Sediment Management for a Sustainable Ecosystem

Syed M. Khalil

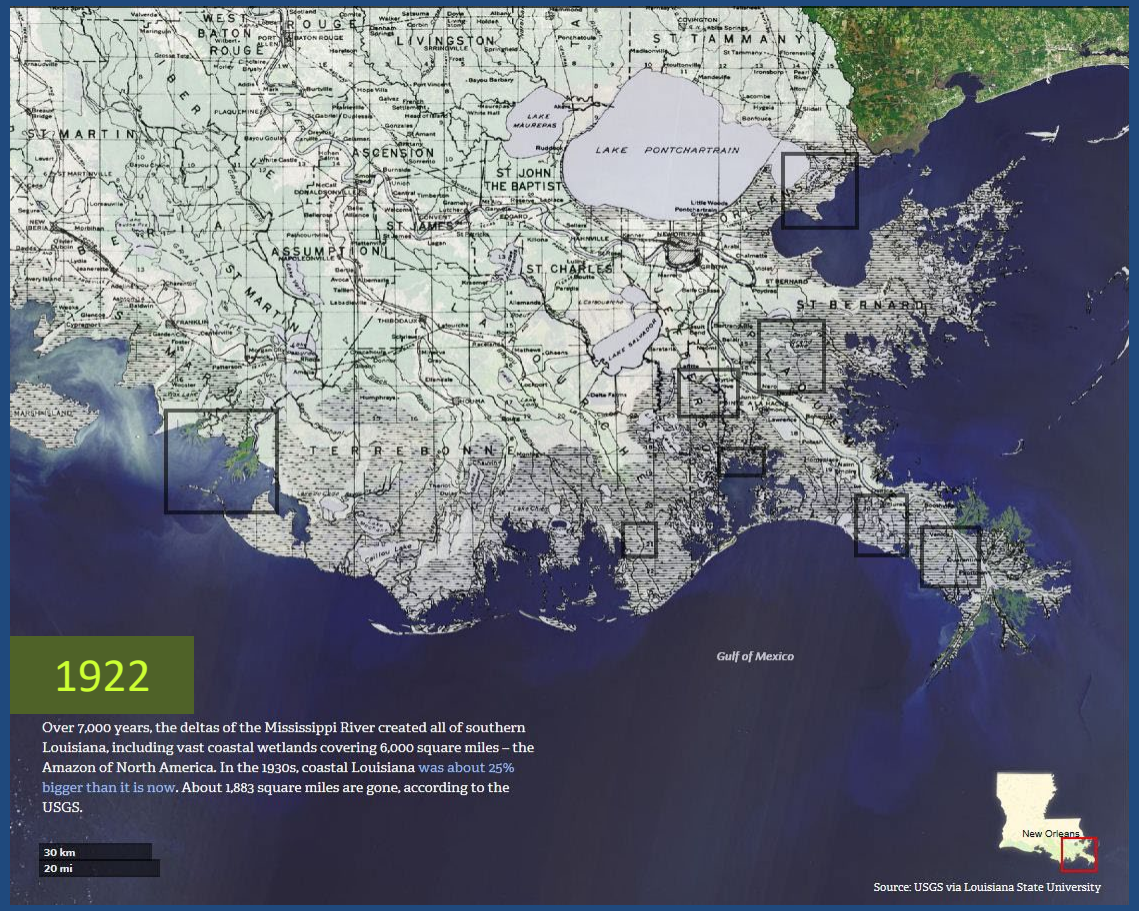
Coastal Day Webinar - March 20th 2024

Baton Rouge

CPRA
Coastal Protection and Restoration Authority of Louisiana

committed to **our coast**

Historical Land Loss (1932-2016) = 1853 mi^2(4800 km^2)



- ~ 6000 mi^2 of the Mississippi River Delta Plain (MRDP) was created in ~7000 yrs.
- In 1930's MRDP was about 25% bigger than now
- In less than 100 years about ~1853 mi^2 has been lost (USGS)

Couvillion et al. 2017

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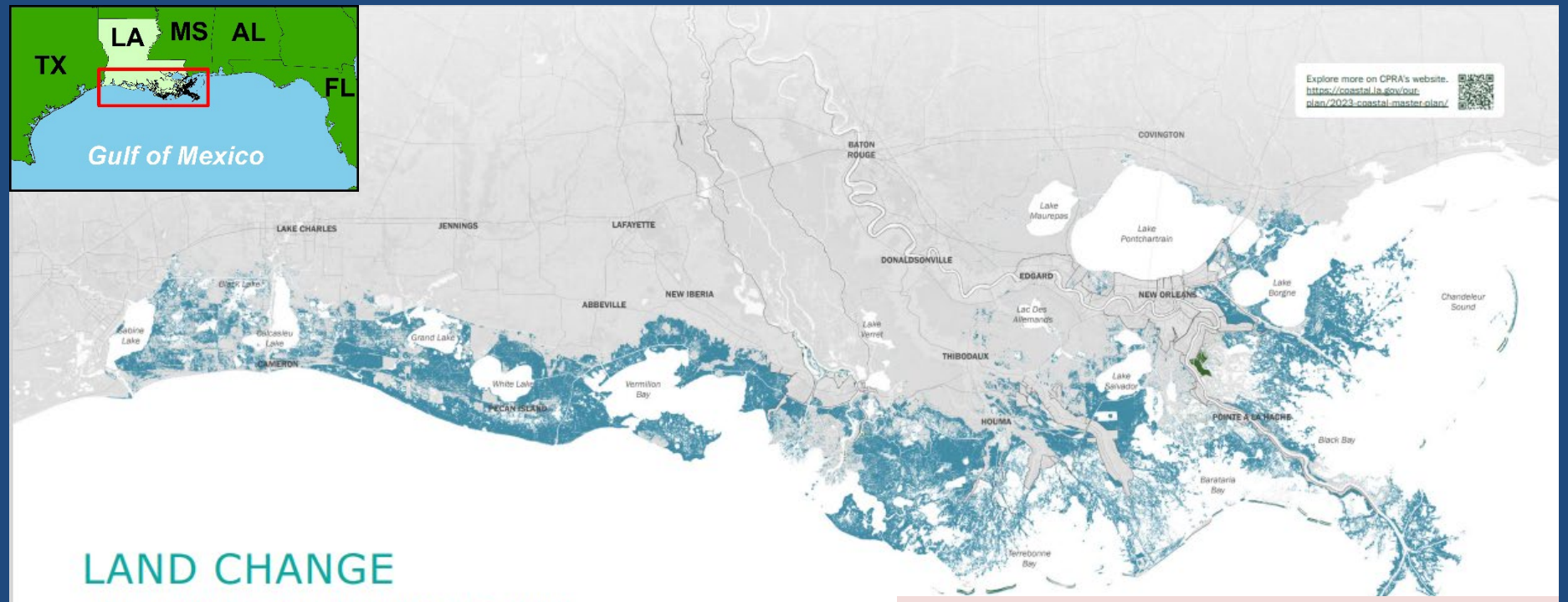
Projected Land Loss Map – Next 50 Years



LAND CHANGE

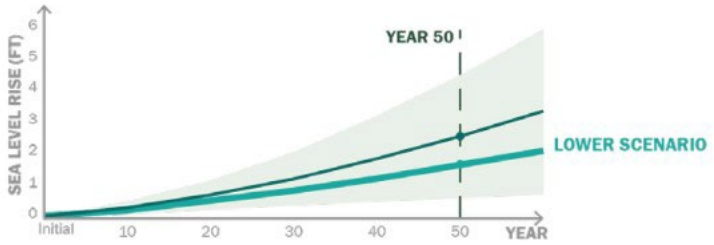
FUTURE WITHOUT ACTION | HIGHER SCENARIO | YEAR 50

Planning under uncertainty requires considering multiple possible future environmental scenarios to understand the range of possible outcomes that the master plan may need to address. Land change projections for the master plan's higher environmental scenario after 50 years are shown above. Under this possible environmental scenario, coastal Louisiana would experience severe climate change impacts, including sea level rise of up to 2.5 ft over the next 50 years. Without the projects selected for the 2023 Coastal Master Plan, the higher scenario ICM outputs predict extensive land loss of 3,000 square miles over that same time period, with every region of the coast affected.

It is important to note that the higher environmental scenario represents a harsher future condition when compared to the lower scenario.

Due to uncertainty around future climate conditions, both scenarios are used in the development of the 2023 Coastal Master Plan to represent a range of future landscapes and to select robust projects that can provide benefits for the coast for whatever future conditions transpire.

CMP 2023 (projection 2070)
Higher scenario *(~2.5 ft. RSLR)* = ~3000 mi^2
Lower scenario *(~1.5 ft. RSLR)* = ~1100 mi^2



Land Gained
Land Lost

Map 3.1: Land Change, Future Without Action, Lower Scenario, Year 50.

N
0 5 10 20
3 MILES

Sustainable Ecosystem Restoration

Building, maintenance, and dissolution of the coastal landscape is primarily a mass-balance between sediment input and accommodation space created due to various natural and anthropogenic causes.

Khalil et al 2018

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Sediment Need for Sedimentological Restoration

Land Loss = Sediment Loss

Sediment-Infusion = Sedimentological Restoration

- Long Term Sediment Need = ~5 –14 BCY *
- Sediment Need to build ~300 mi^2 of land (113 projects:2070) = ~0.9 -1 BCY*
- Near Term Sediment Need (current - next 5 years) = ~150 - 160 MCY
- Sand (13.5 MCY) & Mixed Sediment (46 MCY) Need in Next 2 years = 59.5 MCY

* 1st order estimates

Blum & Roberts 2009; Khalil et al, 2022; Khalil et al, 2018b: Morton et al, 2010

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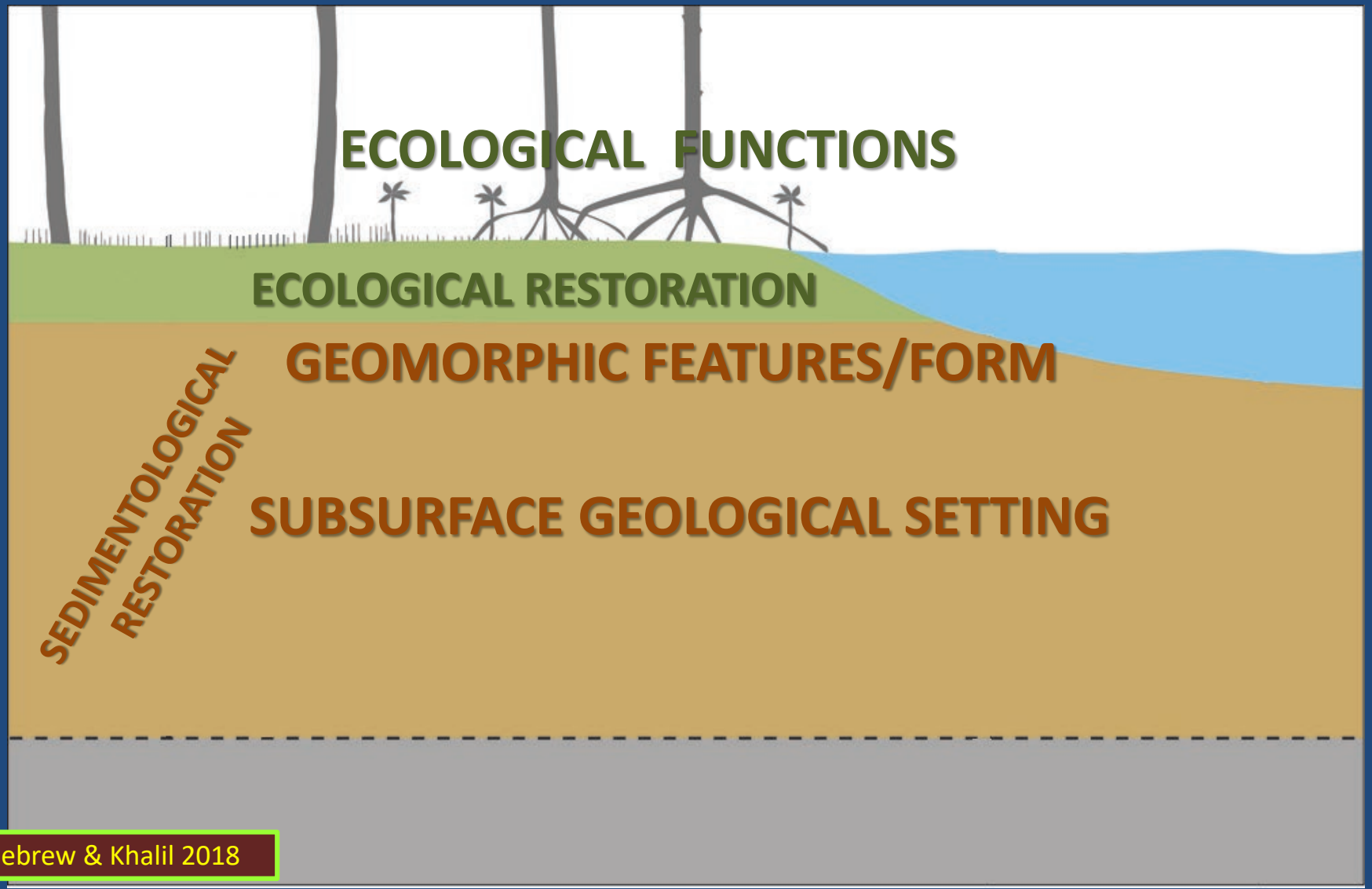
Subsurface Geology ⇨ Geomorphology ⇨ Ecology

ECO_GEOMORPHOLOGY ?



Khalil et al, 2018; Killebrew & Khalil 2018

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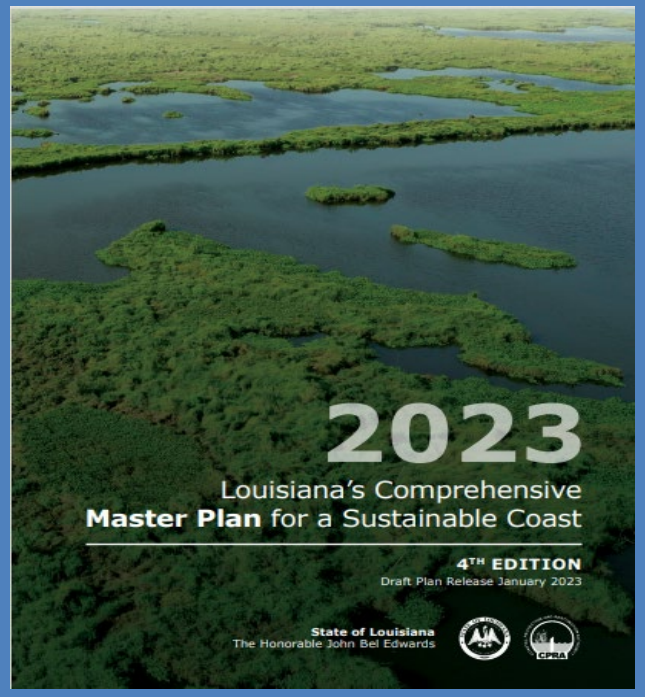
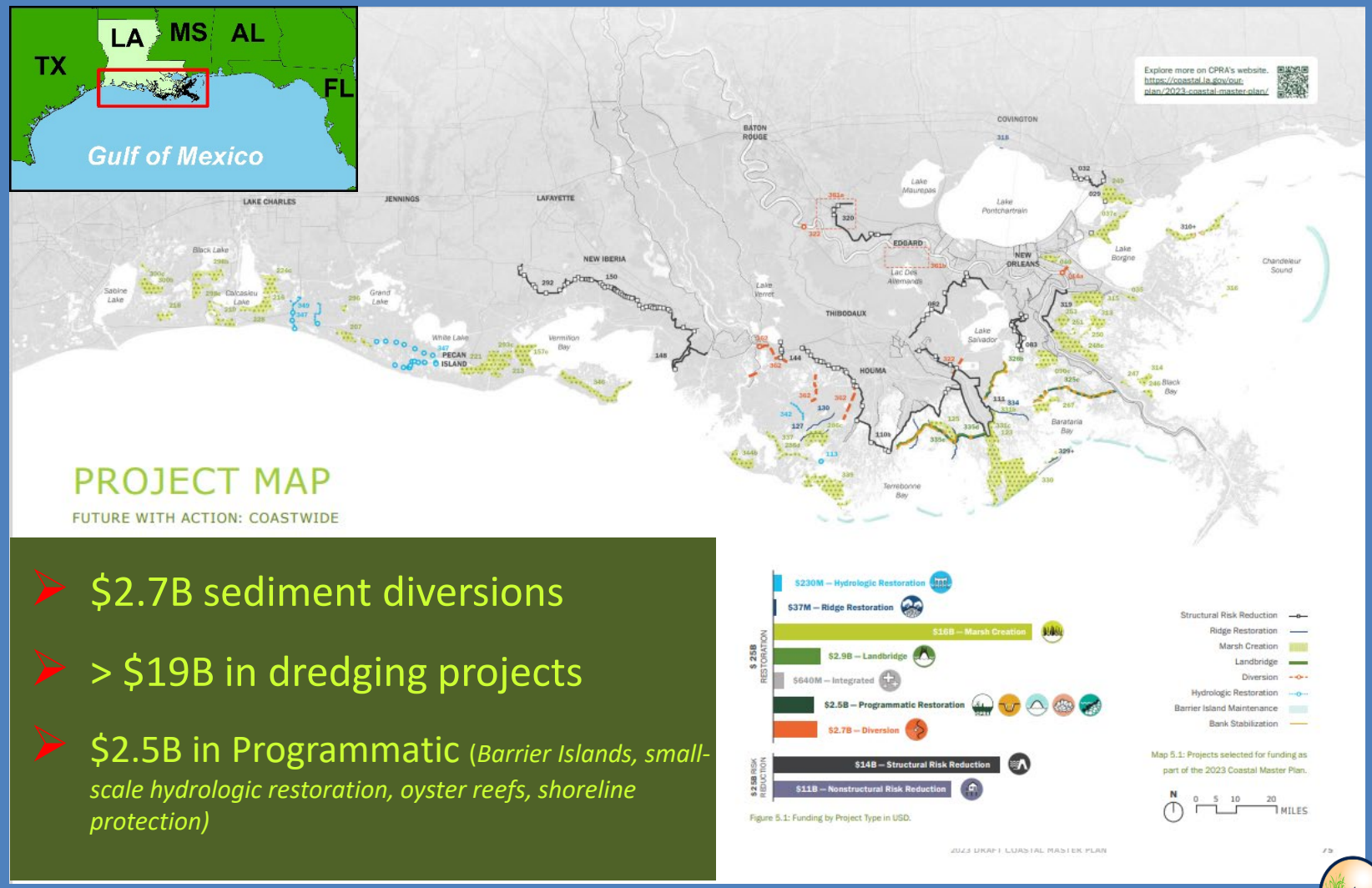
2023 Coastal Master Plan (CMP)



Decision Drivers For Project Selection

Land Loss Reduction

Storm Surge Risk Reduction

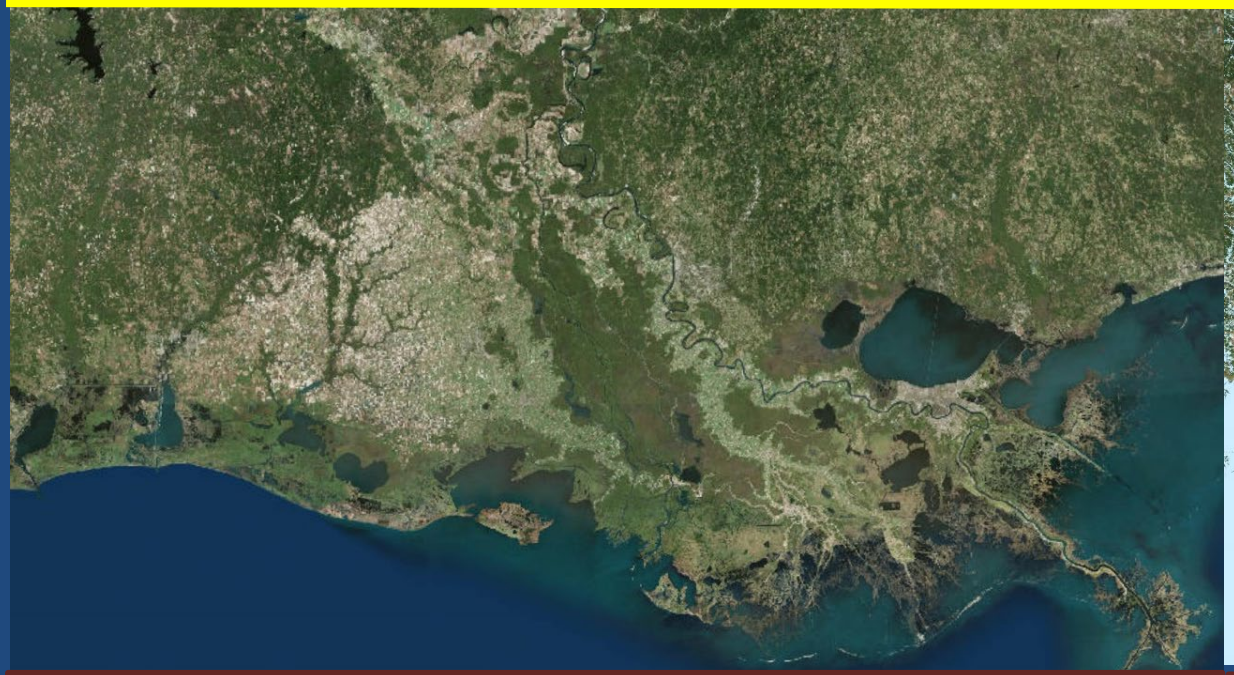


- $2.7B sediment diversions
- > $19B in dredging projects
- $2.5B in Programmatic (*Barrier Islands, small-scale hydrologic restoration, oyster reefs, shoreline protection)*

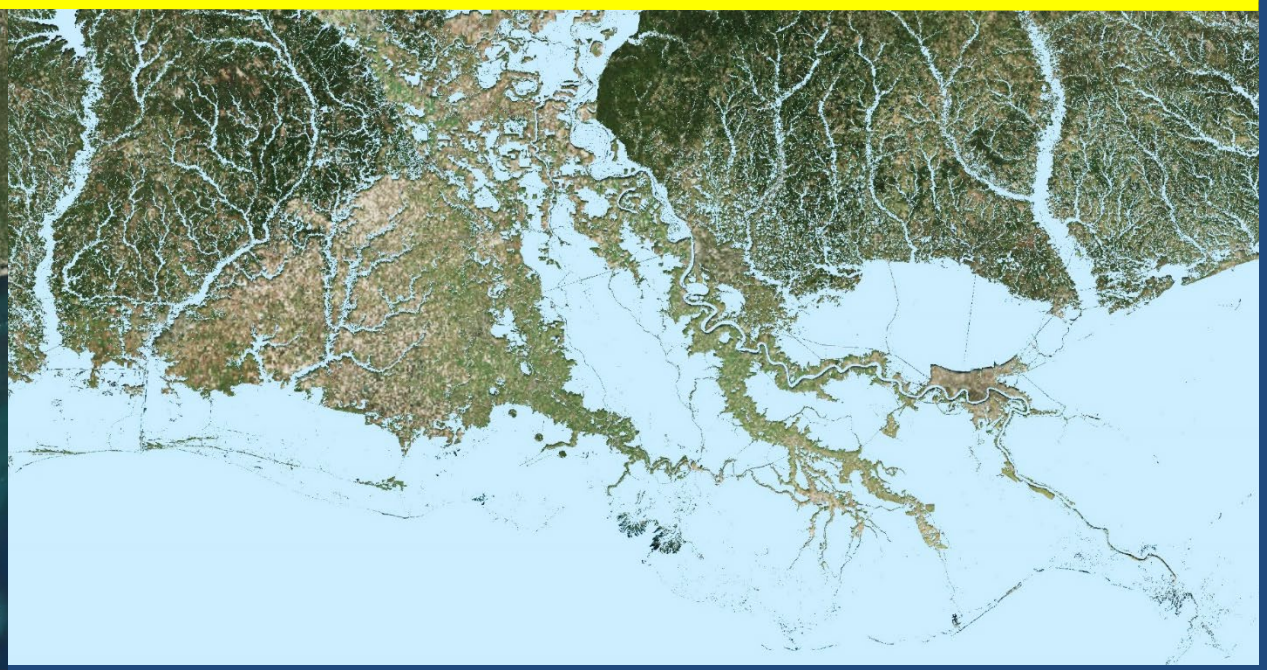
Figure 5.1: Funding by Project Type in USD.

CPRA 2023a

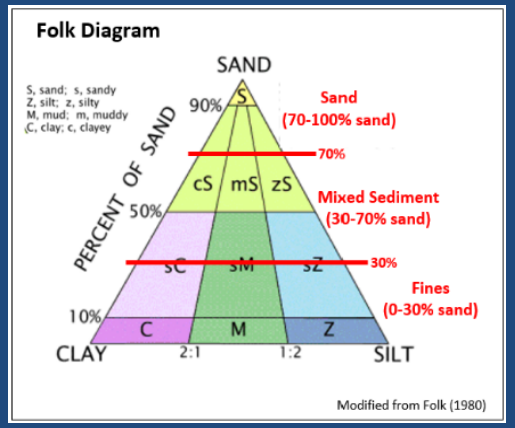
Sand and Mixed Sediment

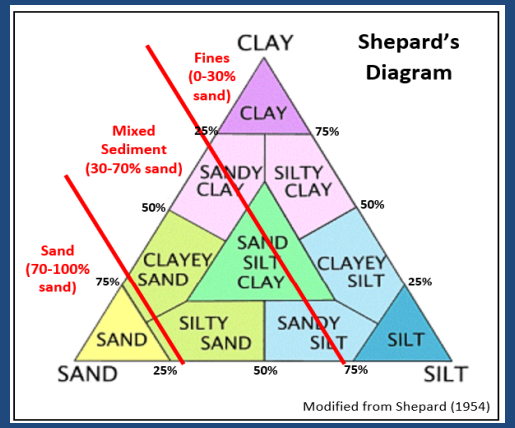


with wetland



without wetland





- Sand: for Beaches/Barrier Islands
- Mixed sediments: for Ridge/Marsh platform creation
- Land Loss cannot be mitigated by "sand" only
- Equal weightage be given to mixed sediment

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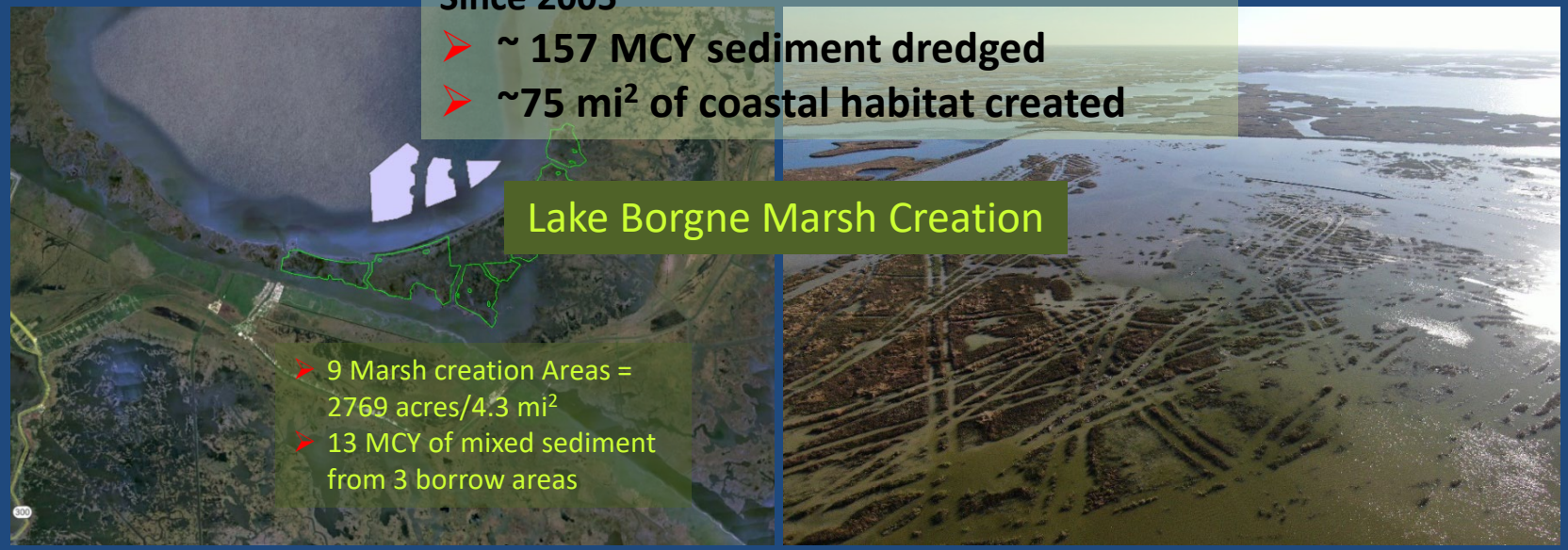
Marsh Platform/Ridge Creation & Barrier Island Restoration (*usage of mixed sediment*)

ECO_GEOMORPHOLOGY

Since 2005

- **~ 157 MCY sediment dredged**
- **~75 mi² of coastal habitat created**



Lake Borgne Marsh Creation

- 9 Marsh creation Areas = 2769 acres/4.3 mi²
- 13 MCY of mixed sediment from 3 borrow areas

ECO_GEOMORPHOLOGY

Spanish Pass - Barataria Basin Ridge/ Marsh Creation

- Ridge/marsh extending 7 mi westward from Venice, LA
- ~16 MCY of mixed sediment
- Total Budget > $100 Million

Caillou Lake Headlands /Barrier Island

- Beach / Dune (Sand) 782 acres
- Marsh (Mxd Sediment) - 169 acres
- Shoreline restored – 4.3 mi
- ~10.5 MCY of Sand from >10 mi

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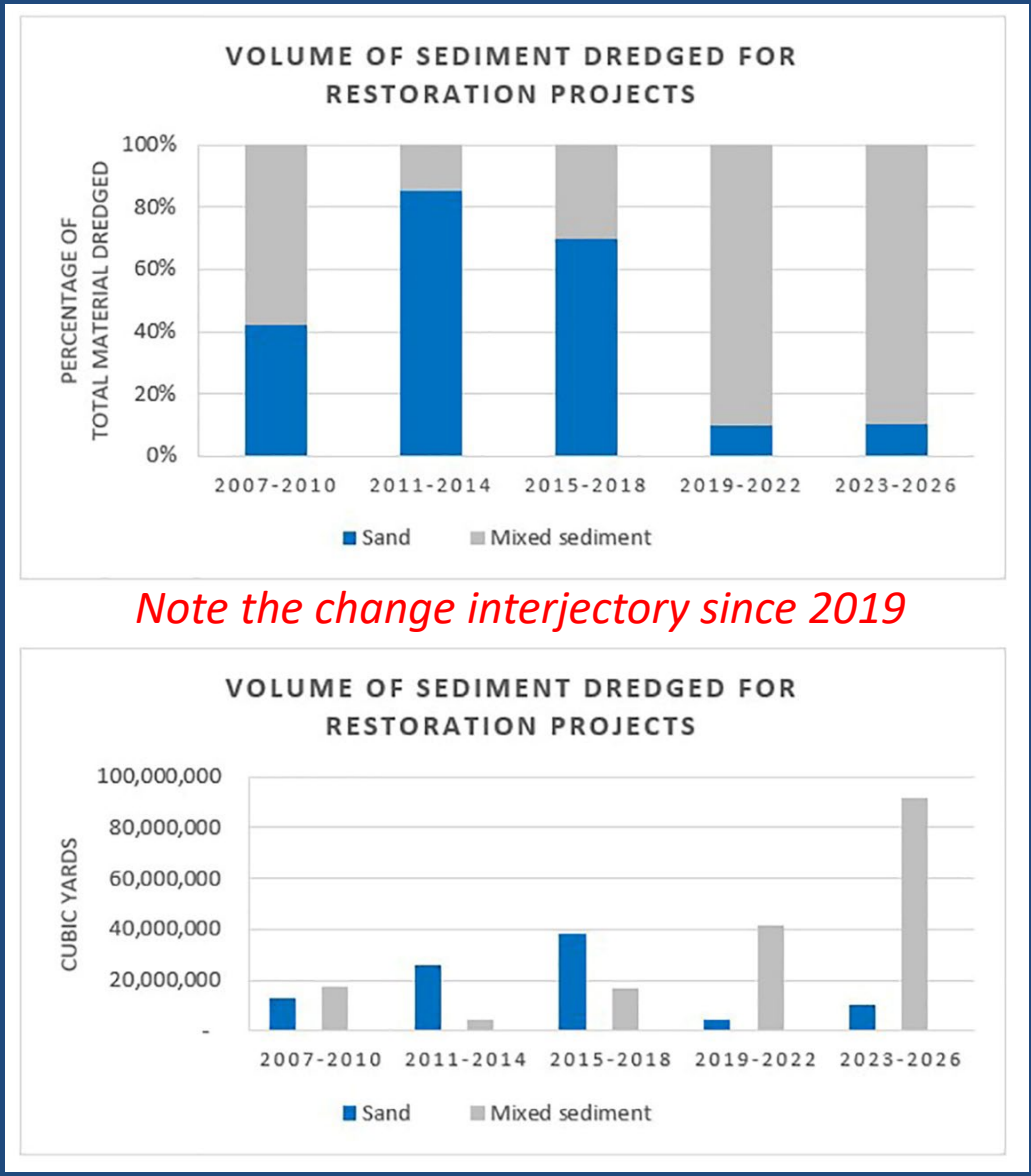
Sand *vs*. Mixed Sediment Dredged for Restoration *2007 – 2026*



Note the change interjectory since 2019

Khalil et al 2023

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Sediment & Sediment Management

Sediment Management

- broad all-encompassing and all-inclusive
- Helps delineate and conserve/preserve all sediment deposits
- Supports informed management decisions for an *efficient* restoration strategy

LA Sediment Management Plan (LASMP)

- conceptualize & developed on RSM-tenets for sustainability
- Holistic system based approach
- Tool for conflict resolution for *multiple uses of seabed and sediment resources*
- Unique to Louisiana but can be a template

Khalil et al, 2022, 2020, 2018 a & b,

SEDIMENT

OCS Waters, State Waters, Coastal Zone, Lower Mississippi & Atchafalaya Rivers

Borrow Area Considerations

Borrow Area Monitoring & Management (BAMM 1 &2)

Monitoring

- Slope Stability Issues
- Evolution through time
- Infilling rate
- Hypoxia

Management

- Optimal Utilization
- Location vs. project
- Location vs. pipeline

Adaptive Management & Programmatic Monitoring

- System Wide Assessment & Monitoring Program (SWAMP)
  - BICM (Barrier Island Comprehensive Monitoring) Program)
  - Geophysical surveys
  - Met-Oceanic Data – Offshore & Inshore wave & current
  - Subsidence – annual rate
  - Eustatic Sea Level Rise

Regional Sediment Management (RSM)

- Diversions (Passive Mgmt.)
- Sediment Resources (Active Mgmt.)
  - *Sediment Deposits*
  - *Sediment - Maintenance Dredging*
  - *Contained Disposal Facilities (CDFs)*

Sediment Evaluation

- Evaluation of potential areas
- Delineation of sand sources in OCS
- Offshore/State & Federal Waters
- Lower Miss River
- Atchafalaya River

Sediment Data Management Tools

- Protocol of exploration
  - Guidelines for sediment searches
- LASARD - LA Sand Resources Database
  - SOP for data acquisition
- SSD Maps - Surficial Sediment Distribution Maps
- LASAAP - LA Sed. Availability & Allocation Program
- OSB - Operational Sediment Budget
- PGM – Predictive Geologic Model

Policies / Regulations

- NEPA
- OSCLA
- Federal Standard
- NTL2009/Pipeline/O&G
- Cultural Resources
- Environment Issues
- Sea Level Rise Policy

Coordination with Stakeholders

Federal, State, Parish, Local, Industry, NGO

Miss River Management Study

- LMRMP - *Lowermost Miss River Mgmt. Program*
- LCA Miss River Delta Mgmt Study
- Atchafalaya Basin Sed Mgmt. Plan
- Others

LOUISIANA SEDIMENT MANAGEMENT PLAN (LASMP)

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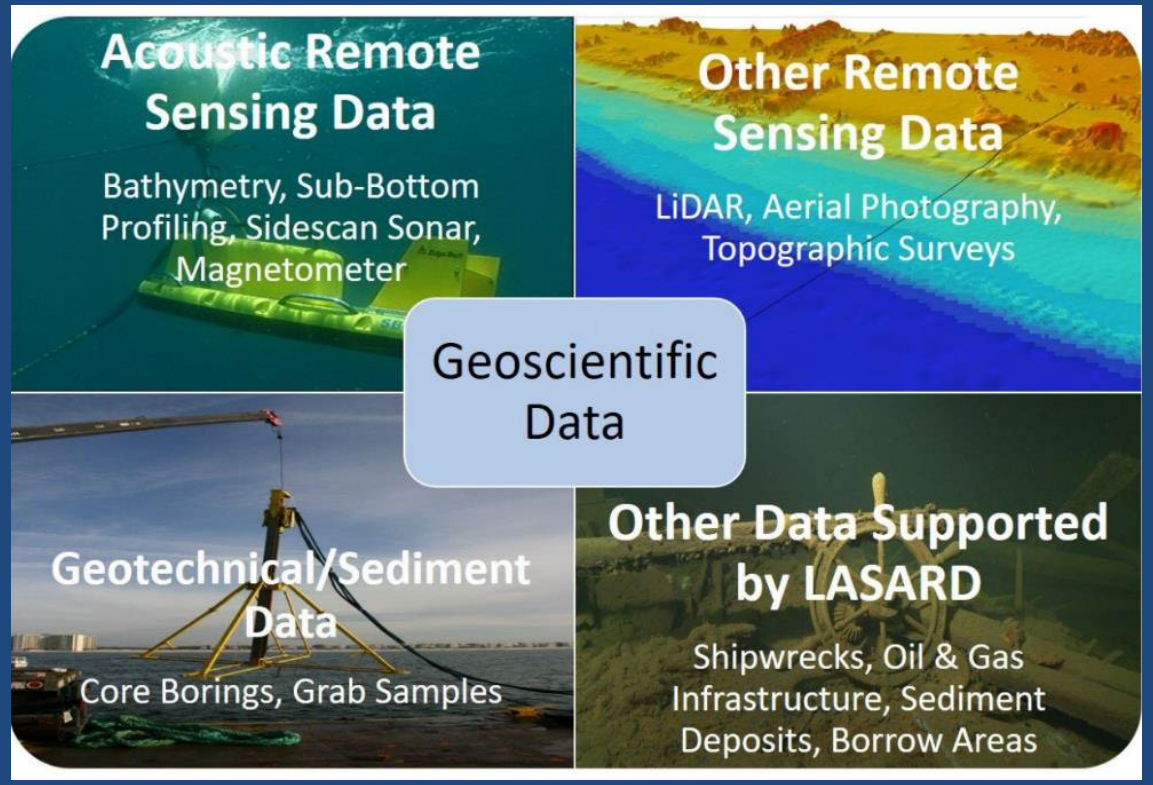
Louisiana Sand/Sediment Resources Database (LASARD)

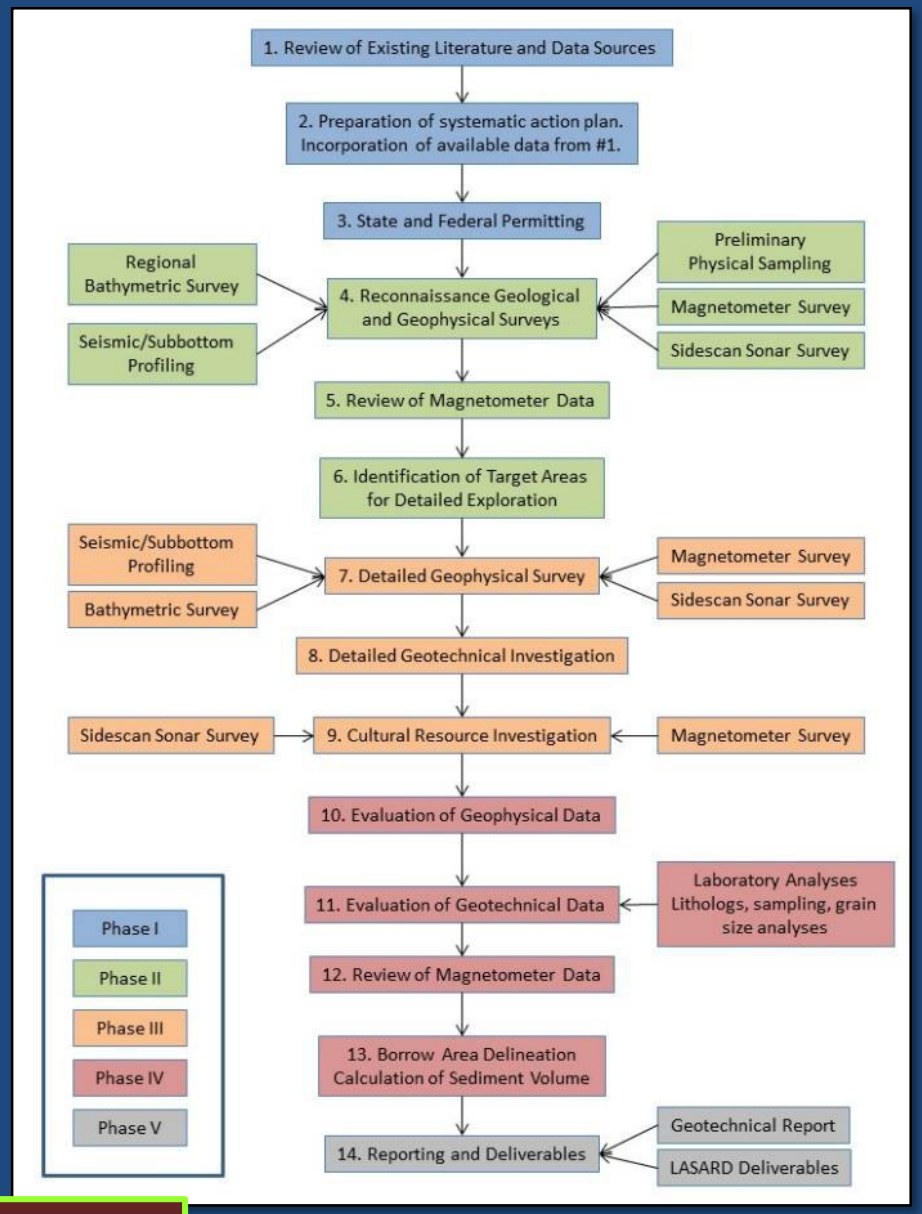


Initiated in 2003 to:

- **Manage** and **maintain** geological, geophysical, geotechnical and other related data pertaining to the exploration of sediment resources
- **Centralize** relevant data from various sources for better **project coordination** and to **facilitate future planning** for delineating and utilizing sediment resources
- Save time , money and any duplication
- **Archive** relevant data including:
  - *CPRA **historic** and **current** project data*
  - ***Legacy** data by other federal, state and local sources*
  - *Data collected through the state's **monitoring,** assessment and **adaptive management programs***
- These data can be easily **queried**

Forrest et al 2023

Protocol/General Guidance For Sediment Exploration



Khalil, 2019

General guidelines for sediment searches / Delta Sand Search Model (DSSM)

- *cost efficient, comprehensive, systematic*

- Initial reconnaissance-level geophysical surveys and geotechnical investigations to identify target areas
- Detailed studies and cultural resource investigations
- Flexible
  - *changes made in the field on basis of data review as it becomes available*
- Adapted to coastal marine morpho-sedimentary units *(in different-aged lobes of the Mississippi Delta that have fine-grained deposits interspersed by sandy deposits of paleo-distributaries and inter-distributaries.)*

http://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=1034)

LASARD - Data Formatting Standards

http://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=12362

Coastal Protection and Restoration Authority

Home Data Library Viewer Outreach Protection Help

CIMS Document Detail

Document Name: **Louisiana Sand Resources Database (LASARD) Standard Operating Procedures for Geo-scientific Dat**

File(s): To preview individual file click 'Preview' link or to download individual file click 'Download' link.

_Readme_LASARD_SOP_01_09_2024.pdf Preview Download [58.6 KB]

Standard_Operating_Procedures_Main_Report_V5_18 Jan 2024.pdf Preview Download [1.8 MB]

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Date: **10-05-2022**

Document Type: **GENERAL PROGRAMMATIC DOCUMENT**

Author(s): **Khalil, Syed M.**
Haywood, Edward L. III.
Wager, Rocky
Forrest, Beth M.

Project(s): **LA-0161**

Hydrographic Basin(s): **ATCHAFALAYA**
BARATARIA
BRETON SOUND
CALCASIEU/SABINE
MERMENTAU
MISSISSIPPI RIVER DELTA
PONTCHARTRAIN
TERREBONNE
TECHE/VERMILION
COASTWIDE
PEARL RIVER

Project Type(s): **OTHER**

Pages:

https://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=12362

Standard Operating Procedures for Geo-scientific Data Management: Louisiana Sand Resources Database (LASARD)

Version 5

Syed Khalil[1], Ed Haywood[1], Rocky Wager[1], and Beth Forrest[2]
[1] *CPRA*, [2] *APTIM*

Coastal Protection and Restoration Authority of Louisiana

October 5, 2022

Louisiana Sand Resources Database (LASARD)

Data Formatting Steps for ArcGIS Pro

Sediment Samples

Coastal Protection and Restoration Authority of Louisiana

Suggested Citation:
Coastal Protection and Restoration Authority (CPRA), 2022. *Louisiana Sand Resources Database (LASARD): Data Formatting Steps for ArcGIS Pro Sediment Samples*. Coastal Protection and Restoration Authority of Louisiana (CPRA), Baton Rouge, LA, 15p.

October 6, 2022

Khalil et al., 2022

LASARD - Electronic Data Delivery Guidelines (EDD)

- In order to help consultants with simplified data deliverables these EDDs contain *detailed instructions*, *attribute specifications*, *shape file & metadata templates*, *file naming conventions*, and *data package structures*.
- All data deliverables submitted to CPRA are **required to follow these protocols**

Electronic Data Delivery (EDD) Guidelines

Sediment Samples / Grain Size Data Requirements

This document contains instructions for data delivery of **sediment samples/grain size data**. This document outlines the folder structure, file contents, and file naming requirements for the data deliverables.

A data deliverable must contain:

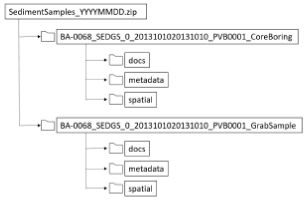
1. a GIS point layer, in Esri shapefile format describing the sampling locations with associated attribution,
2. metadata documents in *.html and *.xml format, and
3. supporting documents such as boring logs, grain size distribution reports and/or curves, geotechnical reports in pdf format.

All delivered spatial data must be provided in the Horizontal Coordinate System: UTM NAD83 Zone 15N (meters) and the Vertical Datum: NAVD88 (feet). Delivered files will be compressed into a single *.zip file named SedimentSamples_YYYYMMDD_ContractorName.zip, where 'YYYYMMDD' is the date the data package was delivered to CPRA, and whose structure, and contents are defined below.

Data deliverables for sediment samples / grain size data must include:

1) Zipped processed data package folder structure and contents:
Example:

Figure 1: Zipped data package deliverable folder structure and contents example



a. **"docs"** folder: Includes final project report and, if applicable, a shortened pdf of each individual core boring and its associated data (e.g., core log, core photos, sediment analyses). Record the name of the core log pdf in the CORLOG_URL field of the shapefile in the row of the feature(s) associated with the file. Record the name of the Project Report pdf in the REPORT_URL field:
   i. .pdf file of the individual CORE LOG
      1. Example Core Log file:https://cims.coastal.louisiana.gov/meta_docs/gis_refs/sediment_samples/BF0093/GLVC-10-01.pdf

   ii. .pdf file of the Project Report
      1. Example Project Report: https://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=12192#

b. **"metadata"** folder: Metadata - FGDC compliant metadata in XML and HTML format and named using the File Naming Convention.
   i. The contractor must ensure the "Data_Quality_Information > Lineage > Process_Step" sections of the metadata record covers the details of any data processing along with pertinent geodetic associated information (including but not limited to Horizontal Coordinate System, Vertical Datum, Geoid, Ellipsoid, Epoch, Vertical Benchmark, etc.). Metadata should clearly address the data collection process and clearly describe the units for any collected or sampled parameters. The contractor must ensure the provided metadata addresses data (e.g., to reports, logs or images) to which each sediment sample/grain size sample will "link."

c. **"spatial"** folder: Vector locations as a GIS point layer using the Esri shapefile format following the CPRA shapefile template for core borings/grab samples data using the geometry and attribution information below and, named using the CIMS File Naming Convention.
   i. Attribute Specifications, Tables: Core Borings and Grab Samples *(also provided in tables below)*
   ii. GIS Shapefile Templates: CoreBoringShapefileTemplate.shp and GrabSampleShapefileTemplate.shp

List of required attributes for each POINT included in a data deliverable.
(From – Attribute Specifications, Tables: Core Borings and Grab Samples)
*NOTE: The following special characters are NOT allowed within any elements: #, <, >, $, +, %, !, `, &, *, ', |, {, }, ?, ", =, /, :, \, ;, @, blank spaces or commas.*

Table 1: Core Boring Attributes

Field Name	*Alias*	*Description*	*Specific GIS Data Type*	*Unknown Data Values*
BOR_METHOD	Core Boring Method	Method used to collect the core boring. (see core boring methods table below)	Text (50)	UNKNOWN
PROGRAM	Program	Funding Program (CWPPRA, LCA, STATE, ...).	Text (20)	UNKNOWN
PROJECT	Project	Project name or title.	Text (200)	UNKNOWN
PROJ_ID	Project ID	Project number (state id, federal id, ...).	Text (20)	UNKNOWN
DATE_COLL	Date Collected	Date collected (YYYYMMDD).	Text (10)	99999999
CORE_ID	Core ID	Core identifier (i.e. GLVC-10-01, CB-01, etc...)	Text (50)	UNKNOWN
PENETRATE	Penetration Depth (ft)	Depth of penetration relative to seafloor/mudline (measured in feet).	Double (10,2)	-9999
CORELENGTH	Core Length (ft)	Total length of core recovered (measured in feet).	Double (10,2)	-9999
RECOVERY	Core Length Recovered (%)	Recovered length of core vs. penetration (measured with percentage).	Double (3,0)	-9999
X	X Coordinate (m)	Easting (X coordinate) value in meters (UTM).	Double (10,2)	-9999
Y	Y Coordinate (m)	Northing (Y coordinate) value in meters (UTM).	Double (10,2)	-9999
Z_FT	Elevation (ft)	Top of core (mudline) elevation (feet, NAVD 88).	Double (10,2)	-9999

T_FINES	Fines Thickness (ft)	Thickness in feet of surficial deposit consisting predominantly (70-100%) of FINES (material passing the #200 sieve) with <30% SAND.	Double (8,2)	-9999
T_MIX	Mixed Sediment Thickness (ft)	Thickness in feet of uppermost mixed sediment deposit containing a mixture of 30-70% sand with the remaining fraction comprised of FINES (material passing the #200 sieve).	Double (8,2)	-9999
T_SAND	Sand Thickness (ft)	Thickness of uppermost sandy deposit containing 30% or less fines (material passing the #200 sieve). Generalized deposit thickness may include minor amounts of mixed sediment or clay.	Double (8,2)	-9999
CONTRACTOR	Contractor	Name of contractor that collected the data.	Text (100)	UNKNOWN
ORG	Organization	Organization that ordered the work.	Text (100)	UNKNOWN
REPORT_URL	Report	Name of report (pdf) Example: **BA-0068 Geotechnical Report.pdf**	Text (200)	UNKNOWN
CORLOG_URL	Log File	Name of Log file (pdf) Example: **B-1.pdf**	Text (200)	UNKNOWN
Meta_xml	XML Metadata File	The CPRA File Naming Convention-compliant file name of the xml metadata file located in the metadata folder. Example: **BA-0068_SEDGS_0_20131010201310l0_PVB0002_CoreBoring.xml**	Text (200)	UNKNOWN
Meta_html	HTML Metadata File	The CPRA File Naming Convention-compliant file name of the html metadata file located in the metadata folder. Example: **BA-0068_SEDGS_0_20131010201310l0_PVB0002_CoreBoring.html**	Text (200)	UNKNOWN
DATA_ID	Dataset ID	Dataset ID used to track deliverables. Use element 5 of the File Naming Convention for Data ID. Example: **PVB0002**	Text (10)	UNKNOWN
COMMENTS	Comments	Special comments pertaining to a specific GIS record.	Text (250)	<NULL>

Table 2: Core Boring Methods

Core Boring Methods *(Examples)*
Air Rotary
Cone Penetrometer (CPT)
Standard Penetrometer (SPT)
Wet Rotary
Push Core
Gravity Core
Piston Core
Vibracore

LASARD - Geospatial Standards

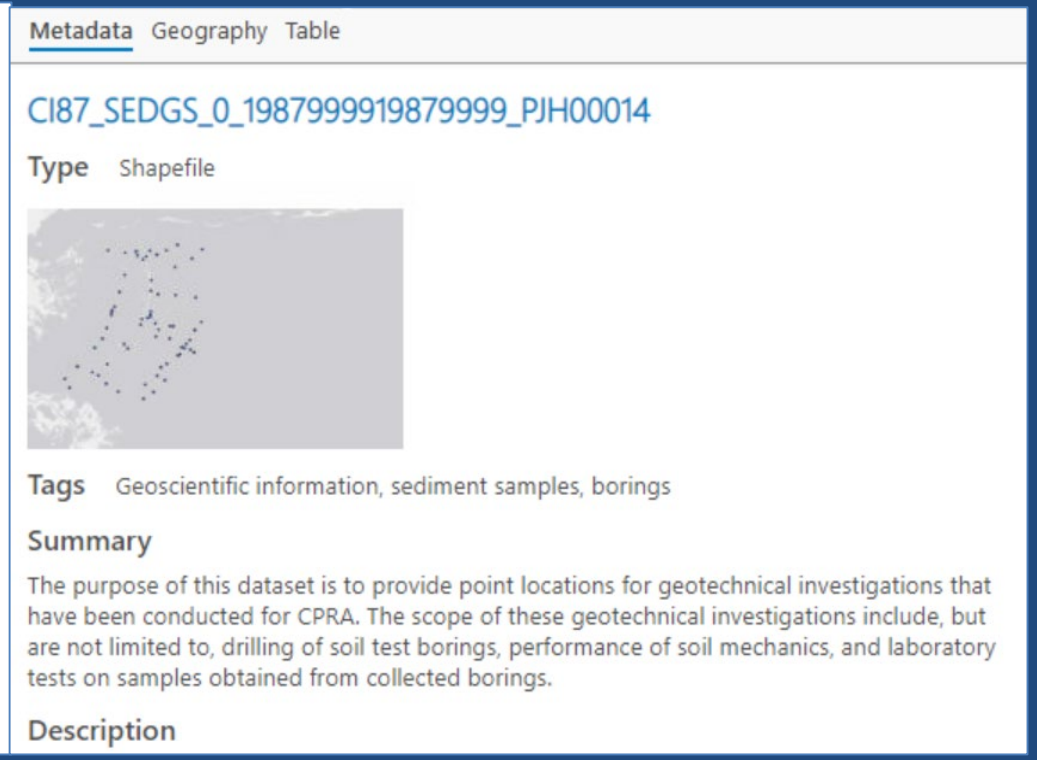
Vector Data
All vector data should be provided in Esri shapefile format.

Raster Data
All raster data should be provided in GeoTIFF or ERDAS Imagine (.img) format. Data may also be provided as a compressed FGDB or ArcGIS raster (mosaic, catalog, dataset). If provided as a raster, compression must be lossless.

Tabular Data (Includes BathyTopo XYZ data)
All xyz survey data should be provided in csv format along with the raw satellite navigation system data files (e.g., RINEX, etc.).

Map Documents
Map documents should be provided in either MXD (ArcMap) or APRX (ArcPro) format. All data should be packaged and provided with the MXD. Data within the MXD (shapefiles, rasters, tables, etc.) should be linked to the correct source file.

Map Elements
All map documents must include the following elements: title, legend, map date, citation for background imagery, scale bar, scale text (absolute scale) and north arrow. Map documents should also include a logo and an inset map that shows location.

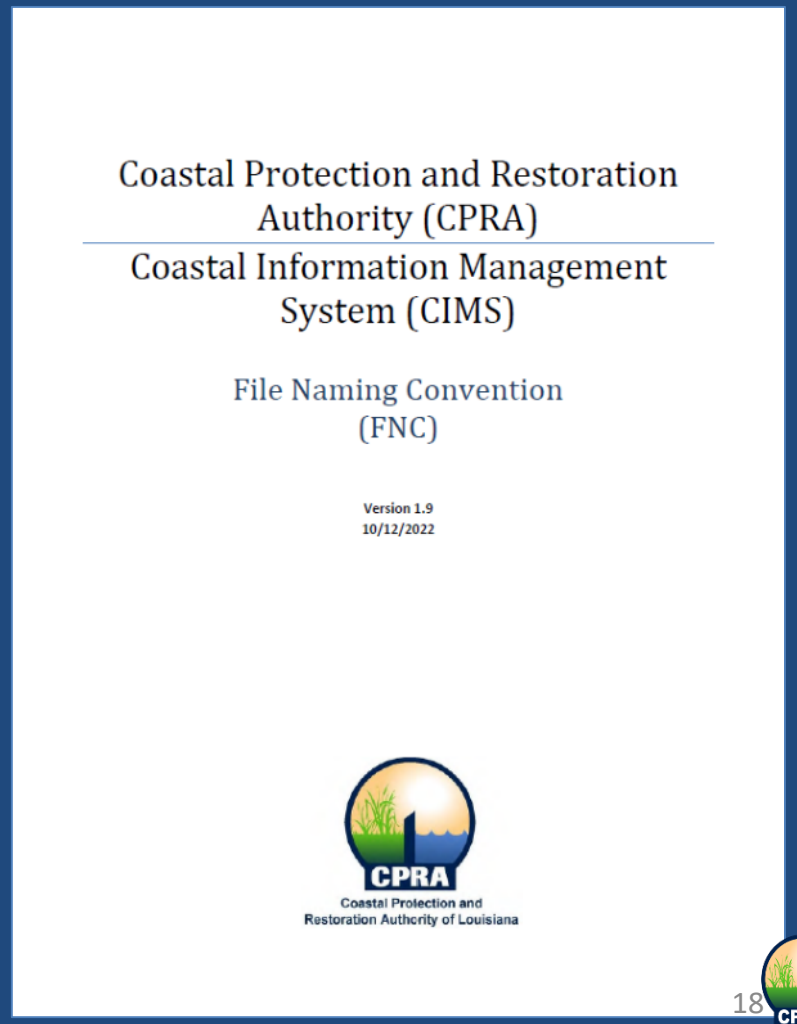


- Vector data must be provided in Esri shapefile format
- Raster data should be provided in GeoTIFF or ERDAS Imagine format
- The horizontal projection must be NAD 83 UTM Zone 15N meters GRS 1980.
- The vertical datum must be NAVD 88.
- All data submittals must include FGDC compliant metadata in both XML and HTML format

LASARD - File Naming Convention

Element	Description	Example
1	Identifies the specific project for which the data collection was completed.	LA-0026
2	Identifies the type of data being delivered within the file.	ELMBB
3	This element is for internal use only. This element is "0" for all deliverables. CPRA Identifies the location of the data based on a defined data delivery grid.	0
4	Identifies the data collection date. or range of the data.	2022101020221011
5	Provides a sequence element to distinguish data packages that might otherwise have the same name. The first character in this sequence indicates whether the data is processed, raw or an analysis product. The remaining sequence is typically the ID of the dataset.	PBF3002
6	This is an optional element that may be used to capture any additional information that may be useful to help identify the data.	Chandeleur

All LASARD deliverables submitted to CPRA must meet this naming convention.



LASARD - Quality Assurance/Quality Control

- Several phases of QA/QC
- QA/QC during
  - Planning
  - Design
  - Development
  - Production
- Overseen by licensed Professional Geologist and/or Professional Surveyor and Mapper
- All data is expected to be QC'ed before LASARD formatting and submittal of deliverables to CPRA

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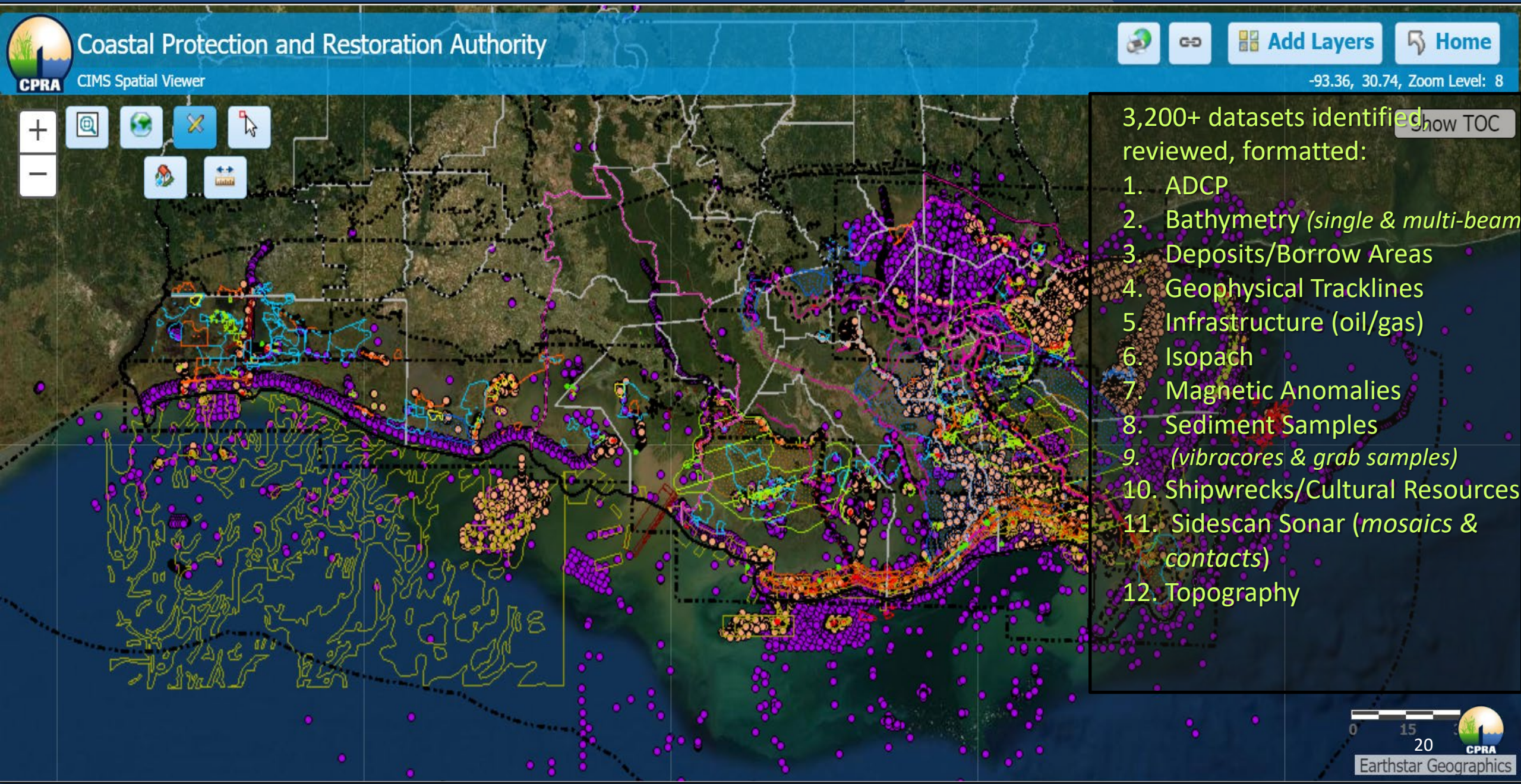
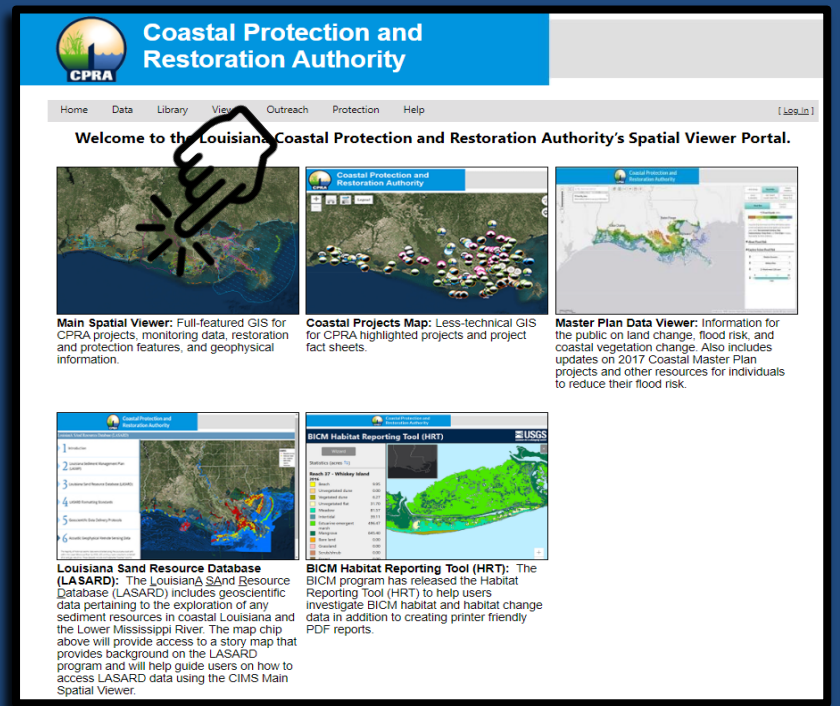
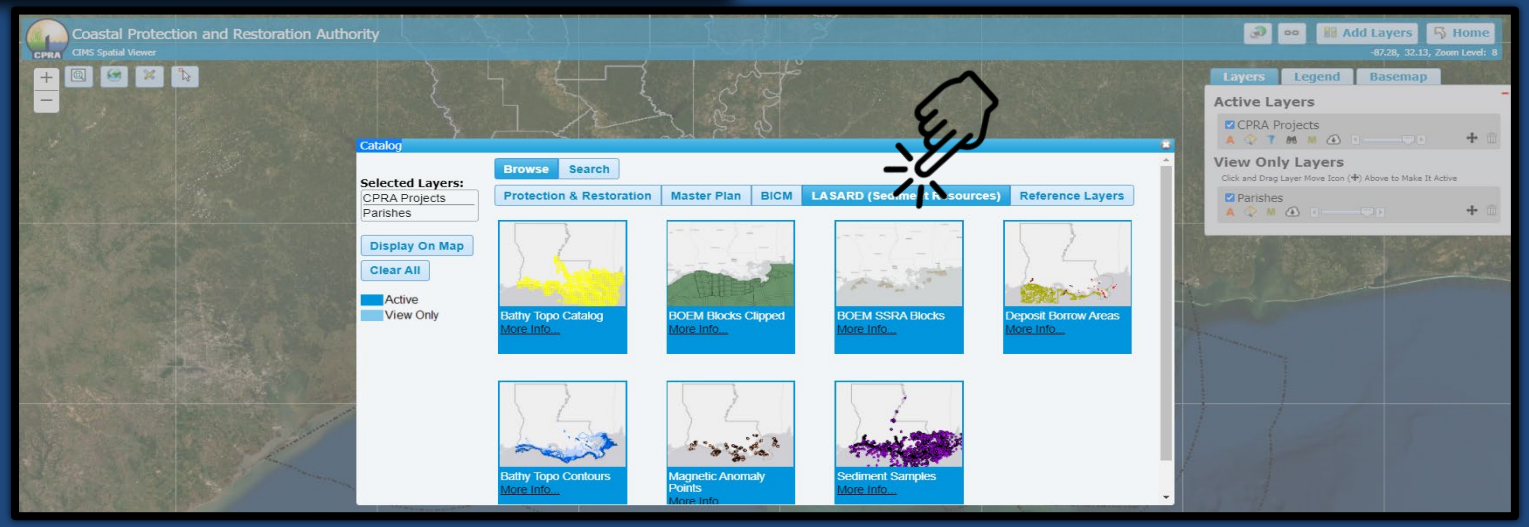

Coastal Protection and Restoration Authority
CIMS Spatial Viewer
Add Layers
Home
-93.36, 30.74, Zoom Level: 8
Show TOC
3,200+ datasets identified, reviewed, formatted:
1. ADCP
2. Bathymetry (single & multi-beam
3. Deposits/Borrow Areas
4. Geophysical Tracklines
5. Infrastructure (oil/gas)
6. Isopach
7. Magnetic Anomalies
8. Sediment Samples
9. (vibracores & grab samples)
10. Shipwrecks/Cultural Resources
11. Sidescan Sonar (mosaics & contacts)
12. Topography
0
15
CPRA
Earthstar Geographics

Coastal Information Management System (CIMS) & LASARD

cims.coastal.louisiana.gov





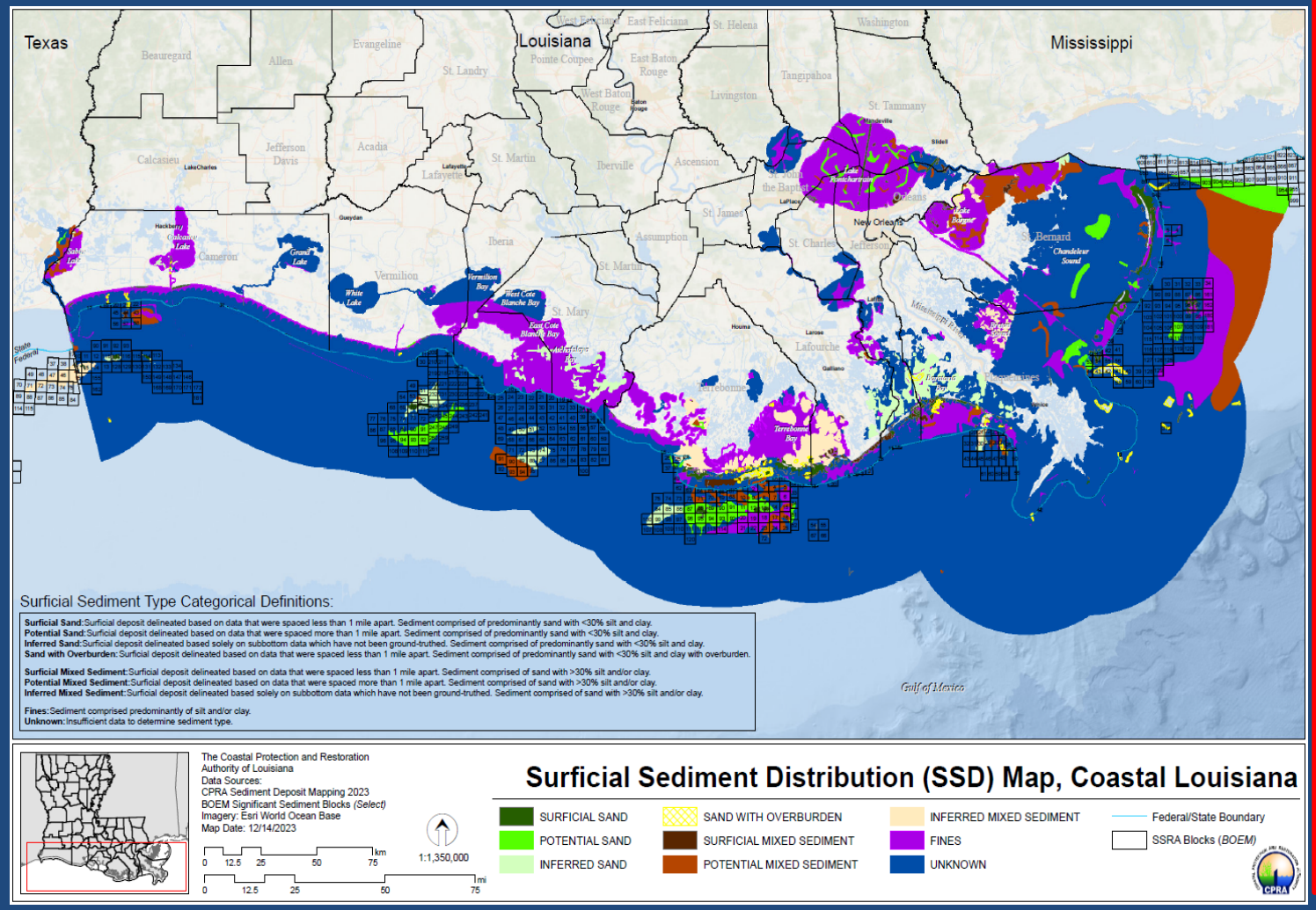
In order to maintain and keep LASARD update we need to upload data you collect in proper format per CPRA's SOP

Please reach out to the Sediment Management Team (SMT) for any clarification about formatting issues.

Help us to help you!

Surficial Sediment Distribution (SSD) Map

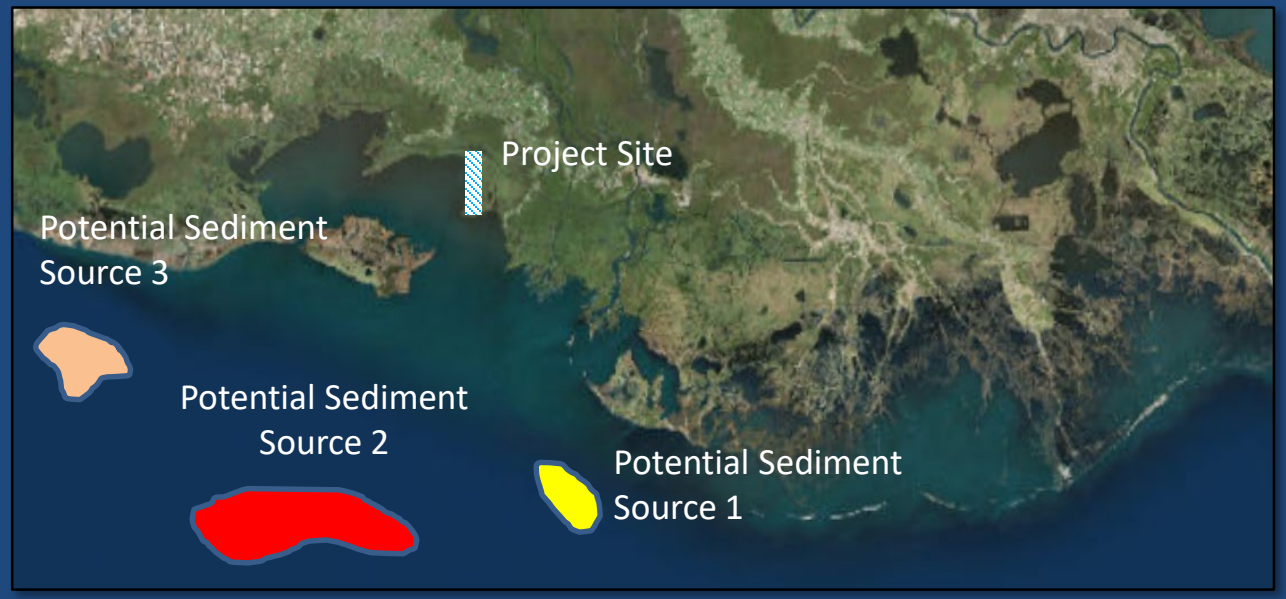
https://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=24126



- Planning tool developed from sediment/acoustic data in LASARD
- Showing *Sand, Mixed Sediment, Fines, & Unknown*
- 1st order volume estimates
- Living Document – updated annually
- identify existing and potential sediment deposits for further investigated for future borrow area delineation/development
- Helpful in BOEM's offshore Significant Sediment Resource Areas (SSRAs)
- Helps in decision for removal/or otherwise of decommissioned P/L

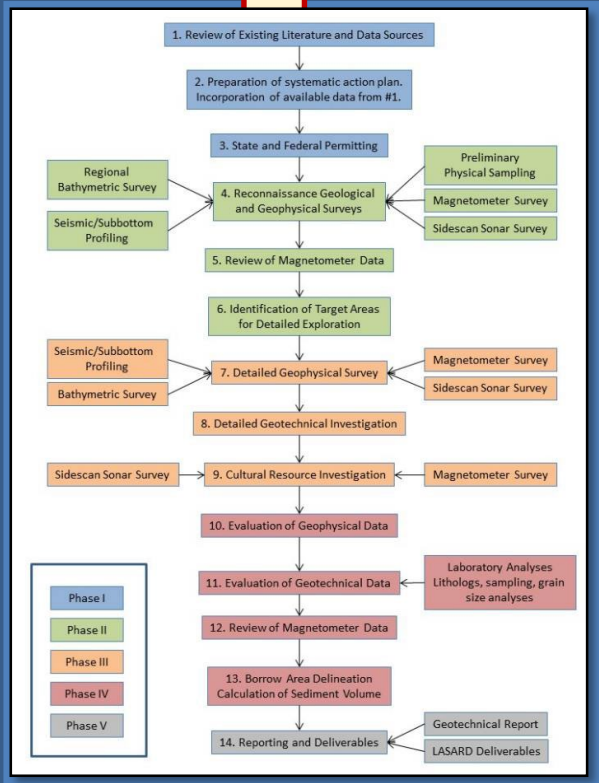
Forrest et al 2019; Khalil et al 2018

Louisiana Sediment Availability and Allocation Program (LASAAP)



- Links sediment needs to potential sand/sediment resources
  - Offshore ; Riverine; Maintenance dredging
- Planning tool that identifies compatible sediment sources for restoration projects identified in the Coastal Master Plan.
- Analyzes restoration and borrow locations with the help of bathymetric, geotechnical, geophysical and sedimentological data in a spatial format

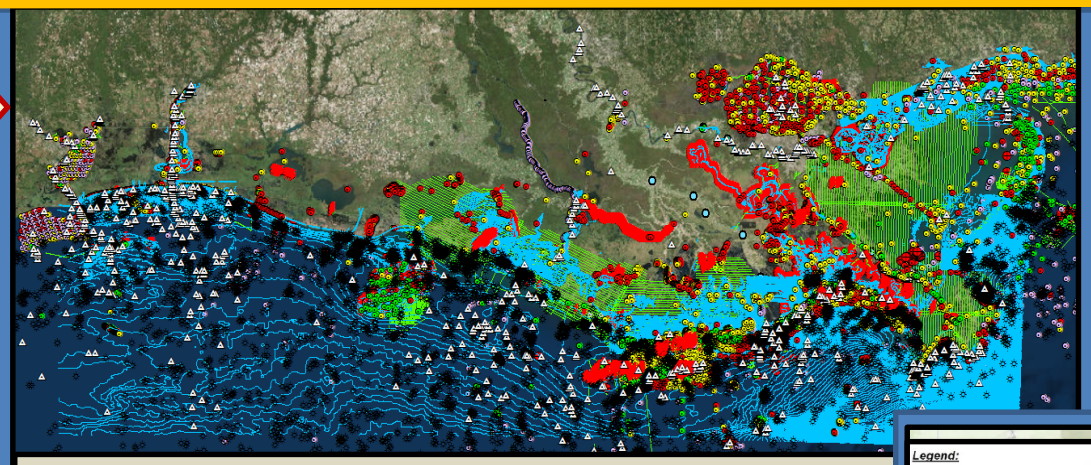
Sediment - Evaluation & Management Tools



DELTA SAND SEARCH MODEL (DSSM)

http://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=1034

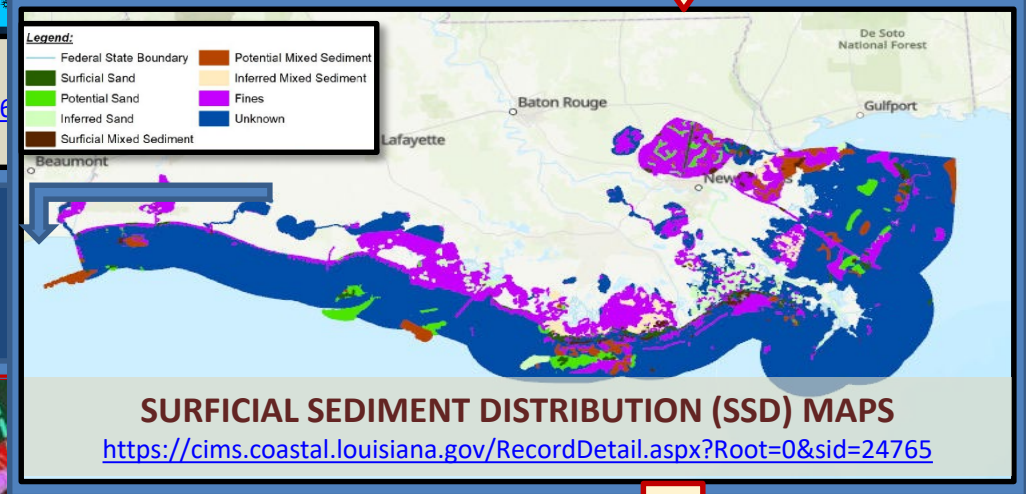
Finkl & Khalil 2005; Khalil 2019; Khalil et al, 2018a,



LASARD – LA SAND RESOURCES DATABASE

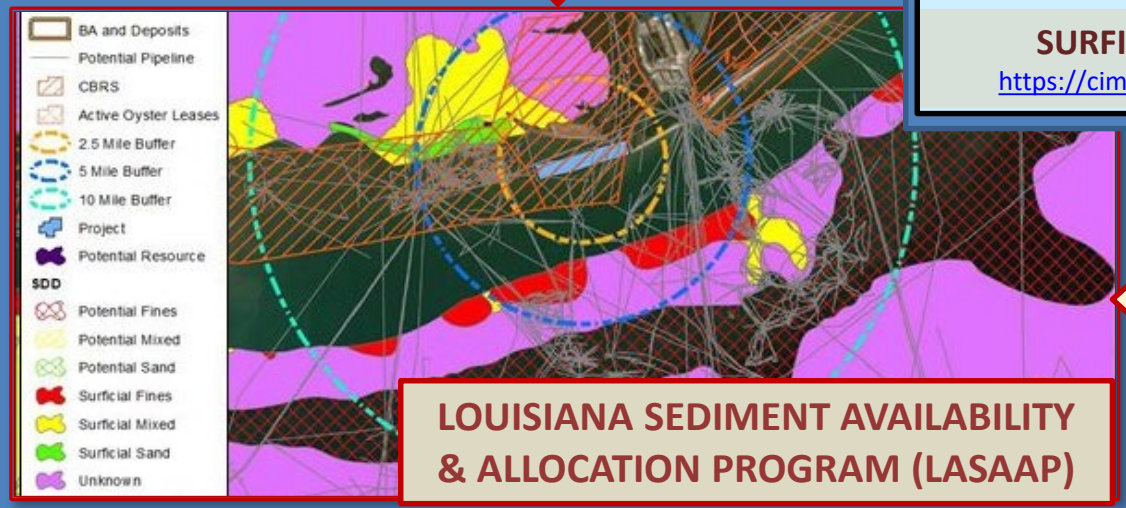
http://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=1236

- Sediment management Implementation on a regional scale
- Resolve multiple-use conflicts



SURFICIAL SEDIMENT DISTRIBUTION (SSD) MAPS

https://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=24765



LOUISIANA SEDIMENT AVAILABILITY & ALLOCATION PROGRAM (LASAAP)

CPRA Coastal Protection and Restoration Authority of Louisiana

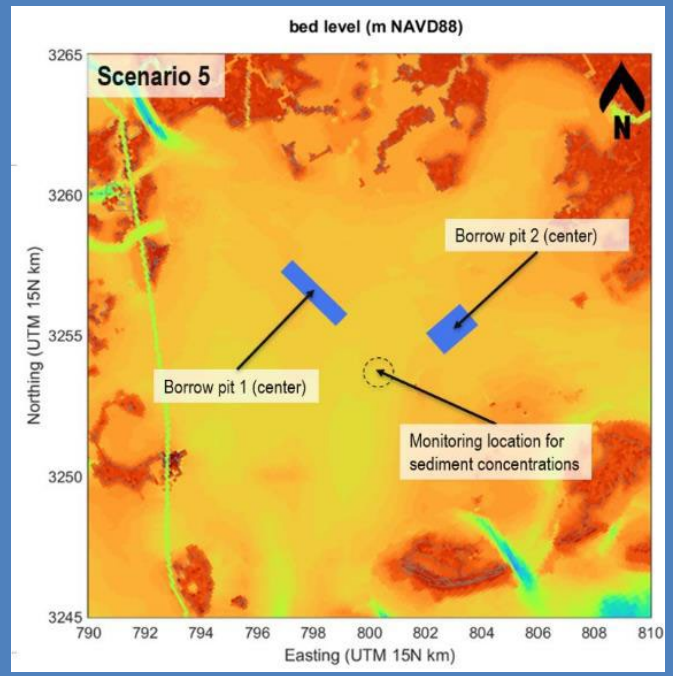
Borrow Area Considerations: Borrow Area Monitoring & Management (BAMM)

BAMM 1

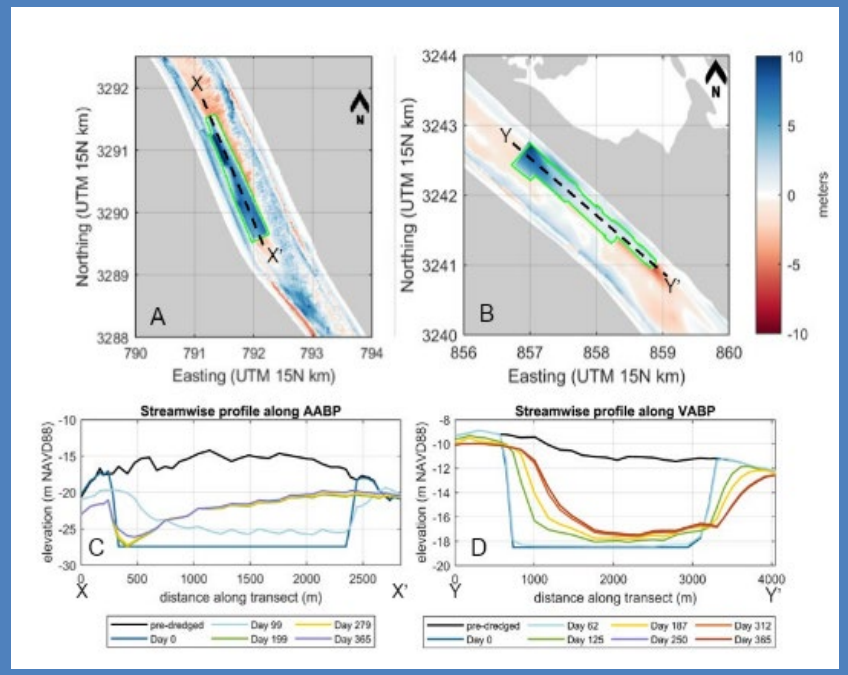
- Project Inventory and Literature Search
- Bathymetric and Geophysical Data Collection
- Hypoxia Monitoring
- Model Development
- Push Core Investigation

BAMM 2

Impact of dredging in bays



Infilling rate in LMR borrow pit

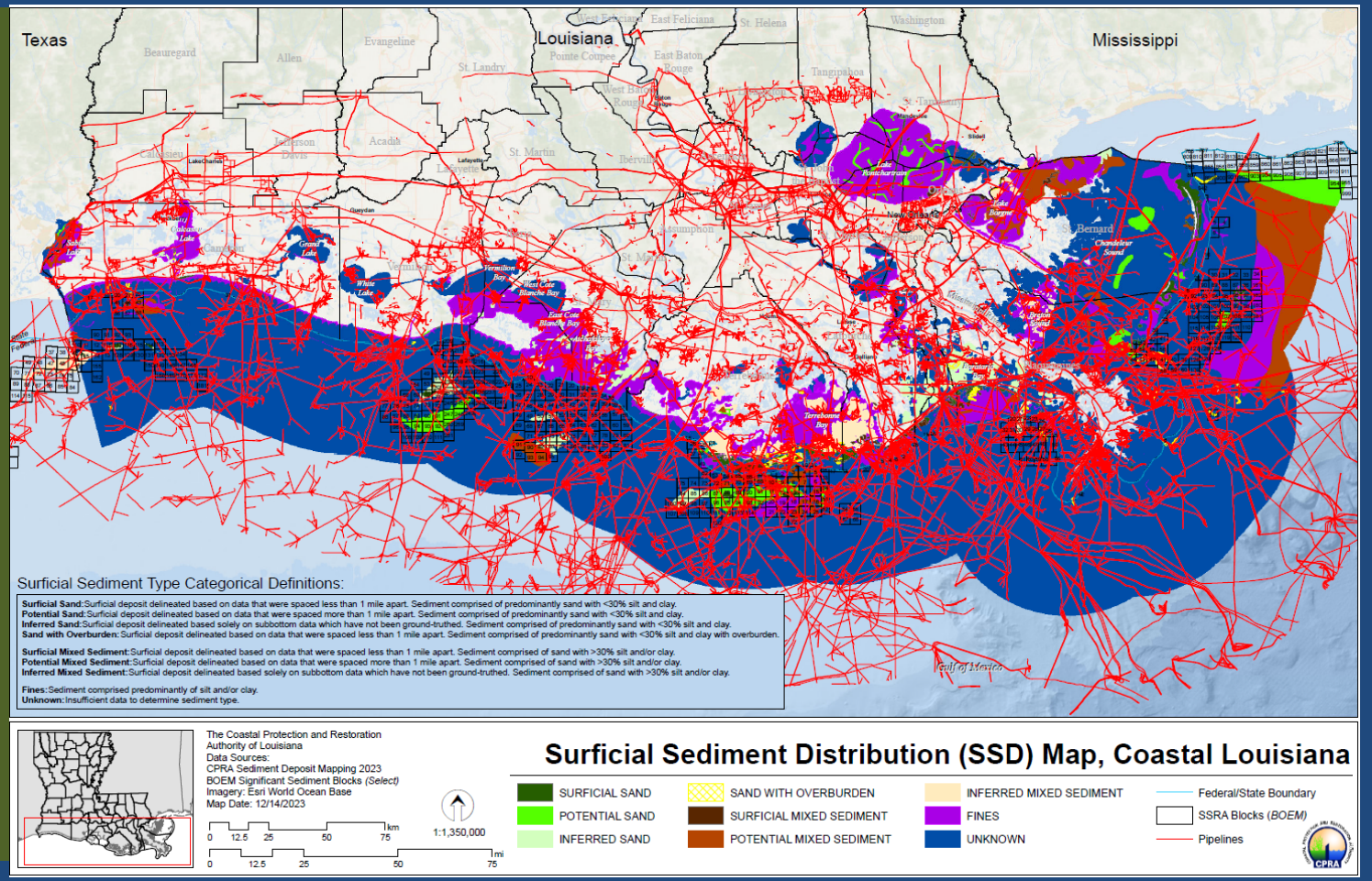


http://cims.coastal.louisiana.gov/DocLibrary/FileDownload.aspx?Root=0&id=15062
https://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=25168
https://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=25089

CBI 2015;TWI 2023 a&b

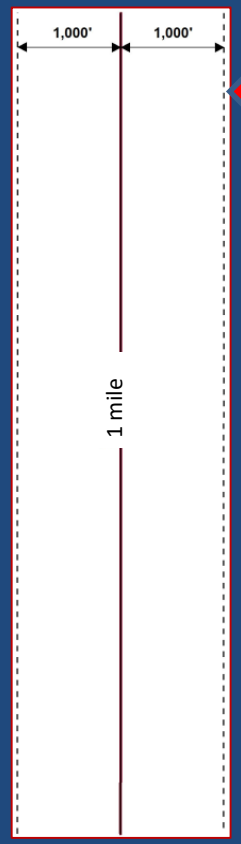
Policies / Regulations & Coordination with Stakeholders

- Key component of a sediment management program
- Numerous rules/regulations during/after investigations/ dredging
- Federal Standard considerations
- Consideration for multiple uses of seabed resources
- Reduction of available offshore sediment resources due to pipeline safety buffers



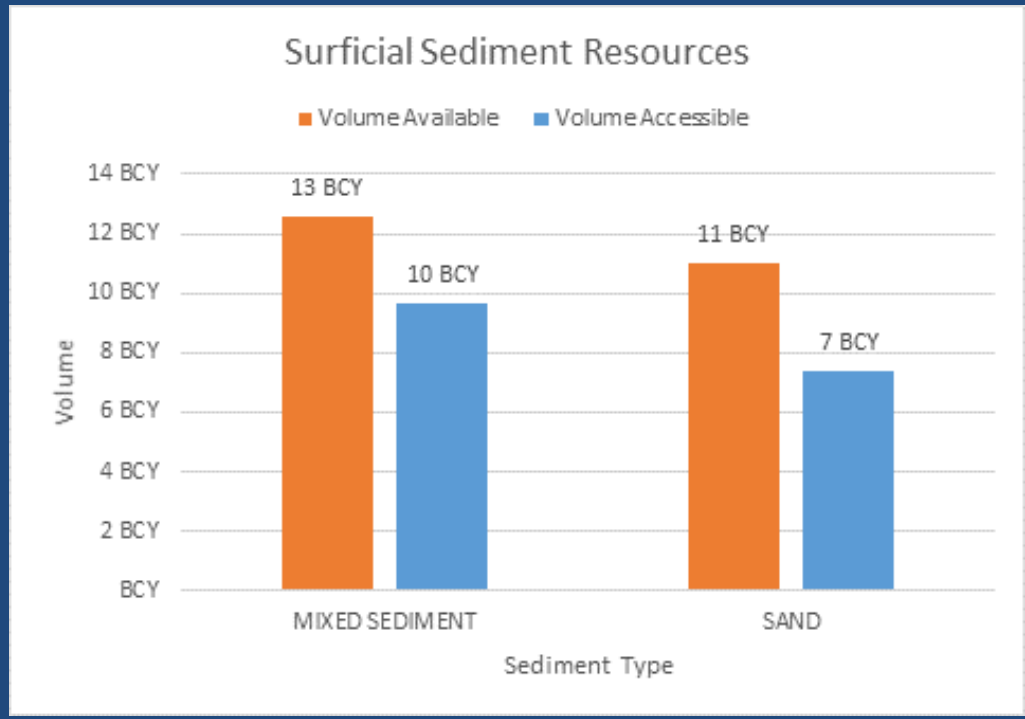
Forrest et al 2019; Khalil et al, 2018a

Multiple use of Sea bed -Policies / Regulations & Coordination with Stakeholders



Volume of sediment resources rendered unavailable by a 1 mile long abandoned pipeline = ~ 3.9 MCY

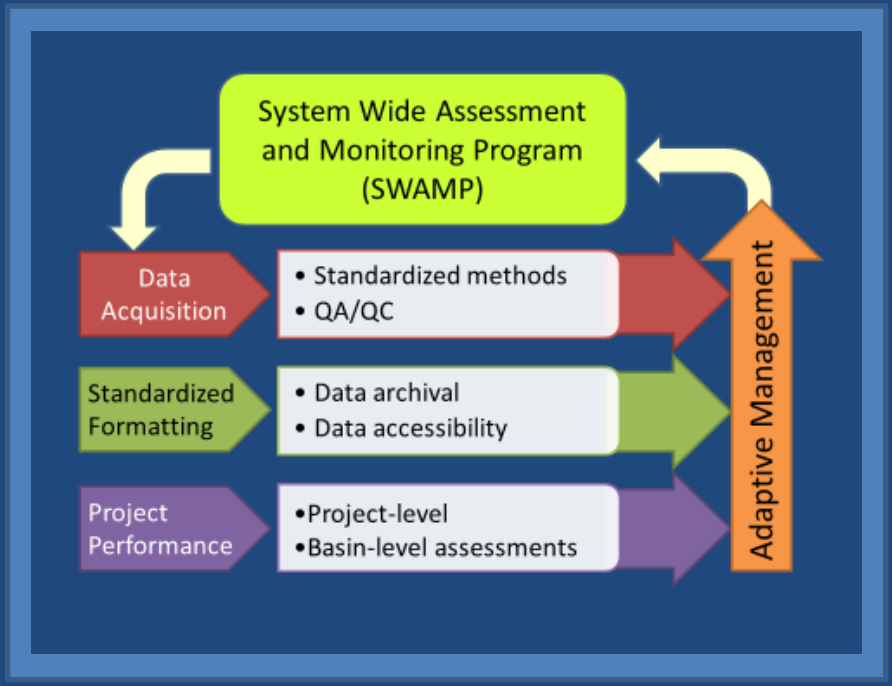
Sediment Type	Total Volume Available (MCY)	Total Volume Accessible (MCY)	% of Total Volume Inaccessible due to P/L Safety Buffer
Sand	1,779	1,387	22
Mixed Sediment	904	589	35
Potential Sand	4,545	3,515	23
Potential Mixed Sediment	8,624	7,167	17
Inferred Sand	3,223	2,123	34
Inferred Mixed Sediment	3,044	2,160	29



Adaptive Management & Programmatic Monitoring

(System Wide Assessment & Monitoring Program -SWAMP)

Implementation of Adaptive Management requires regional monitoring for various parameters

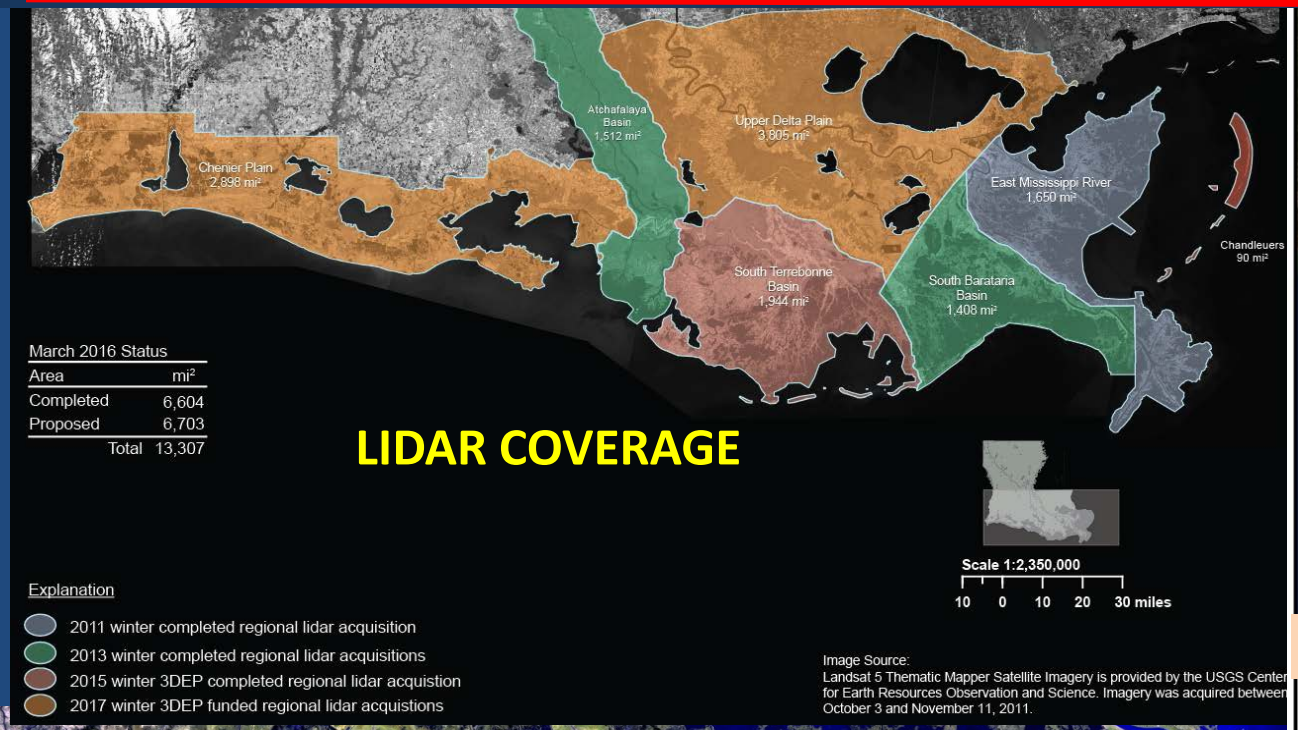


SWAMP

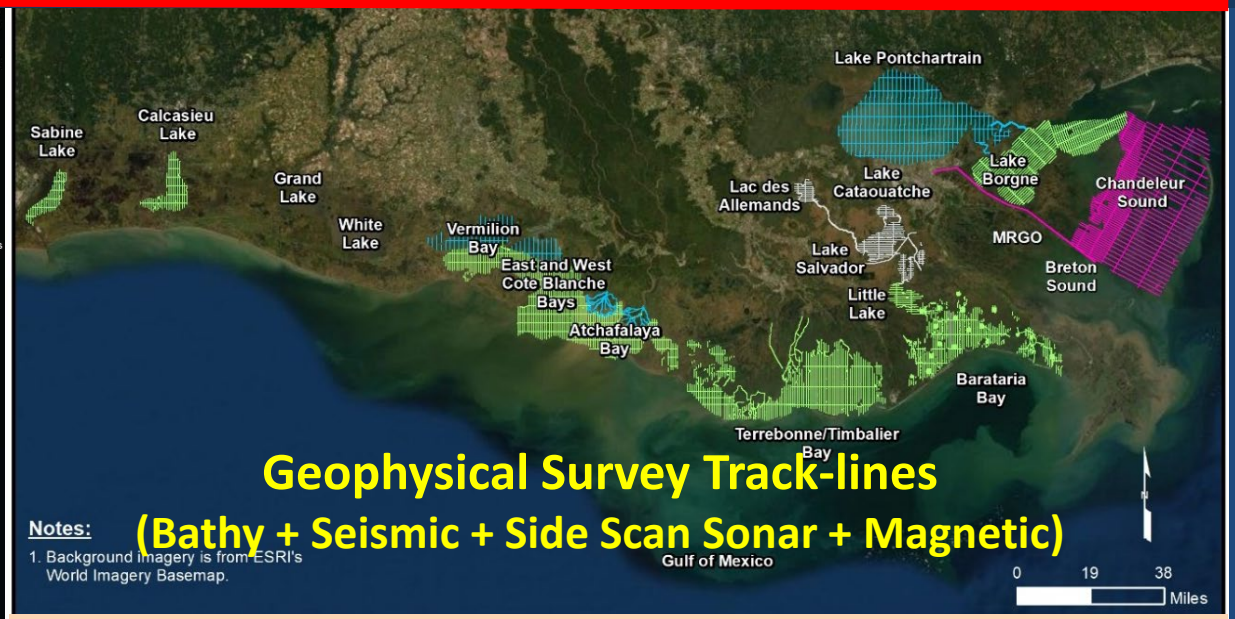
- Physical Terrain
  - Elevation Monitoring
    - Lidar
    - Bathymetric /Geophysical survey
  - Subsidence
- Waves & Currents –Offshore & Bays
- Barrier Island Comprehensive Monitoring (BICM) Program

CPRA
Coastal Protection and Restoration Authority of Louisiana

Leveraging Regional Monitoring Data {SWAMP} for Sediment Management



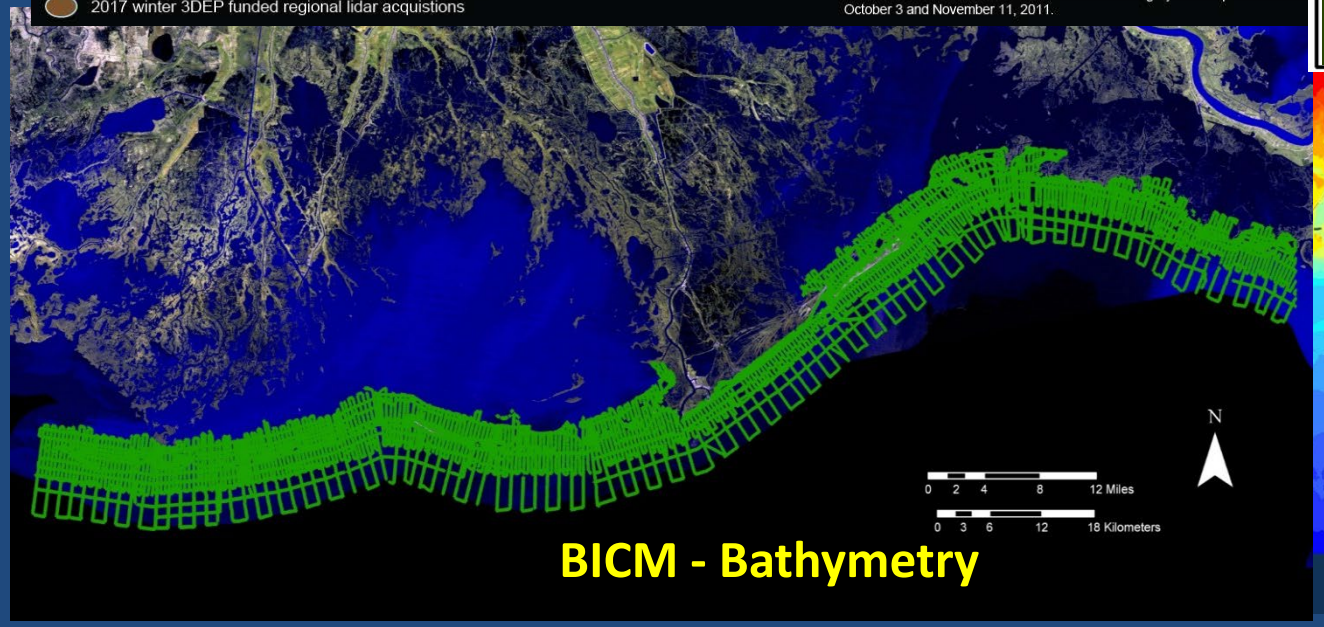
LIDAR COVERAGE



Geophysical Survey Track-lines

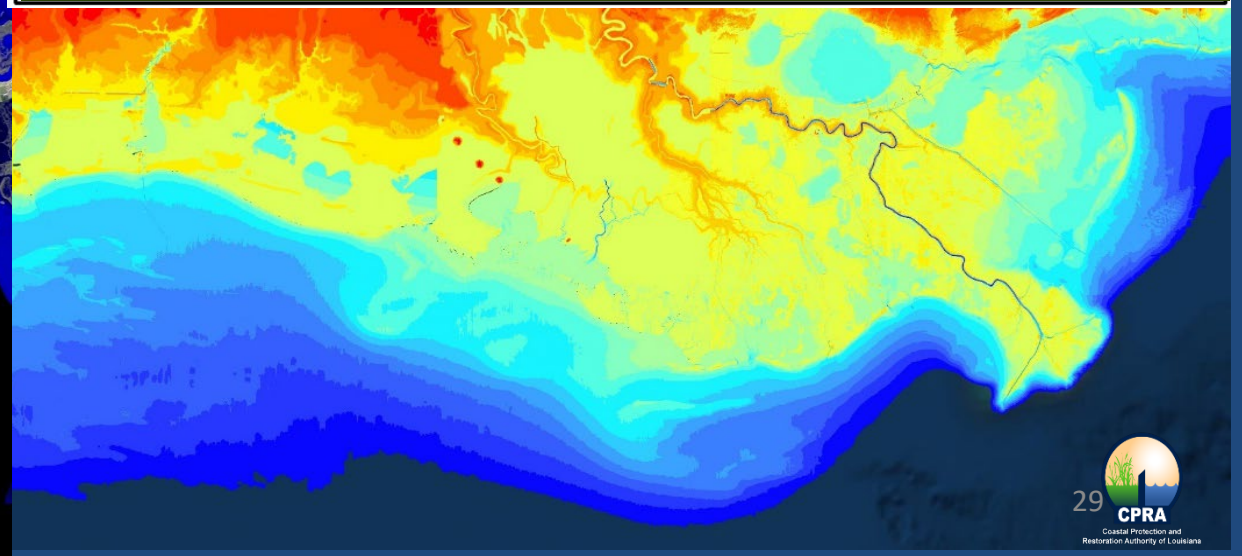
(Bathy + Seismic + Side Scan Sonar + Magnetic)

https://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=24509



BICM - Bathymetry

Topo-Bathy Digital Elevation Map (TBDEM)



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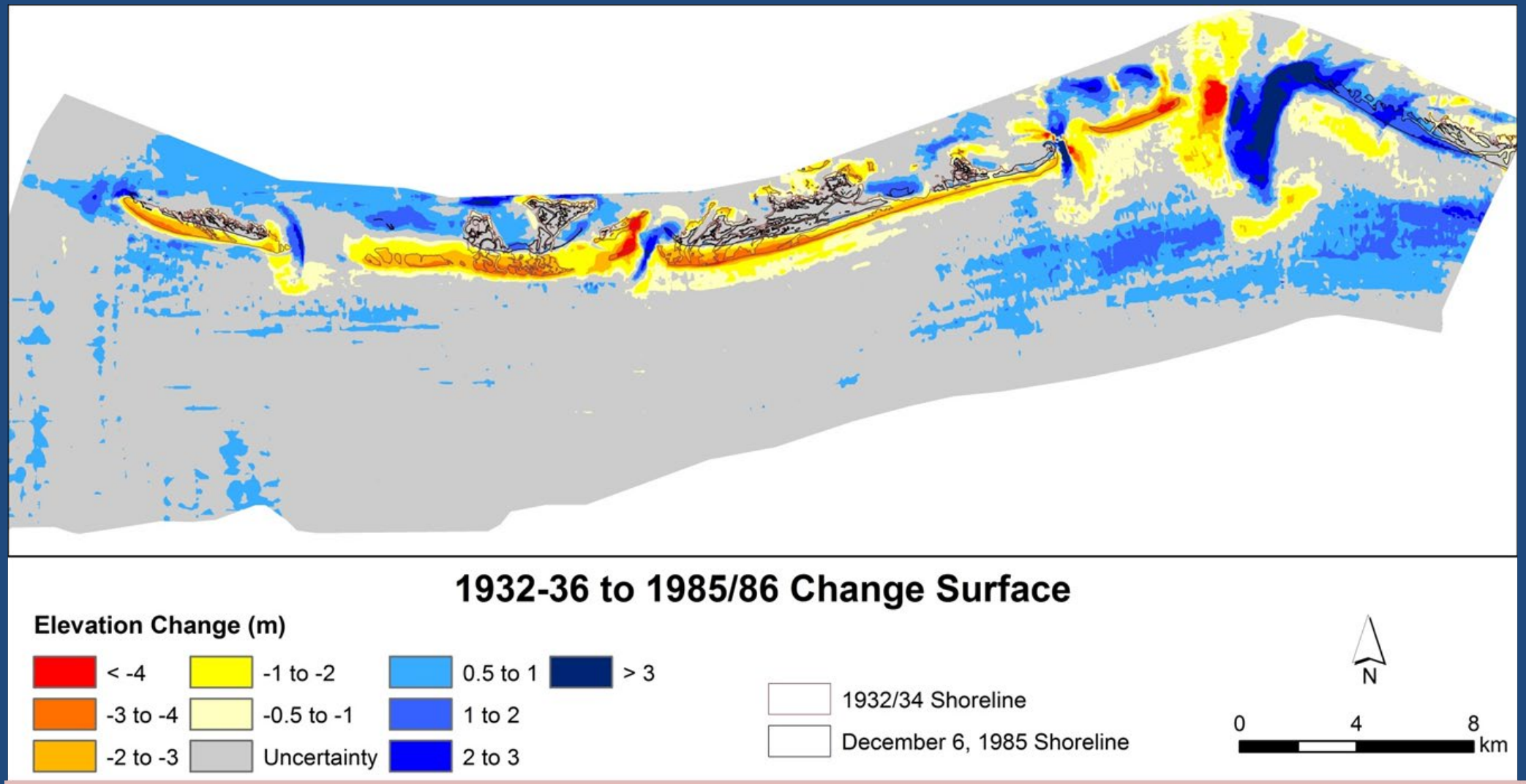
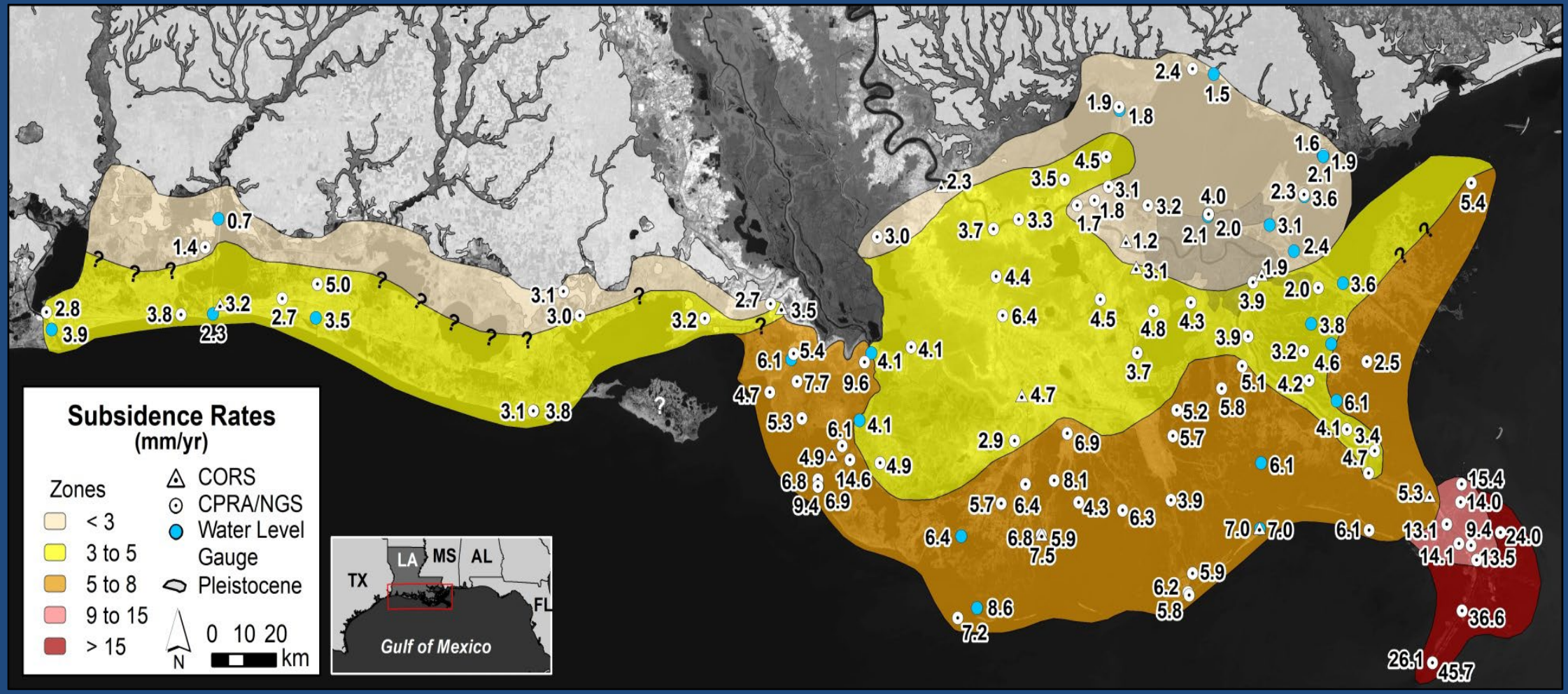
Coastal Protection and Restoration Authority of Louisiana

Operational Sediment Budget - *Bathymetric Change Surfaces*



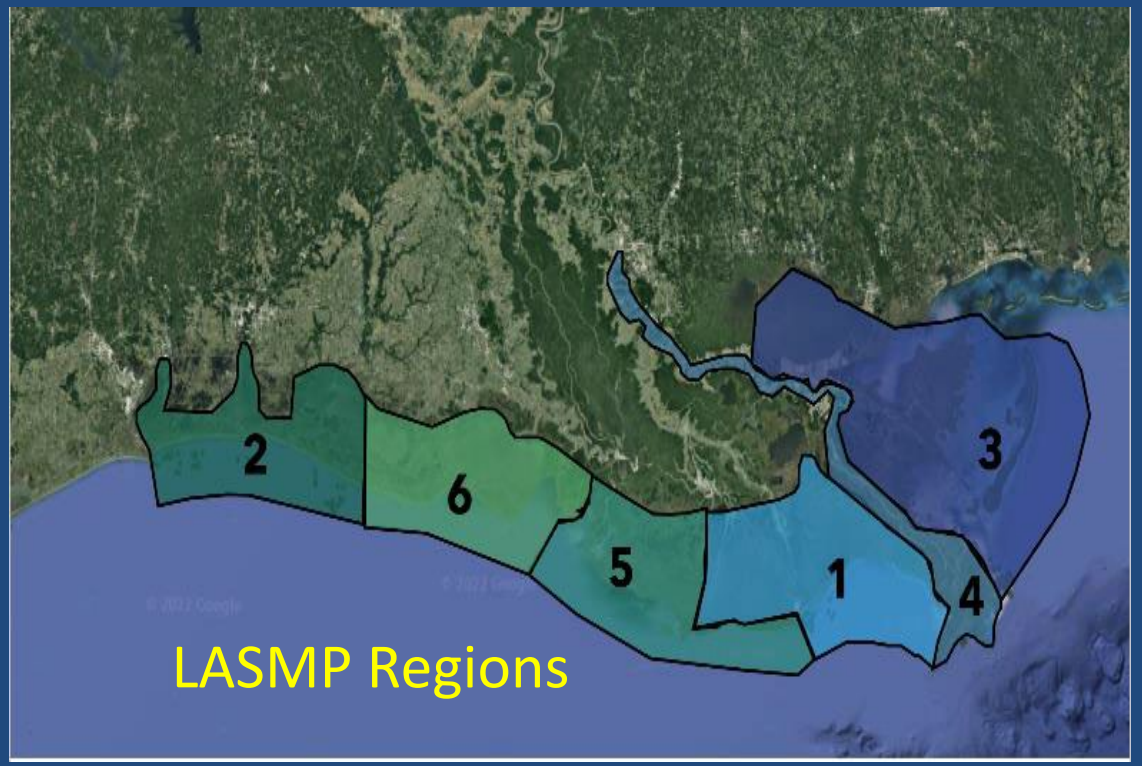
https://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=23926

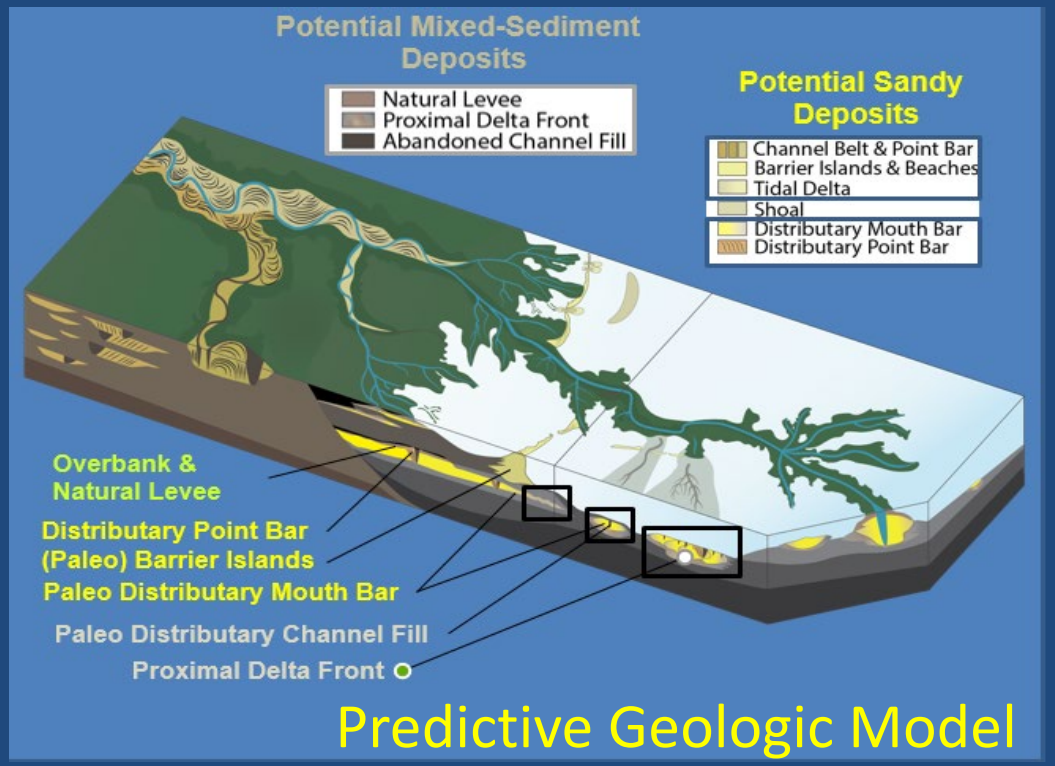
Map of Annual Subsidence Rates and Subsidence Zones



CPRA 2023b; ACRE 2022

LASMP Implementation - Development of Predictive Geologic Model

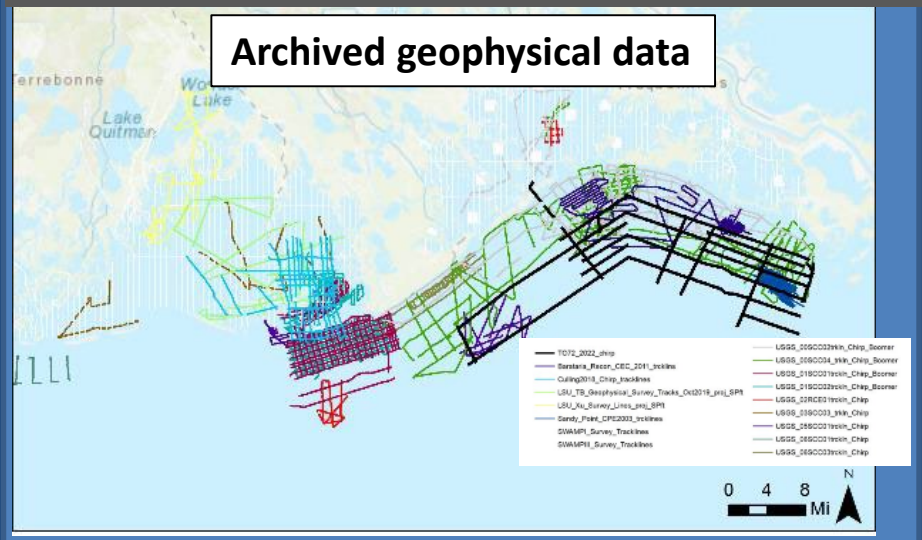


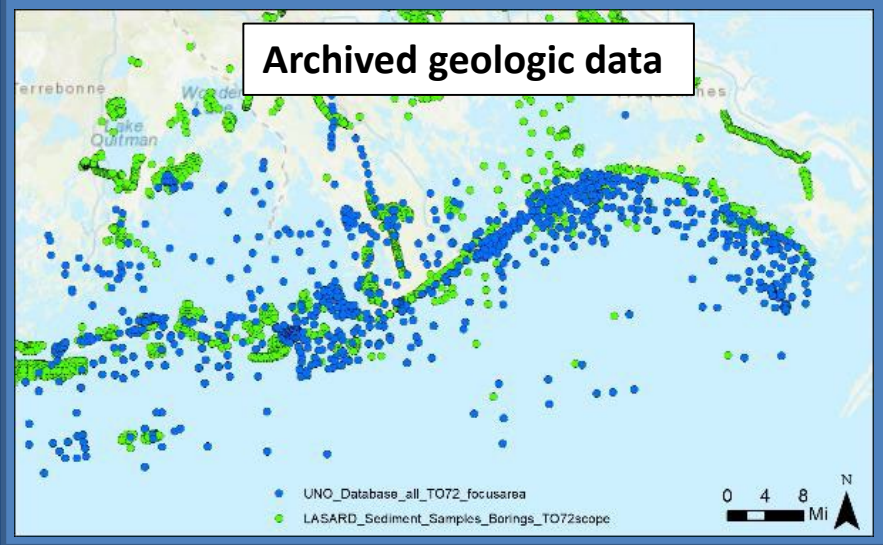


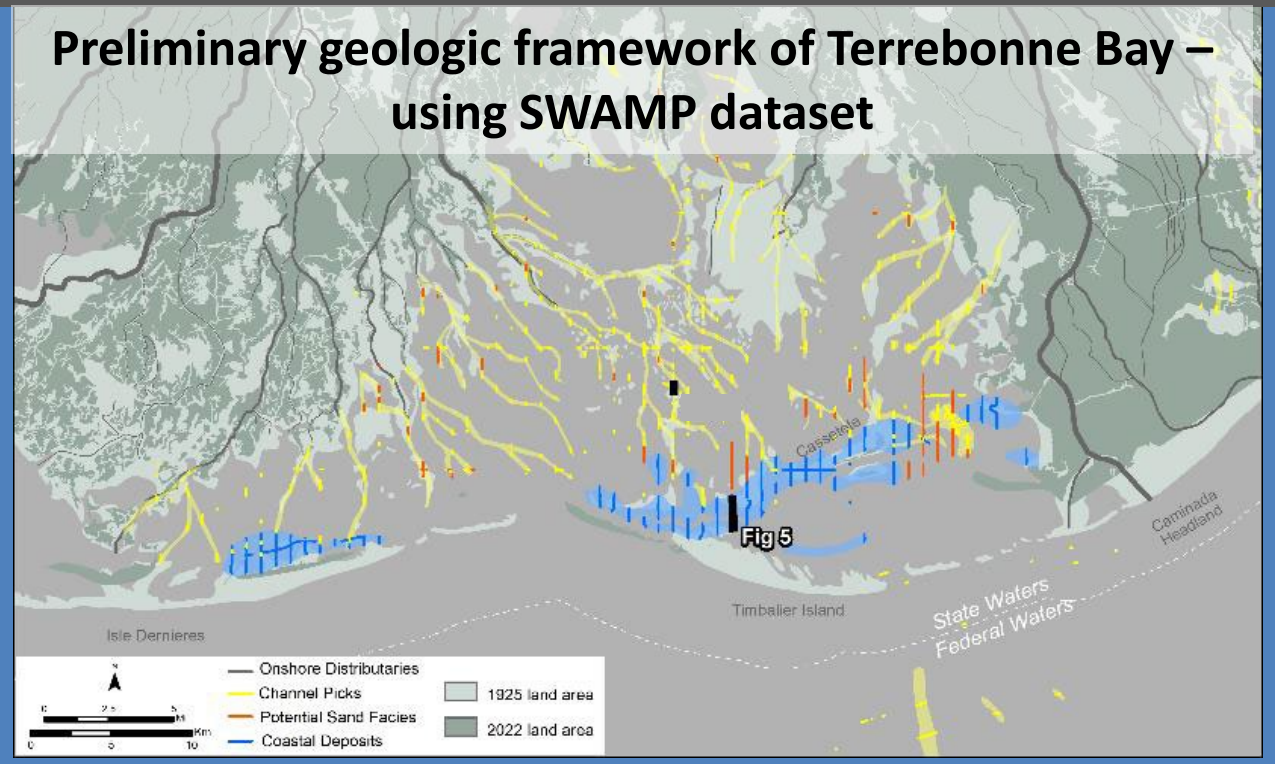
1. Understand and then to predict characteristics, extent & volume of sediment deposits
2. Help guide future investigations on engineering scale
3. Ease of 3D-visualization of subsurface by non-geologists
4. Help develop comprehensive sediment resources inventory
5. leveraging historical and current geoscientific data
6. Started with Barataria and Terrebonne Basins (Region 1) & W Louisiana (Region 2A & B)

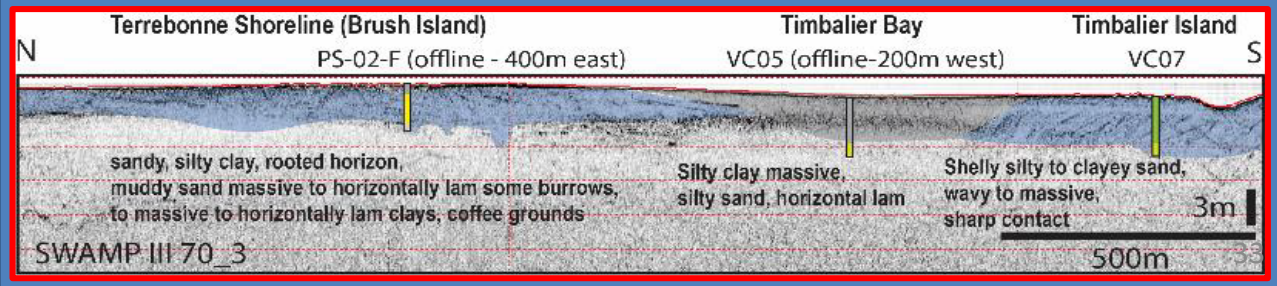
Compilation, Synthesis,& Leveraging of Data

- ~2,000 miles of existing geophysical lines: SWAMP geophysical surveys, USGS, etc.
- ~3,000 sediment borings from LASARD, Louisiana Geologic Survey, and others



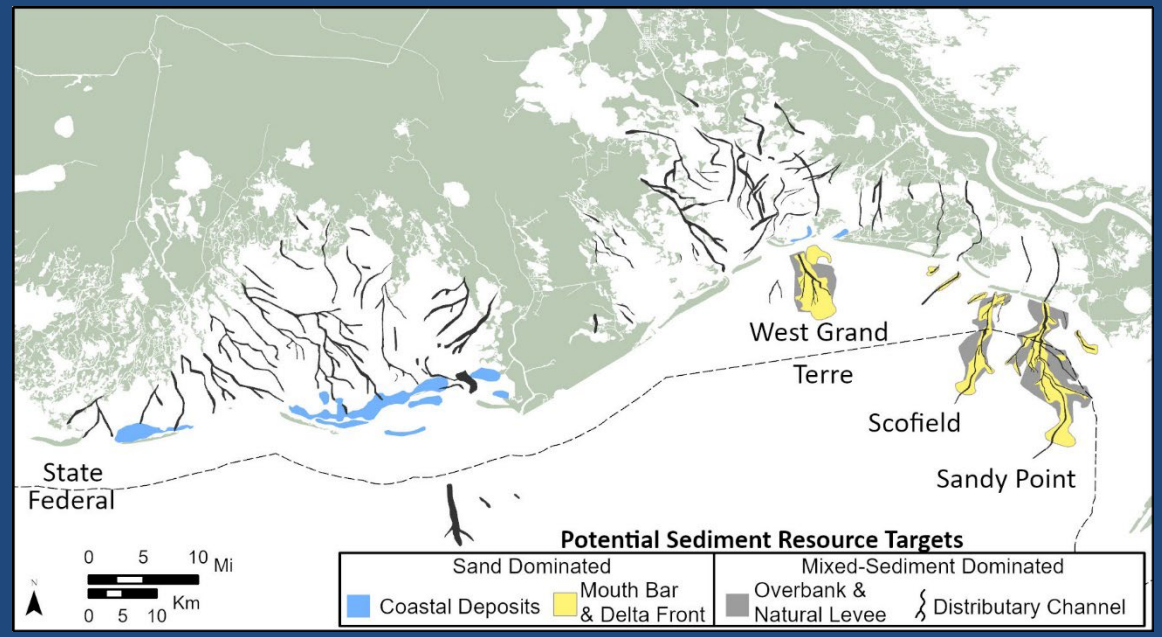






Predictive Geologic Model - Holistic Sediment Resource Distribution

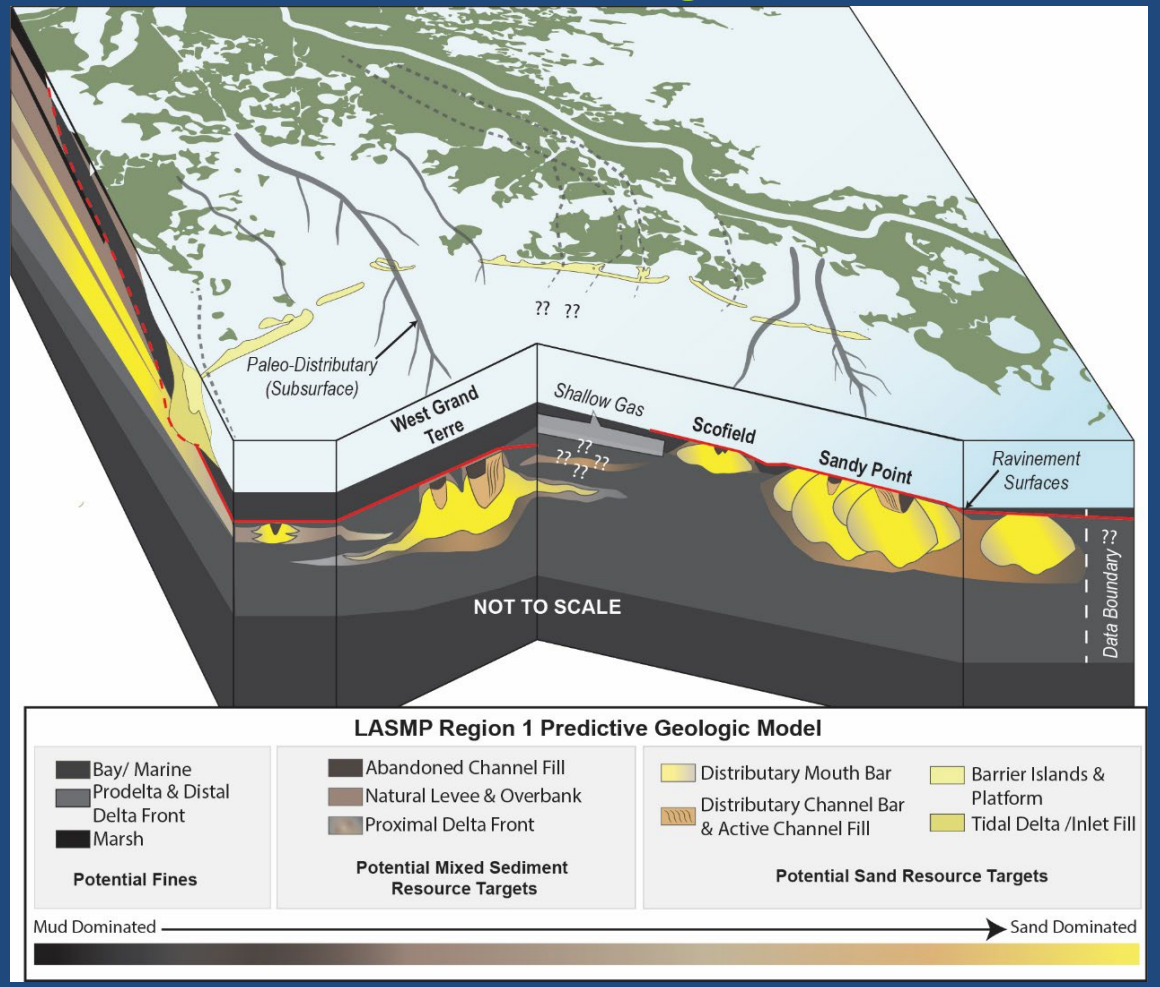
Potential Sediment Resources



Potential Resource	Depositional Env.	Volume Estimate
West Grand Terre	Paleo-Mouth Bar	~68 MCY
Scofield	Paleo-Mouth Bar	~50 MCY
Sandy Point	Paleo-Mouth Bar	~186 MCY

***Volumes are first order estimates**

Predictive Geologic Model



Three-dimensional predictive geologic model of Barataria Bay and the offshore region, highlighting the distribution and relationships of potential sediment resources and fines

FINAL THOUGHTS…

- Sedimentological restoration is the solution for a sustainable ecosystem
- Need for Large quantities of compatible sediment - sand and mixed sediment
- We have taken sediment resources investigation to another level
  - *From delineation of "Offshore Sand" to compilation of SSD Maps with different sediment types*
  - *Leveraging programmatic monitoring data for sediment management to develop Predictive Geologic Models*
- Short term – extend investigation further east in LASMP Region 2B/Cheniers
- Long term – investigate all the remaining 4 LASMP regions

Sediment is survival

Myth 1 – Compatible sediment for restoration is unlimited

Myth 2 – Sand is enough

RESOURCES

1. General Guidelines: Exploration for Sediment Resources for Coastal Restoration. Version_VIII" http://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=1034
2. LASARD SOP - https://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=12362
3. SSD (Surficial Sediment Distribution) Maps - *included the Shore and Beach paper from 2018 and a link to the most recent SSD report from APTIM* https://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=24494
4. SUBSIDENCE - A Brief Chronology of CPRA's Approach and Various Studies for Subsidence Measurements in Coastal Louisiana https://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=24645
5. Report on Stability of Reference Monuments for Documenting Elevation Changes in Consolidating Holocene Sediment in South Louisiana Coastal Environment - https://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=25175
6. Gap Assessment of Geoscientific Data - https://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=25069
7. Louisiana Operational Sediment Budget: Raccoon Point to Sandy Point, 1985-89 to 2013-16 - https://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=23926
8. Geophysical Survey of Coastal Louisiana ; System Wide Assessment and Monitoring Program (SWAMP). Geophysical Surveys Phases I – IV (Chandeleur Sound to Sabine Lake, LA): A Summary Report. https://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=24509
9. Louisiana Borrow Area Management and Monitoring (BAMM) Program (p. 30). Boca Raton, Florida: CB&I Government Solutions.
10. BAMM 2 - Final Report: Assessing the Impact of In-bay Borrow Pits on Estuarine Sediment Dynamics, Barataria Bay, Louisiana https://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=25168
11. BAMM 2 - Numerical Modeling to Estimate Sediment Infilling Rate of Lowermost Mississippi River Borrow Pits and Impacts on Downstream Dredging https://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=25089

References

1. *Applied Coastal Research and Engineering (ACRE). (2020). Louisiana Operational Sediment Budget: Raccoon Point to Sandy Point, 1985-89 to 2013-16 (Contract 4400009020, Task 5; p. 118). Final Report prepared for CPRA of Louisiana.*
2. *Applied Coastal Research and Engineering (Applied Coastal), 2022. Recent Subsidence Trends for Coastal Louisiana: Phase 4 – Southwestern Louisiana Chenier Plain, Teche/Vermilion Basin, Atchafalaya Basin, Western Pontchartrain Basin, and the Mississippi River Delta Basin. Final Report prepared for Louisiana Coastal Protection and Restoration Authority, Baton Rouge, LA, 80 p. plus appendices.*
3. *https://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=24941*
4. *APTIM. (2023). Report on Louisiana Surficial Sediment Distribution (SSD) Map Compilation (p. 178). Aptim Environmental & Infrastructure, LLC (Prepared for Coastal Protection and Restoration Authority of Louisiana).*
5. *Blum, M. D., and Roberts, H. H., 2009, Drowning of the Mississippi Delta due to insufficient sediment supply and global sea-level rise: Nature Geoscience, v. 2, p. 488-491.*
6. *CB&I. (2015). Louisiana Borrow Area Management and Monitoring (BAMM) Program (p. 30). Boca Raton, Florida: CB&I Government Solutions.*
7. *Coastal Protection and Restoration Authority (CPRA) 2023a. Louisiana's Comprehensive Master Plan for a Sustainable Coast. CPRA, Baton Rouge, LA: 171pp. (Available at http://lacoast.gov).*
8. *Coastal Protection and Restoration Authority (CPRA), 2023b. A Brief Chronology of CPRA's Approach & Various Studies on Subsidence Measurements in Coastal Louisiana, Coastal Protection and Restoration Authority of Louisiana (CPRA), Baton Rouge, LA, 16p.*
9. *Couvillion, B.R., H. Beck, D. Schoolmaster, and M. Fischer, 2017. "Land area change in coastal Louisiana 1932 to 2016." U.S. Geological Survey Scientific Investigations Map 3381, 16p. pamphlet, https://doi.org/10.3133/sim3381.*
10. *Finkl, C.W., and S.M. Khalil, 2005. "Offshore exploration for sand sources: general guidelines and procedural strategies along deltaic coasts." J. Coastal Research, SI 44, 203-233.*
11. *Forrest, B., Khalil, S. M., Haywood, E., and Raynie, R. (2019). The Role of Surficial Sediment Distribution Maps in Regional Sediment Management. Proceedings of Coastal Sediments 2019. World Scientific Publishing Company*
12. *Khalil, S.M., 2019. General Guidelines: Exploration for Sediment Resources for Coastal Restoration. Baton Rouge, LA: Coastal Protection and Restoration Authority. Version_VIII.pdf, 23 pp.*
13. *Khalil, S. M., Forrest, B. M, Raynie, R. C., and Haywood, E.L. (2022). Strategic approaches to sediment management for restoration of a deltaic plain. Shore & Beach, Vol. 90, No. 1, Winter 2022, 39-49 pp.*
14. *Khalil, S.M., Forrest, B., Haywood, E., and Raynie, R. (2018a). Surficial Sediment Distribution Maps for Sustainability and Ecosystem Restoration of Coastal Louisiana: Shore & Beach, Vol. 86, No. 3, Summer 2018, 21-28 pp*
15. *Khalil, S.M., Freeman, A. M., Raynie, R.C., (2018b). Sediment Management for Sustainable Ecosystem Restoration of Coastal Louisiana: Shore & Beach, Vol. 86, No. 1 Winter 2018, 17-27 pp.*
16. *Morton, R. A., Bernier, J. C., Kelso, K. W., and Barras, J. A., 2010, Quantifying large-scale historical formation of accommodation in the Mississippi Delta: Earth Surface Process and Landforms, v. 35, no. 14, p. 1625-1641.*
17. *The Water Institute (2023a). Assessing the Impact of In-Bay Borrow Pits on Estuarine Sediment Dynamics, Barataria Bay, Louisiana. Final report prepared for the Coastal Protection and Restoration Authority. Baton Rouge, LA. Task Order 72.1. 31 p + appendices.*
18. *The Water Institute of the Gulf (2023). Numerical Modeling to Estimate Sediment Infilling Rate of Lowermost Mississippi River Borrow Pits and Impacts on Downstream Dep The Water Institute. Prepared for and funded by the Coastal Protection and Restoration Authority. Baton Rouge, LA.*

CPRA
Coastal Protection and Restoration Authority of Louisiana

THANKS

You all for the patiently listening

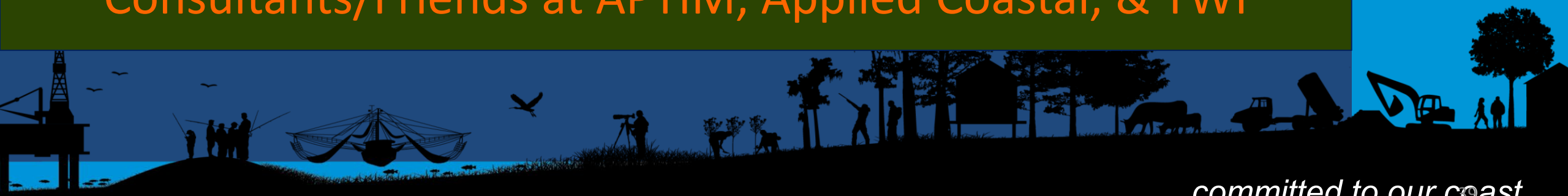
Drs. Charles Finkl & Harry Roberts

Sediment Management Team

CPRA Colleagues

BOEM Collaborators

Consultants/Friends at APTIM, Applied Coastal, & TWI



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