



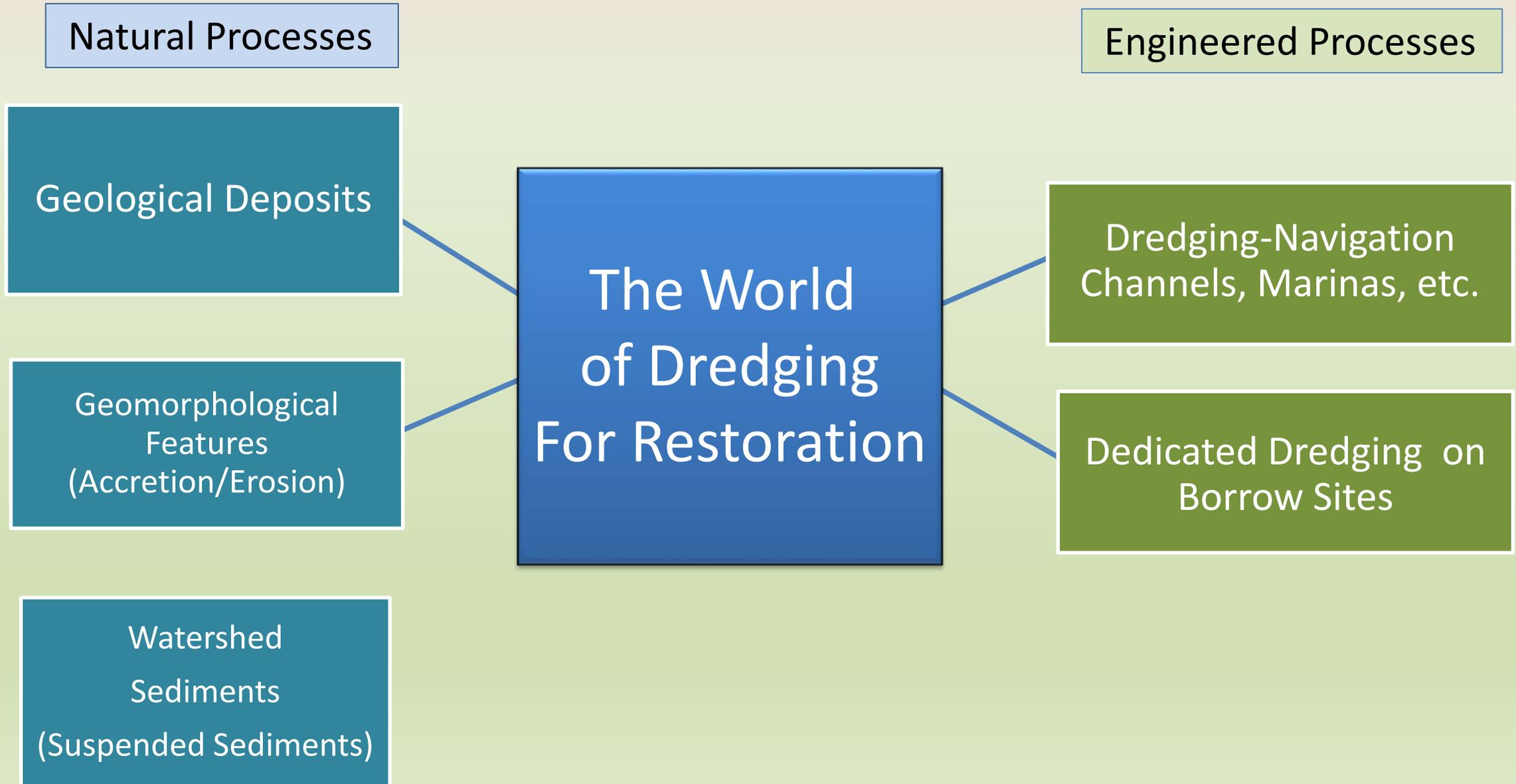
TEXAS GEOLOGICAL DREDGING VS. GEOTECHNICAL DREDGING: CAN WE ANTICIPATE THE FUTURE?

*UNDERSTANDING THE PAST IN ORDER TO
UNDERSTAND THE PRESENT*

Juan Moya Ph.D. P.G.
Matthew Mahoney P.G.
Tim Dellapenna Ph.D.

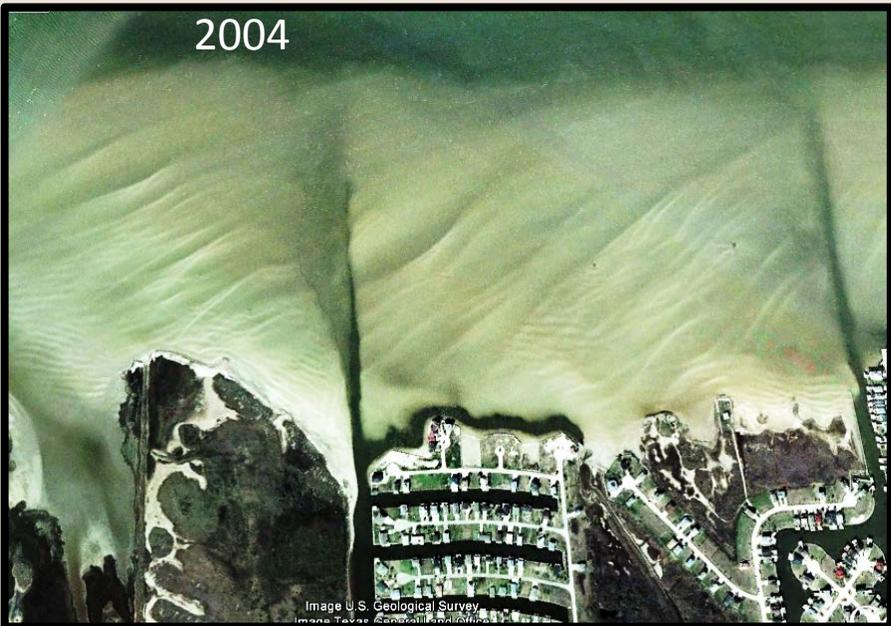


SEDIMENT SOURCES FOR COASTAL RESTORATION AND ENGINEERED BEACHES

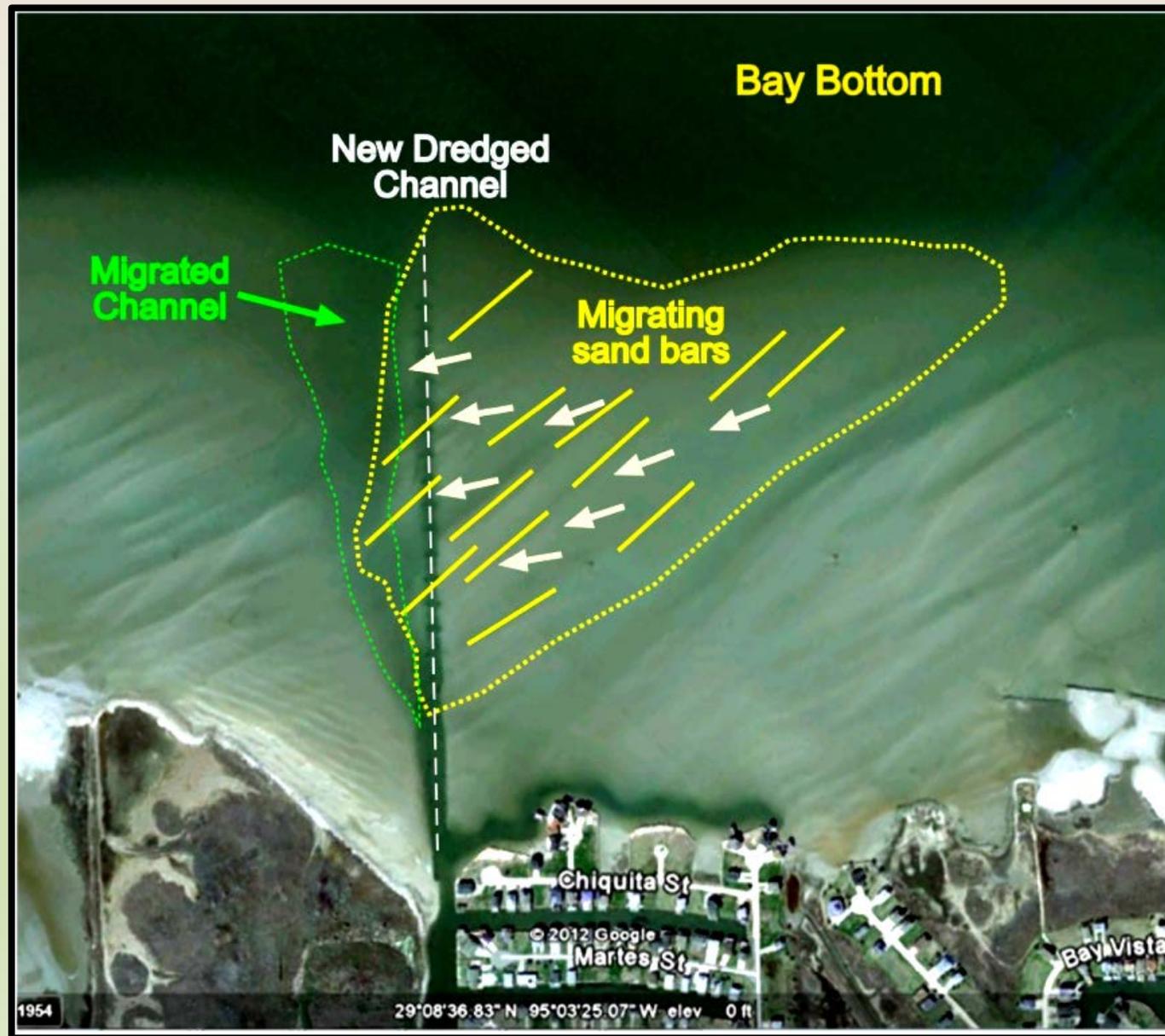


SEDIMENTS MOVE: NATURE DOES NOT RECOGNIZE BOUNDARIES

2004



2010



TEXAS NAVIGATION CHANNELS



U.S. Army Corps
of Engineers @
Galveston District



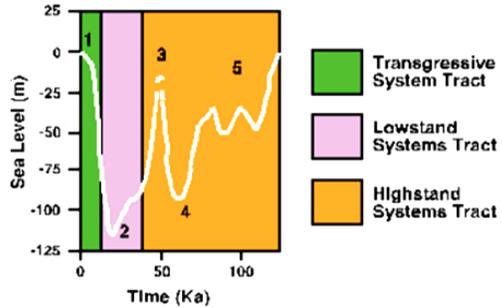
O&M Project Map Book

GIWW - Galveston District



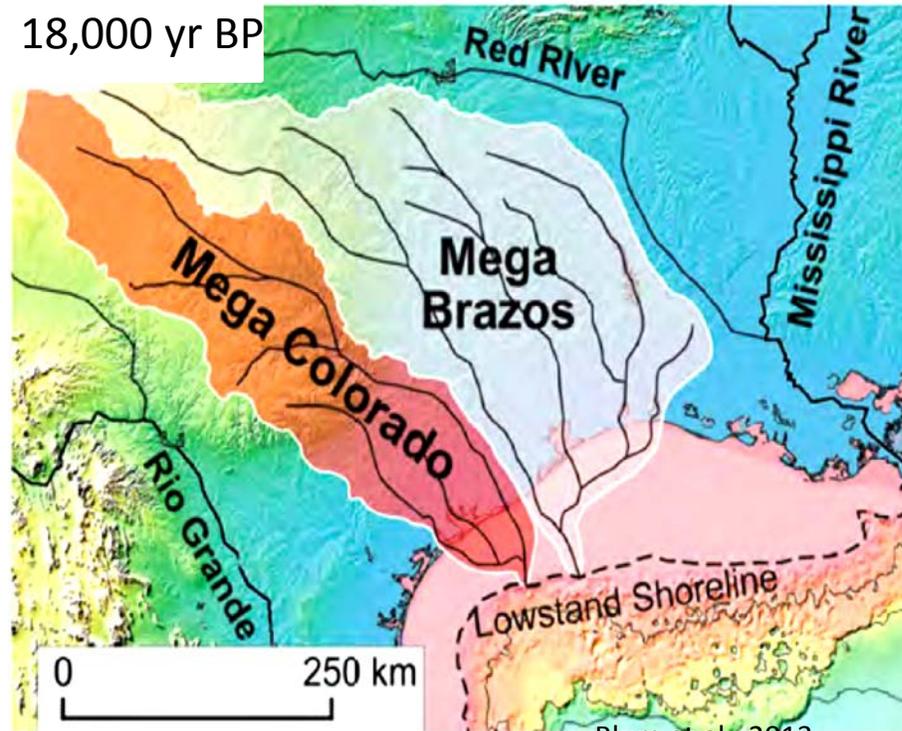
GEOMORPHOLOGICAL SYSTEMS CHANGE AND LEAVE SEDIMENTS BEHIND...

Sea level curve in the Gulf of Mexico through the past 125,000 years



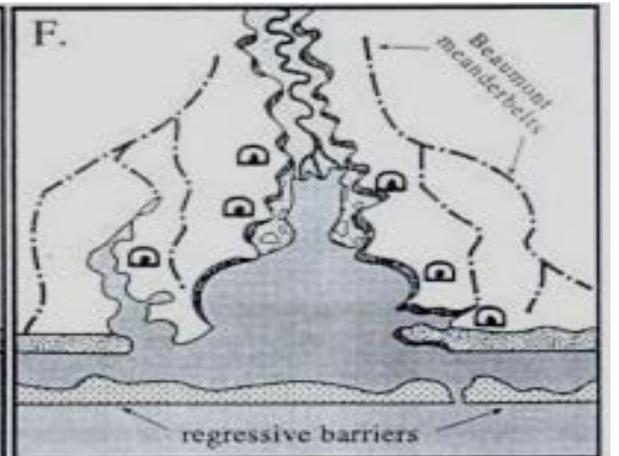
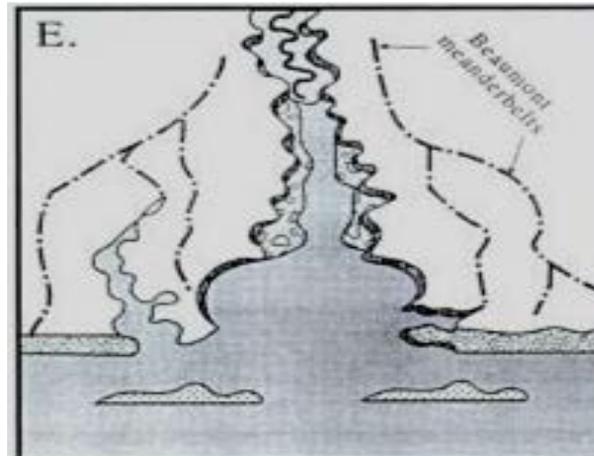
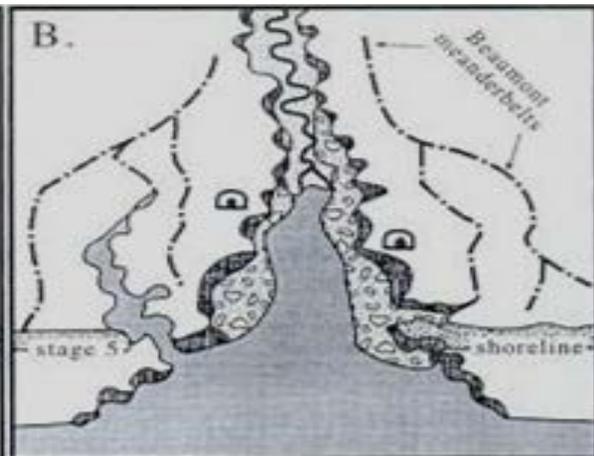
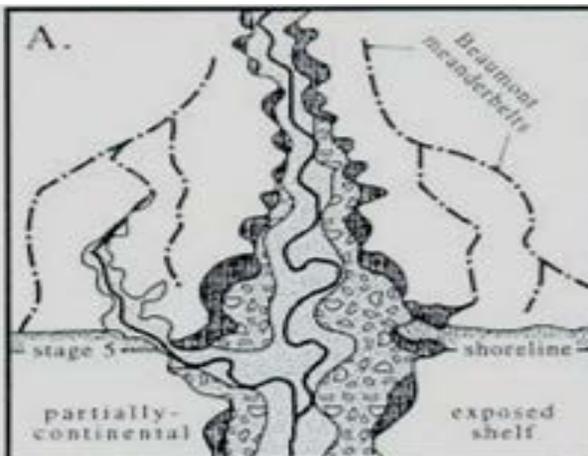
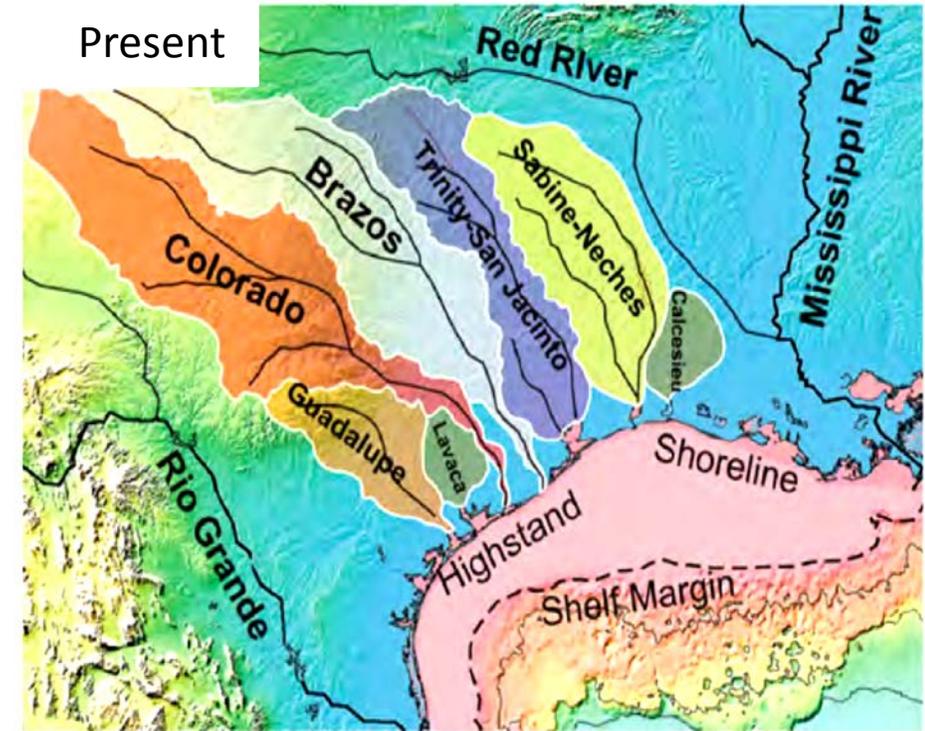
modified from SPECM AP (Imbrie et al., 1984)

18,000 yr BP

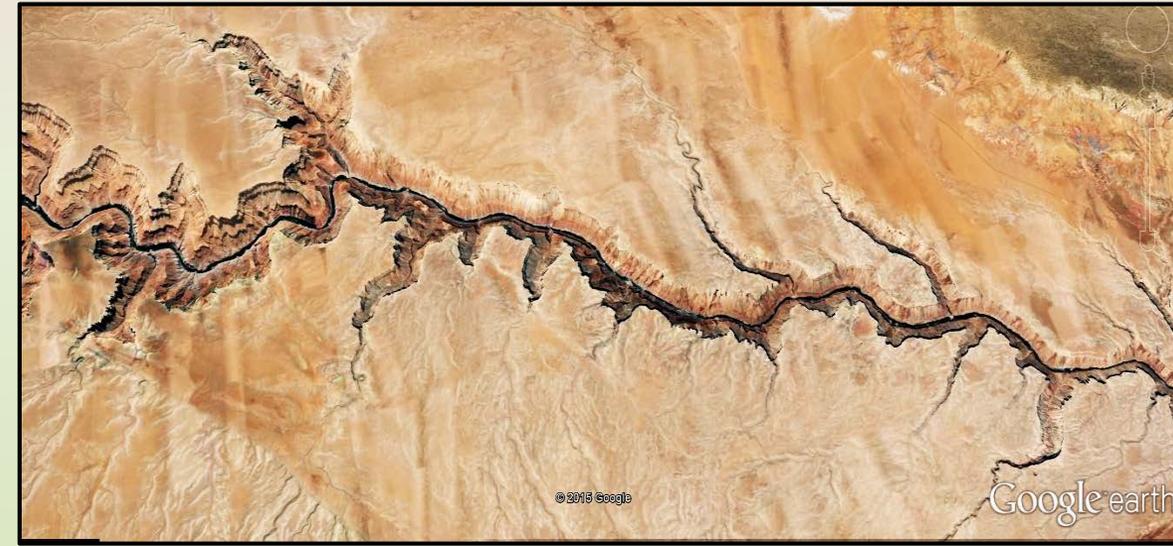
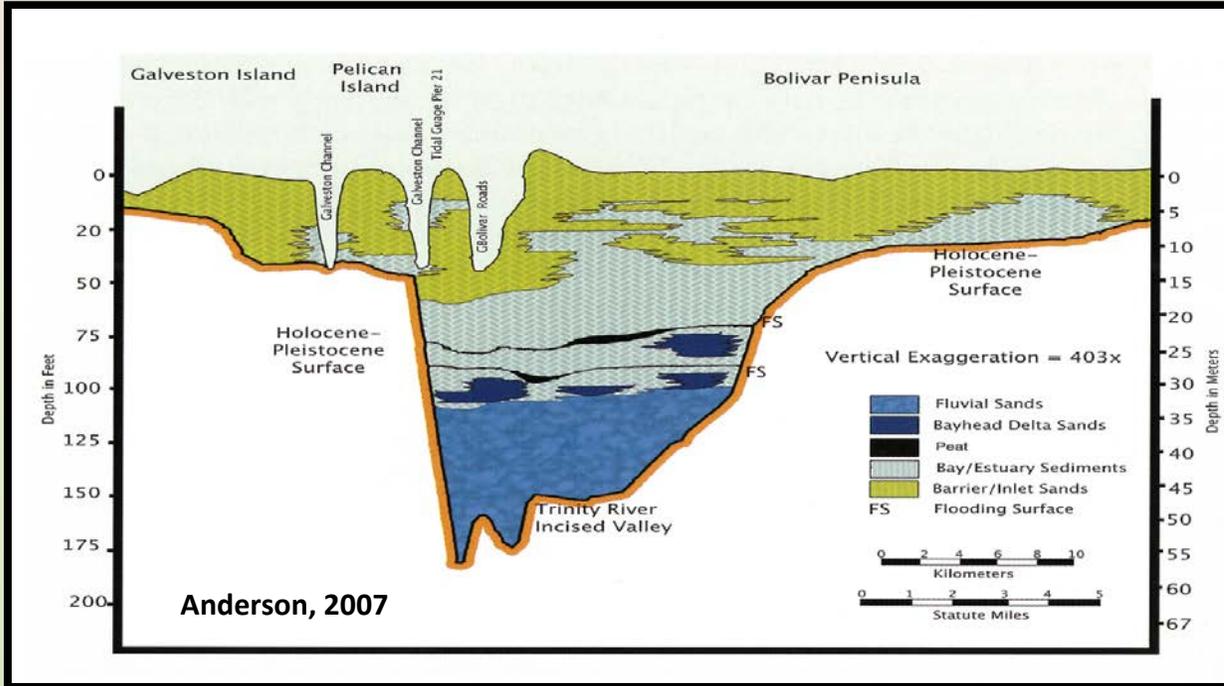


Blum et al., 2013

Present



RIVER VALLEY FILLS ENDED ABOUT 6,000 YEARS BP



MIGRATING FLOOD DELTAS (BOLIVAR PENINSULA AND EAST GALVESTON BAY)



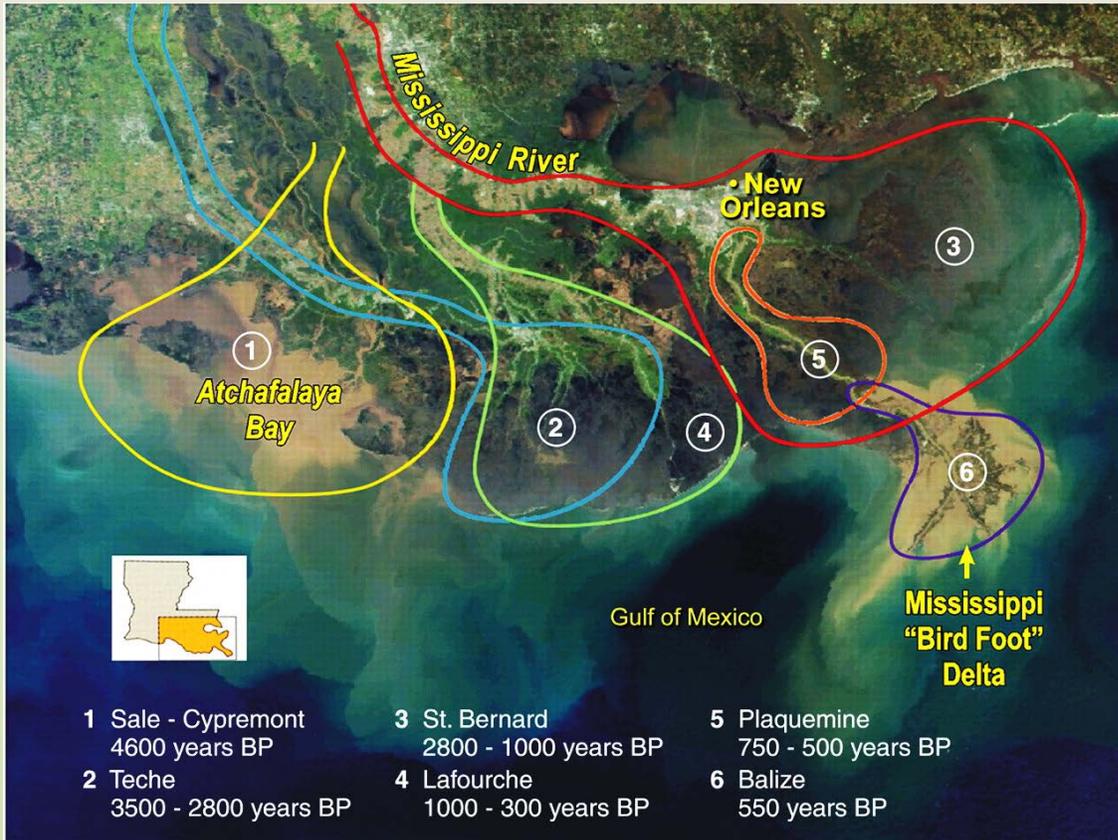
East Galveston Bay Coastal System includes Morphologies and Ecosystems created with **abundant sediment supply** and dynamic processes



It took a few thousands years to get built

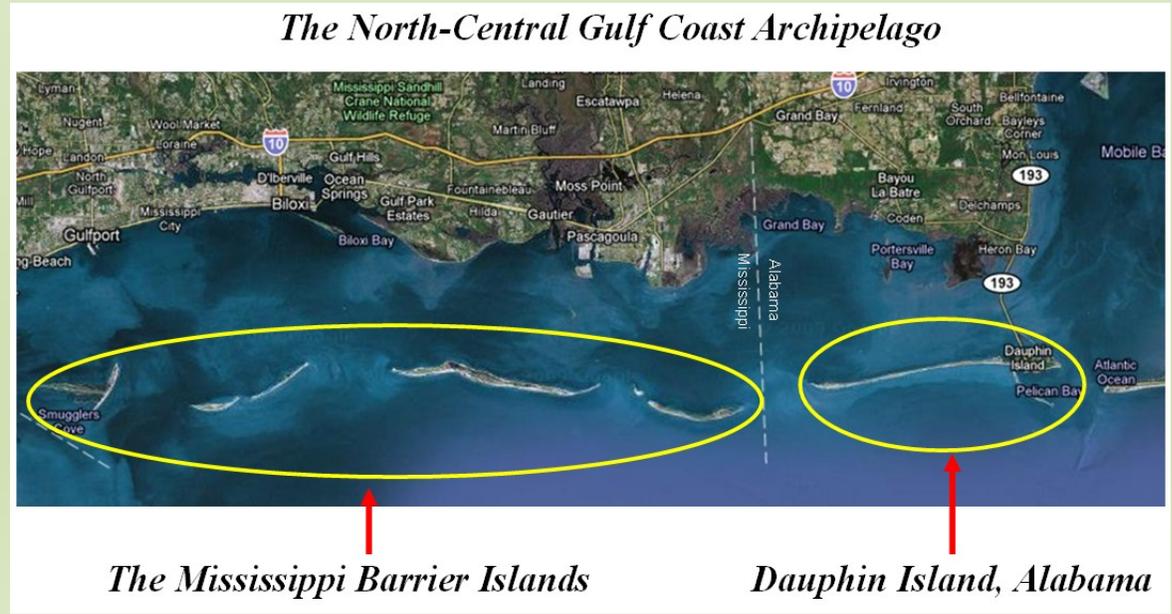
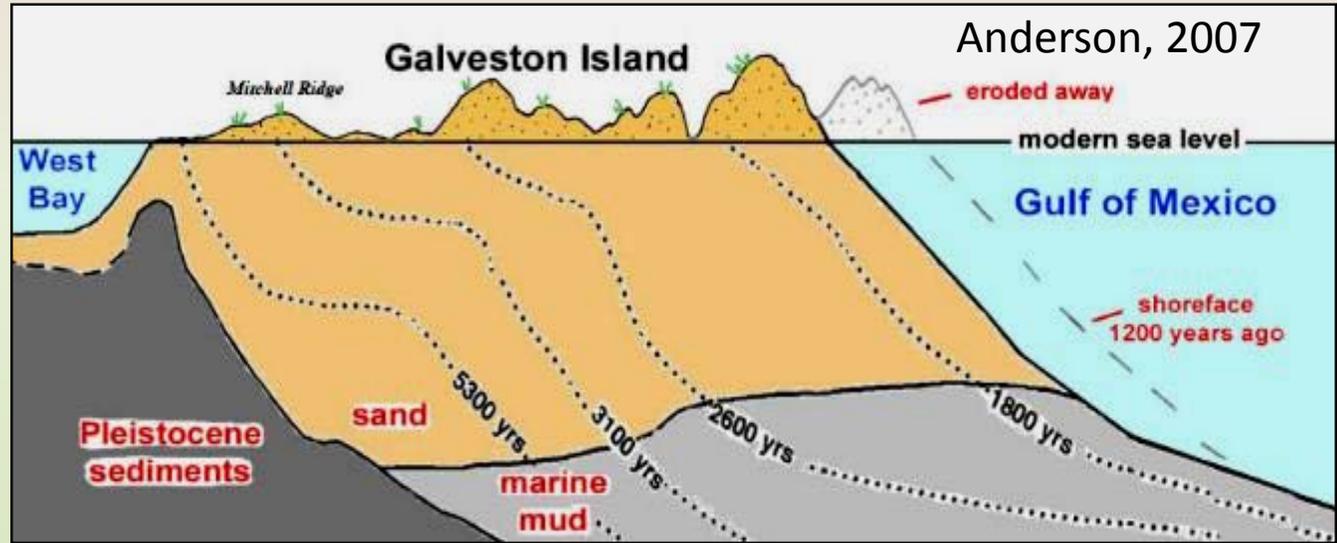
Texas Coastal Systems about **6,000 years old!**

REGIONAL SEDIMENT DEFICITS



<http://www.utexas.edu/beg/>

Sediment Supply is critical at local and regional level

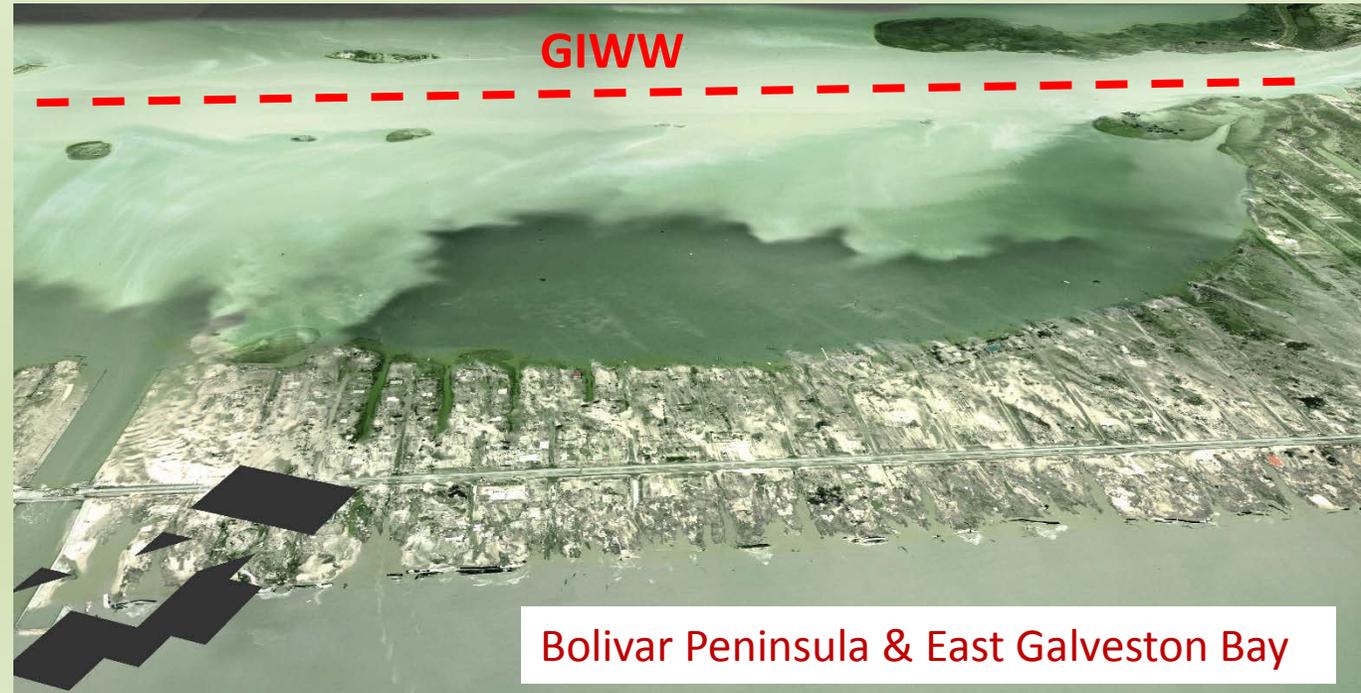
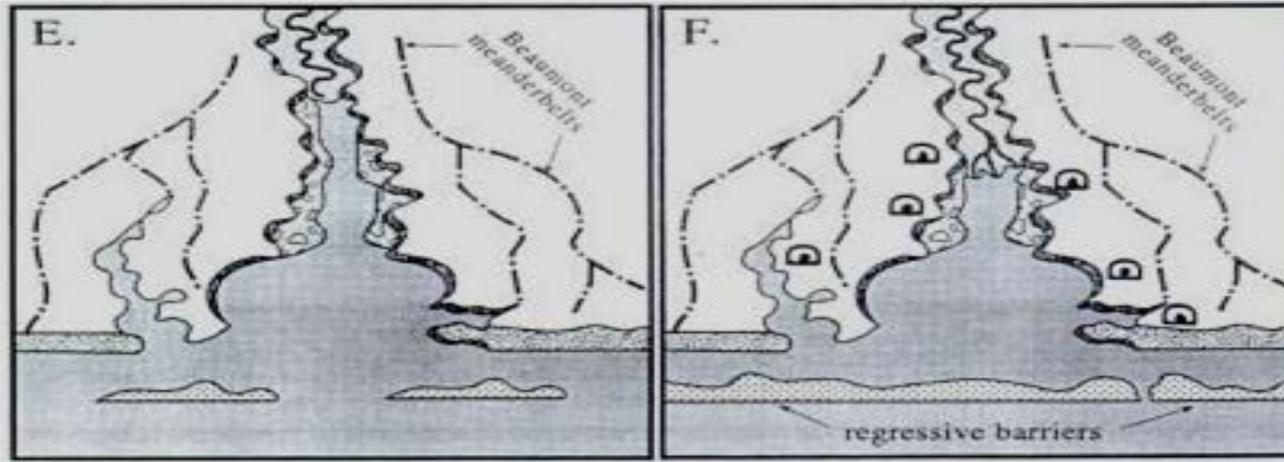


The Mississippi Barrier Islands

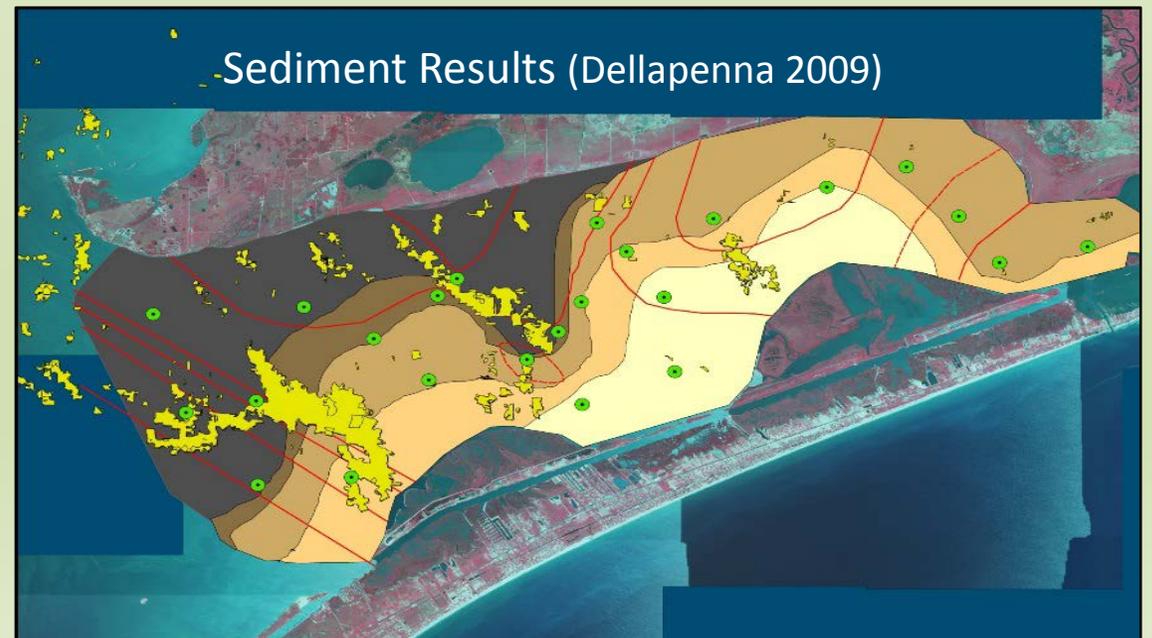
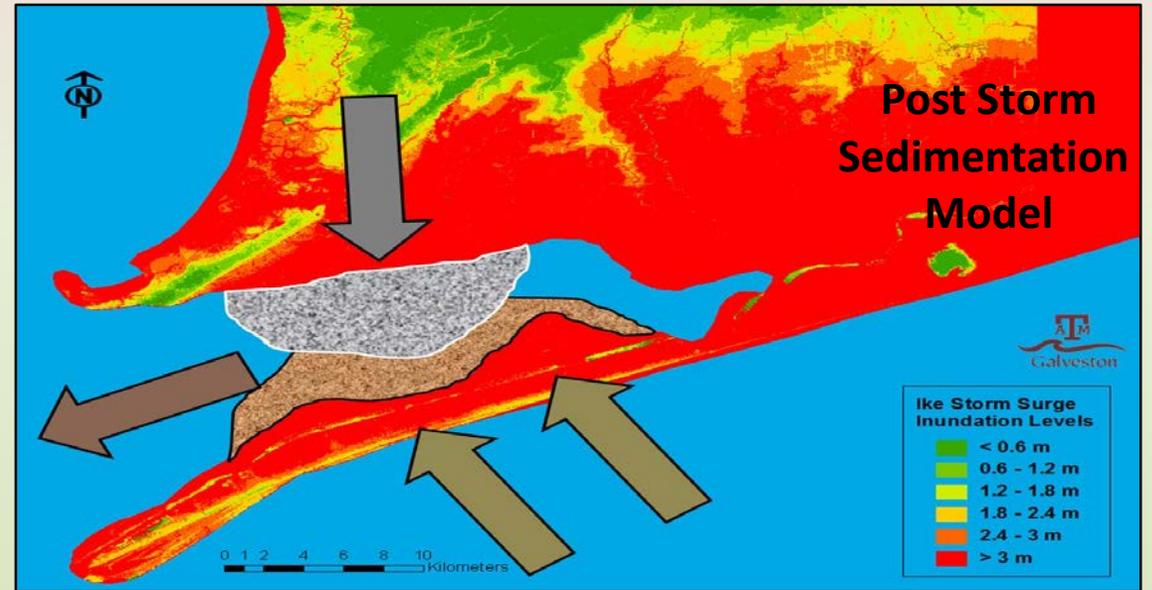
Dauphin Island, Alabama

<http://www.dauphinislandrestoration.org/1-images/satellite/North-Central-Gulf-Coast-Archipelago-6.jpg>

BARRIER ISLANDS AND BAY SEDIMENTATION

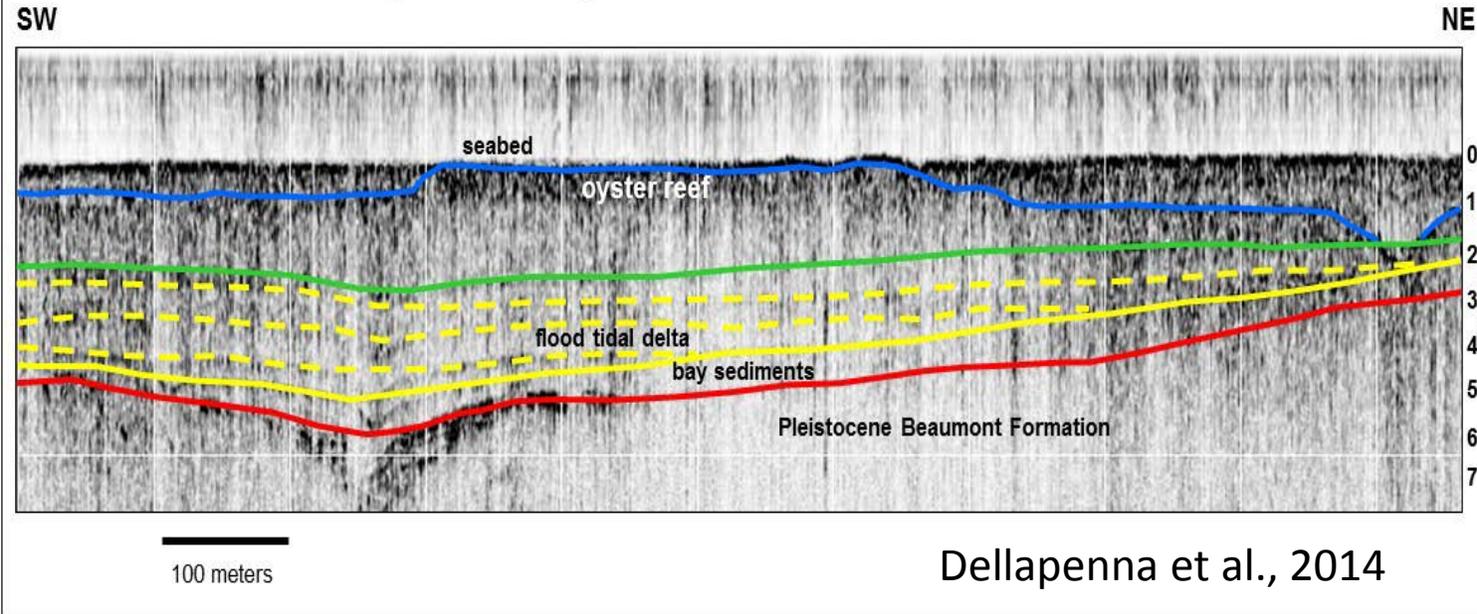


STORM IMPACTS AND SEDIMENT INPUTS

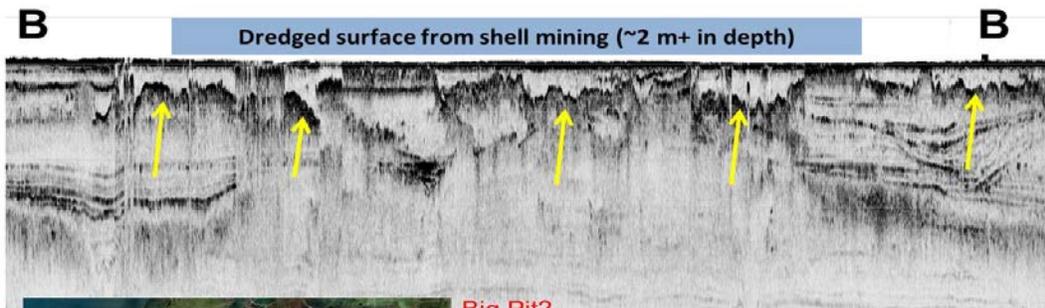
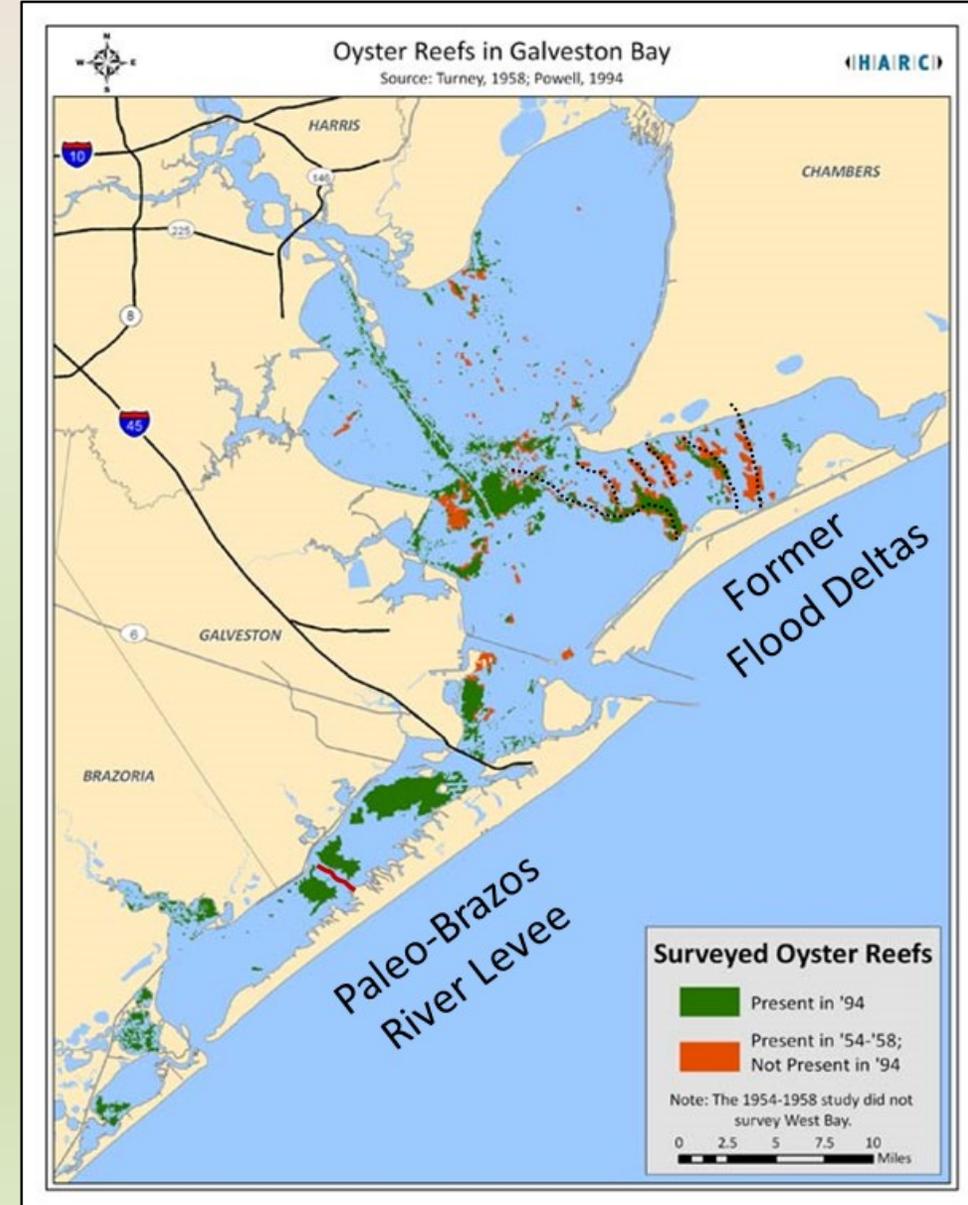


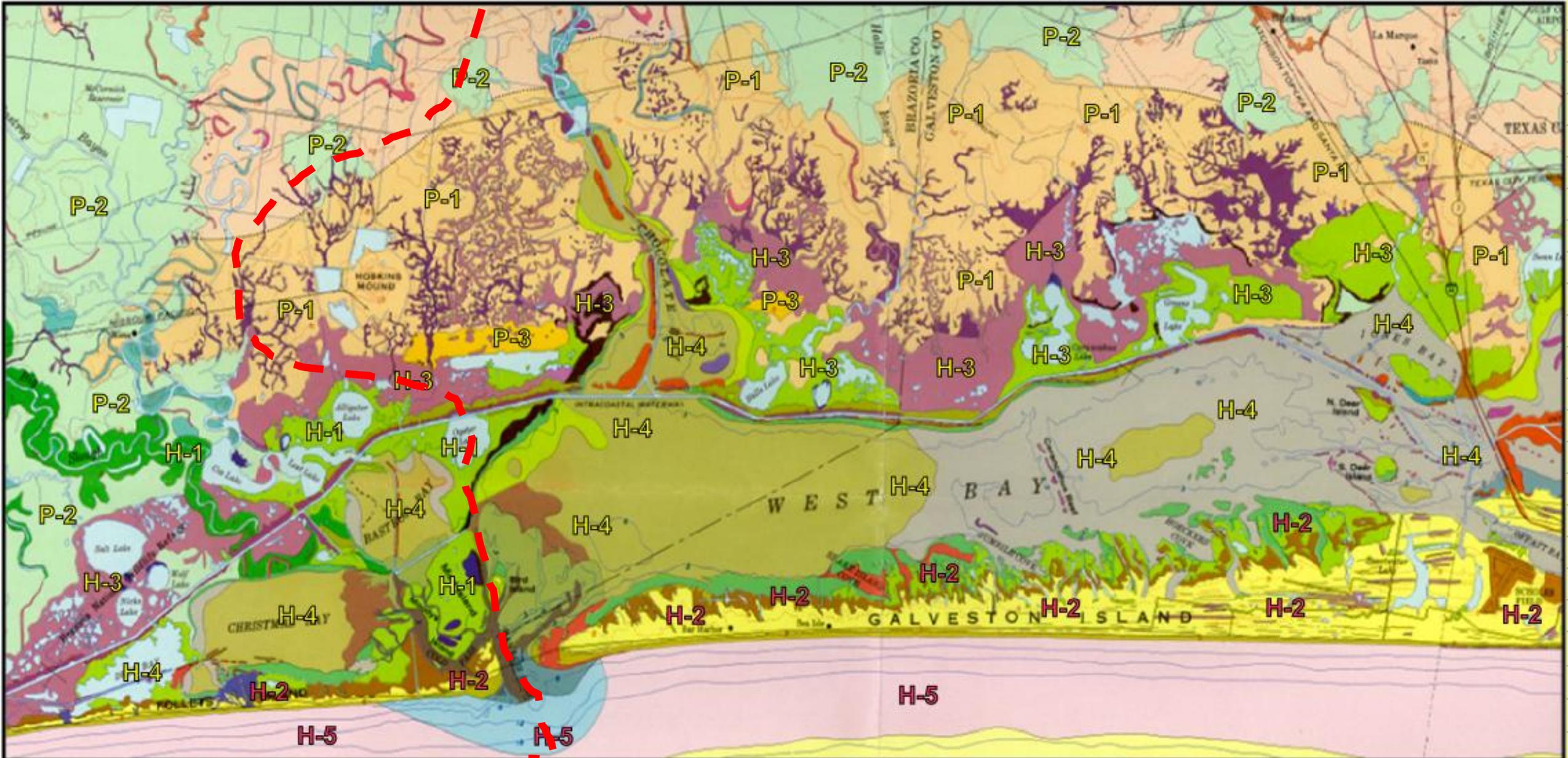
GEOMORPHOLOGICAL EVOLUTION AND ECOSYSTEMS: ECO-GEOMORPHOLOGY OF OYSTER REEFS

Interpreted Chirp Seismic Line 34 over Middle Reef



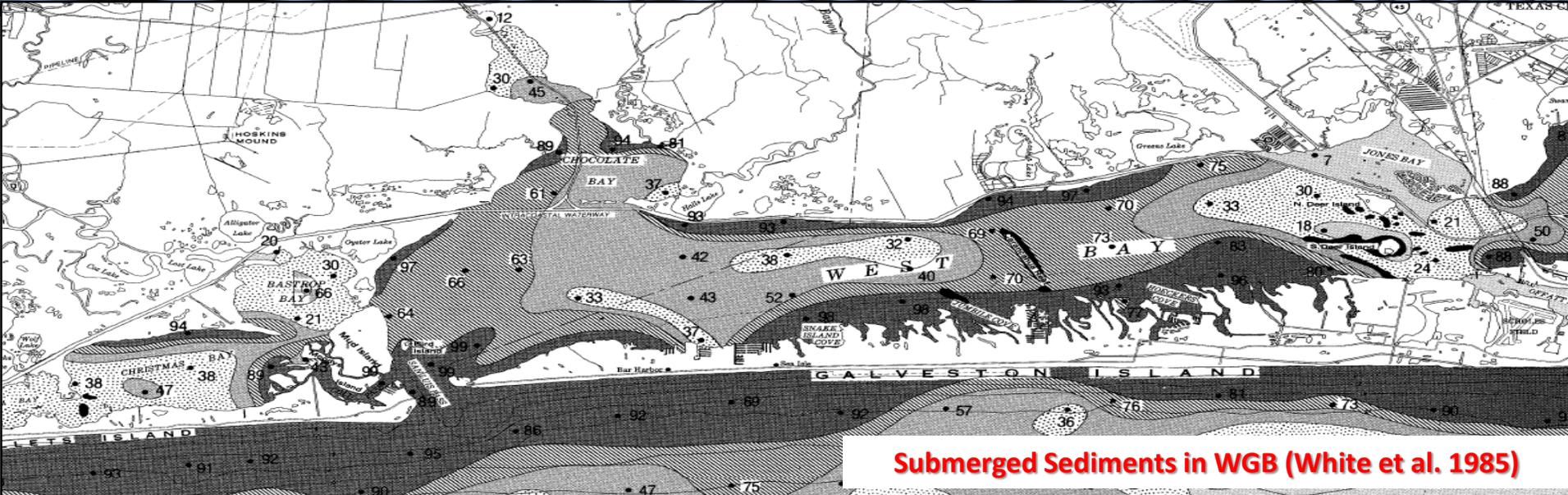
Dellapenna et al., 2014





WEST GALVESTON BAY SEDIMENT METHODOLOGIES: FROM BEG MAPS TO AN RSM PLAN

Passive Methodology



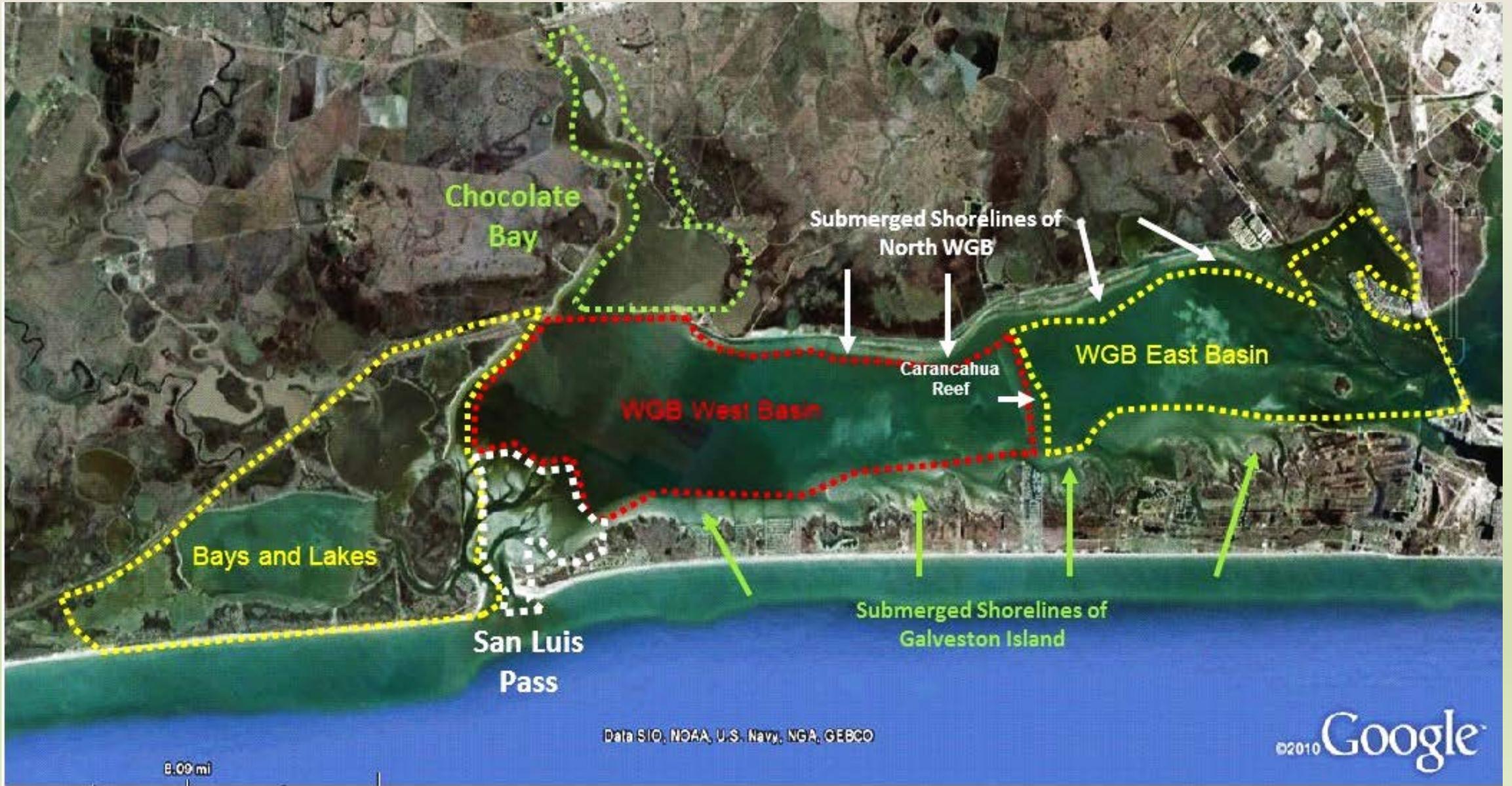
Submerged Sediments in WGB (White et al. 1985)

Pro-Active Methodology



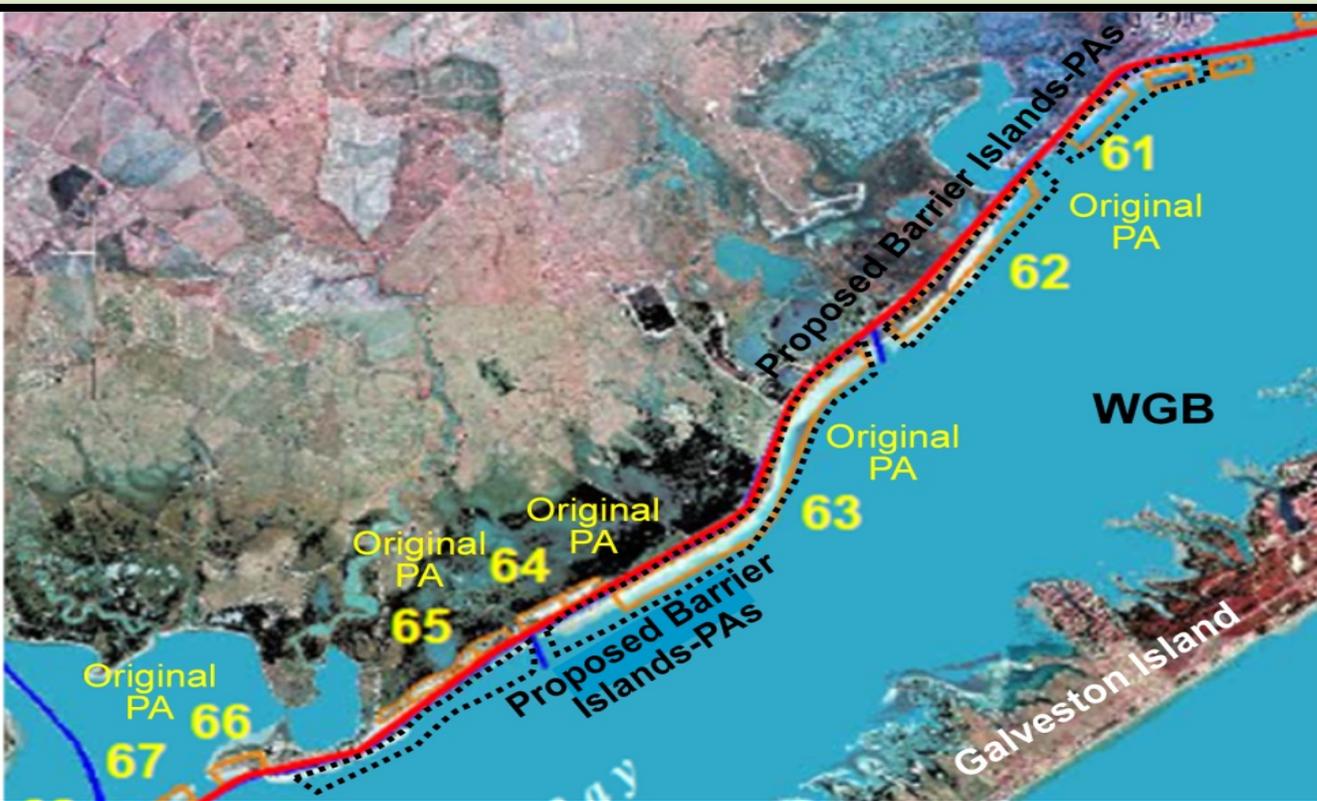
Sampled Sediments in WGB (Moya et. al., 2011)

WEST GALVESTON BAY DOMINATED BY LOCAL SEDIMENTARY CELLS



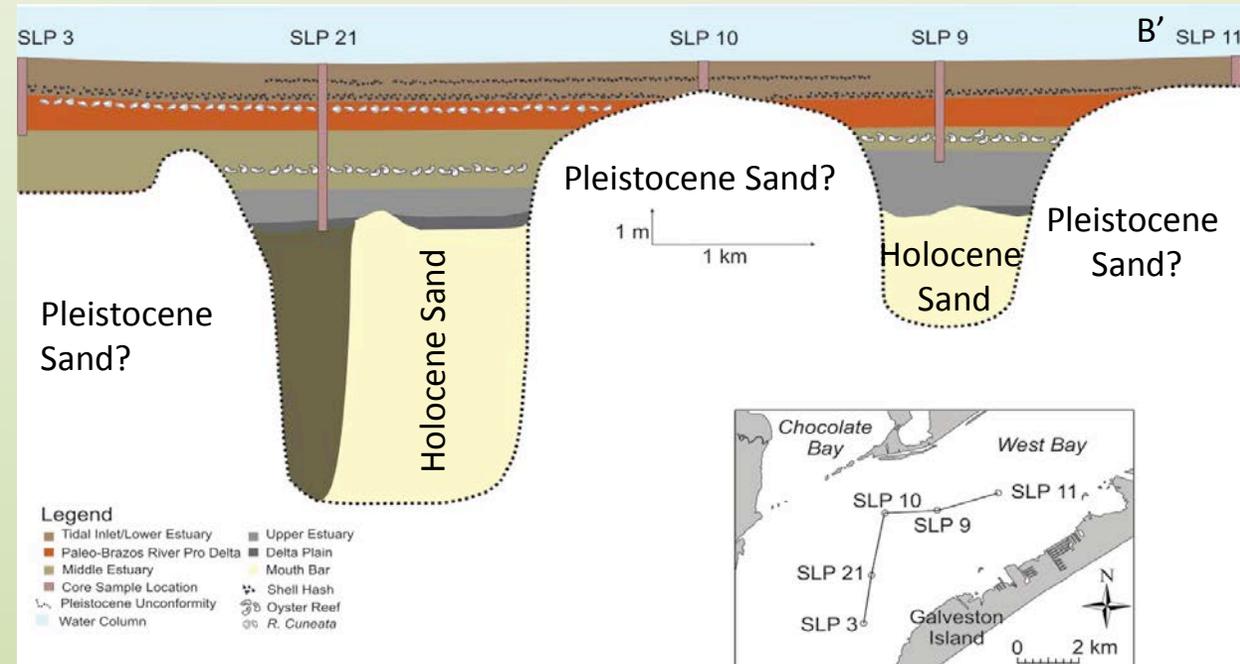
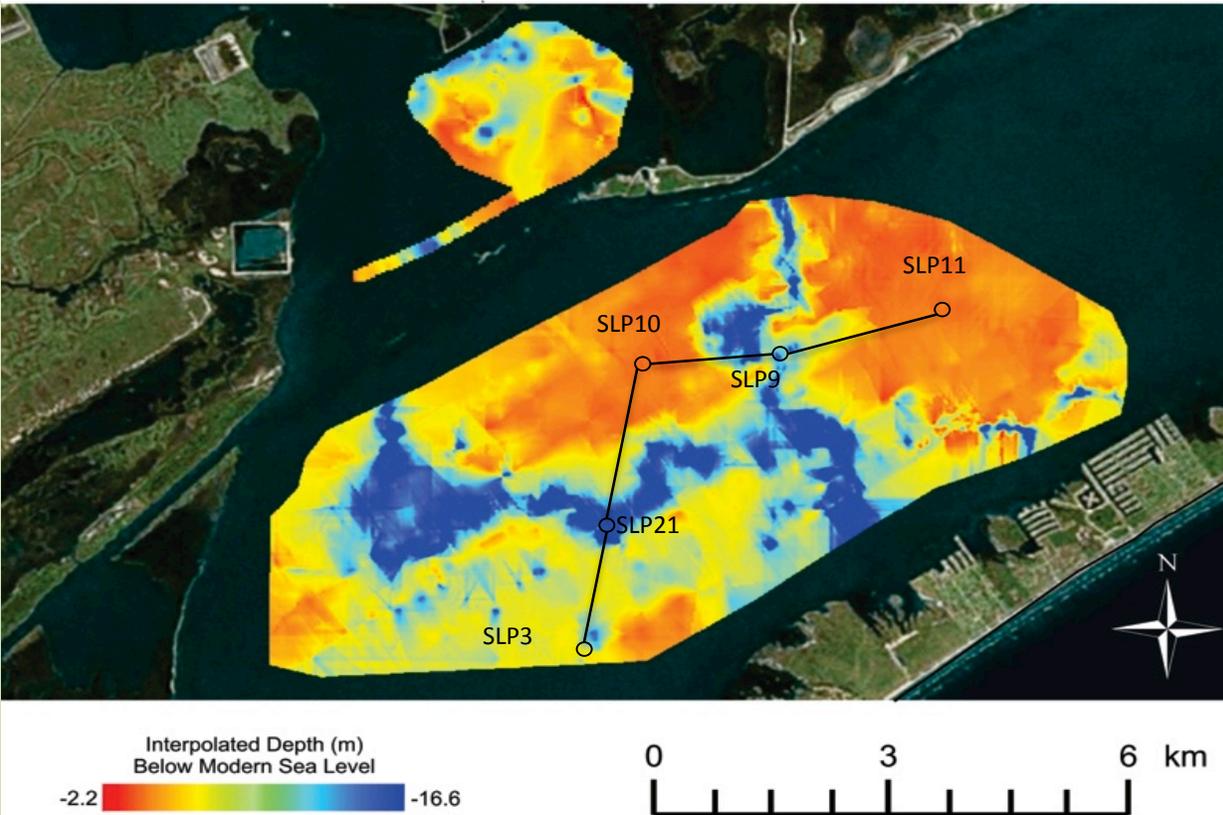
TEXAS NAVIGATION CHANNELS AND GEOLOGICAL PROCESSES

- Dredge Material Placement Areas: Channel Protection and Habitat Alternative
- Habitats disappearing from Adjacent Submerged Lands
- GIWW: A Sediment Trap



(Moya et al., 2012)

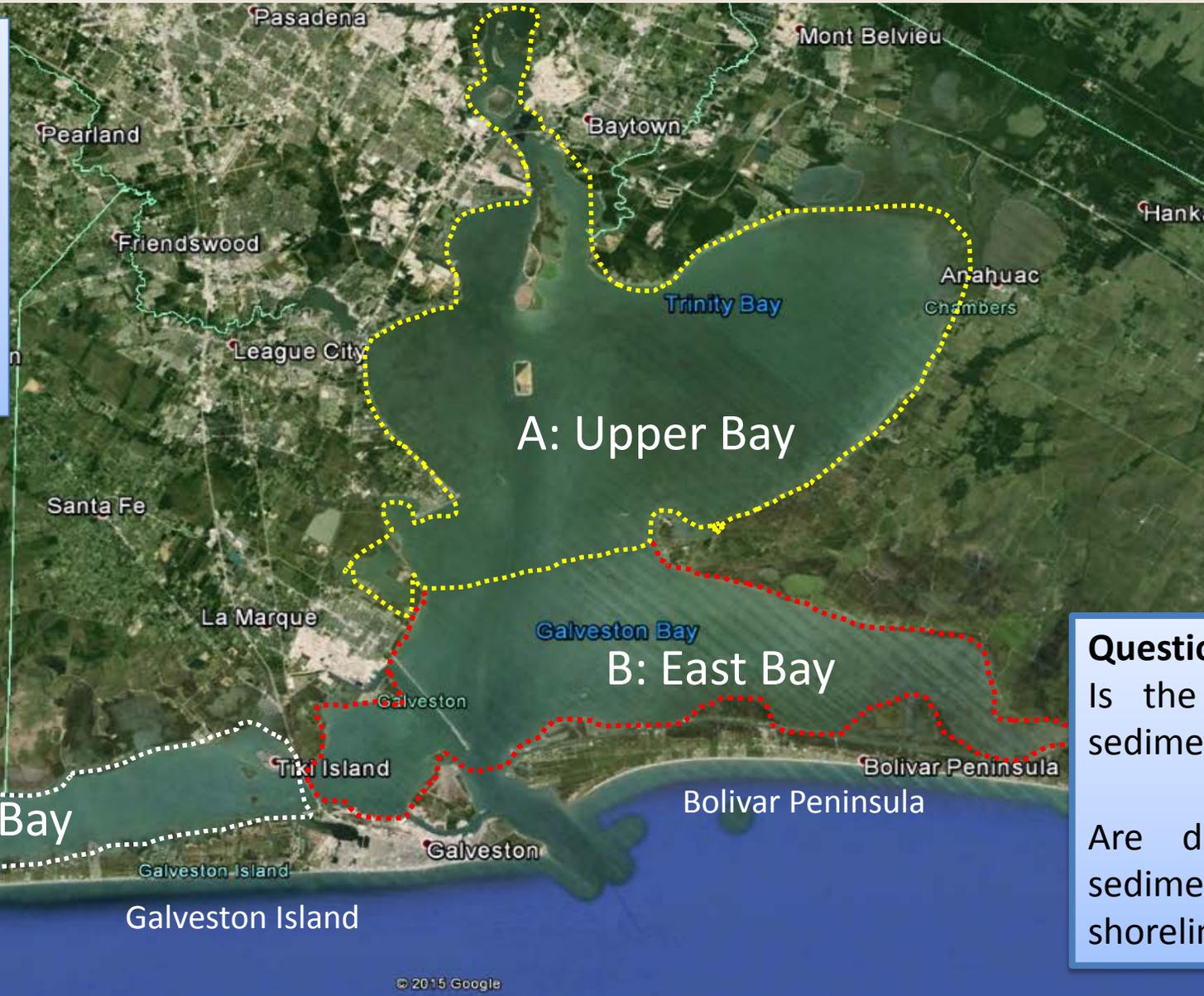
WHERE IS THE SEDIMENT BANK?



Dellapenna et. al., 2014.

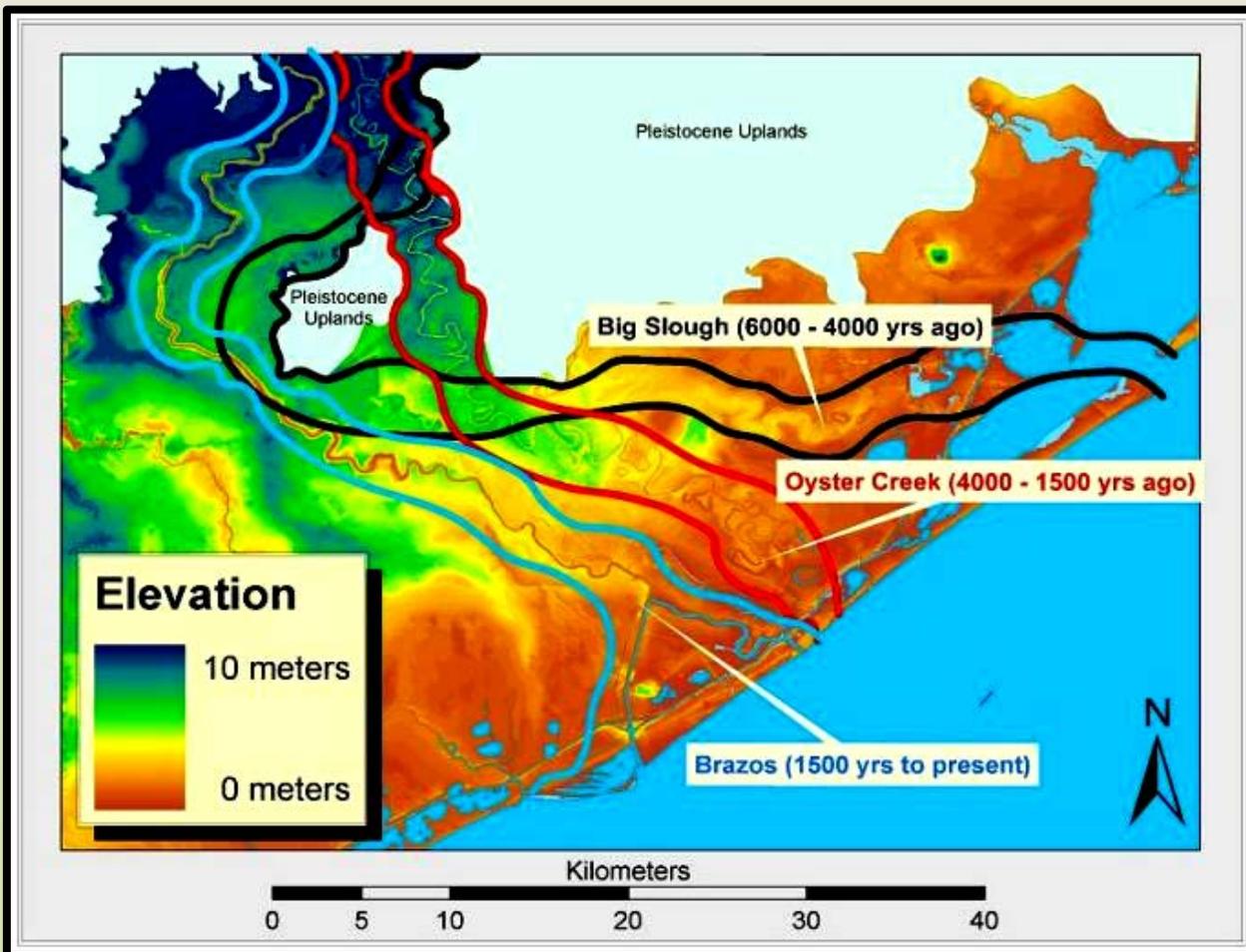
GALVESTON BAY: ONE LARGE BAY, THREE DIFFERENT ESTUARIES

From 1850 to 1993 at least 260 Millions of cubic yards of sediments (and dredge material) were excavated or dredged in Galveston Bay for federally maintained navigation channels (Ward, 1993).



Questions:
Is the Upper Bay a closed sediment system?
Are dredged materials the sediments coming from the shorelines and Bay bottoms?

BRAZOS DELTA: DELTA SYSTEM STARTED REVERSING THE MORPHOLOGICAL PROCESSES



Anderson, 2007.

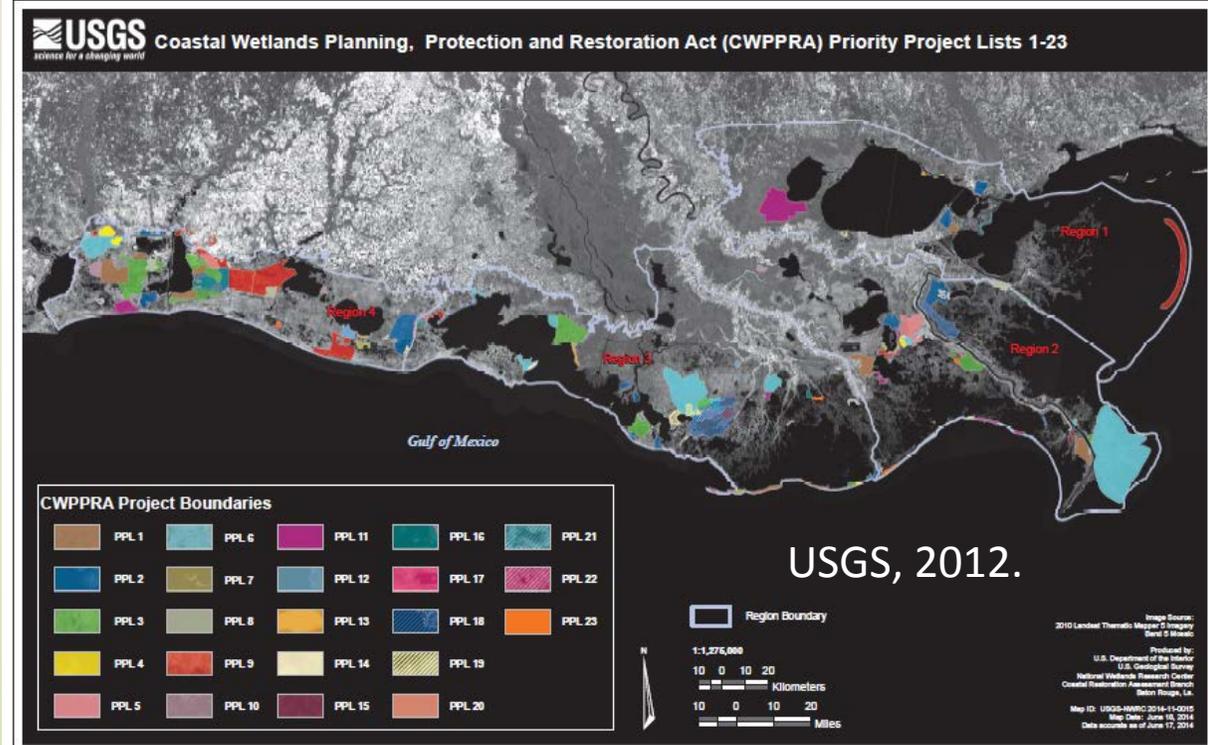
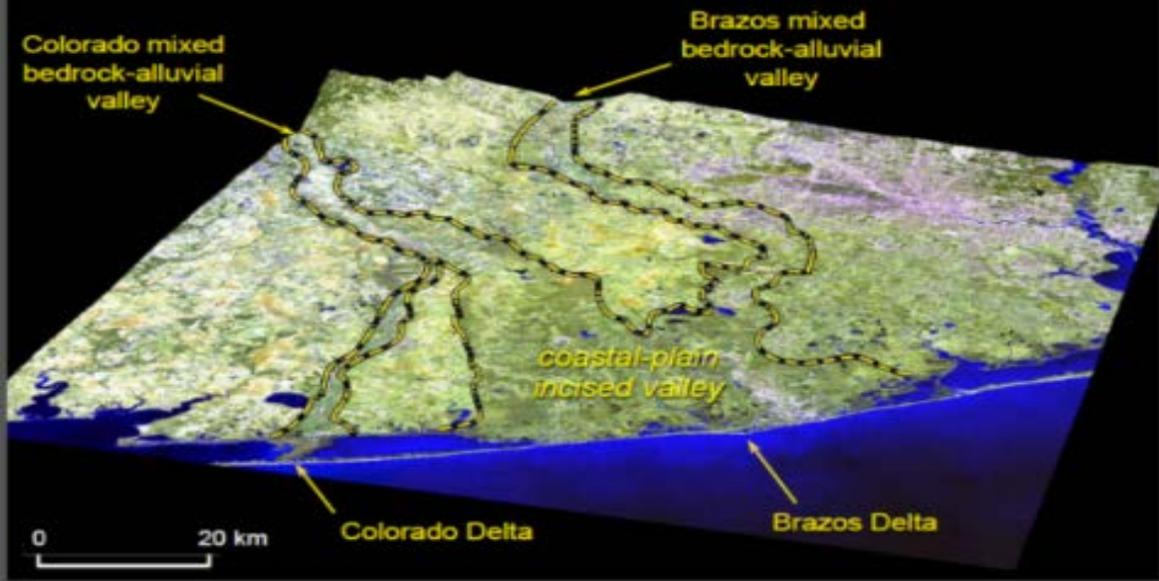


PLATE 3

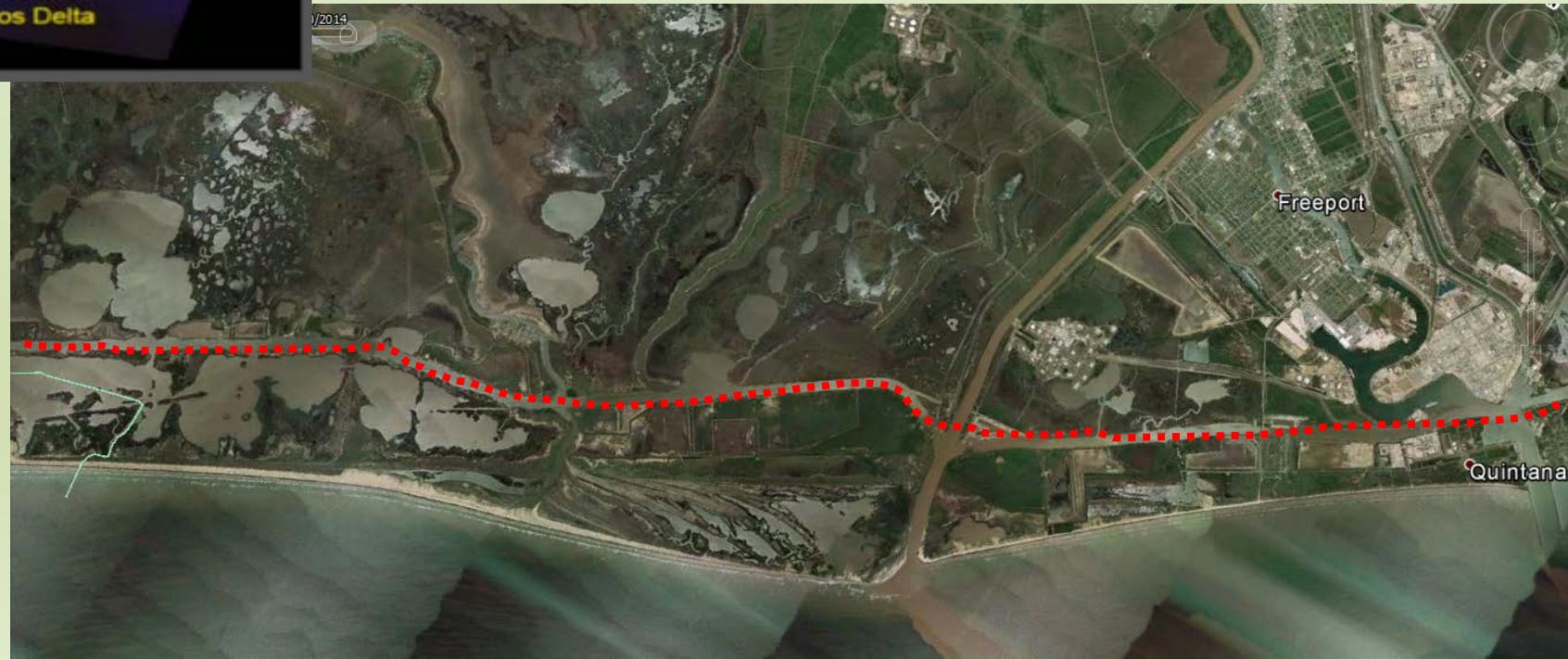
REVERSE GEOLOGIC EVOLUTION AND HABITAT LOSS

Last 100 kyr Glacial-Interglacial Cycle



Accelerated Land Loss:

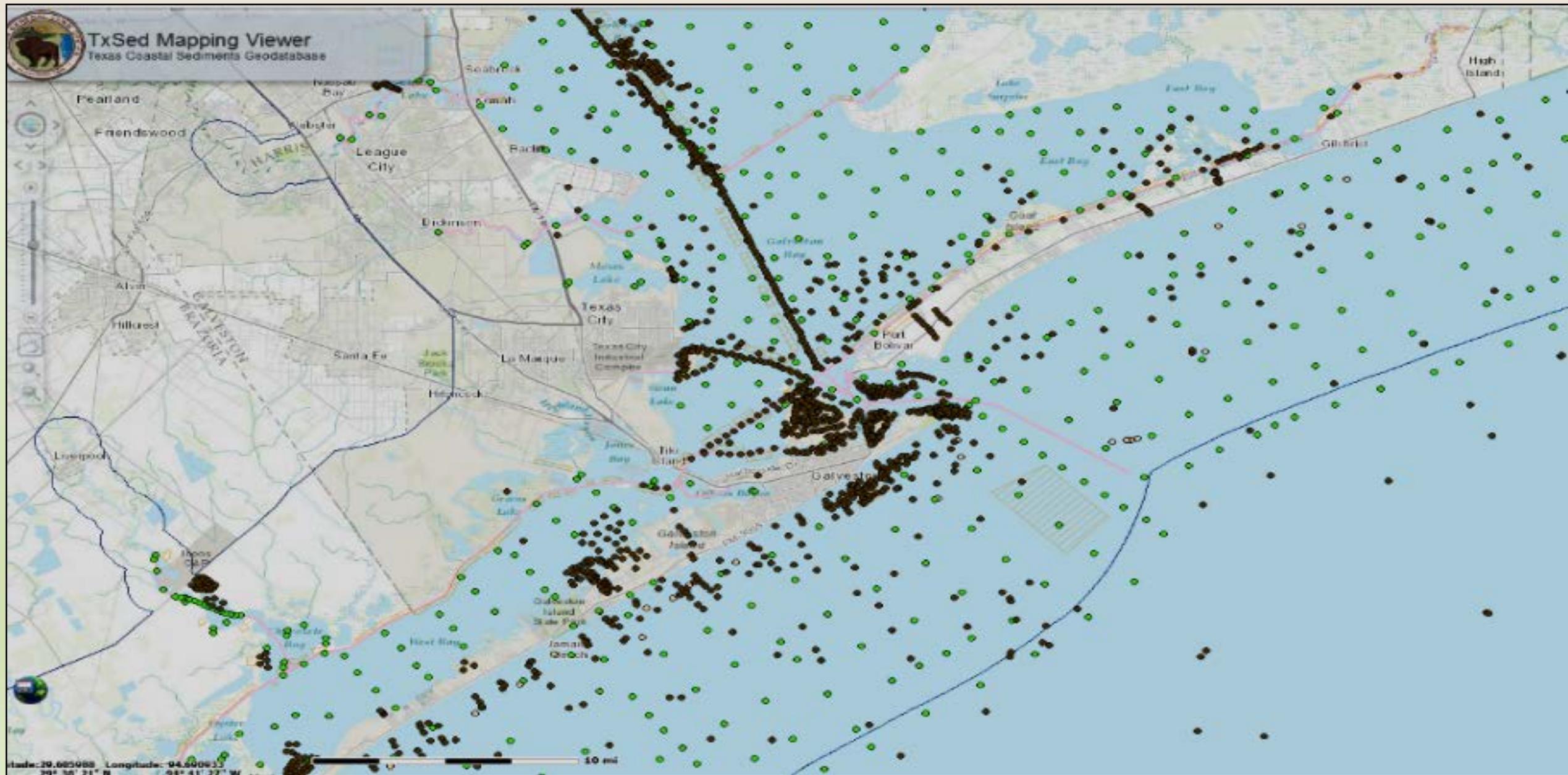
- Relative Sea Level Rise
- Lack of sediment Supply



MODERN BRAZOS RIVER DELTA DOMINATED BY EL NIÑO



TEXAS COASTAL SEDIMENTS GEO-DATABASE (TXSED)



CONCLUSIONS:

We can anticipate the materials that we will be dredging **if we Understand:**

- The geologic evolution of the coastal system
- The geomorphological processes dominating the coastal system
- How ecosystems reacted to these geological and geomorphological changes

We can't build with Nature **if we don't understand:**

- Why Nature is reacting like that (***Reversing Geological Processes***)

Coastal Systems are Complex and ***Require Multidisciplinary Approaches***

Oyster Analysis included: Geophysicist, Geologist, Geomorphologist, Coastal Engineer, Aquatic (Fish and Oyster) Ecologist, and Environmental Planner



Perspective of Geoscientists:

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