Florida Department of
TRANSPORTATION

DRAFT MITIGATION PLAN FOR UNAVOIDABLE IMPACTS TO ESSENTIAL FISH HABITAT

FLORIDA DEPARTMENT OF TRANSPORTATION
DISTRICT 4

PROJECT DEVELOPMENT AND ENVIRONMENT STUDY
COUNTY ROAD 510/85 STREET
From County Road 512 (M.P. 0.0) to 58 Ave (M.P. 5.283),
Indian River County, Florida
ETDM Number: 14233
Financial Management Number: 405606-2-22-02
Federal Aid Project No.: 4984-004-S

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being, or have been, carried out by the Florida Department of Transportation (FDOT) pursuant to 23 U.S.C. §327 and a Memorandum of Understanding dated December 14, 2016, and executed by the Federal Highway Administration and FDOT.

Prepared for
Florida Department of Transportation
District Four
3400 West Commercial Boulevard
Fort Lauderdale, FL 33309-3421

MARCH 2018

Introduction

This Mitigation Plan is intended to provide supplementary information to the Natural Resources Evaluation (NRE) that was produced during the County Road (CR) 510 Project Development and Environment (PD&E) Study. The NRE contains additional detail on project alternatives, baseline conditions, and potential environmental impacts. This Mitigation Plan specifically addresses potential unavoidable impacts to white shrimp Essential Fish Habitat (EFH) and describes mitigation options.

Impact Summary

The extent of potential impacts was assessed by mapping EFH in the project area and overlaying the footprint of the Recommended Alternative. EFH occurs as forested palustrine wetlands in two locations, at the south prong of the St. Sebastian River and at an unnamed tributary approximately 0.4 mile to the west. These wetlands are freshwater and tidally influenced and form EFH for white shrimp. Under the Recommended Alternative there would be a total of approximately 0.65 acres of impacts to these two wetland areas that form EFH.

The wetland area at the south prong of the St. Sebastian River, referred to as AA7 in the NRE, was assigned a Uniform Mitigation Assessment Method (UMAM) score of -0.76. Direct impacts to AA7 under the Recommended Alternative are anticipated be approximately 0.55 acres, with a UMAM functional loss score of -0.418 for the impact assessment area.

The wetland area at the unnamed tributary, referred to in the NRE as AA5, was assigned a UMAM score of -0.43. Direct impacts under the Recommended Alternative are anticipated to be approximately 0.1 acre, with a UMAM functional loss score of -0.043 for the impact assessment area.

Potential indirect impacts could include displacement of white shrimp during removal of the culvert or bridge construction as well as shading from the bridge. The replacement of the culvert with a bridge is an improvement over existing conditions because it creates more natural conditions that enhance the flow of water and movement of wildlife, including white shrimp.

Avoidance, Minimization, and Mitigation

Impacts to EFH were sequentially avoided and then minimized by limiting the width of right-of-way along the south prong of the St. Sebastian River. FDOT *Standard Specifications for Road and Bridge Construction* will be implemented to further minimize impacts. Because at least part of the project area drains into an OFW, the Indian River Lagoon, the stormwater management system is being planned to achieve 50 percent greater treatment of water than under standard specifications, reducing impacts to downstream EFH. Other minimization measures, which may include reductions in the typical section, use of retaining walls to minimize roadway embankments and similar measures will be considered during the project design phase.

Impacts to EFH will also be minimized and environmental conditions improved by replacing the culvert at the south prong of the St. Sebastian River with a bridge. The replacement of an existing culvert with a bridge covers approximately 0.0396 acres, will provide a Relative Functional Gain of 0.47 and is expected to offset approximately 0.0186 credits worth of impacts.

Mitigation for unavoidable impacts to wetlands, including the wetlands that represent EFH, will be required and is a project commitment. The exact extent of impacts and requisite mitigation will be determined during the project design phase and this mitigation plan can be updated at that time. Wetland mitigation will follow UMAM or another applicable scoring system to gauge the function and value of the impacted wetlands as well as mitigation properties.

Mitigation for EFH will show a preference for being located in the same drainage basin (the central Indian River Lagoon basin) and habitat type (freshwater tidal) as the impacted EFH. Off-site mitigation is anticipated through a previously established mitigation bank. However, at this time no mitigation banks exist in the Central Indian River Lagoon Basin that offer freshwater tidal credits. Through coordination with National Marine Fisheries Service (NMFS) it was determined that mitigation for impacts to EFH could be achieved through an existing bank in the central Indian River Lagoon basin that protects any white shrimp EFH habitat type, but that a mitigation ratio of 2:1 or 1.5:1 would be required if the habitat type could not be matched.

The CGW Mitigation Bank is approximately 7.7 miles southeast of the project and is located in the central Indian River Lagoon drainage basin. General wetland mitigation credits for estuarine wetlands are available from the CGW Mitigation Bank. Because the CGW Mitigation Bank offers estuarine instead of freshwater tidal credits, a mitigation ratio of 2:1 or 1.5:1 is anticipated for the proposed project. The CGW Mitigation Bank application is provided as **Appendix A** and contains details on existing conditions, planned restoration, and monitoring. FDOT District 4 owns 1.35 estuarine/forested wetland credits at the CGW Mitigation Bank that are currently available.

The Basin 22 Mitigation Bank is located within the Central Indian River Lagoon drainage basin, approximately 4.5 miles southwest of the project. Its service area includes the proposed project but it does not offer freshwater tidal credits that also protect EFH. The Basin 22 Mitigation Bank contains approximately 109.58 acres of freshwater herbaceous and freshwater forested state wetland mitigation credits. Other mitigation options may be evaluated in subsequent project phases; however, mitigation requirements for unavoidable impacts to wetlands and EFH will be met so that there is no net loss of habitat function or value.

NMFS Conservation Recommendations

NMFS provided the following conservation recommendations: The FDOT should develop a detailed mitigation plan that compensates fully for unavoidable adverse impacts to EFH. The mitigation plan should include:

- A detailed description of the proposed mitigation, including success criteria. The mitigation plan should contain sufficient detail to ensure no net loss of habitat functions and values as a result of project construction.
- Detailed overview and cross-sectional drawings of the mitigation areas with elevations.
- A vegetative planting plan for the mitigation sites.
- A functional assessment, such as UMAM, should be prepared for evaluating the amount of mitigation needed.

In response to these conservation recommendations FDOT offers this Mitigation Plan and refers to information in the CGW Mitigation Bank Restoration Plan included in **Appendix A**. The proposed mitigation is anticipated to offset approximately 0.65 total acres of impacts to white shrimp EFH in the central Indian River Lagoon drainage basin. Wetlands will be scored using UMAM (or another applicable scoring system) to ensure no net loss of habitat function or values. Mitigation is anticipated through the CGW mitigation bank with a mitigation ratio of 2:1 or 1.5:1. The Restoration Plan in **Appendix A** offers success criteria, a vegetative planting plan, and a monitoring program. That Restoration Plan also provides a detailed overview of the mitigation area, but cross-sectional drawings are not available at this time.

Summary

Up to approximately 0.65 total acres of unavoidable impacts to white shrimp EFH are anticipated as a result of the proposed widening of CR 510 at two locations. That EFH is in the form of tidal, freshwater forested wetlands along the south prong of the St. Sebastian River and an unnamed tributary. It is anticipated that mitigation for impacts to EFH will be achieved through estuarine wetland credits from the CGW Mitigation Bank. The CGW Mitigation Bank is in the proper drainage basin and also protects white shrimp EFH. Because the proposed project impacts would be to freshwater tidal wetlands, and the CGW contains saltwater tidal wetlands, a mitigation ratio of 2:1 or 1.5:1 is anticipated. The extent of wetlands and anticipated impacts will be further refined during the design and permitting phase of this project.

APPENDIX A: CGW MITIGATION BANK

CHOWN, GREGORY, WILCOX (CGW)
WETLAND MITIGATION BANK APPLICATION
STATE OF FLORIDA / USACOE JOINT APPLICATION
PART 6 ATTACHMENT

4-061-0165A-ERP

INDIAN RIVER LAGOON SALT MARSH
SECTION 25, TOWNSHIP 32 SOUTH, RANGE 39 EAST
INDIAN RIVER COUNTY, FLORIDA

PREPARED BY

CGW
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I. INTRODUCTION

The purpose of this attachment is to address Part 6 of the ERP/USACOE joint application and to submit additional information relative to the federal agency review of an application for a wetland mitigation bank instrument.

The applicant proposes to develop a mitigation bank involving approximately 150.08 acres fronting the Indian River Lagoon. The proposal includes designs used at other successful saltmarsh creation, restoration and enhancement projects in the vicinity. These include projects at Grove Isle, Copeland's Landing and Grand Harbor in Indian River County. This section of the lagoon is Class III Water, an Outstanding Florida Water, and an Aquatic Preserve (Chapter 62-302, F.A.C.). The property involves land that has been affected by the construction of two mosquito control impoundments. The south impoundment is known as Impoundment 24, or the South John Knight Impoundment, and the north impoundment is known as Impoundment 25, or the Lab Impoundment. The impoundments were managed by the Indian River Mosquito Control District (IRMCD) for a period of time beginning in the early 1960s. The current property owner, Martin A. Gregory, Trustee, requested that IRMCD cease this operation in 1974. Since that time the IRMCD has attempted to control mosquito production through aerial and ground application of larvicides and adulticides. This procedure has been performed as many as 14 times in one year.

A description of the acreage for the property is provided below:

Impoundment 24 (South John Knight)

This impoundment includes a total of 64.07 acres within and including the impoundment dike. The dike surrounds the subject property and approximately 2.45 acres of an adjacent parcel. The subject property includes approximately 61.62 acres for inclusion in the CGW Mitigation Bank.

Impoundment 25 (Lab)

This impoundment includes a total of 82.11 acres within and including the impoundment dike. The dike surrounds the subject property and approximately 1.87 acres of an adjacent parcel. The subject property includes approximately 80.24 acres for inclusion in the CGW Mitigation Bank.

Outside the Impoundments

There are approximately 8.22 acres of the CGW Mitigation Bank that include ditches, a section of impoundment dike south of Impoundment 24, a storm berm fronting Impoundments 24 and 25, or small bays.

II. HISTORICAL CONDITIONS

A review of aerial photography from 1943 to 1994 indicates that the subject area was a typical high salt marsh vegetated by herbaceous species. In the 1930s the salt marsh had been somewhat ditched for mosquito control purposes by the WPA. Shrubs or trees, presumably mangroves, lined the ditches and were scattered in the eastern portions. A storm berm appeared to be along the river front; however it did not appear to have been continuous. Small creeks connected the salt marsh to the Indian River Lagoon. Small bays were at the end of some of the creeks. These creeks are likely to have allowed "daily" tides, when sufficiently high, to inundate the salt marsh.

In the late 1950s to early 1960s, the Indian River Mosquito Control District (IRMCD) began and completed the construction of impoundments which were used to contain water and flood the marsh for the purposes of reducing the locations for mosquito ovipositioning and therefore mosquito production. The water was obtained by pumping water from the Indian River Lagoon. The subject property includes the areas now known as Impoundment 24 (North John Knight) and Impoundment 25 (Lab). The latter impoundment also included the construction of a series of interior dikes for research purposes.

In 1974 the property owner required that IRMCD cease its management operation. Since that time the impoundment structures have not been maintained. A description of existing conditions is provided in this report.

III. EXISTING CONDITIONS

Cover Types

The subject property consists of several coverage types. These are described below, according to impoundment and areas outside the impoundment, and are listed along with the acreage in the table following the descriptions. Please refer to the drawing depicting existing conditions.

Impoundments 24 and 25

Perimeter Dikes
The dikes form the boundary of the respective impoundments. Elevation ranges from 3.0 feet NGVD to slightly over 4.0 feet NGVD. Most of the dike top width is approximately 20 feet but in some areas fronting the Indian River Lagoon the width is approximately 40 feet, not including a storm berm that may also occur between the dike and the lagoon. Vegetation primarily consists of Brazilian pepper (*Schinus terebinthifolius*). The base of the dike is vegetated by mixed mangrove species (*Rhizophora mangle, Avicennia germinans, and Laguncularia racemosa*) and sea oxeye daisy (*Borrichia frutescens*). The dikes are continuous except for one breach fronting the lagoon in each impoundment.

Interior Dikes
There are 9 interior dikes which dissect Impoundment 25. They are spaced evenly so that the areas (salt marsh) between the interior dikes are in approximately 200 foot wide segments. The interior dikes are vegetatively similar to the perimeter dikes. These dikes were constructed for experimental purposes by IRMCD. The dikes extend from the east portion of the impoundment and connect to an interior dike that extends along the near west end of the impoundment (within the area covered by Brazilian pepper) in the south half of the impoundment and to the impoundment back dike (west side of the impoundment) in the north half of the impoundment. The interior dikes are separated from the perimeter dike along the east side of the impoundment by a ditch (perimeter). The dikes are approximately 15 feet wide.

Perimeter Ditches
These ditches were primarily excavated to obtain material for perimeter dike construction. The ditches are approximately 15 feet wide and have a bottom elevation ranging from approximately 0.0 feet to approximately -2.5 feet NGVD. Bottom material consists of organic fines several inches deep. Submerged aquatic vegetation was not observed.

Interior ditches
These ditches were also primarily excavated to obtain material for dike construction. The ditches are approximately 15 feet wide and are on the north and south sides of each interior dike. The bottom elevation of these ditches ranges from approximately 0.0 feet to approximately -1.5 feet NGVD. Bottom material consists of organic fines several inches deep. Submerged aquatic vegetation was not observed.

Salt Marsh
The salt marsh vegetation consists of high marsh species such as salt grass (*Distichlis spicata*), saltwort (*Batis maritima*), glasswort (*Salicornia* spp.), and sea oxeye daisy. Mangrove occur along the banks of the perimeter ditch and interior ditches as well as along small IRMCD swales and natural ponds within the salt marsh. The salt marsh elevation ranges in Impoundment 24 from +0.7 feet at the east end to approximately +1.8 feet NGVD at the west end. The salt marsh elevation in Impoundment 25 is approximately +1.0 feet NGVD. The salt marshes within both impoundments are dissected by WPA ditches.

Brazilian Pepper
This cover type represents areas that have been altered in some manner so as to cause almost complete vegetative cover by Brazilian pepper. Other vegetation found in scattered locations include white mangrove, sea oxeye daisy, and leather fern (*Acrostichum danaeifolium*). The alteration may have been caused by dike construction, obstruction of water movement, change in water salinity at certain locations, and/or some other unknown cause, all synergistically affecting the areas so that they became vegetated by Brazilian pepper. Elevations within the Brazilian pepper areas that do not appear to have had a change in ground contour range from +1.0 foot to +2.4 feet NGVD, the majority of the area being greater than +1.5 foot NGVD.

Oak Hammock
This cover type is found in isolated locations within the west portion of both impoundments. Predominate vegetation is live oak (*Quercus virginiana*), saw palmetto (*Serenoa repens*), sabal palm (*Sabal palmetto*), and extensive invasion by Brazilian pepper. The ground elevation exceeds +2 feet NGVD.

Outside the Impoundments

The areas outside the impoundments have been divided into two main categories, perimeter dike and open water/wetland. These perimeter dike areas are located fronting Impoundments 24 and 25 and make up a portion of Impoundment 23 (South John Knight). These areas are vegetated similar to the Impoundment 24 and 25 perimeter dikes being predominantly Brazilian pepper. The areas fronting the impoundments are separated from the impoundment dike by a shallow ditch and may have been part of a storm berm.

The open water/wetland area consists of tidal ditches, bays, and mangrove wetland. The tidal ditches are located between Impoundments 23 and 24 and Impoundments 24 and 25 and north of Impoundment 25. The ditches are connected to the Indian River Lagoon and also provide drainage outfalls for properties west of the subject area. The ditches are vegetated by mixed mangrove species along the banks or small islands.

COVER TYPE AND ACREAGE SUMMARY TABLE

COVER TYPE	IMPOUNDMENT 24 (ACRES)	IMPOUNDMENT 25 (ACRES)	OUTSIDE IMPOUNDMENT (ACRES)
PERIMETER DIKE	5.66	7.22	1.80
INTERIOR DIKE	0	6.81	-
PERIMETER DITCH	2.66	3.76	-
INTERIOR DITCH	0	5.75 (S)/5.32 (N)*	-
SALT MARSH	44.81	40.32	-
BRAZILIAN PEPPER	6.37	10.09	-
OAK HAMMOCK	2.12	0.97	-
OPEN WATER/ WETLAND	0	0	6.42
TOTAL	61.62	80.24	8.22

Hydrology

The Indian River Lagoon is unusual in several ways when compared to other Florida estuaries. The first is that it has a narrow tidal range, often with less than a foot difference between low and high tide. The second is that the water level fluctuates on an irregular basis because of rain and wind. These sometimes cause a greater fluctuation than the tides. The third is that the lagoon has a regular seasonal increase in water level that may occur as early as August/September and extend to November/December. The tide range remains the same during these months, therefore the higher wetlands become flooded.

Water level data was reviewed from three sources: Grand Harbor, Wabasso and Oslo Road (immediately north, approximately 4.5 miles north and approximately 4 miles south of the subject property, respectively). The Oslo Road data was collected by the Florida Entomology Lab from January 1959 to 1981. The tidal records at Wabasso were recorded from 1960 to 1984. The Grand Harbor Data was collected by Indian River Mosquito Control District from 1991 to 1995. The Oslo Road and Grand Harbor data is provided in the appendix. A summary of the data appears below:

	Entomology Lab	Wabasso
Monthly Max. H. W.	+3.10 NGVD	+2.87 NGVD
Monthly Min. H. W.	-1.12 NGVD	-0.73 NGVD
Monthly Mean Tidal Range	+0.06 to +0.77 NGVD	+0.27 to +0.72 NGVD

The mean high water at Grand Harbor ranged from +0.98 to +1.23, with +1.07 being the mean for the recorded period.

The hydrological influences within the impoundments appear to be rainfall and the Indian River Lagoon. The impoundment perimeter dikes are continuous except for two breaches (one in Impoundment 24 and one in Impoundment 25) and two culverts in Impoundment 24.

The breaches are through the perimeter dike and connect to a shallow ditch that is parallel to and outside the perimeter dike. The Impoundment 24 breach is lower than the outer perimeter dike (storm berm) which at its lowest point is +1.00± foot (NGVD) in elevation. Tidal water must rise above this elevation before entering the breach. The Impoundment 25 breach is similar except that the lowest point in the outer perimeter dike is approximately -0.5 feet NGVD.

The culverts in Impoundment 24 are small in size, are located in the ditches approximately 1400 feet from the Indian River Lagoon, and appear to be in disrepair. The culvert at the south end is actually a culvert (18 inch CAP, -0.35'± invert elevation) that was installed to connect Impoundments 24 and 25 but has broken at a point in the ditch between the two impoundments. The other culvert (15 inch CAP, -19'± control invert elevation) may be partially blocked by debris and mud.

Biological Conditions

The subject salt marsh portion of the impoundments is vegetatively intact in that most of the marsh is vegetated by herbaceous species. The remaining portions, with the exception of the hammock, are disturbed vegetatively and topographically with a correspondingly disturbed biological community. The Impoundment 25 salt marsh is dissected by dikes; both impoundments are separated from the lagoon by a perimeter dike except as noted in the hydrology section of this report. The use of the impoundment by wildlife species has not been documented through sampling but it is anticipated that at times the salt marsh is used by invertebrates, fish, birds, and small mammals. The remaining disturbed areas are poor wetland habitats. Several years ago the endangered *Rivulus* was discovered at the east section of the salt marsh in Impoundment 24. It is anticipated that the proposed activity would not adversely affect the continued existence of this species in the marsh. The table below is a list of species (Endangered, Threatened, Species of Special Concern) which are reported to be in this region and potentially use the site as habitat:

Common Name	Scientific Name	GFC Status	USFWS Status
Common snook	*Centropomus undecimalis*	SSC	-
Rivulus	*Rivulus marmoratus*	SSC	-
American alligator	*Alligator mississippiensis*	SSC	T(S/A)
Atlantic salt marsh snake	*Nerodia fasciata taeniata*	T	T
Eastern brown pelican	*Pelecanus occidentalis*	SSC	-
Woodstork	*Mycteria americana*	E	E
Bald eagle	*Haliaeetus leucocephalus*	E	T
Little blue heron	*Egretta caerulea*	SSC	-
Snowy egret	*Egretta thula*	SSC	-
Roseate spoonbill	*Ajaia ajaia*	SSC	-
White ibis	*Eudocimus albus*	SSC	-

GFC	Florida Game and Fresh Water Fish Commission
USFWS	U. S. Fish and Wildlife Service
E	Endangered
T	Threatened
T(S/A)	Threatened / Similarity of Appearance
SSC	Species of Special Concern

The proposed management plan includes features which will continue the use of the salt marsh area by the above listed species and improve conditions (hydrological conditions, tidal closed loop ditches, ponds, etc.). In addition, better management of the existing salt marsh, creation of salt marsh habitat, creation of tidal creeks and ponds and the removal of exotic nuisance vegetation will improve the ecological condition of the project site.

Water Quality

Water quality sampling was conducted on three separate occasions in Impoundment 24, Impoundment 25, and the Indian River Lagoon. Attached is a map locating the sampling stations. The table below lists the results of the sampling.

DATE	STATION	TEMP. (°C)	SALINITY (‰)	CONDUCTIVITY (μhos/cm)	D.O. (mg/l)
5/22/97*	IMPT. 24	32.5	14	23800	3.5
5/22/97*	IMPT. 25	33.6	18	32000	3.5
5/22/97*	I.R. LAGOON	32.4	17.5	31500	8.8
6/23/97	IMPT. 24	31.1	18.5	30000	0.6
6/23/97	IMPT. 25	35.0	23	40200	4.5
6/23/97	I.R. LAGOON	32.7	32.7	34000	7.7
7/8/97*	IMPT. 24	30.2	18.8	34000	0.7
7/8/97*	IMPT. 25	31.1	16.5	28000	0.9
7/8/97*	I.R. LAGOON	33.0	17.8	30000	4.5

* Low tide conditions (water in Impoundment 24 visually observed to be higher)

It should be noted that for these sampling periods, only the Indian River Lagoon met the state minimum water quality standard for dissolved oxygen (5 mg/l) and that the dissolved oxygen levels for the impoundments were similar even though the tidal breaches in the dike are different and tidal (hydrological) influences are different.

Soils

The subject property contains three soil types as mapped by the SCS (NRCS) on Sheet 29 of the Indian River County Soil Survey (see soils map). These soil types, McKee mucky clay, Riomar clay loam, and Boca fine sand, are described below:

McKee mucky clay loam
This soil is level, very poorly drained, and is associated with mangrove islands and swamps. The soil formed in unconsolidated loamy or clayey deposits and is inundated by fluctuating tides. Typically, the surface layer is mucky clay loam about 1 inch thick. The underlying material is a clay loam about 15 inch thick, a sandy clay to a depth of about 60 inches and a sandy loam to a depth of about 80 inches. Most layers are very fluid when squeezed. Under natural conditions, this soil remains saturated. The natural fertility is high for salt water-tolerant plants.

Riomar clay loam
This soil is nearly level and frequently flooded. It occurs in mangrove swamps adjacent to the Indian River Lagoon. This soil formed in loamy or clayey tidal deposits that are underlain with limestone. Tidal water inundates most of these areas at high tide. Typically, the surface layer is clay loam that has few to common pockets of muck about 8 inches thick. The substratum extends from 20 to 40 inches thick consisting of an upper 7 inches of clay loam and a lower 10 inches of sandy loam. Below that is hard bedrock. Under natural conditions, this soil remains saturated. Fluctuating water levels overwash the surface. The natural fertility is high for salt water-tolerant plants.

Boca fine sand
This soil is nearly level and poorly drained. Typically, the surface is fine sand about 7 inches thick. The subsurface is fine sand to a depth of about 20 inches. The subsoil is fine sandy loam to a depth of 24 inches. Below that is a layer of fractured limestone. In most years, under natural conditions, the water table is within a depth of 10 inches for 2 to 4 months. Natural fertility and the organic content are low.

IV. SALT MARSH MANAGEMENT

The purpose of this section is provide an overview of the types of methods used to manage salt marshes for a variety of ecological goals including reduction of mosquito production. Over the course of approximately 17 years there have been many discussions about salt marsh management through a working committee established to resolve management conflicts, the Subcommittee on Managed Marshes (SOMM). The work of this committee has resulted in an evaluation of marsh management through the review and application of research in the various mosquito control districts. The application has resulted in initiatives by mosquito control districts and state and federal agencies as well as cooperative efforts between private landowners and the mosquito control districts. The recognition of the importance of salt marshes to the lagoon has been heightened in part by this process not only for research and application of salt marsh management, but also for the need for government agencies to purchase privately held marshes.

Numerous papers by Carlson, O'Bryan, Gilmore, Rey, and others have been published discussing the various techniques of salt marsh management and the effects of these techniques on water quality and wildlife resources. Some of the papers are listed with this report.

Salt marsh management to date has included five basic management strategies: year round flooding by pumping, seasonal flooding, no flooding, open with breached dikes, and utilization for waste water retention. Rotary ditching may also be used in conjunction with these management strategies. The SOMM has stressed the importance of making decisions based on local research and local conditions to implement a salt marsh management strategy or plan. The proposed plan has been reviewed by the SOMM and letters of comments submitted to the SOMM are included. The basic plan has not been altered since the presentation, except that a more detailed plan was developed for salt marsh creation in the Brazilian pepper and hammock areas. This plan was reviewed by IRMCD and their suggestions were incorporated into the plan. Breaches were added at the west ends of the impoundments to provide better water circulation and exchange of organisms. The breaches are designed with 18 inch culverts at a +0.5 invert elevation to follow the IRMCD recommendations concerning water retention and water movement across the salt marsh. The culverts are used to preserve IRMCD access to the 30-inch flap gate culverts.

The proposed management plan is best described as open marsh management with limited rotary ditching. Rotary ditching is planned in the maintenance of the existing ditches and creation of a shallow pond with closed loop ditches. The rotary ditching concept is included in the creation of the tidal creeks/runnels with shallow ponds and sills. In addition, the grade of the created marsh was designed to minimize or eliminate the need for rotary ditching or some other technique, including the use of pesticides, after project completion. The proposed management plan uses natural forces to improve and create a near-natural environmental condition that will benefit the Indian River Lagoon and salt marsh within the project area.

Wolfe (1996) discusses open marsh water management (OMWM) and its effects on selected tidal marsh resources. It appears that both positive and negative effects occur with negative effects being associated with ditching and spoil mounding. East Volusia County Mosquito Control District has conducted research on the effects of ditching and rotary ditching on high salt marshes. Their findings and review of literature indicate that the effectiveness of rotary ditching outweighs the impacts to the environment of repeated larvicide applications or impounding (cited Resh and Balling, 1983). The expanded tidal flow provided by the ditches increases the diversity of fish communities. The construction of tidal creeks to allow larvivorous fishes access to mosquito larvae is a viable alternative to salt marsh impoundment and "in the long run provides the most effective, environmentally sound method of mosquito control". Sills in potholes (or shallow ponds) and ditches maintain water in these features and also sustained a reservoir for fishes and allowed fish to pass over the sills to repopulate dried out areas. Wolfe's (1996) concluding remarks state "that OMWM is a *concept* whose primary goal is to control mosquitoes with no adverse effects to other associated resources, but can be integrated into a larger management scheme to enhance selected tidal marsh resources". However, the objective of the proposed mitigation plan is the reverse, to protect existing functioning systems, create a functioning salt marsh, restore impacted resources using the natural forces with a minimum of structural features while at the same time addressing the need to reduce mosquito production, and in this case to reduce the dependency on pesticide applications. The use of adulticides such as Baytex and Dibrom have a wider effect on invertebrates, not just mosquitoes, and therefore pose a greater potential threat to the environment (East Volusia Mosquito Control District). The proposed plan uses "natural" means as techniques to reduce the use of pesticides and control the production of mosquitoes. The natural means such as creek creation using the rotary ditcher and ponds will create habitat and enhance existing habitat conditions in the salt marsh.

V. PROPOSED MITIGATION BANK PLAN AND CONSTRUCTION

Proposed Mitigation Plan

The proposed bank consists of:

- Restoring and improving ecological conditions in an existing salt marsh that has been impacted by ditching, diking, and hydrology alteration
- Creating salt marsh from severely disturbed areas and uplands
- Improving the control of salt marsh mosquito production using ecological management techniques
- Preserving existing wetland and open water areas
- Placing the entire property within a conservation easement/donating to the St. Johns River Water Management District, Indian River County, or other non-profit entity

The following is a discussion of each of the plan elements listed above:

Restoring and improving ecological conditions in an existing salt marsh

This involves:

1. removing an existing perimeter and interior dikes by the removal of Brazilian pepper and lowering the dike to salt marsh elevation,
2. installing tidal breaches to improve tidal influence and tidal replication in existing and created salt marsh
3. installing tidal culverts with flap gates, erecting sills in existing ditches to reduce the drainage effect the ditches have on the salt marsh.

Creating salt marsh from severely disturbed areas and uplands

This involves:

1. removing Brazilian pepper from the disturbed areas and perimeter and interior dikes,
2. grading the area to salt marsh, tidal pond, tidal creek elevations,
3. removing vegetation and grading uplands to salt marsh, tidal pond, and tidal creek elevations.

Improving the control of salt marsh mosquito production by reducing or eliminating the application of pesticides using ecological management techniques

This involves:

1. maintenance excavation of certain existing mosquito control ditches using a rotary ditcher,
2. excavating new closed loop mosquito control ditches and small ponds which will serve as fish reservoir,
3. designing proposed salt marsh, tidal ponds, and tidal ditches to provide habitat and also to reduce future mosquito control rotary ditching or other techniques including pesticide applications,
4. installing tidal culverts with flap gates and tidal breaches to improve access for marine organisms making up the food chain that supports a balanced salt marsh conducive to natural conditions which, in turn, assist in the control of mosquito production.

Preserving existing wetland and open water areas

These areas include the tidal ditches, wetlands and open water north of Impoundment 25, south of Impoundment 24, and between Impoundments 24 and 25.

Construction Schedule

Construction will take place in the following sequence:

1. install turbidity curtains at breaches and old culvert locations and install silt screens along perimeter of salt marsh creation sites and perimeter of perimeter dikes
2. remove vegetation in the Brazilian pepper and hammock areas in the west portion of Impoundments 24 and 25

3. remove Brazilian pepper from Impoundments 24 and 25 perimeter dike
4. grade areas to salt marsh elevation
5. perform ditch maintenance in Impoundment 24 with rotary ditcher
6. perform closed loop ditch excavation and pond creation in Impoundment 24
7. excavate tidal creek and ponds in created salt marsh in Impoundments 24 and 25
8. grade Impoundment 24 perimeter dike to salt marsh elevation, excavate breaches, and install 30-inch culverts
9. grade Impoundment 25 perimeter dike to salt marsh elevation, excavate breaches, and install 30-inch culverts
10. remove turbidity curtains (silt screens to remain in place until vegetation has colonized the areas)

Construction access to certain sections of the Impoundment 25 perimeter dike may be accomplished by traversing some of the interior dikes. The proposed creeks will be excavated to the elevation indicated on the drawings. In the event dense shell or rock is encountered, the creeks will be excavated to the elevation of the shell or rock which is expected to be lower than 0.0 feet, a subtidal elevation.

It is anticipated that all construction will be completed within a 6 to 12 month period. Additional rotary ditching may be required in Impoundment 25 existing salt marsh for 2 to 3 years following the completion of the above referenced construction schedule. IRMCD does not anticipate this to exceed 7500 linear feet of rotary ditches with the locations and configuration to be determined at that time. Because mosquito breeding has not generally been a problem in the existing salt marsh in Impoundment 25, and because of the project design and improved hydrological conditions and fish reservoirs, this rotary ditching is not expected to be necessary.

Monitoring

Monitoring will be conducted for a period of 5 years which will coincide with the ERP and USACOE dredge and fill permits and the expected period to sell the Mitigation Credits. The salt marsh is likely to be functioning normally in that 5 year period. This projection is based on the success rates achieved at the salt marsh created at three projects within Indian River County over the past ten years. These projects include Grove Isle, Copeland's Landing and Grand Harbor. The former two projects were planned and completed by Carter Associates, Inc. and Environmental Consulting Group, Inc.

Monitoring will consist of two semiannual reports, one winter and one summer report. The winter report will be conducted in January - February. The summer report will be conducted in August - September. All reports will be prepared and submitted within 30 days of sampling and will include the following:

1. the project name and respective file number
2. the date of the sampling
3. persons conducting the sampling and preparing the report
4. maps, tables and charts detailing sampling stations/transects and data, etc.
5. photographs taken at permanent photograph stations
6. summary of work completed and corrective steps taken to ensure compliance
7. weather and hydrologic (tidal) conditions
8. summary of observed wildlife

The winter report will be a qualitative report identifying overall vegetative conditions and wildlife use of the area along the transects and adjacent areas.

The summer report will be a quantitative report using transects and quarter meter plots for herbaceous areas and belt transects for forested areas to determine the following:

1. percent total vegetative cover
2. percent cover by species
3. percent cover by nuisance, non-desirable species

Wildlife observations will be performed on a quarterly basis and will be made from permanent stations at various locations during the morning and late afternoon for a predetermined time period at each station. Two of the quarterly observations will coincide with the semiannual report periods. All transect beginning and ending points will be permanently marked.

VI. MODIFIED WETLAND RAPID ASSESSMENT PROCEDURE

The subject property offers two types of development under the "without bank condition" scenario. CGW has considered the potential use of the property and the anticipated future nearby land uses. The nearby areas west of Indian River Boulevard are developing into health care facilities including doctors offices and congregate living facilities. It is therefore possible that a commercial/medical facility could be developed on the west portion of the property using the areas vegetated by oak hammock and Brazilian pepper. This would also include salt marsh areas situated between the areas vegetated by Brazilian pepper.

The second type of development is a single family subdivision located at the northeast portion of the property fronting the Indian River Lagoon. The section of the property abuts Grand Harbor, a residential development. Road access would be available at 45th Street at the northwest corner of the property. The development would use the perimeter dike, but would also extend into the adjacent perimeter ditch and salt marsh. The waterfront amenity makes this a very desirable location for a development.

The "with bank condition" scenario includes the proposed mitigation bank as described above.

Impoundment 24

Brazilian Pepper

1. Wildlife Utilization

a. Without bank condition
The Brazilian pepper area is planned for development of medical/commercial facilities. The area is significantly invaded by an exotic and nuisance species to the extent that little or no ground cover occurs. Wildlife use by wetland dependent species is considered to be extremely low to almost non-existent. In a developed condition the area best fits the description for the score 0.

b. With bank condition
The bank proposal includes the creation of tidal salt marsh, tidal creeks, and tidal ponds. Wildlife use is anticipated to be abundant, including marsh resident and transient fish species, wading birds, and small mammals. The design of the created salt marsh has taken into consideration the need to minimize mosquito production and reduce the use of pesticide applications. This will positively affect wildlife by reducing/eliminating sprays which could affect non-target species. Also, sills are included in the creek design to hold water in the ponds and creeks. This will create a reservoir for fish species and provide foraging areas for wading birds. Some of the fish species will prey upon insect larvae, thereby reducing mosquito production and potentially the use of pesticides. This condition best fits the description for a score of 3.

2. Vegetation Matrix

a. Without Bank Condition
The site is extensively vegetated by an exotic and nuisance species. Either a developed or non-developed condition would warrant a score of 0.

b. With Bank Condition
The proposed plan includes the removal of the exotic and nuisance species and the grading to existing adjacent marsh elevations. This condition will be very conducive to the natural recruitment of salt marsh species. This condition best fits a score of 3.

3. Hydrology

a. Without Bank Condition
The area is within a dike area. The dike has impaired the effects of tidal influence to some degree and obstructed sheet flow of runoff from more landward areas. The ground elevation is slightly higher in some areas than the adjacent salt marsh. Either a developed or non-developed condition would warrant a score of 0.

b. With Bank Condition
The proposed plan includes the grading of land to adjacent salt marsh elevations and the excavation of creeks and ponds to tidal elevations. These tidal bodies will be connected to other waterbodies which are tidally connected to the Indian River Lagoon. Sills are included in the creek design to hold water during certain periods in the creeks and ponds. The hydrology will be restored to natural conditions. This description best fits a score of 3.

4. Water Quality

a. Without Bank Condition
The proposed land use is commercial/medical and is assigned a land use score of 0. The treatment category would probably be a combination of grass swales and dry retention and would therefore be assigned a score of 2. The combined score of land use and treatment category is $(0+2)\div 2=1$.

b. With Bank Condition
The proposed land use is open space and the treatment category is natural undeveloped areas; both have a score of 3. The combined score is $(3+3)\div 2=3$.

Oak Hammock

1. Wildlife Utilization

a. Without Bank Condition
The hammock is an upland and does not provide habitat for wetland dependent species. The hammock is surrounded by Brazilian pepper which does not offer good quality habitat as a transitional/buffer zone. The area would be completely developed by medical/commercial facilities that would not provide wildlife habitat, therefore a score of 0 is assigned.

b. With Bank Condition
A tidal salt marsh with tidal creek and ponds are to be created in this area. Wildlife use and mosquito production reduction measures are described above for the Brazilian pepper area. For these reasons a score of 3 is assigned to proposed bank condition.

2. Vegetation Matrix

a. Without Bank Condition
The hammock is an upland and would be developed into a medical/commercial facility. The area would be in a landscaped condition providing isolated plots of vegetation. A score of 0 is assigned to this land use where wetland overstory/shrub canopy, trees, or other significant vegetative cover is essentially non-existent.

b. With Bank Condition
The proposed plan includes the creation of a salt marsh in the vicinity of and adjacent to an existing created salt marsh. This condition will be very conducive to the natural recruitment of salt marsh species. This condition best fits a score of 3.

3. Hydrology

a. Without Bank Condition
The oak hammock is an upland and will be developed into a medical/commercial facility. A score of 0 is assigned to this type land use without wetland hydrology.

b. With Bank Condition
The proposed plan includes the grading of land to adjacent salt marsh elevations and the excavation of creeks and ponds to tidal elevations. These tidal bodies will be connected to other waterbodies which are tidally connected to the Indian River Lagoon. Sills are included in the creek design to hold water under certain periods in the creeks and ponds. The hydrology will be restored to natural conditions. This description best fits a score of 3.

4. Water Quality

a. Without Bank Condition
The proposed land use is commercial/medical and is assigned a land use score of 0. The treatment category would probably be a combination of grass swales and dry retention and would therefore be assigned a score of 2. The combined score of land use and treatment category is $(0+2)\div 2=1$.

b. With Bank Condition
The proposed land use is open space and the treatment category is natural undeveloped areas; both have a score of 3. The combined score is $(3+3)\div 2=3$.

Perimeter Dike

1. Wildlife Utilization

a. Without Bank Condition
The perimeter dike is an upland vegetated by Brazilian pepper and is not planned for development. Certain bird species may use the dike for loafing while traveling to other sites but it is not considered to be habitat that wetland species would depend upon for continued survival. The area is heavily impacted with exotic and

nuisance species. Because of the relatively high ground elevations, it is unlikely that the area is habitat for wetland dependent species, therefore a score of 0 best fits this area.

b. With Bank Condition
The perimeter dike is to be graded to salt marsh elevations. The proximity to the Indian River Lagoon and to a perimeter ditch results in a wetland habitat along aquatic habitat. The wetland habitat edge is anticipated to be a productive community for a variety of wetland species. This area best fits a score of 3.

2. Vegetation Matrix

a. Without Bank Condition
This area is not planned for development and would remain in its current condition, an area severely invaded by Brazilian pepper. A score of 0 fits the description of this community.

b. With Bank Condition
The perimeter dike is to be graded to salt marsh elevations. The proximity to the Indian River Lagoon and to salt marshes will aide in natural recruitment of native salt marsh species. The elevations will ensure that the area is not invaded by exotic or nuisance species and that salt marsh species will continue to exist. The description of this area best fits a score of 3.

3. Hydrology

a. Without Bank Condition
The area is an upland created from spoil placement. The ground elevation is above normal tide levels. Wetland hydrology is, therefore, lacking. The description of this area best fits a score of 0.

b. With Bank Condition
The perimeter dike is to be graded to salt marsh elevations. The proximity to the Indian River Lagoon and a tidal perimeter ditch will ensure wetland hydrology. The elevations are within the seasonal tidal range for this area of the Indian River Lagoon. The description of this area best fits a score of 3.

4. Water Quality

a. Without Bank Condition
The perimeter dike is not included in the development plan. It is open space and is assigned a land use score of 3. The treatment category is natural undeveloped areas and is assigned a score of 3. The combined score is (3+3)÷2=3.

b. With Bank Condition
The perimeter dike is open space and is assigned a land use score of 3. The treatment category is natural undeveloped areas and is assigned a score of 3. The combined score is (3+3)÷2=3.

<u>Perimeter Ditch</u>

1. Wildlife Utilization

a. Without Bank Condition
The perimeter ditch is not included in the development plan. The ditch provides habitat for transient fish species and, during low water periods, for marsh resident species. The import and export of fish species within the lagoon is limited to periods that the perimeter dike breach is topped. The elevation at the breach is +1.0± foot, higher than the mean high water elevation. This elevation acts as a weir restricting movement of species in and out of the impoundment. Wading bird species forage along the fringe of the perimeter ditch and may roost on the bordering mangrove trees. The Brazilian pepper canopy on the adjacent perimeter dike may adversely affect the use of the area by wildlife species. An overall score of 1.5 best fits the description of this area.

b. With Bank Condition
Wildlife use of the area will benefit from Brazilian pepper removal, perimeter dike grading, breaches and two culverts. Culverts set at -1.0 foot elevation will allow transport of lagoon species at all times except when tides recede and the attached flap gate closes. However, species can use the breaches which are set at +0.5' elevation when tidal conditions allow. This condition is better than the existing breach with a +1.0± foot

elevation. The perimeter ditch is anticipated to be a significant habitat for fish species. The description of this area best fits a score of 3.

2. Vegetation

a. Without Bank Condition
The perimeter ditch does not have any observed submerged aquatic vegetation. Vegetation occurs along the perimeter. Extensive salt marsh vegetation extends toward the interior portion of Impoundment 24. The presence of a perimeter dike vegetated extensively by Brazilian pepper canopy may affect one entire side of the perimeter ditch. The description of this area best fits a score of 2.

b. With Bank Condition
The perimeter ditch vegetative condition will be improved with the removal of the Brazilian pepper on the adjacent perimeter dike. The perimeter dike will be graded to salt marsh conditions which will also serve as a seed source for continued recruitment of salt marsh species rather than a potential Brazilian pepper seed source. The description of this area best fits a score of 3.

3. Hydrology

a. Without Bank Condition
The perimeter ditch has permanently standing water. The water at times is contained within the impoundment until the water rises to an elevation exceeding +1.0 foot. Water may enter or exit the impoundment at one location through a perimeter dike. The perimeter dike interferes with the perimeter ditch hydrology. The description of this site best fits a score of 2.

b. With Bank Condition
The perimeter ditch will continue to have standing water. The water movement and exchange will be improved by the installation of culverts (-1.0 foot invert elevation) and breaches (+0.5 foot elevation). The closing of the flap gate will cause water to move away from the culvert and flow toward the breaches. The description of this area best fits a score of 3.

4. Water Quality

a. Without Bank Condition
The perimeter ditch is not included in the development plan. It is open space and is assigned a land use score of 3. The treatment category is natural undeveloped areas and is assigned a score of 3. The combined score is $(3+3)\div 2=3$.

The perimeter ditch is surrounded by open space including salt marsh and perimeter dike. The water is isolated from tidal waters during periods when the lagoon level is below +1.0 foot elevation. Water exchange is presently limited to one breach (+1.0 foot elevation) in the perimeter dike. Therefore, at times the water temperature may rise and dissolved oxygen may be reduced below acceptable levels. In addition, runoff from the adjacent medical/commercial development will probably enter the perimeter ditch and adversely affect its water quality. The score should be adjusted to take these factors into consideration. The adjusted score is 2.

b. With Bank Condition
The perimeter ditch is open space and is assigned a land use score of 3. The treatment category is natural undeveloped areas and is assigned a score of 3. The combined score is $(3+3)\div 2=3$. The score of 3 is further substantiated by the water quality improvements resulting from the additional breaches and culverts allowing better water movement.

<u>Salt Marsh</u>

1. Wildlife Utilization

a. Without Bank Condition
Some of the salt marsh is included in the proposed development plan to construct a medical/commercial facility. Under this plan the remainder of the salt marsh would continue to be habitat for wildlife species. The existing perimeter dike and the singular breach impair the exchange of lagoon species and therefore diminish the habitat quality. Wading birds would forage along the edge of the perimeter. Use of the salt marsh interior would occur at times when tidal levels top the dike (+1.0 foot elevation) and flood the marsh. Inundation of the

salt marsh areas and movement of fish into the salt marsh lower than +1.0 foot would not occur. Indian River Mosquito Control (IRMCD) sprays the salt marsh with pesticides in order to control mosquito production. The pesticides may affect non-target marsh and aquatic species. Without development in the salt marsh and the IRMCD pesticide applications, this area would receive a score of 2. A score of 1.5, therefore, best fits the description of this area.

b. With Bank Condition
Fish use of the salt marsh is improved by the installation of culverts at -1.0 foot elevation to allow better access to the perimeter ditch and the areas in the marsh when levels rise to the lower levels of the salt marsh. The proposed breaches are lower than the existing breach. Wading birds will extend their foraging areas to the flooded marshes. The bank condition includes the excavation of a shallow pond and closed loop ditches. These will serve as fish reservoirs to assist in reduction of mosquito production that will minimize the need to apply pesticides. The pond and closed loop ditches will also provide habitat for wading birds in addition to fish species. A score of 3 best fits the description of this area.

2. Vegetation Matrix

a. Without Bank Condition
Some of the salt marsh is included in the proposed development plan to construct a medical/commercial facility. The vegetation would continue to exist in the remaining salt marsh. The adjacent Brazilian pepper community may be a seed source to extend into the salt marsh should hydrological conditions change because of natural conditions at the existing breach in the perimeter dike. Without the development in the east portion of the salt marsh and the potential of hydrological impairment in the future, the area would best fit the description of 2. Therefore, a score of 1.5 is given.

b. With Bank Condition
Development in the salt marsh does not occur. The adjacent Brazilian pepper is removed and the area is graded to salt marsh elevations. This eliminates a seed source for potential invasion of an exotic species. The proposed hydrological improvements ensure favorable conditions for salt marsh vegetation. A score of 2.5 best fits the description of this area.

3. Hydrology

a. Without Bank Condition
Under this condition the existing hydrological connection to the lagoon would be impaired by the mosquito control perimeter dike and a single breach at an elevation of +1.0± foot. The conditions would remain the same. These areas would not be inundated by the lagoon under these conditions. The hydrology therefore has affected these conditions. A score of 1.5 is assigned to this unit.

b. With Bank Condition
The proposed plan involves the installation of culverts at a -1.00 foot elevation and five breaches at a +0.5 foot elevation. This will allow lagoon water, when higher than these elevations, to enter the salt marsh an inundate the salt marsh. The location of the breaches and the closing of the flap gates when tidal water recedes will assist in causing more sheet flow across the marsh rather than water entering and exiting at one point. A score of 2.5 best fits the description of this unit.

4. Water Quality

a. Without Bank Condition
It is estimated that approximately 10% of the salt marsh would be developed into commercial/medical facilities. The proposed land use and surrounding land use is also commercial/medical and the land use score is 0. The treatment category score for grass swales with dry retention is 2. The remaining portion of the salt marsh would be preserved as open space land use and is assigned a score of 3 for both the land use and treatment category. The combination score is {[(0x10%) + (3x90%)] + [(2x10%)+(3x90%)]}÷2=2.8.

b. With Bank Condition
The salt marsh is being preserved and enhanced as open space and is assigned a score of 3 for both the land use and treatment categories. In addition, water quality improvements to the perimeter ditch and therefore to the adjacent salt marsh near the perimeter ditch is anticipated. Improved water movement across the salt marsh caused by the placement of the breaches and culverts is expected to improve water quality in the salt marsh.

Impoundment 24 Scoring Summary Table

COVER TYPE	WILDLIFE UTILIZATION		VEGETATION MATRIX		HYDROLOGY		WATER QUALITY		DELTA
	W/O	With	W/O	With	W/O	With	W/O	With	
Brazilian Pepper	0	3	0	3	0	3	1	3	0.9
Oak Hammock	0	3	0	3	0	3	1	3	0.9
Perimeter Dike	0	3	0	3	0	3	3	3	0.75
Perimeter Ditch	1.5	3	2	3	2	3	3	3	0.30
Salt Marsh	1.5	3	1.5	3	1.5	2.5	2.8	3	0.25

Brazilian Pepper

1. Wildlife Utilization

a. Without bank condition
The Brazilian pepper area is planned for development of medical/commercial facilities. The area is significantly invaded by an exotic and nuisance species to the extent that little or no ground cover occurs. The area is impacted by berms and swales. Wildlife use by wetland dependent species is considered to be extremely low to almost non-existent. In a developed condition the area best fits the description for the score of 0.

b. With bank condition
The bank proposal includes the creation of tidal salt marsh, tidal creeks, and tidal ponds. Wildlife use is anticipated to be abundant, including marsh resident and transient species, wading birds, and small mammals. The design of the created salt marsh has taken into consideration the need to minimize mosquito production and reduce the use of pesticide applications. This will positively affect wildlife by reducing/eliminating sprays which could affect non-target species. Also sills are included in the creek design to hold water in the ponds and creeks. This will create a reservoir for fish species and provide foraging areas for wading birds. Some of the fish species will prey upon insect larvae, thereby reducing mosquito production and potentially reducing the use of pesticides. This condition best fits the description for a score of 3.

2. Vegetation Matrix

a. Without Bank Condition
The site is extensively vegetated by an exotic and nuisance species. Either a developed or non-developed condition would warrant a score of 0.

b. With Bank Condition
The proposed plan includes the removal of the exotic and nuisance species and grading to existing adjacent marsh elevations. This condition will be very conducive to the natural recruitment of salt marsh species. This condition best fits a score of 3.

3. Hydrology

a. Without Bank Condition
The area is within a dike area. The dike has impaired the effects of tidal influence to some degree and obstructed sheet flow of runoff from more landward areas. The ground elevation is slightly higher in some areas than the adjacent salt marsh. Berms and swales have altered the hydroperiod of this area. Either a developed or non-developed condition would warrant a score of 0.

b. With Bank Condition
The proposed plan includes the grading of land to adjacent salt marsh elevations and the excavation of creeks and ponds to tidal elevations. These tidal bodies will be connected to other waterbodies which are tidally connected to the Indian River Lagoon. Sills are included in the creek design to hold water under certain periods in the creeks and ponds. The hydrology will be restored to nearly natural conditions. This description best fits a score of 3.

4. Water Quality

a. Without Bank Condition
The proposed land use is commercial/medical and is a assigned as land use score of 0. The treatment category would probably be a combination of grass swales and dry retention and would therefore be assigned a score of 2. The combined score of land use and treatment category is $(0+2)\div 2=1$.

b. With Bank Condition
The proposed land use is open space and the treatment category is natural undeveloped areas; both have a score of 3. The combined score is $(3+3)\div 2=3$.

Oak Hammock

1. Wildlife Utilization

a. Without Bank Condition
The hammock is an upland and does not provide habitat for wetland dependent species. The hammock is surrounded by Brazilian pepper which does not offer good quality habitat as a transitional/buffer zone. The area would be completely developed by medical/commercial facilities that would not provide wildlife habitat, therefore a score of 0 is assigned.

b. With Bank Condition
A tidal salt marsh with tidal creek and ponds are to be created in this area. Wildlife use and mosquito production reduction measures are described above for the Brazilian pepper area. For these reasons a score of 3 is assigned to proposed bank condition.

2. Vegetation Matrix

a. Without Bank Condition
The hammock is an upland and would be developed into a medical/commercial facility. The area would be in a landscaped condition providing isolated plots of vegetation. A score of 0 is assigned to this land use where wetland overstory/shrub canopy, trees, or other significant vegetative cover is essentially non-existent.

b. With Bank Condition
The proposed plan includes the creation of a salt marsh, as described above, in the vicinity of and adjacent to an existing created salt marsh. This condition will be very conducive to the natural recruitment of salt marsh species. This condition best fits a score of 3.

3. Hydrology

a. Without Bank Condition
The oak hammock is an upland and will be developed into a medical/commercial facility. A score of 0 is assigned to this type land use.

b. With Bank Condition
The proposed plan includes the grading of land to adjacent salt marsh elevations and the excavation of creeks and ponds to tidal elevations. These tidal bodies will be connected to other waterbodies which are tidally connected to the Indian River Lagoon. Sills are included in the creek design to hold water under certain periods in the creeks and ponds. The hydrology will be restored to nearly natural conditions. This description best fits a score of 3.

4. Water Quality

a. Without Bank Condition
The proposed land use is commercial/medical and is a assigned as land use score of 0. The treatment category would probably be a combination of grass swales and dry retention and would therefore be assigned a score of 2. The combined score of land use and treatment category is $(0+2)\div 2=1$.

b. With Bank Condition
The proposed land use is open space and the treatment category is natural undeveloped areas; both have a score of 3. The combined score is $(3+3)\div 2=3$.

Perimeter Dike

1. Wildlife Utilization

a. Without Bank Condition
The perimeter dike is an upland vegetated by Brazilian pepper and is planned for development (single family residential). The area is heavily impacted with exotic and nuisance species. Because the proposed development conditions and the existing perimeter are unlikely to provide habitat for wetland-dependent species, a score of 0 best fits this area.

b. With Bank Condition
The perimeter dike is to be graded to salt marsh elevations. The proximity to the Indian River Lagoon and to a perimeter ditch results in a wetland habitat along aquatic habitat. The wetland habitat edge is anticipated to be a productive community for a variety of wetland species. This area best fits a score of 3.

2. Vegetation Matrix

a. Without Bank Condition
This area is planned for development (single family residential). The area which is severely invaded by Brazilian pepper would be replaced by a landscaped condition. A score of 0 fits the description of this community.

b. With Bank Condition
The perimeter dike is to be graded to salt marsh elevations. The proximity to the Indian River Lagoon and to salt marshes will aid in natural recruitment of native salt marsh species. The elevations will ensure that the area is not invaded by exotic or nuisance species and that salt marsh species will continue to exist. The description of this area best fits a score of 3.

3. Hydrology

a. Without Bank Condition
The area is an upland created from spoil placement. The ground elevation is above normal tide levels. Wetland hydrology is therefore lacking. The description of this area best fits a score of 0.

b. With Bank Condition
The perimeter dike is to be graded to salt marsh elevations. The proximity to the Indian River Lagoon and a tidal perimeter ditch will ensure wetland hydrology. The elevations are within the seasonal tidal range for this area of the Indian River Lagoon. The description of this area best fits a score of 3.

4. Water Quality

a. Without Bank Condition
It is estimated that approximately 2/3 or 66.6% of the perimeter dike would be developed into single family residential subdivision and would be assigned a land use score of 2 and a treatment category score of 2.5. The remaining undeveloped section (1/3 or 33.3%) would be assigned a land use and treatment category score of 3. The combined score is $\{[(2x66\%) + (3x33\%)]+[(2.5x66\%) + (3x33\%)]\}\div 2 = 2.4$

b. With Bank Condition
The perimeter dike will be open space and is assigned a score of 3 for both the land use and treatment categories. The combined score is 3.

<u>Interior Dike</u>

1. Wildlife Utilization

a. Without Bank Condition
The interior dike is an upland vegetated by Brazilian pepper and is not planned for development. The area is heavily impacted with exotic and nuisance species and is unlikely to be habitat for wetland dependent species. A score of 0 best fits this area.

b. With Bank Condition
The interior dike is to be graded to salt marsh elevations. The proximity to adjacent salt marsh and to a tidal ditch results in a wetland habitat along aquatic habitat. The wetland habitat edge is anticipated to be a productive community for a variety if wetland species. This area best fits a score of 3.

2. Vegetation Matrix

a. Without Bank Condition
This area is partially planned for development (single family residential). The area is severely invaded by Brazilian pepper. A score of 0 fits the description of this community.

b. With Bank Condition
The interior dike is to be graded to salt marsh elevations. The proximity to an adjacent tidal ditch and to salt marsh will aid in natural recruitment of native salt marsh species. The elevations will ensure that the area is not invaded by exotic or nuisance species and that salt marsh species will continue to exist. The description of this area best fits a score of 3.

3. Hydrology

a. Without Bank Condition
The area is an upland created from spoil placement. The ground elevation is above normal tide levels. Wetland hydrology is therefore lacking. The description of this area best fits a score of 0.

b. With Bank Condition
The interior dike is to be graded to salt marsh elevations. The proximity to the Indian River Lagoon and a tidal ditch will ensure wetland hydrology. The elevations are within the seasonal tidal range for this area of the Indian River Lagoon. The description of this area best fits a score of 3.

4. Water Quality

a. Without Bank Condition
It is estimated that approximately 20% of the interior dike would be developed into commercial/medical facility or single family residential subdivision. The scores are given according to the development type and averaged to give a combination score. The commercial/medical facility is assigned a land use score of 0 and a treatment category score of 2. The single family subdivision is assigned a score for the land use and treatment category of 2 and 2.5, respectively. The remaining undeveloped section is assigned a land use and treatment category score of 3. The combined score for the commercial/medical facility is 2.6 and for the single family subdivision is 2.85. The average score is 2.75.

b. With Bank Condition
The interior dike will be open space and is assigned a score of 3 for both the land use and treatment categories. The combined score is 3.

<u>Perimeter Ditch</u>

1. Wildlife Utilization

a. Without Bank Condition
The perimeter ditch is included in the development plan. The Brazilian pepper canopy on the adjacent perimeter dike may adversely affect the use of the area by wildlife species. The development of portions of the perimeter ditch will diminish the wildlife use of the area. An overall score of 1 best fits the description of this area.

b. With Bank Condition
Wildlife use of the area will benefit from Brazilian pepper removal, perimeter dike grading, four breaches and two culverts. Culverts set at -1.0 foot elevation will allow transport of lagoon species at all times except when tides recede and the attached flap gate closes. However, species can use the existing breach (improved by incorporating a design to ensure its stability) and the proposed breaches (+0.5' elevation) when tidal conditions allow. This condition is better than the existing condition of one tidal connection. The perimeter ditch is anticipated to be a significant habitat for fish species. The description of this area best fits a score of 3.

2. Vegetation

a. Without Bank Condition
The perimeter ditch does not have any observed submerged aquatic vegetation. Mangrove vegetation occurs along the perimeter. Extensive salt marsh vegetation extends toward the interior portion of Impoundment 25. The presence of a perimeter dike as well as nearby interior dikes which are both extensively vegetated by Brazilian pepper canopy may affect the perimeter ditch. A portion of the perimeter ditch will also be developed. The description of this area best fits a score of 2.

b. With Bank Condition
The perimeter ditch vegetative condition will be improved with the removal of the Brazilian pepper on the adjacent perimeter dike. The perimeter dike will be graded to salt marsh conditions which will also serve as a seed source for continued recruitment of salt marsh species rather than a potential Brazilian pepper seed source. The description of this area best fits a score of 3.

3. Hydrology

a. Without Bank Condition
The development plan includes the construction of a single family residential subdivision. The development plan will likely include a tidal connection to the adjacent salt marsh; however, the remaining ditch section will be negatively affected by the proposed development and by any remaining existing perimeter dike which will interfere with the perimeter ditch hydrology. The description of this site in a developed condition best fits a score of 1.5.

b. With Bank Condition
The perimeter ditch will continue to have standing water. The water movement and exchange will be improved throughout the ditch length by the installation and spacing of culverts (-1.0 foot invert elevation), improvement of the existing breach, and new breaches (+0.5 foot elevation). In addition, seasonal and storm tides will flow over the area now occupied by a mosquito control perimeter dike (graded to a +1.0 foot elevation). The description of this area best fits a score of 3.

4. Water Quality

a. Without Bank Condition
It is estimated that approximately 2/3 or 66.6% of the perimeter ditch would be developed into single family residential subdivision and would be assigned a land use score of 2 and a treatment category score of 2.5. The remaining undeveloped section (1/3 or 33.3%) would be assigned a land use and treatment category score of 3. The combined score is $\{[(2x66\%) + (3x33\%)]+[(2.5x66\%) + (3x33\%)]\}\div 2 = 2.4$

b. With Bank Condition
The perimeter ditch will be open space and is assigned a score of 3 for both the land use and treatment categories. The combined score is 3. In addition, the perimeter ditch will be surrounded by open space including salt marsh. The adjacent perimeter dike will be graded to salt marsh elevations. Breaches and culverts as previously described will be provided to facilitate the exchange and movement of water in the perimeter ditch. The spacing of the culverts and breaches are at distances previously suggested by the Governor's Subcommittee on Managed Marshes to assist in improving water quality conditions within perimeter ditches. The description of this area best fits a score of 3.

Interior Ditch

1. Wildlife Utilization

a. Without Bank Condition
A portion of the interior ditches is included in the development plan. The interior ditches presently connect to the perimeter ditch which is included in the plan for a single family residential development; therefore its tidal connection will be impaired. Fish species will continue to use the ditch as habitat. The interior ditch provides habitat for transient fish species and, during low water periods, for marsh resident species. The import and export of fish species with the lagoon will be impaired. Wading bird species forage along the fringe of the interior ditch and may roost on the bordering mangrove trees. The Brazilian pepper canopy on the adjacent interior dike may adversely affect the use of the area by wildlife species. An overall score of 1 best fits the description of this area.

b. With Bank Condition
Wildlife use of the area will benefit from Brazilian pepper removal, the interior and perimeter dike grading, breaches and two culverts. Culverts set at -1.0 foot elevation will allow transport of lagoon species at all times except when tides recede and the attached flap gate closes. However, species can use the existing breach (improved by incorporating a design to ensure its stability) and the proposed breaches (+0.5' elevation) when tidal conditions allow. This condition is better than the existing condition of one tidal connection. The perimeter ditch is anticipated to be a significant habitat for fish species. The description of this area best fits a score of 3.

2. Vegetation

a. Without Bank Condition
The interior ditches do not have any observed submerged aquatic vegetation. Salt marsh vegetation occurs along the perimeter. Extensive salt marsh vegetation extends toward the interior portion of Impoundment 25. The presence of a perimeter dike as well as nearby interior dikes which are both extensively vegetated by Brazilian pepper may affect the interior ditch. The description of this area best fits a score of 2.

b. With Bank Condition
The interior ditch vegetative condition will be improved with the removal of the Brazilian pepper on the adjacent interior dike. The interior dike will be graded to salt marsh conditions which will also provide a seed source for continued recruitment of salt marsh species rather than a potential Brazilian pepper seed source. Some of the interior ditches will be filled to salt marsh elevations. Recruitment by salt marsh vegetation is ensured by the proximity of adjacent salt marsh vegetation. The description of this area best fits a score of 3.

3. Hydrology

a. Without Bank Condition
The development plan includes the construction of a single family residential subdivision in the interior and perimeter ditches. The development plan will likely include a tidal connection to the adjacent salt marsh; however, the remaining perimeter ditch section (some of which will be isolated) will be negatively affected by the proposed development and any remaining existing perimeter dike will interfere with the perimeter ditch hydrology and therefore the interior ditch hydrology. The description of this site in a developed condition best fits a score of 1.

b. With Bank Condition
The interior ditch will continue to have standing water. The water movement and exchange will be improved throughout the interior ditch length by the installation and spacing of culverts (-1.0 foot invert elevation), improvement of the existing breach, new breaches (+0.5 foot elevation) in the perimeter ditch and removal of the interior dikes. In addition, seasonal and storm tides will flow over the area now occupied by a mosquito control perimeter dike (graded to a +1.0 foot elevation). The description of this area best fits a score of 3.

4. Water Quality

a. Without Bank Condition
It is estimated that approximately 20% of the interior ditch would be developed into commercial/medical facility or single family residential subdivision. The scores are given according to the development type and averaged to give a combination score. The commercial/medical facility is assigned a land use score of 0 and a treatment category score of 2. The single family subdivision is assigned a score for the land use and treatment category of 2 and 2.5, respectively. The remaining undeveloped section is assigned a land use and treatment category score of 3. The combined score for the commercial/medical facility is 2.6 and the single family subdivision is 2.85. The average score is 2.75. At times the water temperature may rise and dissolved oxygen may be reduced below acceptable levels. In addition, runoff from the medical/commercial development on the west side of the area will probably enter the interior ditches and adversely affect its water quality. Therefore, an adjusted score of 2 best fits the description of the interior ditch.

b. With Bank Condition
The interior ditch will be open space and is assigned a score of 3 for both the land use and treatment categories. The combined score is 3.

<u>Salt Marsh</u>

1. Wildlife Utilization

a. Without Bank Condition
The salt marsh is included in the proposed development plan to construct a medical/commercial facility and a single family residential subdivision. The remaining portion of the salt marsh will continue to be dissected by interior dikes. Under this plan the diminished area of salt marsh would be habitat for wildlife species. The proposed single family subdivision would impair the exchange of lagoon species and therefore further diminishes the habitat quality. Wading birds would forage along the edge of the remaining interior ditches.

Without the development in the salt marsh this area would receive a score of 2. A score of 1.5 therefore best fits the description of this area.

b. With Bank Condition
Fish use of the salt marsh is improved by the installation of culverts at -1.0 foot elevation to allow better access to the perimeter ditch and the areas in the marsh when levels rise to the lower levels of the salt marsh. The proposed additional breaches will assist in the exchange of lagoon species. Construction of sills at each end of the interior ditches will reduce the draw-down effect of the ditches on the salt marsh and will retain water on the marsh for longer periods than currently occurs. Wading birds will extend their foraging areas and marsh fish species will inhabit the flooded marshes. A score of 3 best fits the description of this area.

2. Vegetation Matrix

a. Without Bank Condition
The salt marsh is included in the proposed development plan to construct a medical/commercial facility and single family subdivision. The remaining salt marsh vegetation would continue to exist; however, some changes may occur because of hydrology alteration. Brazilian pepper from the adjacent community and interior dikes may be a seed source to extend into the salt marsh. A score of 1 best fits the description of the salt marsh after development.

b. With Bank Condition
Development in the salt marsh does not occur. The adjacent Brazilian pepper is removed and the area is graded to salt marsh elevations. This eliminates a seed source for potential invasion of an exotic species. The proposed hydrological improvements ensure favorable conditions for salt marsh vegetation. A score of 3 best fits the description of this area.

3. Hydrology

a. Without Bank Condition
Under this condition the existing hydrological connection to the lagoon would be impaired by the proposed single family subdivision and any remaining mosquito control perimeter dike and interior dike. The segmented salt marsh (between interior dikes and proposed development) would be essentially isolated from tidal waters. The hydrology therefore has been significantly affected by these conditions. A score of 1 is assigned to this unit.

b. With Bank Condition
The proposed plan involves the installation of culverts at a -1.00 foot elevation and breaches as previously described. This will allow lagoon water to enter the salt marsh and inundate the salt marsh at numerous locations. The location of the breaches and the closing of the flap gates when tidal water recedes will assist in causing more sheet flow across the marsh rather than water entering and existing at one point. In addition, because the perimeter dike has been lowered to salt marsh elevations (+1.0), seasonal and storm tides will not be impaired by the perimeter dike. A score of 3.0 best fits the description of this unit.

4. Water Quality

a. Without Bank Condition
It is estimated that approximately 20% of the salt marsh will be developed, of which approximately 5% will be commercial/medical and approximately 15% single family subdivision. The commercial/medical development is assigned a land use score of 0 and a treatment score of 2. The single family subdivision is assigned a land use score of 2 and a treatment score of 2.5. The remaining portion is open space and is assigned a score of 3 for both land use and treatment categories. The land use score is (0x5%) + (2x15%) + (3x75%) = 2.75. The treatment score is (2x5%) + (2.5x15%) + (3x75%) = 2.73. The combined score is (2.75 + 2.73)÷2=2.74. The adjacent medical/commercial development and single family residential subdivision are anticipated to discharge stormwater runoff into the salt marsh, thereby having localized adverse effects. The lowered water quality in the remaining sections of interior ditches will also adversely affect the water quality in the salt marsh. An adjusted score of 2 is assigned to this unit.

b. With Bank Condition
The salt marsh will be preserved as open space and the water quality improved by the enhanced movement of water across the marsh and in the interior and perimeter ditches. A score of 3 is assigned to this unit.

Impoundment 25 Scoring Summary Table

COVER TYPE	WILDLIFE UTILIZATION		VEGETATION MATRIX		HYDROLOGY		WATER QUALITY		DELTA
	W/O	With	W/O	With	W/O	With	W/O	With	
Brazilian Pepper	0	3	0	3	0	3	1	3	0.9
Oak Hammock	0	3	0	3	0	3	1	3	0.9
Perimeter Dike	0	3	0	3	0	3	2.4	3	0.8
Interior Dike	0	3	0	3	0	3	2.75	3	0.77
Perimeter Ditch	1	3	2	3	1.5	3	2.4	3	0.43
Interior Ditch	1	3	2	3	1	3	2.0	3	0.50
Salt Marsh	1.5	3	1	3	1	3	2.74	3	0.48

Outside the Impoundments

The scores assigned to perimeter dike/storm berm and ditches fronting the impoundments were determined using the same rationale for the perimeter dike and ditch associated with the respective impoundments. The other ditches located between the impoundments, south of Impoundment 24 and north of Impoundment 25 are tidally connected to the lagoon, serve as wildlife habitat and are not planned for development. The removal of the Brazilian pepper on the adjacent dikes and lowering of the adjacent dikes to salt marsh elevation will provide some improvements to the vegetative condition.

Outside the Impoundments Scoring Summary Table

COVER TYPE	WILDLIFE UTILIZATION		VEGETATION MATRIX		HYDROLOGY		WATER QUALITY		DELTA
	W/O	WITH	W/O	WITH	W/O	WITH	W/O	WITH	
Perim. dike (24)	0	3	0	3	0	3	1	3	0.75
Ditch (24)	1.5	3	2	3	2	3	3	3	0.3
Perim. dike (25)	0	3	0	3	2.4	3	1	3	0.8
Ditch (25)	1	3	2	3	1.5	3	2.4	3	0.43
Other ditches	3	3	2	3	3	3	3	3	0.1

Mitigation Bank Siting Index

Attached is the Mitigation Bank Siting Index Worksheet. An explanation about how each score was determined appears below.

Established Watershed Issues

The Final Technical Report of the Indian River Lagoon National Estuary Program addresses the importance of salt marsh wetlands and recognizes the importance of restoring areas that have been impacted by mosquito control activities. Government agencies have initiated plans with support from the SWIM Program to restore these marshes. Private landowners are reluctant to allow additional restoration or construction in these areas due to a perception of further loss of landowner rights. The SWIM Program recognizes that public ownership is necessary for coordinated management activity. The program includes substantial funding for the purchase of private lands. A partial solution to the conflicts that arise from improvements to privately owned salt marshes affected by mosquito control activities is the use of impoundments as mitigation projects to offset wetland impacts. "Without some form of trading value such as this, purchase of privately held impoundments may be the only means of implementing restoration efforts in many impoundments."

A score of 3 is given to this category since the project will result in recognizable benefits to the established watershed issues recognized to be critical to the watershed of the bank.

Landscape Mosaic Compatibility

The project site is bordered on the east by the Indian River Lagoon, on the south and north by other salt marshes, and on the west by disturbed salt marsh and citrus grove. Approximately 25% of the property perimeter is citrus grove which will ultimately be developed into commercial properties. This leaves approximately 75% of the site that will blend with the perimeter. A score of 2 is therefore given.

Threatened and Endangered Species

The project site is likely to serve as habitat for threatened and endangered species. The proposed plan includes designs which will attract species and create additional habitat for listed species. Therefore a score of 1 is given.

Expansion of Rare Habitats

The site contains herbaceous marsh which is not common for this region of the lagoon. Mosquito control impoundments through flooding of the marsh have displaced herbaceous communities and replaced them with mangrove forests. A score of 3 is given for this category since the vegetative community is scarce and sufficient in size.

Adjacent Land Uses

The site borders the Indian River Lagoon, an Outstanding Florida Water and an Aquatic Preserve. The proposed project maintains, restores, improves and creates habitat that is important to the resources of the lagoon; therefore a score of 3 is given.

Strategic Habitat Conservation Area

The proposed site is not within an area recognized in Closing the Gaps in Florida's Wildlife Habitat Conservation System (1994) as lands essential to providing a land base necessary to sustain populations into the future. A score of 0 is given.

Aquifer Recharge Area

The site is not considered an aquifer recharge area; therefore a score of 0 is given.

A total score of 12 out of a possible 21 is calculated. Using the formula on the worksheet the MBSI is calculated as follows:

$$MBSI = (12 \div 21) \times 0.1 + 1.0 = 1.057 \text{ or approximately } 1.06$$

VII. MITIGATION BANK CREDITS

The tables below summarize the mitigation bank credits according to existing cover type, acreage, improvement (calculated delta), and temporal factor:

Impoundment 24

COVER TYPE	ACREAGE	DELTA	RAW CREDIT	TEMPORAL FACTOR*	ADJUSTED CREDIT
Brazilian Pepper	6.37	0.9	5.7	-	5.7
Oak Hammock	2.12	0.9	1.9	-	1.9
Perimeter Dike	5.66	0.75	4.25	-	4.25
Perimeter Ditch	2.66	0.30	0.79	-	0.79
Salt Marsh	44.81	0.25	11.2	-	11.2
TOTAL	**61.62**	-	**23.84**	-	**23.84**

* Factor not considered because salt marsh will be functional prior to release of final credits.

Impoundment 25

COVER TYPE	ACREAGE	DELTA	RAW CREDIT	TEMPORAL FACTOR*	ADJUSTED CREDIT
Brazilian Pepper	10.09	0.9	9	-	9
Oak Hammock	0.97	0.9	0.9	-	0.9
Perimeter Dike	7.22	0.8	5.78	-	5.78
Interior Dike	6.81	0.77	5.24	-	5.24
Perimeter Ditch	3.76	0.43	1.62	-	1.62
Interior Ditch	11.07	0.50	5.54	-	5.54
Salt Marsh	40.32	0.48	19.35	-	19.35
TOTAL	**80.24**	-	**47.43**	-	**47.43**

* Factor not considered because salt marsh will be functional prior to release of final credits.

Outside the Impoundment

COVER TYPE	ACREAGE	DELTA	RAW CREDIT	TEMPORAL FACTOR*	ADJUSTED CREDIT
Perimeter dike 24	0.35	0.75	0.26	-	0.26
Ditch 24	0.06	0.3	0.02	-	0.02
Perimeter dike 25	0.40	0.8	0.32	-	0.32
Ditch 25	0.3	0.43	0.13	-	0.13
Other ditches	4.9	0.1	0.49	-	0.49
TOTAL	**6.01**	-	**1.22**	-	**1.22**

* Factor not considered because salt marsh will be functional prior to release of final credits.

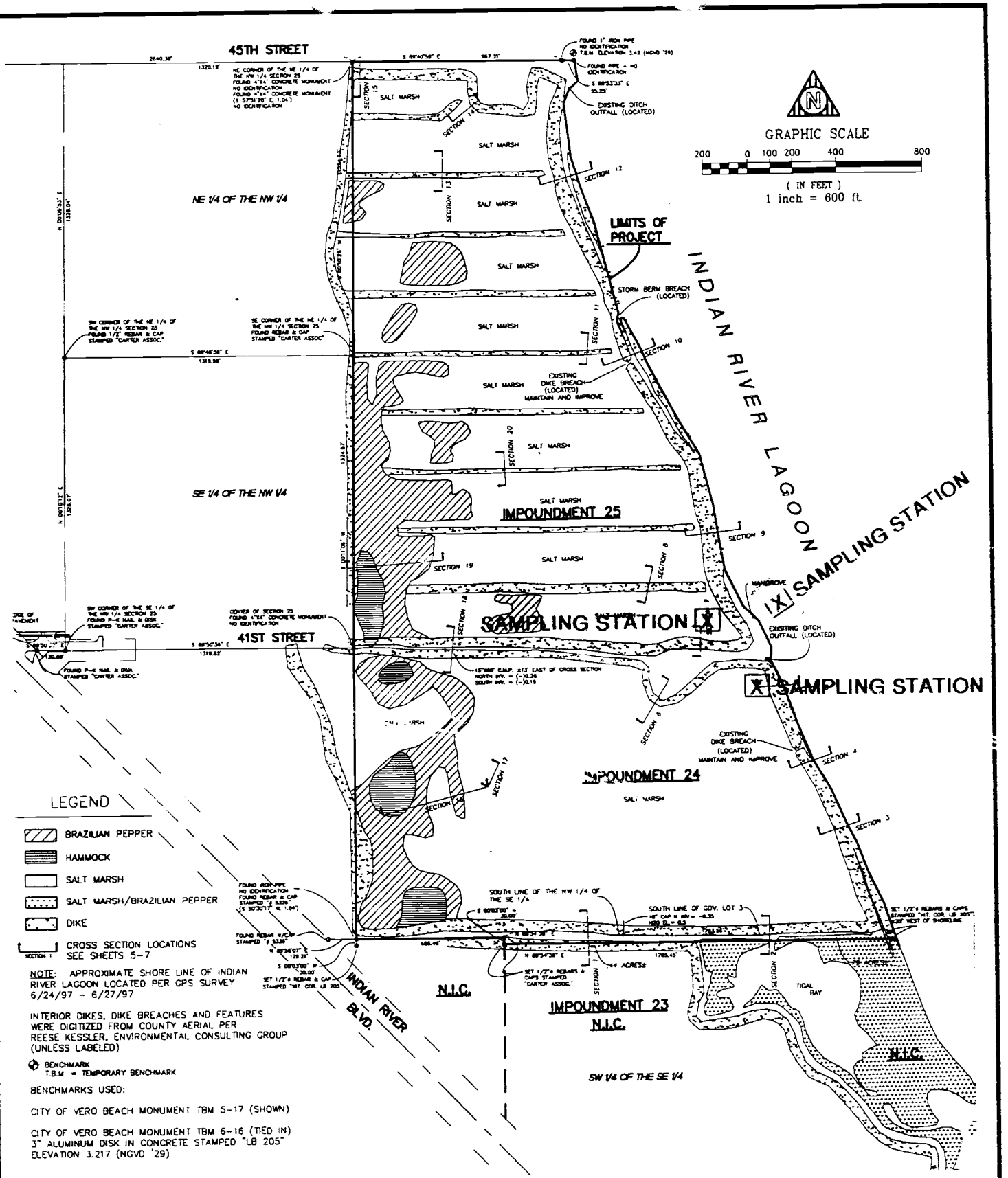
The total credits for the mitigation bank are calculated as follows:

Adjusted Credit Total	×	MBSI	=	Final Total Credit for Mitigation Bank
(23.84+ 47.43 + 1.22)	×	1.06	=	76.84

VIII. MITIGATION BANK SERVICE AREA

The proposed service area includes the Indian River Lagoon, excluding the Banana River, from S.R. 402 in Titusville on the north to the Ft. Pierce Inlet on the south. The service area is based on the similarity of ecological conditions. These include climatic conditions, historical extent of herbaceous salt marsh, the species which would use the restored salt marsh and the Indian River Lagoon, and comments received from the MBRT. There have been concems raised by the MBRT about the artificial basins created by causeways across the lagoon and the appropriateness of the proposed mitigation bank salt marsh for the areas between the causeways. The appropriateness should be based on site-specific conditions. Relatively minor impacts to severely disturbed and small areas may be better offset by participation in a mitigation bank rather than in attempts to offset the impacts onsite.

IX. APPENDIX



WATER QUALITY SAMPLING STATIONS

Environmental Consulting Group, Inc.
150 Oxford Road, Suite 130
Fern Park, Florida 32730 (407) 331-6599

Chown, Gregory, Wilcox (CGW)
Mitigation Bank Proposal
Indian River County, Florida

TIDE DATA AT OSLO ROAD, INDIAN RIVER COUNTY
JANUARY 1959 - DECEMBER, 1981

TIDES AT OSLO ROAD

FLORIDA MEDICAL ENTOMOLOGY LABORATORY, VERO BEACH, FL

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL

1959	J	F	M	A	M	J	J	A	S	O	N	D	YEAR	
HIGH: NO. TIDES	55	54	60	58	52	53	60	54	58	60	58	54		
MEAN	.64	.38	.61	.55	.44	.84	.60	.45	1.00	1.24	1.56	1.09	.73	
MAX.	1.43	.98	1.17	1.45	.76	1.66	1.13	.77	1.98	1.93	2.11	1.89	2.11	
LOW: NO. TIDES	57	54	60	57	53	58	60	55	58	60	58	54		
MEAN	-.03	-.26	-.02	-.11	-.20	+.20	-.07	-.19	+.34	+.57	+.83	+.37	+.12	-.07
MIN	-.74	-.77	-.57	-.71	-.54	-.42	-.48	-.49	-.52	+.05	+.32	-.22	-.77	
1960														
HIGH: NO. TIDES	52	56	60	56	59	58	60	53	48	60	56	37		
MEAN	.92	.71	.69	.39	.79	.91	.31	.86	1.73	1.58	1.23	.93	.96	
MAX.	1.50	1.23	1.28	1.25	1.22	1.50	1.03	1.36	2.60	2.18	1.98	1.36	2.60	
LOW: NO. TIDES	54	56	60	56	59	58	60	51	49	60	57	38		
MEAN	+.19	+.05	.00	-.31	+.10	+.19	-.16	+.13	+.90	+.84	+.47	+.22	+.25	+.15
MIN.	-.19	-.50	-.43	-.76	-.26	-.20	-.24	-.22	+.04	+.36	-.12	-.09	-.76	
1961														
HIGH: NO. TIDES	59	54	60	58	60	57	59	60	58	60	58	60		
MEAN	.73	.48	.63	.50	.52	.47	.29	.52	1.02	1.48	1.25	.72	.72	
MAX.	1.20	1.01	1.18	1.11	1.10	1.09	.73	1.01	1.30	1.90	1.75	1.42	1.90	
LOW: NO. TIDES	58	53	60	53	60	53	60	60	58	59	53	61		
MEAN	.00	-.27	-.19	-.23	-.22	-.21	-.40	-.20	+.29	+.74	+.50	.00	-.01	-.26
MIN.	-.48	-.72	-.78	-.70	-.70	-.70	-.67	-.53	-.18	+.23	+.10	-.41	-.78	
1962														
HIGH: NO. TIDES	43	41	60	57	60	41	59	46	57	59	57	60		
MEAN	.41	.48	1.00	.27	.86	.62	.69	.26	1.10	1.40	1.15	.99	.78	
MAX.	1.05	1.28	1.52	.85	1.15	1.15	1.17	.95	1.80	2.25	1.95	1.95	2.25	
LOW: NO. TIDES	42	41	60	56	63	42	60	43	55	60	56	60		
MEAN	-.23	-.21	+.26	-.44	+.18	+.12	+.05	-.02	+.34	+.63	+.37	+.20	+.10	+.08
MIN	-.70	-.63	-.35	-.90	-.35	-.25	-.50	-.30	-.55	+.21	-.20	-.35	-.90	
1963														
HIGH: NO. TIDES	58	54	60	53	59	53	59	41	39	59	59	60		
MEAN	.87	.64	.08	.22	.45	.44	.32	.61	1.39	1.21	.80	.67	.68	
MAX.	1.50	1.20	.75	.75	1.16	1.32	.55	1.65	2.35	1.60	1.20	1.30	2.35	
LOW: NO. TIDES	58	54	60	58	58	57	51	43	36	60	60	59		
MEAN	+.10	-.02	-.41	-.30	-.24	-.21	-.35	-.07	-1.12	+.41	+.02	-.07	.00	-.22
MIN.	-.35	-.50	-.90	-1.10	-.55	-.65	-.65	-.60	-.25	+.10	-.51	-.65	-1.10	

1-11.

March 4, 1983

TIDES AT OSLO ROAD

FLORIDA MEDICAL ENTOMOLOGY LABORATORY, VERO BEACH, FLA.

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL

1964	J	F	M	A	M	J	J	A	S	O	N	D	YEAR	
HIGH: NO. TIDES	44	55	49	58	52	52	59	60	58	60	55	60		
MEAN	.32	.22	.24	.18	.73	.50	.04	.39	1.20	1.34	1.00	.61	.56	
MAX.	.80	.60	.75	.79	2.00	1.19	.83	2.35	2.06	1.90	1.90	1.35	2.35	
LOW: NO. TIDES	44	55	47	58	52	52	59	59	58	60	54	60		
MEAN	-.34	-.35	-.44	-.44	+.07	-.14	-.58	-.27	+.47	+.60	+.26	-.06	-.10	-.23
MIN.	-.75	-.72	-.80	-.95	-.45	-.74	-.99	-.63	-.22	-.30	-.30	-.41	-.99	
1965														
HIGH: NO. TIDES	60	47	60	53	59	58	56	58	58	60	58	61		
MEAN	.45	.42	.25	.57	.18	.27	.26	.25	1.00	1.16	1.23	.76	.53	
MAX.	1.06	1.09	1.00	1.15	.68	.30	.75	.53	2.90	1.60	1.80	1.32	2.90	
LOW: NO. TIDES	60	48	60	52	59	53	56	58	58	60	53	60		
MEAN	-.23	-.22	-.37	-.10	-.45	-.35	-.41	-.40	-.38	+.46	+.54	+.05	-.09	-.40
MIN.	-.90	-.78	-1.00	-.40	-.78	-.78	-.75	-.65	-.38	-.08	-.15	-.26	-1.00	
1966														
HIGH: NO. TIDES	60	54	60	58	55	53	53	53	58	59	59	59		
MEAN	.80	.51	.60	.39	.58	.80	.64	.62	.86	1.15	1.19	.94	.75	
MAX.	1.22	1.60	1.16	.92	1.04	1.45	1.12	1.38	1.48	1.58	2.05	1.23	2.05	
LOW: NO. TIDES	60	54	59	58	55	53	53	54	58	60	58	60		
MEAN	+.14	-.14	-.09	-.32	-.09	+.11	-.02	-.05	+.23	+.42	+.48	+.21	+.07	+.01
MIN.	-.32	-.92	-.40	-.72	-.43	-.40	-.45	-.45	-.35	-.35	-.02	-.45	-.92	
1967														
HIGH: NO. TIDES	60	54	60	58	60	58	60	60	58	60	58	59		
MEAN	.58	.47	.29	.47	.45	1.04	.39	.45	1.32	1.22	1.20	.68	.71	
MAX.	.99	1.32	.96	1.12	1.14	1.67	.88	.81	1.92	1.59	1.51	1.15	1.92	
LOW: NO. TIDES	60	54	60	58	59	53	60	61	58	60	58	60		
MEAN	-.11	-.18	-.39	-.18	-.18	+.35	-.24	-.22	+.59	+.47	+.23	-.02	+.02	+.07
MIN	-.59	-.79	-1.12	-.72	-.59	-.30	-.60	-.65	-.11	+.19	-.17	-.39	-1.12	
1968														
HIGH: NO. TIDES	60	44	59	58	27	58	42	60	58	55	58	54		
MEAN	.71	.83	.33	.43	.33	.22	.41	.58	1.25	1.42	.91	.49	.70	
MAX.	1.20	1.26	.78	1.08	.76	1.62	.80	1.23	1.91	2.03	1.41	.84	2.03	
LOW: NO. TIDES	60	44	60	58	26	53	40	59	57	54	59	53		
MEAN	+.04	+.14	-.29	-.20	-.30	+.08	-.26	-.14	+.50	+.69	+.17	-.18	+.02	-.16
MIN.	-.50	-.23	-.92	-.92	-.50	-.38	-.46	-.46	-.02	+.20	-.32	-.59	-.92	

TIDES AT OSLO ROAD

FLORIDA MEDICAL ENTOMOLOGY LABORATORY, VERO BEACH, FLA

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL

1969	J	F	M	A	M	J	J	A	S	O	N	D	YEAR
HIGH: NO. TIDES	60	54	54	50	59	22	49	60	49	47	52	60	
MEAN	.54	.75	.68	.33	.65	.69	.40	.65	1.28	1.78	1.40	.74	.82
MAX.	1.27	1.29	1.52	.79	1.23	.91	.89	1.47	2.10	2.76	2.27	1.50	2.76
LOW: NO. TIDES	60	54	54	50	59	21	51	61	49	47	52	60	
MEAN	-.14	+.06	+.03	-.32	-.05	+.01	-.26	-.06	+.52	+1.00	+.67	+.05	+.13 — .05
MIN.	-.60	-.39	-.59	-.80	-.50	-.17	-.57	-.40	+.07	+.59	+.12	-.69	-.80
1970													
HIGH: NO. TIDES	47	54	60	58	60	58	60	60	58	60	58	55	
MEAN	.58	.46	.32	.52	.45	.65	.43	.52	1.10	1.46	1.14	.94	.71
MAX	1.03	1.29	1.20	1.25	1.11	.98	.82	.88	2.15	2.00	1.95	1.30	2.15
LOW: NO. TIDES	47	54	60	57	60	58	60	60	58	60	58	57	
MEAN	-.09	-.20	-.32	-.15	-.23	-.05	-.18	-.14	+.20	+.78	+.40	+.07	.00 — .15
MIN.	-.52	-.69	-.80	-.69	-.65	-.39	-.48	-.41	-.28	+.32	-.05	-.10	-.80
1971													
HIGH: NO. TIDES	50	53	60	58	60	58	60	60	58	55	58	53	
MEAN	.55	.20	.34	.43	.45	.46	.33	.52	1.02	1.48	1.66	1.10	.71
MAX.	1.18	.82	1.23	1.13	.93	.89	.67	1.00	1.96	2.08	2.33	2.30	2.33
LOW: NO. TIDES	49	54	60	58	60	58	60	59	58	47	58	54	
MEAN	-.14	-.42	-.30	-.23	-.18	-.19	-.31	-.13	+.29	+.63	+.88	+.37	+.02 — .20
MIN.	-.73	-.33	-.80	-.63	-.65	-.43	-.70	-.49	-.29	+.20	+.21	-.22	-.83
1972													
HIGH: NO. TIDES	60	56	59	58	59	54	60	60	58	60	58	60	
MEAN	.53	.31	.64	.67	1.10	1.00	.43	.65	1.23	1.45	1.28	.81	.91
MAX.	1.59	1.53	1.10	1.66	1.80	1.58	1.18	1.03	1.62	1.89	1.82	1.36	1.89
LOW: NO. TIDES	60	56	61	56	58	54	60	59	58	59	56	59	
MEAN	+.12	+.12	-.02	+.01	+.38	+.28	-.21	-.04	+.48	+.69	+.53	+.11	+.20 +0.10
MIN.	-.57	-.37	-.38	-.63	-.22	-.26	-.59	-.52	+.10	+.25	+.11	-.29	-.63
1973													
HIGH: NO. TIDES	61	55	60	47	57	58	59	60	58	60	58	61	
MEAN	1.06	.95	.91	.81	.48	.51	.64	.78	1.19	1.93	1.34	.75	.95
MAX.	1.93	1.81	1.37	1.30	1.00	.58	1.06	1.36	1.78	2.64	2.25	1.58	2.64
LOW: NO. TIDES	60	54	60	48	57	58	60	60	58	60	58	62	
MEAN	+.35	+.27	+.30	+.16	-.17	-.17	-.06	+.07	+.41	+1.11	+.53	+.01	+.23 — .08
MIN.	-.06	-.25	-.20	-.16	-.47	-.51	-.30	-.25	0.00	+.46	+.07	-.71	-.71

TIDES AT OSLO ROAD

FLORIDA MEDICAL ENTOMOLOGY LABORATORY, VERO BEACH, FLA

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL

Check = 1973

1974	J	F	M	A	M	J	J	A	S	O	N	D	YEAR	
HIGH: NO. TIDES	58	55	60	58	60	58	60	60	58	60	58	60		
MEAN	.45	.61	.44	.45	.61	.76	.91	.93	1.23	1.77	1.20	.80	.85	
MAX.	.88	1.06	1.13	1.08	1.01	1.24	1.29	1.43	1.92	2.97	1.90	1.22	2.97	
LOW: NO. TIDES	58	55	60	58	59	58	60	60	58	60	57	60		
MEAN	-.27	-.11	-.27	-.21	-.09	+.03	+.14	+.16	+.40	+.94	+.38	+.04	+.10	+.05
MIN.	-.71	-.50	-.80	-.55	-.41	-.39	-.13	-.15	-.21	+.28	+.01	-.50	-.80	
1975														
HIGH: NO. TIDES	50	54	60	53	59	54	60	57	53	59	58	56		
MEAN	.41	.63	.59	.60	.82	1.01	.78	.60	1.03	1.38	1.19	1.02	.84	
MAX.	.96	1.06	1.15	1.05	1.33	1.41	1.51	1.08	1.61	2.12	2.19	1.65	2.19	
LOW: NO. TIDES	52	54	53	53	59	44	57	57	53	60	58	56		
MEAN	-.23	-.10	-.14	-.11	-.07	+.18	+.02	-.11	+.26	+.56	+.39	+.23	+.07	+.01
MIN.	-.75	-.51	-.53	-.51	-.23	-.11	-.31	-.48	.20	+.02	+.01	-.49	-.75	
1976														
HIGH: NO. TIDES	59	56	60	57	59	58	44	59	58	59	58	62		
MEAN	.47	.12	.32	.67	.57	1.09	.60	.76	1.04	1.13	.96	.90	.72	
MAX.	.99	.95	.83	1.45	1.20	1.93	.91	1.96	1.68	1.72	1.86	1.40	1.96	
LOW: NO. TIDES	57	56	60	58	60	53	45	59	58	53	53	60		
MEAN	-.23	-.57	-.41	-.09	-.15	+.27	-.19	.00	+.24	+.32	+.18	+.13	-.04	-.02
MIN.	-.77	-.59	-.72	-.39	-.61	-.15	-.52	-.64	-.27	-.19	-.33	-.52	-.89	
1977														
HIGH: NO. TIDES	43	54	60	53	60	57	49	60	57	60	44	49		
MEAN	.46	.25	.39	.32	.80	.84	.35	.71	.95	1.12	1.48	.93	.72	
MAX.	.91	.86	.86	.67	1.50	1.42	.82	1.20	1.29	1.78	1.90	1.53	1.90	
LOW: NO. TIDES	47	54	60	52	60	58	49	50	57	60	45	49		
MEAN	-.25	-.45	-.32	-.39	+.03	+.10	-.35	-.06	+.17	+.37	+.64	+.18	-.03	-.07
MIN.	-.79	-.83	-.72	-.72	-.41	-.36	-.64	-.29	-.13	-.08	+.19	+.14	-.83	
1978														
HIGH: NO. TIDES	59	54	60	56	60	58	58	60	52	59	58	57		
MEAN	.39	.76	.76	.54	.54	.67	.57	.62	1.10	1.69	1.68	.81	.84	
MAX.	.92	1.49	1.40	1.20	.95	1.07	.91	1.10	1.72	2.19	2.51	1.59	2.51	
LOW: NO. TIDES	54	54	60	56	60	58	58	59	51	60	58	56		
MEAN	-.22	.00	.00	-.19	-.17	-.05	-.14	-.13	+.28	+.85	+.84	+.03	+.08	-.12
MIN.	-.68	-.57	-.41	-.58	-.46	-.42	-.62	-.38	-.18	+.53	+.06	-.47	-.46	

TIDES AT OSLO ROAD

FLORIDA MEDICAL ENTOMOLOGY LABORATORY, VERO BEACH, FLA.

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL

1979	J	F	M	A	M	J	J	A	S	O	N	D	YEAR
HIGH: NO. TIDES	59	53	24	54	60	58	58	60	58	52	58	59	
MEAN	.72	.61	.44	.29	.61	.87	.72	.58	1.14	1.20	1.12	1.01	.78
MAX.	1.28	1.12	.73	.59	1.58	1.85	1.36	.90	3.10	1.54	1.84	1.87	3.10
LOW: NO. TIDES	60	53	22	54	60	58	57	60	57	52	58	59	
MEAN	-.01	-.12	-.30	-.40	-.13	+.10	-.05	-.16	+.33	+.36	+.32	+.19	+.01 — -.01
MAX.	-.44	-.45	-.78	-.80	-.64	-.50	-.51	-.49	-.07	-.19	-.28	-.27	-.80
1980													
HIGH: NO. TIDES	59	55	60	58	58	45	49	60	56	57	58	60	
MEAN	1.09	1.08	.55	.62	.77	.78	.49	.44	1.04	1.14	1.05	.96	.83
MAX.	1.63	2.03	1.18	1.00	1.39	1.33	.81	1.20	1.50	1.65	1.79	1.67	2.03
LOW: NO. TIDES	60	56	60	58	59	46	50	60	56	56	57	59	
MEAN	+.27	+.28	-.19	-.12	+.01	-.04	-.26	-.32	+.22	+.34	+.29	+.20	+.06 — +.13
MAX.	-.07	-.13	-.72	-.49	-.34	-.25	-.67	-.67	-.04	-.17	-.23	-.29	-.72
1981													
HIGH: NO. TIDES	60	52	60	45	45	58	58	60	57	60	49	61	
MEAN	.77	.70	.62	.57	.56	+.29	+.57	+.72	1.23	1.21	1.58	0.57	.77
MAX.	1.27	1.15	1.12	.93	1.11	+.90	+.92	1.63	1.73	2.15	2.42	1.47	2.46
LOW: NO. TIDES	60	52	60	46	41	53	60	60	56	56	49	60	
MEAN	-.05	-.02	-.09	-.32	-.11	-.42	-.15	+.02	0.45	+.35	+.78	-.16	+.48 — -.1
MAX.	-.47	-.46	-.77	-.74	-.49	-.75	-.55	-.52	+.11	-.26	+.16	-.70	-.77
													2.3 — -.09

1.37

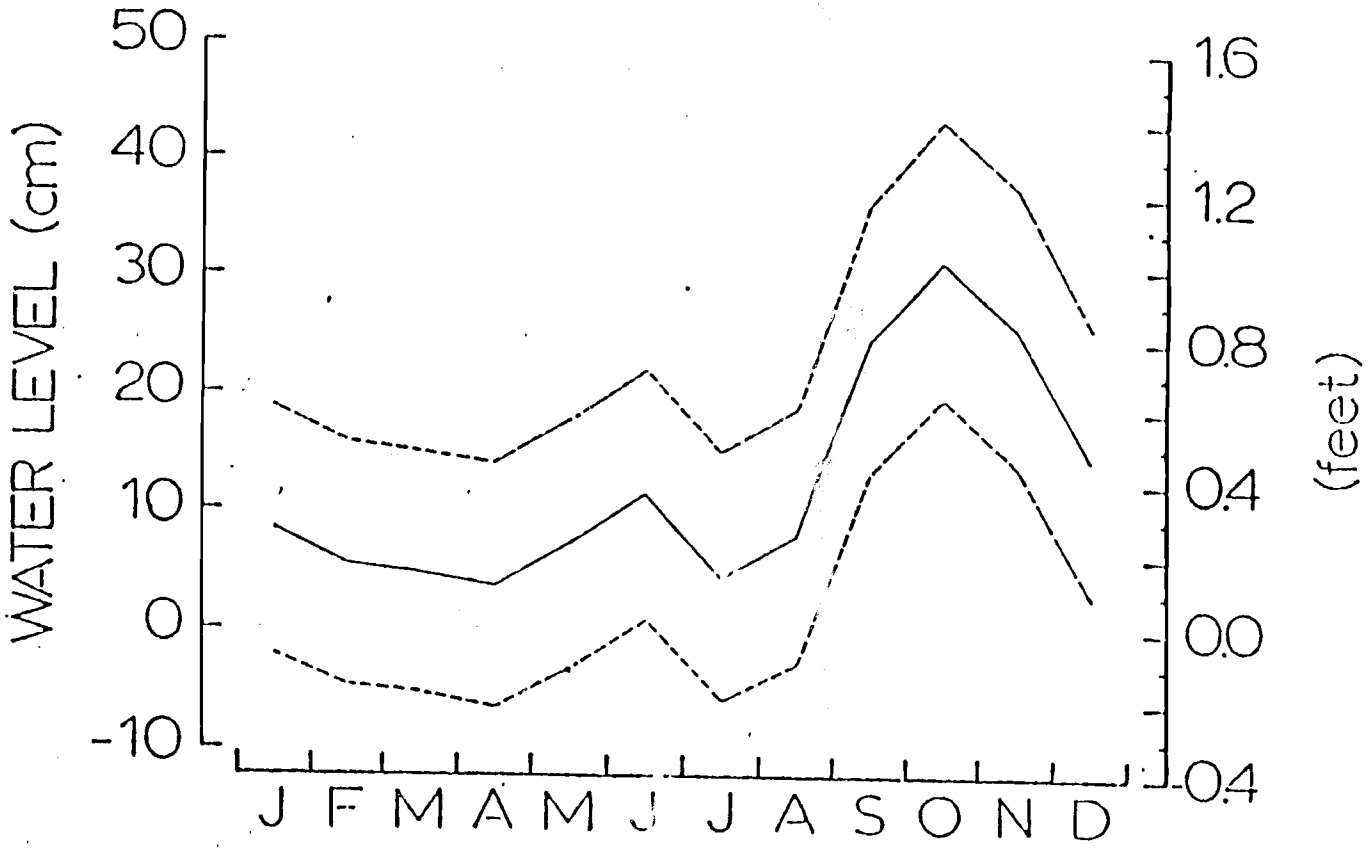


Figure 1. Mean monthly water levels relative to mean sea level at Florida Medical Entomology Laboratory (27°35.38'N, 80°21.90'W) in Vero Beach, Florida. Envelope defines mean high and low water, 1959-1977.

GRAND HARBOR TIDE DATA
DAILY MEAN HIGH WATER
JULY 12, 1991 - NOVEMBER 7, 1995
RECORDED BY INDIAN RIVER MOSQUITO CONTROL DISTRICT

		1991	1992	1993	1994	1995	MEAN
1			0.99	0.95	0.71		0.88
2			1.48	0.89	0.63		1.00
3			1.47	1.09	0.79	1.73	1.27
4			1.52	0.85	0.74	1.75	1.22
5			1.32	0.86	0.82	1.77	1.19
6			1.25	0.94	0.52	1.46	1.04
7			1.41	0.83	0.65	1	0.97
8			1.3	0.86	0.66	1.08	0.98
9			1.12	1.12	1.18	1.07	1.12
10			0.98	1.4	0.99	0.97	1.09
11			1.13	1.28	0.78	0.99	1.05
12			0.92	1.35	0.79	0.87	0.98
13			0.65	1.33	1.07	0.75	0.95
14			0.61	1.55	1.05	0.6	0.95
15	JAN		0.84	1.62	0.81	0.64	0.98
16			0.88		0.74	0.88	0.83
17			0.83		0.48	1.06	0.79
18			0.7	1.37	0.39	1.15	0.90
19			0.83	1.4	0.93	1.05	1.05
20			1.48	1.34	0.86	1.23	1.23
21			1.07	1.09	0.9	1.06	1.03
22			0.84	1.11	0.75	0.9	0.90
23			0.55	1.13	0.52	0.62	0.71
24			0.64	0.96	0.45	0.67	0.68
25			0.76		0.39	0.87	0.67
26			0.59		0.56	0.7	0.62
27			0.43		0.53	0.66	0.54
28			0.4	1.02	0.48	0.56	0.84
29			0.61	1.5	0.5	0.55	0.80
30			0.7	1.37	0.57	0.92	0.89
31			0.9	1.27	1.07	1.01	1.06
1			1.03	1.02	1.14	0.9	1.02
2			1.15	1.25	1.37	0.74	1.13
3			1	1.33	1.16	0.61	1.03
4			0.78	1.37	0.72	0.35	0.81
5			0.95	1.39	0.6	0.57	0.88
6			1.11	1.62	0.56	0.53	0.98
7			1.48	1.58	0.72	0.47	1.06
8			1.31	1.76	0.56	0.36	1.00
9			1.35	1.84	0.42	0.62	1.06
10			1.36	1.68	0.33	0.12	0.87
11			1.39	1.68	0.25	0	0.83
12			1.24	1.58	0.45	0.27	0.89
13			1.12	1.53	0.69	0.69	1.01
14	FEB		1.13	1.49	1.09	0.6	1.08
15			0.89	1.35	0.81	0.38	0.86
16			0.85	1.02	0.69	0.3	0.72
17			0.81	1.2	0.9	0.4	0.83
18			0.87	1.55	1.18	0.38	1.00
19			0.93	1.74	1.43	0.57	1.17
20			0.98	1.34	1.2	0.84	1.09
21			1.06	1.12	1.22	0.82	1.06
22			0.71	0.99	1.14	0.94	0.95
23			0.59		0.95	0.79	0.78
24			0.53		0.98	0.64	0.72
25			0.6		1.2	0.88	0.89
26			0.32		1.3	0.72	0.78
27			0.49		1.31	0.54	0.78
28			0.55		1.15	0.57	0.76
29			0.35				0.35

		1991	1992	1993	1994	1995	MEAN
1			0.23		0.91	0.71	0.62
2			0.27		0.44	1.13	0.61
3			0.33		0.71	1.21	0.75
4			0.27		0.91	1.02	0.73
5			0.29	0.91	0.83	0.99	0.76
6			0.38	0.92		0.84	0.71
7			0.43	0.89		0.72	0.68
8			0.57	0.93	0.67	0.6	0.69
9			0.53	0.81	0.62	1.06	0.76
10			0.32	0.67	0.7	1.6	0.82
11			0.47	0.53	1.11		0.70
12			0.61	0.56	0.95	0.89	0.75
13			0.55	0.61	0.74	0.97	0.72
14			0.54		0.89	0.91	0.78
15	MAR		0.56		0.85	0.97	0.79
16			0.87		0.73	1.11	0.90
17			0.67		0.81	1.2	0.89
18			0.42	1.09	0.61	1.33	0.86
19			0.39	1.49	0.43	1.63	0.99
20			0.54	1.18	0.42	1.81	0.99
21			0.86	1.35	0.44	1.42	1.02
22			0.7	1.2	0.48	1.25	0.91
23			0.53	0.84	0.51	1.08	0.74
24			0.97	0.87		1.08	0.97
25			0.75	1	0.64	1.23	0.91
26			0.78	0.94	0.64	1.11	0.87
27			0.66	0.98	0.49	0.98	0.78
28			0.59	1.07	0.25	1.1	0.75
29			0.58	0.97	0.43	1.27	0.81
30			0.42	0.83	0.67	1.21	0.83
31			0.64	0.77	0.72	1.33	0.88
1			0.7	0.8	0.91	1.5	0.98
2			0.74	0.83	0.83	1.46	0.97
3			0.98	0.97	0.52	1.43	0.98
4			1.07	0.72	0.57	0.98	0.84
5			0.93	0.84	0.57	0.98	0.83
6			0.89	1.28	0.42	1.13	0.93
7			0.65	1.33	0.57	1.45	0.96
8			0.61	1.38	0.8	1.33	1.03
9			0.91	1.02	0.56	1.19	0.92
10			0.68	1.03	0.49	1.26	0.87
11			0.62	1.2	0.4	1.05	0.82
12			0.9	0.97	0.21	0.92	0.75
13			1.31	0.81	0.15	1.15	0.86
14			1.65	0.75	0.23	1.51	1.06
15	APR		1.46	0.6	0.05	1.55	0.92
16			1.21	0.79	0.07		0.69
17			0.99	1.04	0.28		0.77
18			0.97	0.99	0.55	0.97	0.87
19			0.86	0.94	0.42	0.97	0.80
20			0.63	0.76	0.41	0.84	0.66
21			0.48		0.37	0.64	0.50
22			0.68		0.56	0.61	0.62
23			0.61		0.86	0.6	0.69
24				0.6	1.08	0.66	0.78
25				0.15	0.96	1.06	0.72
26				0.14	0.89	1.01	0.68
27			1.04	0.36	0.82	0.94	0.79
28			1.04	0.96	0.72	0.92	0.91
29			1.25	0.83	0.59	1.03	0.93
30			1.09	0.71	0.51	0.81	0.78

		1991	1992	1993	1994	1995	MEAN
1			1	0.66	0.58	0.82	0.77
2			0.94	0.68	0.61	0.56	0.70
3			0.74	0.67	0.73	0.76	0.73
4			0.79	0.65	0.85	0.81	0.78
5			0.92	0.73	1.1	0.85	0.90
6			0.79	0.68	0.93	0.98	0.85
7			1.05	0.88	0.7	1.01	0.91
8			1.14	0.92	0.71	0.94	0.93
9			0.92	0.99	0.75	0.73	0.85
10			0.81	0.77	0.76	0.56	0.73
11			0.83	0.79	0.75	0.79	0.79
12			0.88	0.63	0.89	0.93	0.83
13			0.86	0.49	0.88	0.94	0.79
14			0.79	0.66	0.86	0.98	0.82
15	MAY		0.98	0.72	0.83	0.94	0.87
16			0.89	0.75	0.71	1.17	0.88
17				0.79	0.67	1.15	0.87
18				0.57	0.85	0.88	0.77
19				0.59	0.97	0.8	0.79
20				0.78	1.59	0.8	1.06
21				0.83	1.99	1.19	1.34
22				1.06	1.86	1.47	1.46
23				1.12	1.54	1.41	1.36
24				0.73	1.47	1.32	1.17
25			1.21	0.57		1.27	1.02
26			1.05	0.58	1.28	1.2	1.03
27			1.02	0.64	1.18	1.13	0.99
28			1.11	0.78	1.17	0.92	1.00
29			1.11	0.74	1.26	0.89	1.00
30			1.25	0.85	1.31	0.96	1.09
31			1.37	0.98	1.11	0.86	1.08
1			1.48	1.28	1.09	0.83	1.17
2				1.13	1.08	0.69	0.97
3			1.4	1	0.99	0.6	1.00
4			1.11	0.95	0.98	0.71	0.94
5			1.28	0.87	0.96	0.54	0.91
6			1.19	0.7	0.88	0.56	0.83
7				0.69	0.8	0.65	0.71
8			1.1	0.71	0.71	0.65	0.79
9			1.05	0.58	0.73	0.66	0.76
10			1.14	0.37	0.81	0.75	0.77
11			1.19	0.24	1.04	0.78	0.81
12			1.2	0.22	1.03	0.79	0.81
13				0.27	0.93	0.87	0.69
14			1.2	0.56	0.81	0.98	0.89
15	JUN			0.89	0.77	1.17	0.94
16				0.82	0.69	0.96	0.82
17				0.77	0.91	1.05	0.91
18				0.57	1.03	1.23	0.94
19				0.64	1.05	1.21	0.97
20				0.68	1.12	1.02	0.94
21				0.7	1.18	0.93	0.94
22				0.7	1.09	0.98	0.92
23				0.8	0.99	0.9	0.90
24				0.85	0.8	1.03	0.89
25				0.85	0.77	0.98	0.87
26				0.88	0.6	0.99	0.82
27				0.78	0.48	1	0.75
28				0.82	0.43	1.12	0.79
29				0.81	0.32	1.15	0.76
30				0.77	0.46	1.22	0.82

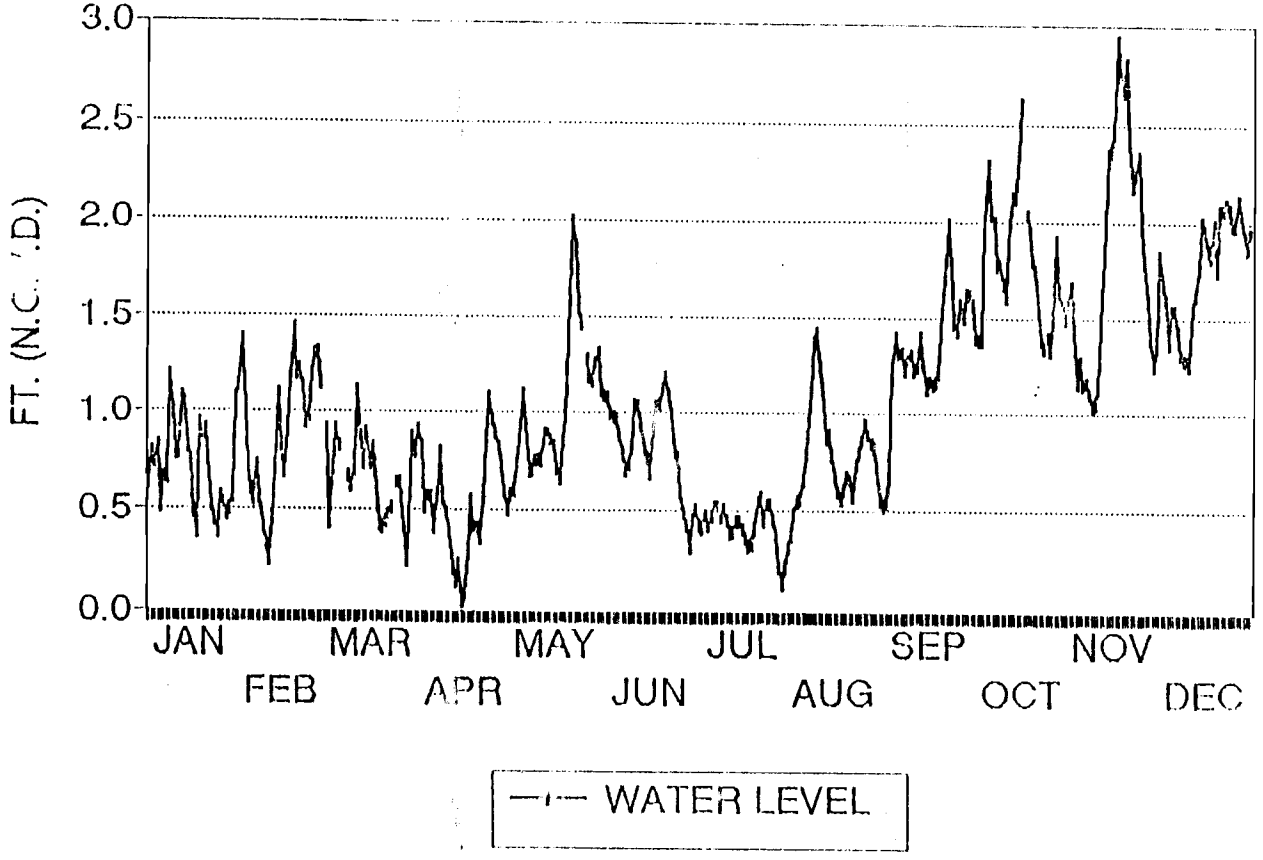
		1991	1992	1993	1994	1995	MEAN
1				0.84	0.5	1.23	0.86
2				0.83	0.43	1.09	0.78
3				0.65	0.42	1	0.69
4				0.65	0.47	0.89	0.67
5				0.5	0.43	0.9	0.61
6				0.55	0.47	0.95	0.66
7				0.62	0.52	1.06	0.73
8				0.67	0.52	1	0.73
9				0.57	0.47	0.97	0.67
10				0.48	0.5	0.87	0.62
11		1		0.45	0.46		0.64
12		1.13		0.37	0.39		0.63
13		1.22		0.31	0.4		0.64
14		1.32		0.12	0.45		0.63
15	JUL	1.16		0.2	0.45	1.26	0.77
16		1.01		0.21	0.41	1.18	0.70
17		0.99		0.25	0.37	1.04	0.66
18		0.9		0.41	0.33	0.9	0.64
19		0.82		0.6	0.34	0.87	0.66
20		0.84		0.68	0.41	0.91	0.71
21		0.82		0.81	0.54	0.84	0.75
22		0.84		0.82	0.57	0.59	0.71
23		0.76		0.87	0.46	0.42	0.63
24		0.71		0.87	0.53	0.38	0.62
25		0.64		0.58	0.53	0.49	0.56
26		0.67		0.6	0.46	0.39	0.53
27		0.81		0.69	0.38	0.37	0.56
28		0.86		0.85	0.22	0.39	0.58
29		0.79		0.72	0.14	0.45	0.53
30		0.72		0.64	0.22	0.67	0.56
31		0.73		0.56	0.32	0.88	0.63
1		0.66		0.62	0.38	1.12	0.70
2		0.61		0.6	0.49	2.26	0.99
3		0.65		0.46	0.55	0.79	0.61
4		0.67		0.29	0.56	1.07	0.65
5		0.66		0.21	0.65	1.07	0.65
6		0.61		0.2	0.78	1.05	0.66
7		0.68		0.12	0.96	1.06	0.72
8		0.78		0.22	1.11	1.23	0.83
9				0.31	1.37	1.52	1.10
10		0.98	0.58	0.42	1.42	1.7	1.02
11		0.99	0.5	0.51	1.24	1.57	0.96
12		0.9	0.41	0.59	1.13	1.67	0.94
13		0.9	0.47	0.44	0.87	1.6	0.86
14		0.88	0.4	0.39	0.89	1.6	0.83
15	AUG	0.91	0.5	0.46	0.78	1.63	0.86
16		1	0.6	0.87	0.67	1.71	0.97
17		1.19	0.7	1.12	0.6	1.47	1.02
18		1.07	0.86	1.01	0.57	1.4	0.98
19		0.9	0.93	1	0.61	1.53	0.99
20		0.8		0.95	0.67	1.78	1.05
21		0.82	1.01	0.98	0.65	1.81	1.05
22		0.82	1.01		0.58	1.96	1.09
23		0.76	1.23	1.31	0.73	1.9	1.19
24		0.81	1.24	1.32	0.8	1.49	1.13
25		0.81	1.14	1.25	0.85	1.47	1.10
26		0.87	1.22	1.24	0.94	1.73	1.20
27		0.96	1.21	1.23	0.88	1.79	1.21
28		1.06	1.09	1.07	0.84	1.73	1.16
29		1.11	1.08	1.02	0.82	1.8	1.17
30		1.13	1.08	1.09	0.72	2	1.20
31		1.16	1.05	1.03	0.56	2.1	1.18

		1991	1992	1993	1994	1995	MEAN
1		1.23	0.94	0.94	0.53	2.04	1.14
2		1.35	0.84	0.93	0.55	2.16	1.17
3		1.55	0.68	0.94	0.66	2.23	1.21
4		1.7	0.61	0.91	1.24	2.17	1.33
5		1.74	0.47	0.83	1.4	2.14	1.32
6		1.74		0.97	1.31	2.21	1.56
7		1.66		1.04	1.32	2.25	1.57
8		1.7	0.81	1.13	1.23	2.38	1.45
9		1.99	0.82	1.1	1.28	2.34	1.51
10		2.09	0.86	0.93	1.3	2.25	1.49
11		2	0.88	0.89	1.23	2.16	1.43
12		1.92	1	1.07	1.24	2.18	1.48
13		1.75	1.22	1.08	1.4	2.04	1.50
14		1.59	1.34	1.24	1.26	1.95	1.48
15	SEP	1.56	1.38	1.3	1.14	1.77	1.43
16		1.4	1.38	1.33	1.17	1.67	1.39
17		1.35	1.36	1.28	1.15	1.66	1.36
18		1.29	1.28	1.43	1.17	1.69	1.37
19		1.33	1.17	1.35	1.21	1.9	1.39
20		1.41	1.19	1.34	1.54	1.9	1.48
21		1.74	1.17	1.32	1.7	1.86	1.56
22		1.86	1.19	1.33	1.98	1.51	1.57
23		1.97	1.3	1.22	1.77	1.45	1.54
24		2.15	1.47	1.24	1.48	1.63	1.59
25		1.82	1.66	1.11	1.44	1.76	1.56
26		1.81	1.62	1.07	1.57	1.89	1.59
27		1.88	2.05	1	1.51	1.76	1.64
28		1.9	2.58	1.12	1.62	1.83	1.81
29		1.88		1.62	1.61	2.02	1.78
30		2.09		1.61	1.57	2.21	1.87
1		2.21		1.42	1.4	2.09	1.78
2		2.22		1.45	1.39	1.32	1.80
3		2.07		1.48	1.39	1.38	1.58
4		2.1		1.53	2	1.51	1.79
5		2.08		1.41	2.29		1.93
6		2.08		1.55	2.03		1.89
7		2.46		1.53	2		2.00
8		2.5		1.48	1.77	1.67	1.86
9		2.45		1.48	1.77	1.65	1.84
10		2.47		1.51	1.67	1.84	1.87
11		2.37		1.54	1.61	1.94	1.87
12		2.06		1.71	1.99	1.71	1.87
13		1.96		1.68	2.12	1.84	1.90
14		1.75		1.63	2.11	1.66	1.79
15	OCT	1.61		1.79	2.35	1.75	1.88
16		1.81		1.58	2.6	2.15	2.04
17		1.76		1.94		2.15	1.95
18		1.62		2.05	2.03	2.15	1.96
19		1.67		1.71	1.94	2.44	1.94
20		1.75			1.79		1.77
21		1.6			1.74		1.67
22		1.8		1.42	1.59	2.3	1.78
23		1.74		1.54	1.39	2.17	1.71
24		1.71		1.75	1.35	1.96	1.69
25		1.79		1.78	1.4	2.07	1.76
26		0.85		1.9	1.33	1.66	1.44
27		0.84	1.62	2.03	1.48	1.76	1.55
28		1.14	1.66	1.73	1.89	1.43	1.57
29		1.24		1.6	1.61	1.87	1.58
30		1.35		1.28	1.55	1.61	1.45
31		1.31		1.31	1.5		1.37

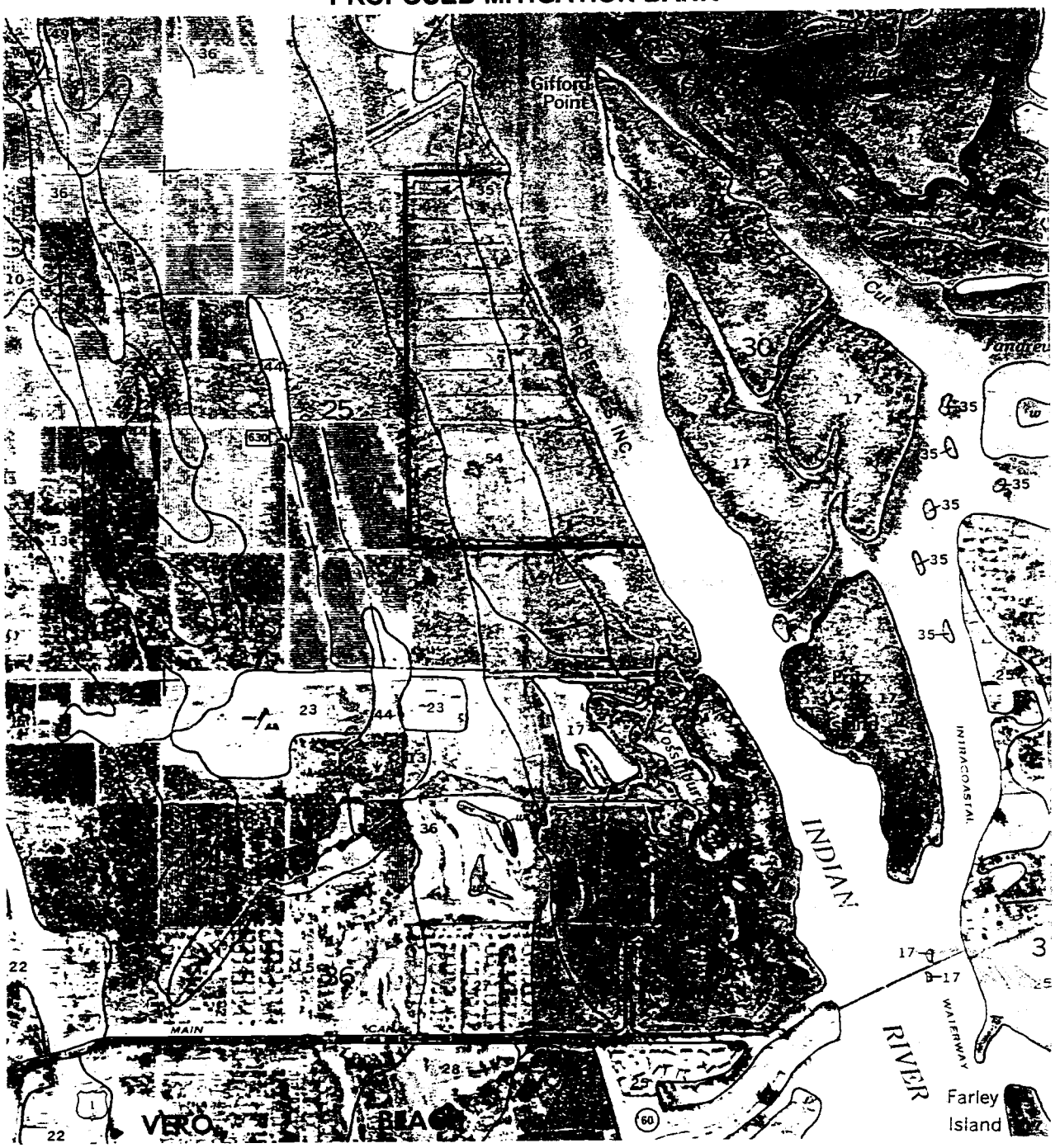
		1991	1992	1993	1994	1995	MEAN
1		1.09	1.38	1.57	1.56		1.40
2		1.03	1.25	1.46	1.66		1.35
3		1.35	1.2	1.19	1.42		1.29
4		1.6	1.06	1.12	1.17		1.24
5		1.5	1.03	0.97	1.27	1.54	1.26
6		1.41	1.23	0.89	1.15	1.48	1.23
7		1.44	1.58	1.03	1.16	1.25	1.29
8		1.45	1.73	1.19	1.11	1.41	1.38
9		1.43	1.71	1.25	1.04	1.58	1.40
10		1.14	1.74	1.76	1.06	1.31	1.40
11		0.72	1.5	1.98	1.14	1.08	1.28
12		0.65		1.35	1.62	1.31	1.23
13		0.58		1.34	1.81	1.43	1.29
14				1.23	2.35	1.44	1.67
15	NOV			1.29	2.36	1.43	1.69
16		1.47		1.03	2.45	1.32	1.57
17		1.42		0.9	2.91	1.34	1.64
18		1.24		0.94	2.74	1.42	1.59
19		1.19		1.03	2.56	1.52	1.60
20		1.07	1.7	1.18	2.3	1.46	1.64
21		0.98	1.52	1.44	2.41	1.51	1.57
22		0.95	1.46	1.58	2.19	1.7	1.60
23		1	1.62	1.96	2.23	1.4	1.64
24		1.24	1.53	1.99	2.34	1.48	1.71
25		1.37	1.36	2.23	1.97	1.84	1.75
26		1.37	1.19	2.08	1.79	1.57	1.62
27		1.11	1.19	1.92	1.59	1.27	1.42
28		1.21	1.47	2.01	1.39	1.05	1.43
29		1.1	1.47	1.77	1.26	0.9	1.30
30		0.97	1.28	1.67	1.35	1.12	1.28
1		0.92	1.1	1.68	1.82	1.14	1.33
2		0.82	0.86	1.82	1.67	1.19	1.27
3		0.58	0.9	1.75	1.59	0.98	1.16
4		0.93	0.84	1.72	1.37	1.06	1.18
5		1.01	0.7	1.39	1.54	1.04	1.14
6		0.89	0.82	1.49	1.54	0.96	1.14
7		0.78	0.66	1.44	1.43	1.04	1.07
8		0.64	0.8	1.44	1.31		1.05
9		0.54	0.87	1.5	1.29		1.05
10		0.55	0.68	1.36	1.28		0.97
11		0.65	0.96	1.5	1.26		1.09
12		0.65	1.24	1.91	1.55		1.34
13		0.63	1.11		1.62		1.12
14		0.54	1.2		1.76		1.17
15	DEC	0.82	1.28		2		1.37
16		1.03	1.12		1.95		1.37
17		0.78	1.13		1.85		1.25
18		0.55	1.19		1.82		1.19
19		0.88	1.34		1.98		1.40
20		0.93	1.12		1.75		1.27
21		0.68	1.06	1.15	2.06		1.24
22		0.81	0.99	1.23	2.06		1.27
23		0.76	0.82	1.08	2.09		1.19
24		0.89	1	1.22	2.07		1.30
25		1.03	0.94	1.08	1.97		1.26
26		0.93	1.07	0.86	1.97		1.21
27		0.97	1.18	0.65	2.11		1.23
28		0.81	1.27	0.52	2.03		1.16
29		1.02	1.43	0.57	1.91		1.23
30		0.91	1.26	0.86	1.86		1.22
31		0.93	0.95	0.98	1.93		1.20
MEAN HIGH		1.23	0.98	1.04	1.05		1.07

GRAND HARBOR WATER LEVELS

1994 DAILY MEAN HIGH WATER



CGW PROPERTIES, INC.
PROPOSED MITIGATION BANK



SCALE:

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

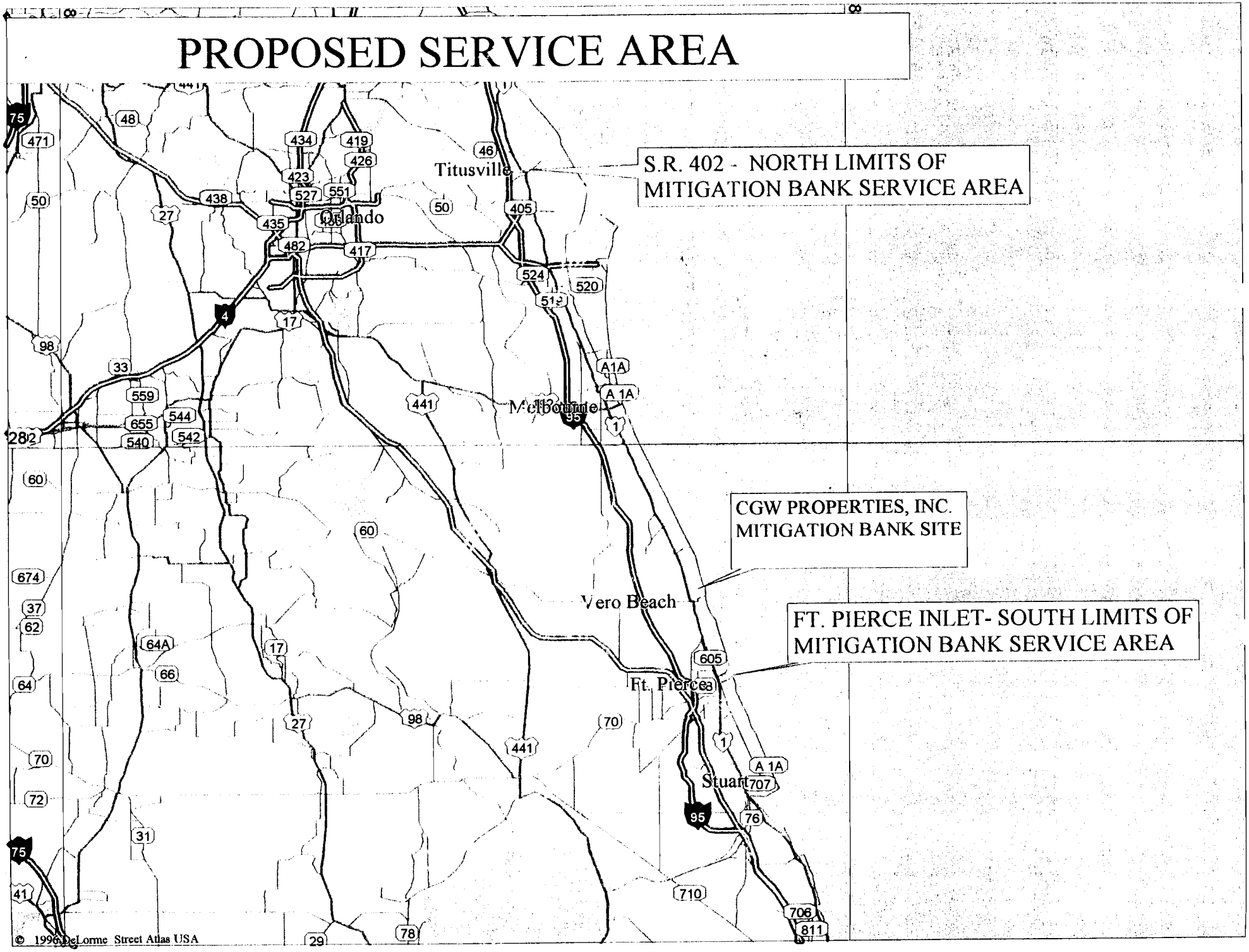
1 .5 0 1 Kilometer

Soil Legend

Map Symbol	Soil Type
35	McKee Mucky Clay Loam
54	Riomar Clay Loam
36	Boca Fine Sand

SOILS MAP

PROPOSED SERVICE AREA



References:

Carlson, Douglas B. and Joseph D. Carroll, Jr. 1985. Developing and implementing impoundment management methods benefiting mosquito control, fish and wildlife: A two year progress report about the technical subcommittee on mosquito impoundments. Journal of the Florida Anti-Mosquito Association, Vol. 56, No. 1.

Carlson, Douglas B., R. Grant Gilmore and Jorge R. Rey. Salt marsh impoundment management on Florida's central east coast: Reintegrating isolated high marshes to the estuary. Proceedings of the 12th Annual Conference on Wetlands Restoration and Creation.

Carlson, Douglas B. and Peter D. O'Bryan. 1988. Mosquito production in a rotationally managed impoundment compared to other management techniques. Journal of the American Mosquito Control Association, Vol. 4, No. 2.

Carlson, Douglas B. and Robert R. Vigliano. 1985. The effects of two different water management regimes on flooding and mosquito production in a salt marsh impoundment. Journal of the American Mosquito Control Association, Vol. 1, No. 2.

Cox, James, Randy Kautz, Maureen MacLaughlin and Terry Gilbert. 1994. Closing the gaps in Florida's wildlife habitat conservation system. Florida Game and Fresh Water Fish Commission, Tallahassee, FL.

East Volusia Mosquito Control District. 1997. Best management practices: Rotary ditching on high marshes. East Volusia Mosquito Control District, Dayton Beach, FL.

Gilmore, R. Grant. Fish, macrocrustacean and avian population dynamics and cohabitation in tidally influenced impounded subtropical wetlands.

Harrington, Jr., R.W. and E. S. Harrington. 1982. Effects on fishes and their forage organisms of impounding a Florida salt marsh to prevent breeding by salt marsh mosquitoes. Bulletin of Marine Science, Vol. 32, No. 2.

Harrington, Jr., R.W. and E. S. Harrington. 1961. Food selection among fishes invading a high subtropical salt marsh: From onset of flooding through the progress of a mosquito brood. Ecology, Vol. 42, No. 4.

Resh, V.H. and S.S. Balling. 1983. Ecological impacts of mosquito control recirculation ditches on San Francisco Bay marshlands: Study conclusions and management recommendations. Proceedings and Papers of the Fifty-First Annual Conference of the California Mosquito and Vector Control Association, Inc.

Resh, V.H. and S.S. Balling. 1983. Tidal circulation alteration for salt marsh mosquito control. Environmental Management. Vol. 7, No. 1.

Wolfe, Roger J. 1996. Effects of open marsh water management on selected tidal marsh resources: A review. Journal of the American Mosquito Control Association, Vol. 12, No. 4.

Woodward-Clyde Consultants. 1994. Physical features of the Indian River Lagoon. Final Technical Report. Indian River Lagoon National Estuary Program, Melbourne, FL.

Woodward-Clyde Consultants. 1994. Biological resources of the Indian River Lagoon. Final Technical Report Vol. 1. Indian River Lagoon National Estuary Program, Melbourne, FL.

Woodward-Clyde Consultants. 1994. Biological resources of the Indian River Lagoon. Final Technical Report Vol. 2. Indian River Lagoon National Estuary Program, Melbourne, FL.

Florida Department of Agriculture & Consumer Services
BOB CRAWFORD, Commissioner

Please Respond To:
Subcommittee on Managed Marshes (SOMM)
Douglas Carlson, Chairman
P.O. Box 670
Vero Beach, Florida 32961
(561) 562-2393 FAX (561) 562-9619

March 18, 1997

Mr Reese Kessler
Environmental Consulting Group
P.O. Box 181518
Casselberry, FL 32718-1518

Re: Subcommittee on Managed Marshes (SOMM) review of CGW proposal for Indian River County Impoundments #25, #24 & #23.

Dear Reese,

Enclosed are comments from SOMM members concerning your office's above-referenced plan which you presented at the February 1997 SOMM meeting in Palatka. As always, SOMM appreciates your efforts to solicit our comments which we hope will be of benefit in designing the best possible project for this site. Both at the meeting and through these comments, I believe it is apparent that SOMM members are supportive of your proposal and appreciative that you and your clients have worked closely with the Indian River Mosquito Control District to try and develop a plan acceptable both from a natural resource and mosquito control standpoint. This project has undergone several revisions over the past year or so and the current version includes these sometimes difficult concessions to diverse concerns. Virtually everyone commenting encourages an arrangement whereby Impoundment #23 can be included in the project as that would make for a more complete management plan for this sensitive stretch of the lagoon.

Feel free to contact me if I can be of any further assistance. If any additional members should provide comments, I will forward them to you. We look forward to working with you on this project.

Sincerely yours,

Doug Carlson

Douglas Carlson
Chairman

cc: SOMM members
MBRT members
Mr. C. Chown

FLORIDA GAME AND FRESH WATER FISH COMMISSION

March 6, 1997

ALLAN L. EGBERT, Ph.D., Executive Director
VICTOR J. HELLER, Assistant Executive Director

OFFICE OF ENVIRONMENTAL SERVICES
BRADLEY J. HARTMAN, Director
FARRIS BRYANT BUILDING
620 South Meridian Street
Tallahassee, FL 32399-1600
(904) 488-6661
SUNCOM 278-6661
FAX (904) 922-5679
TDD (904) 488-9542

Mr. Douglas Carlson, Chairman
Subcommittee on Managed Marshes
P.O. Box 670
Vero Beach, FL 32961

Re: Preliminary Impoundment Management Plan for Indian River County Impoundments #24 and #25

Dear Doug:

The preliminary plan for I.R.C. Impoundments #24 and #25, as presented by Reese Kessler at our last SOMM meeting, should significantly improve their fish and wildlife habitat value, and the interaction of these wetlands with the Indian River Lagoon. I hope the Mitigation Bank Review Team gives some credit for the preservation of these lands, in addition to the credits for their functional improvement.

Sincerely,

Brian Barnett

Brian S. Barnett, Assistant Director
Office of Environmental Services

BSB/tgw
irci2425
ORG 2-5/3

LEE COUNTY MOSQUITO CONTROL DISTRICT

941-694-2174
SUNCOM 725-1011
FAX 941-693-5011
POST OFFICE BOX 60005
FORT MYERS, FLORIDA 33906

WILLIAM R. OPP, DIRECTOR

Doug Carlson, Chair
Subcommittee on Managed Marshes
Indian River Mosquito Control District
Vero Beach, Florida 32961-0670

Dear Doug,

Upon review of the C G W Properties Mitigation Bank proposal I would like to offer the following comments:

- This revised plan is far superior to previous designs based on mosquito production.
- This plan has dropped Impoundment number 23 from the overall design. Leaving this section out of the project greatly diminishes the total positive worth of this project.

I support the project as detailed; however, I would strongly recommend Impoundment 23 be included for mitigation credit. There should be some mitigation worth to insuring this section comes under public ownership and for protecting the adjoining impoundments function and design. Protecting this impoundment will help to maintain control of mosquitoes in an environmentally-sound manner. When awarding mitigation credit the regulating agency should keep in mind any alterations to a site can positively or negatively impact mosquito breeding. Control of that mosquito breeding can then impact the site. Increasing the value assigned to Impoundment 23 could prevent impact due to pesticides.

Sincerely,

Shelly S. Redovan

Shelly S. Redovan
Biologist, Lee County Mosquito Control District

BOARD OF COUNTY COMMISSIONERS

ST. LUCIE COUNTY FLORIDA

MOSQUITO CONTROL DISTRICT

14 March 1997

FRANK D. S. EVANS
DIRECTOR

Mr. Douglas Carlson
Chairman Subcommittee on Managed Marshes
Indian River Mosquito Control District
Post Office Box 670
Vero Beach, Florida 32961-0670

Subject: CGW (Mitigation Bank)

Dear Mr. Carlson,

The presentation by Mr. Kessler was well received as all questions were answered completely.

The fundamental problem with this proposal is whether Indian River Mosquito Control District can live with the proposed mitigation and restoration. From the discussion at the Palatka meeting, it appeared that the District was reasonably satisfied, and that modifications to the original proposal had been made in response to District suggestions.

Impoundment #24 & 25 are the focus of this proposal, but Impoundment #23 would be an asset to the overall project.

It is unfortunate that Impoundment #23 is not included in the Mitigation Bank, perhaps another approach can be explored to include this impoundment in the future. In any event it seems endless pesticide treatments will be a continuing concern for this region without some form of water management.

If that is the best management available under the circumstances, then let see how many mitigation credits CGW will be awarded to make it financially feasible.

Best of luck in trying to balance reasonable Mosquito and sandfly control, and the private owners seeking financial return form this property.

Sincerely Yours,

Frank D. S. Evans
Director of Mosquito Control District

Mr. Douglas Carlson
Chairman SOMM
Indian River Mosquito Control District
P.O. box 670
Vero Beach, Fl. 32961-0670

10- March 1997

RE: CGW property proposal.

Dear Doug,

I have reviewed the information presented to the SOMM on 18 Feb. 1997 regarding the CGW properties proposal. Since both of these impoundments are already open to the estuary via existing breaches I view this not as a reconnection project but, an improvement project. With additional breaches and lowering the dike elevation to allow tidal flow, faunal access to the marsh should be improved. I believe that any steps taken to improve the conditions of an impoundment or highly impacted salt marsh has merit and should be encouraged. However, I have several concerns regarding this project.

1. Besides exotics what is the composition of existing marsh vegetation.?
2. Will this increased opening of this impoundment allow greater chance for invasion of Red mangroves onto the marsh surface, and displace the present marsh surface vegetation?
3. When the exotics are removed, what will prevent them from coming back before marsh vegetation can be established. Are the exotics growing on spoil, if so what will be done with the spoil after removal?
4. Will the equipment used in the removal and/or lowering of the dikes and exotics impact the existing marsh vegetation and faunal components (i.e. nests...)?
5. Will these modifications still allow for effective non chemical mosquito control?.

Regards

Douglas M. Scheidt
SOMM Member

BREVARD MOSQUITO CONTROL DISTRICT
2870 GREENBROOKE ST.
VALKARIA, FLORIDA
32950
(407) 952-6322 FAX 952-4535
E-MAIL: DSTAYLOR@FIT.EDU

February 24, 1997

Mr. Doug Carlson
Chairman
SOMM
PO Box 670
Vero Beach, FL
32961-0670

RE: Comments on IRC Imps. 23-25, Mitigation Bank

Dear Doug:

Addition of Imp. 23 to this proposal would enhance management of the area as a unit and is recommended.

Imp. 24: Please note that one of the largest Rivulus marmoratus populations in Indian River County is found in the eastern portion of this impoundment. Ditching (as proposed) does not appear to intrude into this habitat and should not. Any cleaning of old hand ditches in this area could impact this fish. Distichlis dominated marshes benefit greatly from burning (at least in northern Brevard County) and this management tool should be investigated for this marsh. It is apparent that this area has not burned for some time. The need to close any installed culverts (flapgates) should be justified beyond a need to "enhance" water quality.

Imp. 25: I am still not clear if the flowing well at the SW corner of this impoundment has been plugged. If not, this should be incorporated into the plan. Excavation of ponds within current Brazilian pepper areas should be carefully considered. The need for ponds for wading bird habitat or fish reservoirs should be documented. It might be more beneficial to restore these areas to high marsh, as in many cases open-water habitats are not in the short supply that healthy high marsh systems are, especially considering the area of existing ditch that will be retained.

Thank you for the opportunity to comment.

Sincerely,

D. Scott Taylor
Environmental Resources Specialist

Indian River Mosquito Control District

P.O. Box 670, Vero Beach, Florida 32961-0670
PHONE: (407) 562-2393 • FAX: (407) 562-9619
5655 41ST STREET

E. J. BEIDLER, Director

Mr. Doug Carlson
Chairman, Subcommittee on Managed Marshes

March 17, 1997

RE: Comments on CGW Mitigation Bank project.

Dear Mr. Carlson,

As you are aware, I have met with Reese Kessler (environmental consultant for CGW) several times and on site in regards to this project and attended Reese's presentation at the SOMM meeting in Palatka on Feb. 18. I would like to offer my comments on the project as follows.

The plan presented by Reese at the SOMM meeting incorporates many aspects that have the potential to improve source reduction mosquito control at these sites. The installation of culverts and additional breaches at the specified elevations should improve water quality and flushing. Installing permanent ponds and digging rotary ditches from these ponds to known breeding potholes will greatly improve mosquito control and help reduce or eliminate chemical applications.

In regards to the ditch filling in Impoundment # 25 (Lab), great care needs to be taken to ensure that the fill is evenly spread and compacted to avoid potholes or settling that could become breeding areas. The clearing of exotics off the perimeter dikes will benefit mosquito control access to other areas of the marsh.

It is hoped that CGW will pursue improvements at Impoundment #23 (South John Knights) as culverting this isolated impoundment would allow for greatly improved natural resource benefits and at the same time allow trapping of tidal water to help control mosquitoes.

Henry Dean, Executive Director
John P. Wehle, Assistant Executive Director
Charles T. Myers III, Deputy Assistant Executive Director

WATER MANAGEMENT DISTRICT

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March 21, 1997

Mr. Douglas Carlson
Indian River Mosquito Control District
PO Box 670
Vero Beach, FL 32961-0670

RE: SOMM review of CGW Properties Mitigation Bank Proposal

Dear Mr. Carlson:

As part of our participation in the Subcommittee on Managed Marsh, the following is the review you requested. The plan appears to provide some significant environmental benefit. Dike lowering, added culverts and breaches, and exotic removal are all very positive. The addition of some high marsh ponds to increase wildlife benefits and potentially reduce mosquito production is also positive.

There are still some questions. Will the internal dikes in Impoundment 25 be lowered to a consistent 1.5 ft or to as close to marsh elevation as possible and no higher than 1.5 ft? If the former is the goal and the marsh elevation is less than 1.5 ft, the final configuration would leave a series of ridges across the marsh. This would appear to inhibit flow across the marsh surface. The second question deals with the proposed closed-loop rotary ditches. This type of ditch would appear to increase the area impacted by doubling the amount of ditching needed to reach a potential breeding site. In places where the closed-loop ditches have been used (Lost Creek, Volusia County), the distal portion of the ditch appears to deteriorate quickly. The dendritic-type ditch systems that meander, branch, and shallow at breeding site ends, with a single connection to the water source, appear more natural and better at maintaining themselves. The success of these has been demonstrated in Volusia County. Finally, the methods used for "scraping down" dikes and pepper areas, and the method of pond construction need to be considered carefully to minimize impacts to the surrounding areas.

Thank you for the opportunity to review this project.

Sincerely,

Ronald Brockmeyer
Environmental Specialist

Robert Virnstein
Supervising Environmental Specialist

RB:RV:rcs

c: Todd Gipe
Joel Steward
IRL-IMP