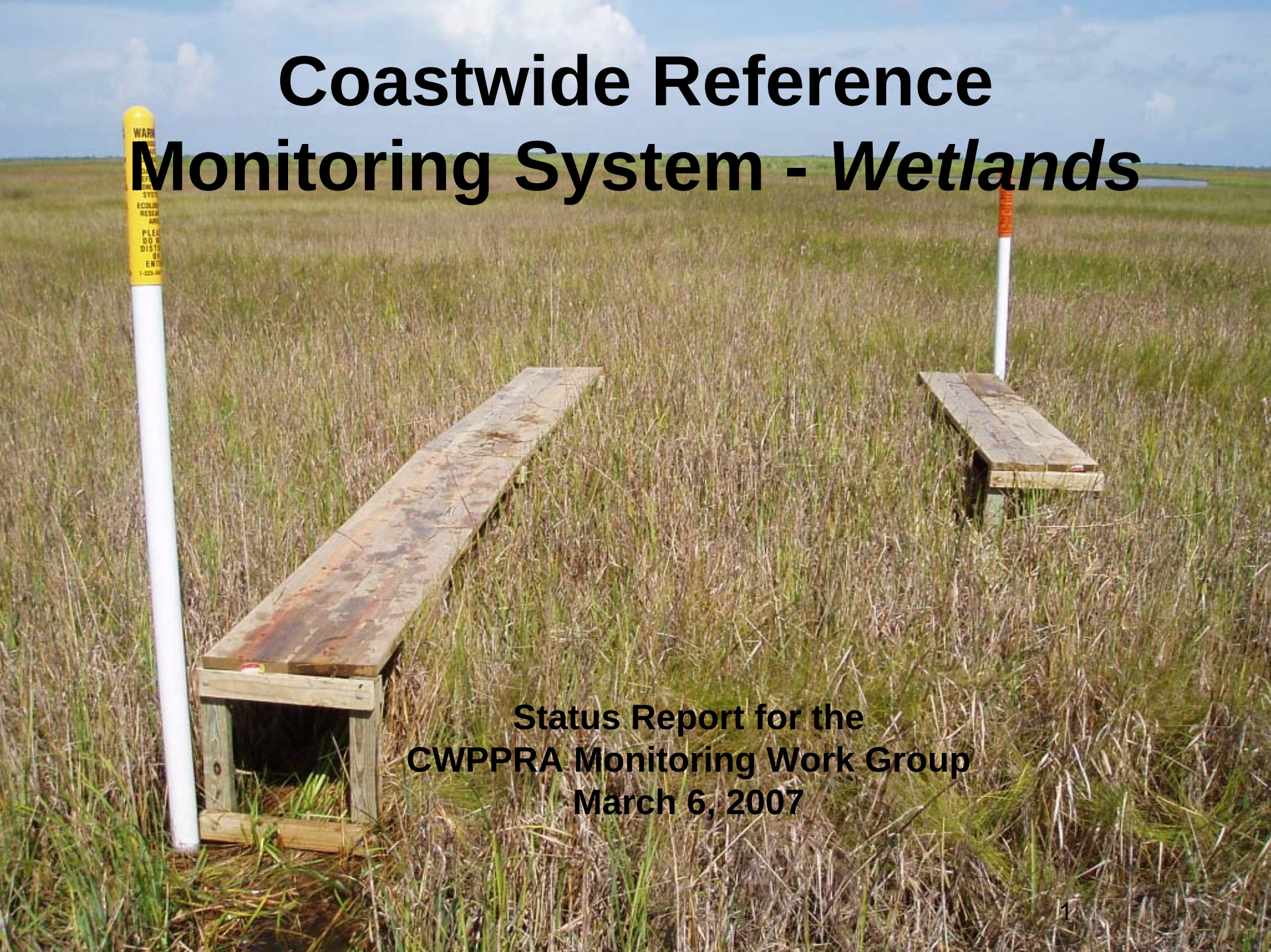
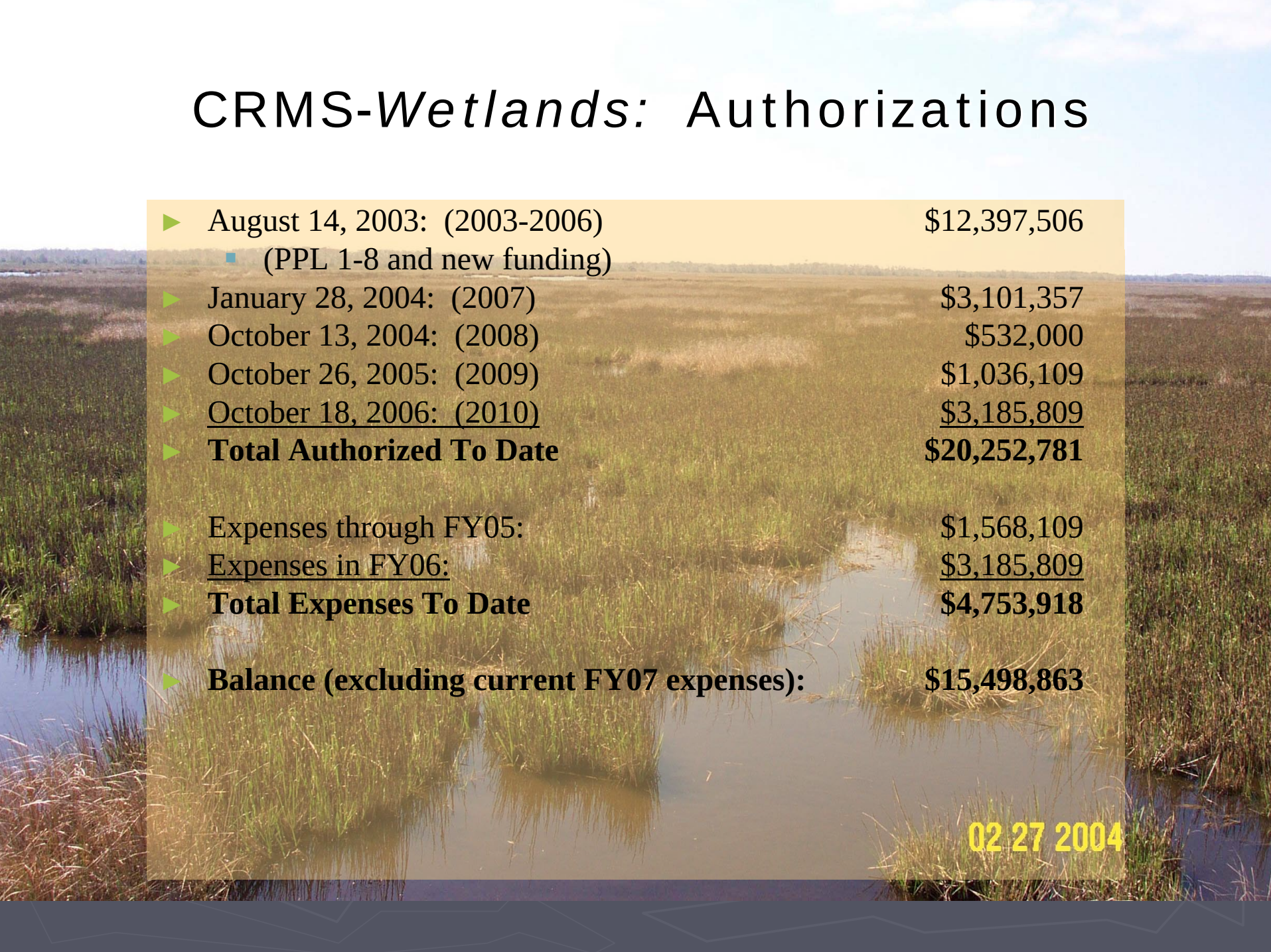
Coastwide Reference Monitoring System - *Wetlands*



Status Report for the
CWPPRA Monitoring Work Group
March 6, 2007

CRMS-*Wetlands:* Authorizations

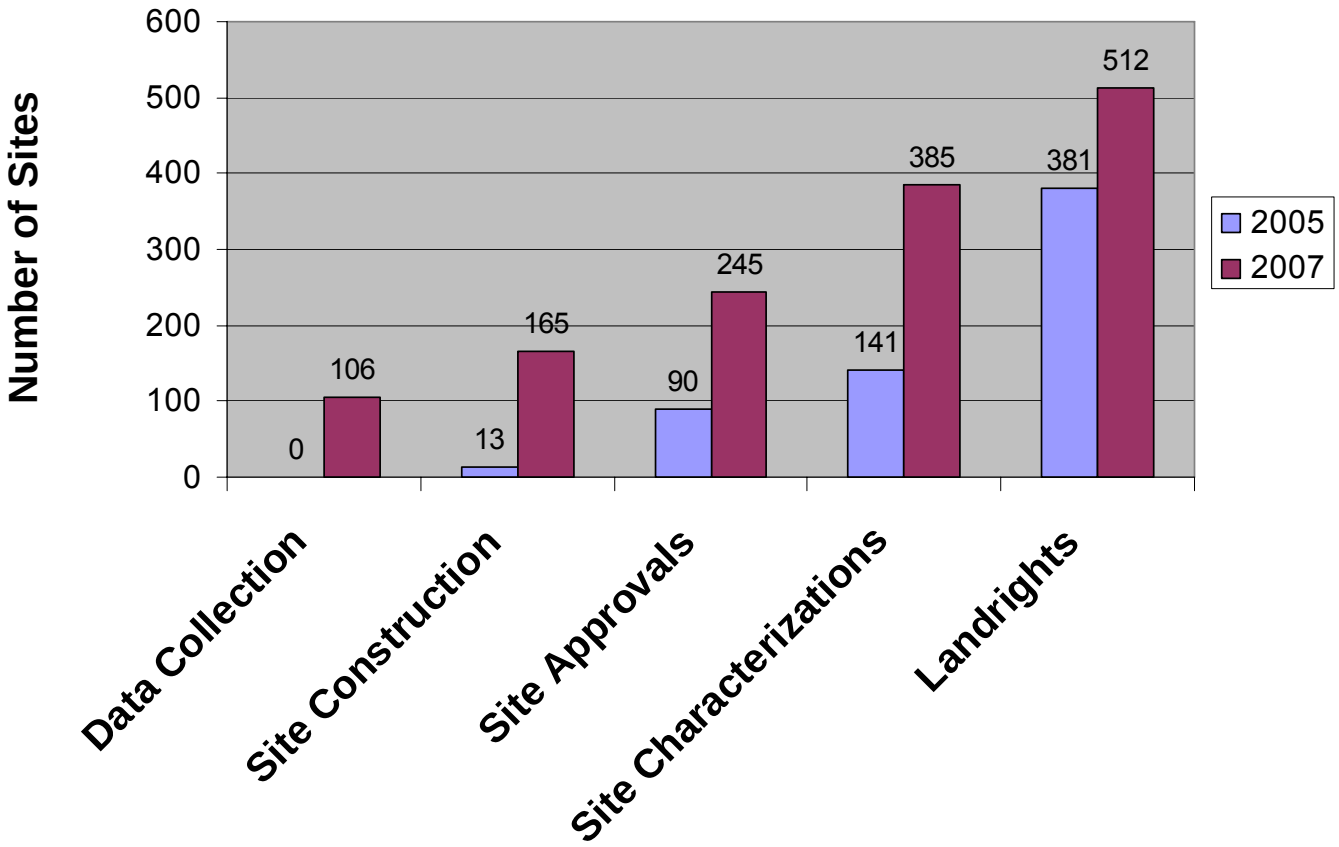
August 14, 2003: (2003-2006)	$12,397,506
(PPL 1-8 and new funding)	
January 28, 2004: (2007)	$3,101,357
October 13, 2004: (2008)	$532,000
October 26, 2005: (2009)	$1,036,109
October 18, 2006: (2010)	$3,185,809
Total Authorized To Date	**$20,252,781**
Expenses through FY05:	$1,568,109
Expenses in FY06:	$3,185,809
Total Expenses To Date	**$4,753,918**
Balance (excluding current FY07 expenses):	**$15,498,863**



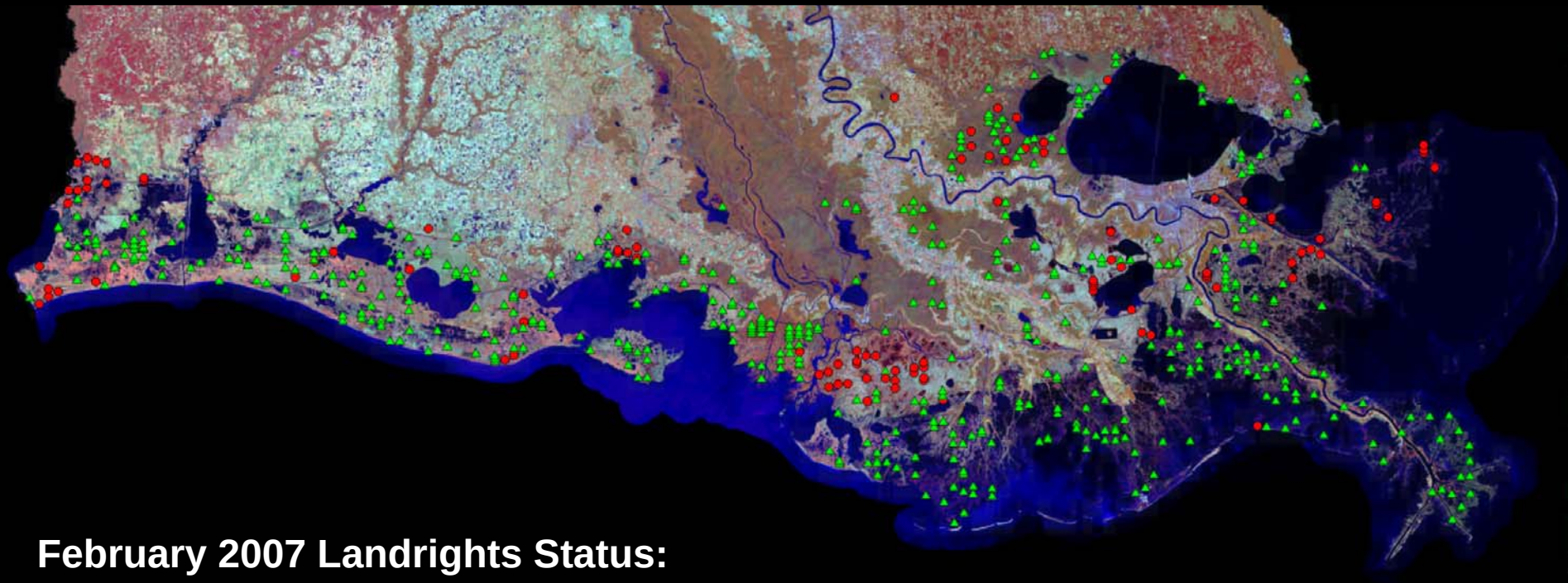
CRMS-*Wetlands:* Milestones

- Landrights
  - 512 of 612 sites secured to date
- Cost Share Agreement
  - DNR-USGS finalized June 8, 2004
- Contracting
  - Data Collection - Coastal Estuary Services – finalized February 1, 2005
  - Equipment – Hach Environmental – Equipment to support 300 sites received August 05 – July 06
  - Presently working to secure remaining hydrologic sampling equipment (187 Units)
- Methodologies-Training-QA/QC
  - DNR, USGS and CES staff – phased training in March and August 2005 on SOP's and QA/QC
  - DNR, USGS and CWPPRA agency personnel – monitoring data and information access through SONRIS and LaCoast

CRMS-*Wetlands:* Milestones



Coastwide Reference Monitoring System - *Wetlands*



February 2007 Landrights Status:

- ▲ **SECURED: 512**
- ● **PENDING: 100**

	Secured	Pending	Total
Annual Stations	162	25	187
Year 1 Stations	115	28	143
Year 2 Stations	117	21	138
Year 3 Stations	118	26	144
Total	512	100	612

LANDRIGHTS

CRMS-*Wetlands*: Implementation

- Site Characterization Report
  385 completed to date

Site Characterization Sheet (Page 1 of 3)

Site: CRMS0489 (Annual) **Basin:** TV
Date and Time (CST) of Site Visit: 06/15/2005 @ 08:46 **Agency:** CES
Field Personnel: B. Handley, G. Thibodeaux, J. Cancienne, R. Broussard **Weather:** Clear, 90°F, Winds SW @ 0 - 5mph

1. Site Location and Access: Has site been relocated from original CRMS centerpoint? Yes

	Easting:	Northing:
Site Coordinates (Center Point; UTM, NAD83 Meters)	641213	3275486

Access: Nearest City: Burns Highway Access: Rt. 317
Boat Ramp: Burns Point Rec. Area Landing
Type of Water Vessel: Any
Directions from field office: Follow Hwy. 14 east to US-90. Take US-90 south to the Rt. 317 exit toward Burns Point/Centerville. Turn right and take Rt. 317 to Burns Point. The Rec. Area will be on the right. Pay $1.00 entry fee. The ramp is at the end of the road.
Direction from boat ramp to site: Follow the coast to the north. Just past the second large keyhole, enter a small bayou. The sonde is placed on the right side about 30m/100ft. up the bayou. The center is 15m/50ft into the marsh from there.
Site Restrictions: Contact Clyde Breaux (337-836-9481) for Delores Arnaud prior to visit.
Location of Secondary Benchmark: TV04-SM-03
Other: See Site Location and Access (continued), Page 3

2. Continuous Recorder Details:

	Easting:	Northing:
Coordinates of Location (UTM, NAD 83 Meters)	641203	3275496

Recommended Set-up (Wooden post, Mono-pole, Well): Wooden post
Description of area [describe water body (size, depth, consistency of bottom), distance from edge, salinity]: 15ft/5m wide, 2.25ft/0.6m deep, very steep-sided, moderately firm-bottomed trenasse; 30.3°C, 471µS, 0.2ppt; sonde 2ft/0.6m from edge.

3. Boardwalk Details:

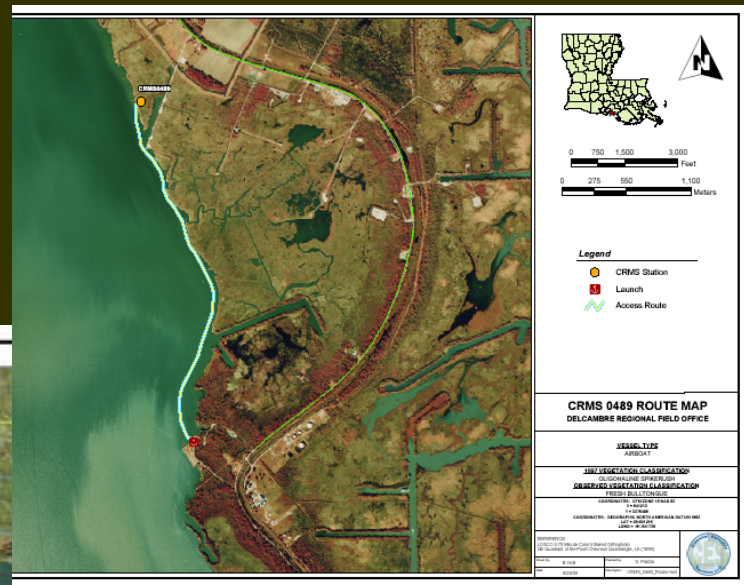
	Easting:	Northing:
Coordinates of Access Point (UTM, NAD83 Meters)	641213	3275486

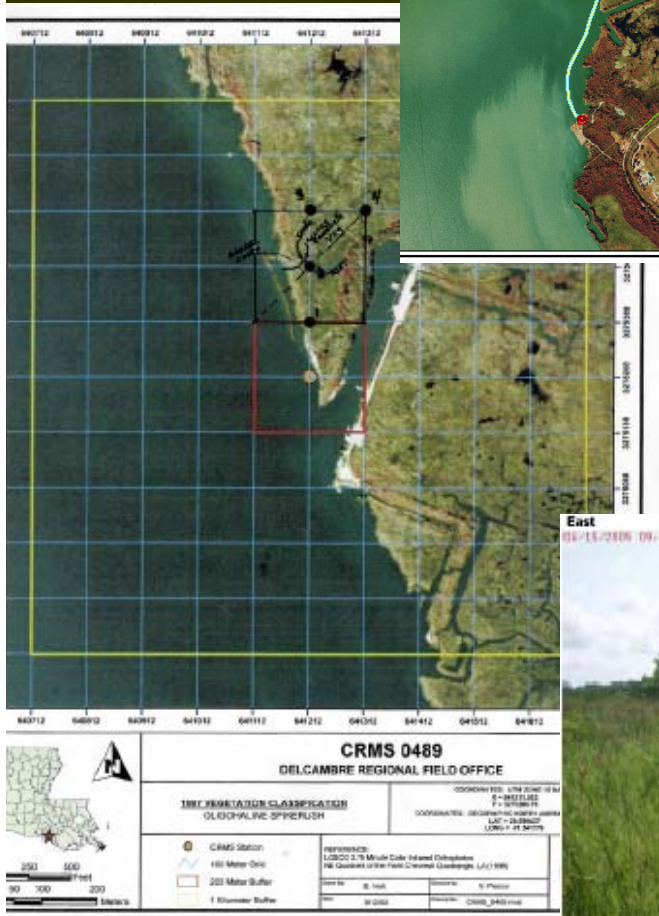
Direction/Bearing of Access Boardwalk (degrees): No access boardwalk required
Approximate length of Access (Additional) Boardwalk (ft): No access boardwalk required
Direction/Bearing of Base Boardwalk (degrees): 138°

4. Site Layout Details: (airboat access direction, vegetation transect orientation, RSET location, etc)
Airboat access is from the SW, veg. transect NE-SW, RSET SW of base boardwalk

5. Photos:

Number	Direction	Time Stamp	Number	Direction	Time Stamp
1	N	9:43			
2	E	9:43			
3	S	9:43			
4	W	9:43			





CRMS-*Wetlands* : Implementation

- Construction of sites began in July 2005
  - Approximately 165 sites constructed

- All presently secured sites to be built & operational by July 2007

CRMS-*Wetlands*: Implementation

Data Collection (as of February 2007):

- **60 benchmarks incorporated into LDNR vertical control network**
- **179 CRMS sites – post-hurricane assessments; 49 sites required repair**
- **106 CRMS sites all parameters; 215 CRMS sites vegetation sampling**
- **Coastwide aerial photography and satellite imagery collected Fall 2005 available on lacoast.gov**
- **Land:water analysis complete on 55 CRMS sites using aerial photography and coastwide using satellite imagery (150 in peer review)**

CRMS-*Wetlands*: Implementation

Data Availability (as of February 2007):

- **88 Continuous hydrographic stations**
- **100 Pore water salinity stations**
- **215 Vegetation sites (2,150 stations)**
- **87 Soil properties stations**
- **85 RSET/Accretion stations**
- **55 Land:water analyses (150 in peer review)**

Data available through DNR SONRIS, USGS, or CWPPRA Websites

CRMS-*Wetlands:* Projections through July 2007

- **Meet with Monitoring Workgroup in Spring 2007**
- **Install remaining benchmarks**
- **Complete construction of all year 1 sites**
- **Data collection on all year 1 sites**
- **Web enable vegetation and sediment data and develop on-the-fly graphics**
- **Assemble analysis team to support basin-level assessments**

CRMS Implementation Status:

Are we on Track/What have we learned?

•Slow start due to prolonged contractor selection process and contractor training.
•Landowner involvement/review in site placement (in-field) has slowed construction.
•Learning that landrights and uncertainty of access are more challenging than anticipated.
•Authorization for Access routes to sites involves additional landowners in many cases.

What obstacles are we encountering?

•Increased post-hurricane contractor costs (fuel costs, surveying costs, labor).
•More DNR & USGS involvement than anticipated (labor/work-in-kind, swamp uncertainties).
•Problems with reliability of electronic field equipment has been resource drain.
•Major hurricanes damaged some sites (early O&M costs), pushed schedule back, and raised costs.
•Higher O&M than anticipated due to high incident of marsh burning.

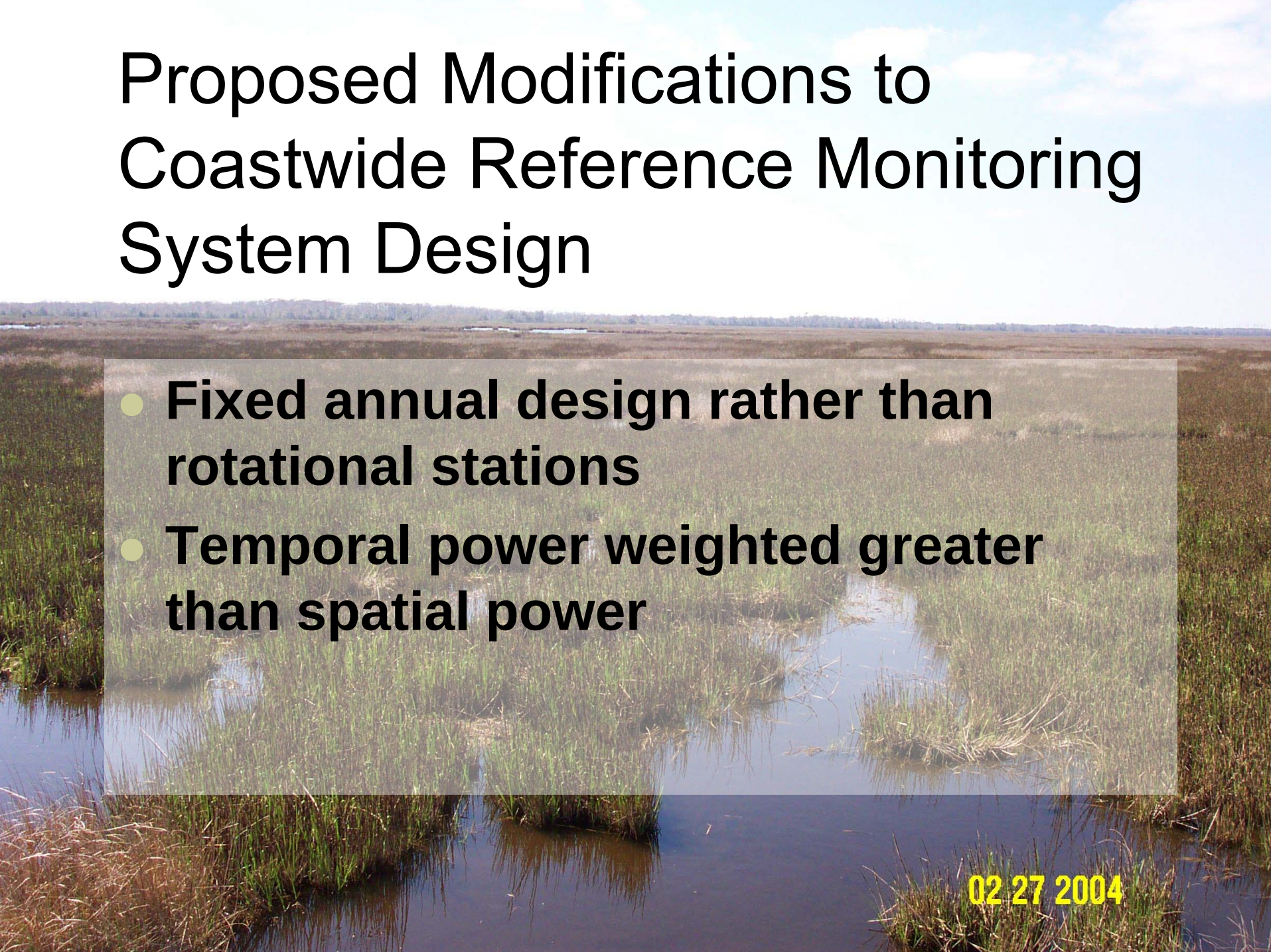
Fiscal and Technical Review:

•Can we take what we have learned over the past 18 months and develop a more streamlined approach that will reduce costs and effort, but maintain scientific integrity.

Questions?

Proposed Modifications to Coastwide Reference Monitoring System Design

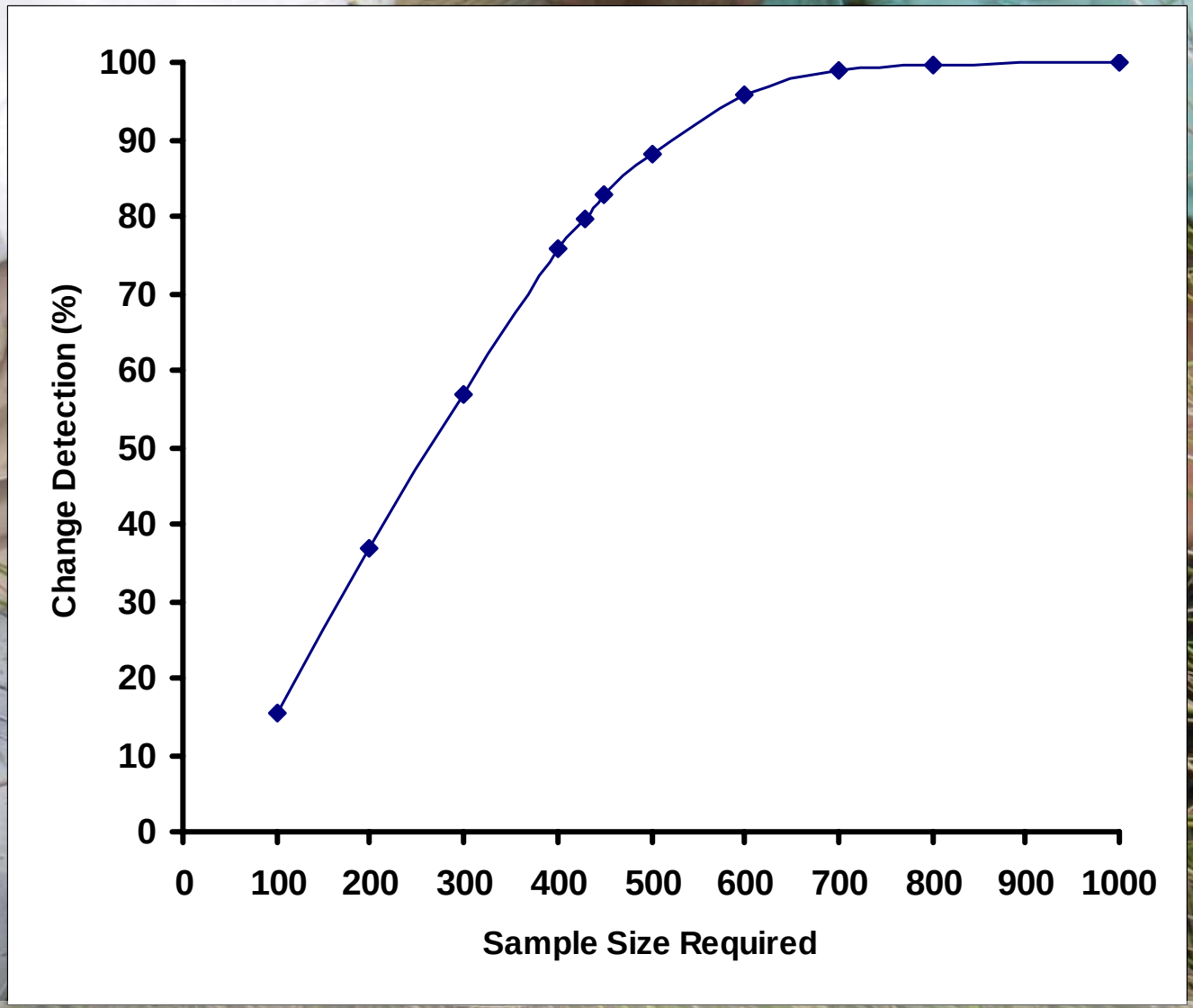
- **Fixed annual design rather than rotational stations**
- **Temporal power weighted greater than spatial power**



Design Features

- **Fixed annual rather than rotational sampling design**
  - **Change from 612 stations over 3 years (200 fixed annual, 33% of remainder each year, Barataria pilot equals 342 sites per year)**
  - **Fixed annual design – same 392 stations each year sampled**
  - **Established rules to eliminate station overlap and clustering**
- **Rationale**
  - **Improved ability to assess finer temporal changes, with reduction in power (90% to 80% confidence) in assessing coastwide change (compensated with additional spatial data)**
  - **Retains close to original station allocations to project/non-project areas, basins, and vegetation types within basins**
  - **Overcomes difficulty in securing remaining landrights; does not require new deployments each year, reducing construction costs, learning curves on site logistics, and decreases uncertainties regarding resource requirements**

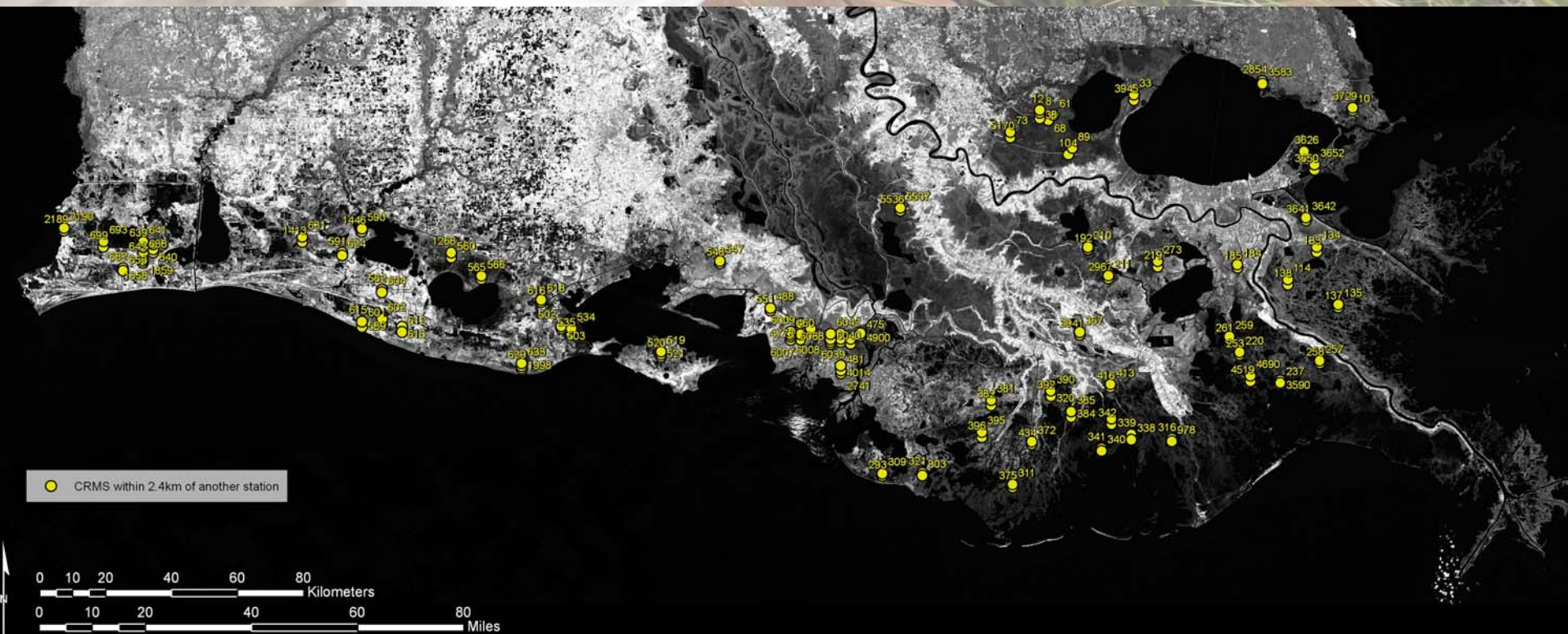
Power Assessment



Suggests approximately 400 randomly selected samples would detect a 20% change in marsh type between time one and time two 80% of the time.

CRMS Stations Proximity Analysis

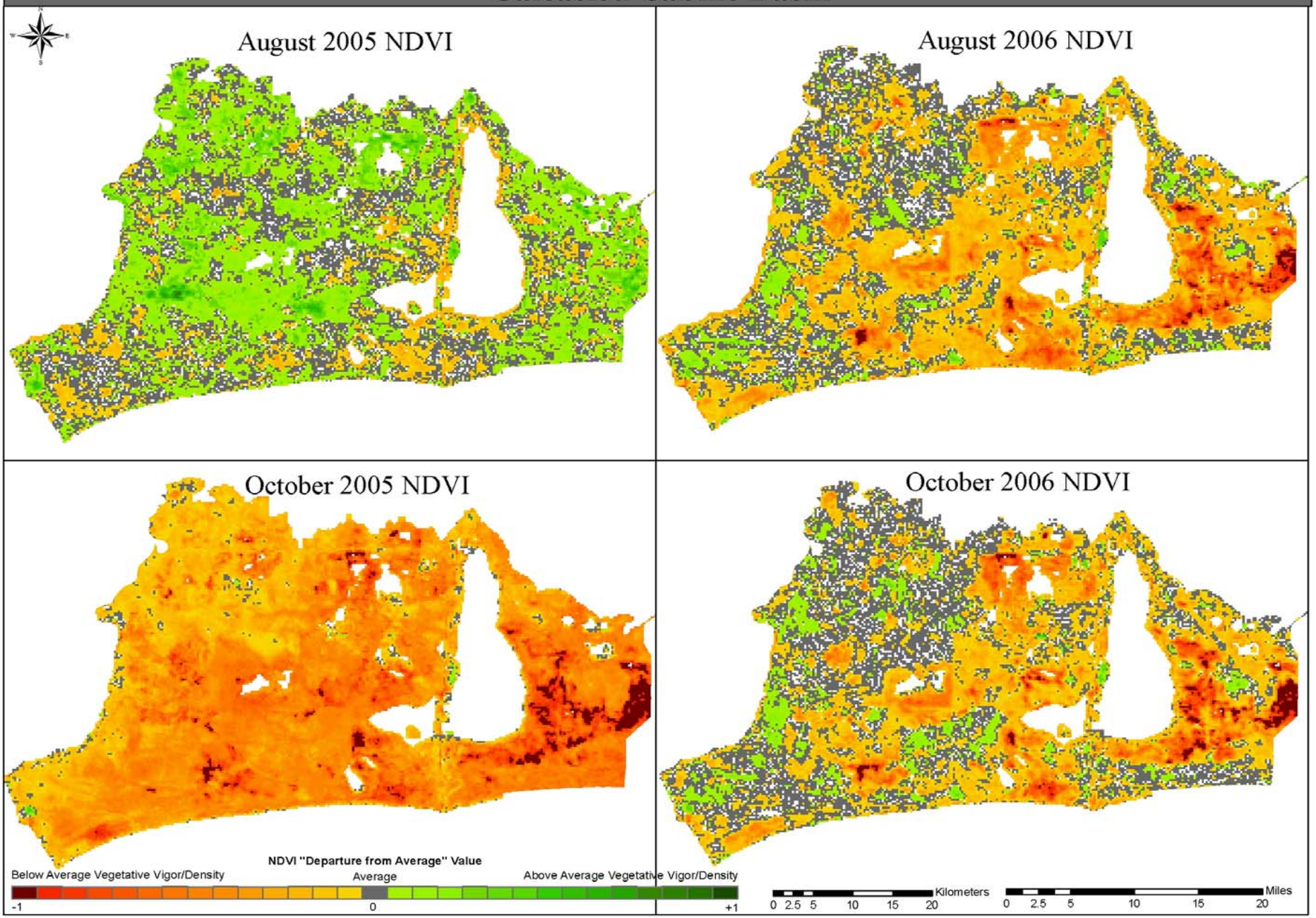
- North-South Chabreck Linscombe samples taken at 0.8 km intervals – 1 km^2 CRMS station size caused overlap
- 92 stations overlap at 1.6 km and 150 stations overlap at 2.4 km
- 2.4 km separation selected from USFWS Wetland Status & Trends design and from Emad Habib uncertainty assessment findings



DRAFT

MODIS Monthly NDVI Composite "Departure from Average"
Calcasieu-Sabine Basin

DRAFT



Station Allocations

392 Design

	Basin									
Vegetype	AT	BA	BS	CS	ME	MR	PO	TE	TV	**Total**
Deltaic Mixture	5		1			3		3		**12**
Delta Roseau Cane						8				**8**
Fresh Bulltongue	2	1		3	5		1	4	9	**25**
Fresh Maidencane		9		1	15			11		**36**
Fresh Spikerush		1						7		**8**
Mesohaline Mixture		1	1	3	3			1	1	**10**
Mesohaline Wiregrass		12	4	2	3		9	14	20	**64**
Oligohaline Bulltongue		2				1	4			**7**
Oligohaline Mixture				4	2				1	**7**
Oligohaline Spikerush	3	4					3	3	3	**16**
Oligohaline Wiregrass		10	12	30	23		4	7	9	**95**
Polyhaline Oystergrass		13	2			1	9	22		**47**
Swamp	10	12					27	6	2	**57**
Total	**20**	**65**	**20**	**43**	**51**	**13**	**57**	**78**	**45**	**392**

Station Allocations

392 Design

Basin

	AT		BA		BS		CS		ME		MR		PO		TE		TV		**Total**	
Vegetype	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
Deltaic Mixture		5				1					3					3			**3**	**9**
Delta Roseau Cane											8								**8**	**0**
Fresh Bulltongue		2		1			3		1	4				1	3	1	4	5	**11**	**14**
Fresh Maidencane				9			1		5	10					9	2			**15**	**21**
Fresh Spikerush				1											7				**7**	**1**
Mesohaline Mixture				1		1		3	3							1		1	**3**	**7**
Mesohaline Wiregrass			4	8		4	2		3				1	8	3	11	7	13	**20**	**44**
Oligohaline Bulltongue			2									1		4					**2**	**5**
Oligohaline Mixture							3	1	2									1	**5**	**2**
Oligohaline Spikerush		3	2	2									1	2	3		3		**9**	**7**
Oligohaline Wiregrass			10		4	8	23	7	10	13			4		6	1		9	**57**	**38**
Polyhaline Oystergrass				13	1	1					1			9		22			**2**	**45**
Swamp		10		12									8	19		6		2	**8**	**49**
Total	**0**	**20**	**18**	**47**	**5**	**15**	**32**	**11**	**24**	**27**	**12**	**1**	**14**	**43**	**31**	**47**	**14**	**31**	**150**	**242**

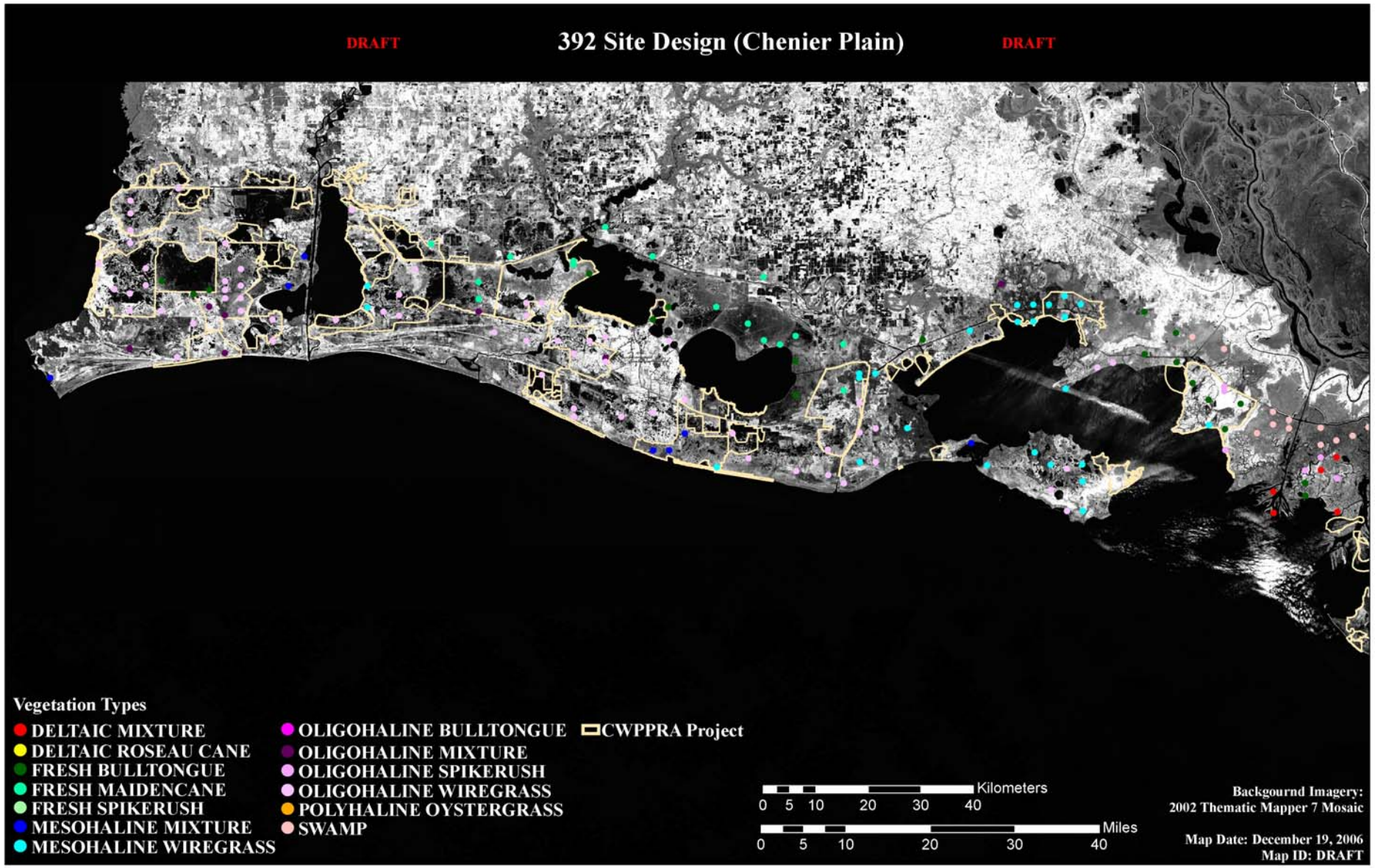
Original vs. Modified Design Within Project Stations

- BA-33 30 stations to 9 (boundary changed since initial design)
- BS-10 1 station to 0
- CS-22 1 station to 0
- CS-27 5 stations to 4
- CS-29 12 stations to 10
- CS-30 1 station to 0
- ME-17 6 stations to 4
- TE-10 6 stations to 5
- TE-32a 3 stations to 2
- TE-34 17 stations to 13
- TV-04 8 stations to 7
- TV-11b 1 station to 0
- TV-19 5 stations to 4

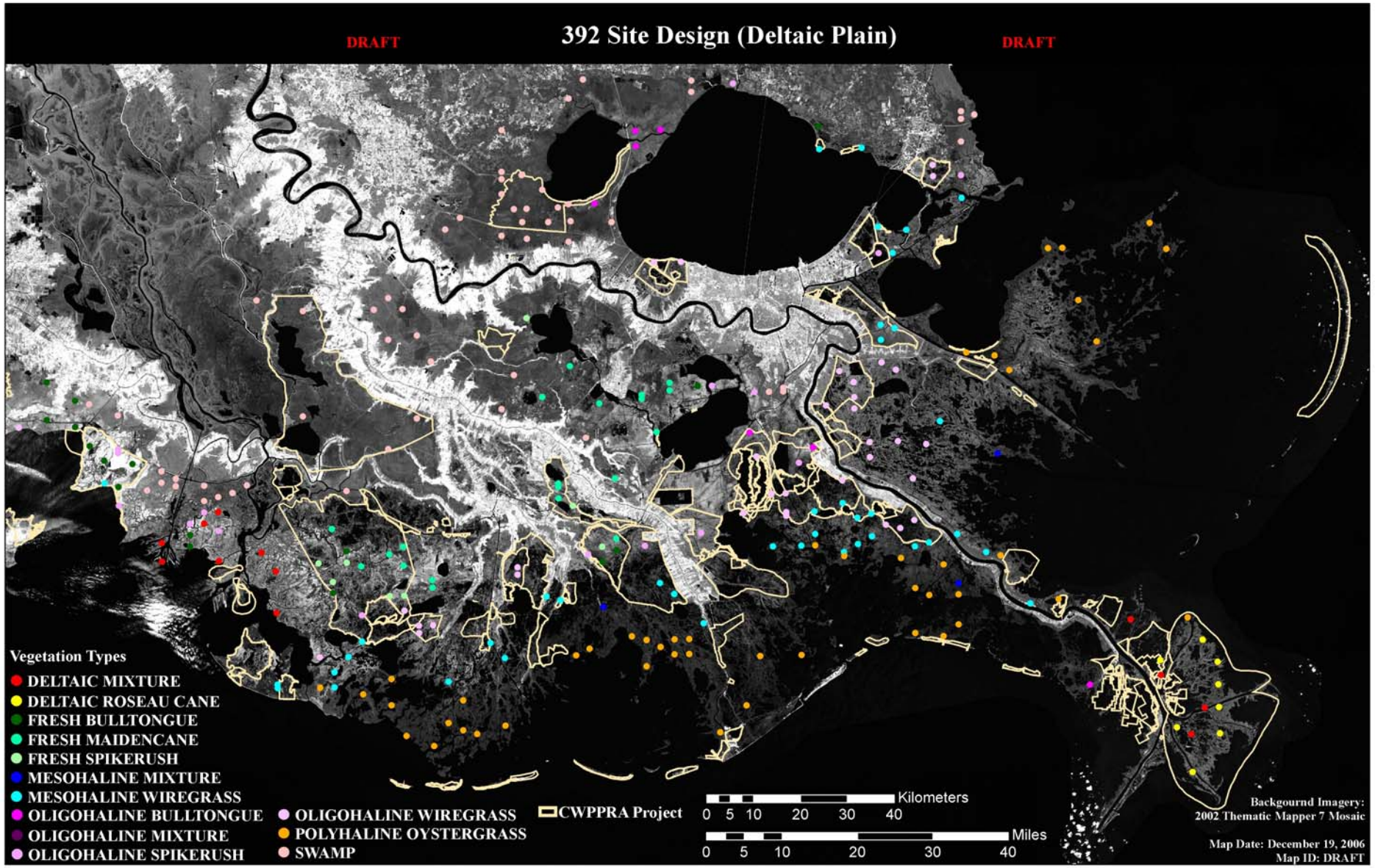
Original vs. Modified Design Sampling Frequency

- Spatial Data: Land:water analysis from aerial photography and satellite imagery from every 3 years to every 4 years
- Vegetation: Emergent marsh and forested stations from annual to every other year
- Hydrologic: Continue hourly collection of data but service gages from 12x/yr to 9x/yr, therefore sample porewaters 9x/yr
- Sediments/Soils: No change

392 Site Design (Chenier Plain)



392 Site Design (Deltaic Plain)



If Redesign is implemented:

- <38 sites remaining to secure landrights (progressing well).
- Estimate construction will be complete on all secured sites by July 2007.
- 2007 will be YEAR 1 of data collection.
- 2008 will produce summary report of first years' data and status & trends.
- Costs:
  - Original 2003 pre-hurricane estimate on original design $66.7M
  - Post-hurricane cost increases (i.e., fuel, labor and landrights acquisition) have risen sharply
  - With redesign, costs will be higher but more closely in line with original estimate
- Potential outside funding sources/contributors
  - LCA
  - CIAP
  - OCS

Data and Information Availability

LaCoast

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Coastwide Reference Monitoring System (CRMS)

Wetland restoration efforts conducted in Louisiana under the Coastal Wetlands Planning, Protection and Restoration Act require monit
as well as monitoring the cumulative effects of all projects in restoring, creating, enhancing, and protecting the coastal landscape. The ef
monitoring approach in Louisiana has been limited because of difficulty in finding comparable test sites. A multiple reference approach i
hydrogeomorphic functional assessments and probabilistic sampling.

This approach includes a suite of sites that encompass the range of ecological condition for each stratum, with projects placed on a cor
Trajectories in reference sites through time are then compared with project trajectories through time. The approach proposed could se
ecosystems.

PowerPoint presentation

Contacts

DNR > OCRM > Coastal Restoration Division (CRD)

Louisiana.gov

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Coastal Management
Coastal Restoration

Monitoring Data

Hydrographic, accretion, herbaceous marsh vegetation, soil properties, and surface elevation data collected by the LDNR / CRD Monitoring Section are now available on-line. All downloaded files will be in zipped, comma-delimited format with headers that describe the data. For a detailed explanation of all data types, please review the Data Descriptions document.

Hydrographic Data

Hydrographic data are now available in two general formats: data collected monthly and data collected hourly. Parameters sampled generally include: water level, water temperature, specific conductance, and salinity. In some rare instances water velocity and wind speed / direction are sampled at stations where hourly data are collected.

Monthly Data

Link: Retrieve Monthly Data (via SONRIS Lite)

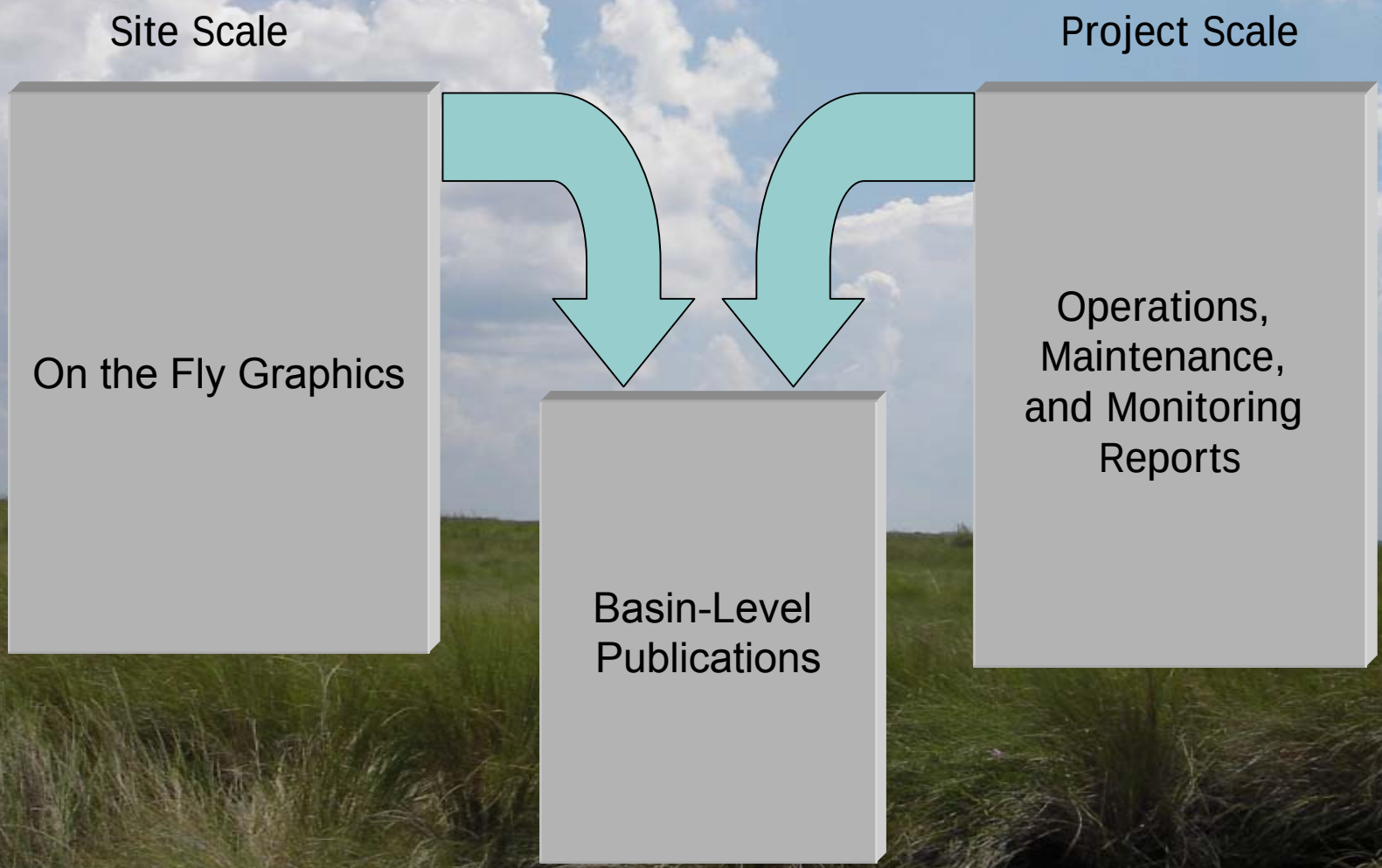
Monthly hydrographic data can be downloaded by either project or station number for any range of dates that data are available. These files are relatively small as there are only approximately 12 records per station per year. In general, there is a much larger spatial distribution of stations where monthly data are collected than where hourly data are collected. The LDNR currently monitors over 400 stations throughout the coastal zone for monthly hydrographic data.

Hourly Data

Link: Retrieve Hourly Data (via SONRIS Lite)

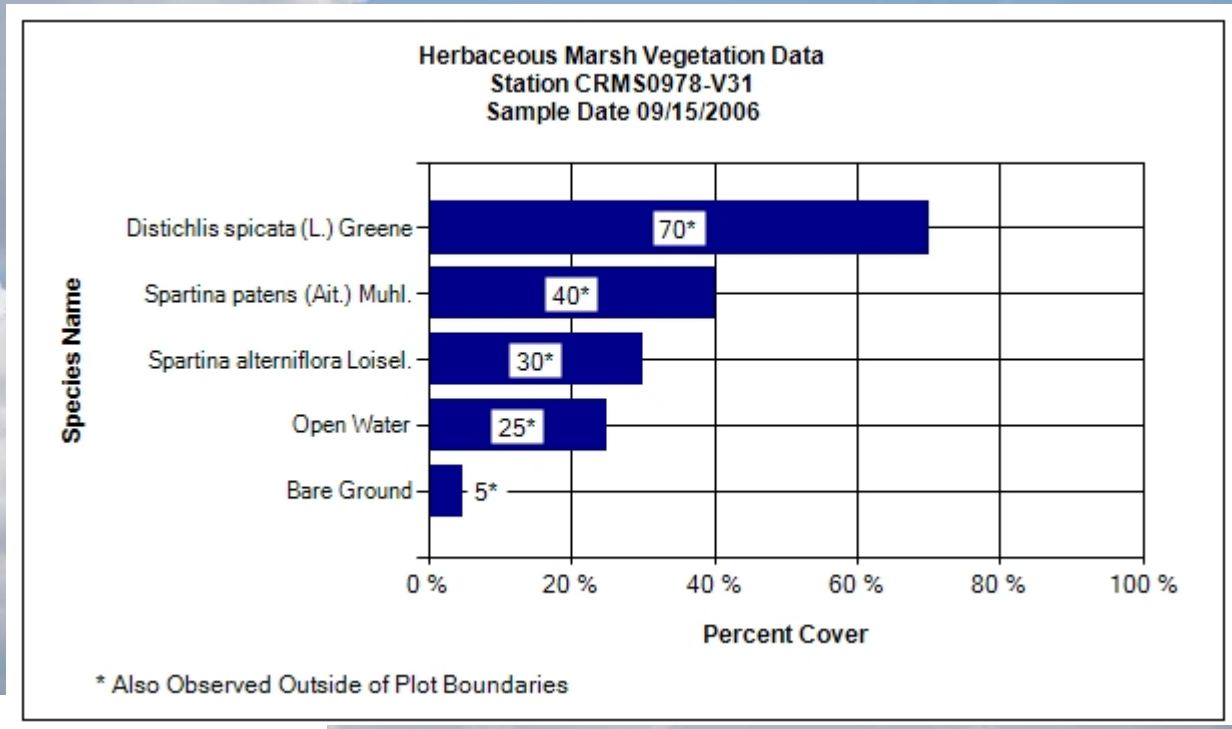
Hourly hydrographic data may also be downloaded by project or by station number; however these files are much larger than the monthly files. For example, since one year of hourly sampling will yield approximately 8,760 records, a file for a project collecting data at

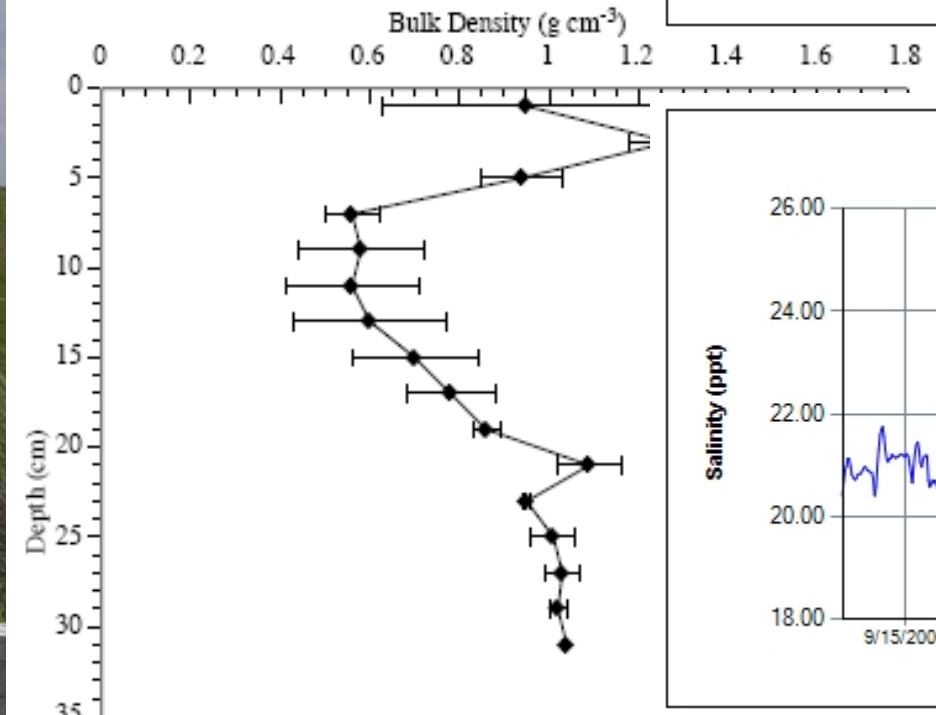
Data Analysis & Reporting Approach

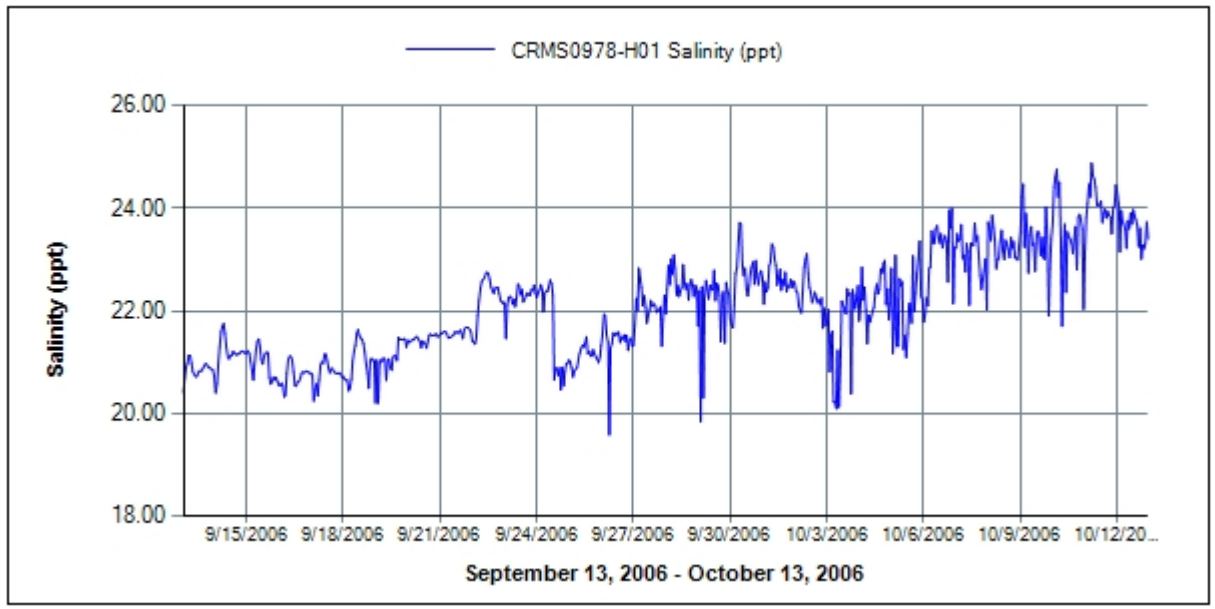


CRMS-*Wetlands* Data

- Site-scale







LaCoast

PROVISIONAL DATA SUBJECT TO REVISION

Station: BA02-56 FROM: Jun 24 1997 12:00AM TO: Oct 25 2006 12:00AM

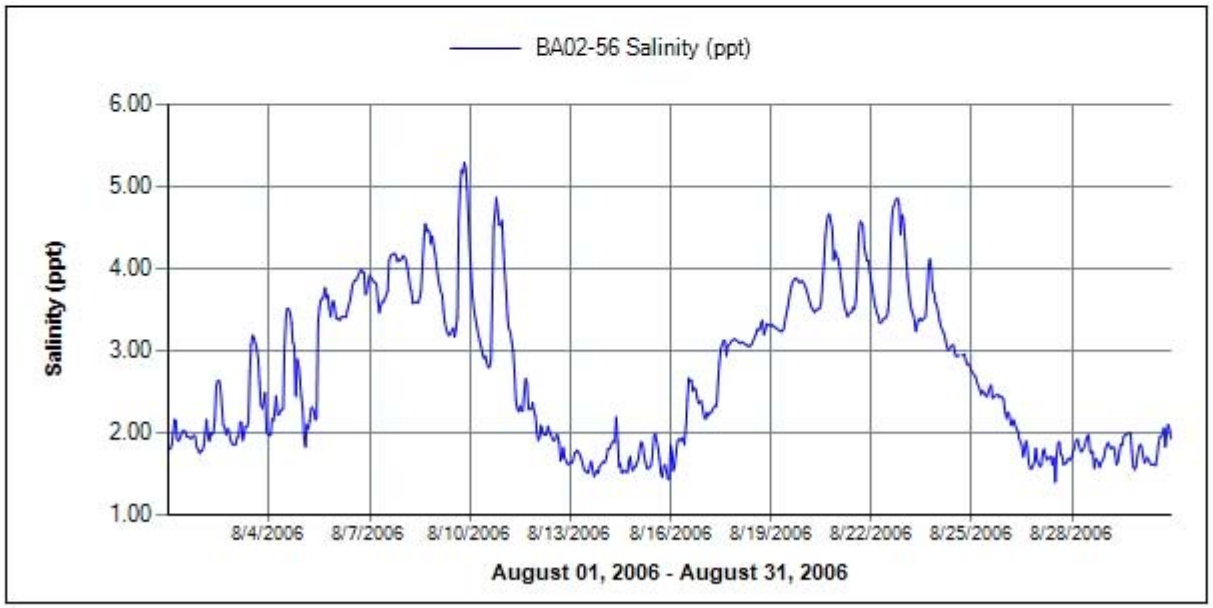
Station Type: Continuous

Parameters:
- [x] Salinity
- [ ] Water Temp
- [ ] Water Level

Days: (•) 30 days ( ) 60 days ( ) 90 days

Start Date: 08/01/2006

Create Graph



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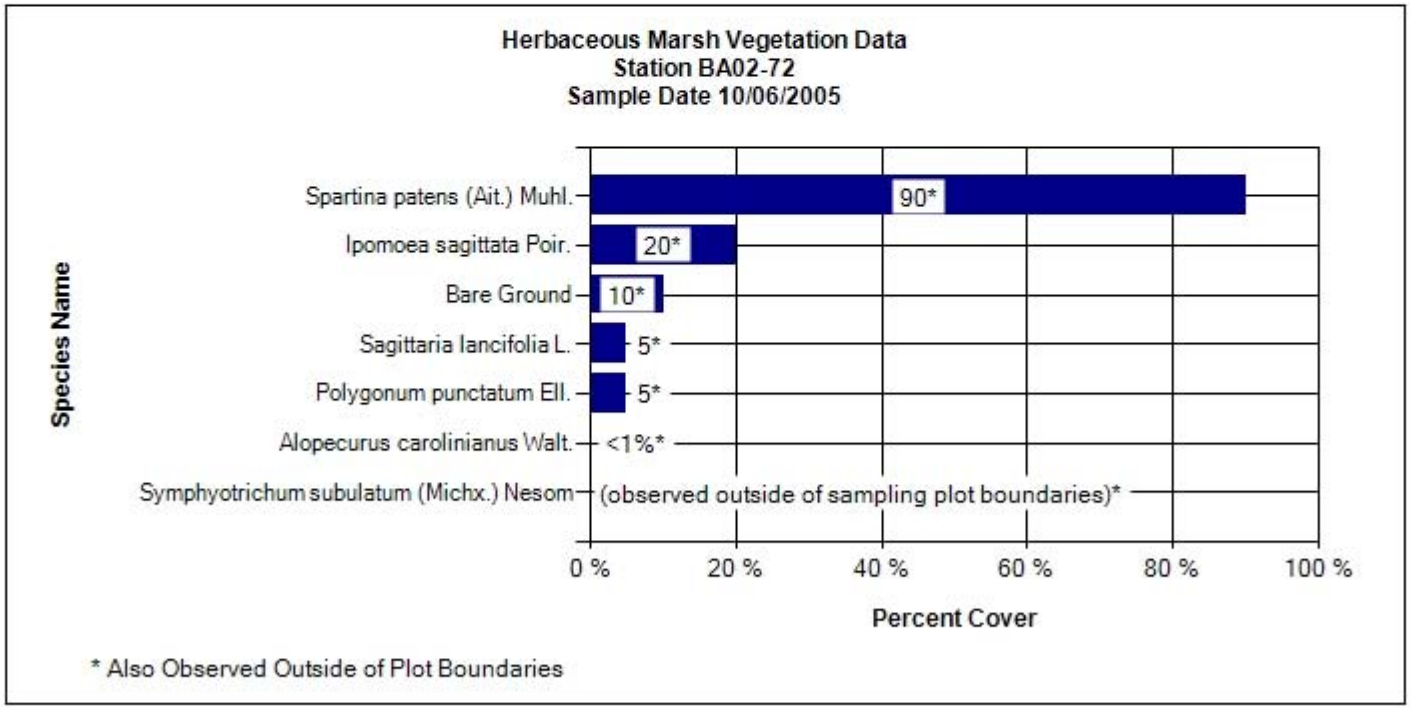
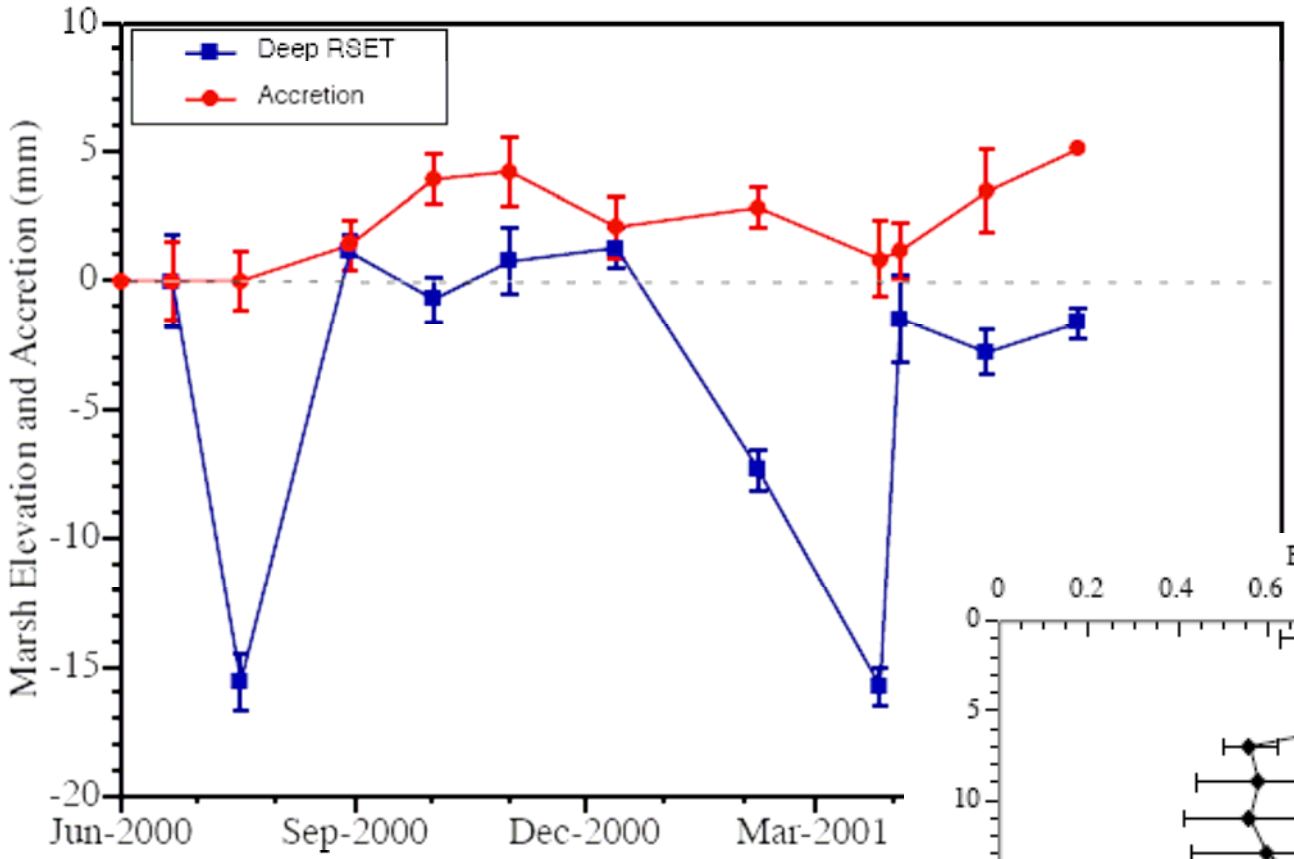
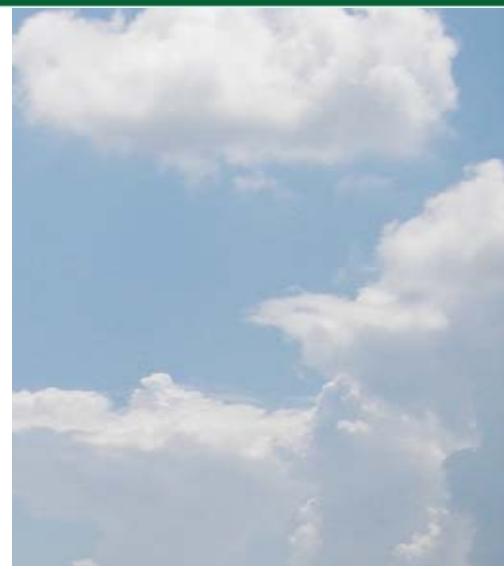
PROVISIONAL DATA SUBJECT TO REVISION

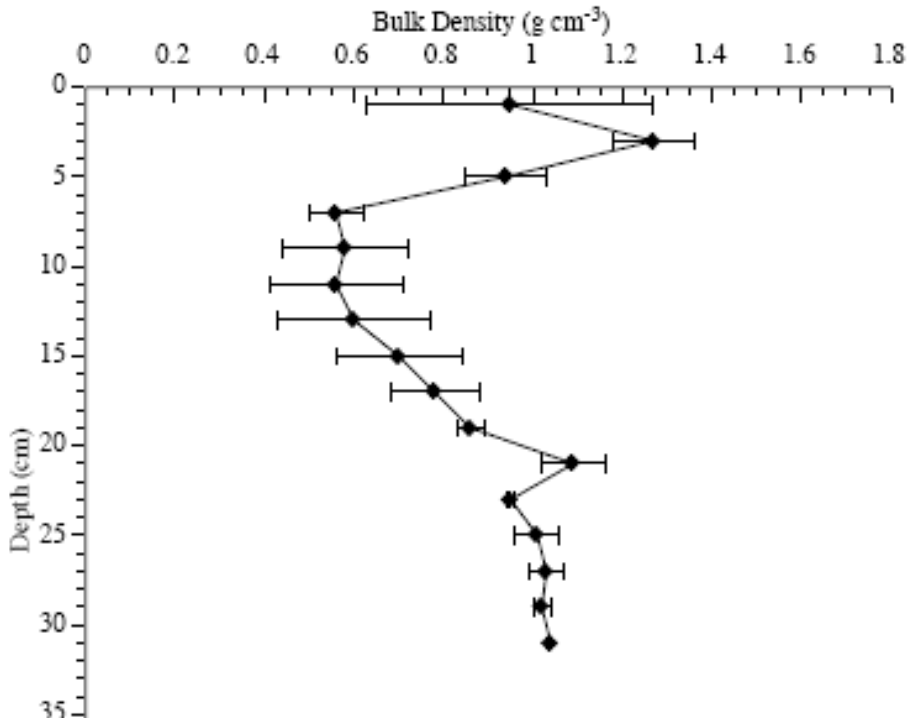
Station: BA02-72
Station Type: Vegetation
Collection Date: 10/06/2005
Create Graph



LaCoast


Deep RSET
Accretion
Marsh Elevation and Accretion (mm)
10
5
0
-5
-10
-15
-20
Jun-2000
Sep-2000
Dec-2000
Mar-2001




Bulk Density (g cm-3)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
Depth (cm)
0
5
10
15
20
25
30
35

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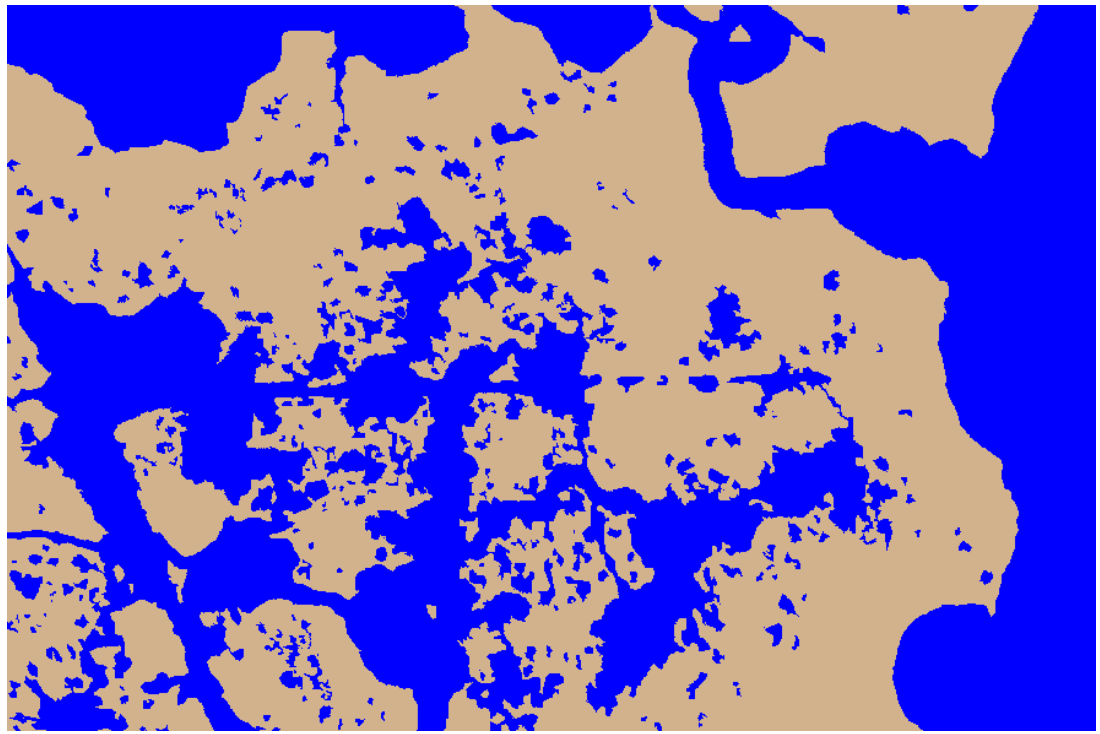
Coast 2050
LCA

Specific CRMS Station Data

Color Infrared Image TIFF
Color Infrared Image's World File

Land / Water Image TIFF
Land / Water Image's World File

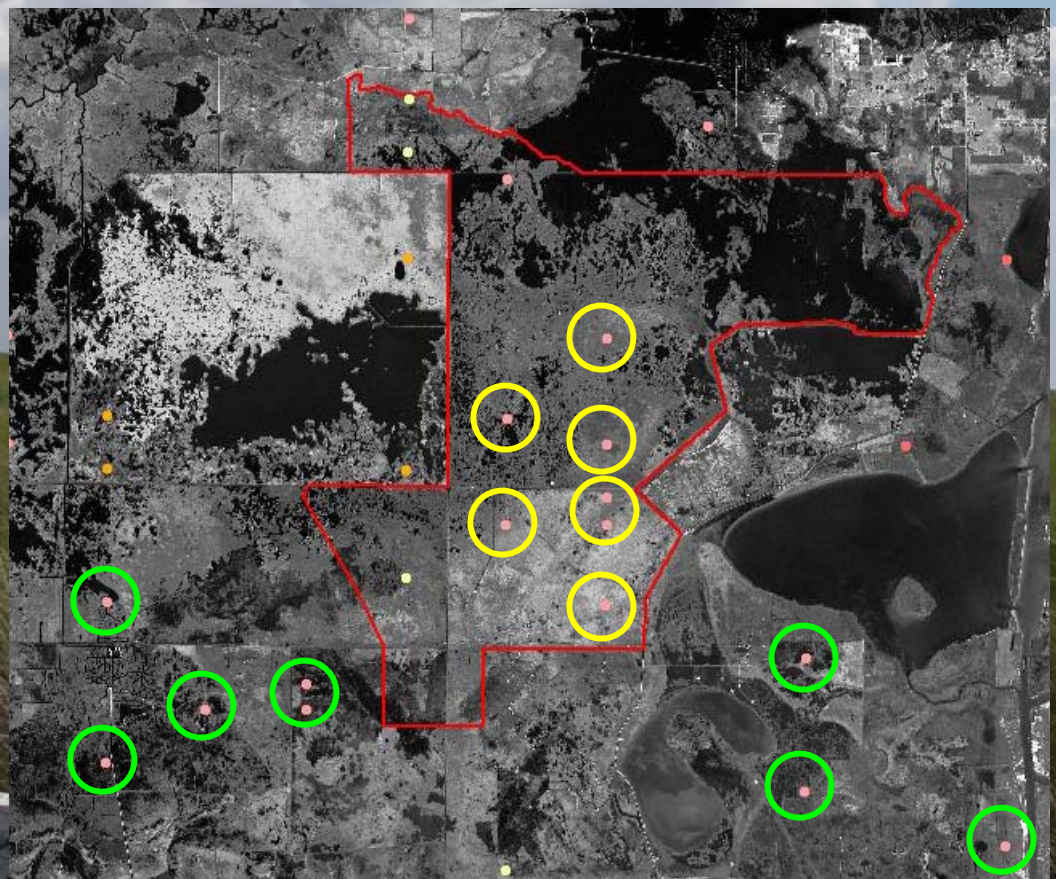
The image files are about 1,000 x 1,000 pixels each.



CRMS-*Wetlands* Data Analysis

CRMS-Wetlands will facilitate the investigation of:

- Project-scale effects



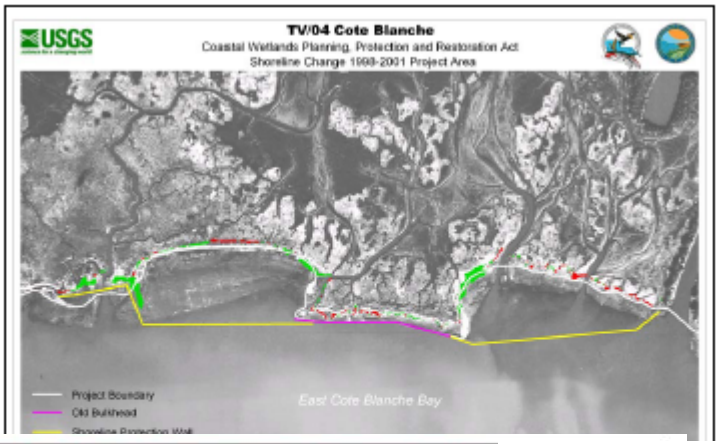
CRMS Stations
- DELTAIC MIXTURE
- DELTAIC ROSEAU CANE
- FRESH BULLTONGUE
- FRESH MAIDENCANE
- FRESH SPIKERUSH
- MESOHALINE MIXTURE
- MESOHALINE WIREGRASS
- OLIGOHALINE BULLTONGUE
- OLIGOHALINE MIXTURE
- OLIGOHALINE SPIKERUSH
- OLIGOHALINE WIREGRASS
- POLYHALINE OYSTERGRASS
- SWAMP
- CWPPRA Polygons

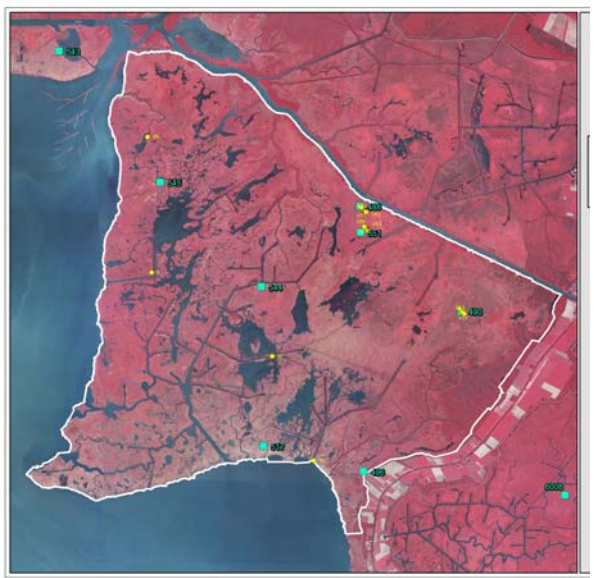
Project Oligohaline Wiregrass

Reference Oligohaline Wiregrass

CRMS-*Wetlands* Data Reporting

- Individual project effects





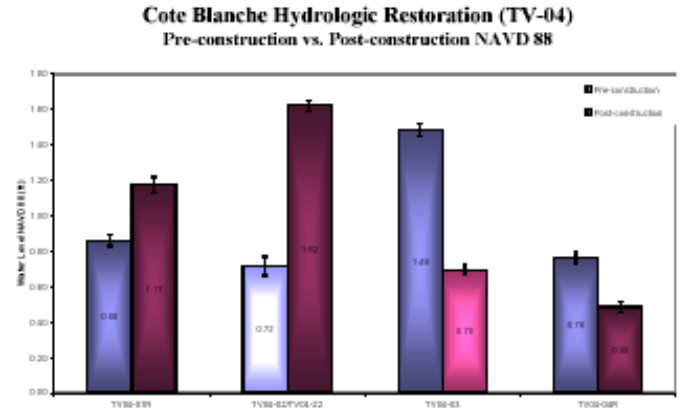


Figure 13. Mean daily water level at four YSI continuous recorder stations located in the Cote Blanche Hydrologic Restoration (TV-04) project area during pre-construction (6/19/97 – 6/30/98) and post-construction (1/1/03 – 12/31/03) periods.

* Water levels for post-construction at station TV04-22 and TV04-04R are not tied into a datum due to damage from Hurricane Lili in October of 2002.

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

2004 Operations, Maintenance, and Monitoring Report

for

Cote Blanche Hydrologic Restoration

State Project Number TV-04
Priority Project List 3

June, 2005
St. Mary Parish

Prepared by:

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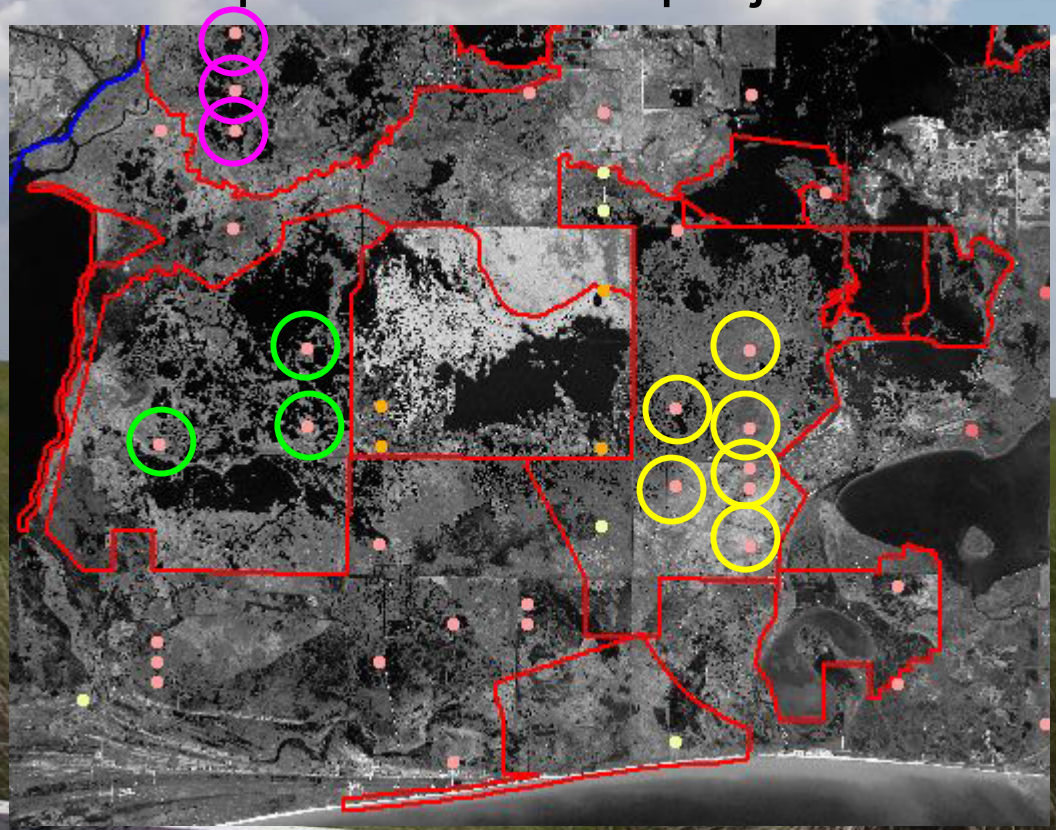
CRMS-*Wetlands* Data Analysis

CRMS-Wetlands will facilitate the investigation of:

- Comparison of one project vs another project



CRMS Stations
- DELTAIC MIXTURE
- DELTAIC ROSEAU CANE
- FRESH BULLTONGUE
- FRESH MAIDENCANE
- FRESH SPIKERUSH
- MESOHALINE MIXTURE
- MESOHALINE WIREGRASS
- OLIGOHALINE BULLTONGUE
- OLIGOHALINE MIXTURE
- OLIGOHALINE SPIKERUSH
- OLIGOHALINE WIREGRASS
- POLYHALINE OYSTERGRASS
- SWAMP
- CWPPRA Polygons

CS-23 Oligohaline Wiregrass

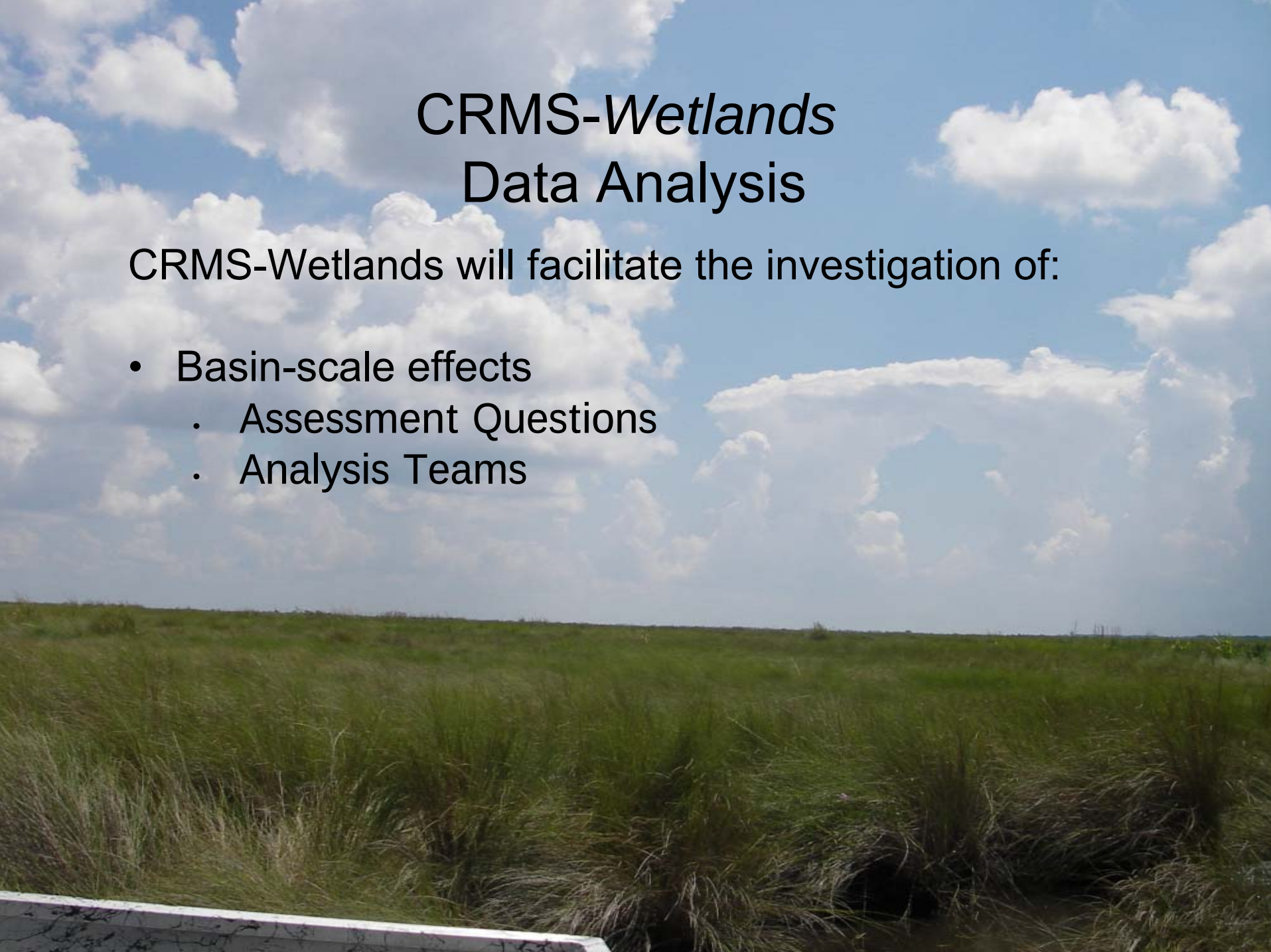
CS-32 Oligohaline Wiregrass

CS-27 Oligohaline Wiregrass

CRMS-*Wetlands* Data Analysis

CRMS-Wetlands will facilitate the investigation of:

- Basin-scale effects
  - Assessment Questions
  - Analysis Teams



CRMS-*Wetlands* Data Analysis

- Assessment Questions

Example Basin-scale Question:
Did the Breaux Act sustain a diversity of vegetation types in the hydrologic basins?

Explanation:
The habitat value of a wetland is not only dependent on the presence of emergent vegetation, but also on the diversity of habitats and how that diversity is maintained. For example, if all emergent vegetation was polyhaline oystergrass marsh, the quality of habitat would be reduced. Therefore, the program should maintain the salinity gradient typical for Louisiana coastal estuaries.

H_0:
The diversity of vegetation types in the hydrologic basin after the program is less than or equal to the diversity of vegetation types in the same hydrologic basin before the program.

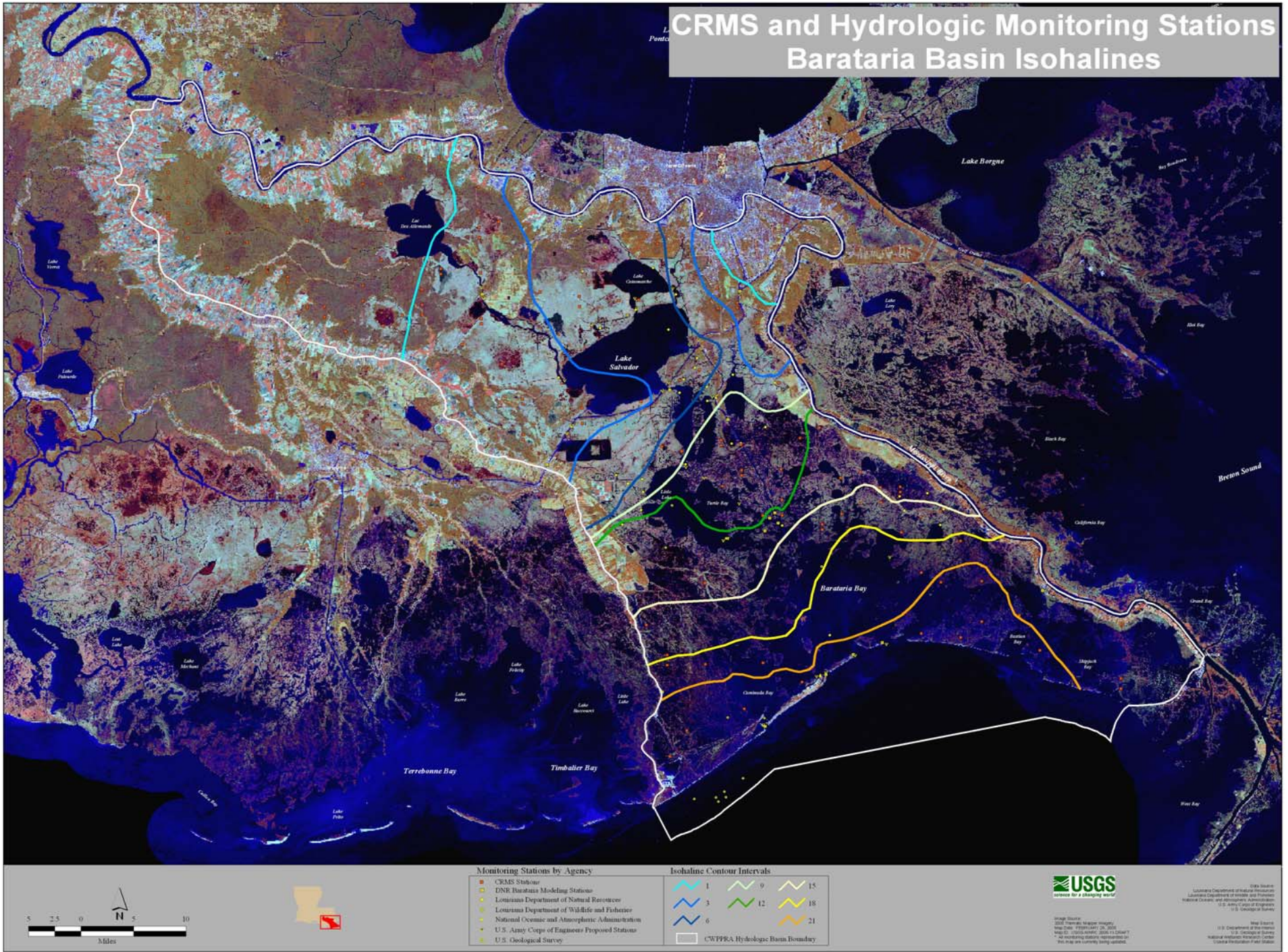
Sub-question:
What are the salinity and flooding thresholds that contribute to species and community changes?

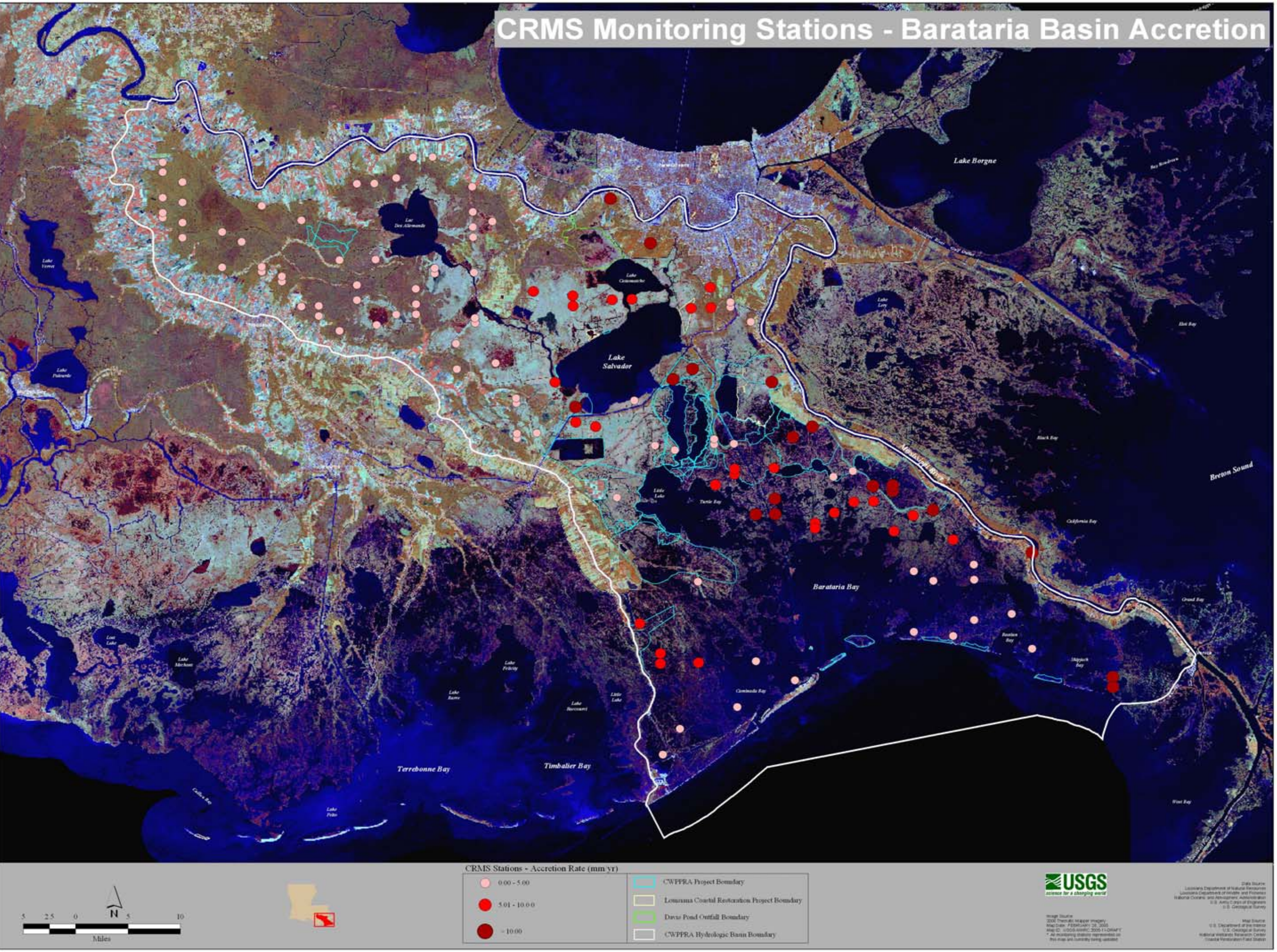
CRMS-*Wetlands*
Data Analysis Team Approach

- Component Teams
  - Landscape
  - Vegetation
  - Soils
  - Hydrology
- Coastwide Synthesis Team
  - Co-chaired by LDNR and USGS
  - Members include chairs of each Component Team
- Geospatial and Statistical Support to all teams

CRMS-*Wetlands*
Data Analysis Team Approach

- Component & Synthesis Teams:
  - Tasked with developing analytical framework and tools for synthesizing and reporting
  - Analytical framework designed for site, project, basin, & coastwide scales
  - Products intended to be responsive to the needs of CWPPRA restoration and management
- Approach
  - Develop a strawman analytical framework and product development for review and comment by CWPPRA agencies
  - Targeting September 2007


CRMS and Hydrologic Monitoring Stations
Barataria Basin Isohalines
Lake Borgne
Lake Salvador
Barataria Bay
Terrebonne Bay
Timbalier Bay
Breton Sound
Monitoring Stations by Agency
CRMS Stations
DNR Barataria Modeling Stations
Louisiana Department of Natural Resources
Louisiana Department of Wildlife and Fisheries
National Oceanic and Atmospheric Administration
U.S. Army Corps of Engineers Proposed Stations
U.S. Geological Survey
Isohaline Contour Intervals
1
3
6
9
12
15
18
21
CWPPRA Hydrologic Basin Boundary
N
5 2.5 0 5 10
Miles
USGS
science for a changing world


CRMS Monitoring Stations - Barataria Basin Accretion
Lake Borgne
Lac Des Allemands
Lake Cataouatche
Lake Salvador
Little Lake
Turtle Bay
Barataria Bay
Breton Sound
Terrebonne Bay
Timbalier Bay
CRMS Stations - Accretion Rate (mm/yr)
0.00 - 5.00
5.01 - 10.00
> 10.00
CWPPRA Project Boundary
Louisiana Coastal Restoration Project Boundary
Davis Pond Outfall Boundary
CWPPRA Hydrologic Basin Boundary
Miles
N
USGS
science for a changing world

CRMS-*Wetlands* Coastwide Reporting Approach

Suggestions

- Basin-level tools to be made available on-line, similar to “on-the-fly” graphics (single variable)
- Developing interpretive maps (overlays of multiple data layers)
- Coastwide synthesis (i.e., reports, workshops, MWG meetings)

CRMS-*Wetlands* Coastwide Reporting Approach

Discussion

- What are agency thoughts towards the suggested products and reporting approaches?
- What products and reporting approach will best serve the restoration and management community?

CRMS-*Wetlands*
Potential Data Applications & Integrations

- CWPPRA funding CRMS-*Wetlands* and LCA S&T funding Barrier Island Comprehensive Monitoring
- Link to EPA Rapid Assessments
- Refinement of LCA Desktop Models
- Establishment of Project-Specific and Basin-Level Performance Measures