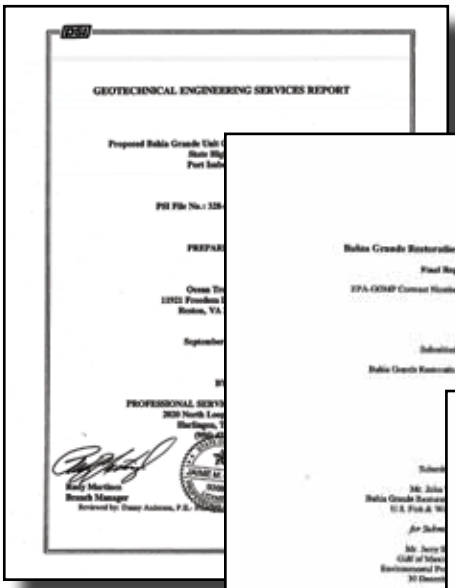


4 Final Environmental Assessment

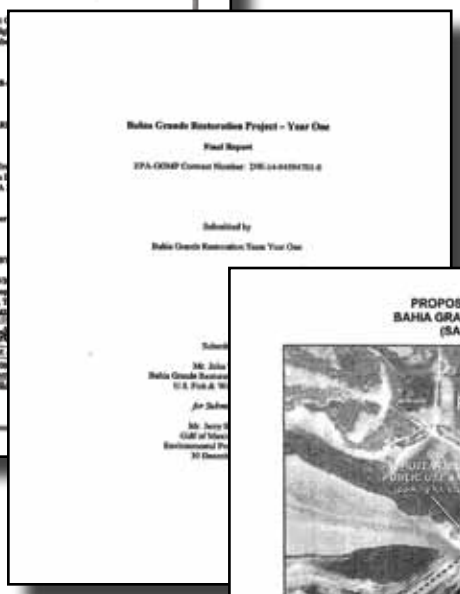


5 Solicitation for Public Input

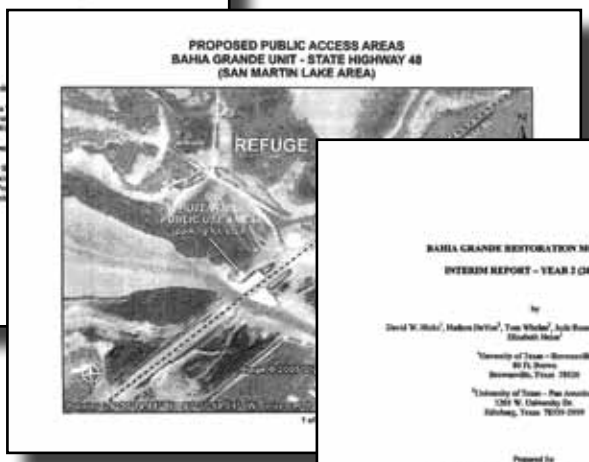
6 Construction Specifications for Tidal Exchange Channels



7 Geotechnical Engineering Services Report

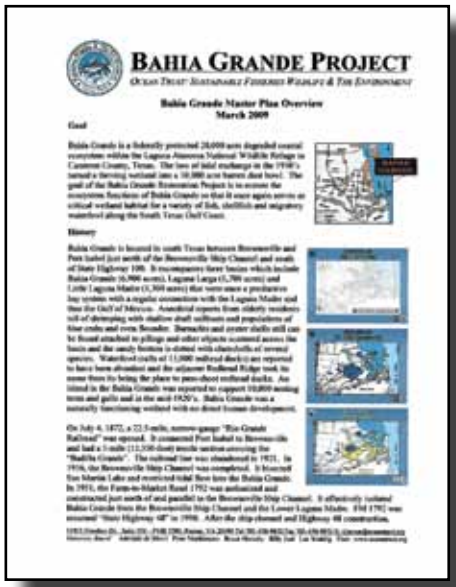


8 Bahia Grande Restoration Project
Year 1 Final Report



Proposed Public Access 9

Interim Monitoring Report 10



11 Master Plan Overview

These Bahia Grande case study materials can be found online at http://www.habitat.noaa.gov/partners/toolkits/tidal_hydro/portfolio_resources/tidalhydro-bahiagrande.zip.

Hopedale Tidal Hydrology Restoration Project

Yscloskey, St. Bernard Parish, LA

A failed 1950s water control structure in the canal negatively affected more than 3,800 acres of marsh habitat impounded by levee and road construction.

Photo Credit: CWPPRA

Background

In the 1950s a water control structure was installed on the canal that connects the interior Hopedale project area to Bayou La Loutre. The project area is an impoundment created through road and levee development. Over time, the culverts degraded, prevented the drainage of high tides and stormwater runoff, resulting in impounded water on the marsh and restricted fish passage, and negatively impacting 3,805 acres.

Outcomes / Status

A new control structure was installed with three flap gates. Hydrology data is being collected and flow seems to be restored. The project team is still waiting for marsh function data, but anecdotally the marsh looks more robust.

A new water control structure, consisting of three flap gates and two fish gates, was installed to restore a healthy hydroperiod and to allow for fish passage.

Photo Credit: CWPPRA

Lessons Learned

- Be prepared to encounter traditional problems, such as indecisiveness of landowners and inclement weather (in this case, a storm event required equipment to be moved offsite and it was a constant battle to dewater the site due to high water table).
- Develop a clear Statement of Work. If you are not specific in the SOW, the contractor may not provide exactly what you require.
- Make sure your project is adequately funded up-front so you do not run short on funds.
- Have clear goals and objectives, they are important in determining project design.

Project Contact

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225-389-0508 ext. 206

Visit the State of Louisiana's Hopedale Hydrologic Restoration Project website at http://dnr.louisiana.gov/crm/coastres/project.asp?id=PO-24.

Hopedale Tidal Hydrology Restoration Project Details

Project Identification, Feasibility, and Planning

Project Start / Completion Dates	January 2004 to January 2005
Historic Tidal Modification (reason)	Historic levee and road impoundment degraded more than 3,000 acres of interior wetland. A water control structure built in the 1950s to remedy the impacted wetlands failed, thus re-creating the impoundment.
Impacts of Historic Tidal Modification	This area was once an intermediate to brackish marsh with open tidal exchange. Levees and roads were built that resulted in an impounded system subject to anoxic conditions and excessive water levels. As a result, there was increased interior wetland loss and stressed vegetation. A set of three culverts were installed in the 1950s to open exchange but they have since failed, reverting the area back to an impoundment with no fisheries access.
Project Partners	Lead: Louisiana Department of Natural Resources Others: NOAA National Marine Fisheries Service (NMFS), St. Bernard Parish
Funding Sources	NOAA Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) Program

Goals and Objectives

Goals and Objectives	Re-establish tidal exchange and relieve impoundment conditions; achieve healthy hydro-period: reduce periods of high water to levels found in reference marshes/high water to stand on marsh for no longer than one week; provide fisheries access.

Project Design

Design Techniques	Install a water control structure with three flap gates and two fish gates. The design was based on water level data collected inside and outside of existing structure and topographic and bathymetric surveys used in the hydrodynamic model (USEPA's SWIM model).
Design Narrative	The site had relatively simple hydrology with just a few water inflows and outflows. The design was set to achieve specific targets: high water to stand on the marsh for no longer than one week; structure openings were to allow for somewhat of a tidal signal (under normal conditions); a model was used to evaluate different sizes of openings and different operational strategies. The resulting design called for one water control structure consisting of three flap gates (an 84-inch diameter culvert with a flap door: when the water level is higher inside than outside, it will drain; when the water level is higher on the outside, it will remain closed) and two fish gates (tall thin slots in the structure of two feet wide by seven feet tall; under normal conditions they remain open, but they can be closed during tropical events). The goal was to minimize operational scenario: the only time for operation (i.e., closing of flap gates) is if a storm approaches, then all of the control structures are closed. If there is a significant event causing high water levels, all of the gates can be fully opened. If the water level gets too low inside, there is an option to close the fish access gates. Sea level rise was factored into the modeling in terms of projecting water levels in the future.

Permitting

Permits	USACE Section 404; State Coastal Use Permit

Construction and Maintenance

Total Budget	$2,280,000, including $620,000 for construction, does not include construction oversight. Additional engineering design and administration: $330,000 to $400,000 total, and federal and state supervision and management.
Construction Narrative	Over nine months of construction, the project removed three existing corrugated metal pipes and rock structures located within Hopedale Canal and replaced them with a sheet and pipe pile gated structure, along with associated walkways and riprap protection. The site required construction of temporary cofferdams for dewatering the existing canal during construction. The Hopedale control structure consists of a sheet and pipe pile wall, which spans the channel and extends past both banks with an overall length of 137.9 feet. The top of cap plate elevation is set at +8 feet NAVD 88. The structure has three Whipps combination gates and two Whipps fish gates installed with the invert elevation at –7 feet NAVD 88. The biggest issue with site construction has been low water in the winter. The pilings are 80 feet below ground and are designed to last 20 years.
As-built Monitoring	Datasonds are deployed in the project area and reference area. They record water level and salinity data. These continuous data recorders uplink water levels to an online system. They trigger a call to a pager if certain operational procedures (water levels) are met. (So far only had to operate for Hurricane Katrina.) There is maintenance and rehabilitation planned for the control structure but no replacement planned.

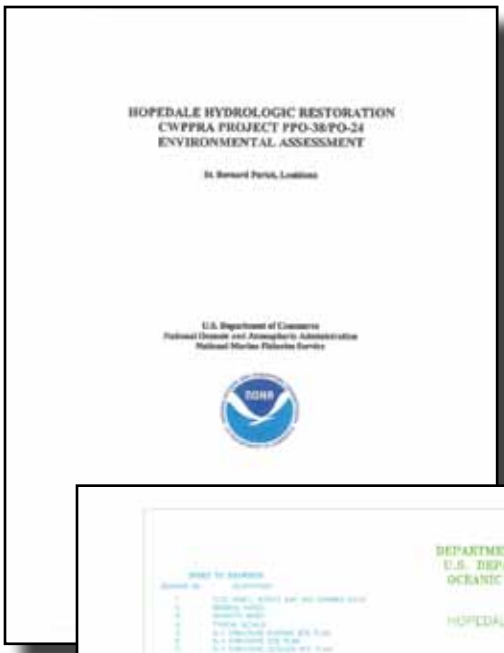
Scientific Evaluation and Monitoring

Monitoring Budget	$500,000 (budgeted $300,000 for long-term monitoring and maintenance for 20 years, but due to post storm events, data acquisition, rehabilitation event at year 10, and annual cleaning, will cost closer to $500,000).
Scientific Evaluation	Monitoring water level and marsh response through aerial photography analysis (pre-construction and planning for 10 and 20 years post); salinity (no significant effect on salinity yet); water level analysis (compare annually inside and outside at different stations, so far it is successful); some vegetation monitoring (using transects to assess percent cover and species composition).

Community Involvement

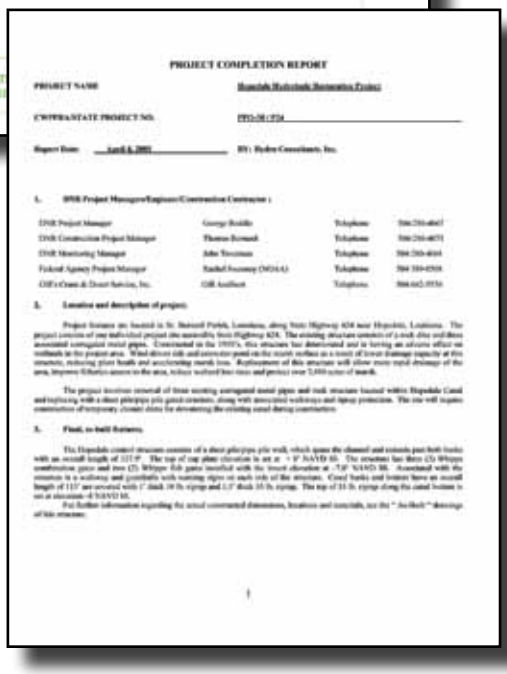
Volunteer Components	None
Stakeholder Engagement and Community Outreach	This project was subject to requirements of CWPPRA and proposed by the landowner and local government who had seen significant land loss in the area. The process included creating project-specific fact sheets, a dedication ceremony, and a project website.

Additional Hopedale Restoration Documents Available Online

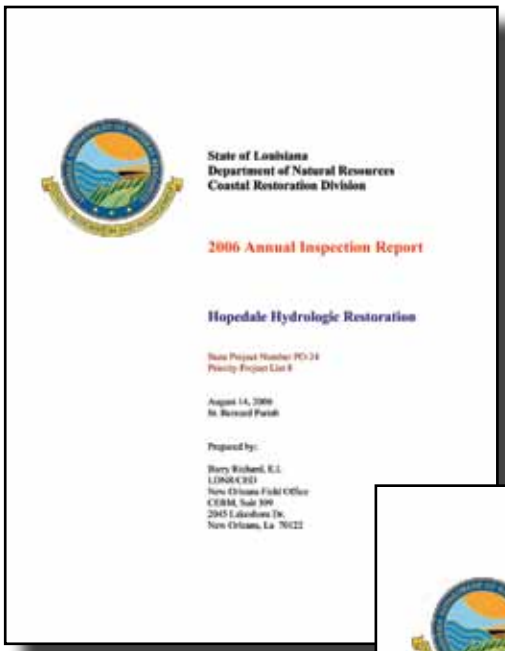


1 Hopedale Hydrologic Restoration Environmental Assessment

2 Project Construction Plans
As-Built Drawings



Hopedale Tidal Hydrology Restoration Project Completion Report 3



State of Louisiana
Department of Natural Resources
Coastal Restoration Division

2006 Annual Inspection Report

Hopedale Hydrologic Restoration

4 Annual Inspection Resport
Post Katrina

State of Louisiana
Department of Natural Resources
Coastal Restoration Division and
Coastal Engineering Division

2006 Operations, Maintenance, and Monitoring Report

Hopedale Hydrologic Restoration (PO-24)

5 2006 Operations, Maintenance, and Monitoring Report

These Hopedale case study materials can be found online at http://www.habitat.noaa.gov/partners/toolkits/tidal_hydro/portfolio_resources/tidalhydro-hopedale.zip.

St. Vincent Island Estuarine Habitat Restoration Project

St. Vincent National Wildlife Refuge, Franklin County, FL

Historic construction of multiple roads resulted in blockage of tidal hydrology and fish access to more than 2,300 acres of estuarine marsh.

Photo Credit: NOAA

Background

St. Vincent Island National Wildlife Refuge is a 12,490-acre barrier island on the western end of Apalachicola Bay, Florida, in the Gulf of Mexico. Prior to Refuge establishment, road construction and other anthropogenic modifications severely altered the natural hydrology of freshwater, brackish, and intermediate wetlands on the island. In 2000, the U.S. Geological Survey (USGS) completed a map report that identified restoration options to accomplish surface water hydrologic habitat improvements. The USGS specifically identified the potential for removal of 45 miles of roads on the island. This project aimed to restore one section of the island (2,389 acres total, approximately 1,925 acres of estuarine wetland) by improving the hydrologic connection between the estuarine marshes, freshwater marshes, and the Gulf of Mexico.

Outcomes / Status

Construction activities included installation and replacement of culverts and removal of the road bed by scraping down overburden and filling adjacent ditches. Water is now flowing through the culverts, connecting the marsh on either side, and fish have been seen moving across the previously existing road bed. In addition, marsh vegetation is growing over the re-graded "roads." Eventually, these road beds will disappear into the marsh.

Additional project information can be found online at the St. Vincent project website at http://www.fws.gov/saintvincent/.

Lessons Learned

- The logistics associated with moving supplies to "a very primitive site with equipment that is already worn out" was the biggest lesson learned for this project (Monica Harris, Refuge Manager). All supplies had to come from the mainland, creating a logistical hassle. Only equipment that met certain weight requirements (due to barge restrictions) could reach the island and thus be used for the project.
- Consider creative ways to rely on volunteers in the face of budget and staff cuts.
- Working in a soft environment is difficult. Even a seemingly simple task like installing the silt fence was complicated in the soft marsh conditions.
- Simple plans do not necessarily mean simple execution. Plans for the proejct were great on paper but could not necessarily be executed the same way.
- Flexibility is critical, especially when plans change. For example, the dump truck was not adequate to move dirt (the number of loads would have been unmanageable), so the team had to rely on scraping and pushing the dirt instead.

Project Contact

Refuge Manager
U.S. Fish and Wildlife Service
850-653-8808

St. Vincent Island Estuarine Habitat Restoration Project Details

Project Identification, Feasibility, and Planning

Project Start / Completion Dates	August 2007 to June 2008
Historic Tidal Modification (reason)	Several roadbeds were constructed through estuarine marsh using fill material borrowed from marsh adjacent to road, creating ditches.
Impacts of Historic Tidal Modification	Road construction and other modifications resulted in blockage of tidal hydrology and fisheries access through the 2,389-acre freshwater and estuarine marsh system.
Project Partners	Lead: U.S. Fish and Wildlife Service Others: NOAA Restoration Center, Supporters of St. Vincent National Wildlife Refuge, Inc., Franklin County Workcamp, Apalachicola National Estuarine Research Reserve, St. Vincent Island Shuttles, Apalachicola National Forest
Funding Sources	NOAA Community-based Restoration Program; Fish America Foundation

PGoals and Objectives

Goals	Re-establish hydrologic flow and connectivity by removing and breaching berm roads. Restore hydrologic connectivity of approximately 1,900 acres of estuarine marsh and 2,389 total wetland acres by scraping down berm roads and installing low water crossings and culverts.

Project Design

Design Techniques	Scrape-down and removal of road berms and dikes; culvert replacement and new placement; low water crossing installation using oyster shell on remaining road.
Design Narrative	Restoration activities included scrape-down and/or removal of three existing north-south roads across the marsh. Two access roads were remained as required for Refuge management. On one, a small failing culvert was replaced with two aluminum 36-inch culverts. On the second, four large low water crossings were established (each 60 to 80 feet long and covered with oyster shells) and one culvert was replaced to allow for sheet flow of water.

Permitting

Permits	Internal (USFWS) Section 7 consultation made the process relatively easy; Northwest Florida Water Management District; Franklin County permit.

PConstruction and Maintenance

Total Budget	$92,407
Construction Narrative	Construction at this site presented several challenges. The remote location required creative thinking and logistical planning to move shells and equipment. The original plan to move dirt from the road to the borrow pits by dump truck was impractical due to the volume of dirt and number of trips required. Instead, bulldozers and backhoes were used to push and scoop the dirt. Working in saltwater made it difficult to rent equipment due to fears of degrading the equipment. Several staff left the project before completion, so volunteer labor had to be organized and trained to run appropriate equipment.
As-built Monitoring	Monitored water flow through culverts; monitored elevations of culverts and low water crossings.

Scientific Evaluation and Monitoring

Scientific Evaluation

Collected photo points (before and after); measured water flow through culvert; monitored marsh vegetation; and conducted bird survey (research and monitoring); local school did baseline fishery survey in 2004 (before), which will allow for a follow-up survey (after).

Community Involvement

Volunteer Components

Volunteers were involved in all aspects of the project including grant management, fieldwork, and monitoring. Volunteers coordinated and administered the grant as well as installed and removed a silt fence, picked up supplies, assisted in culvert installation, and removed soil from roads. Volunteers were trained and certified to use heavy equipment. Volunteers also helped with project outreach and education.

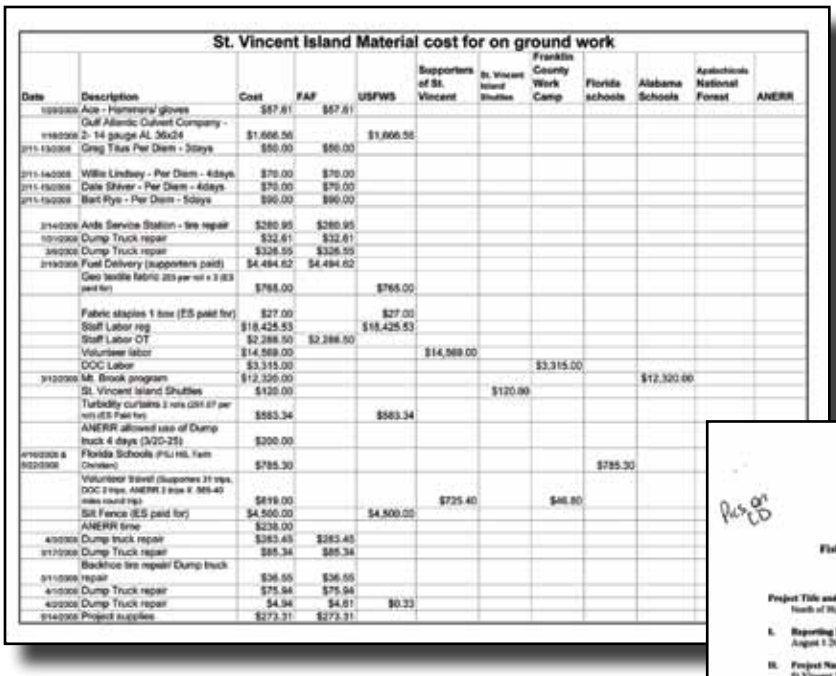
Stakeholder Engagement and Community Outreach

Engaged Friends of St. Vincent group in planning and implementation; conducted some meetings with recreational hunters who were concerned about losing access to parts of the island as a result of road closures. Several schools from Alabama and Florida visited the site to receive education about the project and the whole island. Forgotten Coast Television visited the site with the Friends of St. Vincent, and created a replaying feature on the tourist channel. Other outreach included articles in local papers, a poster in the NWR visitor center, and an open house event, including visits to the island and tours describing the hydrology project.

A combination of road removal, low water crossings and culvert placement (pictured here) was used to restore tidal connection previously severed through road construction.

Photo Credit: NOAA

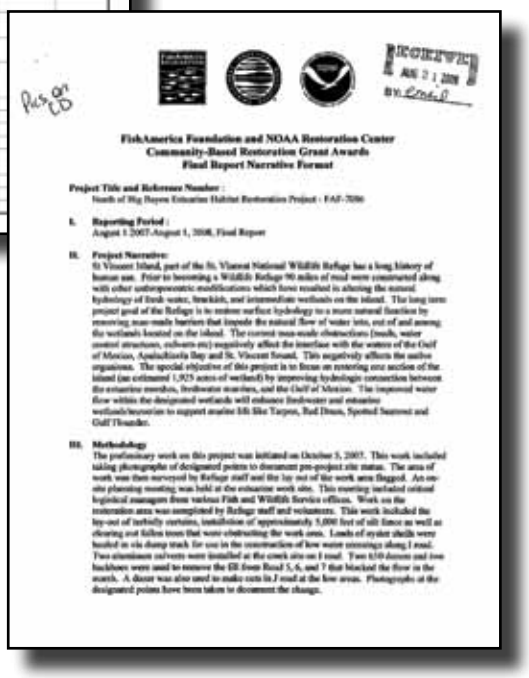
Additional St. Vincent Island Restoration Documents Available Online



St. Vincent Island Material cost for on ground work

Date	Description	Cost	FAF	USFWS	Supporters of St. Vincent	St. Vincent Island Shuttles	Franklin County Work Camp	Florida schools	Alabama Schools	Apalachicola National Forest	ANERR
1/29/2008	Axe - Hammers/ gloves	$57.61	$57.61								
1/16/2008	Gulf Atlantic Culvert Company - 2- 14 gauge AL 36x24	$1,666.56		$1,666.56							
2/11-13/2008	Greg Titus Per Diem - 3days	$60.00	$60.00								
2/11-14/2008	Willie Lindsey - Per Diem - 4days	$70.00	$70.00								
2/11-15/2008	Dale Shiver - Per Diem - 4days	$70.00	$70.00								
2/11-13/2008	Bart Ryo - Per Diem - 3days	$90.00	$90.00								
2/14/2008	Ards Service Station - tire repair	$280.95	$280.95								
1/31/2008	Dump Truck repair	$32.61	$32.61								
2/6/2008	Dump Truck repair	$326.55	$326.55								
2/19/2008	Fuel Delivery (supporters paid)	$4,494.62	$4,494.62								
	Geo textile fabric (83 paid for)	$768.00		$768.00							
	Fabric staples 1 box (ES paid for)	$27.00		$27.00							
	Staff Labor reg	$18,425.53		$18,425.53							
	Staff Labor OT	$2,288.50	$2,288.50								
	Volunteer labor	$14,569.00			$14,569.00						
	DOC Labor	$3,315.00					$3,315.00				
3/12/2008	Mt. Brook program	$12,320.00							$12,320.00		
	St. Vincent Island Shuttles	$120.00				$120.00					
	Turbidity curtains 2 rolls ($241.67 per roll) (ES Paid for)	$583.34		$583.34							
	ANERR allowed use of Dump truck 4 days (3/20-23)	$200.00									
4/16/2008 & 5/22/2008	Florida Schools (FSU HS, Farm Christian)	$785.30						$785.30			
	Volunteer travel (Supporters 31 trips, DOC 3 trips, ANERR 2 trips X 585.40 miles round trip)	$819.00			$725.40		$46.80				
	Silt Fence (ES paid for)	$4,500.00		$4,500.00							
	ANERR time	$238.00									
4/3/2008	Dump truck repair	$283.45	$283.45								
3/17/2008	Dump Truck repair	$85.34	$85.34								
3/11/2008	Backhoe tire repair/ Dump truck repair	$36.55	$36.55								
4/1/2008	Dump Truck repair	$75.94	$75.94								
4/2/2008	Dump Truck repair	$4.94	$4.61	$0.33							
3/14/2008	Project supplies	$273.31	$273.31								

1 Line Item Costs



FishAmerica Foundation and NOAA Restoration Center
Community-Based Restoration Grant Awards
Final Report Narrative Format

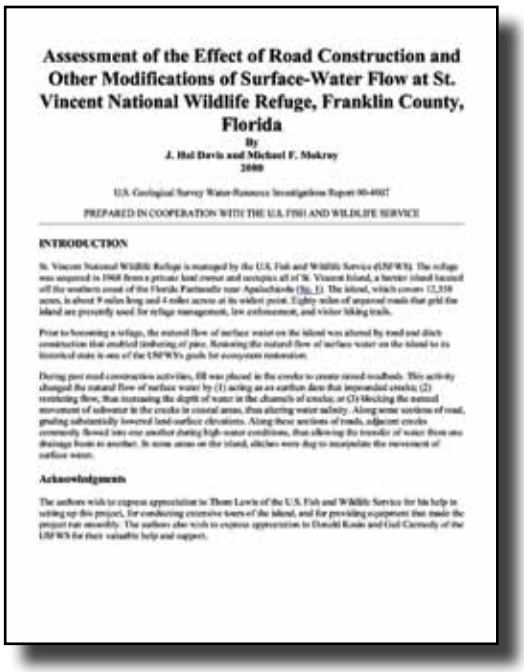
Project Title and Reference Number :
North of Big Bayou Estuarine Habitat Restoration Project - FAF-7086

I. Reporting Period :
August 1 2007-August 1, 2008, Final Report

II. Project Narrative:
St Vincent Island, part of the St. Vincent National Wildlife Refuge has a long history of human use. Prior to becoming a Wildlife Refuge 90 miles of road were constructed along with other anthropocentric modifications which have resulted in altering the natural hydrology of fresh water, brackish, and intermediate wetlands on the island. The long term project goal of the Refuge is to restore surface hydrology to a more natural function by removing man-made barriers that impede the natural flow of water into, out of and among the wetlands located on the island. The current man-made obstructions (roads, water control structures, culverts etc) negatively affect the interface with the waters of the Gulf of Mexico, Apalachicola Bay and St. Vincent Sound. This negatively affects the native organisms. The special objective of this project is to focus on restoring one section of the island (an estimated 1,925 acres of wetland) by improving hydrologic connection between the estuarine marshes, freshwater marshes, and the Gulf of Mexico. The improved water flow within the designated wetlands will enhance freshwater and estuarine wetlands/habitat to support marine life like Tarpon, Red Drum, Spotted Seatrout and Gulf Flounder.

III. Methodology
The preliminary work on this project was initiated on October 5, 2007. This work included taking photographs of designated points to document pre-project site status. The area of work was then surveyed by Refuge staff and the lay out of the work area flagged. An on-site planning meeting was held at the estuarine work site. This meeting included critical logistical managers from various Fish and Wildlife Service offices. Work on the restoration area was completed by Refuge staff and volunteers. This work included the lay-out of turbidity curtains, installation of approximately 5,000 feet of silt fence as well as clearing out fallen trees that were obstructing the work area. Loads of oyster shells were hauled in via dump truck for use in the construction of low water crossings along I road. Two aluminum culverts were installed at the creek site on I road. Two 610 dozers and two backhoes were used to remove the fill from Road 5, 6, and 7 that blocked the flow in the marsh. A dozer was also used to make cuts in J road at the low areas. Photographs at the designated points have been taken to document the change.

2 Final Project Report



Assessment of the Effect of Road Construction and Other Modifications of Surface-Water Flow at St. Vincent National Wildlife Refuge, Franklin County, Florida

By

J. Hal Davis and Michael F. Mokray

2000

U.S. Geological Survey Water-Resource Investigations Report 00-4007

PREPARED IN COOPERATION WITH THE U.S. FISH AND WILDLIFE SERVICE

INTRODUCTION

St. Vincent National Wildlife Refuge is managed by the U.S. Fish and Wildlife Service (USFWS). The refuge was acquired in 1968 from a private land owner and occupies all of St. Vincent Island, a barrier island located off the southern coast of the Florida Panhandle near Apalachicola (fig. 1). The island, which covers 12,358 acres, is about 9 miles long and 4 miles across at its widest point. Eighty miles of unpaved roads that grid the island are presently used for refuge management, law enforcement, and visitor hiking trails.

Prior to becoming a refuge, the natural flow of surface water on the island was altered by road and ditch construction that enabled timbering of pine. Restoring the natural flow of surface water on the island to its historical state is one of the USFWS's goals for ecosystem restoration.

During past road construction activities, fill was placed in the creeks to create raised roadbeds. This activity changed the natural flow of surface water by (1) acting as an earthen dam that impounded creeks; (2) restricting flow, thus increasing the depth of water in the channels of creeks; or (3) blocking the natural movement of saltwater in the creeks in coastal areas, thus altering water salinity. Along some sections of road, grading substantially lowered land-surface elevations. Along these sections of roads, adjacent creeks commonly flowed into one another during high-water conditions, thus allowing the transfer of water from one drainage basin to another. In some areas on the island, ditches were dug to manipulate the movement of surface water.

Acknowledgments

The authors wish to express appreciation to Thom Lewis of the U.S. Fish and Wildlife Service for his help in setting up this project, for conducting extensive tours of the island, and for providing equipment that made the project run smoothly. The authors also wish to express appreciation to Donald Kosin and Gail Carmody of the USFWS for their valuable help and support.

3 Published Report

Assessment of the Effect of Road Construction and Other Modifications of Surface-Water Flow at St. Vincent National Wildlife Refuge, Franklin County, FL

These St. Vincent case study materials can be found online at http://www.habitat.noaa.gov/partners/toolkits/tidal_hydro/portfolio_resources/tidalhydro-stvincent.zip.

Fort DeSoto Tidal Hydrology Restoration Project

Fort DeSoto Park, Pinellas County, FL

A causeway constructed in the 1950s to connect the islands and mainland at the mouth of Tampa Bay was breached by a 40-foot span bridge to restore tidal circulation and benefit more than 1,000 acres of estuarine habitat. The larger circle to the left denotes the location of the constructed bridge; the smaller circle to the right shows the location of the second planned bridge.

Photo credit: NOAA

Background

In the late 1950s, tidal flow between bays in the Fort DeSoto Park Aquatic Habitat Management Area in Pinellas County, Florida, was severed due to dredging and filling activities for the creation of casueways. Scientific data collected in the late 1970s revealed that the area was degraded due to impediments to tidal flow. Summertime water temperatures in the bays became extremely elevated leading to very low dissolved oxygen levels, as well as severe seagrass stress resulting in blade necrosis. It is estimated that over 1,000 acres of mangrove, soft bottom, and seagrass habitat (approximately 200 acres) were negatively impacted.

Outcomes / Status

The causeway has been breached and a newly constructed bridge has restored circulation between the bays of Fort DeSoto Park. The channel was lined with limestone boulders and the wingwalls were armored with limestone. The final channel was excavated to match the subsurface grades and allow water to flow. Unforeseen events have made it difficult to interpret the monitoring data; however, some patterns do exist.

- Previously, salinity levels experienced extreme fluctuation based upon rainfall, but levels have become more consistent.

- Quantitative nekton data are difficult to interpret due to extreme events (tropical weather, red tides) following the breach, but observations indicate that fish and crabs migrated into the area within a few days after construction.

- There have been changes in the seagrass population but it is difficult to discern at this time if they are a result of the project. Heavy matting of some epiphytes has disappeared. Approximately 200 acres of seagrass have the potential to be enhanced or restored but the monitoring plan does not allow for a definitive footprint.

- It will likely take many years for the soil and sediment to respond to increased supply of oxygen in water. Currently, fauna only exist in the uppermost oxygenated sediment layer.

Lessons Learned

- Predicting project outcomes or preparing for issues that arise can be difficult until the project is underway. For instance, Fort DeSoto was once a bombing range. At the beginning of construction, a magnetometer found a large amount of metal underground. This held up construction, but turned out to be dredge pipe.

- Estimating budget was a challenge; the original estimate of $1,600,000 was only enough to complete one bridge, though the team had planned to complete two.

- Give careful consideration to bid advertisement language. The original request for bids referred to a "re-circulation" project – bidders thought it was a water line project and few contractors bid. Re-advertising with more appropriate language brought down the cost by approximately $200,000.

Project Contact

Eric Fehrmann
Pinellas County Department of Environmental Management
efehrmann@co.pinellas.fl.us
727-464-4761

Fort DeSoto Tidal Hydrology Restoration Project Details

Project Identification, Feasibility, and Planning

Project Start / Completion Dates	March to November 2005 (construction)
Historic Tidal Modification (reason)	Causeways were created in the late 1950s and early 1960s around Fort DeSoto to support access between islands.
Impacts of Historic Tidal Modification	The initial concern was about faunal utilization but over time the focus shifted to seagrass health. Submerged aquatic vegetation (SAV) was primarily affected by the hydrologic changes. Mangrove and soft bottom/sand habitat were negatively impacted by increased organic sedimentation. Increased temperatures and extreme salinity fluctuations were also indicators of ecological impact.
Project Partners	Lead: Pinellas County Others: NOAA Restoration Center, National Fish and Wildlife Foundation, Tampa Bay Estuary Program, Southwest Florida Water Management District, U.S. Environmental Protection Agency
Funding Sources	Southwest Florida Water Management District (SWIM), U.S. Environmental Protection Agency (USEPA) and USEPA Gulf of Mexico Program, Pinellas County Environmental Foundation, NOAA Community-based Restoration Program, Florida Department of Community Affairs, U.S. Fish and Wildlife Service

Goals and Objectives

Goals	Restore tidal flow and circulation to improve water quality, SAV, and fisheries habitat.

Project Design

Design Techniques	Causeway breach; bridge construction; vegetation planting. Beyond original project scope: storm water treatment was incorporated along the road including ponds for runoff.
Design Narrative	Removed a 40-foot section of causeway (widest opening possible at this location for a single-span bridge without additional pilings). A wider opening would have been better for the habitat, but the project team had to balance habitat need with bridge functionality and cost. The project team originally considered two double box culverts, but flow velocity would have been too high and there would have been large pulses of water. With a high water velocity, culvert safety would also have been a concern for boaters. Design required a four-foot clearance at high tide for kayaking and canoeing, stability to withstand a hurricane, and enough structural strength for emergency vehicles. All of this increased costs. Project team had to navigate some Department of Transportation questions about ownership. The approaches and slopes of the created channel were replanted with native vegetation and the area under the channel was lined with native Florida limestone to provide unique and beneficial habitat and provide bottom stability.

Permitting

Permits	USACE NWP 27; Florida Environmental Resource Permit (followed joint permitting process between state and USACE). Southwest Florida Water Management District permit. Standard permit conditions included a stop work order with manatee sitings. Total process took about one year. Pre-permitting and on-site meetings were very useful.

Construction and Maintenance

Total Budget	$1,600,000 ($1,200,00 from non-county partners)
Construction Narrative	Construction involved using cranes, a front-end loader, dump trucks, dredge pumps, jet pumps (for pilings), steamrollers, and a long arm excavator. The saltwater environment was damaging to the equipment.
As-built Monitoring	Contractor had to meet construction specifications regarding excavation depths and slopes.

Scientific Evaluation and Monitoring

Monitoring Budget	$500,000 for five years.
Scientific Evaluation	Researchers collected pre- and post-restoration data to assess improvements in water circulation, quality, and seagrass health (also analyzing sediment cores and recording fish usage of the restored habitat). The County partnered with the University of South Florida to collect data, including bathymetry; water chemistry (temperature, dissolved oxygen, turbidity, nutrients, and salinity over seven years at seven sites using data loggers); nekton (seined in established seagrass beds and soft bottom sites, block netting in mangroves, identified species, recorded lengths/weights); seagrass (mapped from aerial photography and ground-truthed, shoot counts and epiphytes based on seven years of sampling); macrofauna (swim transects, extreme fluctuation during rainfall and high temps but now has flattened out); and sediments (cores taken to analyze hydrogen sulfide). The site experienced four tropical weather events the first year the bridge opened, and a major red tide the second year. Unforeseen events have made it difficult to evaluate data; however, patterns do exist (see below). Long-term monitoring is needed to evaluate project effectiveness over time.

Community Involvement

Volunteer Components	Volunteers helped with vegetation planting and scientific sampling.
Stakeholder Engagement and Community Outreach	Provided news/media events and interviews; produced government access channel program; developed a billboard for Fort DeSoto Trail (hiking, biking, and in-line skating trail) describing the project and its associated benefits. The project has been well received by the public (more so than expected).

Water quality monitoring was implemented at stations throughout the affected bays both before and after the causeway was breached.

PHoto credit: NOAA

Additional Fort DeSoto Restoration Documents Available Online

Ft. DeSoto Recirculation Project Financial Status Report
November 16, 2004

Ft. DeSoto Water Quality Improvement Project Financial Partners:

Southwest Florida Water Management District	$416,250
EPA Gulf of Mexico Program	$100,000
EPA (direct)	$50,000
Pinellas County Environmental Foundation	$250,000
NOAA	$75,000
Designated money from Fl. Dept. of Comm. Affairs (NOAA oil drilling fund)	$108,629
U.S. Fish & Wildlife (Florida Gulf Coast Coastal Program)	$70,000
SWIM (SWFWMD) mitigation funds from FDOT	$170,000
Total:	$1,267,879

FORT DESOTO RECIRCULATION PROJECT

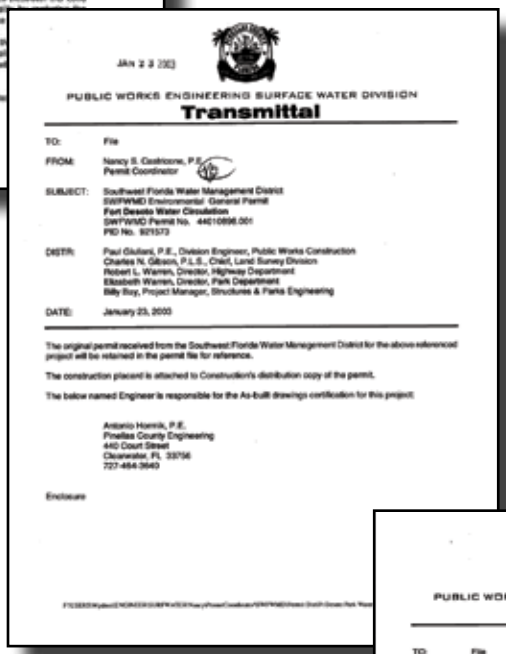
PROJECT DESCRIPTION: The project will include the construction and performance evaluation of 42' span bridges to replace portions of the filled causeways at Ft. DeSoto Park. Summertime temperatures become extremely elevated in these areas leading to very low dissolved oxygen levels as well as severe seagrass stress and fish kills.

The natural tidal flux and wind driven gulf/bay water will pass between the cells will help modulate water temperature and improve water qua
historic circulation patterns that existed prior to the filling of the

Preliminary modeling predicts a 100% exchange of water in th
25% for the larger bay. The bridges will be designed to al
vessels to travel between the bays and provide a canoe trail w
added public benefit.

A public education informational display will be constructe
project and acknowledge project participants.

1 List of Financial Partners for the Fort DeSoto Tidal Hydrology Restoration Project



JAN 2 2 2003

PUBLIC WORKS ENGINEERING SURFACE WATER DIVISION

Transmittal

TO: File

FROM: Nancy S. Cashicone, P.E.
Permit Coordinator

SUBJECT: Southwest Florida Water Management District
SWFWMD Environmental General Permit
Fort Desoto Water Circulation
SWFWMD Permit No. 44010896.001
PID No. 921573

DISTR: Paul Giuliani, P.E., Division Engineer, Public Works Construction
Charles N. Gibson, P.L.S., Chief, Land Survey Division
Robert L. Warren, Director, Highway Department
Elizabeth Warren, Director, Park Department
Billy Boy, Project Manager, Structures & Parks Engineering

DATE: January 23, 2003

The original permit received from the Southwest Florida Water Management District for the above referenced project will be retained in the permit file for reference.

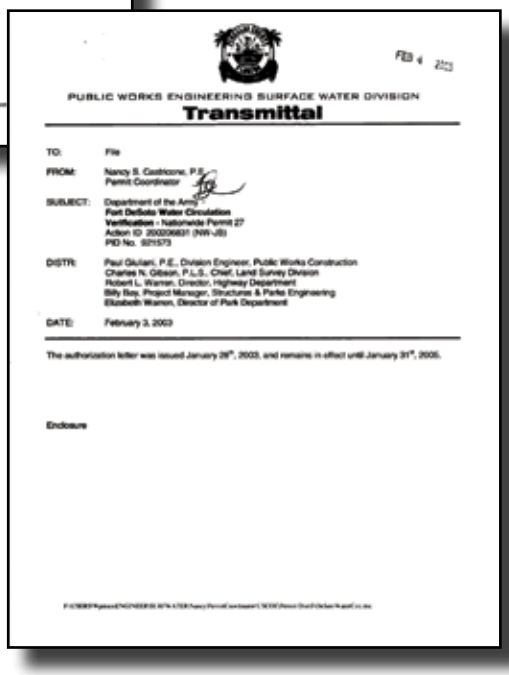
The construction placard is attached to Construction's distribution copy of the permit.

The below named Engineer is responsible for the As-built drawings certification for this project:

Antonio Hornik, P.E.
Pinellas County Engineering
440 Court Street
Clearwater, FL 33756
727-464-3640

Enclosure

2 Southwest Florida Water Management District Environmental General Permit



FEB 4 2003

PUBLIC WORKS ENGINEERING SURFACE WATER DIVISION

Transmittal

TO: File

FROM: Nancy S. Cashicone, P.E.
Permit Coordinator

SUBJECT: Department of the Army
Fort DeSoto Water Circulation
Verification - Nationwide Permit 27
Action ID 200306631 (NW-JS)
PID No. 921573

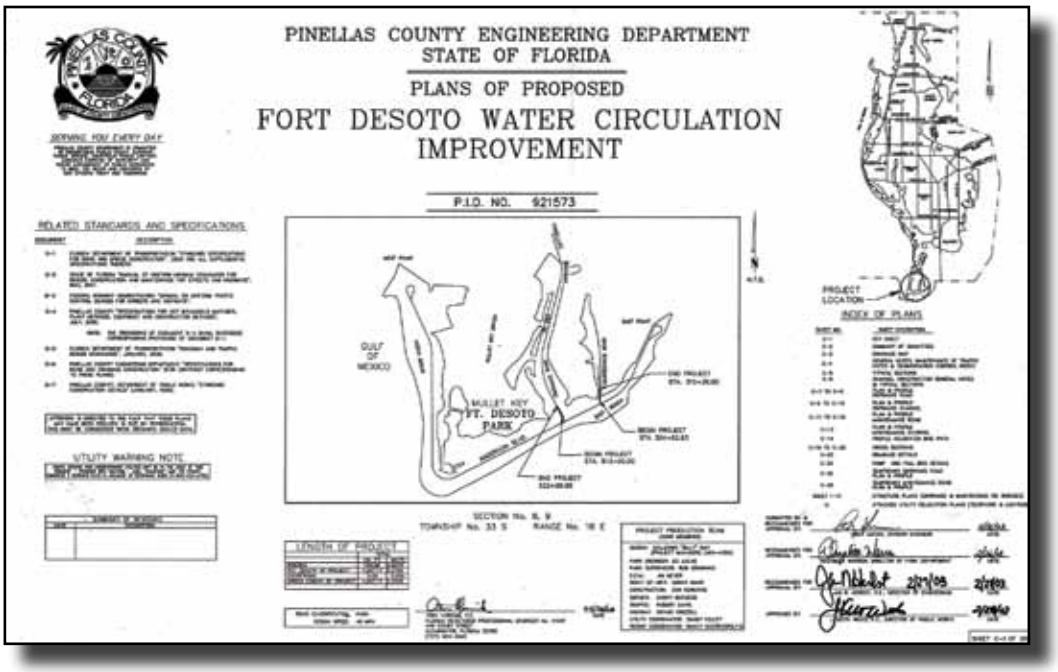
DISTR: Paul Giuliani, P.E., Division Engineer, Public Works Construction
Charles N. Gibson, P.L.S., Chief, Land Survey Division
Robert L. Warren, Director, Highway Department
Billy Boy, Project Manager, Structures & Parks Engineering
Elizabeth Warren, Director of Park Department

DATE: February 3, 2003

The authorization letter was issued January 28th, 2003, and remains in effect until January 31st, 2005.

Enclosure

U.S. Army Corps of Engineers Nationwide Permit 27 3



4 Project Designs

These Fort DeSoto case study materials can be found online at http://www.habitat.noaa.gov/partners/toolkits/tidal_hydro/portfolio_resources/tidalhydro-fortdesoto.zip.

Newman Branch Tidal Hydrology Restoration Project

Apollo Beach, Hillsborough County, FL

While the goal of the project was to restore tidal influence to the project site, flexibility in the permit language allowed for on-site modifications. This allowed the project team to create a meandering wetland footprint, thereby saving well-established oak trees.

Photo Credit: NOAA

Background

Newman Branch Creek is a tidally influenced waterway that drains into Tampa Bay from the southeastern reaches of Hillsborough County, Florida. The Creek's historic meandering pattern previously supported large amounts of mangrove forest and salt marsh habitats, but much of the Creek was channelized over time, altering adjacent saltern and wetland areas. Approximately 5.1 acres along Newman Branch Creek was heavily modified to operate as an aquacultural facility (tropical fish farm) for many years before being abandoned. The area contained 20 distinct (seven large and 13 smaller) ponds that were hydrologically severed from tidal influences of the Creek and had become dominated by Brazilian pepper (*Schinus terebinthifolius*). Another parcel along the Creek, approximately one acre in size, was entirely infested with Australian pine (*Casuarina equisitifolia*). An additional 5.8-acre area had been altered by the placement of fill during past dredging of the Creek. This restoration project was undertaken to develop an important public-private partnership to restore fish habitat function to privately owned land.

Outcomes / Status

The project has resulted in approximately 12 acres of habitat restoration including the removal of invasive exotic species (primarily Brazilian pepper and Australian pine), the breaching of a man-made berm to rehydrate a saltern community, and the re-creation of a variety of native estuarine habitats to provide a salinity gradient for marine species. In addition, the surrounding 48 acres have been enhanced by the removal of all the exotic vegetation. Fish, amphibians, birds, and other native species will benefit. It is also anticipated that tens of thousands of visitors will be educated on the importance of these habitat types through Tampa Electric Company's outreach efforts.

Lessons Learned

- This project was the first public-private venture in the Tampa Bay area specifically formulated for habitat restoration purposes, and paved the way for more of these types of cooperative projects. In fact, this project won the 2008 Environmental Project of the Year award from the Hillsborough County Planning Commission.
- It may be a challenge to justify spending public funds on private property, but the natural resources have no preference for land ownership and the details can be worked out to ensure proper management. Restoration of privately owned areas may be the only option for restoration in some areas.
- Permit applications that can include a "flexibility clause" to allow for some minor on-site modifications during construction, based on on-site conditions, can be beneficial. It can improve the effectiveness of the project and also decrease the costs of stopping construction in order to seek minor permit modifications.
- As-built monitoring is important to ensure that construction achieves the appropriate elevations.

Project Contact

Thomas F. Ries, Director
Ecosphere Restoration Institute
(formerly PEER, Inc.)
813-376-9076

Additional information on this project can be found online at http://www.tampaelectric.com/environmental/stewardship/restoration/.

Newman Branch Tidal Hydrology Restoration Project Details

Project Identification, Feasibility, and Planning

Project Start / Completion Dates	March to August 2007
Historic Tidal Modification (reason)	The placement of spoil during the dredging of Newman Branch Creek (presumably to increase water flow to relieve flooding) resulted in loss of tidal influences within the adjacent saltern and wetland communities for approximately 60 years.
Impacts of Historic Tidal Modification	The loss of tidal influence blocked over 5 acres of historic saltern communities from regular tidal flushing, resulting in the loss of habitat functionality. Adjacent historic wetlands (approximately 5 acres) and upland habitat (1 acre) were overtaken by invasive vegetation.
Project Partners	Tampa Electric Company (TECO), Ecosphere Restoration Institute (ERI), Southwest Florida Water Management District's (SWFWMD) Surface Water Improvement and Management (SWIM) program, NOAA Restoration Center, volunteers from TECO.
Funding Sources	NOAA Community-based Restoration Program, Pinellas County Environmental Fund, Southwest Florida Water Management District (SWIM), Tampa Electric Company, Ecosphere Restoration Institute

Goals and Objectives

Goals and Objectives	Restore the saltern habitat, and restore/create oligohaline and tidal wetland habitat. Re-establish natural tidal connection to improve habitat quality for fisheries and birds.

Project Design

Design Techniques	Identify past configuration of the Creek using aerial imagery; breach existing spoil berm; create oligohaline ponds (for amphibians) that flow down into tidal wetlands created from tropical fish farm ponds; breach berms between tropical fish farm ponds to create tidal wetlands.
Design Narrative	Design addressed three distinct areas along the creek, totaling approximately 12 acres. At the northernmost site, breaching interconnected 20 ponds adjacent to Newman Branch Creek to create a freshwater pond and establish a salinity gradient toward the Creek. At the 1-acre upland site, exotic vegetation was removed. The resulting grades were then appropriate for planting of native marsh communities. The third and largest (5.8-acre) site had been altered by the placement of fill during the dredging of the creek. Breaches within the fill areas rehydrated the saltern communities.

Permitting

Permits	USACE NWP 27; Florida Department of Environmental Protection Notice General (NG) Permit, Hillsborough County EPC Approval, Tampa Port Authority's concurrence.

Construction and Maintenance

Total Budget	$165,000
Construction Narrative	Heavy equipment was used to breach existing spoil berm. Flexibility in permit language allowed for on-site modifications, resulting in ability to meander wetland footprint to save well-established oak trees.
As-built Monitoring	The construction activities were supervised by an estuarine ecologist to ensure that the appropriate grades and elevations were achieved.

Scientific Evaluation and Monitoring

Monitoring Budget	Not available.
Scientific Evaluation	The Florida Marine Research Institute is currently monitoring species richness and utilization of habitats by avifaunal and fisheries species. Because the wetland site was so heavily colonized with invasive species and because the saltern site was completely cut off from tidal influence, it is assumed that no fish species could use the site previously. Recovery and natural recruitment of the plant communities is also being monitored.

Community Involvement

Volunteer Components	To date, hundreds of volunteers have helped plant thousands of native freshwater and estuarine marsh plants.
Stakeholder Engagement and Community Outreach	Tampa Electric Company (TECO) provided access to their land (12 acres), placed a perpetual conservation easement over these parcels, funded the removal of all exotic vegetation from the surrounding 48 acres (approximate), and purchased a large educational sign to inform visitors of the importance of these native habitat types. In addition, they organized numerous volunteer planting events. Finally, TECO's adjacent Manatee Viewing Center, which has approximately 315,000 visitors annually, is currently building a recreational trail so people can visit the site and learn of the importance of these native habitats.

This former fish pond had been overtaken by vegetation, and was not providing fully functional, tidally influenced habitat.

Photo Credit: NOAA

Additional Newman Branch Restoration Documents Available Online

AGREEMENT NO. 04 CONO0093

AGREEMENT
AMONG THE
SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
AND
PEER, INC.
AND
TAMPA ELECTRIC COMPANY
FOR THE
NEWMAN BRANCH FISHERIES HABITAT RESTORATION PROJECT (R085)

THIS AGREEMENT is made and entered into by and among the SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, a public corporation of the State of Florida, whose address is 2379 Broad Street, Brooksville, Florida 34604-6899, for itself and on behalf of the Alafia River Basin Board, hereinafter collectively referred to as the "DISTRICT," and PEER, INC., a notfor-profit organization, whose address is 5802 East Fowler Avenue, Tampa, Florida 33617, hereinafter referred to as the "CONTRACTOR", and TAMPA ELECTRIC COMPANY, a private corporation, whose address is 702 North Franklin Street, Tampa, Florida 33602, hereinafter referred to as the "LANDOWNER."

WITNESSETH

WHEREAS, the DISTRICT desires to engage the CONTRACTOR with consent of LANDOWNER to perform fisheries habitat restoration for a portion of Newman Branch Creek of Tampa Bay, hereinafter referred to as the "PROJECT"; and

WHEREAS, the CONTRACTOR represents that it possesses the requisite skills, knowledge, expertise and resources and agree to provide the desired services to the DISTRICT; and

WHEREAS, the DISTRICT, CONTRACTOR and LANDOWNER have agreed on the type and extent of services to be rendered and funding each shall contribute towards completing or accomplishing the PROJECT.

NOW THEREFORE, the DISTRICT and the CONTRACTOR and LANDOWNER, in consideration of the mutual terms, covenants and conditions set forth herein, agree as follows:

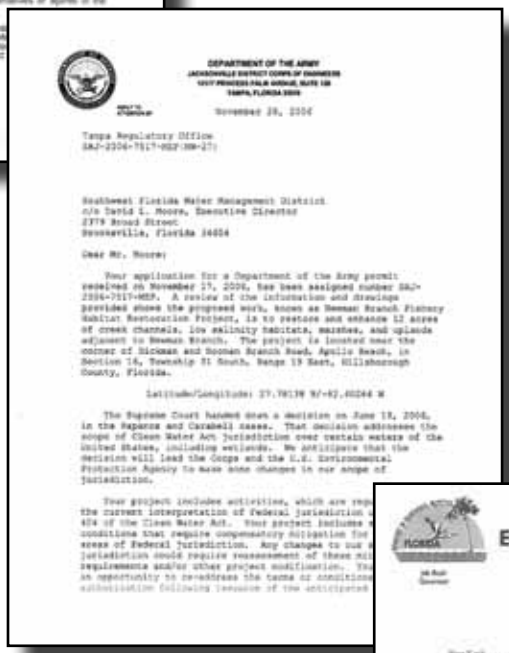
1. ACCESS. The LANDOWNER hereby grants permission to the DISTRICT and CONTRACTOR to enter upon and use the LANDOWNER's real property located in northwestern Tampa Bay Proper, just south of the Big Bend Power Plant off of Dickman Road, for the purposes provided herein.

2. INDEPENDENT CONTRACTOR. The CONTRACTOR and LANDOWNER will perform as independent Contractors and not as employees, representatives or agents of the DISTRICT or of one another.

3. PROJECT MANAGERS AND NOTICES. Each party hereby des... forth below as its respective Project Manager. Project Ma... PROJECT coordination and will be each party's prime conta... reports will be sent to the attention of each party's Project ... postage paid, to the parties' addresses as set forth below:

Page 1 of 7

1 Newman Branch Tidal Hydrology Restoration Project Cooperative Agreement



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
1157 PINELLAS PALM AVENUE, SUITE 100
TAMPA, FLORIDA 33606

November 28, 2006

Tampa Regulatory Office
SAJ-2006-7517-MEP-27)

Southwest Florida Water Management District
c/o David L. Moore, Executive Director
2379 Broad Street
Brooksville, Florida 34604

Dear Mr. Moore:

Your application for a Department of the Army permit received on November 17, 2006, has been assigned number SAJ-2006-7517-MEP. A review of the information and drawings provided shows the proposed work, known as Newman Branch Fishery Habitat Restoration Project, is to restore and enhance 12 acres of creek channels, low salinity habitats, marshes, and uplands adjacent to Newman Branch. The project is located near the corner of Dickman and Noonan Branch Road, Apollo Beach, in Section 16, Township 31 South, Range 19 East, Hillsborough County, Florida.

Latitude/Longitude: 27.78138 N/-82.40244 W

The Supreme Court handed down a decision on June 19, 2006, in the Rapanos and Carabell cases. That decision addresses the scope of Clean Water Act jurisdiction over certain waters of the United States, including wetlands. We anticipate that the decision will lead the Corps and the U.S. Environmental Protection Agency to make some changes in our scope of jurisdiction.

Your project includes activities, which are reg... the current interpretation of Federal jurisdiction ... 404 of the Clean Water Act. Your project includes ... conditions that require compensatory mitigation for ... areas of Federal jurisdiction. Any changes to our ... jurisdiction could require reassessment of these mi... requirements and/or other project modifications. Th... an opportunity to re-address the terms or conditions ... authorization following issuance of the anticipated

2 U.S. Army Corps of Engineers Nationwide Permit 27

Department of
Environmental Protection

Southwest District
13051 North Telecom Parkway
Temple Terrace, FL 33637-0926
Telephone: 813-632-7600

DEC 6 2006

Tampa Electric Company
c/o David L. Moore
Southwest Florida Water Management District
2379 Broad Street
Brooksville, Florida 34604

File No. 29-0267911-002, Hillsborough County

Dear Mr. Moore:

This is to acknowledge receipt of your notice on November 17, 2006 of intent to use a Noticed General Permit, pursuant to Rule 62-341.405, Florida Administrative Code (F.A.C.) to perform the restoration of a 12 acre area that will include the removal of all non-native vegetation and the restoration/enhancement of a creek channel, low salinity habitats, marshes and uplands. The project is located at the corner of Dickman Road and Noonan Branch Road, Section 16, Township 31 South, Range 19 East, Hillsborough County.

In addition to regulatory authorization under Rule 62-341.405, F. A. C., this type of activity also requires both proprietary and federal authorizations. Proprietary authorization is required pursuant to Chapters 253 and 258 F.S., to use state-owned submerged lands for private purposes. Federal authorization is needed for works in waters of the United States through the State Programmatic General Permit (SPGP) program.

Your notice has been reviewed by Department staff for all three types of authorizations: regulatory, proprietary and federal. The authority for review and the outcomes of the reviews are listed below. Please read each section carefully. Your project may not have qualified for all three authorizations. If your project did not qualify for one or more of the authorizations this specific notice dealing with that authorization will advise you how to obtain it. **You may NOT commence your project without all three authorizations.** If you change the project from what you submitted, the authorization(s) granted may no longer be valid at the time of commencement of the project. Please contact us prior to beginning your project if you wish to make any changes.

REGULATORY REVIEW - APPROVED

Based on the forms, drawings, and documents submitted herein and with your notice, it appears that the project meets the requirements for the Noticed General Permit under Rule 62-341.405, F.A.C.

Please be advised that the construction phase of the noticed general permit must be completed within five years from the date the notice to use the noticed general permit was received by the Department. If you wish to continue the noticed general permit beyond the expiration date, you

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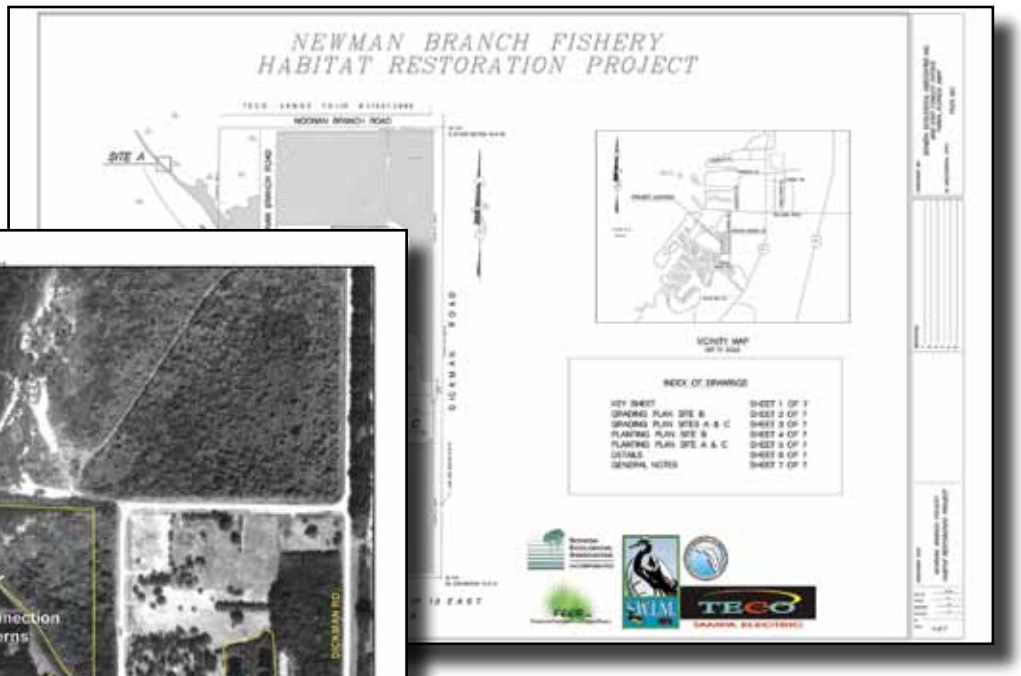
RECD DEC 07 2006

Southwest Florida Department of Environmental Protection General Permit Approval 3



4 **Project Construction Plans**

5 **Aerial View of the Project Site**

These Newman Branch materials can be found online at http://www.habitat.noaa.gov/partners/toolkits/tidal_hydro/portfolio_resources/tidalhydro-newmanbranch.zip.

Don Pedro Tidal Hydrology Restoration Project

Cape Haze, Charlotte County, FL

Culverts installed under an existing road bed allow for tidal waters flow into the historically degraded marsh site.

Photo Credit: NOAA

Background

In the late 1940s, a shell/marl road was created along the mangrove shoreline fringe of Lemon Bay (near Cape Haze) in what is now Don Pedro Island State Park. Material used to build up the road was excavated from the mangroves and marsh habitats. (A house at the end of the road was a drop-off point for anglers to leave their catch for further processing.) Aerials from the mid- to late-1940s show the road restricting tidal flow from the north (Gulf of Mexico) to the south. In addition, on the south end of the site, spoil from canal dredging completely blocked tidal flow to a large salt marsh area, essentially transforming it to a freshwater marsh.

Outcomes / Status

Culverts were installed under the roadway on the north end of the site and breaches were made in the dredge spoil at the south end of the site with some amount of regrading. Fourteen acres have been treated to remove exotic vegetation: Brazilian pepper (*Schinus terebithifolius*), melaleuca (*Melaleuca quinquinervia*), and cogon grass. In January 2007, prescribed burns were conducted over areas with exotic vegetation. Additional results still pending.

Lessons Learned

- Start early with logistic planning and lining up contractors.
- Use local contractors unless it is a very large project (costs are lower and they may be more sensitive to local habitat concerns).
- Do not underestimate the project costs; the simplest project is not necessarily simple to implement.
- Plan for high transport costs for dredge spoil removal.
- Be prepared for delays due to weather impacts if you are in a hurricane prone area. In this case, hurricane-impacts caused delays in getting contractors on board. Material and equipment costs increased as well.
- Remember the pre-application process is very important (staff turnover at regulatory agencies may require that you hold additional meetings).
- Specify types of equipment the construction contractor may and may not use if working at a sensitive site (due to the damage that can be done). For example, consider specifying soft track/tire/tread equipment.
- Remember that the damage done by construction is sometimes not worth the benefit of the project.
- Work closely with and supervise contractor during on-site construction.
- Call contractor references to verify past projects implemented.

For more information, please visit the Don Pedro Island State Park website at http://www.floridastateparks.org/donpedroisland/default.cfm.

Project Contact

Annette Nielsen
Florida Department of
Environmental Protection
Division of Recreation and Parks
Charlotte Harbor Preserve
annette.nielsen@dep.state.fl.us
941-575-5861
941-964-2965 (Don Pedro Park)

Don Pedro Tidal Hydrology Restoration Project Details

Project Identification, Feasibility, and Planning

Project Start / Completion Dates

Spring 2008

Historic Tidal Modification (reason)

Road construction and dredge spoil disposal blocked tidal flow to mangrove and marsh system.

Impacts of Historic Tidal Modification

Thirty-two acres of mangrove and salt marsh were impacted due to road construction and dredge and fill activities. Drying of the mangrove system resulted in unhealthy mangroves and the invasion of exotic species (*malelueca* and Brazilian pepper, Australian pines). The salt marsh system was almost entirely converted to a freshwater marsh system.

Project Partners

Lead: Florida Department of Environmental Protection – Division of Recreation and Parks

Others: NOAA Community-based Restoration Program, Barrier Islands Park Society, Charlotte Harbor Environmental Learning Center, Inc., Charlotte Harbor National Estuary Program.

Funding Sources

Gulf of Mexico Foundation, NOAA Community-based Restoration Program, Barrier Island Park Society

Goals and Objectives

Goals

Restore tidal flow to 32 acres of salt marsh and mangrove habitat by eliminating obstruction to tidal flow, thereby eliminating the exotic and invasive species. Remove fill from south end of the site (dredge spoil area) and install four culverts on the north end of the site beneath an existing roadway.

Project Design

Design Techniques

Installation of four culverts (none previously in place); removal of invasive vegetation; breaching and grading of dredge spoil (brought down to appropriate elevation for salt marsh and mangroves). Conducted prescribed burn in some areas.

Design Narrative

A great deal of work was done with SWFWMD to ensure that the culvert placement and designs allowed for tidal flow and circulation. An engineering contractor completed surveys for culvert design, placement, and background studies of the site for previous land use permitting, and recommended four 18-inch culverts, each 12 feet long. (The roadbed is not appropriate for heavy vehicle traffic and mostly accommodates pedestrians.) Insufficient funding was obtained to complete removal of all dredge spoil, since transportation of material for removing dredge spoil was cost prohibitive. An engineering company helped identify the most cost-effective areas to remove dredge spoil. Low velocity of flow over dredge spoil area meant that stabilization of the dredge spoil was not of concern.

Permitting

Permits

USACE NWP 27 (submitted letter and copy of Southwest Florida Water Management District permit and the federal permit was approved within a matter of days). The permitting process with the Southwest Florida Water Management District was lengthy. There were numerous engineering requirements (less information required on the ecology of the project) since SWFWMD had concerns about upstream flooding. This required a lot of engineering drawings and data that resulted in extra time and expenses by the project team. A pre-application meeting was held, but staff turnover at the regulatory agency held up the process as new staff were educated on the project.

Construction and Maintenance

Total Budget	$104,800 ($30,753 for consulting on design, drawings, permitting, and as-built; $39,228 for construction including excavation, culvert placement, construction of coffer dams near scour locations, capping road bed)
Construction Narrative	Construction equipment included a front-end loader, backhoe, larger tractor for placing culverts, and a dump truck. During construction phase, it was determined that the road bed material was not appropriate to support the culverts so had to cap with other materials (shell).
As-built Monitoring	Team monitored culvert locations and elevations, and dredge spoil grading elevations (to match elevation of adjacent marsh).

Scientific Evaluation and Monitoring

Scientific Evaluation	Currently undergoing monitoring. Another season (at least) is needed to evaluate project and seasonal transport. Team is currently using elevation stakes to monitor tidal height and vegetative changes using photo points and random transects (looking for both exotics and native species). Conducted pre- and post-project surveys of wading birds.

Community Involvement

Volunteer Components	Seventeen volunteers have contributed over 250 hours, plus additional hours that were not captured. Volunteers helped primarily with exotic species removal, coastal cleanup, and outreach. They also organized and led two kayak trips through the restored mangrove site.
Stakeholder Engagement and Community Outreach	Stakeholder involvement was a challenge; local interest in project was low. The project team conducted some outreach to developers working across the highway (to discuss future plans for the land) and invited new residents to participate in volunteer programs. The team worked with partners, Barrier Island Park Society and Charlotte Harbor Environmental Center, to conduct wading trips at Lemon Bay. An interpretive program was developed to demonstrate the ecology of the area and why restoration was important. Kiosk, signs, and flyers (seagrass, mangroves, and marsh education) were also created to increase project support and awareness.

Dredge spoil resulting from canal creation and maintenance was breached to allow for tidal flow through the southern portion of the restoration site.

Photo Credit: NOAA

Additional Don Pedro Restoration Documents Available Online

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
RESOURCE REGULATION DIVISION
PRE-APPLICATION MEETING NOTES

FILE NUMBER
PA 4832

Date: January 31, 2008 9:00 a.m.
Project Name: DON PEDRO LAND BASE WETLAND RESTORATION
Attendees: Annette Nielsen and Karsten Wilson w/FDEP, David Z. Sue, P.E. and Robert S. Bonicoro, Sr. WS w/ the District

County: Charlotte
Total Land Acreage: 98.0 acres
Sec/Twp/Rge: 34/41S/20E & 3/42S/20E
Project Acreage: 2.0 acres +/-

Prior On-Site/Off-Site Permit Activity:
- 4/02/0025-001 currently under review for development to east of project site.

Project Overview:
- Existing park site that has some previous encroachments: fill road and berm from canal to south.
- Proposing to place 4 – 18" culverts under roadway and remove spoil berm next to canal.

Environmental Discussion:
- Existing upland and coastal wetlands on site.
- Need to set construction limits and the limits of wetlands located within the proximity of the work zone for review by District staff at time of permit application.
- Any wetland impacts, temporary or permanent, must be depicted on the plans and shown in the wetland tables. Due to the small impacts anticipated, square feet may be utilized to define areas of impact rather than acreage.
- Any temporary impacts will need to be restored to natural grade.
- Effective sediment and erosion control measures should be maintained around the work zones.
- All spoil removed should be taken off site and properly disposed in a self-contained upland disposal area.

Site Information Discussion:
- Existing canal with spoil berm along south project boundary to be removed.
- Fill road runs east to west thru middle of site was placed circa 1990's is currently utilized as a pedestrian walkway.
- Provide the topographic information of the project site, signed by a PLS/PSM or P.E..

Water Quality Discussions:
- N/A

Water Quality Discussions:
- Wetlands / Wet Detention, Wetlands / Wet Detention, Offsite Offsite, Other Wetlands
- A dewatering plan with BMP's will need to be provided to include the design of temporary sumps, pumps and pump sizes, if applicable. The Construction Surface Water Management plan, signed by the owner will also be necessary, pursuant to Section 3.5.4 of the ERP Basis of Review.

Sovereign Lands Discussion:
- Need to conduct title check for SSL. District will send request prior to applic
- May need a Letter of Consent.

Operation and Maintenance/Legal Information:
- Provide copies of the fee simple deed of the project area or other satisfactory control. F.A.C. reference will be satisfactory for park service.

Application Type and Fee Required:

1 **Southwest Florida Water Management District Resource Regulation Division Pre-Application Meeting Notes**

ASH ENGINEERING, INC.

June 7, 2006

Ms. Annette Nielsen
Florida Department of Environmental Protection
Charlotte Harbor Preserve State Park
12301 Burnt Store Road
Punta Gorda, FL 33955

RE: Civil Design and Permitting for Hydrologic Restoration
Don Pedro Island State Park Land Base
Ash Proposal: 06AEW

Dear Ms. Nielsen:

Ash Engineering, Inc. (Ash) is pleased to present this proposal to **Florida Department of Environmental Protection** (FDEP), to provide **civil design and permitting for the hydrologic restoration of Don Pedro Island State Park Land Base**. The following highlights the project, as it is understood, along with specific project tasks and associated fees.

BACKGROUND

Don Pedro Island State Park Land Base is located at 9400 Placida Road, Cape Haze, Florida 33946 in Charlotte County. This is state land operated by the Florida Department of Environmental Protection. The existing wetland hydrology has been altered in the past by the installation of a raised road and placement of dredge spoil on the project site. FDEP wishes to install culverts under the road and remove the spoil material to improve the hydrology of the wetland areas.

PROJECT TASK DESCRIPTIONS

Task 1 – Project Management and Quality Assurance:

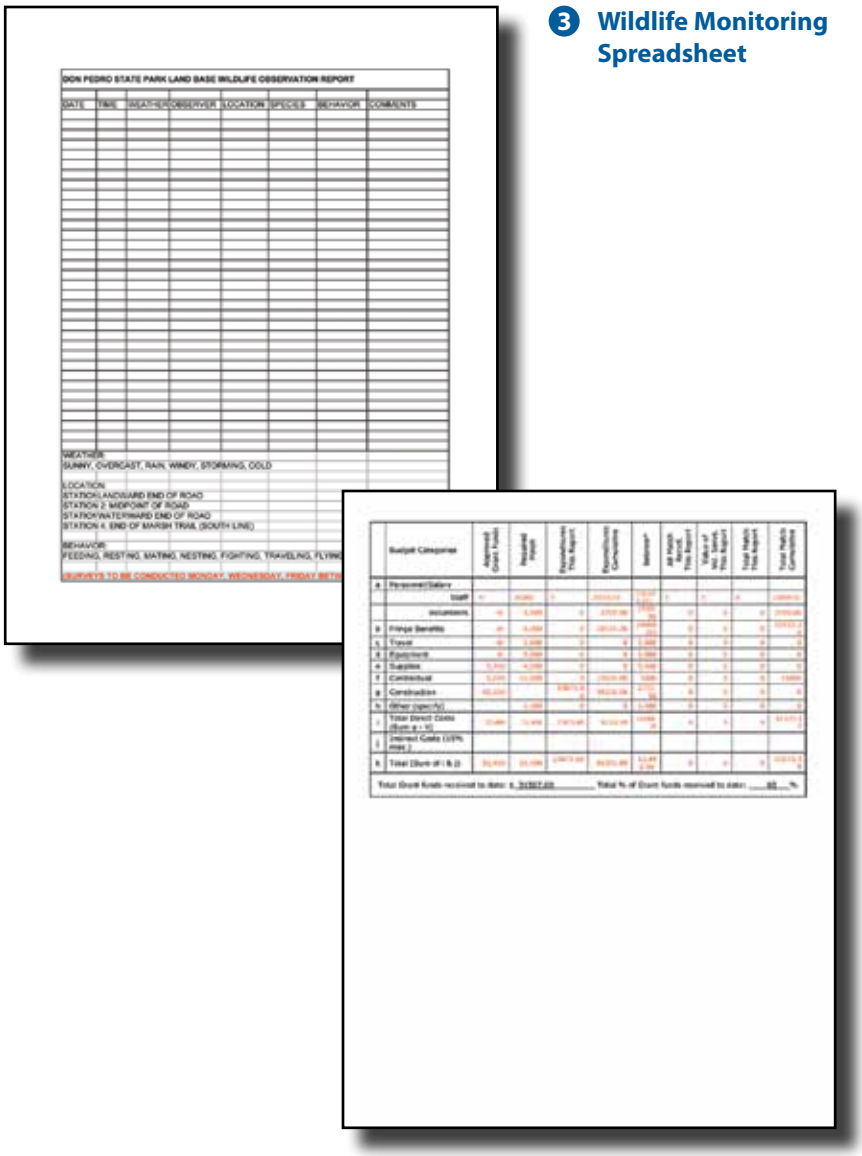
This task includes project management, client communications, clerical work, and work planning. This also includes a program of Quality Control and Quality Assurance and ensures the best product possible for the client.

Task 2 – Background Investigation:

Using all known information about the site, Ash will research:
- Plats
- Restrictions
- FEMA
- Zoning

CIVIL • WATER & WASTEWATER • ENVIRONMENTAL • UTILITY • CONSTRUCTION
INDUSTRIAL/PORT • SUBSURFACE UTILITY ENGINEERING • ECOLOGICAL SCIENCES

2 **Civil Design and Permitting Contracting Proposal**



DON PEDRO STATE PARK LAND BASE WILDLIFE OBSERVATION REPORT

DATE	TIME	WEATHER	OBSERVER	LOCATION	SPECIES	BEHAVIOR	COMMENTS

WEATHER:
SUNNY, OVERCAST, RAIN, WINDY, STORMING, COLD

LOCATION:
STATION 1 LANDWARD END OF ROAD
STATION 2 MIDPOINT OF ROAD
STATION WATERWARD END OF ROAD
STATION 4 END OF MARSH TRAIL (SOUTH LINE)

BEHAVIOR:
FEEDING, RESTING, MATING, NESTING, FIGHTING, TRAVELING, FLYING

SURVEYS TO BE CONDUCTED MONDAY, WEDNESDAY, FRIDAY BETW

3 Wildlife Monitoring Spreadsheet

4 Project Financial Report

These Don Pedro case study materials can be found online at http://www.habitat.noaa.gov/partners/toolkits/tidal_hydro/portfolio_resources/tidalhydro-donpedro.zip.

Clam Bayou Tidal Hydrology Restoration Project

Sanibel Island, Lee County, FL

Background

In the 1950s and 1960s land-bridges, or causeways, were constructed to connect Sanibel and Captiva Islands to mainland Florida. The construction of these causeways using dredged material from the adjacent bayous, along with other development, bisected Clam Bayou and Dinkins Bayou and halted all natural tidal flushing between the two mangrove-dominated systems. This transformed the area from a healthy tidal estuary to an artificially impounded freshwater system. More than 150 acres of mangroves were lost, healthy oyster reefs and seagrass beds disappeared, water quality declined, and important nursery and estuarine fisheries habitat degraded, resulting in the complete collapse of this estuary.

Outcomes / Status

As of 2006, tidal flushing has been restored between Clam and Dinkins Bayou. Three box culverts, placed under the causeway, allow water to flow between the two bayous, reestablishing an appropriate salinity regime and natural daily tidal flows. This directly benefits a total of 400 acres of habitat (150 acres of mangroves, more than 20 acres of oyster bars, and more than 120 acres of seagrass beds).

Lessons Learned

- Project was a success, specifically for seagrass, oysters, and fish in Clam and Dinkins Bayou.
- Mangroves will take longer to fully establish on restoration site edge.
- This concept may have application at other nearby locations. Project team is actively pursuing other similar projects.
- Volume of water and flow velocity are critical for determining size of culvert. Recommend measuring the volume and velocity at most restricted point, then using that information to determine the size of breach required at the new flow point.

Project Contact

Robert Loflin
Natural Resources Director
City of Sanibel
rob.loflin@ci.sanibel.fl.us
239-472-3700

Three box culverts, placed under the causeway, allow tidal water to flow between two bayous that had been hydrologically separated since construction of the road in the 1950s and 1960s.

Photo Credit: NOAA

Clam Bayou Tidal Hydrology Restoration Project Details

Project Identification, Feasibility, and Planning

Project Start / Completion Dates	March 2004 to February 2006
Historic Tidal Modification (reason)	Dredge and fill causeways were constructed to provide access from the mainland to Sanibel and Captiva Islands. The causeways cut off tidal flow to mangrove habitat in Clam and Dinkins Bayou creating an impounded freshwater system.
Impacts of Historic Tidal Modification	Four hundred acres of estuarine habitat were blocked from tidal influence resulting in extreme salinity fluctuations, periodic low dissolved oxygen levels, fish kills, and algae growth. Habitats included mangrove, oyster reef/shell bottom, salt marsh, submerged aquatic vegetation, and soft bottom.
Project Partners	*Lead:* City of Sanibel *Others:* NOAA's Community-based Restoration Program, U.S. Fish and Wildlife Service, South Florida Water Management District, Sanibel-Captiva Conservation Foundation, Clam Bayou Preservation Association, JN Ding Darling National Wildlife Refuge.
Funding Sources	NOAA Community-based Restoration Program, Fish America Foundation, South Florida Water Management Distirct, U.S. Fish and Wildlife Service, City of Sanibel.

Goals and Objectives

Goals	Restore salt marsh and natural habitat; prevent fish kills and mangrove die-offs; restore seagrass beds and oyster bars; and improve water quality.

Project Design

Design Techniques	Culvert installation (three 10-foot by 10-foot, side by side, poured on site); mangrove planting.
Design Narrative	The team determined that hydrologic flushing would be best achieved through the installation of three box culverts beneath Sanibel-Captiva Road. These culverts would provide a permanent tidal connection to Dinkins Bayou and the greater water body of Pine Island Sound. Important design inputs included volume of flow, invert elevation of culverts, local tidal elevation, and desire to keep channel as natural (with minimal hardening) as possible. Engineering considerations included bathymetry and hydrologic modeling. Sea level rise was not considered in the design (life span of culvert is only 40 years). Minor changes in design identified during planning and construction involved using more lime rock and rip-rap to secure banks since tidal velocity was higher than expected. (This alternative was selected instead of seawalls which provide little habitat value.)

Permitting

Permits	USACE NWP 27 (no delays associated with ESA or NEPA – the permitted design allowed for manatee movement). Florida DEP General Permit (took a few months).

Construction and Maintenance

Total Budget	$875,000 ($200,000 for land acquisition)
Construction Narrative	Project team was pleased with the contractors and engineers. Team encountered some issues associated with managing utility pipes and power lines along road. (This was planned into design but was time consuming due to negotiations with individual utilities.) Project also required traffic management. Again, this was anticipated but did take time and care. Construction equipment included track hoe (large excavator), loaders, bulldozers to remove road surface, and a dump truck for fill rock.
As-built Monitoring	Measured invert elevations of culverts (critical in order to achieve maximum flow). Road construction also had critical design elements that were inspected by the City of Sanibel's Public Works Department.

Scientific Evaluation and Monitoring

Scientific Evaluation	Monitored parameters include temperature, vegetation presence or absence, fish density and diversity (seine netting, identify all fish), and salinity. Team also monitored for habitat stabilization and persistence.

Community Involvement

Volunteer Components	Volunteers helped with numerous mangrove plantings.
Stakeholder Engagement and Community Outreach	Clam Bayou Preservation Association (formed by the surrounding homeowners) was the early force behind the project with initial interest focused on aesthetics of the stagnant system. They hired a coastal engineer to study bayou flow and bathymetry. The City of Sanibel then took over the project and had a comprehensive assessment of the site conducted. The citizens remained engaged in vegetation planting of over 5,000 mangroves.

Local volunteers planted more than 5,000 mangroves following construction of the box culverts.

Photo Credit: NOAA

Additional Clam Bayou Restoration Documents Available Online

Clam Bayou/Dinkins Bayou Culvert Feasibility Study

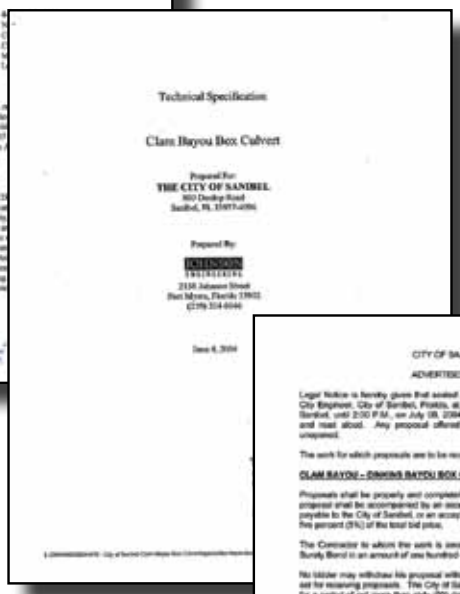
Scope of Work

1 **Clam Bayou Culvert Feasibility Study Scope of Work**

United States Department of the Interior

March 13, 2004

2 **U.S. Fish & Wildlife Service ESA Determination Letter**

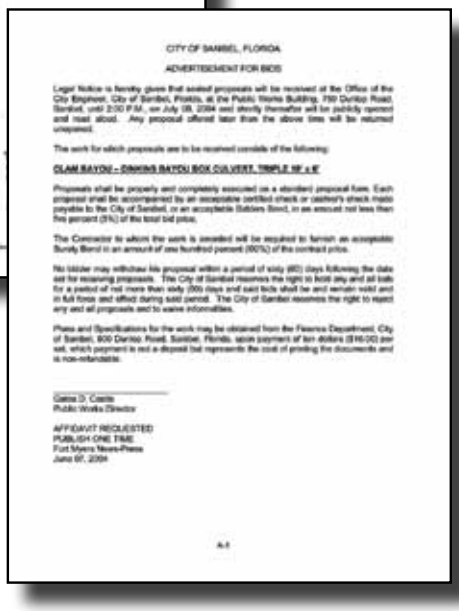


Technical Specification

Clam Bayou Box Culvert

THE CITY OF SANIBEL

3 **Technical Specifications for the Clam Bayou Box Culvert**



CITY OF SANIBEL, FLORIDA

ADVERTISEMENT FOR BIDS

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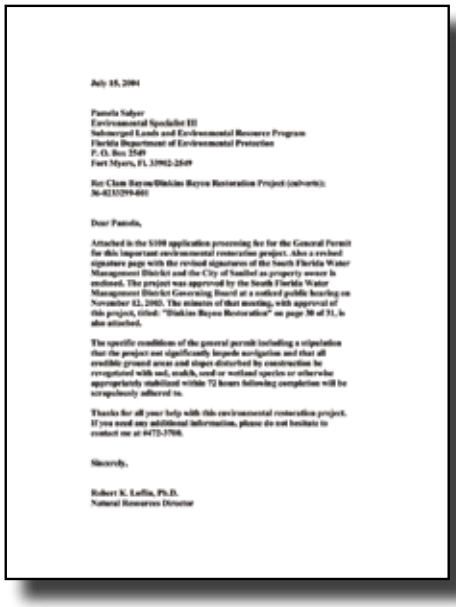


5 **Florida Department of Environmental Protection General Permit Application**

These Clam Bayou case study materials can be found online at http://www.habitat.noaa.gov/partners/toolkits/tidal_hydro/portfolio_resources/tidalhydro-clambayou.zip.

September 7, 2004

Mike Nowicki
Project Manager
West Permits Section
Department of the Army
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Re: Clam Bayou Restora
(NW-MN)

Dear Mike:

Attached please find a c
Restoration Project (the
Dinkins Bayou) and the
temporary cut to the Gu
combined both of these p
application.

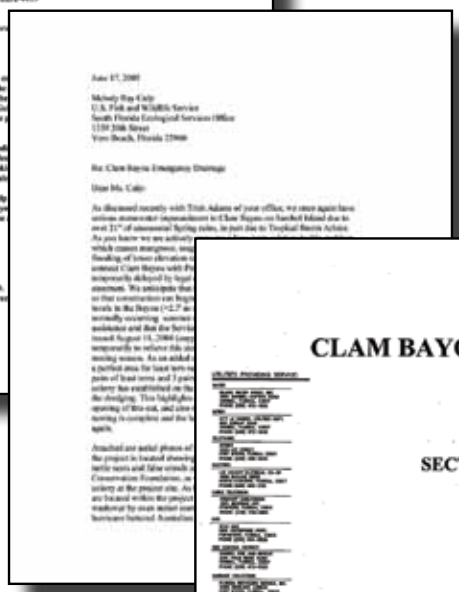
We are all set with fend
and federal sources), de
permitting and are hoki
office so we can schedul

Thanks for all your help
restoration project. If yo
don't hesitate to call me

Sincerely,

Robert K. Loflin, Ph.D.
Natural Resources Direc

6 U.S. Army Corps of Engineers Permit Application



June 17, 2005

Melody Ray Cady
U.S. Fish and Wildlife Service
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

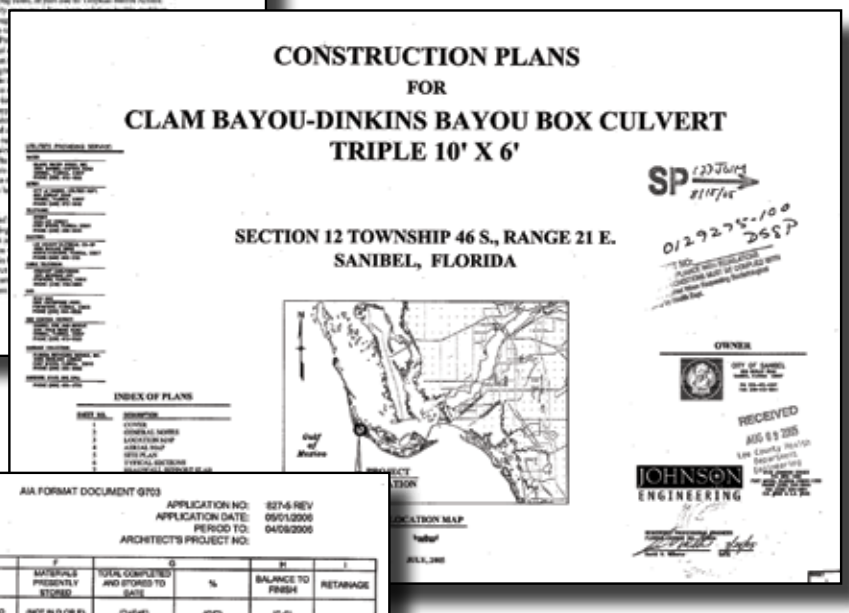
Re: Clam Bayou Emergency Drainage

Dear Ms. Cady:

As discussed recently with Trish Adams of your office, we once again have
serious stormwater impoundment in Clam Bayou on Sanibel Island due to
over 21" of seasonal flying rains, in part due to Tropical Storm Arlene.
As you know we are actively
which causes overgrown, sma
flooding of lower elevation
entered Clam Bayou with Pe
temporarily delayed by legal
assessment. We anticipate that
so that construction can begin
levels in the Bayou (+2.7 as
seriously occurring, sometim
molestation and that the Serv
issued August 16, 2004 temp
temporarily to relieve this situ
moving waters. As an added
a perfect area for least terns an
pair of least terns and 3 pair
solitary has established on the
the dredging. This highlights
opening of the cut, and also
moving is complete and the b
again.

Attached are aerial photos of
the project is located showing
turtle nests and false crawls
Conservation Foundation, a
solitary at the project site. As
are located within the project
marginal by exact water mar
hurricane Ivanhoe. Attached

7 Letter to the U.S. Fish & Wildlife Service Regarding Clam Bayou Emergency Drainage



CONSTRUCTION PLANS
FOR
CLAM BAYOU-DINKINS BAYOU BOX CULVERT
TRIPLE 10' X 6'

SECTION 12 TOWNSHIP 46 S., RANGE 21 E.
SANIBEL, FLORIDA

INDEX OF PLANS

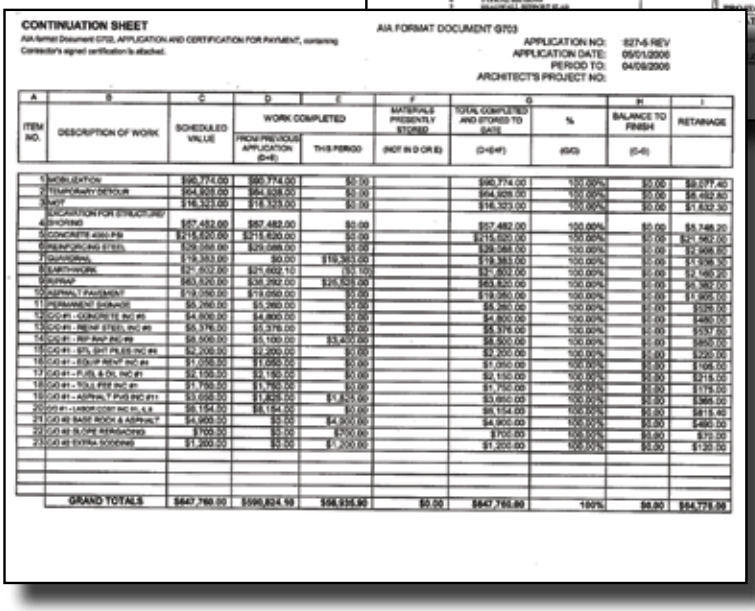
LOCATION MAP

OWNER

RECEIVED

JOHNSON ENGINEERING

8 Project Construction Plans



CONTINUATION SHEET
AIA Format Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor's signed certification is attached.

AIA FORMAT DOCUMENT G703

APPLICATION NO: 827-6 REV
APPLICATION DATE: 05/01/2006
PERIOD TO: 04/09/2006
ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED		MATERIALS PRESENTLY STORED	TOTAL COMPLETED AND STORED TO DATE	%	BALANCE TO FINISH	RETAINAGE
			FROM PREVIOUS APPLICATION (D+E)	THIS PERIOD	(NOT IN D OR E)	(D+E+F)	(G/C)	(C-G)	
1	MOBILIZATION	$90,774.00	$90,774.00	$0.00		$90,774.00	100.00%	$0.00	$9,077.40
2	TEMPORARY DEVOUR	$64,928.00	$64,928.00	$0.00		$64,928.00	100.00%	$0.00	$6,492.80
3	MOT	$16,323.00	$16,323.00	$0.00		$16,323.00	100.00%	$0.00	$1,632.30
4	EXCAVATION FOR STRUCTURE/ SHORING	$57,482.00	$57,482.00	$0.00		$57,482.00	100.00%	$0.00	$5,748.20
5	CONCRETE 4000 PSI	$215,620.00	$215,620.00	$0.00		$215,620.00	100.00%	$0.00	$21,562.00
6	REINFORCING STEEL	$29,088.00	$29,088.00	$0.00		$29,088.00	100.00%	$0.00	$2,908.80
7	SHORING	$19,363.00	$0.00	$19,363.00		$19,363.00	100.00%	$0.00	$1,936.30
8	BULKHEADS	$21,602.00	$21,602.10	$32.10		$21,602.00	100.00%	$0.00	$2,160.20
9	RIPRAP	$63,620.00	$38,292.00	$25,328.00		$63,620.00	100.00%	$0.00	$6,362.00
10	ASPHALT PAVEMENT	$19,050.00	$19,050.00	$0.00		$19,050.00	100.00%	$0.00	$1,905.00
11	PERMANENT SIGNAGE	$5,260.00	$5,260.00	$0.00		$5,260.00	100.00%	$0.00	$526.00
12	CO #1 - CONCRETE INC #5	$4,800.00	$4,800.00	$0.00		$4,800.00	100.00%	$0.00	$480.00
13	CO #1 - REINF STEEL INC #5	$5,376.00	$5,376.00	$0.00		$5,376.00	100.00%	$0.00	$537.60
14	CO #1 - RIP RAP INC #5	$8,500.00	$5,100.00	$3,400.00		$8,500.00	100.00%	$0.00	$850.00
15	CO #1 - STL SHT PILES INC #6	$2,200.00	$2,200.00	$0.00		$2,200.00	100.00%	$0.00	$220.00
16	CO #1 - EQUIP REM INC #6	$1,050.00	$1,050.00	$0.00		$1,050.00	100.00%	$0.00	$105.00
17	CO #1 - FUEL & OIL INC #1	$2,150.00	$2,150.00	$0.00		$2,150.00	100.00%	$0.00	$215.00
18	CO #1 - TOOL EXP INC #1	$1,750.00	$1,750.00	$0.00		$1,750.00	100.00%	$0.00	$175.00
19	CO #1 - ASPHALT PVG INC #11	$3,650.00	$1,825.00	$1,825.00		$3,650.00	100.00%	$0.00	$365.00
20	CO #1 - LABOR COST INC #1,5,8	$8,154.00	$8,154.00	$0.00		$8,154.00	100.00%	$0.00	$815.40
21	CO #2 BASE ROCK & ASPHALT	$4,900.00	$0.00	$4,900.00		$4,900.00	100.00%	$0.00	$490.00
22	CO #2 SLOPE REMASONRY	$700.00	$0.00	$700.00		$700.00	100.00%	$0.00	$70.00
23	CO #2 EXTRA SODDING	$1,200.00	$0.00	$1,200.00		$1,200.00	100.00%	$0.00	$120.00
	GRAND TOTALS	$647,760.00	$590,824.10	$56,935.90	$0.00	$647,760.00	100%	$0.00	$64,775.99

Contractor Bid for Construction 9

Tarpon Bay Tidal Hydrology Restoration Project

Isles of Capri, Collier County, FL

Background

In the development boom of the 1950s and 1960s, a road was constructed on the Florida gulf coast connecting a small group of islands called the Isles of Capri. This road was designed without any culverts or bridges and consequently halted all tidal flushing and water transport between the islands. This complete bisection of the two major bay systems, Johnson Bay and Tarpon Bay, resulted in poor water quality and degradation of important nursery and estuarine habitat.

Outcomes / Status

The first phase of the project has resulted in the installation of a 10-foot by 10-foot box culvert that allows for tidal exchange and manatee passage between the two bays. Mangroves are recruiting well, but it is still too early to determine changes in water quality and fisheries (although local homeowner anecdotes suggest that water quality appears to be improved).

For more information, please visit the Tarpon Bay website at http://www.rookerybay.org/publications/past-projects/tarpon-bay-hydrologic-restoration.

Lessons Learned

- Have realistic goals based on funding.
- Be involved with the community. Community buy-in will be important for project support and overall success.
- Be prepared for unexpected problems to arise. Even sound project design and planning cannot curtail all issues a project team may encounter.
- Seek recommendations on contracting/construction companies. After failures of one company, the company hired by the project team to complete construction was actually recommended by another resource organization.
- Conduct more pre-project monitoring, especially flow rates.

Project Contact

Rookery Bay
National Estuarine Research Reserve
Florida Department of
Environmental Protection
239-417-6310

Construction of a 10-foot by 10-foot culvert reconnected Johnson and Tarpon Bay, which had been hydrologically separated since construction of a causeway in the 1950s.

Photo Credit: NOAA

Tarpon Bay Tidal Hydrology Restoration Project Details

Project Identification, Feasibility, and Planning

Project Start / Completion Dates	August 2003 to April 2004
Historic Tidal Modification (reason)	A road/causeway was constructed connecting the multiple islands, the Isles of Capri. Fill material was transported to the site; no dredge material was used.
Impacts of Historic Tidal Modification	Road construction that halted tidal flushing resulted in degraded water quality and seagrass habitat. Fisheries resources were also impacted.
Project Partners	Lead: Rookery Bay NERR Others: NOAA Restoration Center, Florida Department of Environmental Protection, U.S. Fish and Wildlife Service, Isle of Capri Civic Association
Funding Sources	NOAA Community-based Restoration Program, U.S. Fish & Wildlife Service Coastal Program

Goals and Objectives

Goals	Restore natural flushing between Johnson Bay (approximately 480 acres) and Tarpon Bay (approximately 360 acres) by removing fill material, and installing two culverts and one small bridge to reconnect the two bays (the current project phase completed one culvert). Re-establish tidal exchange to improve water quality, resulting in positive effects on seagrass beds and associated organisms.

Project Design

Design Techniques	One culvert installation; one culvert and small bridge installation pending.
Design Narrative	Installed a 10-foot by 10-foot box culvert with an interior of 8 by 8 feet so that manatees could pass through. Volume and velocities of flow, as well as manatee passage, has major influence on project design. Aerial photos used extensively to determine appropriate culvert sites.

Permitting

Permits	USACE Nationwide Permit 27. "No effect" determination for ESA. South Florida Water Management District; Collier County vegetation removal permit.

Construction and Maintenance

Total Budget	$1,295,000
Construction Narrative	Original project contractors presented several problems, including using inappropriate equipment (equipment was too small for a major project), leaving trash behind, damaging nearby property, and creating safety issues at the site. After contracting with a different construction firm, large backhoes and a large crane were utilized, along with dewatering equipment. Project fell seven months behind schedule and resulted in working long hours.
As-built Monitoring	Evaluated invert elevation; location and placement of rip rap; channel width and depth.

Scientific Evaluation and Monitoring

Scientific Evaluation

Collected baseline data, such as bathymetric mapping, water quality, species surveys, and vegetation maps. Monitoring has continued throughout this project with the help of local volunteers. Three areas are surveyed routinely:

1) Mangrove monitoring, both recruitment and planting (e.g., photopoints; counting other vegetation species);

2) Water quality (too soon to tell effect even after five years); quarterly samples sent to Lakewatch (free service) to analyze phosphorus, nitrogen, and chloraphyl-a levels;

3) Species surveys, twice a year, dry season and wet season (trawling at three different locations for presence/absence – too early to tell, but not seeing major community shift).

Community Involvement

Volunteer Components

Restoration project volunteers were involved with mangrove planting, water quality monitoring, and fisheries monitoring.

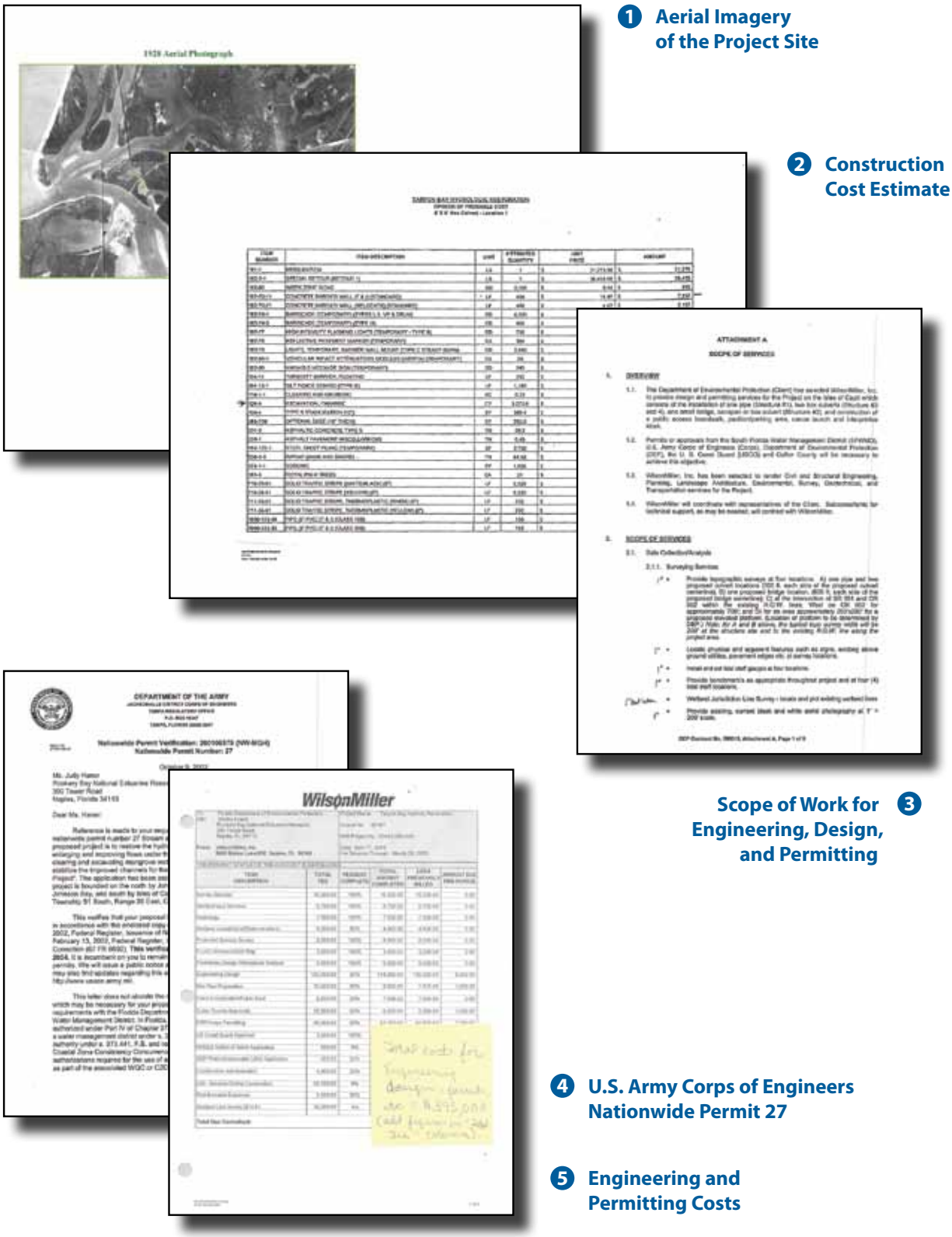
Stakeholder Engagement and Community Outreach

The restoration site was very visible to the local community so the project team attended civic association monthly meetings and provided project updates. An article about the project was also published in a local newspaper.

A tidal channel flowing through the installed box culvert (foreground, below flowers) was created by the removal of fill dirt from the causeway.

Photo Credit: NOAA

Additional Tarpon Bay Restoration Documents Available Online



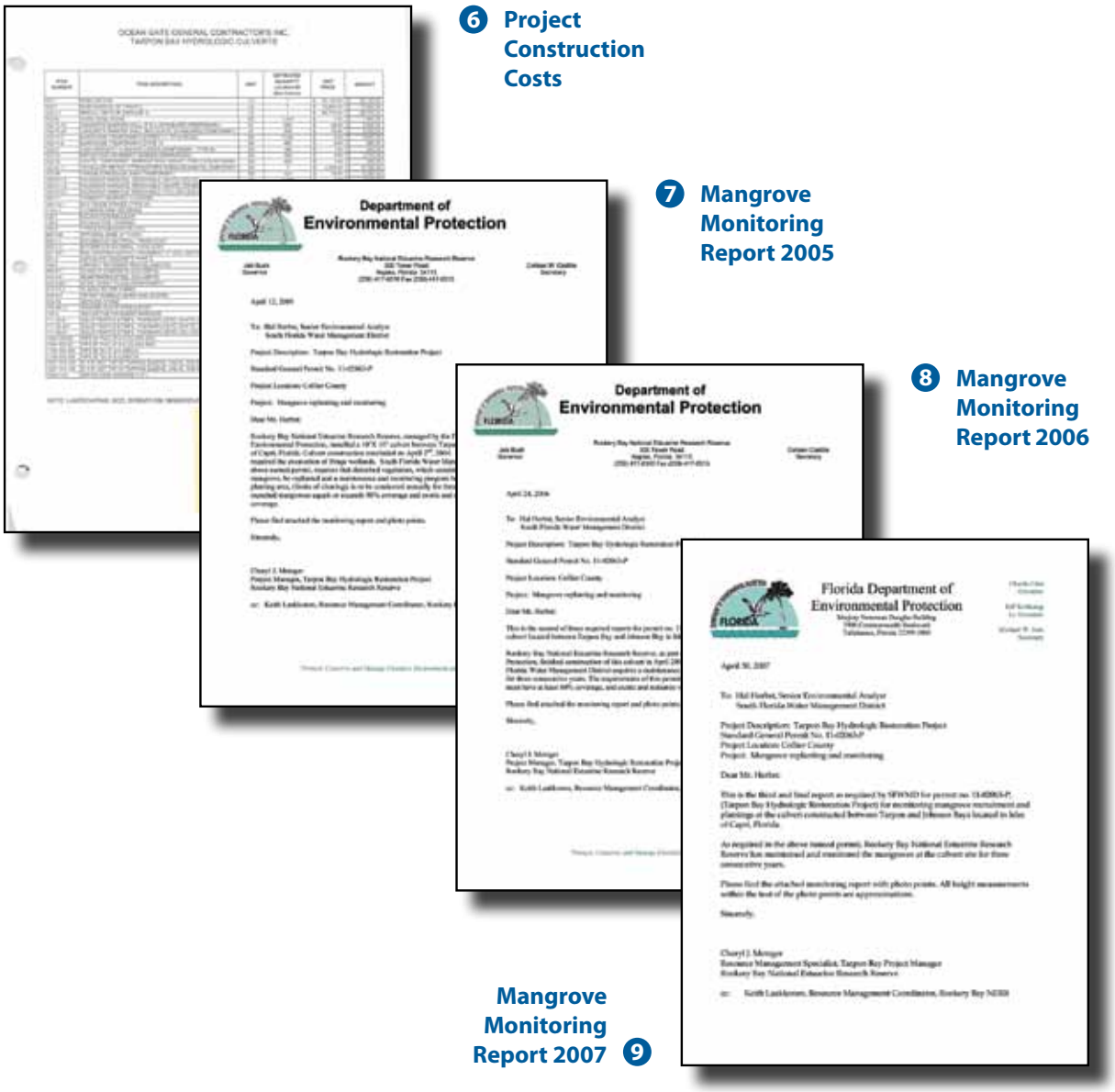
1 Aerial Imagery of the Project Site

2 Construction Cost Estimate

3 Scope of Work for Engineering, Design, and Permitting

4 U.S. Army Corps of Engineers Nationwide Permit 27

5 Engineering and Permitting Costs



6 Project Construction Costs

7 Mangrove Monitoring Report 2005

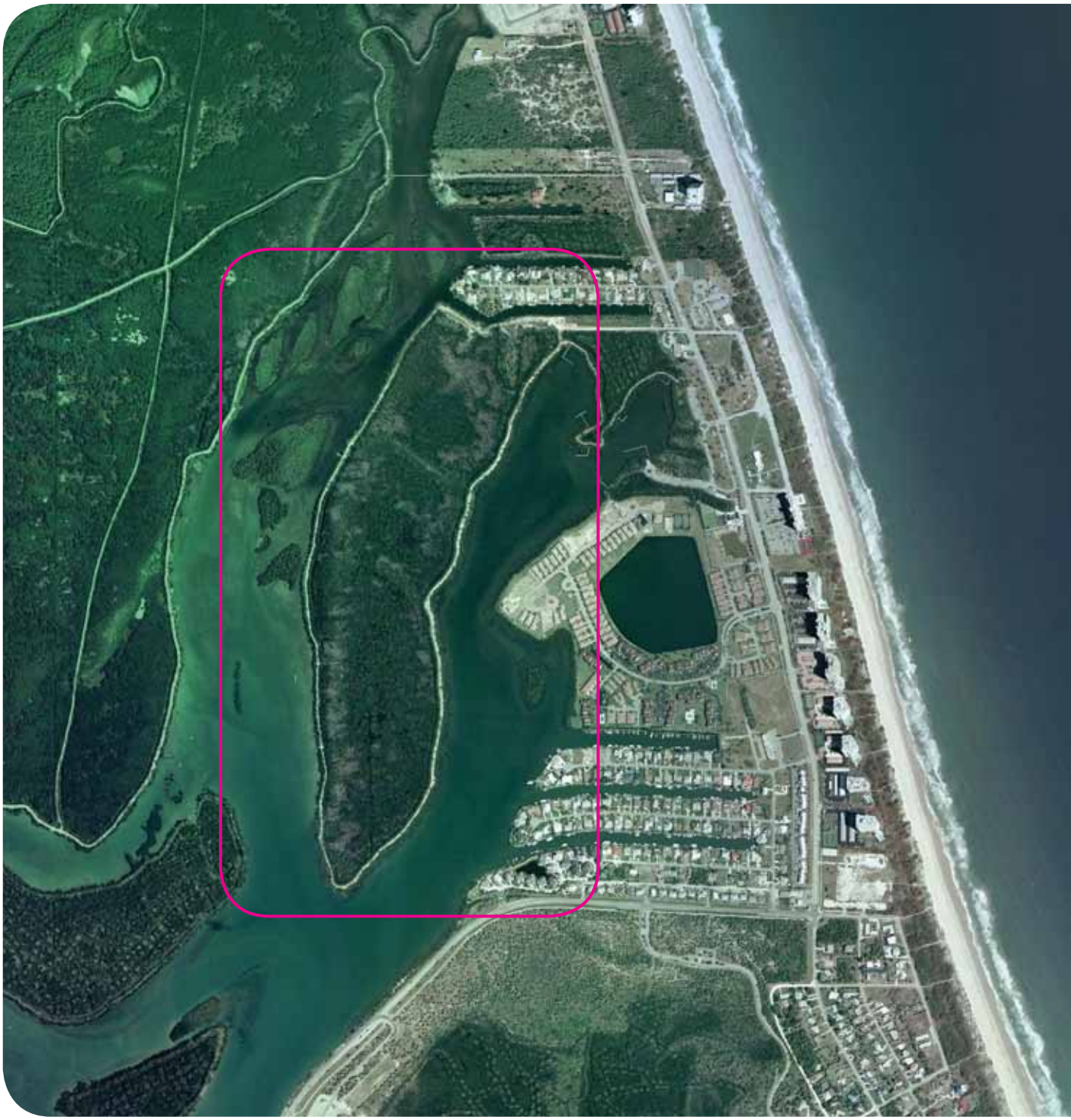
8 Mangrove Monitoring Report 2006

Mangrove Monitoring Report 2007 9

These Tarpon Bay case study materials can be found online at http://www.habitat.noaa.gov/partners/toolkits/tidal_hydro/portfolio_resources/tidalhydro-tarponbay.zip.

Wildcat Cove Tidal Hydrology Restoration Project

North Hutchison Island, St. Lucie County, FL



Background

Wildcat Cove Preserve encompasses 129 acres and stretches for two miles along the Indian River Lagoon (IRL) on the east coast of Florida. This preserve was once a high salt marsh subject to tidal flows and dominated by black and white mangrove, saltwort and glasswort. In the early 1960s, this salt marsh was impounded for mosquito control purposes and eventually became completely disconnected from the lagoon. Over time, the estuarine habitat related functions declined.

Outcomes / Status

The historic wetland hydrology of the Wildcat Cove Preserve site has been restored through the placement of culverts and removal of invasive plant species. Six culverts were installed to reconnect the impounded mangrove habitat of the preserve to the IRL. Water flow and tidal exchange between the two water bodies has been restored, which in turn helped stabilize approximately 94 acres of mangrove habitat and almost 5 acres of upland habitat.

Lessons Learned

- Studies of this technique at similar sites in the area show increases in health of seagrass beds on outside of new culverts.
- Perimeter ditches created by the impounding process (being the borrow-area from which the dike fill material was removed), appeared to function similarly to tidal creek-like habitat, when remaining open year-round. (Gilmore, et al. 1987)
- Data from the open marsh revealed that 38 species of marine fish utilized the man-made perimeter ditch system, which was constantly open to the estuary, compared with 12 species for the isolated impounded marsh. (Gilmore, et al. 1987)
- Marshes with lower substrate elevation (+0.3 to +0.8 feet NGVD) appear to require greater numbers of culverts, as many as 10 ac/culvert, to approximate high wind-tide elevations in the open period. Those open impoundments with higher substrate elevations (+1.3 feet NGVD and above), appear to require fewer culverts, approximately 16 ac/culvert (+/-). (Gilmore, et. al. 1987).

Project Contact

Jim David, Director
Saint Lucie County
Mosquito Control District
jdavid@co.st-lucie.fl.us
(772) 462-1686

Common mosquito control management practices of the past led to the impoundment and subsequent impairment of vast amounts of Florida's salt marshes. Fortunately, new techniques in mosquito control have been developed that are allowing the return of tidal flushing to these areas. The 129-acre Wildcat Cove Preserve serves as a model of this new type of management that controls mosquito's while also providing valuable estuarine habitat

Photo Credit: © Google 2007, © TerraMetrics 2010; Satellite imagery by U.S. Geological Survey

Wildcat Cove Tidal Hydrology Restoration Project Details

Project Identification, Feasibility, and Planning

Project Start / Completion Dates	January 2005 to February 2006
Historic Tidal Modification (reason)	In order to improve the quality of life for residents and expand development, dikes were built around salt marshes in the 1960's, creating impoundments that eliminated the conditions for mosquito breeding.
Impacts of Historic Tidal Modification	The mangrove and salt marsh system were eventually disconnected from the IRL and tidal flushing. Over time, impoundments trapped water, creating floods that destroyed the high marsh vegetation. Water quality conditions also deteriorated and transient juvenile fish could not access the area. Creeks remained within impounded areas but were left as "dead ends" at interfaces with the dikes.
Project Partners	South Florida Water Management District, Marine Resources Council, Fish America Foundation, St. Lucie Mosquito Control District, Florida Communities Trust, University of Florida, Florida Office of Greenways and Trails.
Funding Sources	NOAA's Community-based Restoration Program, Fish America Foundation, St. Lucie County Mosquito Control District

Goals and Objectives

Goals and Objectives	Goal: Increase hydrologic connectivity through installation of culverts Objectives: Rrestore high marsh vegetation, improve water quality and allow fisheries access.

Project Design

Design Techniques	Installation of culverts through dikes. Removal of invasive plant species and replacement with native vegetation.
Design Narrative	Corrugated aluminum culverts of 30-inch diameter set at -2.5 NAVD were placed at 500-foot intervals to achieve optimal flushing, fisheries access, and diversity. Culvert is 68% full at mean high tide. Modeling was not used; conducted initial flow studies. No new channels were created within impounded system.

Permitting

Permits	"Standard General Permit" from state. The state coordinated all other permitting issues with all state and federal agencies.

A series of culverts were installed through the berm impounding the wildcat cove preserve that restored historic tidal flow from the Indian River Lagoon.

Photo Credit: NOAA

Construction and Maintenance

Total Budget	$84,000 ($5,000 per culvert)
Construction Narrative	The culvert installation process occurred over a three-day period. An excavator was used to create ditches for the culverts by excavating the center of 30-foot dike. "Keyways" were then set on either side. On the second day, keyways were popped and culverts were dropped and set in ditch over geotextile fabric. The keyways were set again very quickly. This was done in 15-20 minutes, right when the tide was at extreme low to minimize turbidity. On the third day, dirt and rip rap were put in to secure culverts, completing the construction.
As-built Monitoring	Culvert elevation

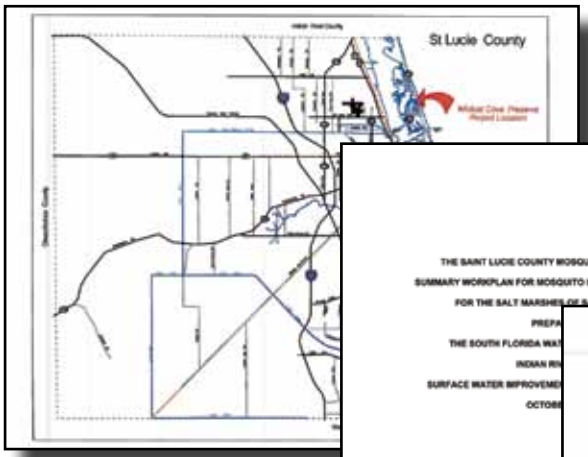
Scientific Evaluation and Monitoring

Monitoring Budget	Not available.
Scientific Evaluation	Several water quality parameters were monitored, including: temperature, salinity, dissolved oxygen, pH, and redox. Water levels within the preserve, vegetation growth, wildlife, and mosquito landing rates were also monitored. Fisheries were not monitored, but results from a similar project in the area have shown direct benefit around new culverts for spawning sea trout, snook, and redfish.

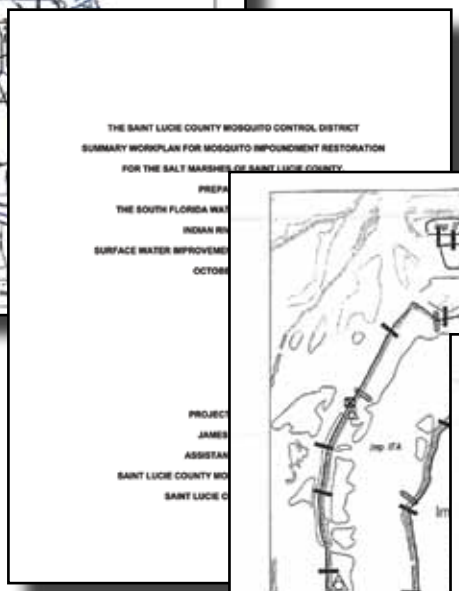
Community Involvement

Volunteer Components	Volunteers participated in planting of native vegetation within impoundments.
Stakeholder Engagement and Community Outreach	Educational signs were placed at strategic points within the Wildcat Cove Preserve describing the importance of preserving wetlands, mangrove communities, and seagrass beds.

Additional Wildcat Cove Restoration Documents Available Online

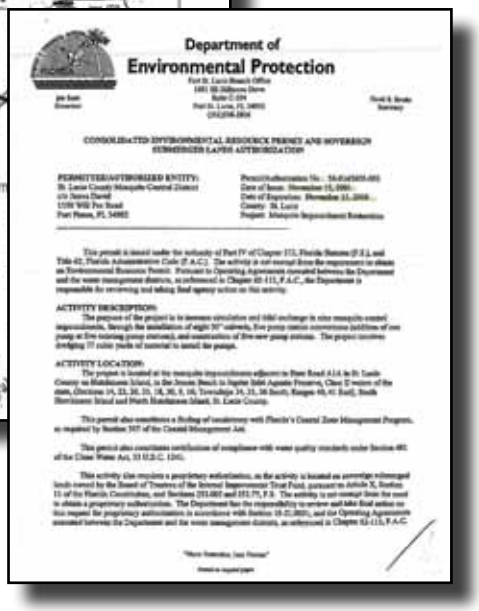


1 **Wildcat Cove Project Location Maps**

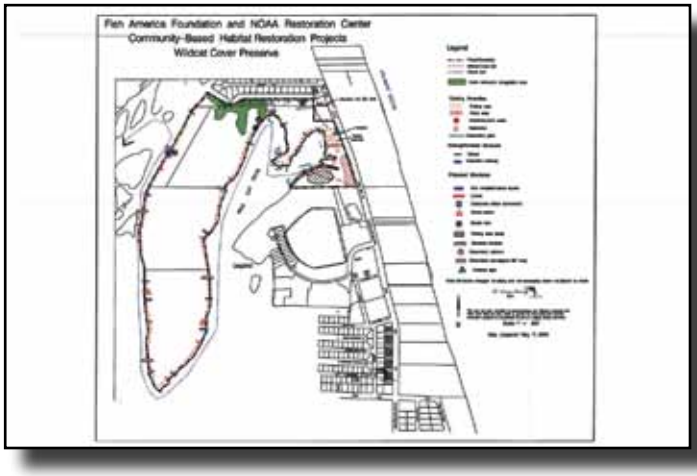


2 **Project Work Plan**

3 **Engineering Drawings**

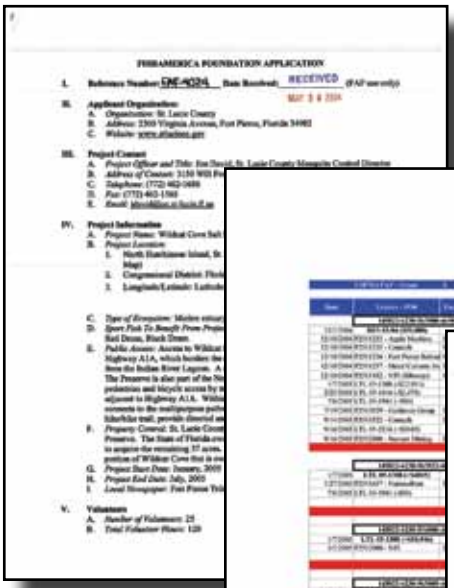


4 **Florida Department of Environmental Protection General Environmental Resource Permit**



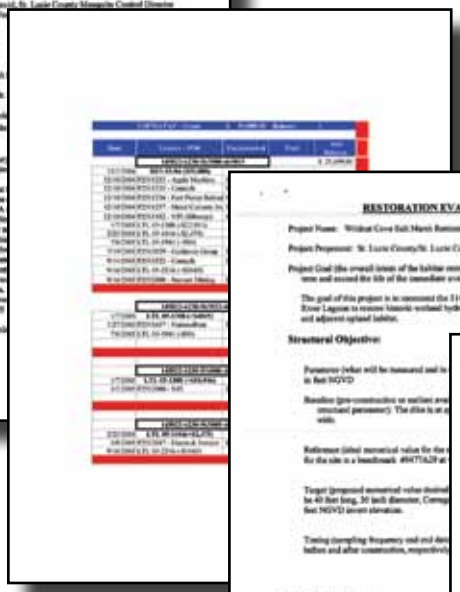
5 **Conceptual Site Plan**

These Wildcat Cove materials can be found online at http://www.habitat.noaa.gov/partners/toolkits/tidal_hydro/portfolio_resources/tidalhydro-wildcatcove.zip.

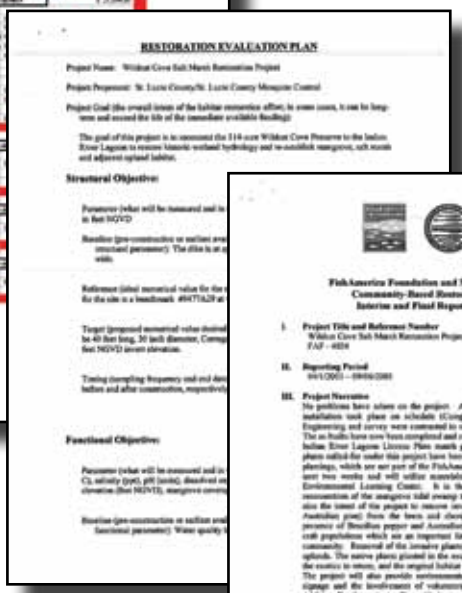


FISHAMERICA FOUNDATION APPLICATION

6 FishAmerica Foundation Application for Funding

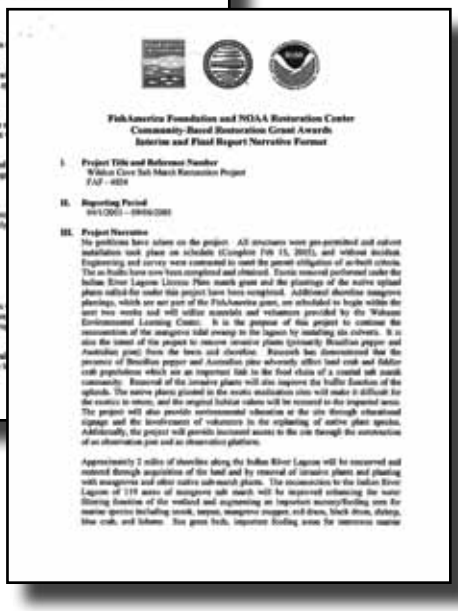


7 Expense Report



RESTORATION EVALUATION PLAN

8 Restoration Evaluation Plan



FishAmerica Foundation and NOAA Restoration Center
Community-Based Restoration Grant Awards
Interim and Final Report Narrative Format

Final Project Report 9

10 Additional Project Photos

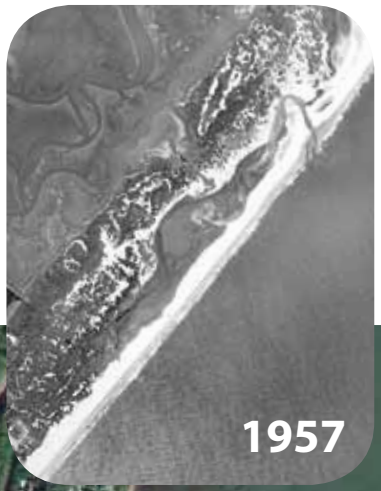
PROGRESS IN WETLAND MANAGEMENT IN ST. LUCIE COUNTY, FLORIDA
BY THE ST. LUCIE COUNTY MOSQUITO CONTROL DISTRICT

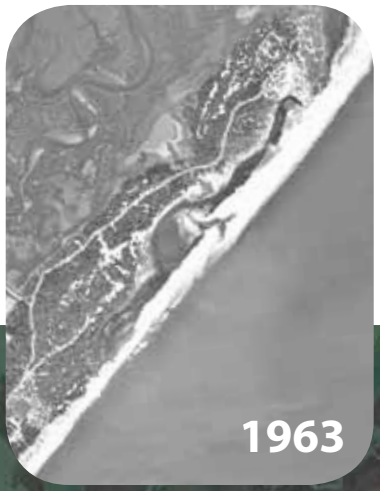
11 Published Report
Wetland Management for Mosquito Control

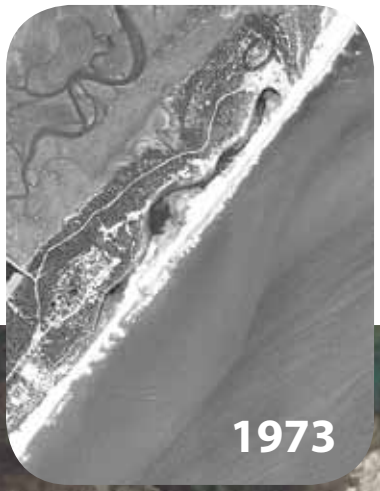
12 Interpretive Brochure

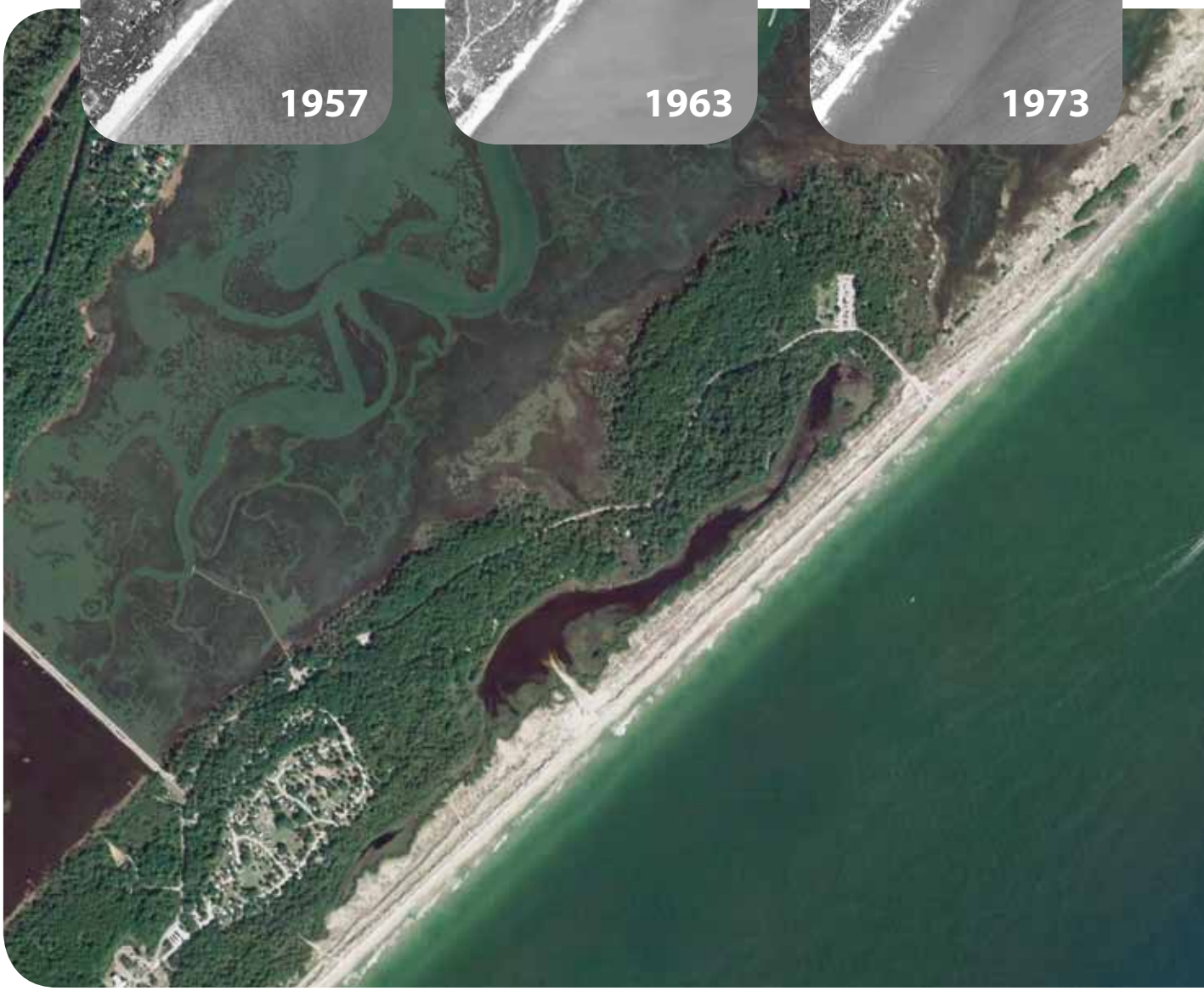
Sandpiper Pond Tidal Hydrology Restoration Project

Huntington Beach State Park, Georgetown County, SC









Background

Throughout its history, Sandpiper Pond maintained a continuous connection with the ocean by way of a meandering inlet through coastal dunes. The construction of the Murrells Inlet Jetties in the vicinity of this 35-acre estuary eventually caused changes in the coastal geologic processes that led to the acceleration of sediment accretion on adjacent beaches. This impact, coupled with several tropical storms, led to the eventual development of large sand dunes and eventual blockage of the inlet. Subsequently, the lack of tidal flushing led to the slow degradation of the estuary that culminated in multiple fish kill events.

Outcomes / Status

Since the tidal connection between Sandpiper Pond and the ocean has been reestablished, the site has steadily continued to return to its historic estuarine condition. Salinity levels have stabilized and the coverage of spartina grass has expanded. Birds and marine organisms have returned to inhabit the pond. Overall the project resulted in the restoration of 35 acres of salt marsh and tidal mudflats.

Additional information can be found online at the Huntington Beach State Park website at www.southcarolinaparks.com/park-finder/state-park/1020.aspx.

Lessons Learned

- The original inlet was cut on a direct line between the pond and ocean, resulting in slowly eroding walls that eventually required maintenance. A meandering channel was then built and was found to maintain the opening for longer intervals.
- Participation by the local university yielded tremendous help for the project relating to the collection of scientific monitoring data and implementation of educational activities.
- Adaptive management of the project led to the identification of an outlying area of the pond that was lagging behind in terms of water quality improvement. This led to the development of a second phase of the project that included placement of a culvert underneath a road adjacent to the inlet. This action greatly improved tidal flushing in the area.

Project Contact

Mike Walker
Huntington Beach State Park
16148 Ocean HWY
Murrells Inlet, SC 29576
(843) 235-8755

Sandpiper Pond in Murrells Inlet, SC, is a dynamic coastal estuary that for decades connected with the Atlantic Ocean by way of a continuously meandering channel. Due to accelerated sedimentation rates, the pond became impounded and a series of fish kills occurred. Current management of the pond by the South Carolina State Parks includes maintenance of the tidal connection.

Photo Credit: Data from SIO, NOAA, U.S. Navy, NGA, GEBCO

Image U.S. Geological Survey, Image ©2010 TerraMetrics, ©2007 Google

Sandpiper Pond Tidal Hydrology Restoration Project Details

Project Identification, Feasibility, and Planning

Project Start / Completion Dates	July 2004 to July 2005
Historic Tidal Modification (reason)	Sandpiper Pond was not intentionally impounded. The inlet connecting the pond with the ocean became closed in the early 1990s due to accretion of sediments. This was caused by the alteration of coastal geologic functions due to the construction of the Murrells Inlet Jetties. Additionally, hurricanes and other coastal storms contributed to the blockage of the inlet. Historical photos indicate that the inlet meandered for decades, but always remained open to the ocean.
Impacts of Historic Tidal Modification	Thirty-five acres of estuarine habitat (including salt marsh and tidal mud flat) were blocked from tidal influence due to the blockage of an inlet, resulting in extreme salinity fluctuations, low dissolved oxygen levels, invasion of *Phragmites,* and fish kills. Shorebird and migratory bird habitat was lost. A nature trail that bordered the area saw a marked decrease in use as diversity of habitat was lost.
Project Partners	South Carolina State Parks, Friends of Huntington Beach State Parks, Coastal Carolina University, NOAA's Community-based Restoration Program, The Nature Conservancy
Funding Sources	South Carolina State Parks, NOAA's Community-based Restoration Program, The Nature Conservancy

Goals and Objectives

Goals and Objectives	Goal:	Restore salt marsh and mud flat habitat through the construction of a tidal inlet and installation of culverts.
	Objectives:	Reduce invasion of *Phragmites* and encourage growth of *Spartina*; improve water quality and prevent fish kills.

Project Design

Design Techniques	Breaching of sand dune; installation of culverts.
Design Narrative	The project team decided to restore tidal flow by re-creating a natural inlet with no armoring. Historic aerial photos were used to determine the best location to breach the dune barrier and restore tidal flow. The inlet was designed to receive water only at very high tides in order to not create a barrier to public beach access. This initial action did not provide enough tidal circulation, prompting the project team to take additional action. This second phase involved the replacement of culverts under an adjacent road to facilitate additional tidal exchange.

Permitting

Permits	USACE and South Carolina OCRM. The permits stipulated no construction during migratory turtle nesting season.

Construction and Maintenance

Total Budget	$66,000 ($3,300 for construction). Most costs were associated with outreach and education activities.
Construction Narrative	The first phase of construction involved the transplanting of dune vegetation by volunteers. Two bulldozers were then used during low tide periods to push sand out of the way. Maintenance of the channel is part of the Park's plan and is accomplished by Park personnel on an as-needed basis. The original breach was accomplished within a few days. In the second phase, degraded culverts were removed from underneath a Park road and replaced with larger culverts.
As-built Monitoring	Channel and culvert elevation.

Scientific Evaluation and Monitoring

Scientific Evaluation	A local university added considerably to the project, as several professors from various disciplines took part in extensive pre- and post-monitoring of geology, water quality, vegetation, fish/aquatic life, and birds.

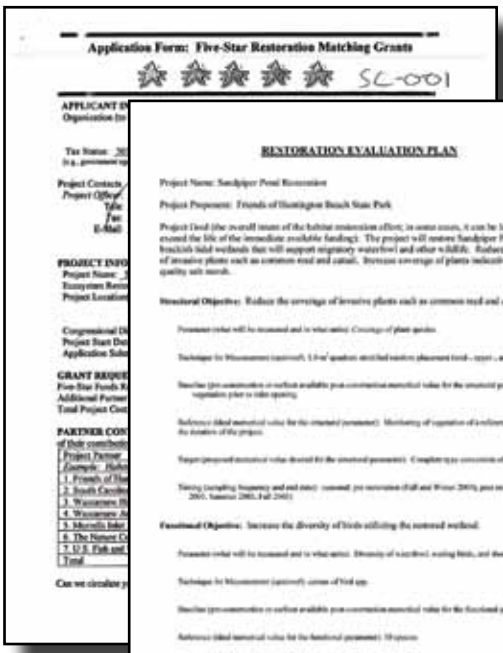
Community Involvement

Volunteer Components	Volunteers took part in movement of plants, scientific monitoring, creation of outreach materials and displays, and implementation of educational activities.
Stakeholder Engagement and Community Outreach	The project was initiated and overseen by a stakeholder organization, The Friends of Huntington Beach State Park. The project team held several meetings with area citizens and pertinent resource management agencies to ensure success. The project took place in the State Park, so it received many visitors. The project also included development of educational displays and ramps for handicap access. A mini-symposium was held by researchers to demonstrate the project research results to the public.

The restored tidal inlet at Sandpiper Pond at low tide. Annual maintenance is required to sustain tidal flow and counter sedimentation through the dune system.

Photo Credit: SC State Parks

Additional Sandpiper Pond Restoration Documents Available Online



Application Form: Five-Star Restoration Matching Grants

SC-001

1 NFWF Five-Star Grants Application for Funding

RESTORATION EVALUATION PLAN

2 Restoration Evaluation Plan

The Sun News (Myrtle Beach, SC)
Wed, Mar. 09, 2005
By Kelly Marshall

Ailing state park inlet ready for restoration by bringing ocean water farther inland

An old inlet at Huntington Beach State Park, now shrunk to the size of small, shallow pond, will get a new lease on life by this spring.

Sandpiper Inlet, once a thriving salt marsh, is almost dry and is overrun with phragmites, an invasive species of plant, said Mike Walker, a nature interpreter at the park.

Most wading birds have deserted the inlet, leaving only a few species that enjoy shallow, stagnant water.

Walker presented plans to restore the inlet, using the cleansing motion of ocean tides, during the annual Chowder Talk in Murrells Inlet on Tuesday night. He asked residents and members of Murrells Inlet 2007 to help move sea oats and other native plants out of harm's way so heavy equipment can shift some sand and open a path to the ocean by April.

It is the first time biologists have attempted to return an inlet to its natural state in South Carolina, although similar projects have taken place in Florida, Walker said.

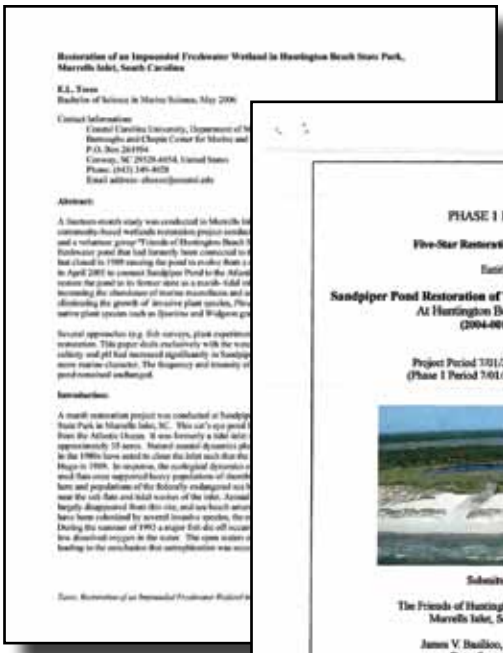
"We're going to cut a channel through the sand dunes that were put in artificially after Hurricane Hugo," Walker said. "It's basically for wildlife diversity. The Waccamaw Audubon Society has been trying to do bird counts, and it is appallingly low."

Anna Hyatt Huntington and her husband, Archer Huntington, owned the property before it became the state park.

Anna Huntington chose the name Sandpiper Inlet because of the wide variety of birds attracted to the salt marsh.

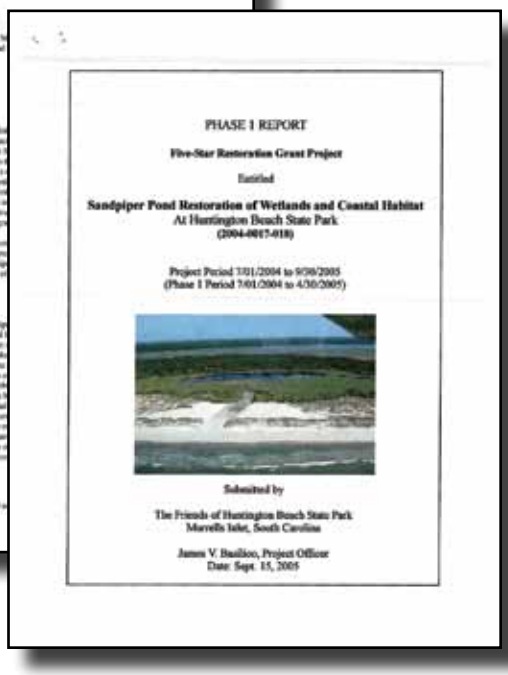
Time and some mistakes made after Hurricane Hugo, however, caused Sandpiper Inlet to close in, Walker said.

In the News 3
Ailing state park inlet ready for restoration by bringing water further inland



Restoration of an Impounded Freshwater Wetland in Huntington Beach State Park, Murrells Inlet, South Carolina

4 Water Quality Study:
Restoration of an Impounded Freshwater Wetland in Huntington Beach State Park, Murrells Inlet, South Carolina



PHASE I REPORT

Five-Star Restoration Grant Project

Entitled

Sandpiper Pond Restoration of Wetlands and Coastal Habitat
At Huntington Beach State Park
(2004-0017-018)

Project Period 7/01/2004 to 9/30/2005
(Phase I Period 7/01/2004 to 4/30/2005)

Submitted by

The Friends of Huntington Beach State Park
Murrells Inlet, South Carolina

James V. Basilico, Project Officer
Date: Sept. 15, 2005

5 Phase I Report

Join us for a Mini-Symposium sharing the monitoring results of the Five-Star Grant Project,

Sandpiper Pond Restoration of Wetlands & Coastal Habitat

November 7, 2005
Huntington Beach State Park
Education Center
Murrells Inlet, SC

Agenda

Noon	Restoration Site Tour *Meet at Education Center*	Jim Sullivan, *Friends of Huntington Beach State Park* *Huntington Beach State Park Staff*
12:30 PM	Welcome Comments	Keith Windham & Chris Lovelace, *Park Management*
1:00 PM	Introductory Remarks	Stewart Schaefer, *NOAA Community-Based Restoration Program*
1:20 PM	Project Overview	*Friends of Huntington Beach State Park and Staff*
1:40 PM	Coastal Geology, Landscape Change and Aerial Photographic History	Scott Harris & Greg Nelson (Megan Willis), *Coastal Carolina University*
2:00 PM	Water Quality Results	Eric Tosso (Susan Libes & Joe Bennett), *Coastal Carolina University*
2:20 PM	Vegetation Results	Keith Walters & Jim Luken, *Coastal Carolina University*
2:40 PM	**Break**	
2:50 PM	Fish / Aquatic Life Surveys	Richard Morris, *Coastal Carolina University*
3:10 PM	Bird Counts	Nick Pratkiewicz, *Waccamaw Audubon Society*
3:30 PM	Discussion of Future Management & Assessment Options	*Huntington Beach State Park Staff*
4:00 PM	**Wrap-up**	

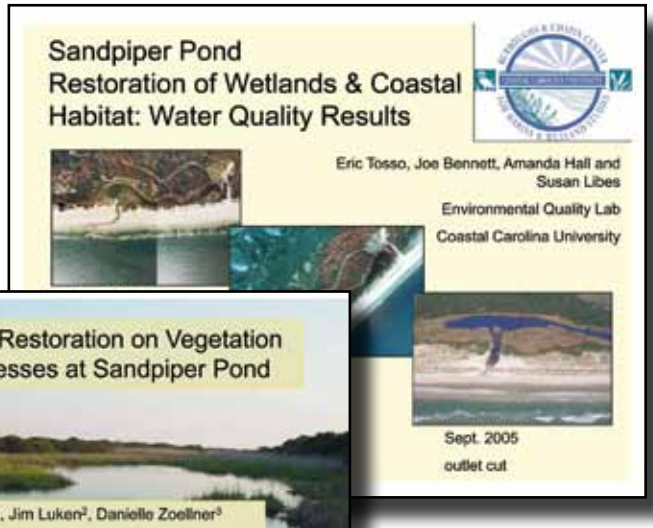
* Please RSVP to the HBSP Education Center at 843-235-8755 or huntingtonbeacheducation@scprt.com by Nov. 6, 2005.

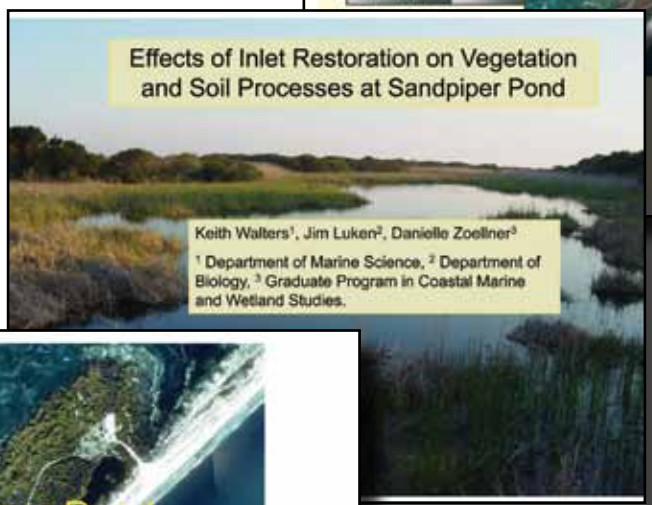
6 Symposium Agenda

7 Symposium Presentation: *Water Quality*

8 Symposium Presentation: *Vegetation and Soil*

9 Symposium Presentation: *Fish and Macrocrustaceans*





These Sandpiper Pond case study materials can be found online at http://www.habitat.noaa.gov/partners/toolkits/tidal_hydro/portfolio_resources/tidalhydro-sandpiperpond.zip.

North River Farms Wetland Restoration Project

Carteret County, NC

The creation of tidal creeks through a former wetland that had been converted to agricultural use is just one key component of the large-scale hydrologic restoration of North River Farms in Carteret County, North Carolina.

Photo Credit: North Carolina Coastal Federation

Background

North River Farms, located in Carteret County, North Carolina, is a 6,000-acre area that was converted from a complex of wetland habitats to a flat and drained agricultural area. In addition to the thousands of acres of lost habitat, the polluted runoff water from North River Farms and an adjacent large-scale corporate farm led to impacts in the nearby estuary, including the closure of one of the region's most productive areas for oyster harvesting.

Outcomes / Status

The first large phase of this long-term project has been completed, resulting in the restoration of 808 acres of freshwater, tidal and forested wetlands and the protection of 1,183 acres of marsh and woodlands. The second large phase of restoration will use similar innovative practices to restore 2,168 additional acres. Water quality improvements in the lower part of the watershed have also been recorded, resulting in the re-opening of oyster beds for harvest.

Revegetation efforts at North River Farms commence following the re-contouring and excavation of soils to achieve desired surface elevations.

Photo Credit: North Carolina Coastal Federation

Lessons Learned

- The North Carolina Coastal Federation (NCCF) took creative action to help raise money for the project, such as offering a 10-year lease to farmers for a portion of the property (2,168 acres) that will also be eventually restored. Also, a private mitigation bank bought an additional section of land (385 acres) and another parcel (1,435 acres) was bought by private investors to establish a hunting area. Both of these tracts have been placed in the Federal Wetlands Reserve Program.

- NCCF has used $4,000,000 in grants from NC Clean Water Management Trust Fund to purchase a total of 4,159 acres.

Project Contact

Dr. Lexia Weaver, Coastal Scientist
North Carolina Coastal Federation
lexiaw@nccoast.org
252-393-8185

For more information, visit the North River Farms Marsh Restoration Project website from the NC Coastal Federation at http://nccoast.org/restoration-education/north-river-farms.asp.

Project Identification, Feasibility, and Planning

Project Start / Completion Dates	1999 to present
Historic Tidal Modification (reason)	Land was converted from salt marsh, tidal forest, and upland forest to agriculture. Modifications included grading and filling of area and creation of a large network of drainage ditches.
Impacts of Historic Tidal Modification	6,000 acres of salt marsh, tidal forest, and upland forest habitats were eliminated. Ditches built in the area and surrounding large-scale agriculture led to the transport of polluted water to the nearby estuary, resulting in impacts to oyster beds, including eventual closure.
Project Partners and Funding Sources	Open Grounds Farm; 1804 Wildlife Partners, LLC; Restoration Systems, LLC; NC Clean Water Management Trust Fund; Duke University; NC State University; NC Shellfish Sanitation Section; NC Coastal Land Trust; NC Division of Marine Fisheries; NC Ecosystem Enhancement Program; NC Attorney General's Environmental Enhancement Grant Program; NC Albemarle-Pamlico National Estuary Program; Z. Smith Reynolds Foundation; NC Partners Program; Restore Our Southern Rivers; Restore America's Estuaries; U.S. Environmental Protection Agency; Fish America Foundation; National Fish and Wildlife Foundation; National Oceanic and Atmospheric Administration; North American Wetlands Conservation Act Grant Program; U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program; U.S. Department of Agriculture Natural Resources Conservation Service Wetlands Reserve Program; The Nature Conservancy.

Goals and Objectives

Goals	Re-establish historic hydrologic patters. Restoration of tidal creeks, salt marsh and forested wetland habitats. Water quality improvements, including the filtration of runoff from a large, adjacent corporate farm through the newly restored wetlands.

Project Design

Design Techniques	Excavation and re-contouring of soils; diversion of drainage water back to surface for sheet flow; construction of tidal creeks.
Design Narrative	Design focused on recreating varying landscape elevation changes rather than flat farmland. Ditches were plugged at random to encourage surface flooding. Hydrologic modifications diverted large channels back onto the surface and through a network of re-created creeks. This helped slow water to increase filtration and permeation. Salt marsh and forested wetland were also manually planted with appropriate species.

Permitting

Permits	U.S. Army Corps of Engineers section 104 permit, obtained through coordination with the North Carolina Coastal Area Management Act (CAMA) permit. A separate Erosion Control/ Sedimentation Control Plan was required through the Land Quality Section of the North Carolina Department of Environment and Natural Resources. There were no ESA issues.

The incorporation of volunteers in restoration is a key component of the North River Farms project. The North Carolina Coastal Federation utilizes full-time education and outreach staff to coordinate these volunteer efforts.

Photo Credit: North Carolina Coastal Federation

Construction and Maintenance

Total Budget	Over $4,000,000
Construction Narrative	Construction activities were conducted year round. Weather and its effect on access to the property were the major concerns. Construction involved large-scale movement of soil. Local contracting companies that have experience with the project proponent and restoration helped to ensure smooth implementation. A private consultant was hired to provide close oversight of the construction team.
As-built Monitoring	Elevations of newly contoured/excavated areas.

Scientific Evaluation and Monitoring

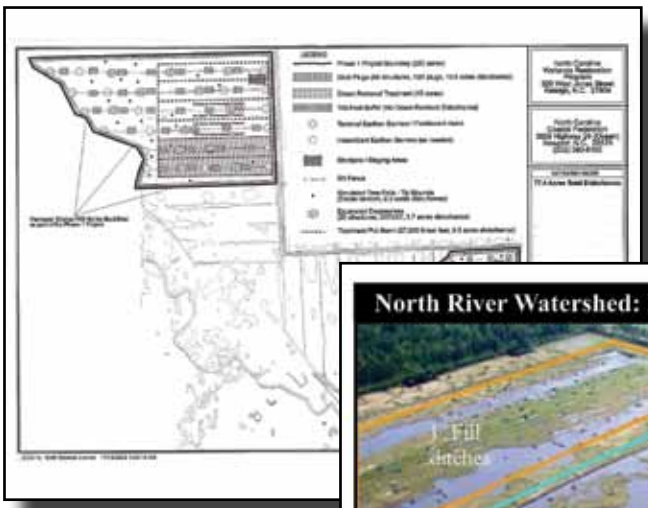
Scientific Evaluation	Water quality; vegetation; water quality effects upon local water bodies and shellfish were studied.

Community Involvement

Volunteer Components	Students and volunteers played a significant role in the large-scale revegetation practices.
Stakeholder Engagement and Community Outreach	Despite the remoteness of the site, many groups have visited and learned about this project. The project utilized dedicated staff members for extensive project outreach and education elements. The adjacent corporate farm was brought in as a supporter.

Additional North River Farms Restoration Documents Available Online

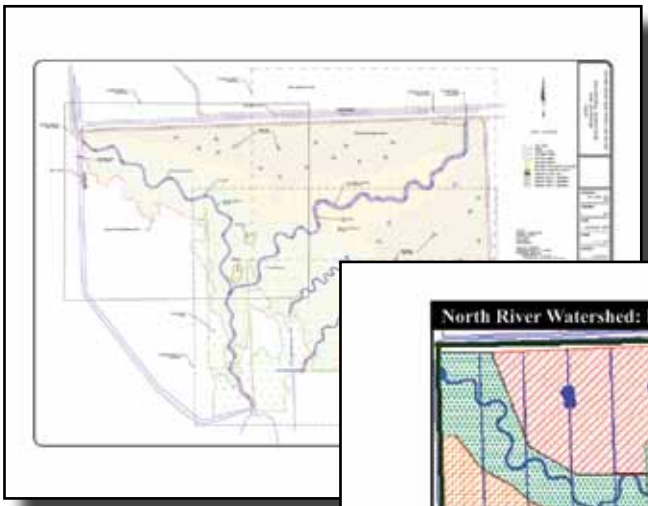
1 North River Farms Project Area Map



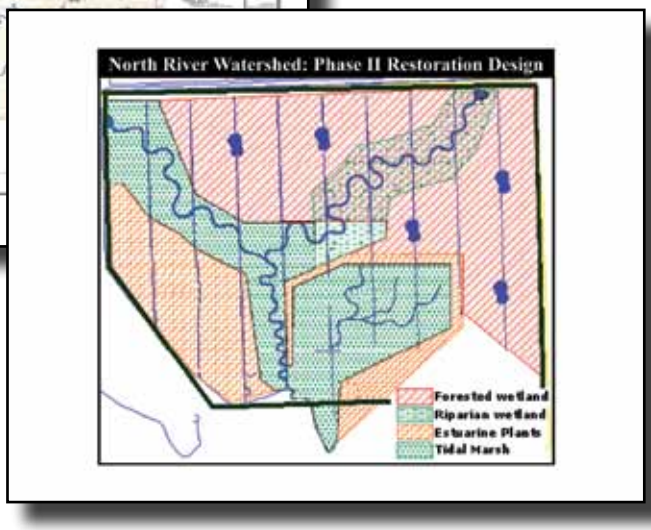
2 Phase I Plan Drawings

3 Phase I Restoration Design

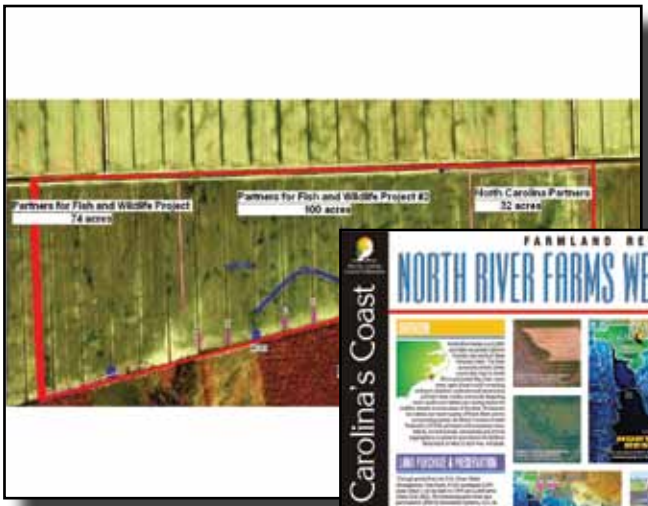
These North River case study materials can be found online at http://www.habitat.noaa.gov/partners/toolkits/tidal_hydro/portfolio_resources/tidalhydro-northriver.zip.



4 Phase II Plan Drawings



5 Phase II Restoration Design



6 Phase III Plan

7 Outreach Sign

Little River Marsh Restoration Project

North Hampton, Rockingham County, NH

Two 6x12-foot box culverts were installed to bring tidal flow into the marsh and drain stormwater runoff.

Photo credit: UNH

Scientific monitoring of restoration effectiveness included measures of soil salinity, vegetation, seagrass, fish communities, and birds.

Photo Credit: Dave Burdick

A volunteer measures the increased soil salinity, which will help reduce the non-native Phragmites australis, *seen in the background.*

Photo credit: Dave Burdick

Background

For over a century, Little River salt marsh deteriorated because it lacked a connection to the ocean of sufficient size to allow adequate tidal flow to the marsh. In an attempt to abate local flooding problems, community residents installed a culvert known locally as "the trunk" near the fish houses at Little Boar's Head in 1890. This was replaced by a 30-inch culvert in 1929 and again with a 48-inch culvert in 1948. All of these early culverts were too small to allow adequate tidal flow into the marsh, resulting in upland flooding and domination of invasive species.

Outcomes / Status

Installing an appropriately-sized culvert has allowed water to reach a larger part of the marsh surface. Soil salinity has increased dramatically, the number of invasive species is decreasing, and area homes are no longer flooded during extreme tide events. The project team is now working to reduce an unexpected mosquito problem that was created during the restoration.

Additional information can be found online at the Little River project website at http://www.nh.nrcs.usda.gov/technical/Ecosystem_Restoration/Little_River.html.

Lessons Learned

- Help stakeholders understand the potential negative changes to the system. Here, the red maple swamp on two sides of the system is dying back. It not only looks unappealing to residents, but when a dead tree tips over, increased mosquito breeding habitat is created in the depression at the base of the trees.
- Measure the creek channel dimensions/ cross-section prior to restoration.
- Use GPAC (Global Programme of Action Coalition) monitoring protocols.
- In retrospect, the project team could have improved pre-restoration nekton sampling by using a more systematic approach.
- The reduction in flooding that has resulted from the restoration project has allowed for development of previously un-buildable lots in the study area. It would have been great to conserve or protect those lands prior to construction.

Project Contact

Dr. David Burdick
University of New Hampshire
603-862-5129

Project Identification, Feasibility, and Planning

Project Start / Completion Dates

Spring to Fall 2000 (construction)

Historic Tidal Modification (reason)

The two main points of water flow to this system were constricted as a result of historic road construction and a second, naturally occurring ephemeral inlet to the Gulf of Maine. In 1890, residents decided to close the inlet permanently, so they installed a culvert about a half mile from the natural mouth of the Little River to increase tidal flow. In 1929, residents replaced the original culvert with 30-inch round culvert. In 1948, residents replaced the 30-inch culvert with 48-inch culvert.

Impacts of Historic Tidal Modification

Approximately 200 acres of the wetland were lost to historic development, leaving only 180 acres of restorable wetland. Of this area, only 30 acres of marsh remained functional habitat, while the rest experienced invasion by brackish and freshwater vegetation species (both native and exotic, including *Phragmites* and loosestrife). The site was previously a high marsh system with small rivers which converted to red maple forest and scrub when the wetlands were lost. Upland flooding due to the undersized culvert has impacted infrastructure.

Project Partners

Lead: New Hampshire Coastal Program (part of the NH Department of Environmental Services);

Others: National Resource Conservation Service (planning lead), Town of North Hampton

Funding Sources

Natural Resource Conservation Service; National Coastal Wetland Conservation Grant Program; U.S. Fish and Wildlife Service; Town of North Hampton; local private donations; NOAA; New Hampshire Department of Environmental Services; the Fuller Foundation; New Hampshire Department of Transportation; Ducks Unlimited.

Goals and Objectives

Goals

Reduce local flooding of homes and infrastructure; re-establish salt marsh over 170 acres (including the 30 that still function as a historic salt marsh).

Project Design

Design Techniques

Replace the culvert to the Gulf of Maine with a large double box culvert. Replace an upstream culvert with a box culvert. Dredge and re-grade portions of the creek bed and marsh surface.

Design Narrative

U.S. Army Corps of Engineers (USACE) and stakeholder input both influenced design. At site one, a small culvert was built to connect two internal parts of the system (80-acre and 40-acre system) and a large double culvert was built to maintain contact with the Gulf of Maine. The main creek had to be dredged and re-graded to enlarge it and ensure that some saltpans remained in the system. USACE constructed several models to show how the design would impact rainfall flooding and storm tide flooding.

Permitting

Permits

USACE

Construction and Maintenance

Total Budget	$1,860,000 ($1,310,000 for construction)
Construction Narrative	Construction was a challenging process. The small culvert was placed in just a few days, but the large culverts required traffic rerouting and temporary removal of of a fish house from the culvert site. Installation of the large culvert required a minimum of six weeks. Multiple contractors were used, one for marsh work and another for installing culverts.

Scientific Evaluation and Monitoring

Monitoring Budget	$25,000 for pre-project monitoring (two years) and $30,000 for post-project monitoring (a 5-year effort, but reducing over time)
Scientific Evaluation	The reference site was located six miles north of the project site at an area where the main inlet was changed but the marsh is relatively healthy. Parameters included: tidal range (using water level recorders for two-week periods at both sites before and immediately following construction, one by the small culvert and one by the large outlet); soil salinity (using hand-held optical refractometer); vegetation (using transects for percent cover of marsh species over four years); soil organic matter; seagrass survey (*Ruppia* data was collected pre-construction, but not post); fish sampling (conducted post-construction but there is no good pre-construction data, using ditch nets and lift nets); bird monitoring by Audubon Society (before and after construction).

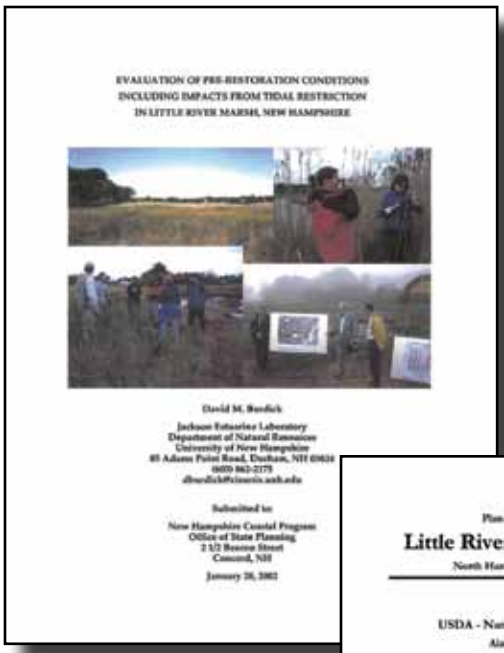
Community Involvement

Volunteer Components	Volunteers helped monitor salinity, fish communities, and marsh vegetation.
Stakeholder Engagement and Community Outreach	Local buy-in was important but a challenge. A series of public meetings in both towns were led by the U.S. Army Corps of Engineers and the Natural Resources Conservation Service (for two purposes, one for flooding issues and one for habitat restoration). The dedication ceremony for the project was attended by U.S. Senator Gregg.

The main tidal creek in the Little River Marsh required dredging and regrading to allow for adequate tidal flow into the system.

Photo Credit: Dave Burdick

Additional Little River Marsh Restoration Documents Available Online



EVALUATION OF PRE-RESTORATION CONDITIONS
INCLUDING IMPACTS FROM TIDAL RESTRICTION
IN LITTLE RIVER MARSH, NEW HAMPSHIRE

David M. Burdick
Jackson Estuarine Laboratory
Department of Natural Resources
University of New Hampshire
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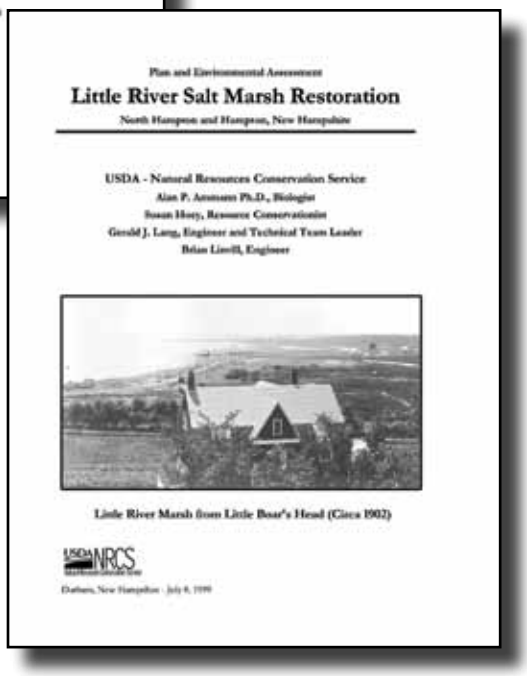
(603) 862-2175
dburdick@cisunix.unh.edu

Submitted to:
New Hampshire Coastal Program
Office of State Planning
2 1/2 Beacon Street
Concord, NH

January 28, 2002

1 Evaluation of Pre-Restoration Conditions



Plan and Environmental Assessment

Little River Salt Marsh Restoration

North Hampton and Hampton, New Hampshire

USDA - Natural Resources Conservation Service
Alan P. Asmussen Ph.D., Biologist
Susan Hoey, Resource Conservationist
Gerald J. Long, Engineer and Technical Team Leader
Brian Linell, Engineer

Little River Marsh from Little Boar's Head (Circa 1902)

USDA NRCS

Durham, New Hampshire - July 8, 1999

2 Plan and Environmental Assessment for Little River Salt Marsh Restoration

ENVIRONMENTAL
Fact Sheet

Environmental Services

WMD-CP-14 2005

NH Salt Marsh Restoration: Little River Salt Marsh, N. Hampton

Year of Project: 2000
Type of Project: Tidal Restriction Removal
Contractor: Northeast Wetland Restoration
Primary Project Partners: Town of N. Hampton, Natural Resources Conservation Service, NH Coastal Program
Type of Monitoring: Post-Restoration for Phase I and Pre-Restoration for Phase II

Location: Little River Salt Marsh is located on Route 1A (Ocean Boulevard) in North Hampton, just southwest of Route 111 and just northwest of North Hampton State Beach. The main tidal creek is located at the intersection of Route 1A and Sea Road. Parking is available at North Hampton State Beach, however, for volunteer monitors, please park at the Lamprey Homestead Conservation Area on Route 111 just before it intersects with Route 1A.

The Little River Salt Marsh is a back barrier marsh lying between Little Boar's Head in North Hampton and a rocky headland just south of North Shore Road in Hampton. USDA soil maps indicate that originally the marsh was approximately 393 acres in size. Until recently most of the original marsh had been greatly reduced to 100 acres. The amount of healthy salt marsh was only 42 acres.

Background: After nearly a decade of partnership efforts, adequate tidal flow has been restored to Little River Salt Marsh. Now, recovery of native marsh habitat can begin and freshwater flooding caused by an inadequate outlet will end.

The Issues:

Tidal Restriction. For over a century, there has been inadequate salt water flow into the marsh. Little River salt marsh deteriorated because it lacked a connection to the ocean of sufficient size to allow adequate tidal flow to

Little River Pre-Restoration Aerial – October 2000

3 Project Fact Sheet

These Little River case study materials can be found online at http://www.habitat.noaa.gov/partners/toolkits/tidal_hydro/portfolio_resources/tidalhydro-littleriver.zip.