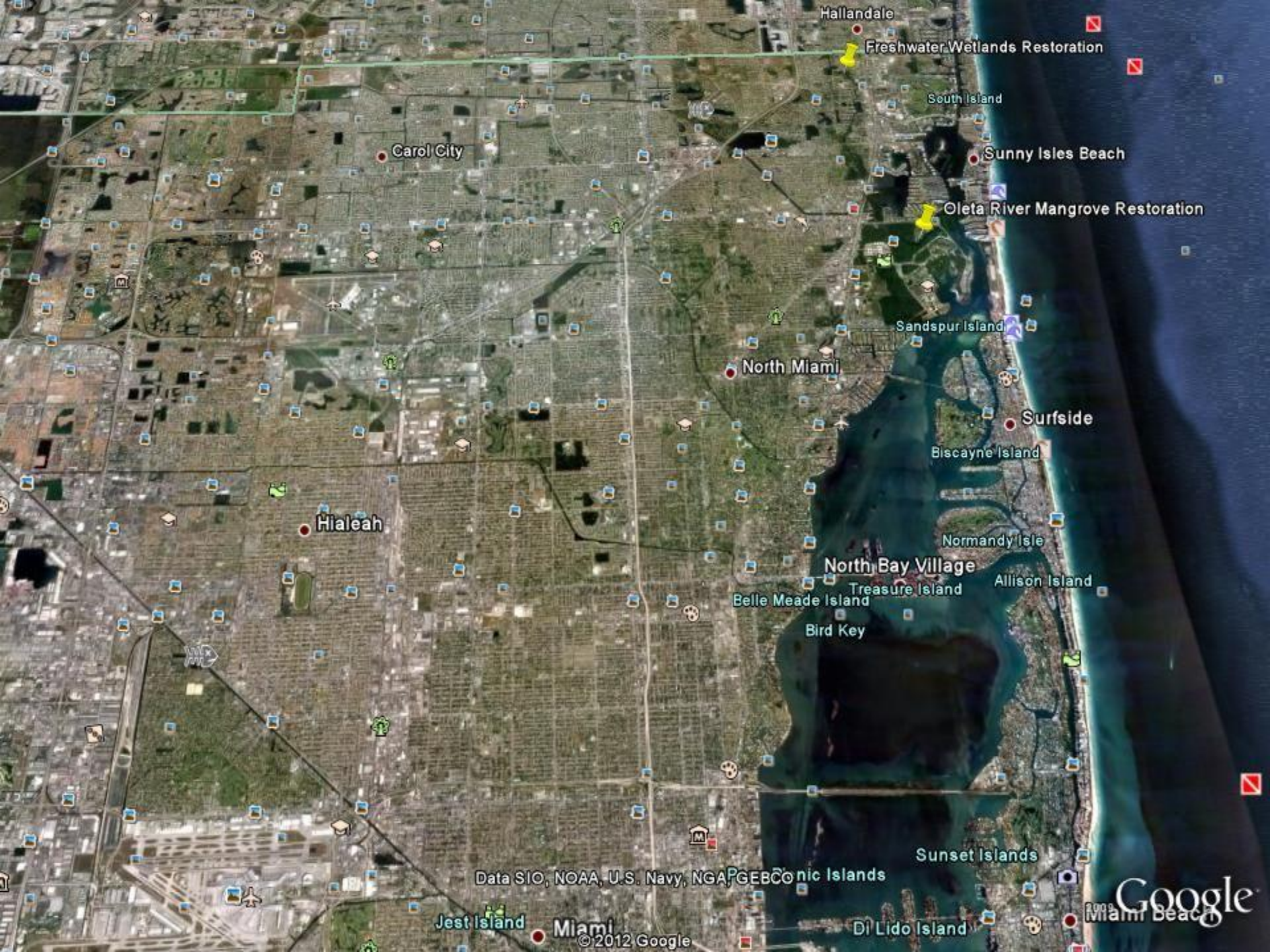
INTEGRATION OF HABITAT HETROGENEITY AND COST EFFECTIVE RESTORATION TECHNIQUES AND STRATEGIES INTO INNOVATIVE LARGE-SCALE WETLANDS RESTORATION EFFORTS IN SOUTH FLORIDA URBAN AREAS

GARY R. MILANO, MS
MIAMI-DADE COUNTY, FLORIDA

Coastal Restoration Accomplishments

- **600 acres wetland restoration and enhancement**
- **22 island improvement projects**
- **7 miles shoreline stabilized**
- **100+ acres coastal hammocks and dunes**
- **12 bay artificial reefs**
- **Seagrass Restoration (north Bay, ongoing)**
- $50 million (54% provided by Miami-Dade County) at more than 50 sites
- Partners: FIND, SFWMD, FDEP, USDA, ACOE, Municipalities, Not for profit organizations


Hallandale
Freshwater Wetlands Restoration
South Island
Carol City
Sunny Isles Beach
Oleta River Mangrove Restoration
Sandspur Island
North Miami
Surfside
Biscayne Island
Hialeah
Normandy Isle
North Bay Village
Treasure Island
Allison Island
Belle Meade Island
Bird Key
Sunset Islands
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
nic Islands
Jest Island
Miami
© 2012 Google
Di Lido Island
Miami Beach
Google

Highland Oaks Park Freshwater Wetlands Restoration

- Clearing exotic vegetation, dredging, and widening creek bed to enhance hydrologic connection with isolated wetlands
- Existing tree resources preserved. Headwaters of the Oleta River
- The only natural river in Miami-Dade County with a direct connection to Biscayne Bay
- Restore habitat for anadromous fish species
- Enhance wetland functions through improved hydrology and establishment of appropriate flora

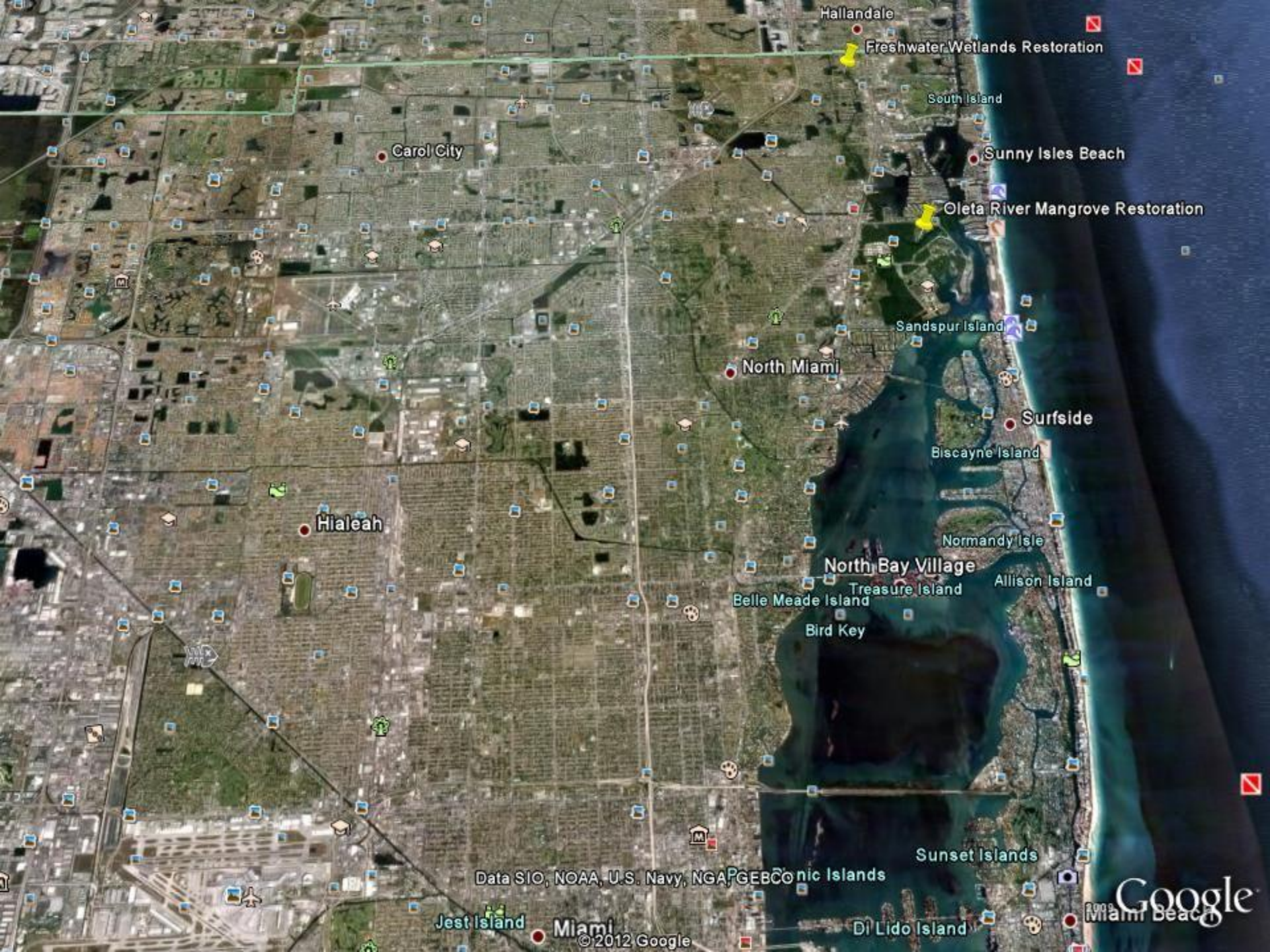
Thalia geniculata
(Alligator flag)

Taxodium distichum
(Bald cypress)

Eleocharis interstincta (Knotted spikerush)

Pontederia cordata (Pickerelweed)

Sagittaria lancifolia (Bulltongue arrowhead)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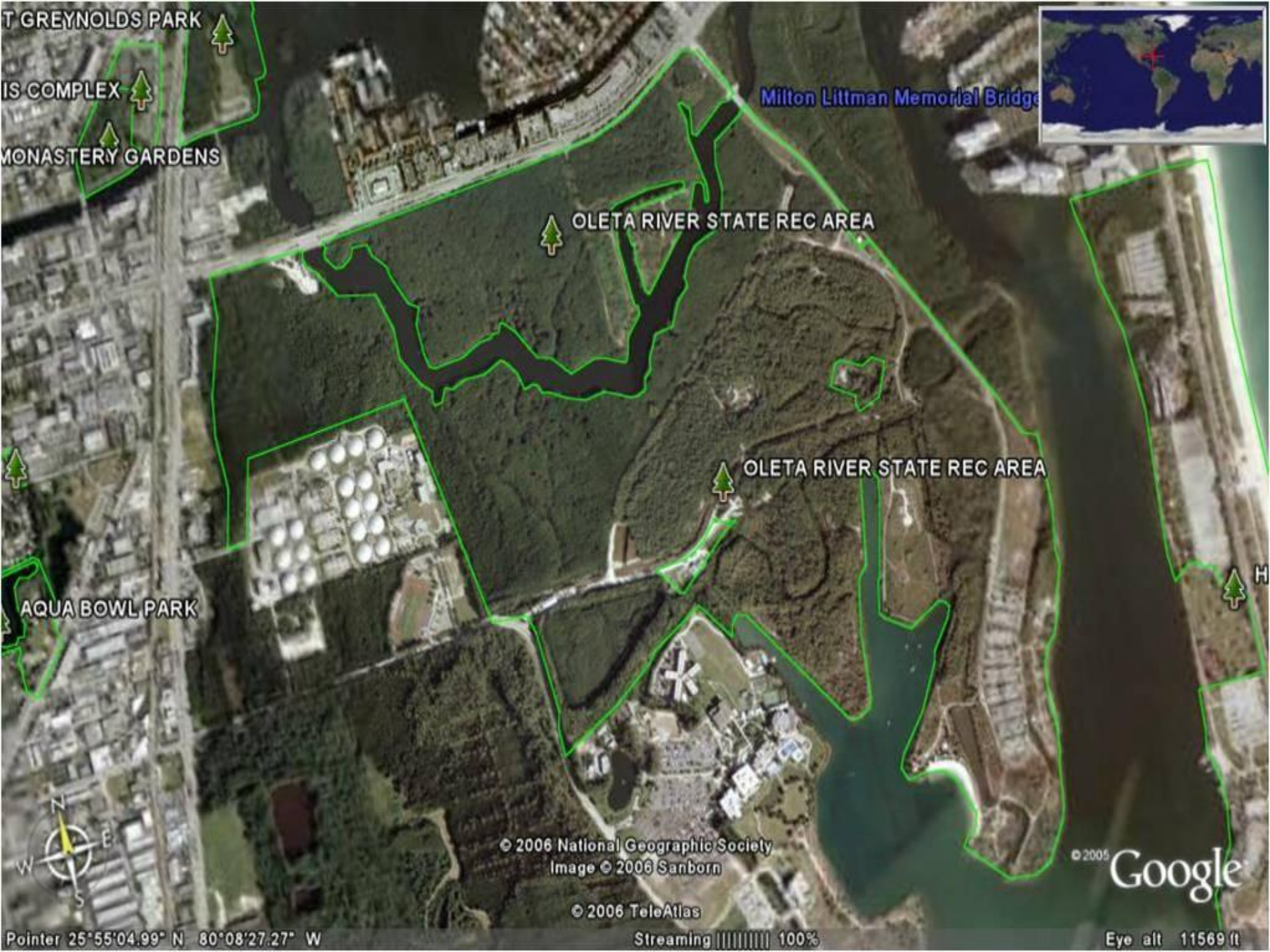
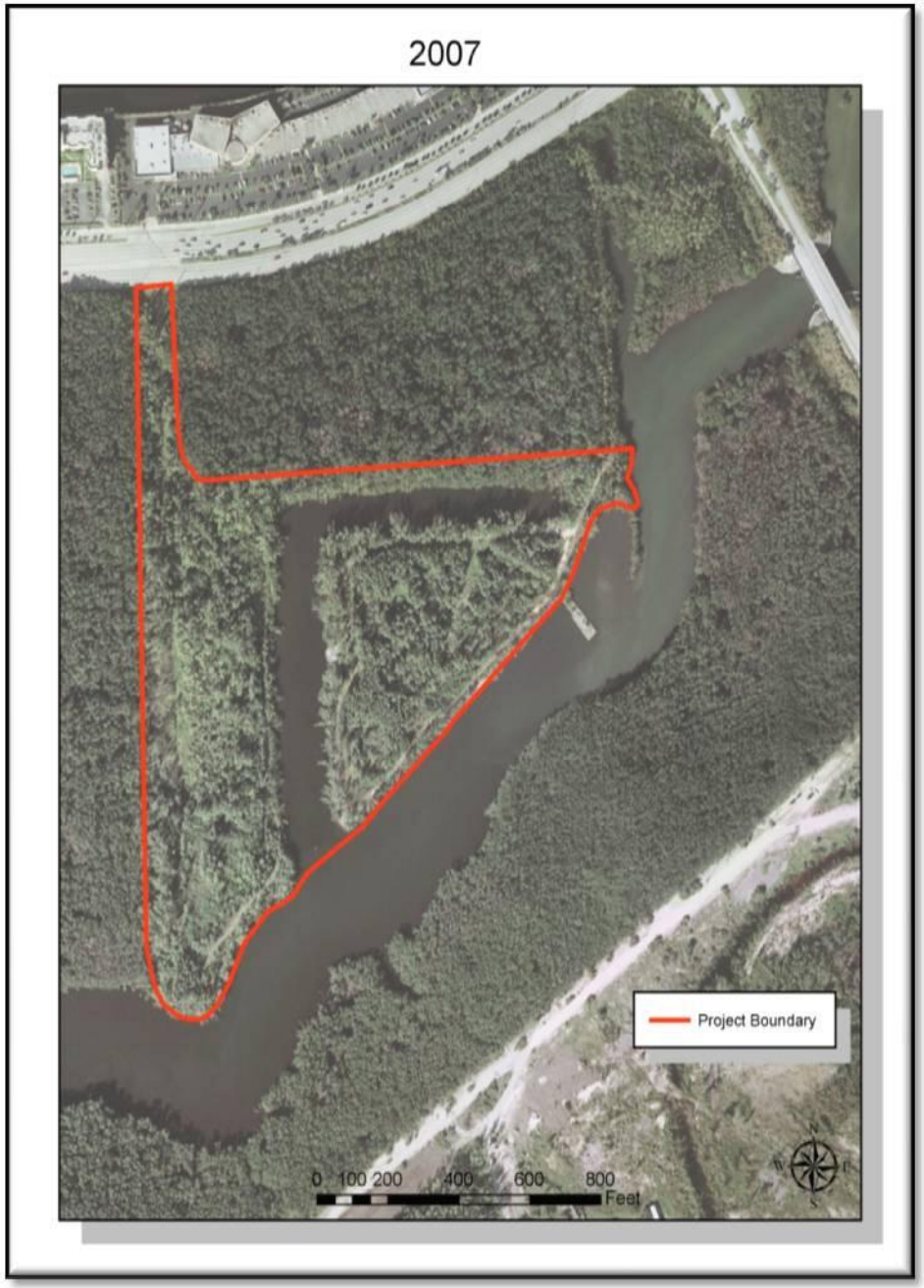
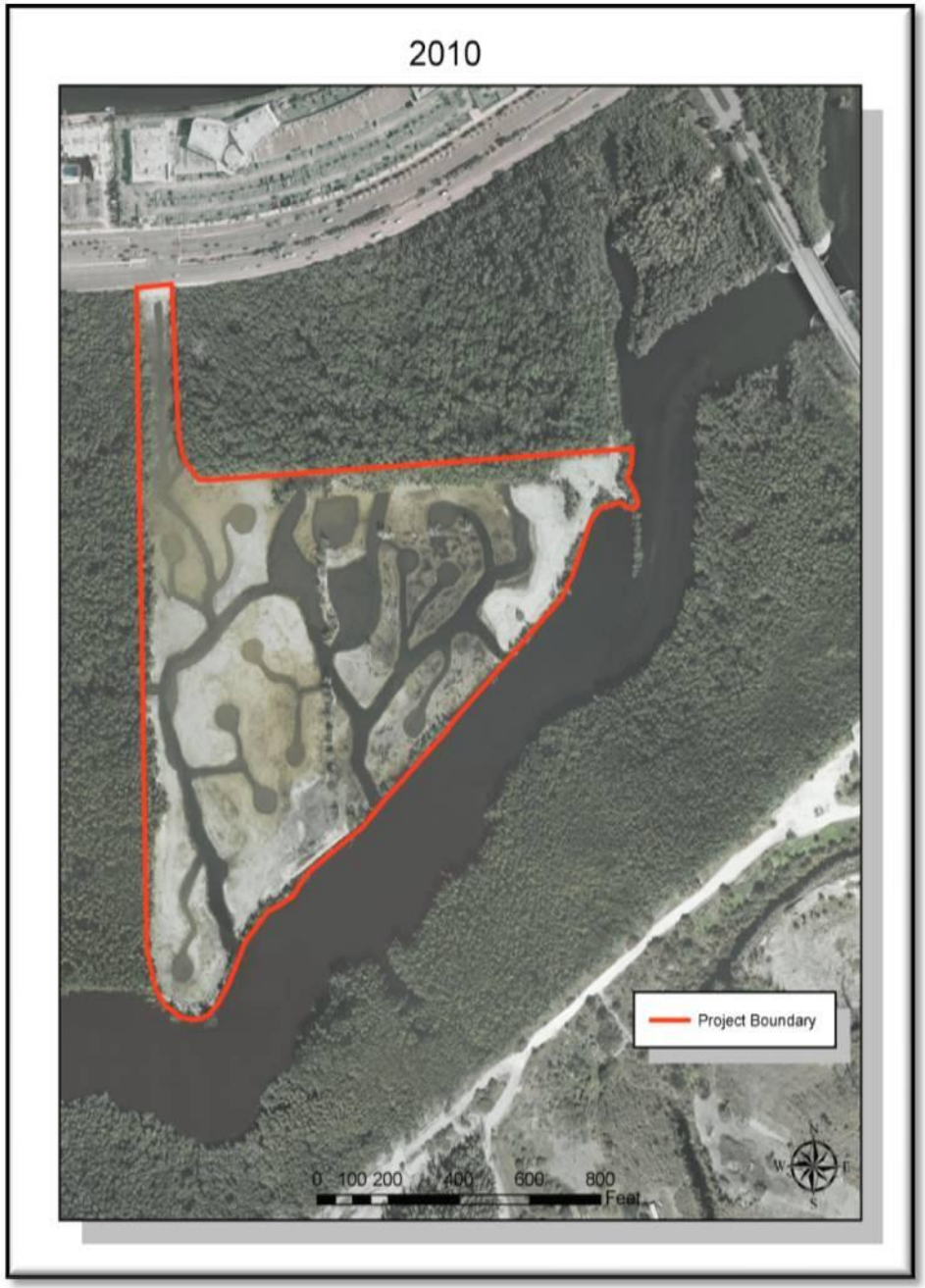
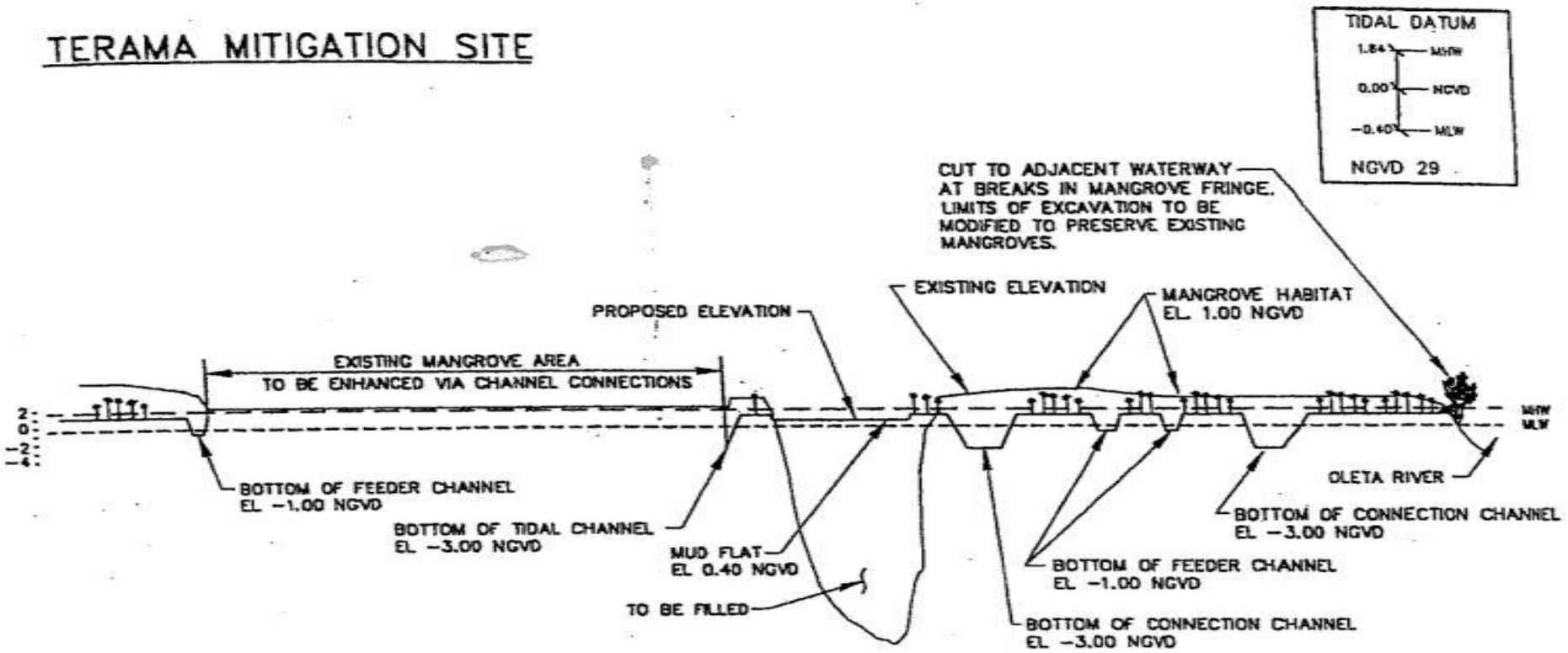

T GREYNOLDS PARK
IS COMPLEX
MONASTERY GARDENS
Milton Littman Memorial Bridge
OLETA RIVER STATE REC AREA
OLETA RIVER STATE REC AREA
AQUA BOWL PARK
© 2006 National Geographic Society
Image © 2006 Sanborn
© 2006 TeleAtlas
© 2005 Google
Pointer 25°55'04.99" N 80°08'27.27" W
Streaming 100%
Eye alt 11569 ft

Oleta River State Park Wetlands Restoration





TERAMA MITIGATION SITE



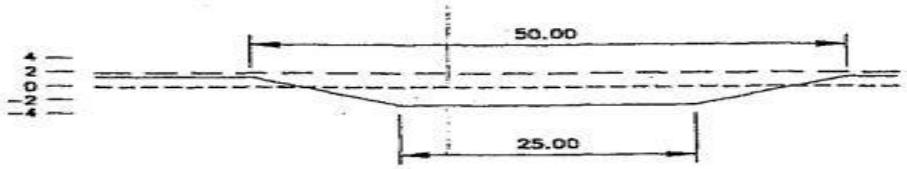
SECTION QQ

VERTICAL SCALE 1=10

HORIZONTAL SCALE 1=150

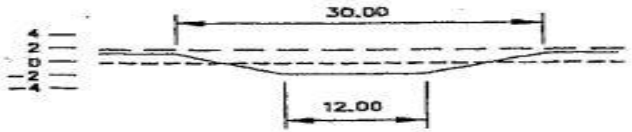
TYPICAL SECTIONS FOR STANDARD SITE FEATURES

TIDAL DATUM
1.54 — MHW
0.00 — NGVD
-0.40 — MLW
NGVD 29



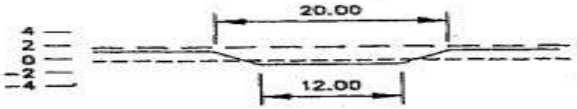
3:1 SIDE SLOPE

MAIN CHANNEL -3.0



3:1 SIDE SLOPE

FLUSHING CHANNEL -2.

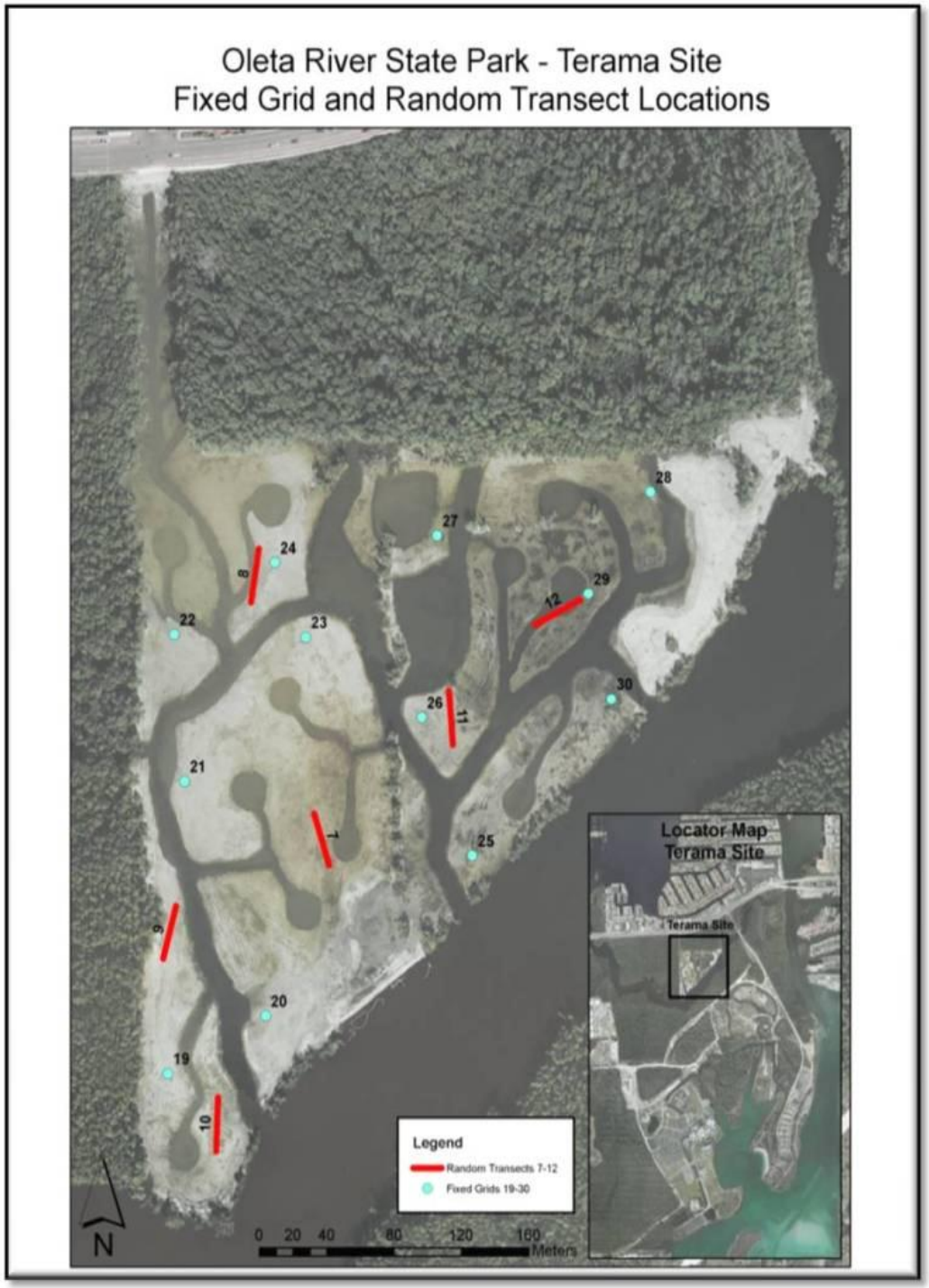


2:1 SIDE SLOPE

FEEDER CHANNEL -1.00

2:1 SIDE SLOPE

TIDAL POOL -1.50



Callinectes sapidus

Eudocimus albus

Monitoring for Success

February 2010

May 2010

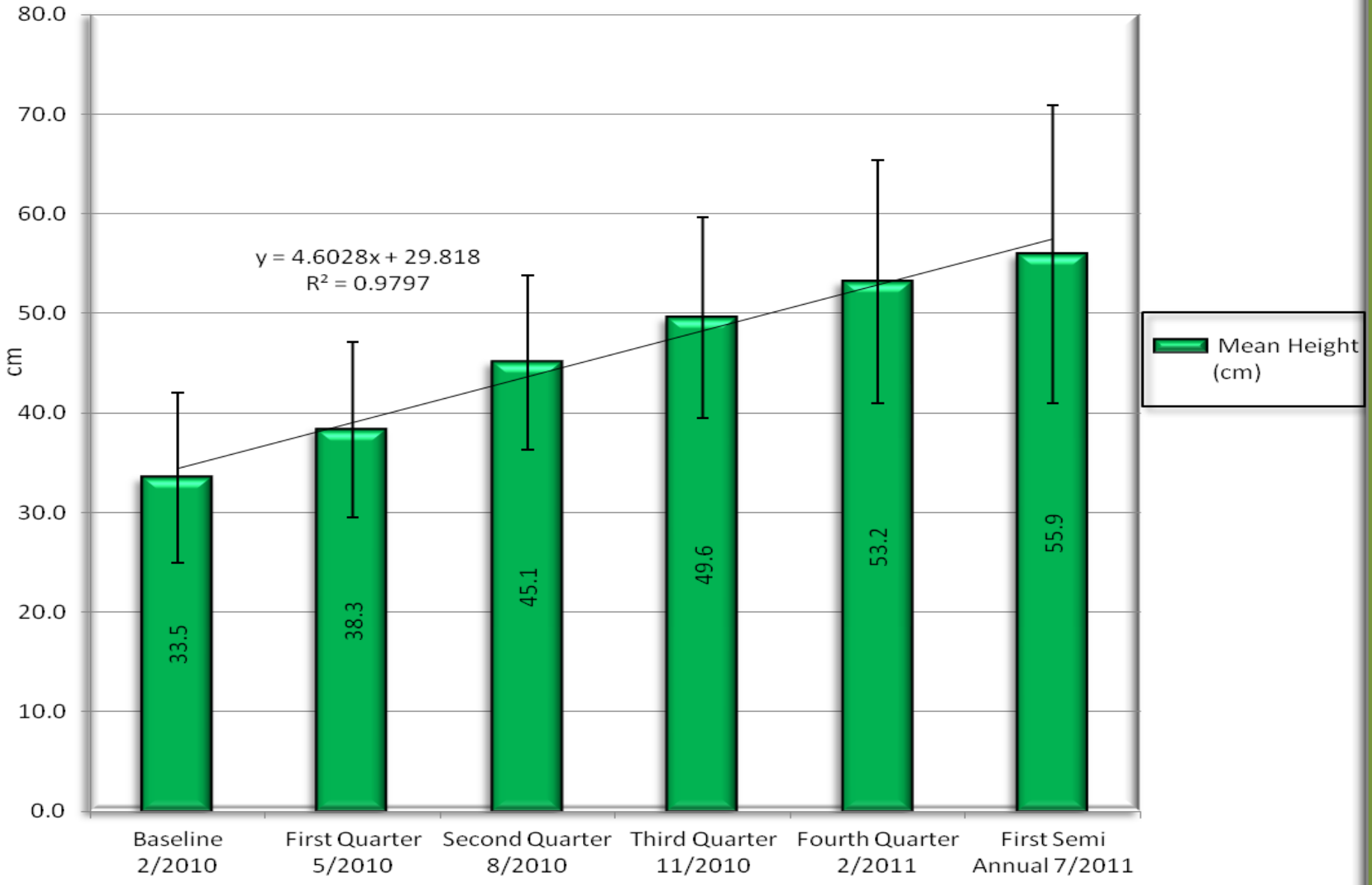
August 2010

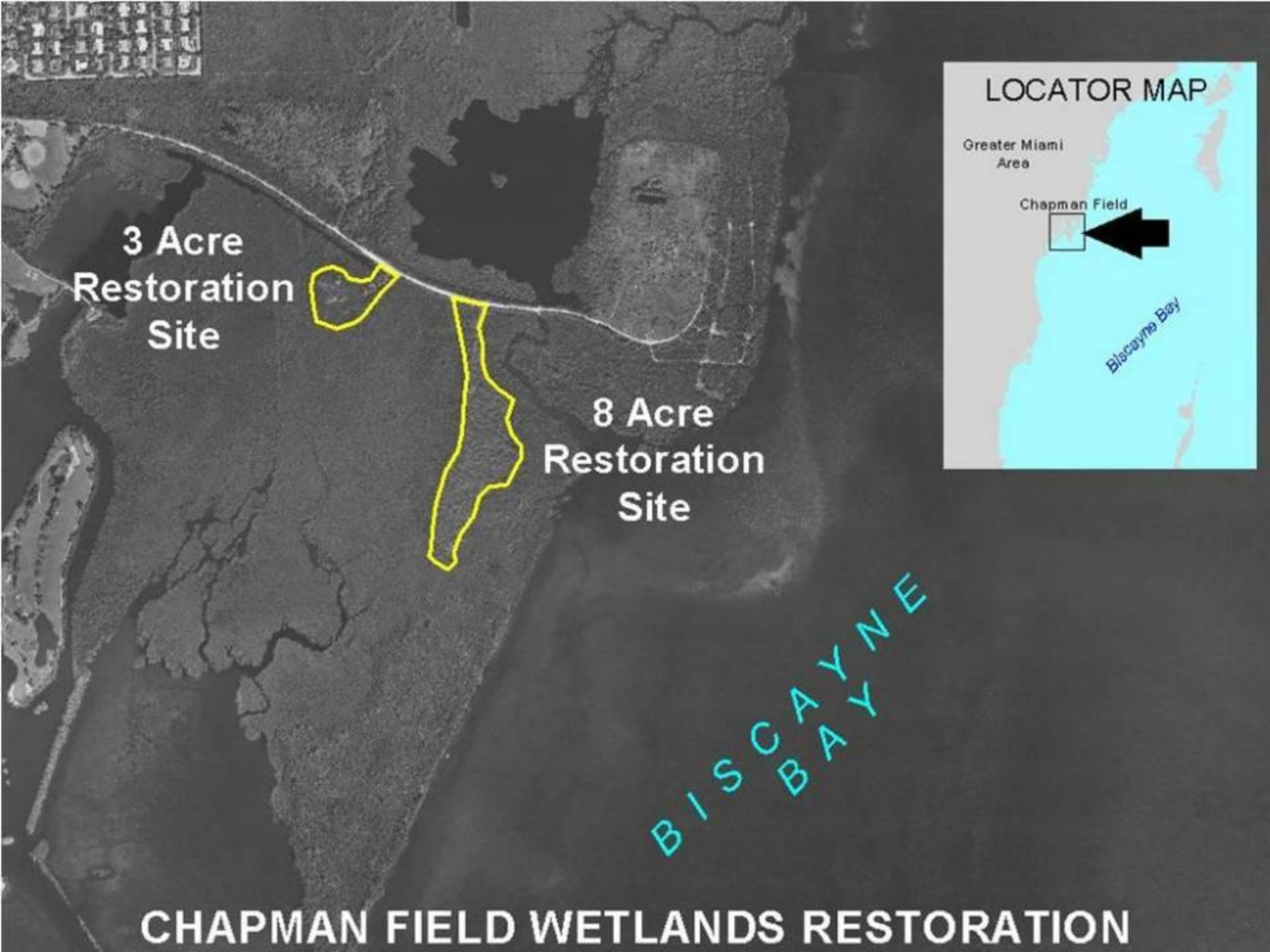
November 2010

February 2011

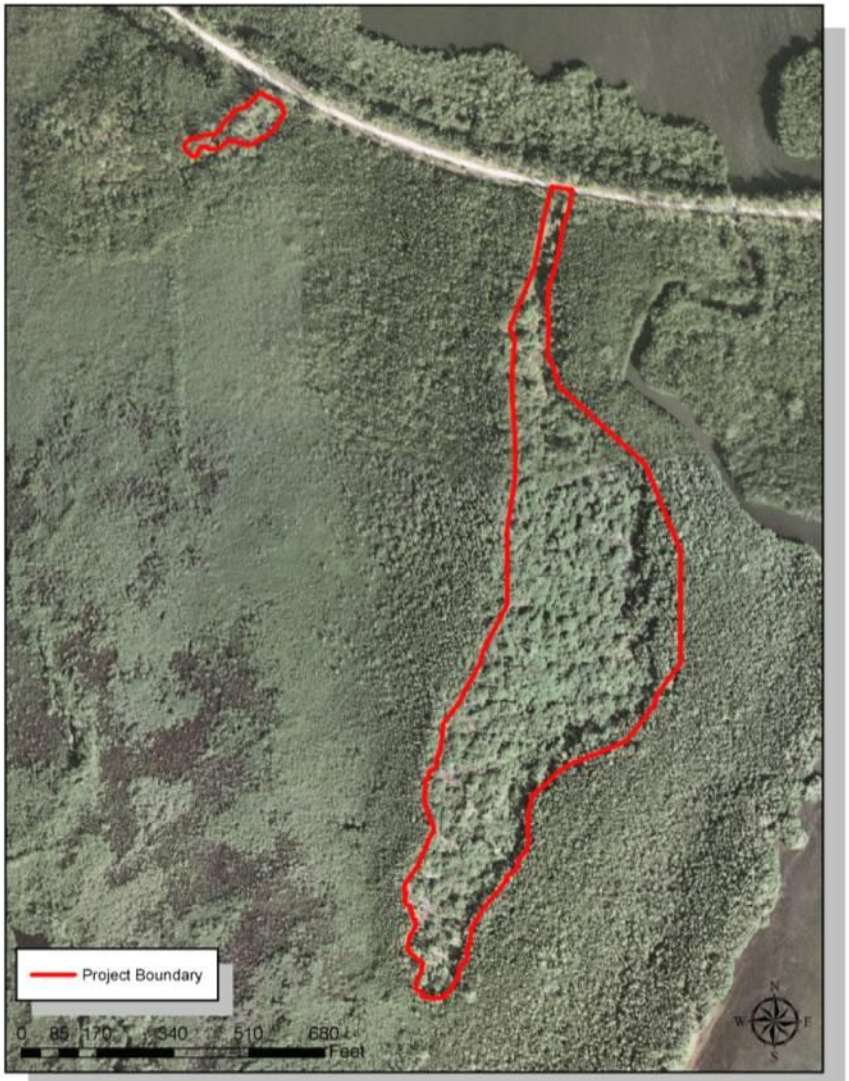
July 2011

Rhizophora mangle Heights

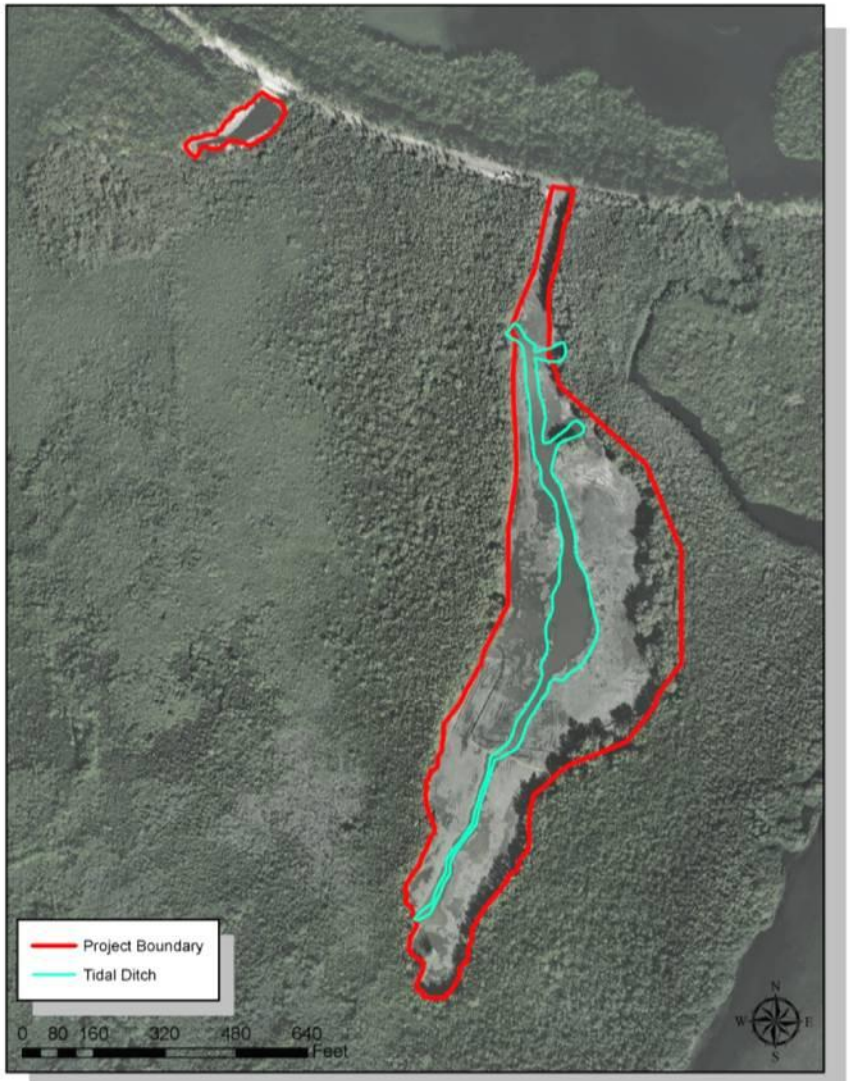



LOCATOR MAP
Greater Miami Area
Chapman Field
Biscayne Bay
3 Acre Restoration Site
8 Acre Restoration Site
BISCAYNE BAY
CHAPMAN FIELD WETLANDS RESTORATION

2007


Project Boundary
0 85 170 340 510 680
Feet
N
W
E
S

2010

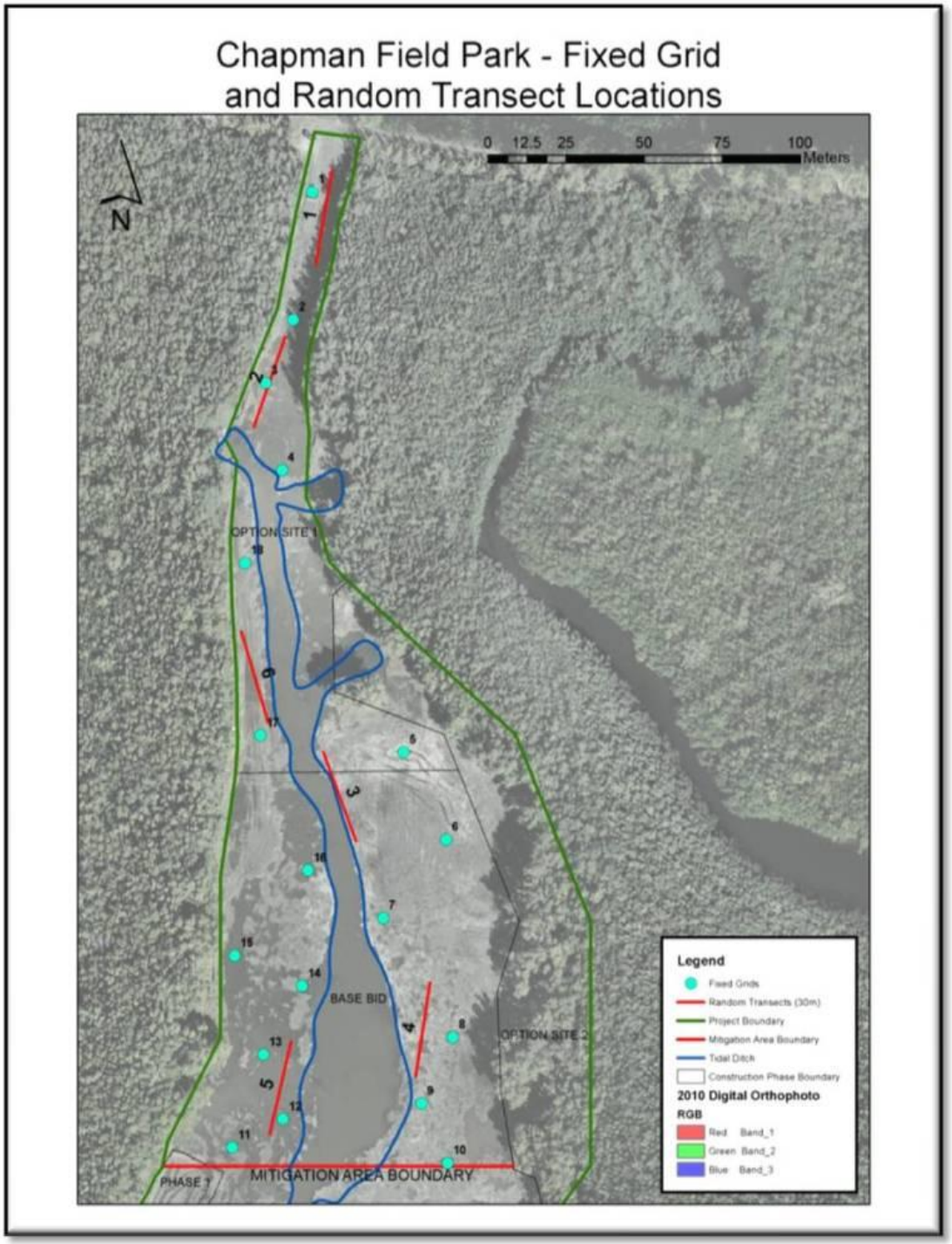

Project Boundary
Tidal Ditch
0 80 160 320 480 640
Feet
N
W
E
S


KOBELCO


KOMATSU
12 01 2009 14 34


12 01 2009 13 35


12 03 2009 12 49



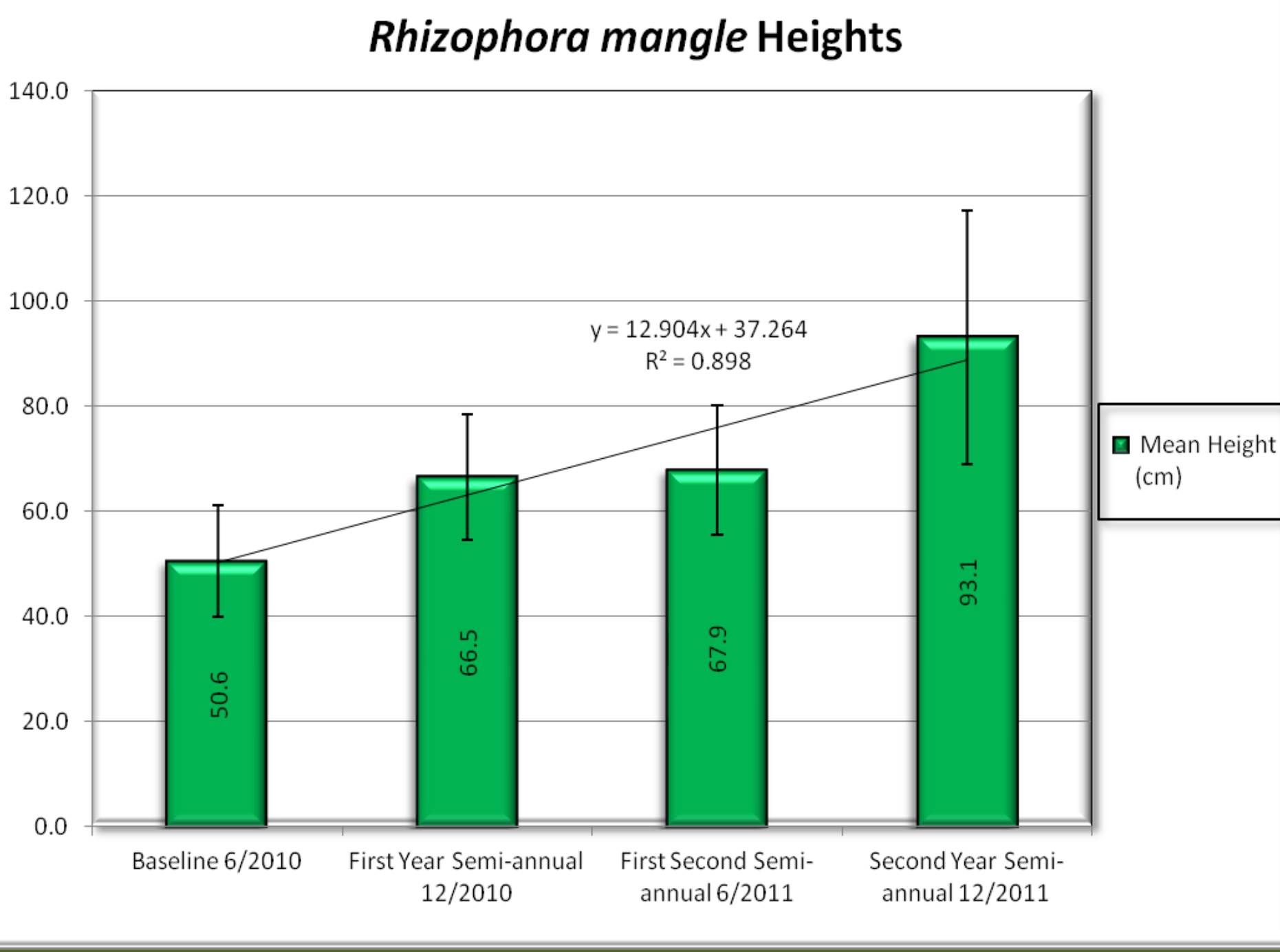
Tidal Connection Creek

June 2010

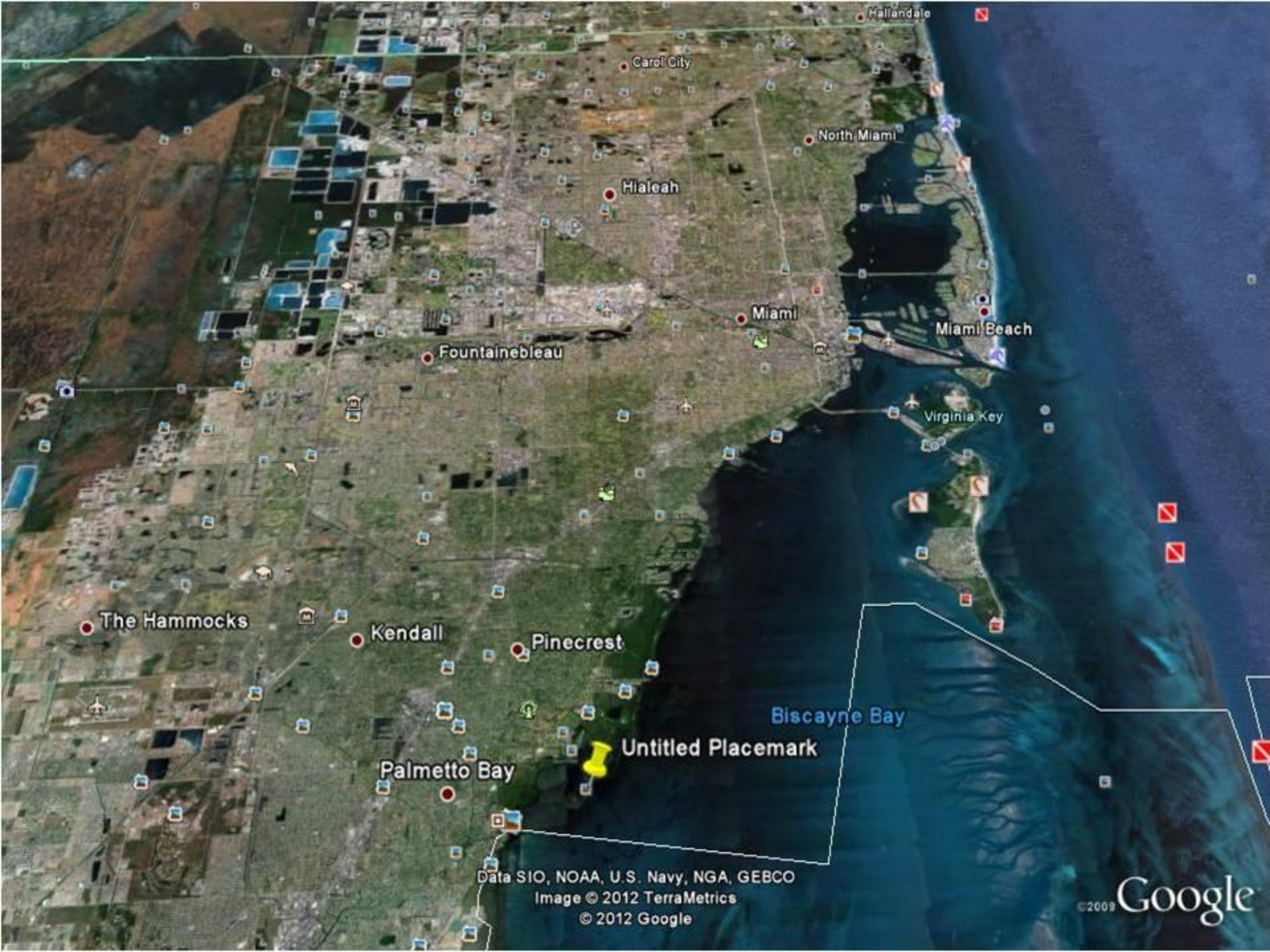
December 2010

June 2011

December 2011


Rhizophora mangle Heights
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
y = 12.904x + 37.264
R² = 0.898
50.6
66.5
67.9
93.1
Baseline 6/2010
First Year Semi-annual 12/2010
First Second Semi-annual 6/2011
Second Year Semi-annual 12/2011
Mean Height (cm)


Chicken Key Wetlands
Restoration


Hallandale
Carol City
North Miami
Hialeah
Miami
Miami Beach
Fountainebleau
Virginia Key
The Hammocks
Kendall
Pinecrest
Biscayne Bay
Untitled Placemark
Palmetto Bay
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2012 TerraMetrics
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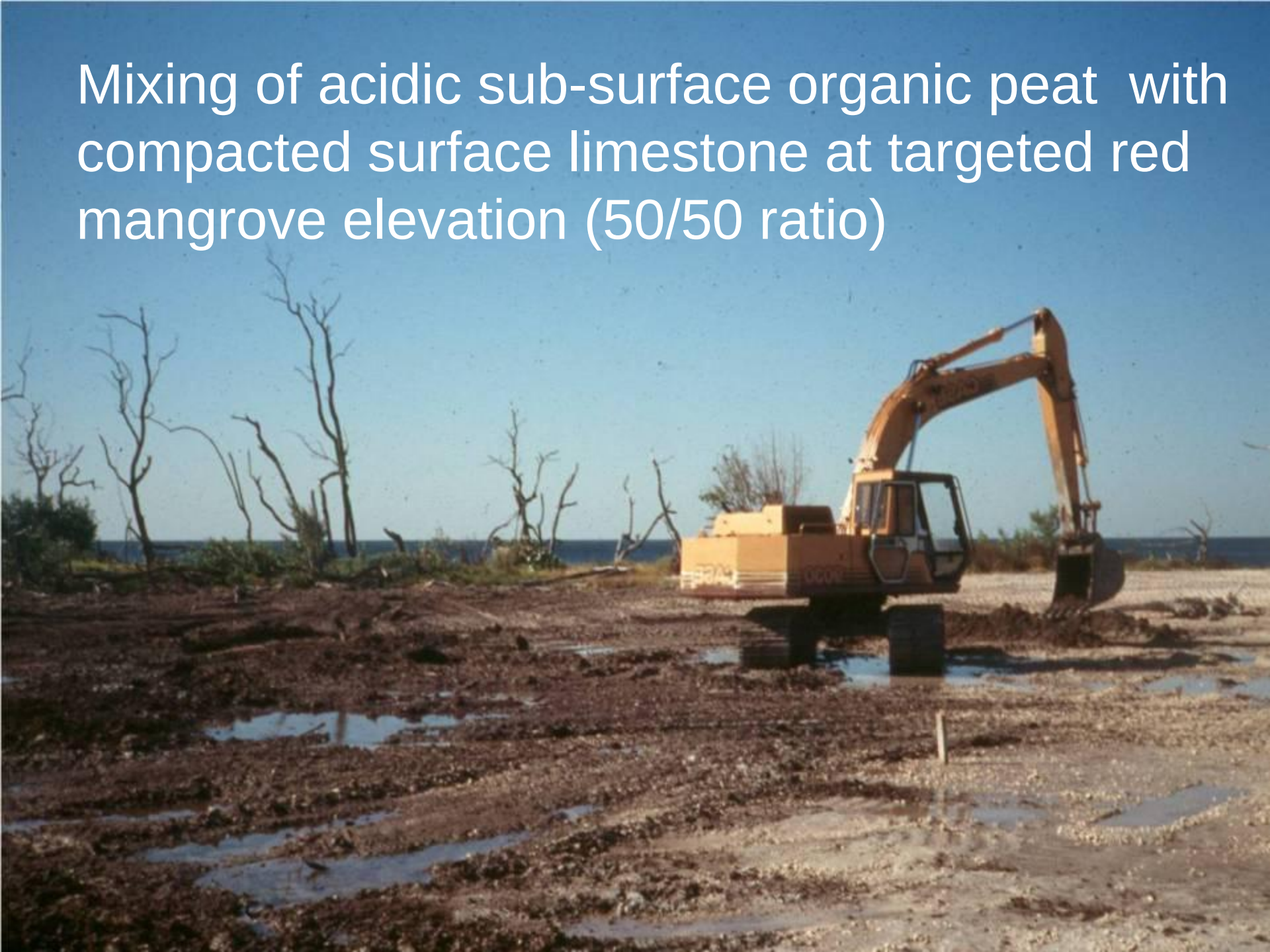
Mixing of acidic sub-surface organic peat with compacted surface limestone at targeted red mangrove elevation (50/50 ratio)



TYPICAL RIPRAP SECTION N.T.S.

TYPICAL MANGROVE PLANTER SECTION N.T.S.

PREPARED BY:
METROPOLITAN DADE COUNTY
ENVIRONMENTAL RESOURCES MANAGEMENT
111 NW FIRST ST.
SUITE 1310
MIAMI, FLORIDA 33128

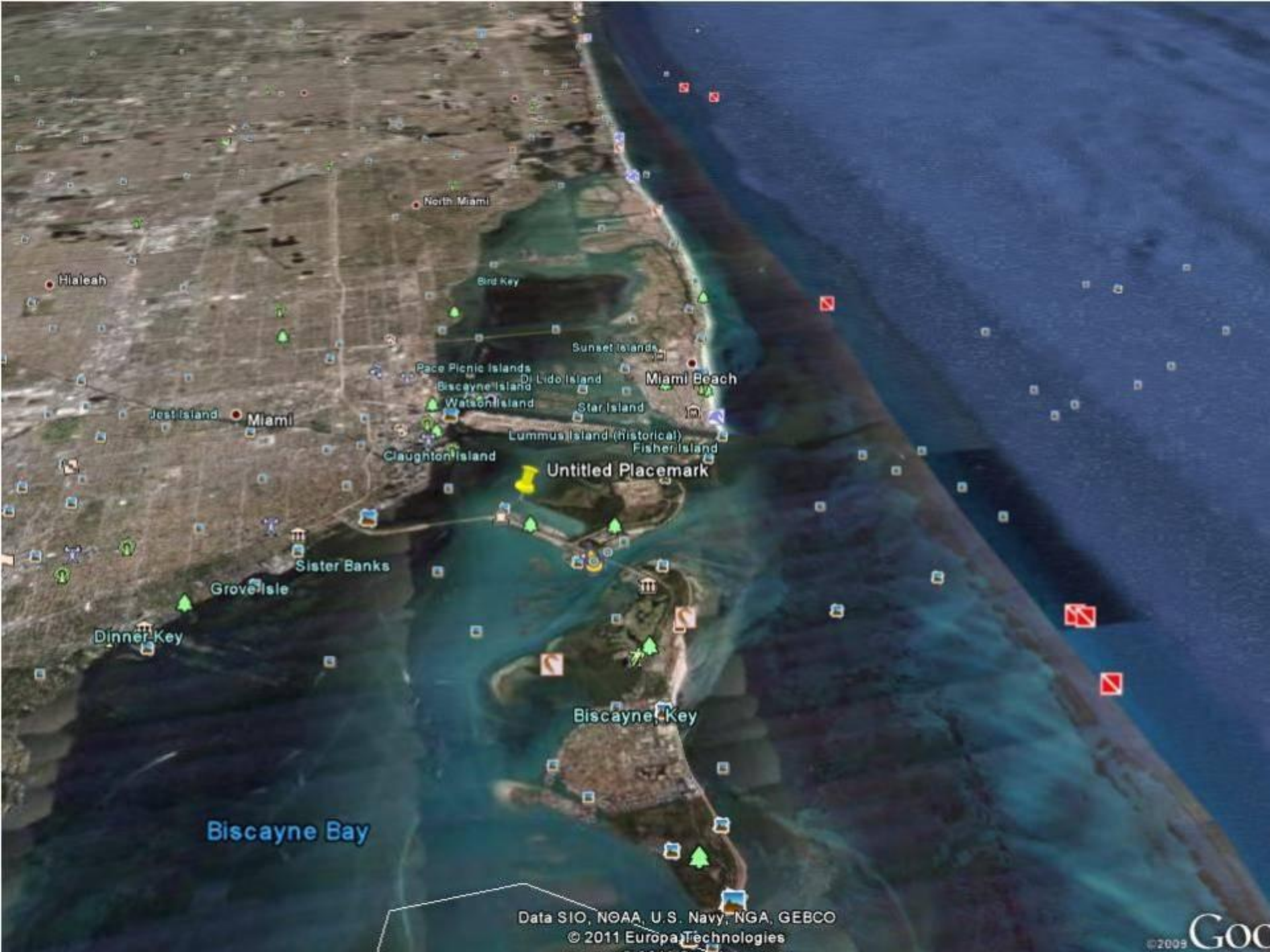
PURPOSE:
PROPOSED ACTIVITIES

DATUM: N.G.V.D.

SHEET 4 OF 7

DATE: 6-5-91

LOCATION: NORTH MIAMI, FLORIDA.


North Miami
Hialeah
Bird Key
Sunset Islands
Pace Picnic Islands
Di Lido Island
Miami Beach
Biscayne Island
Watson Island
Star Island
Jost Island
Miami
Lummus Island (historical)
Fisher Island
Claughton Island
Untitled Placemark
Sister Banks
Grove Isle
Dinner Key
Biscayne Key
Biscayne Bay
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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VIRGINIA KEY
FISHER ISLAND
BISCAYNE BAY
MIAMI MARINA
CITY OF MIAMI
WATER TREATMENT PLANT
MIAMI MARINE STADIUM
VIRGINIA KEY
RICKENBACKER
CAUSEWAY
MAST ACADEMY
NOAA-AOML
MIAMI SEAQUARIUM
UNIVERSITY OF MIAMI
EXPERIMENTAL HATCHERY
NATIONAL MARINE
FISHERY SERVICE
ATLANTIC OCEAN
ROSENSTIEL SCHOOL OF MARINE
AND ATMOSPHERIC SCIENCE
BEAR CUT
KEY BISCAYNE
BISCAYNE BAY
CRANDON MARINA

Virginia Key Ecosystem Restoration:

- **100 acres of exotic vegetation removal,**
- **35 acres of red mangrove (*Rhizophora mangle*) wetlands creation,**
- **18 acres of black mangrove (*Avicennia germinans*) and white mangrove (*Laguncularia racemosa*) wetlands creation,**
- **5 acres of high marsh creation,**
- **20 acres of maritime hammock creation,**
- **5 acres of dune community creation,**
- **15 acres of coastal strand creation, and**
- **Community outreach and education.**

Total Cost: 3 Million


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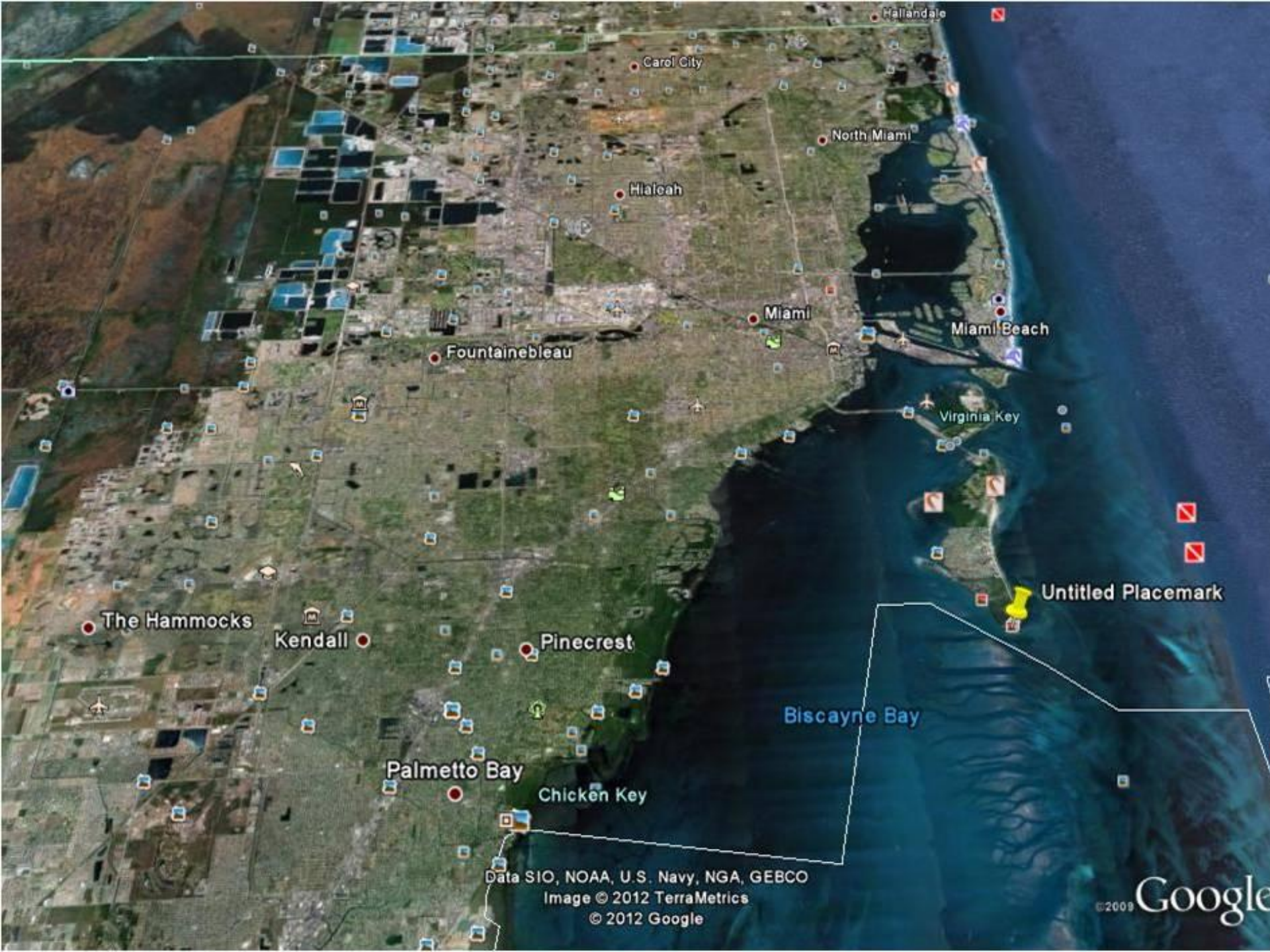
25°45'21.45" N 80°08'54.31" W elev 9 ft
Eye alt 39

Key Biscayne Ecosystem Restoration:

- **280 acres of exotic vegetation removal,**
- **90 acres of red mangrove (*Rhizophora mangle*) wetlands creation,**
- **5 acres of black mangrove (*Avicennia germinans*) and white mangrove (*Laguncularia racemosa*) wetlands creation,**
- **15 acres of isolated freshwater wetlands,**
- **15 acres of high marsh wetlands creation,**
- **80 acres of maritime hammock creation,**
- **20 acres of dune community creation,**
- **70 acres of coastal strand creation, and**
- **Community outreach and education.**

Total Cost: 7 Million


Hallandale
Carol City
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Fountainebleau
Virginia Key
Untitled Placemark
The Hammocks
Kendall
Pinecrest
Biscayne Bay
Palmetto Bay
Chicken Key
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2012 TerraMetrics
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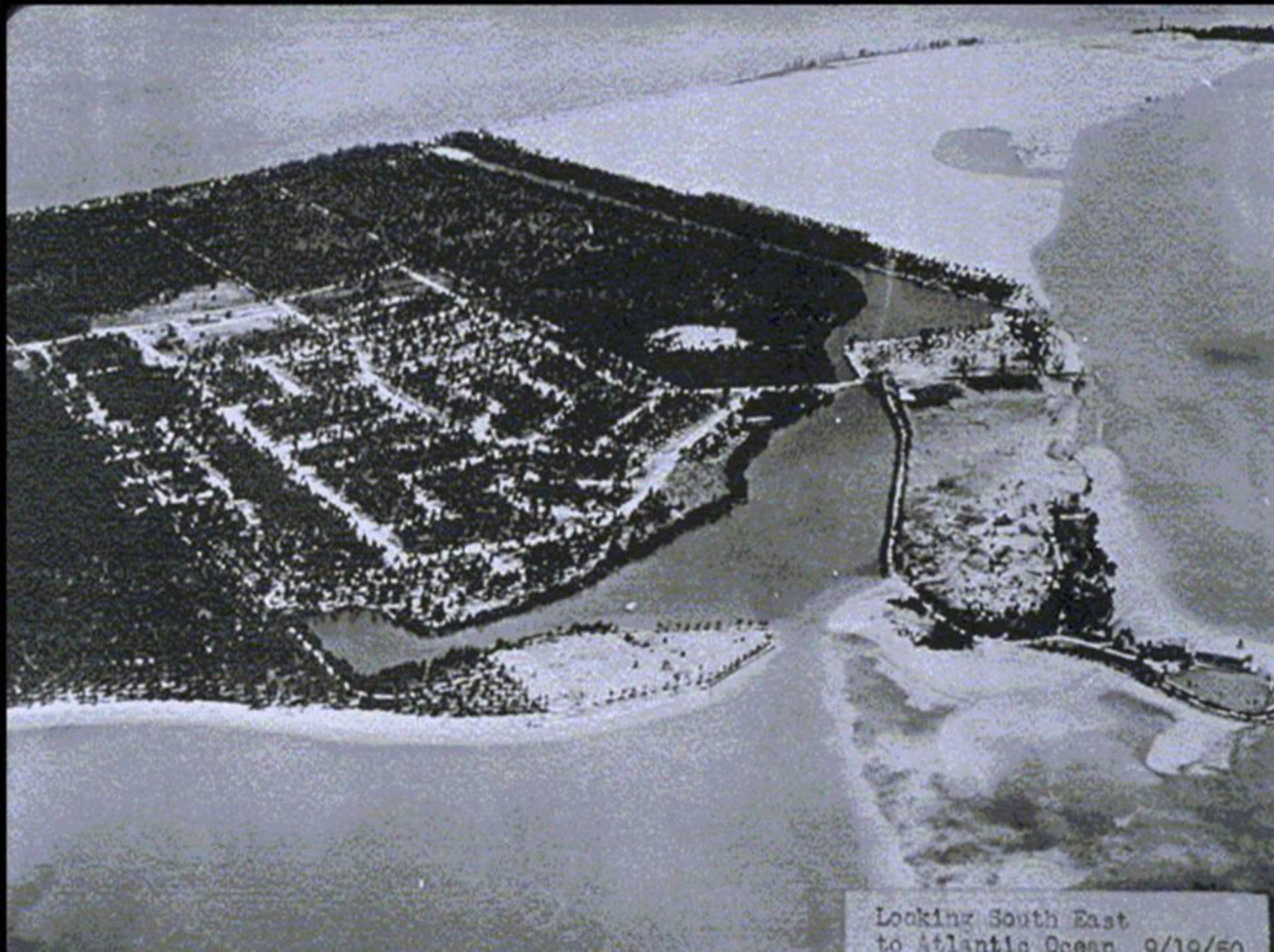
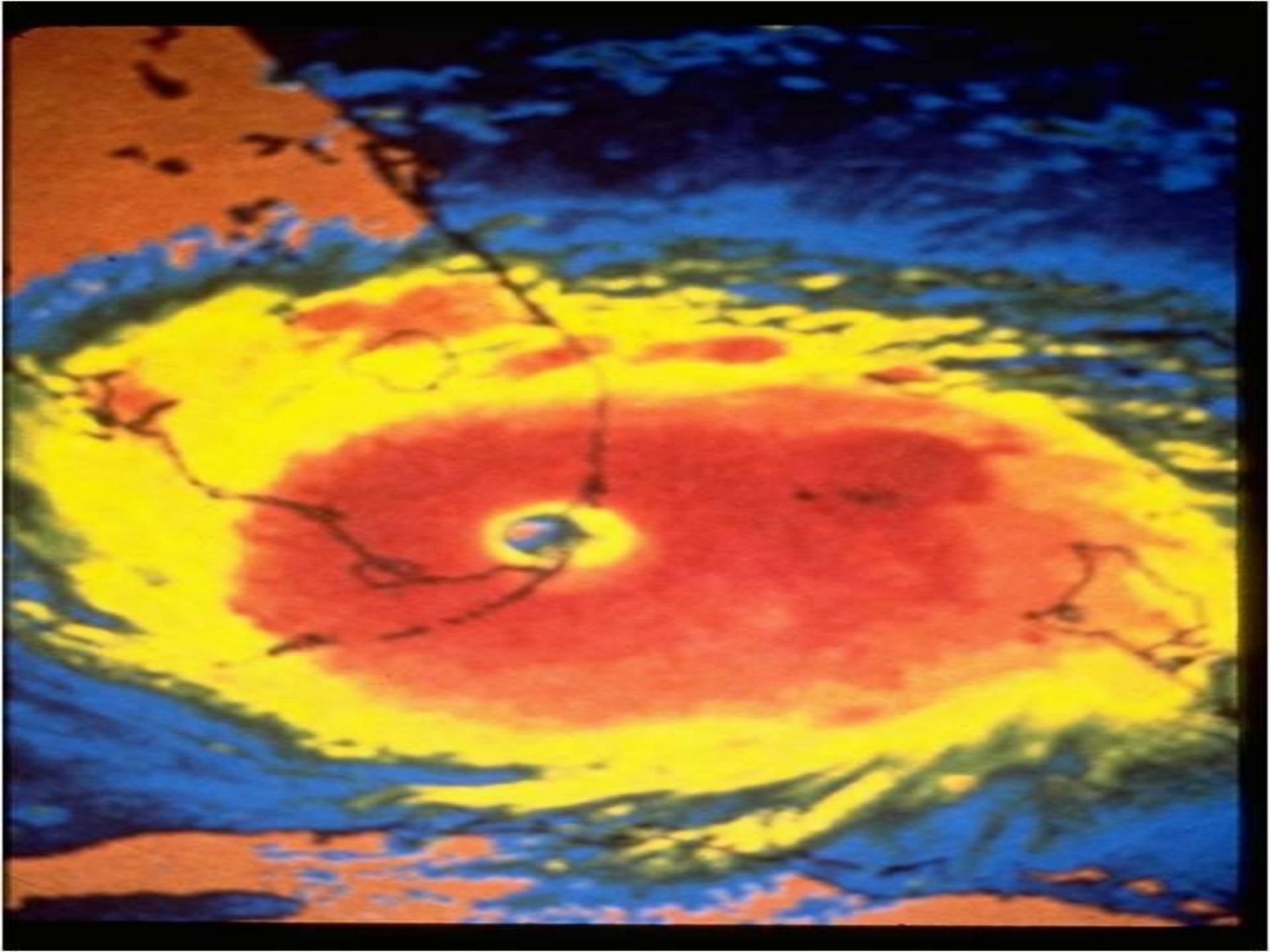


Looking South East
to Atlantic Ocean 9/19/50



South Key Biscayne: Cape Florida Ecological Restoration Plan

Beach Dune

Coastal Strand

Freshwater Wetlands

Maritime Hammock

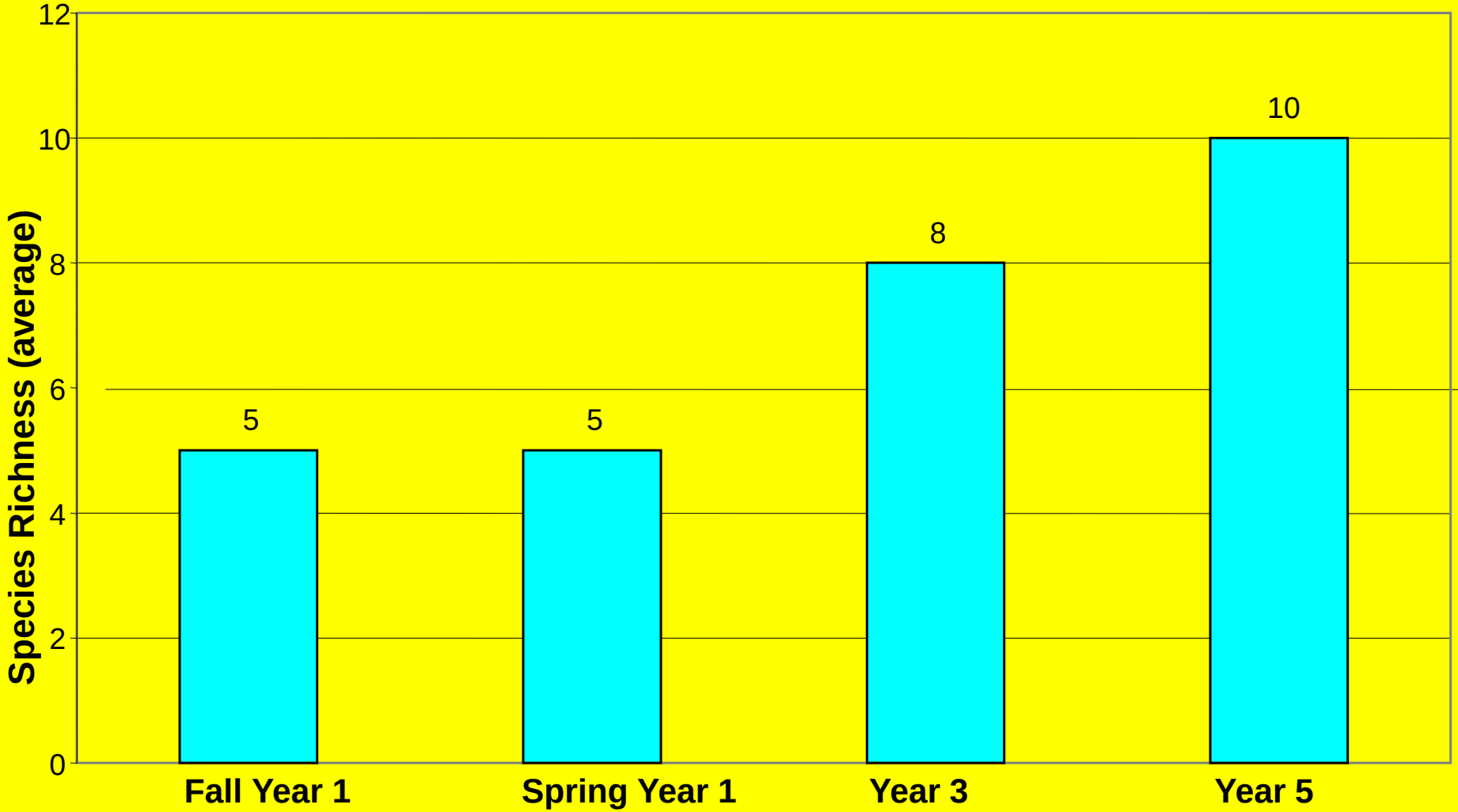
Mangrove Forest


Restoration Period: 1996 – 2000
Fill Removed 650,000 cubic yards
36,000 truck loads (18CY/Truck)

Fish Monitoring Conclusions:

- Fish assemblage changes were observed during the monitoring period.
- Fish taxa richness significantly increased with the age of the wetlands restoration site.
- Fish taxa maximum size significantly increased with the age of the wetlands restoration site.
- These results support coastal habitat restoration as a viable conservation strategy.
- The presence of commercially and recreationally important species indicates that the restoration area is functioning to support species of fisheries value.

Tidal Pool Fish Species Richness



Summary:

- **Habitat heterogeneity is being created in large-scale restoration efforts by providing low energy areas and explicit topographic wetland features.**

- **Historically filled wetlands are being restored utilizing cost-effective spoil disposal plans.**

- **Turning (mixing) of subsurface soils (up to 2 meters) is a cost-saving technique to correct for displaced soils resulting from substrate compaction.**

- **Mangrove planting is being conducted along high/moderate wave energy shorelines utilizing temporary protection barriers and encasements.**

- **Restored wetlands are functioning to support important commercial and recreational fisheries species.**

Thanks to our Restoration Partners!

Environmentally Endangered Lands

Florida Inland Navigation District
A Special State Taxing District
for the continued management & maintenance
of the Atlantic Intracoastal Waterway

National Parks Conservation Association
Protecting Our National Parks for Future Generations

NACO National Association of Counties
The Voice of America's Counties

FishAmerica Foundation

Tropical Audubon Society

Urban Environment League

macy's

LAN.com

NOAA National Oceanic and Atmospheric Administration
United States Department of Commerce

National Fish and Wildlife Foundation

Goldman Sachs

FedEx

Key Biscayne Community Foundation

hands on miami

FIU Florida International University

NATURE VALLEY

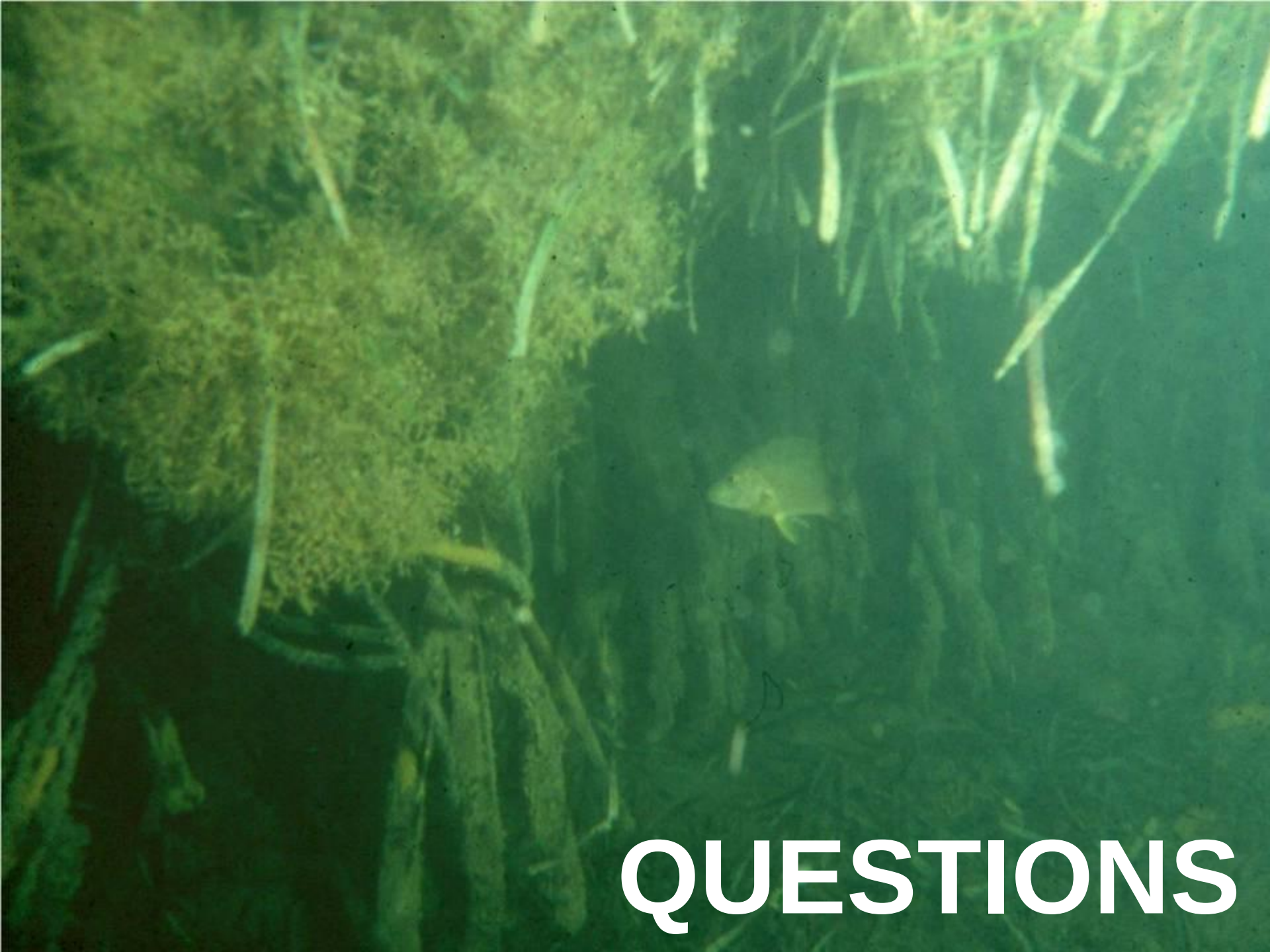
TREEmendous Miami

Dade Community Foundation

Sierra Club
Founded 1892

mia sci
miami science museum

the reclamation project


QUESTIONS

- **Most frequently Occurring Fish Species** (≥ 5 ponds)

•**3 in 2000/2001** - Goldspotted Killifish, Rainwater Killifish,Yellowfin Mojarra

6 in 2002 – Above spp. + Great Barracuda, Mojarra spp., Bay Anchovy.

9 in 2004 – Goldspotted Killifish, Rainwater Killifish, Great Barracuda, Mojarra sp., Gobie spp., Needlefish spp., Silversides, White Mullet, and Flounder.

- **Presence of Commercially Important Species.**
  Gray Snapper, Bluestriped Grunt, Sailors Choice, Barracuda, and Snook: Increase in Number of Ponds Observed

2001, 0% - 2002, 10%, - 2004, 33%

Increase in number and size

2001- 0

2002- 225 mm (n=1)

2004- ranged from 20-360mm (n=9).

Results

Nine Tidal Ponds from (2000-2004)

- 30 Fish Taxa were Observed.
- Significant Increase in Fish Taxa (richness).
  - Richness = 1.3158*Age + 4.0526
  - R^2 = 0.3825; P=0.0006
- Significant Increase in Maximum Fish Size.

2001- Atlantic Needlefish, Redfin Needlefish, Striped Mullet

2002 – Great Barracuda, White Mullet, Mullet spp.

2004 – Snook, Needlefish spp., White Mullet.