Revised Narrative to Accompany RESTORE Act Ecosystem Restoration Project Proposal Sheet for the Fruit Farm Creek Mangrove Restoration Project

Prepared by Roy R. Lewis III, PWS, President, Coastal Resources Group, Inc., October 7, 2012

Introduction

Rookery Bay National Estuarine Research Reserve (RBNERR) is located in Naples, Florida and was created in 1978 after years of public involvement and environmental conservation to preserve approximately 110,000 acres of mixed coastal uplands and wetlands, 45,845 acres of which are subtropical mangrove forest. Within the U.S. Fish and Wildlife Service (USFWS) "Strategic Landscape Conservation Approach," we have recommended that mangrove forests of southwest Florida including the Ten-Thousand Islands and the RBNERR, are focal areas and should be a geographic priority. The successful restoration of mangroves in this area will serve as a model for similar efforts in south Florida, the Gulf of Mexico and the Caribbean Sea. With the problems of global climate change and sea level rise facing all the mangroves of these areas, improved hydrology to allow for adaptation to rising water levels is an essential part of the management of these ecosystems, and a healthy hydrologic system supports these adaptations.

Great potential exists to reverse the loss of mangrove forests worldwide through the application of ecological, hydrological and engineering approaches, including careful cost evaluations prior to design and construction. Mangrove forest restoration projects commonly fail to achieve significant plant cover either because there is a misunderstanding of mangrove forest hydrology, or, acceptance of the false assumption that simply planting mangroves is all that is required to establish a fully-functional mangrove ecosystem or both (Lewis 2000, Lewis 2005, Lewis 2009) Even restoration projects that meet a restoration goal within 3 to 5 years often fail to provide adequate habitat for fish and invertebrates unless very carefully designed (Turner and Lewis 1997, Bosire et al. 2008, Lewis and Gilmore 2007).

Previous research has documented the general principle that mangrove forests worldwide exist largely in a raised and sloped platform above mean sea level and are inundated at approximately 30% or less of the time by tidal waters (Lewis 2005). More frequent flooding causes stress and death of these tree species. Prevention of such damage requires application of the same understanding of mangrove hydrology. A fully successful ecological restoration design must mimic tidal stream morphology and hydrology along an estuarine gradient across a hetero-geneous mixture of mangrove ecosystem communities in order not only to restore plant cover, but also fish and invertebrate habitat (Lewis and Gilmore 2007)

Within the RBNERR there is an area of approximately 250 acres showing damage and stress believed to be the result of a roadway that prohibits adequate hydrologic connection and tidal flow between the northern and southern half of the project site (Figures 1, 2 and 3). Surface water levels are significantly higher and the hydroperiod is significantly longer in the damaged

area in when compared to an adjacent reference site. This has been demonstrated by the use of Hobo Data Loggers and subsequent hydrologic data analysis and modeling for use in the restoration design (Figure 1). Three phases of construction and restoration are proposed: 1a (16 acres), 1b (78 acres) and 2 (131 acres) for a total of 225 acres (64 acres of dead mangroves restored, 161 acres of severely stressed mangroves prevented from dying). An additional 800 acres of the adjacent estuary are impaired due to the lack of full connectivity to these visibly distressed mangroves (Figure 3) and can be expected to show signs of stress and exhibit areas of dead mangroves in the near future. Thus the total area of mangroves expected to benefit from hydrologic restoration is 1,025 acres. Extended periods of flooding within the damaged areas has been noted since 1993 and has resulted in an expansion of the area of mangrove forest die-off since that time (Worley, K., personnel communication) (Figure 3). Furthermore, the movement of fish and invertebrates into and out of the area is very restricted, and the export of detrital material to the adjacent estuary is substantially reduced. As a result, the ecological functions this area of RBNERR has been lost or impaired. Following completion of the entire project (Phases 1a, 1b and 2 including culvert installation), direct measurement of the increased function of restored fish and invertebrate habitat will be made as part of this proposed science-based restoration program.

In addition, the mangrove die-off area can be easily seen from the CR 92 (Figure 3) and this has in some regard raised public awareness of the problem. However, residents of the local area had little or no knowledge of why the forest was dying, how the RBNERR was planning to overcome the problem, or how mangroves benefit their local community at large. Investigators proposed to address these problems with an inventory and project design program followed by a three phase construction program and an associated public education program. The inventory and project design and permitting tasks have been completed using a $50,000 grant from the USFWS Coastal Program. An additional $25,000 grant from the Coastal Program combined with $10,000 in local cash donations, $90,000 in locally donated materials and labor were used to complete Phase 1a (Figure 4) on September 3, 2012. Monitoring of that phase of the project is currently underway.

Inventory and Project Design Tasks

1) Facilitate a coordinated restoration effort among identified project stakeholders (completed);
2) Perform background characterization tasks, such as topographic surveys, hydrologic modeling, and historical change detection, and prepare maps and reports from these tasks (completed);
3) Prepare a cost effective restoration plan to restore the hydrology to the largest possible area of damaged mangroves and impaired estuarine habitat (completed)
4) Prepare and submit a Joint Environmental Resource Permit (ERP) and Federal Dredge and Fill permit application to the South Florida Water Management District (SFWMD) and the U.S. Army Corps of Engineers (USACOE) (completed).
5) Coordinate permitting with the City of Marco Island as needed (completed).

6) Coordinate permitting and review agency comments and respond to requests for additional information (RAIs) through the issuance of the ERP and Federal Dredge and Fill permits (completed – all permits issued).
7) Conduct a three-day workshop on "Mangrove Forest Ecology, Management and Restoration" on-site for interested stakeholders, agency personnel and RBNERR staff (completed February 2011).
8) Incorporate up to ten (10) "young professionals" from area schools, colleges and/or universities in an on-going program to develop hands-on capabilities in restoration project design, implementation and monitoring for the life of the project (in progress).

As noted above, an additional $25,000 has been granted to CRG by the USFWS in order to complete these tasks for Phase 1a only (Figure 4).

9) Prepare construction drawings for the permitted project (completed).
10) Assist with bidding and contractor selection for the actual restoration work (completed).
11) Supervise construction work and compliance reporting (construction completed, compliance reports being filed).
12) Conduct monitoring of the project in conjunction with the "young professionals" team (underway with the Conservancy).
13) Make adjustments to the restoration plan as data on the success of vegetation establishment and faunal use are collected and analyzed (in progress).
14) Prepare and circulate regular reports on the progress of the project (underway).

This proposal to the Southwest Florida Regional Ecosystem Restoration Plan is for completion of the same six tasks above (9-14) over a three year period for the completion of Phases 1b and 2. The proposed installation and monitoring of additional culverts in Phase 1b and 2 would cost approximately $1.4 million.).

Project Location and Description:

RBNERR is located in the West Florida subregion of the West Indian Biogeographic Region and within the physiographic region of the Ten Thousand Islands. The mangrove die-off area of concern is located along County Road 92 (CR 92 also known as San Marco Road) approximately one mile west of the town of Goodland, in Collier County, in southwest Florida (Township 52 South, Range 26 East, and primarily Sections 14 and 15 but also portions of Sections 10, 11, 13) between Latitude 25.9397 and 25.9242, Longitude 81.6552 and 81.6866 (See Figure 1).

Three clearly visible mangrove die-off areas have been identified comprising 64 acres (Figures 1-3), but are expanding. These areas are characterized by dead trees that remain standing and are most visible south of CR 92, but also exist on the north of CR 92. The area surrounding the visibly dead forest is stressed from extended flooding and has been estimated to be 161 acres in size and is expanding in area, again predominately on the south side of CR 92. The estuarine mangrove area to benefit from complete hydrological restoration of the site is estimated to be approximately 1,025 acres.

Tasks Completed To Date

Task 1. Establish Restoration Steering Committee

At the onset of the project the Restoration Team consisting of the project investigators met and formed a Restoration Steering Committee comprised of stakeholders and project partners. These included RBNERR staff and representatives from USFWS South Florida Ecological Services Office, the Conservancy for Southwest Florida, the Florida Fish and Wildlife Conservation Commission and the City of Marco Island, as well as representatives of the adjacent residential developments, Key Marco and Stevens's Landing. This Restoration Team has worked with the Steering Committee to confirm the project goals and roles of each partner/stakeholder. Subsequent meetings have been held during the development of the project.

Task 2. Gather and synthesize existing information on the Fruit Farm Creek restoration area and prepare a restoration plan.

A topographic and bathymetric survey has been completed in order to characterize the existing conditions of the site. Hydrology and tidal flow within the areas of concern have been modeled based upon the placement of six hydrologic monitor devices (Hobo Meters) in: (1) the closest unimpacted (control) creek systems, the flow way into the mangroves from the existing single culvert, and a three more in the dead mangrove areas. In addition, other biological, physical and permitting constraints within the project site have been identified, including the presence of non-native vegetation that will be removed as part of the final restoration plan. Restoration alternatives have been analyzed using a hydrologic model and evaluated based on cost efficiency and likelihood of meeting project goals. A preferred alternative was selected and permit drawings prepared.

Task 3: Permitting

Based on the preferred alternative, a Joint Environmental Resource Permit (ERP) and Federal Dredge and Fill permit application was prepared and submitted to the South Florida Water Management District SFWMD and the U.S. Army Corps of Engineers (USACOE). Coordination with the U.S. National Marine Fisheries Service is regarding the endangered smalltooth sawfish (*Pristis pectinata*) was initiated and resulted in a "no impact expected" decision. All permits have been issued.

Task 4. Implement Restoration Plan

The complete restoration plan includes installation of three 54 inch diameter culverts in addition to the retention of the existing 60 inch culvert under CR 92. Phase 1a (Figure 4) has been funded by the second grant from the USFWS Coastal Program ($25,000), public donations of $10,000, and $90,000 in donated materials and labor to construct a tidal channel. The restoration team will work with the City of Marco Island to plan, design and install the minimum cost effective means of restoring tidal flows and allowing natural restoration processes to begin per the principles of Ecological Mangrove Restoration (EMR) as outlined in Lewis (2005, 2009) and Lewis et al. (2006) when full funding is available (estimated to be $1.4 million).

Task 5: Environmental Review and Compliance Monitoring

The complete restoration plan includes a full restoration monitoring program including a Time Zero report, and Time Zero plus 3, 6, 9, 12, 18, 24, 36, 48 and 60 months reports (10 total). Twelve 5m (16.5 ft) X 5m permanent plots would be established within both the dead mangrove area and in reference areas. The restoration site data would be compared to reference sites located within basin black mangroves (*Avicennia germinans*) located adjacent to the project site. It is expected that 80% cover by a mixture of volunteer saltwort (*Batis maritima*) and mangroves would be naturally established after 24 months), and 80% mangrove cover established within 60 months through volunteer mangrove recruitment. No planting of mangroves is needed nor planned based upon previous work at locations like Clam Bay in the City of Naples where volunteer mangroves established on their own. Regular sampling for fish using Breder traps will take place during the regular sampling for vegetative cover within the fixed plots.

Project Benefits to Coastal Ecosystems

Mangrove and estuarine habitats provide critical nursery areas for a number of larval and juvenile finfish and shellfish species of commercial and recreational importance. Many adult fish species take shelter and feed within mangrove habitats as well. Some fish species that will benefit from this project include the endangered fish species the smalltooth sawfish (*Pristis pectinata*) which is reported at its smallest sizes using shallow (<2.4 m) protected mangrove areas, and important recreational and commercial fish and shellfish species such as snook (*Centropomus undecimalis*), sheepshead *(Archosargus probatocephalus),* mangrove snapper (*Lutjanus griseus*), tarpon (*Megalops atlanticus),* red drum (*Sciaenops ocellatus*), spotted seatrout *(Cynoscion nebulosus),* stone crabs (*Menippe mercenaria)*, blue crabs *(Callinectes sapidus),* pink shrimp *(Farfantepenaeus duorarum*) and oysters (*Crassostrea virginicus).* An estimated 75% of the game fish and 90% of the commercial fish species in south Florida depend on mangrove systems.

Restoration of the mangrove die-off areas and the associated mangroves and estuarine system will provide additional foraging and roosting areas for shore and wading birds such as the roseate spoonbill (*Platalea ajaia*), frigatebird (*Fregata magnificans*), double-crested comorant (*Phalacrocorax auritus*), great blue heron (*Adrea herodias*), snowy egret (*Egretta thula*), green heron (*Butorides virescens*), reddish egret (*Egretta rufescens*) and migratory birds such as the brown pelican (*Pelecanus occidentalis*).

Contributing Partners:

The principle investigator from the Coastal Resources Group, Inc. (CRG) Mr. Roy R. Lewis III, Professional Wetland Scientist (PWS) will donate half of his time spent on the project and Dorothea Zysko, PWS, co- investigator from The Ecology Group will donate one-quarter of her time spent on the project

RBNERR staff is committed to contribute staff time and technical support with each task involved in reaching the project goals, including playing a primary role on the core restoration team, assisting in the topographic survey, creation of mapping documents throughout the planning and implementation phases using information generated during the topographic and other surveys, and monitoring the biological resources, including fish and bird species. In addition, the RBNERR's Trimble GeoExplorer® unit, GIS computer, and statistical software for data analysis have been used during survey work and the preparation of the restoration plan. Jeff Carter, Stewardship Coordinator is contributing specifically 0.75 man months per year for the three year project as part of this proposal.

The Conservancy for Southwest Florida staff have conducted work and made important contacts over the past several years characterizing the mangrove-die off areas. They have agreed to participate as a member of a restoration steering committee and in this regard will contribute staff time and technical support over the course of the project, including conducting all the required compliance and monitoring data collection. These donated efforts are valued at $150,000.

The City of Marco Island is expected to contribute staff time and technical expertise in characterizing the existing biological conditions of the site and in the public education and outreach components of the project.

Representatives of the residential developments adjacent to the die-off areas have expressed concern and willingness to participate in resolving the mangrove die-off problem because it has direct visual and odor impacts on their properties. These representatives have be contacted and engaged to become members of the steering committee. In addition, the developments have been requested to make a cash donations to the implementation phase of work and directly assist in the public education outreach component of residents living in their communities. To date these groups have contributed $10,000 that has been used as part of the required match for the Phase 1a implementation funding from the USFWS.

Project Costs:

Total costs to implement this proposal is $1.94 million. Total requested RESTORE funding is $1.4 million over three years. A total match of $439.000 in in-kind cash donations and services, including $75,875 in USFWS Coastal Program grants has been provided to date to match the requested grant. Total-non-federal match is $365,000 to date.

Literature Cited (all documents available at www.mangroverestoration.com)

Bosire, JO., F. Dahdough-Guebas, M. Walton, B.I. Crona, R.R. Lewis III, C. Field, J.G. Kairo and N. Koedam. 2008. Functionality of restored mangroves: A review. Aquatic Botany 89:251-259.

Lewis, RR, 2000. Ecologically based goal setting in mangrove forest and tidal marsh restoration in Florida. Ecol. Eng. 15, 191-198.

Lewis, RR, 2005. Ecological engineering for successful management and restoration of mangrove forests. Ecol. Eng. 24, 403-418.

Lewis, RR. 2009. Methods and criteria for successful mangrove forest restoration. Chapter 28., pages 787-800 in GME Perillo, E Wolanski, DR Cahoon, and MM Brinson (eds.) Coastal Wetlands: An Integrated Ecosystem Approach. Elsevier Press.

Lewis, RR, A Quarto, J Enright, E Corets, J Primavera, T Ravishankar, OD Stanley and R Djamaluddin (eds). 2006. Five Steps to Successful Ecological Restoration of Mangroves. YARL and the Mangrove Action Project. Yogyakarta, Indonesia. 64 p.

Lewis, RR, and RG Gilmore. 2007. Important considerations to achieve successful mangrove forest restoration with optimum fish habitat. Bull. Mar. Sci. 80(3):823-837.

Turner, RE, and RR Lewis. 1997. Hydrologic restoration of coastal wetlands. Wetlands Ecol. Manage. 4(2):65-72.

Fruit Farm Creek Mangrove Restoration

Dorothea P. Zysko, C.E., PWS • Joshua R. Evans, P.E.
Roy R. Lewis, III, PWS

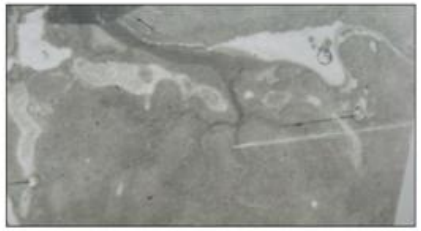
RESTORATION OF A BLACK MANGROVE BASIN FOREST IN MARCO ISLAND, FL

Die-off Area #2

Prop Roots and Roots Closing Tidal Creeks

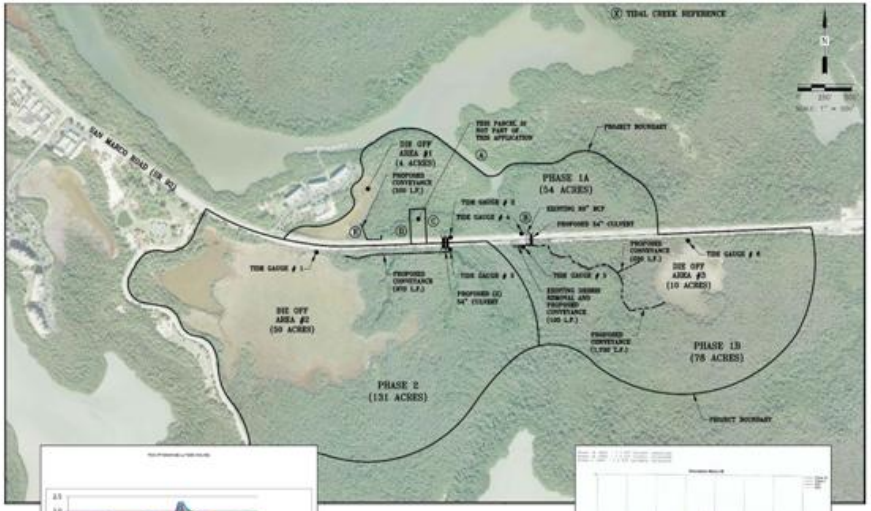
Existing Partially-functional 60 Inch Culvert

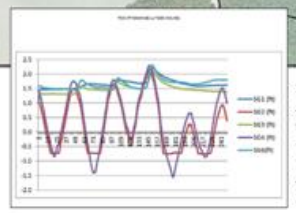
Accumulation of elemental sulfur/sulfur-reducing bacteria

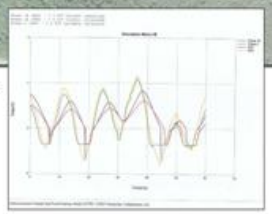


1929 Aerial Photography

1940 Aerial Photography







Existing tidal data was used to create and calibrate a hydrologic model of the existing mangrove system. The model was then utilized to size and locate culvert improvements that would approximate and restore the natural tidal prism.

Three black mangrove basin forests totaling 64 acres located in the Rookery Bay National Estuarine Research Reserve near Marco Island, Florida, have died from inadequate flushing and altered tidal hydrology. With a grant from the U.S. Fish and Wildlife Service, donated matching time from the professional design team, and private funding, these areas will be restored and 161 additional acres will benefit utilizing the Ecological Mangrove Restoration (EMR) approach.

THE PROPOSED RESTORATION PLAN CONSISTS OF NINE (9) ELEMENTS:

1. Installation of a new 54 inch culvert at the location of partially functioning 60 inch culvert at Tidal Creek A/B.
2. Installation of two new 54 inch culverts at Tidal Creek D across SR 92 along with minor impacts associated with the sumps.
3. Removal/trimming of red mangrove roots and prop roots in Tidal Creek E.
4. Removal of red mangrove roots in Tidal Creeks B and E.
5. Removal of up to 30 mangroves in Tidal Creeks B (20) and E (10).
6. Re-excavation/excavation of roadside ditch and removal of black mangroves and pneumatophores between proposed culvert at Tidal Creek C and Die-off Area #2.
7. Debris (construction mat) removal and improved conveyance at location of existing culvert at Tidal Creek B.
8. Approximately 350 linear of feet of discretionary mangrove trimming/alteration as part of the Adaptive Management Plan.
9. Optional post-construction planting for educational purposes.

Figure 1

Figure 2. Total Project Area (Phases 1 And 2) = 64 acres of dead mangroves and 161 acres of stressed mangroves = 225 acres

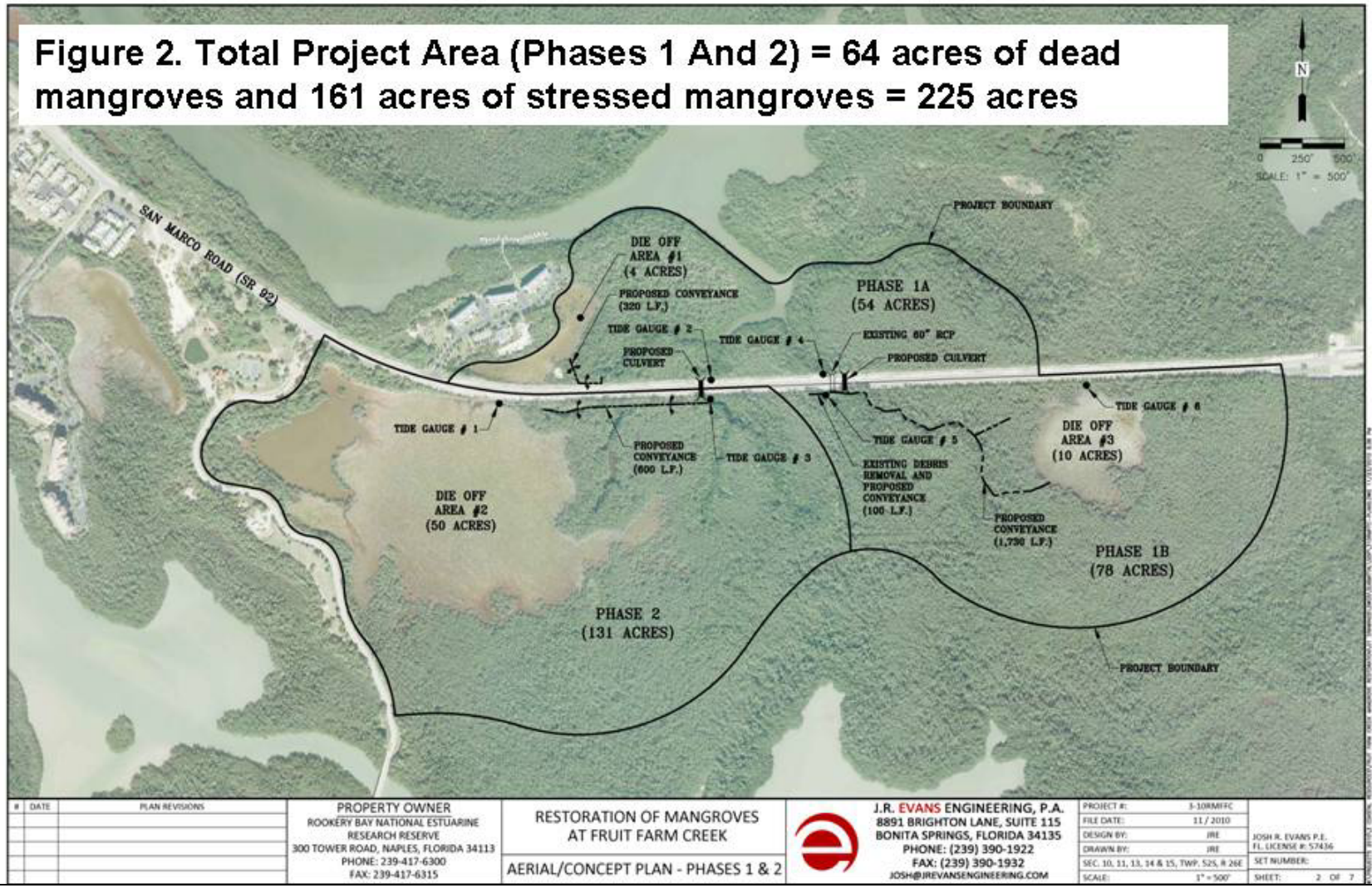
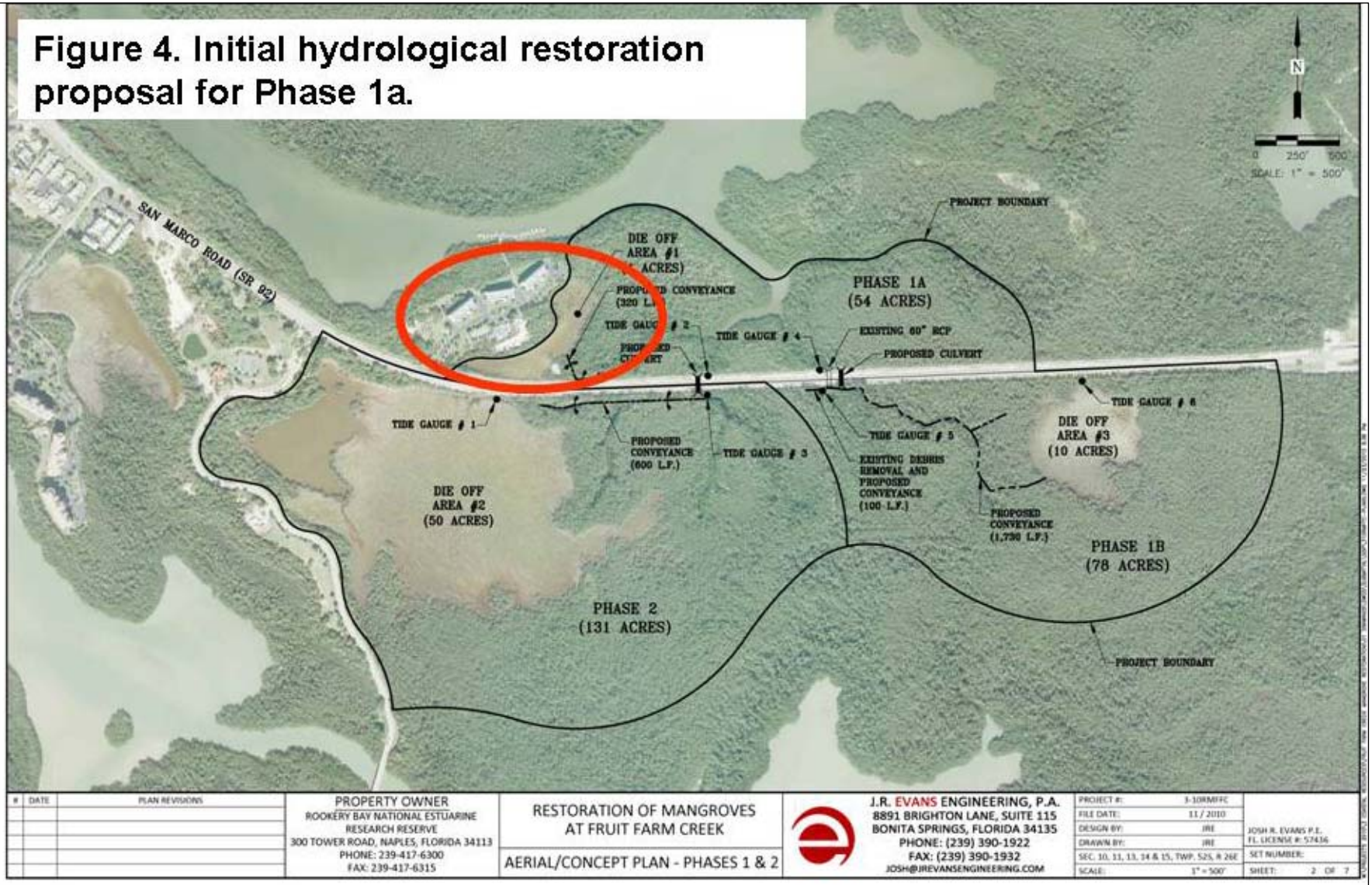


Figure 3. Rookery Bay Fruit Farm Creek Proposed Restoration Site – January 21, 2011

Figure 4. Initial hydrological restoration proposal for Phase 1a.



#	DATE	PLAN REVISIONS

PROPERTY OWNER
ROOKERY BAY NATIONAL ESTUARINE RESEARCH RESERVE
300 TOWER ROAD, NAPLES, FLORIDA 34113
PHONE: 239-417-6300
FAX: 239-417-6315

RESTORATION OF MANGROVES AT FRUIT FARM CREEK

AERIAL/CONCEPT PLAN - PHASES 1 & 2

J.R. EVANS ENGINEERING, P.A.
8891 BRIGHTON LANE, SUITE 115
BONITA SPRINGS, FLORIDA 34135
PHONE: (239) 390-1922
FAX: (239) 390-1932
JOSH@JREVANSENGINEERING.COM

PROJECT #:	3-10RMFFC
FILE DATE:	11/2010
DESIGN BY:	JRE
DRAWN BY:	JRE
SEC. 10, 11, 13, 14 & 15, TWP. 52S, R 26E	
SCALE:	1" = 500'

JOSH R. EVANS P.E.
FL. LICENSE #: 57436
SET NUMBER:
SHEET: 2 OF 7