

# Association of State Wetland Managers Gulf Restoration Webinar Series

Wetland Restoration  
Pre- and Post-Hurricane Katrina

*Perspectives of an  
Environmental Manager*

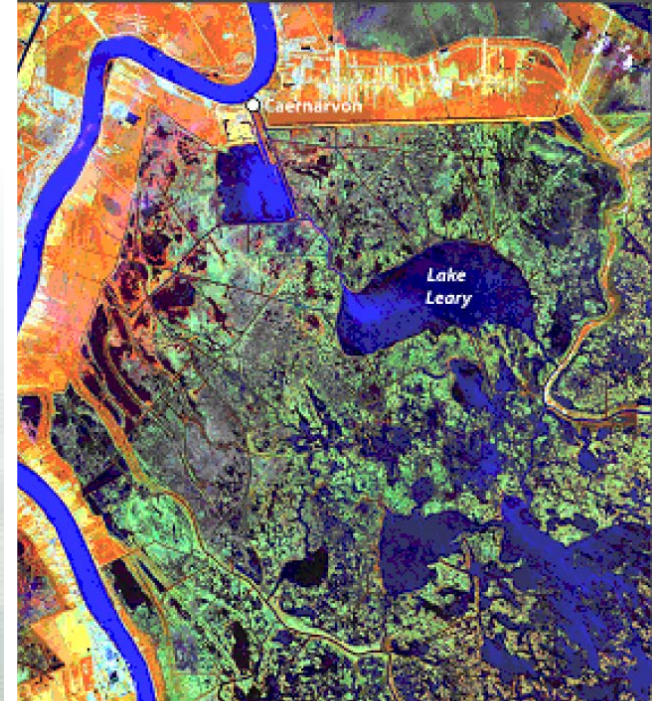
William Klein

New Orleans District

27 June 2016



US Army Corps of Engineers  
**BUILDING STRONG**



# US Army Corps of Engineers

## Environmental Mission, Goals & Operating Principles

- **Goal:** focus on ecosystem structure and processes, sustainable management
- **Objective:** contribute to National Ecosystem Restoration (NER)
  - ▶ NER outputs: increases in the net quantity/quality of desired ecosystem resources
- **Ecosystem Restoration Approach:** protect or restore ecosystem structure and functions associated with hydro regime
- **Partnerships**



# Environmental Operating Principles

- Foster **sustainability** as a way of life throughout the organization.
- Proactively consider **environmental consequences** of all Corps activities and act accordingly.
- Create mutually supporting economic and environmentally **sustainable solutions**.
- Continue to **meet our corporate responsibility and accountability** under the law for activities undertaken by the Corps, which may impact human and natural environments.
- Consider the environment in employing a **risk management and systems approach** throughout the life cycles of projects and programs.
- **Leverage scientific, economic and social knowledge** to understand the environmental context and effects of Corps actions in a **collaborative** manner.
- Employ an **open, transparent process** that respects views of individuals and groups interested in Corps activities.



# Select Restoration (and other) Laws

- **National Environmental Policy Act 1969**
- WRDA 1986 – Section 103 (cost-share)
- WRDA 1990 – Environmental Protection
- Continuing Authorities Program (CAP)
  - ▶ WRDA 1986 – Section 1135
  - ▶ WRDA 1992 – Section 204
  - ▶ WRDA 1996 – Section 206
- WRDA 2007 – Section 2039 / Section 2036 (AM&M)

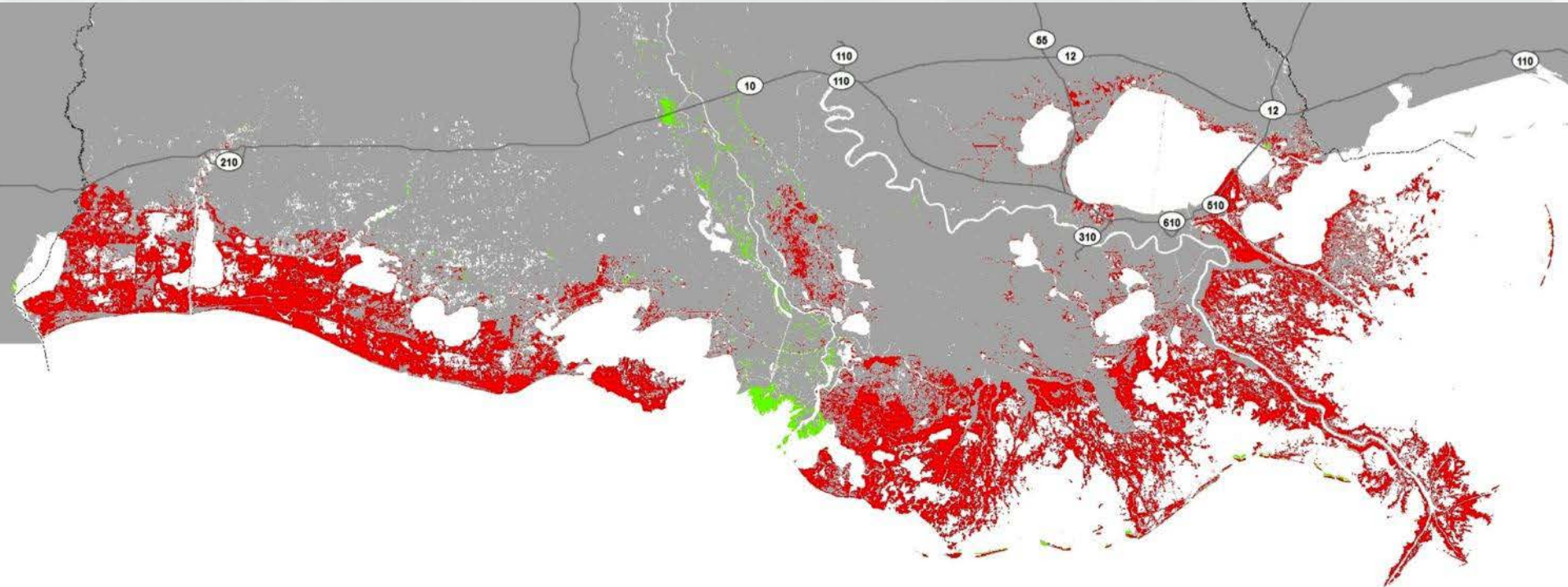


# The Problem: Coastal Land Loss

1932 – 2010: -1.1 million acres

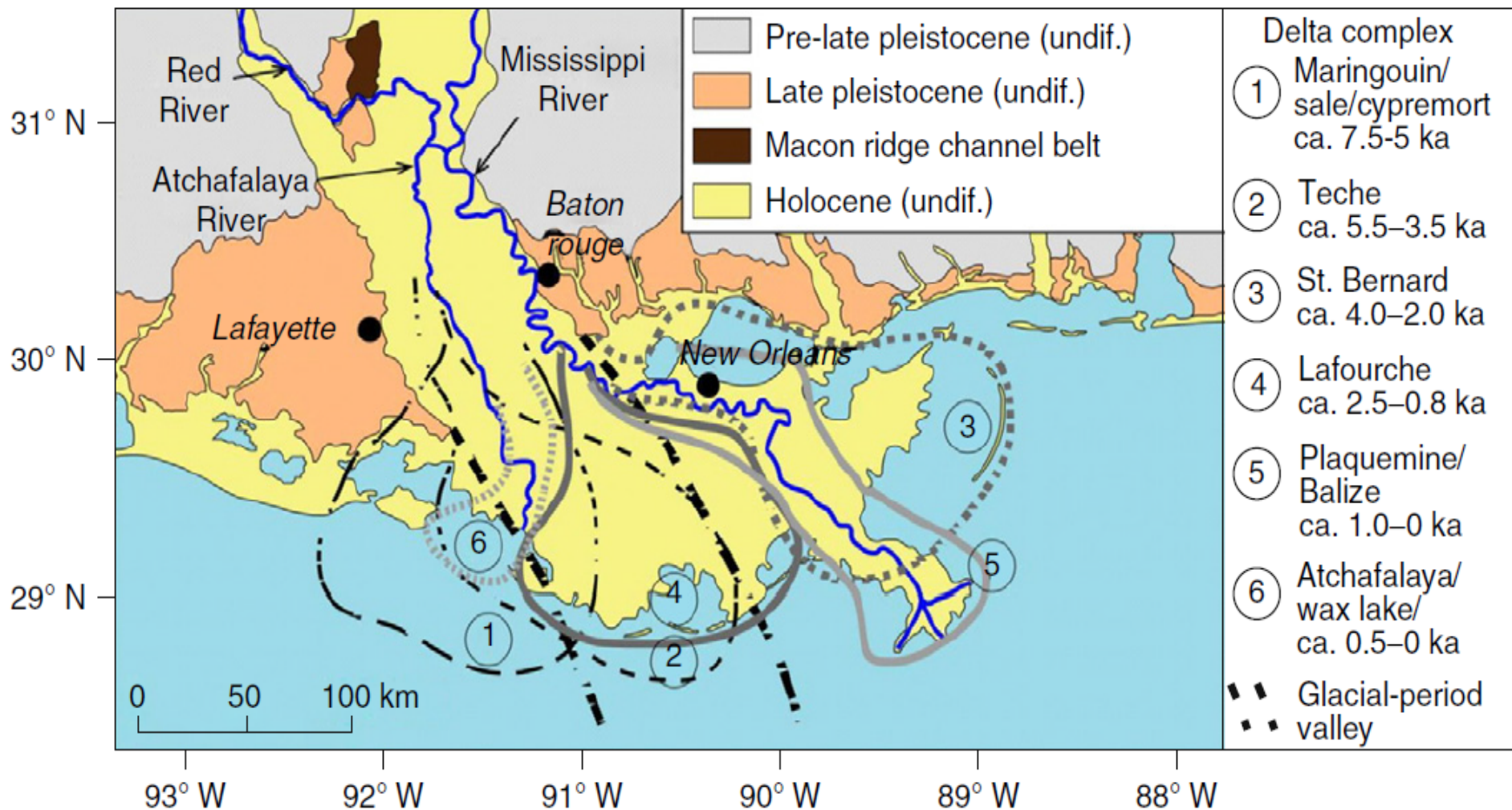
Ave rate of loss (1985-2010) = -10,600 acres/year

2010 – 2060: estimated -1.35 to -2.99 million acres



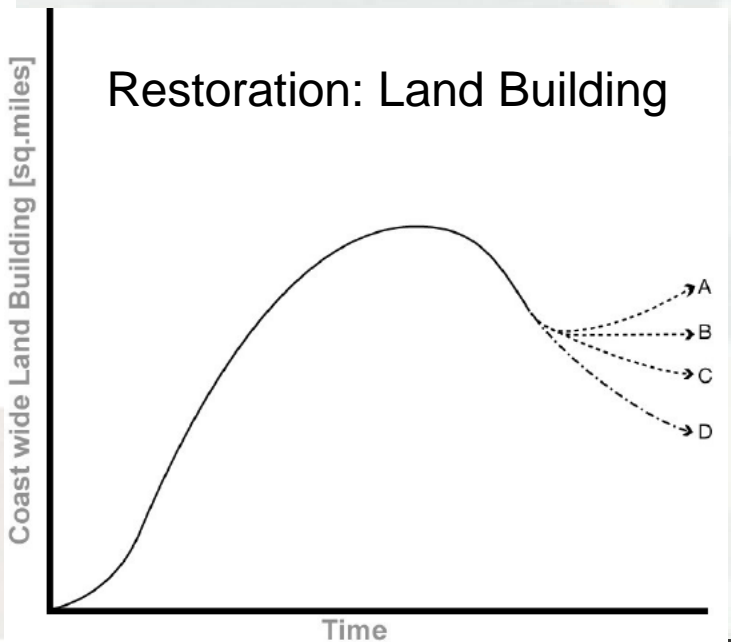
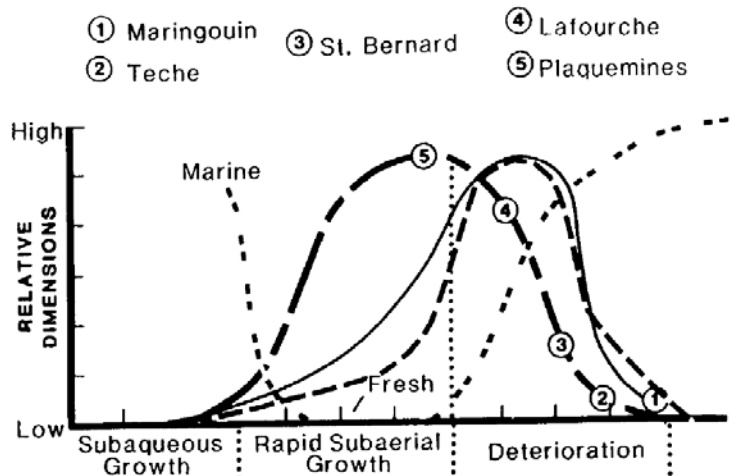
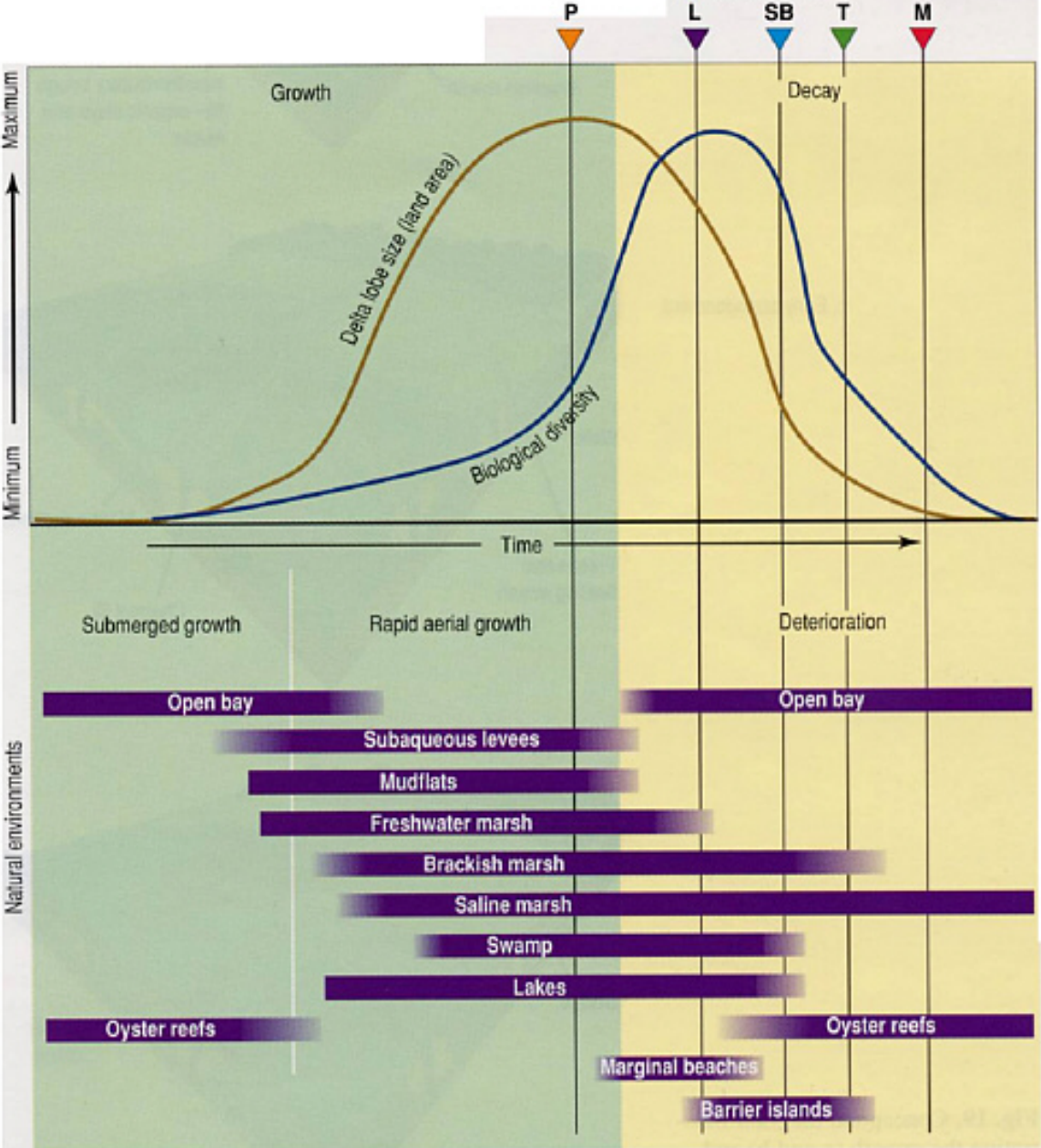
# Mississippi Delta Plain

Environmental Manager – Know the “Real” Ground Rules



# Delta Cycle Ecological Productivity

- Current stage of specific delta lobes
- ▼ Plaquemine P
  - ▼ Teche T
  - ▼ Lafourche L
  - ▼ St. Bernard SB
  - ▼ Maringouin M



# CHANS

## Major Causes Of Wetland Loss

Barrier  
Island  
Degradation



Subsidence



Storms



Sea Level  
Rise



Salt Water  
Intrusion



Sediment  
Reduction



Canals



Oil & Gas  
Development



Levee  
System





# Pre-Katrina: Selected Restoration Efforts

## Pre-1980s

- Caernarvon Freshwater Diversion authorizations 1965, 1974, 1986
- Davis Pond Freshwater Diversion authorizations 1928, 1965, 1986, 1996

## 1990s

- 1990 CWPPRA Program first Federal statutory mandate for restoration of Louisiana's coastal wetlands
- 1991 Caernarvon Freshwater Diversion begins operation (see later slide)
- 1998 Coast 2050 Plan published (basis for LCA Study)
- 1999 Breton Island restoration
- Section 206 (1996 WRDA) - Aquatic Ecosystems.



# Pre-Katrina Selected Restoration Efforts

## 2000's

- 2002 Davis Pond Diversion begins operation
  - 2003 West Bay Sediment Diversion (50,000 cfs)
  - 2003 LCA Comprehensive Ecosystem Restoration Plan
  - 2005 LCA Near-Term Ecosystem Restoration Plan Final Report
- 

## 2005 Katrina (August) and Rita (September)



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# Post-Katrina Restoration Efforts

- WRDA 2007 Section 7003 authorizes 2005 LCA Plan
- 2011 LCA 6 projects feasibility completed move to PED
- 2012 MRGO Ecosystem Restoration Study completed
- 2012 LCA BBBS feasibility completed move to PED
- 2012 start LCA Mississippi River Hydrodynamic and Delta Management, 1<sup>st</sup> large scale, long term study
- 2016 Southwest Coastal Louisiana Final Integrated Report



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# Hurricane Katrina and Others

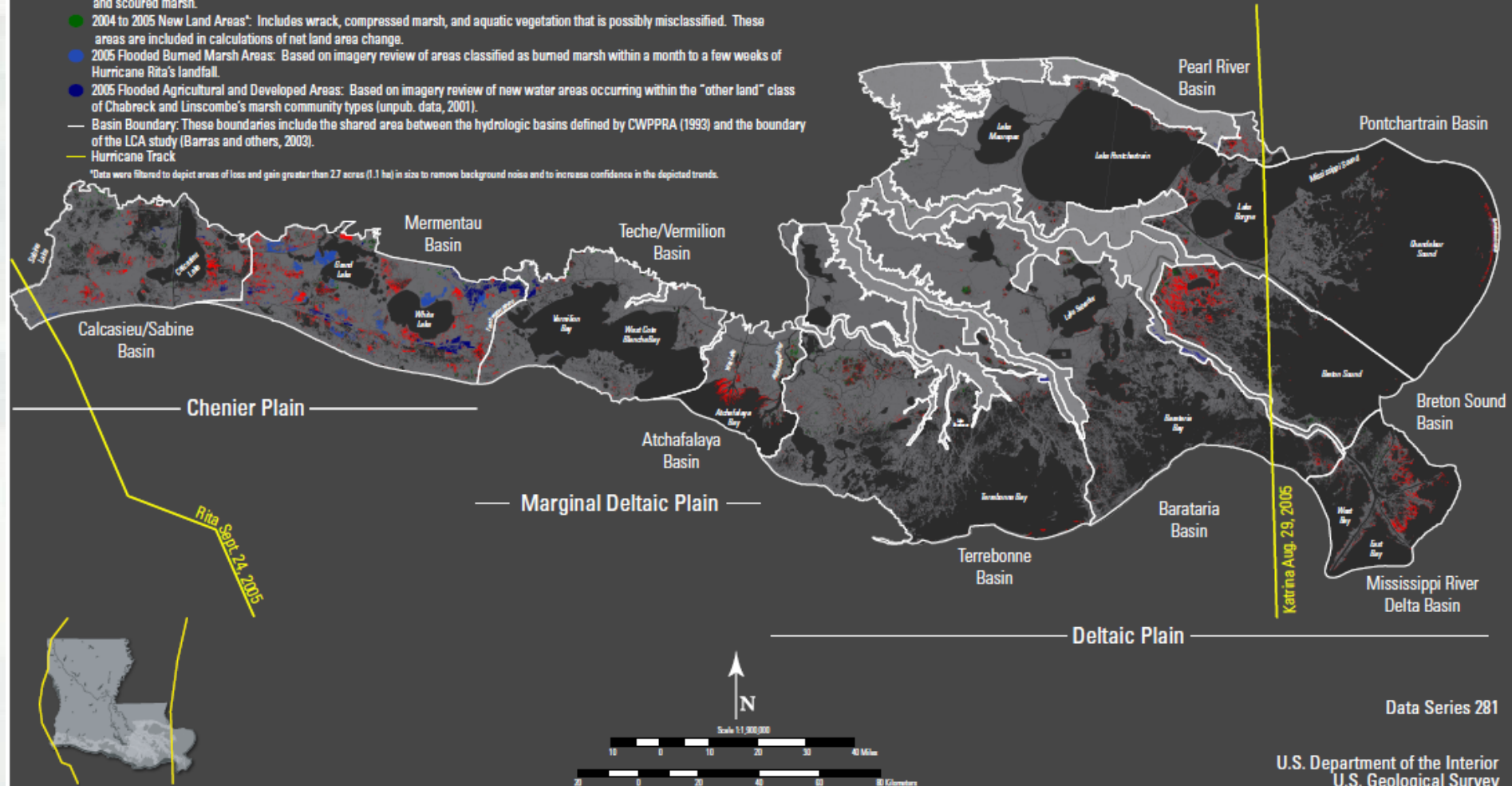
- Hurricane Cindy (July 2005)
- Hurricane Dennis (July 2005)
- **Hurricane Katrina (August 2005)**
- **Hurricane Rita (September 2005)**
- Hurricane Gustav (August 2008)
- Hurricane Ike (September 2008)
- Hurricane Isaac (August 2012)



# Land Area Change in Coastal Louisiana After the 2005 Hurricanes: Overview

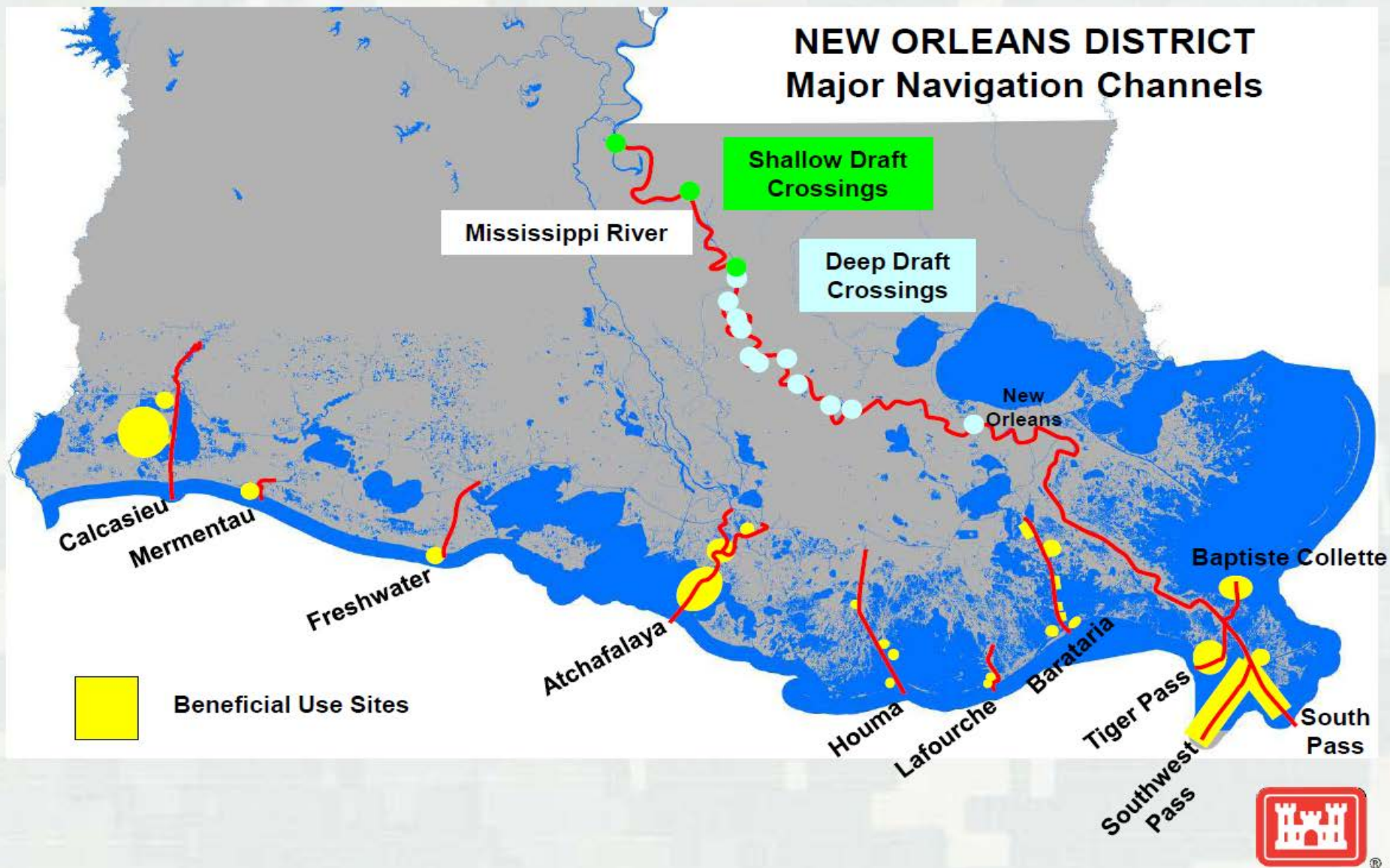
- 2005 Land
- 2005 Water
- Fastlands: Agricultural, developed, and upland areas surrounded by levees that are generally considered non-wetlands (LOSR, 2002) and that are excluded from calculations of net land area change.
- 2004 to 2005 New Water Areas (Decreased Land Areas)\*: Includes flooded marsh, sheared marsh, eroded marsh, and scoured marsh.
- 2004 to 2005 New Land Areas\*: Includes wrack, compressed marsh, and aquatic vegetation that is possibly misclassified. These areas are included in calculations of net land area change.
- 2005 Flooded Burned Marsh Areas: Based on imagery review of areas classified as burned marsh within a month to a few weeks of Hurricane Rita's landfall.
- 2005 Flooded Agricultural and Developed Areas: Based on imagery review of new water areas occurring within the "other land" class of Chabreck and Linscombe's marsh community types (unpub. data, 2001).
- Basin Boundary: These boundaries include the shared area between the hydrologic basins defined by CWPPRA (1993) and the boundary of the LCA study (Barras and others, 2003).
- Hurricane Track

\*Data were filtered to depict areas of loss and gain greater than 27 acres (1.1 ha) in size to remove background noise and to increase confidence in the depicted trends.



Data Series 281

# Pre-Katrina: Beneficial Use of Dredged Material



# Beneficial Use of Dredged Material

(\* Marsh Habitat

\*\* Barrier Island Habitat)

Navigation Channel	Year	Authority	Marsh/ Barrier Island Acreage	Cubic Yards Discharge	Total Cost
Houma Navigation Canal (Wine Island)	1991	1135	18.7**	600,000	\$400,000
Barataria Bay Waterway (Grand Terre)	1996	204	86**	666,258	\$1,133,000
Barataria Bay Waterway (Grand Terre)	1999	204	94*	620,000	\$100,000
Barataria Bay Waterway (Dupre Cut)	1999	204	70*	580,000	\$78,000
Calcasieu River (Brown Lake)	1999	204	132*	1,960,639	\$1,064,000
Calcasieu River (SNWR)	1993	1135	340*	1,840,243	\$259,852
Calcasieu River (SNWR)	1996	204	360*	1,291,236	\$537,000
Calcasieu River (SNWR)	1999	204	230*	1,394,000	\$806,000
MR-GO (Mile 14-12)	1999	204	50*	1,600,000	\$353,000
MR-GO (Breton Island)	1999	204	125**	1,101,000	\$175,000
MR-GO (Mile 14-12)	2003	204	40*	1,513,221	\$580,000

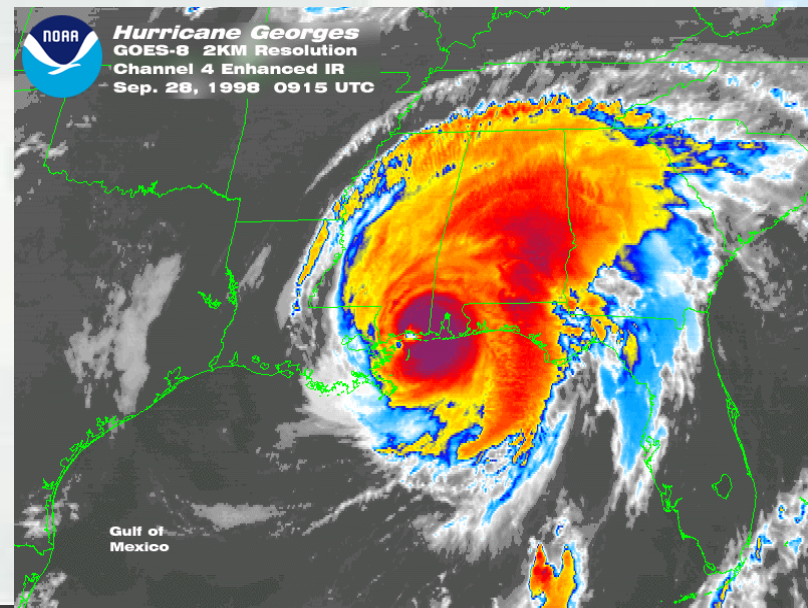
1993 Breton Island  
National Wilderness Preservation System



1915 President Roosevelt  
Breton Island



1999 Breton Island





# cubic feet per second

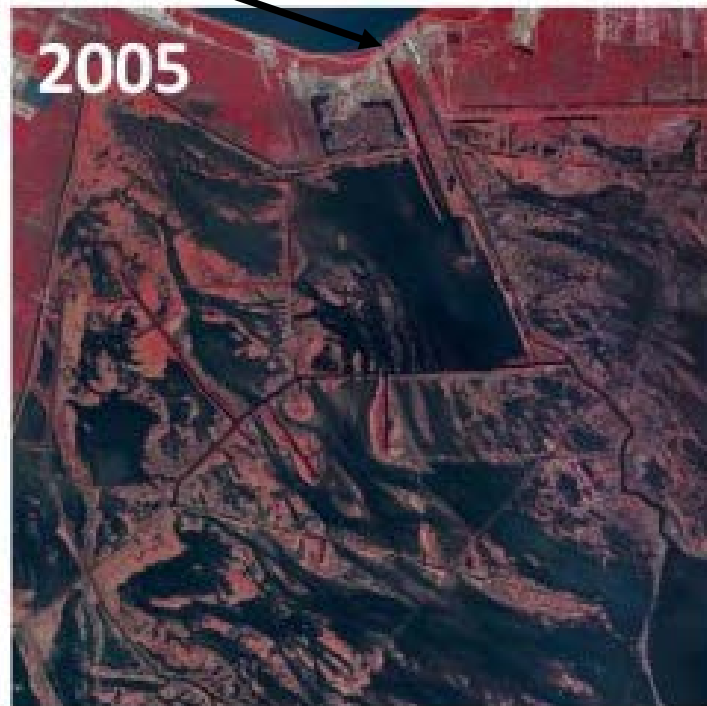
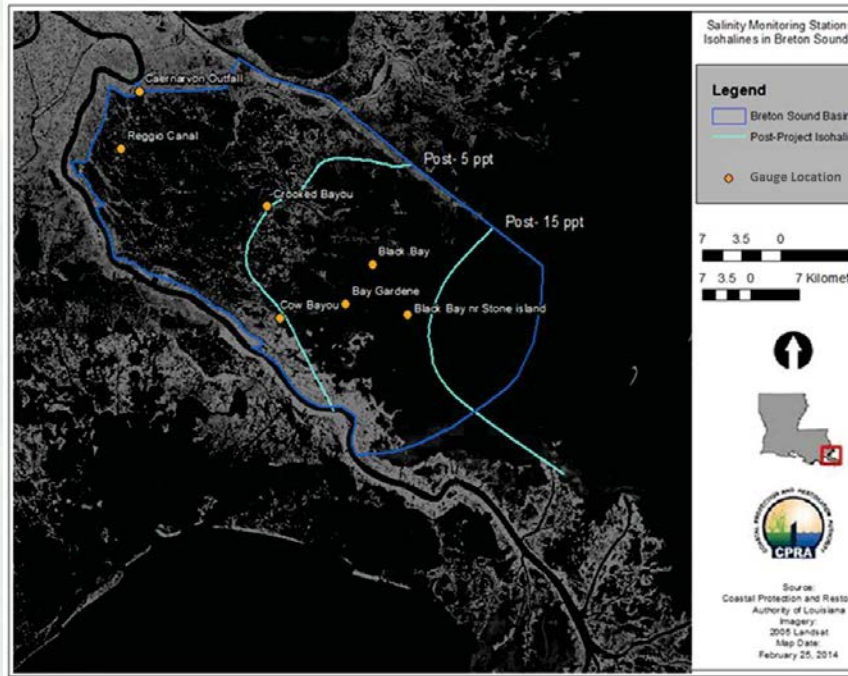
- 1 cubic foot per second (cfs)  $\approx$  7.5 gallons per second



- Average refrigerator  $\approx$  25 cubic feet
- 1000 cfs  $\approx$  40 refrigerators per second
- 8000 cfs  $\approx$  320 refrigerators per second



# Caernarvon Diversion (1991)

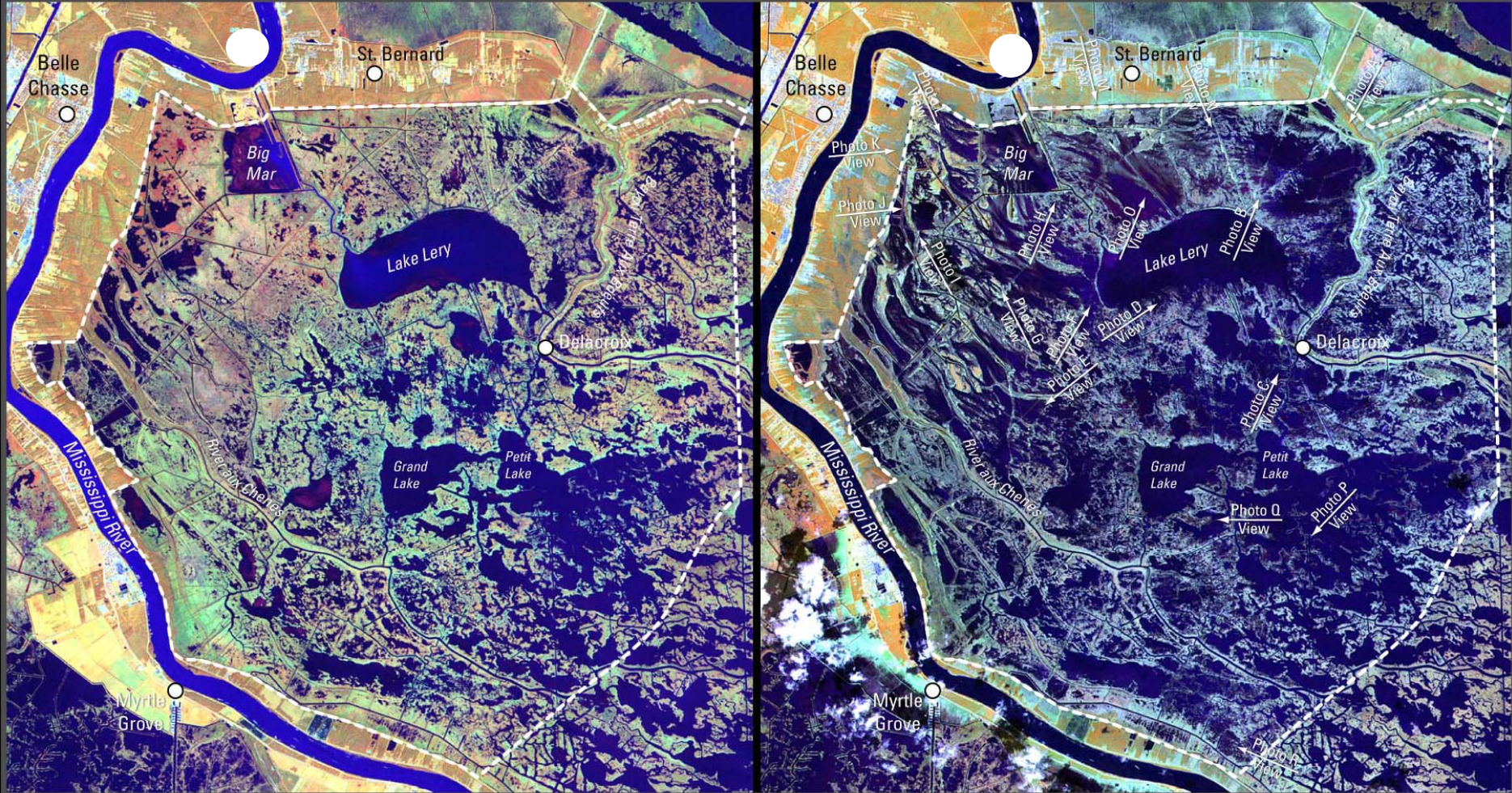


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**Delacroix, Louisiana**  
**Comparison of Marsh Shears Before and After Hurricanes Katrina and Rita**  
**(Landsat 5 Thematic Mapper Satellite Imagery)**

November 7, 2004

October 25, 2005



----- Shear Impact Zone



Data Series 281

U.S. Department of the Interior  
U.S. Geological Survey

Image Source:  
Landsat 5 Thematic Mapper Satellite  
Imagery is provided by the USGS Center for  
Earth Resources Observation and Science.  
Bands 4 (near-ir), 5 (mid-ir), and 3 (visible  
red) are displayed.

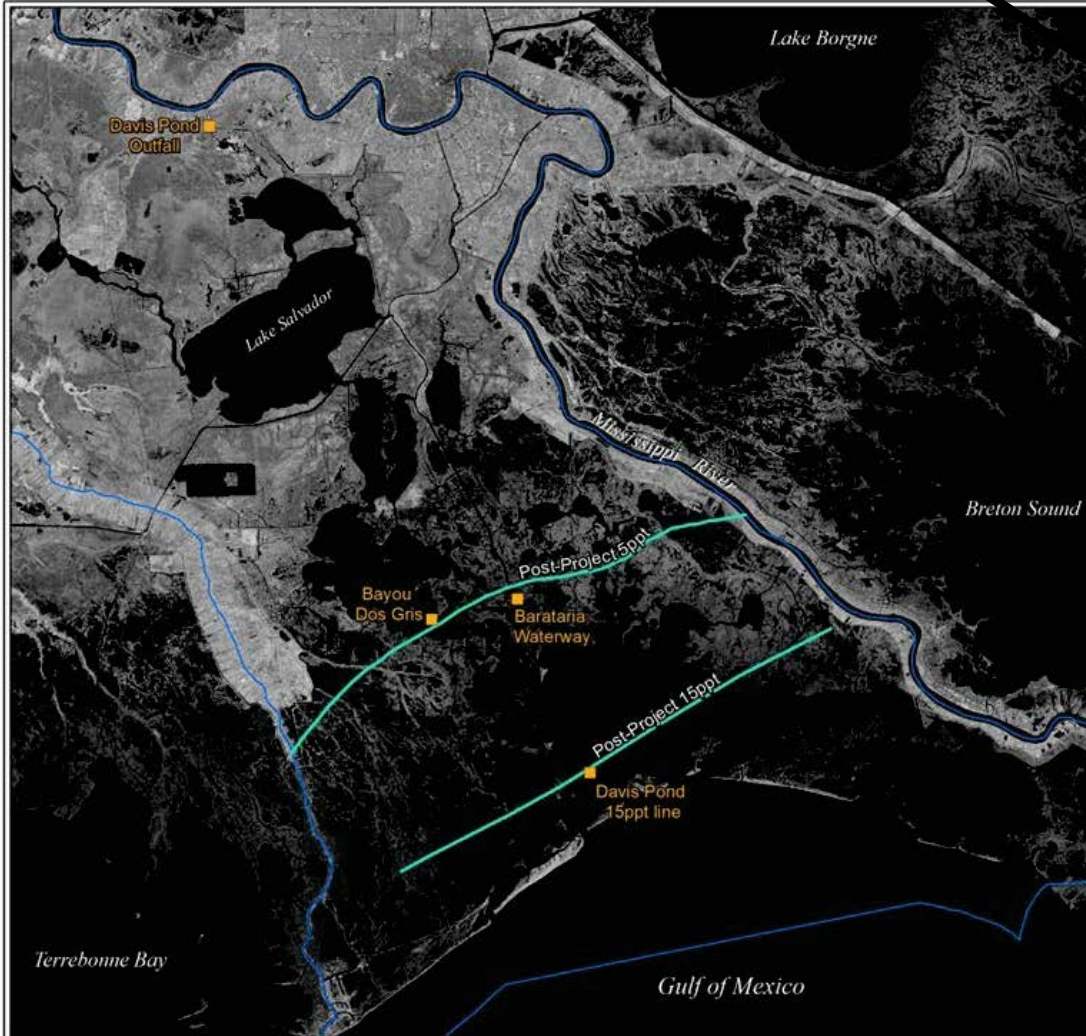
# Davis Pond Freshwater Diversion (2002)



November 18, 1999



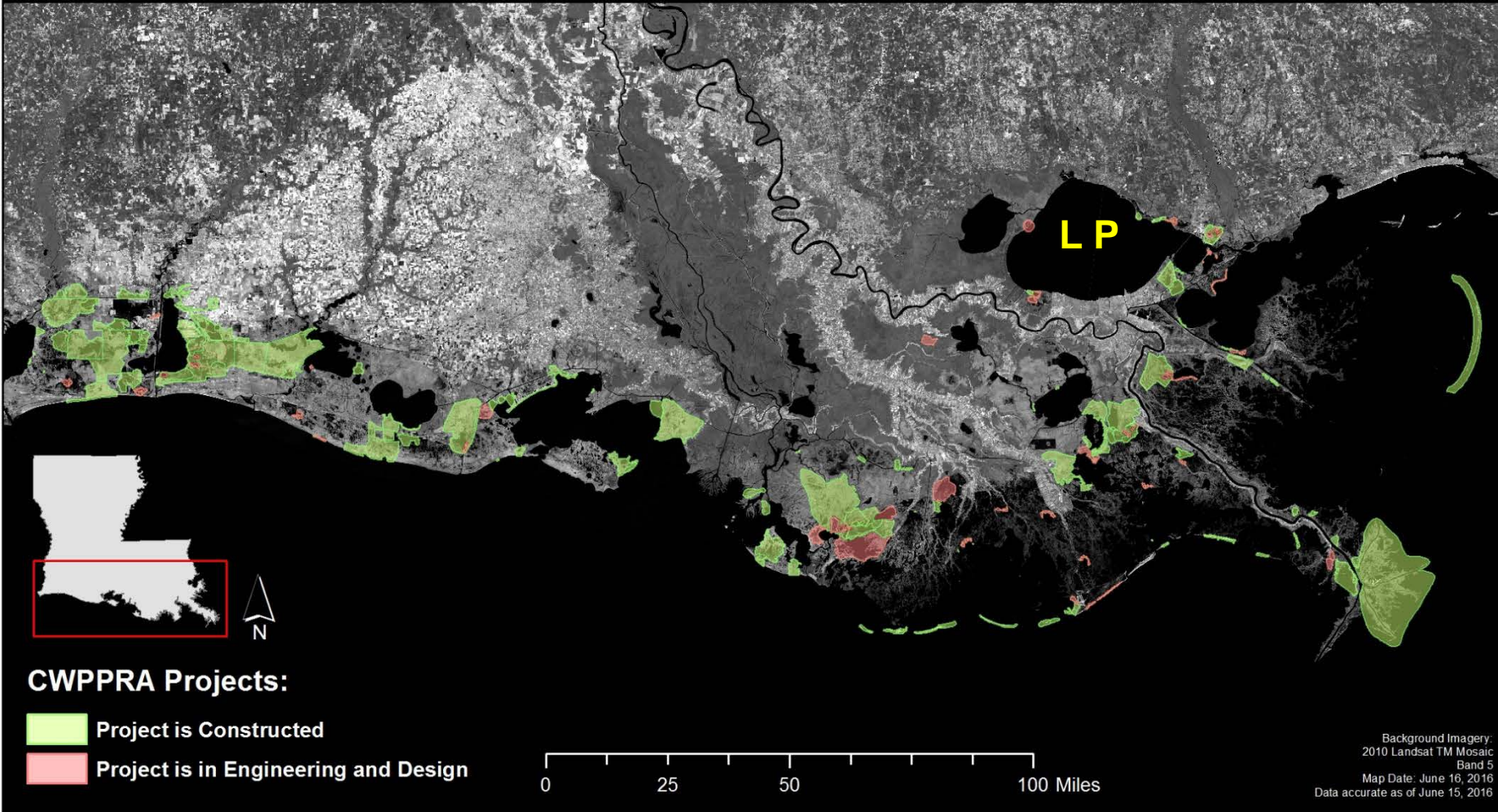
December 15, 2003



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# CWPPRA

## Coastal Wetlands Planning, Protection and Restoration Act Projects by Construction Status



# Coast 2050 Plan (1998)

## Protect Shoreline

Keep shoreline in place in critical areas.

## Maintain Shoreline Integrity

Let shore roll back, but prevent interior marsh erosion.

## Maintain Sabine River Inflow

## Maintain Atchafalaya Mudstream

Continue shoreline accretion along Chenier Plain.

## Improve Hydrology/Drainage

Lower water levels in swamps. Allow more natural flow of water. Provide flood protection if necessary.

## Reduce Sedimentation in Cote Blanche Bays and Vermilion Bay and Maintain as Brackish

## Lower Water Levels

Modify flow patterns to tidal marshes to the south.

## Move Fresh Water South into Tidal Marshes

Move Atchafalaya waters into tidal marshes. In Chenier Plain, use water from lakes to freshen southern brackish marshes.

## Beneficial Use of Dredged Material or Dedicated Dredging

Create marsh in various sites along the coast.

## Maximize Land Building in Atchafalaya Delta

Separate navigation from delta. Train lobe toward Four League Bay.

## Maintain Land Bridges

Preserve the three land bridges to prevent marine forces from moving inland and large lakes from joining.

## Small Diversions from Mississippi River (<5,000 cfs)

Allow river water and nutrients to nourish swamps and marshes. Flood protection where needed. Provide outfall management.

## Optimize Atchafalaya Flow to West and East

Use Atchafalaya sediments and nutrients to preserve marshes.

## Conveyance Channel from Mississippi River to Build Deltas

Build marsh and nourish adjacent wetlands in area of highest land loss.

## Solve the Mississippi River Gulf Outlet Problem

Close MRGO when deep-draft container facilities are available on river. In interim, stabilize north bank, purchase oyster leases, create marsh in southern lobes of Lake Borgne.

## Delta-building Diversions from Mississippi River (15,000-100,000 cfs)

Build marsh and nourish adjacent marsh. Address oyster issues.

## Multi-purpose Control of Navigation Channels

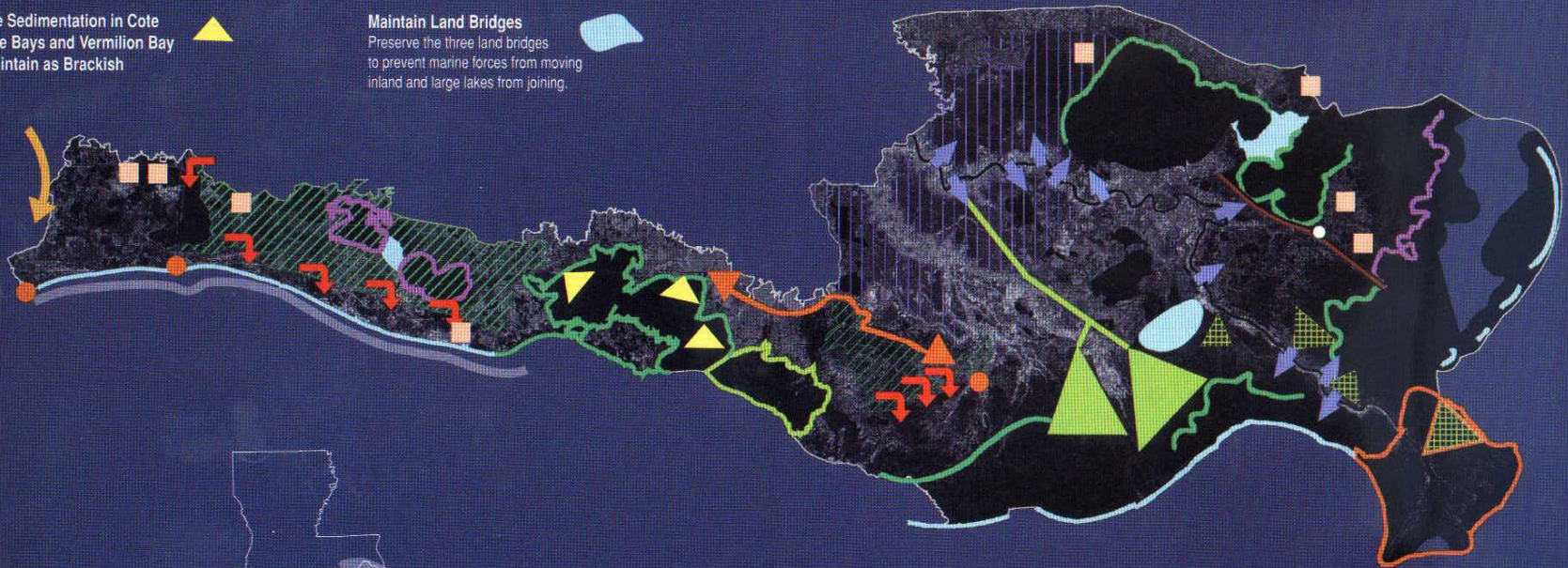
Prevent saline waters from continuing to damage marshes to north. Retain fresh water.

## Restore/maintain Barrier Islands, Headlands, Shorelands

Use most cost-effective means to protect these first lines of defense from storms.

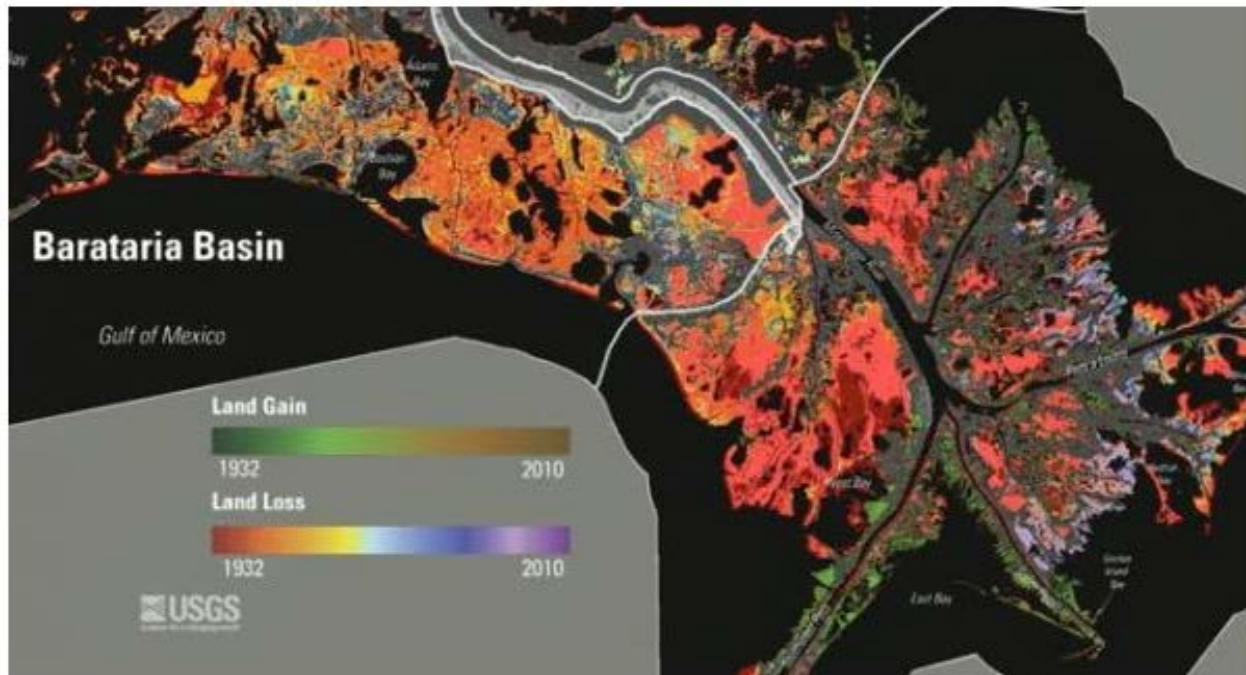
## Prevent Loss of Sediments into the Deep Gulf

Separate navigation from riverine processes. Build sediment trap and pump out to create marsh.



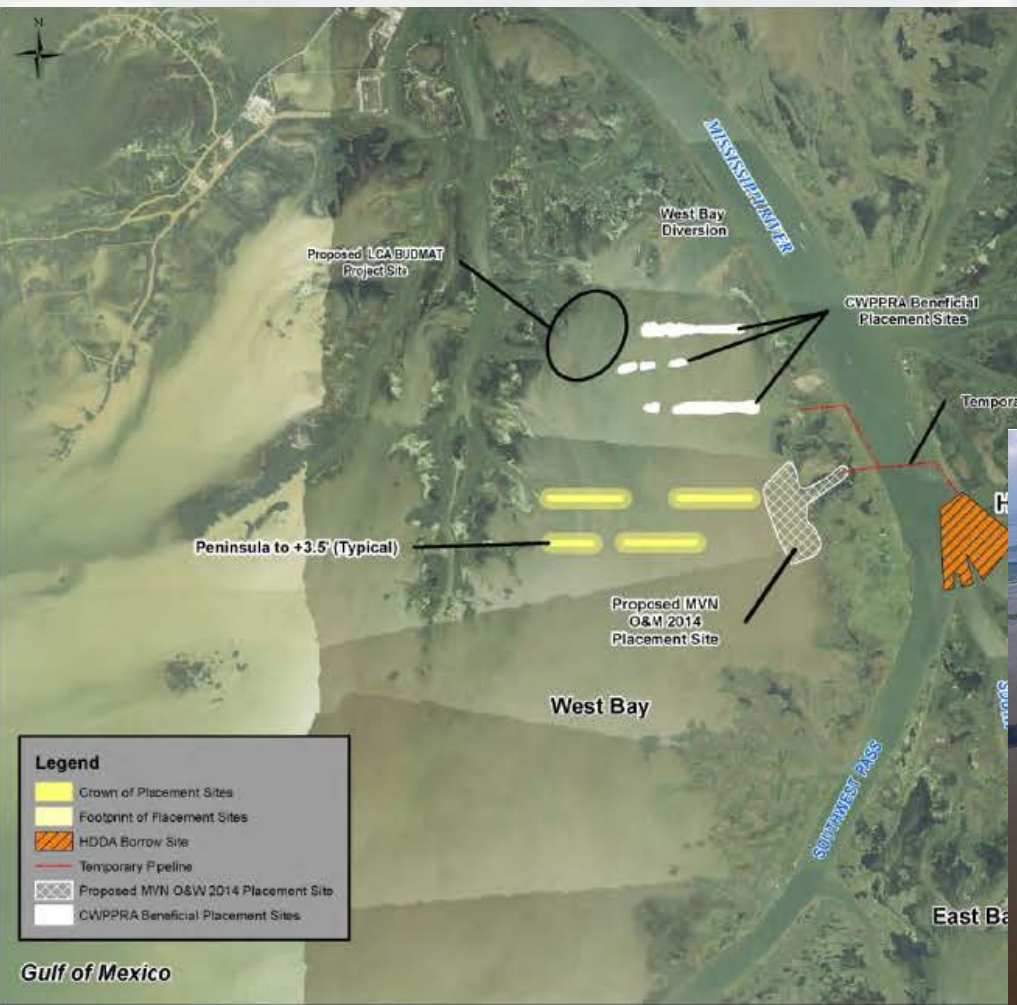
*Coast 2050 Ecosystem Strategies*

# West Bay Sediment Diversion (2003)



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# West Bay Wetland Creation 2009, 2014, & future (adaptive mgt & monitoring)





# MRGO Ecosystem Restoration (2012)

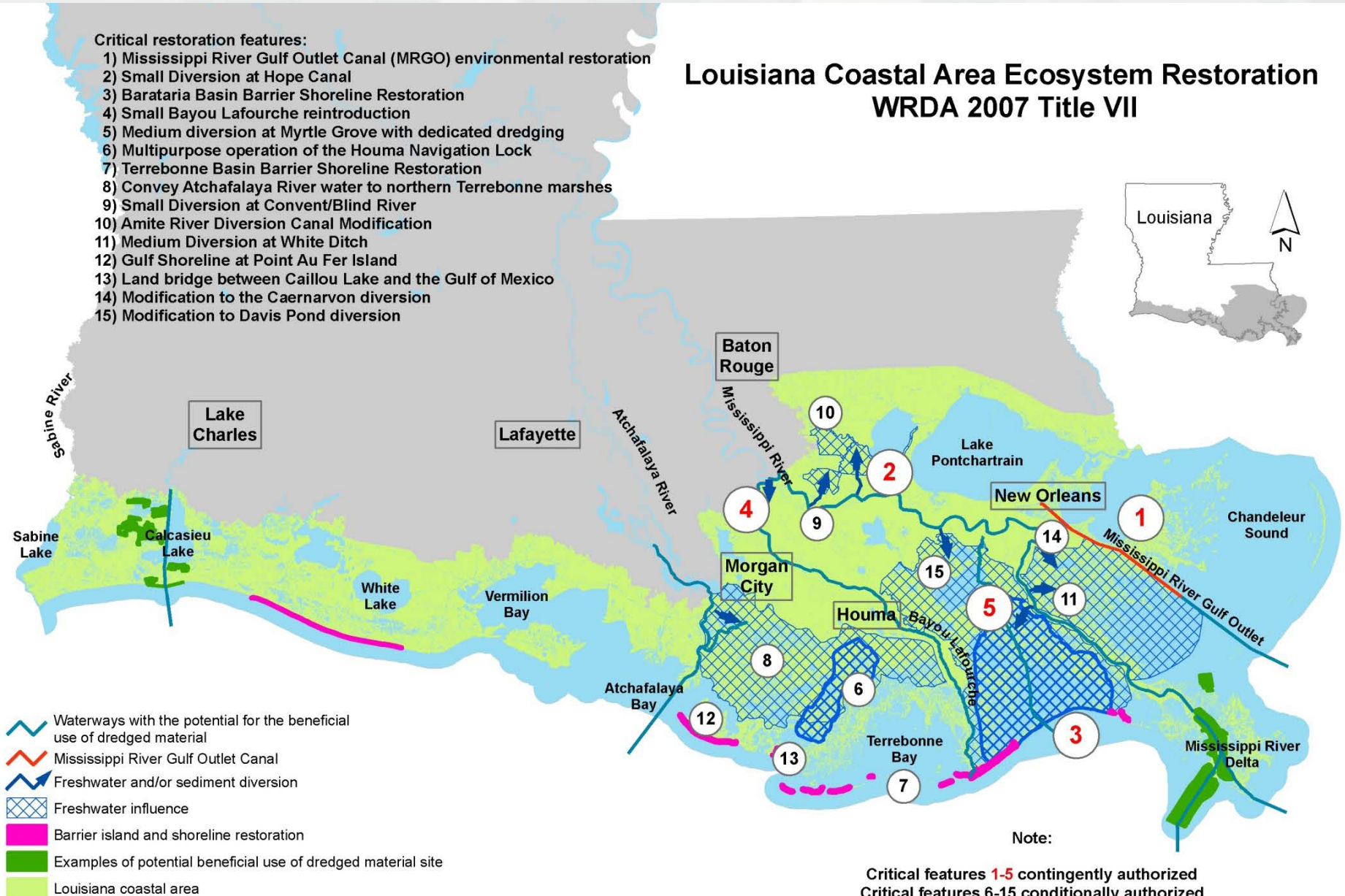


# 2005 LCA Plan

## Louisiana Coastal Area Ecosystem Restoration WRDA 2007 Title VII

### Critical restoration features:

- 1) Mississippi River Gulf Outlet Canal (MRGO) environmental restoration
- 2) Small Diversion at Hope Canal
- 3) Barataria Basin Barrier Shoreline Restoration
- 4) Small Bayou Lafourche reintroduction
- 5) Medium diversion at Myrtle Grove with dedicated dredging
- 6) Multipurpose operation of the Houma Navigation Lock
- 7) Terrebonne Basin Barrier Shoreline Restoration
- 8) Convey Atchafalaya River water to northern Terrebonne marshes
- 9) Small Diversion at Convent/Blind River
- 10) Amite River Diversion Canal Modification
- 11) Medium Diversion at White Ditch
- 12) Gulf Shoreline at Point Au Fer Island
- 13) Land bridge between Caillou Lake and the Gulf of Mexico
- 14) Modification to the Caernarvon diversion
- 15) Modification to Davis Pond diversion



# WRDA 2007 Authorized LCA Program Components

- Sec. 7006(c)(1) – LCA 5 near-term projects conditionally authorized for construction.
- Sec. 7006(e)(1) – LCA 4 additional projects contingently authorized, subject to feasibility studies.
- Sec. 7006(e)(3) – LCA 6 addition projects contingently authorized, subject to Chief of Engineers Report.
- Four (4) other program elements
  - ▶ Sec. 7002 -Comprehensive Plan
  - ▶ Sec. 7005 -Modifications to Existing Projects (Mod to Davis Pond; Mod to Caernarvon)
  - ▶ Sec. 7006(b)(1) -Demonstrations Projects
  - ▶ Sec. 7006(d) -Beneficial Use of Dredged Material (BUDMAT)
- Sec. 7002 Investigations of other large scale concepts.

\*Total LCA Ecosystem Restoration \$1,996,500,000

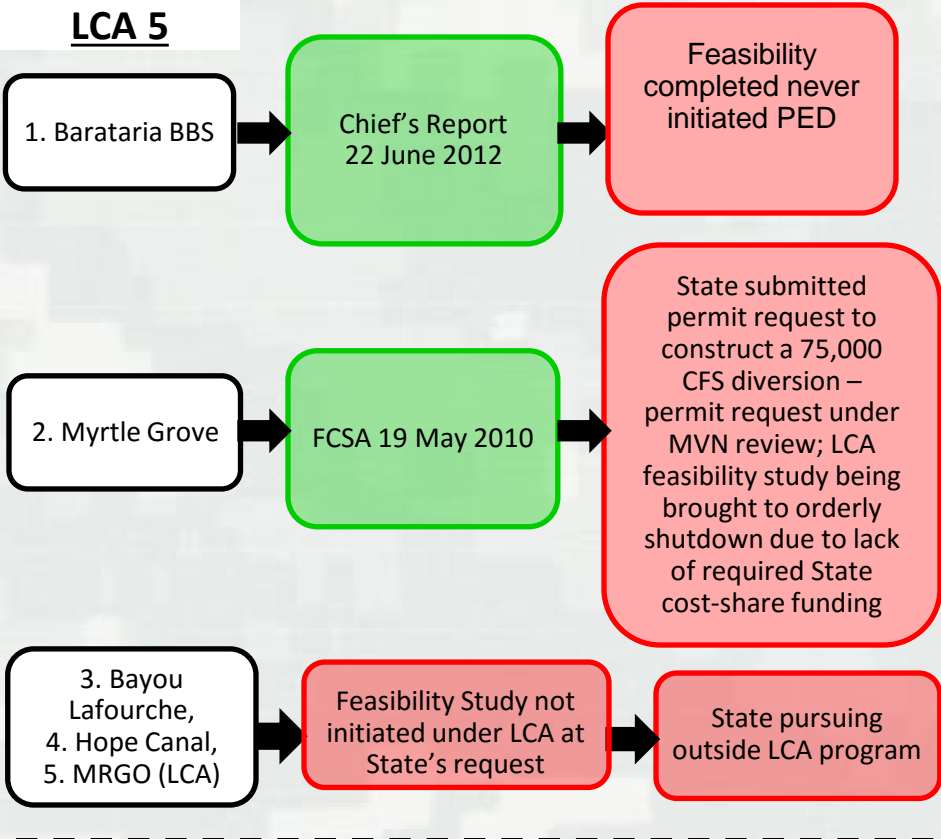


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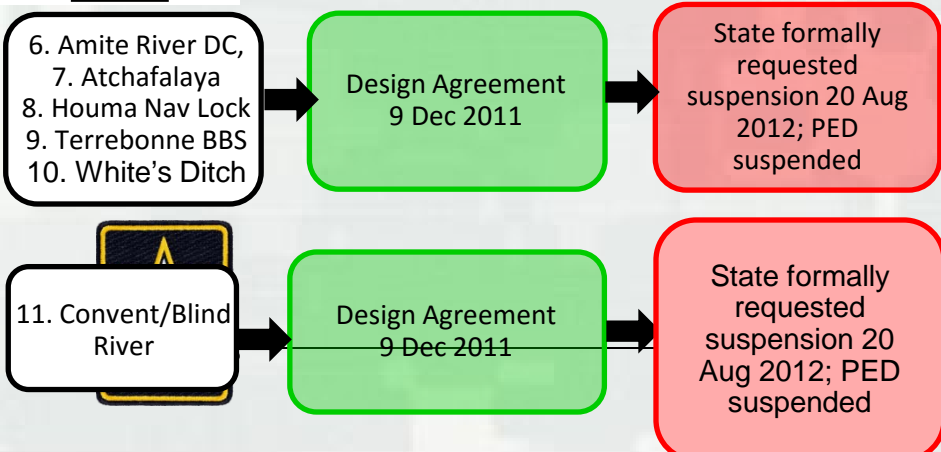
# New Orleans District Coastal Restoration Scorecard

As of 12 Feb 2016

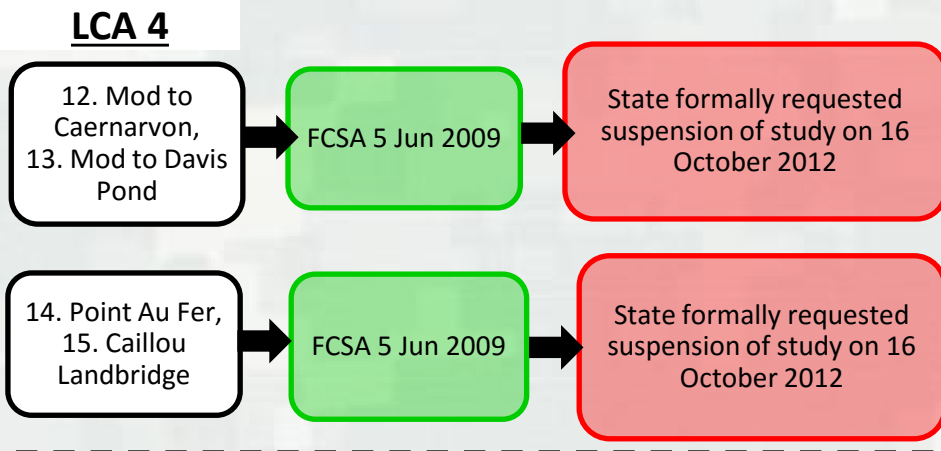
## LCA 5



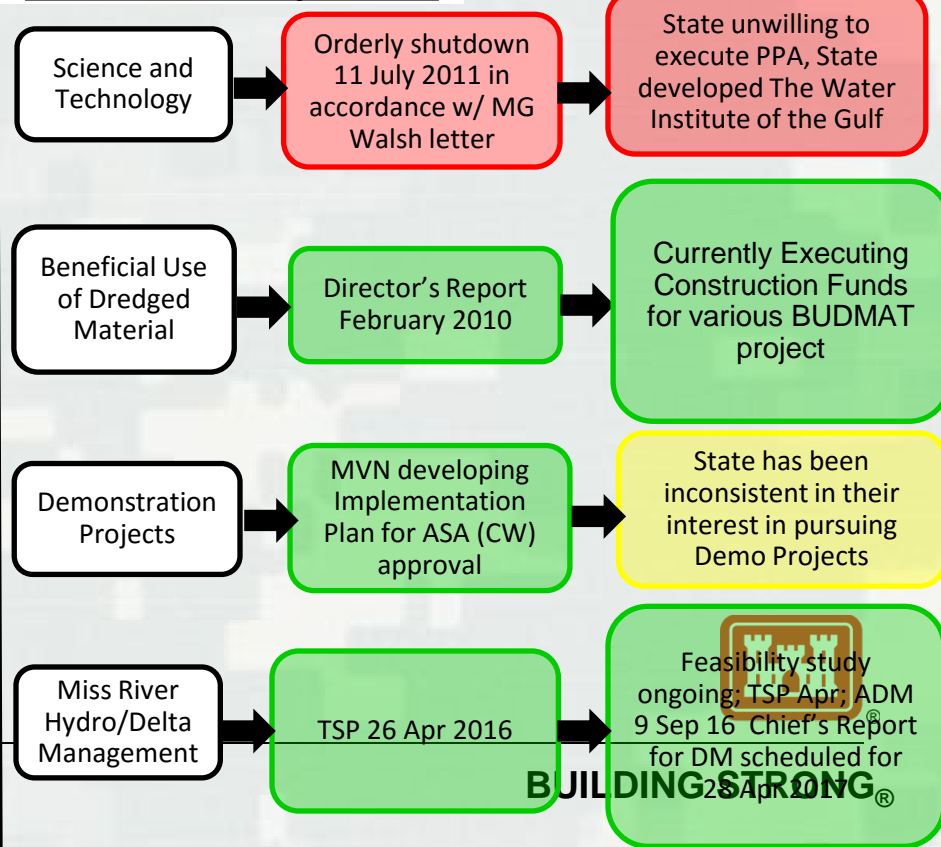
## LCA 6



## LCA 4



## Other LCA Components



# LCA Update

- May 25, 2016 Letter LA State signed crediting project partnership agreements seeking credit for design & construction of:
  - ▶ Terrebonne Basin Barrier Shoreline Restoration (Whiskey Island)
  - ▶ Barataria Basin Barrier Shoreline (Caminada Headland & Shell Island)
  - ▶ Amite River Diversion Canal Modification
  - ▶ Small Bayou Lafourche Reintroduction
  
- State requests utilize credit granted for above in order to implement following:
  - ▶ Terrebonne Basin Barrier Shoreline
  - ▶ Barataria Basin Barrier Shoreline (Back Barrier Marsh Creation)
  - ▶ Beneficial Use of Dredged Material
  - ▶ Small Diversion at Convent/Blind River
  - ▶ Southwest Coastal Louisiana



# Southwest Coastal Louisiana (2016)

- Study Area: 4,700 square mile (3,000,800 acres)
- NED Plan had nonstructural risk reduction for about 4000 structures
- NER Plan: 49 ER measures address critical land loss and ecosystem degradation, stabilize the wetland perimeter geomorphology
- Restore net total 15,448 acres
  - ▶ 9 marsh restoration: net total 7,900 acres
  - ▶ 5 shoreline protection: net total 6,135 acres
  - ▶ 35 chenier reforestation: 1,413 acres live oak and hackberry

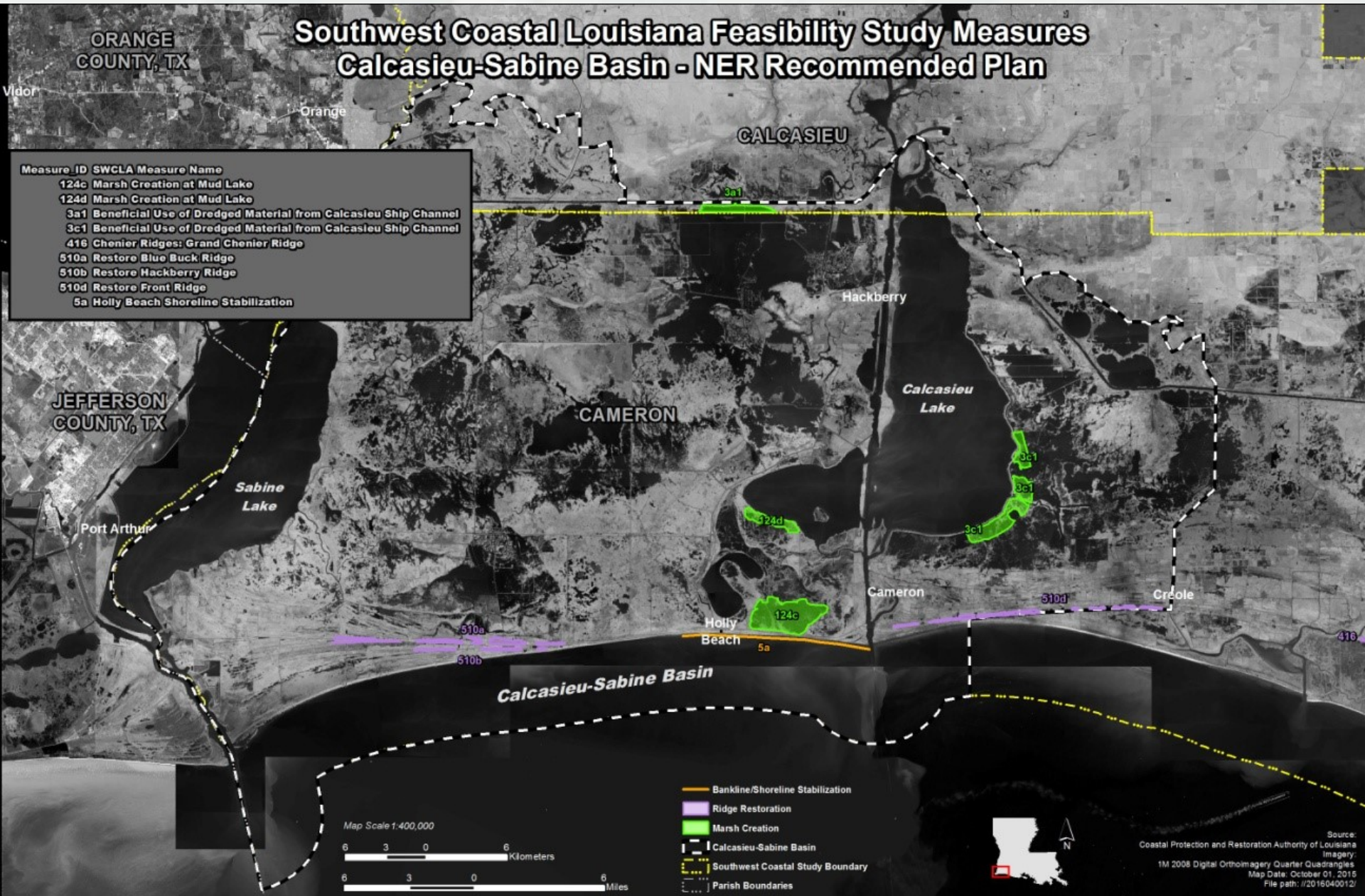
\* Includes protection of 335 acres of designated critical wintering habitat threatened piping plover / rufus red knot



# Southwest Coastal Louisiana

## Southwest Coastal Louisiana Feasibility Study Measures Calcasieu-Sabine Basin - NER Recommended Plan

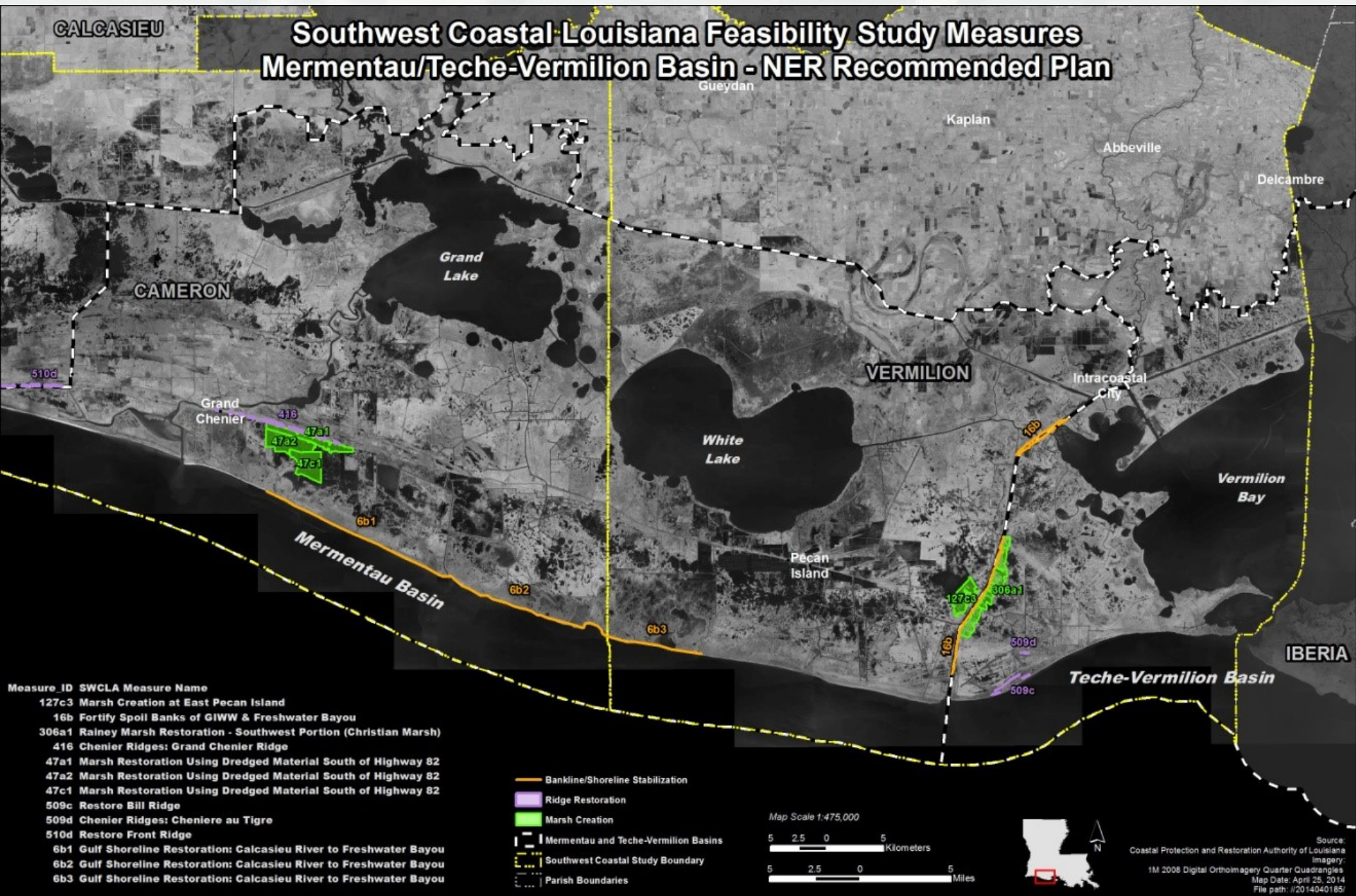
Measure_ID	SWCLA Measure Name
124c	Marsh Creation at Mud Lake
124d	Marsh Creation at Mud Lake
3a1	Beneficial Use of Dredged Material from Calcasieu Ship Channel
3c1	Beneficial Use of Dredged Material from Calcasieu Ship Channel
416	Chenier Ridges: Grand Chenier Ridge
510a	Restore Blue Buck Ridge
510b	Restore Hackberry Ridge
510d	Restore Front Ridge
5a	Holly Beach Shoreline Stabilization



- Bankline/Shoreline Stabilization
- Ridge Restoration
- Marsh Creation
- Calcasieu-Sabine Basin
- Southwest Coastal Study Boundary
- Parish Boundaries

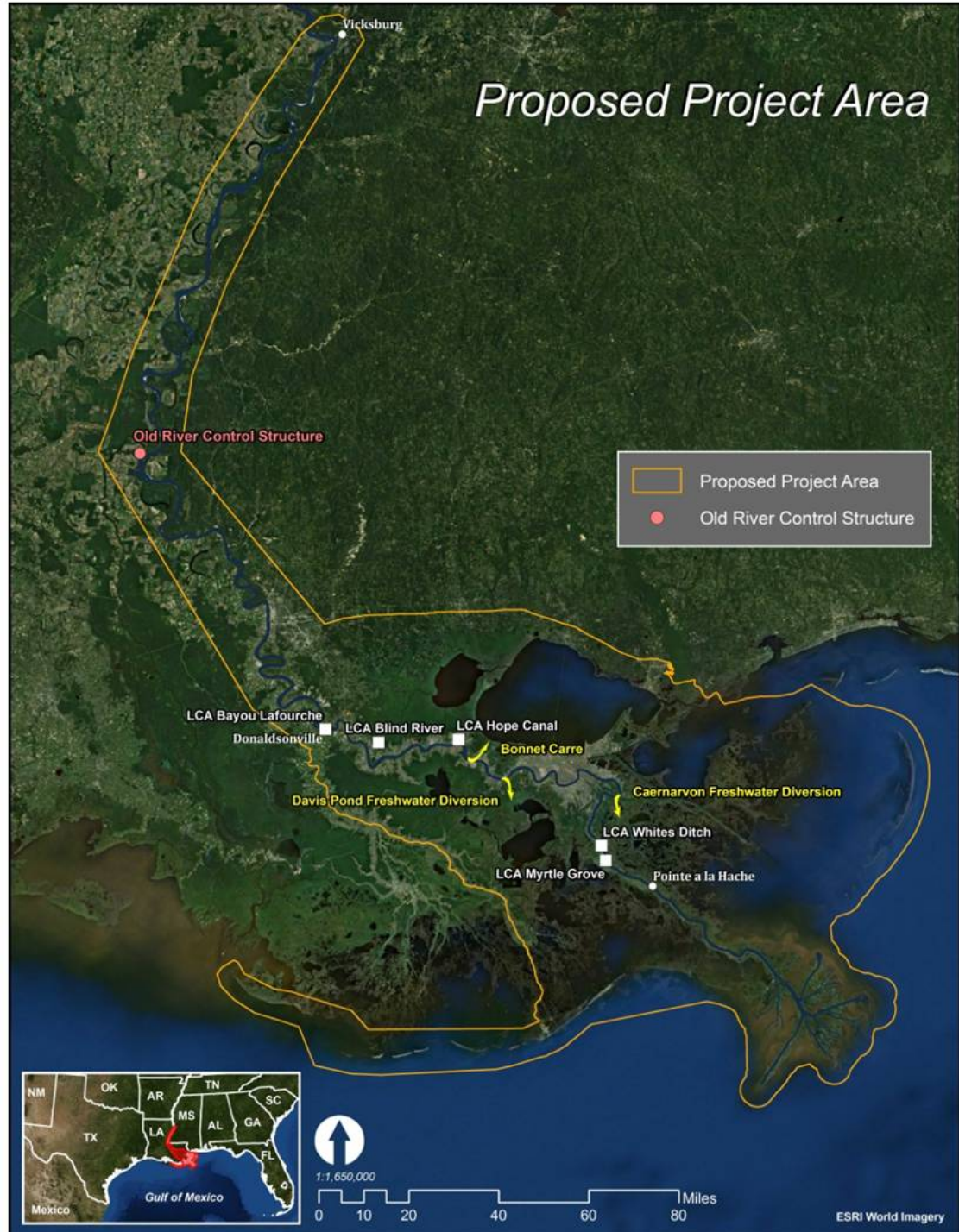


# Southwest Coastal Louisiana



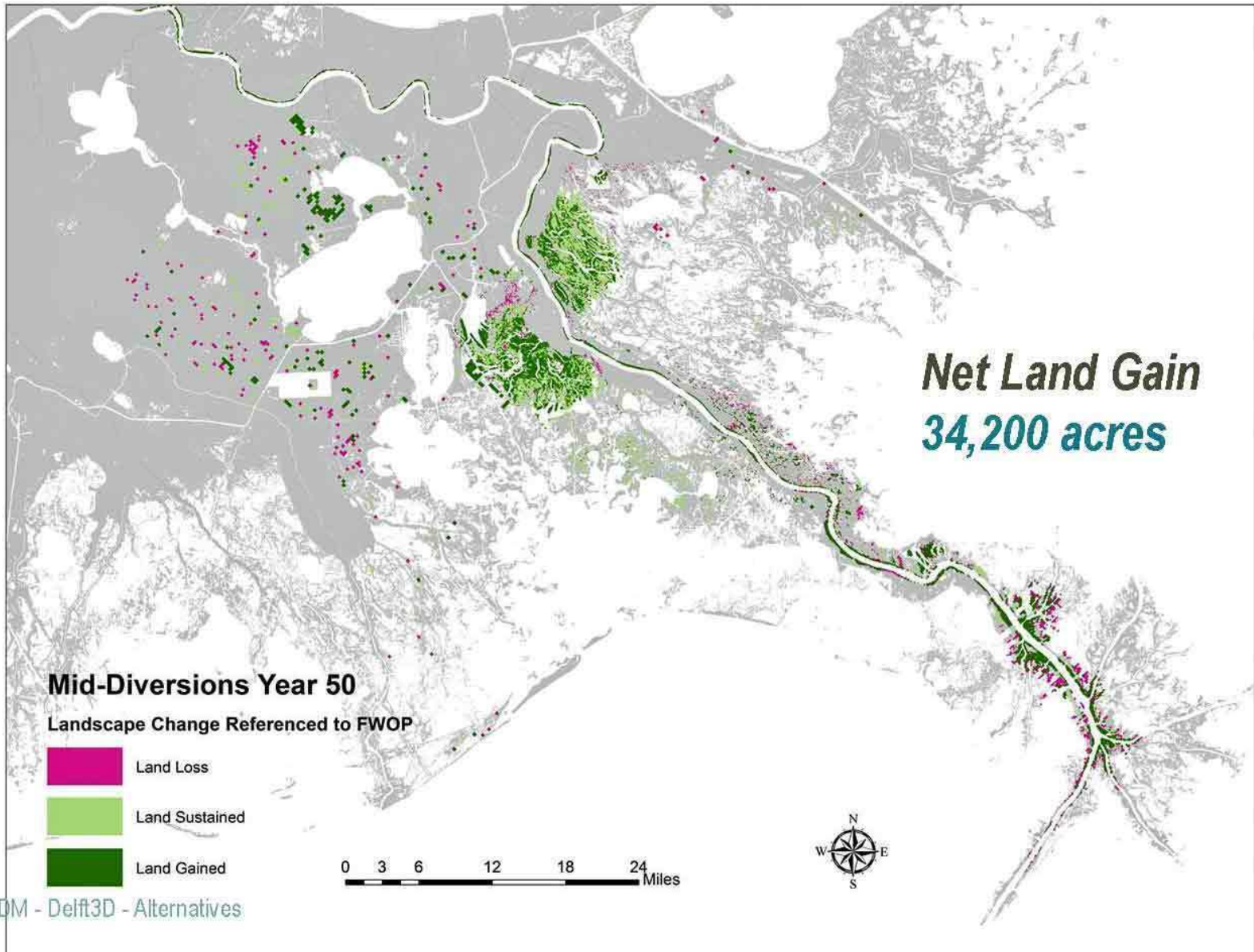


# Mississippi River Hydrodynamic and Delta Management Study (ongoing)



# LAND CHANGE BY YEAR 2070

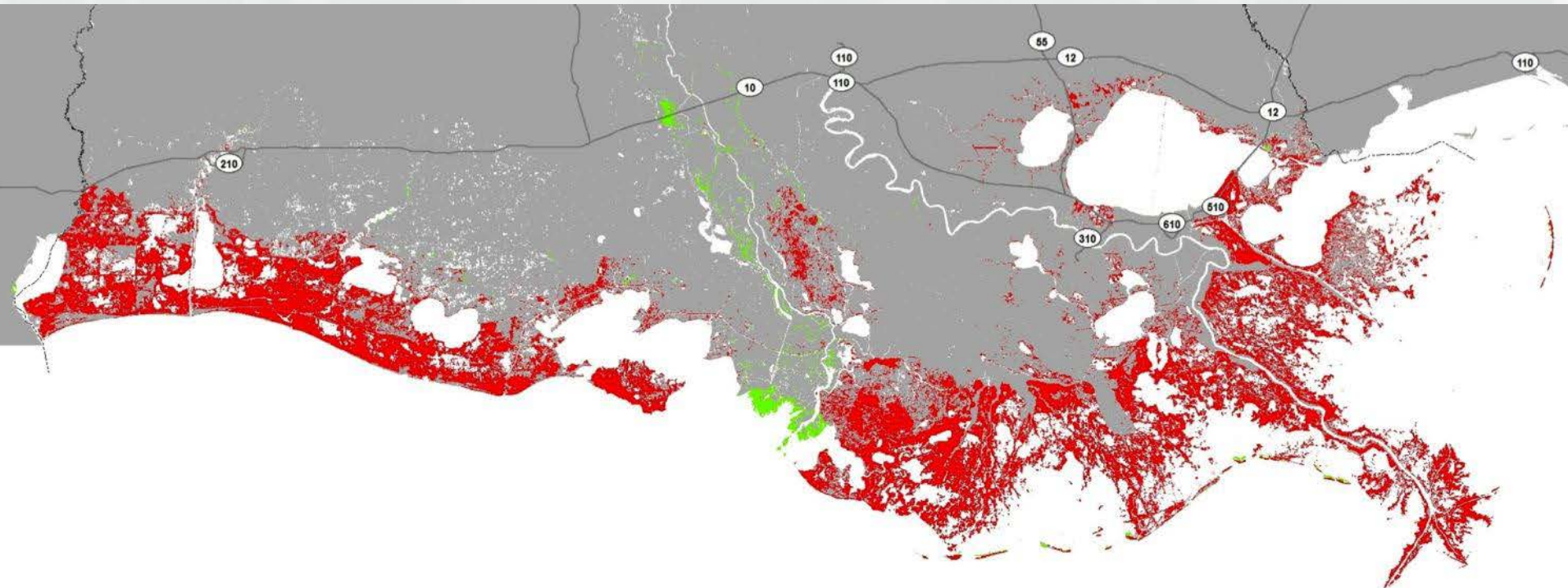
## MID DIVERSIONS



# The Future - 2060

- USGS (2013):

*Our findings suggest that despite the efficacy of restoration projects in mitigating losses in certain areas, net loss of wetlands in coastal Louisiana is likely to continue. Model results suggest certain areas may eventually be lost regardless of proposed restoration investment, and, as such, other techniques and strategies of adaptation may have to be utilized in these areas.*



# Future

- FY1991 \$9.4 billion budget
  - ▶ Ecosystem restoration: \$1 billion
- FY2017 (proposed): \$4.6 billion requested
  - ▶ Ecosystem Restoration: \$374 million

## HOW CAN YOU MAKE A PROPOSAL?

WRRDA 2014 Section 7001: Proposals for Future Water Resources Development projects:

<http://www.wrrda7001proposals.us/>

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