A Texas Coast-Wide Project to Restore Wetlands through the Beneficial Use of Dredged Material – Beneficial Use Design

Rick Coupe, Anchor QEA, and Carter Coleman, Ducks Unlimited

WEDA Dredging Summit and Expo 2022, Houston, Texas

ANCHOR QEA

DUCKS UNLIMITED

SARGENT CONSULTING

Texas Department of Transportation

Introduction

Design Objectives

- Programmatic Goal: Develop “shovel-ready” BU sites along Texas Coast that can be utilized for public and private dredged material
- Project-Specific Goals
  - Select sites, develop 60% designs, and prepare permit applications for BU sites along the Texas Coast
  - 8 sites selected from pool of 160+
  - 2 alternate sites selected
  - End goal to create healthy high marsh with tidal connectivity

Siting Criteria

- Suitable for tidal estuarine marsh habitat
- No armored protection required
- Target open water areas
- Held by willing property owners
- Located near sediment source(s)
- Limited natural and cultural resource concerns
- Site identified (positively) elsewhere

ANCHOR QEA

Data Collection

- Elevation Surveys
  - Open water bottom elevation
  - Marsh edge and platform elevation
  - Access open-source elevation data (USGS, TNRIS, etc.) to develop DEM
- Site-Specific Water Surface Elevation
  - Utilize publicly available date (NOAA tide gauges, etc.)
  - Develop frequency distribution curves
- Healthy Marsh Vegetation Surveys
  - Identify healthy marsh vegetation populations at each Site
  - Survey specific elevation range in which various species thrive

ANCHOR QEA

Survey Coverage Examples

2020 Site Survey Points

Aerial Imagery Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

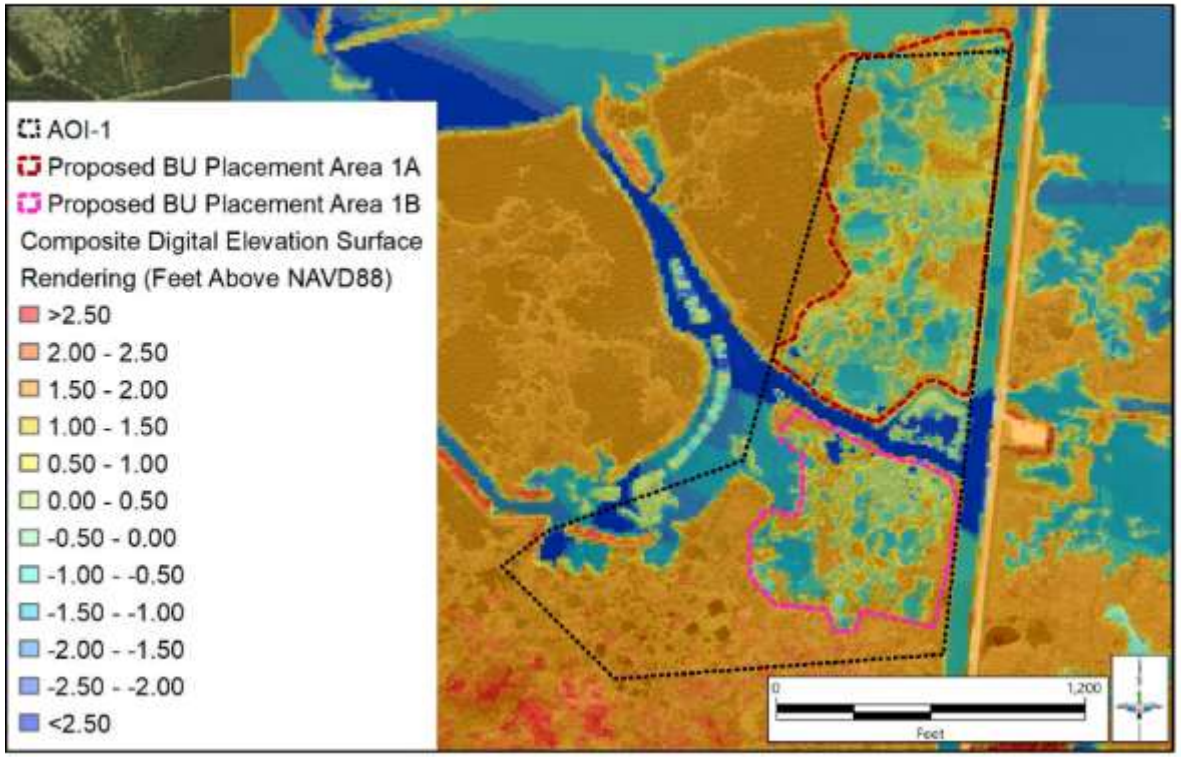
2020 Site Survey Points

Aerial Imagery Source: USDA FSA (NAIP)

ANCHOR QEA

Data Analysis – Digital Elevation Models

Proposed 30% BU Placement Area Footprints in AOI-1



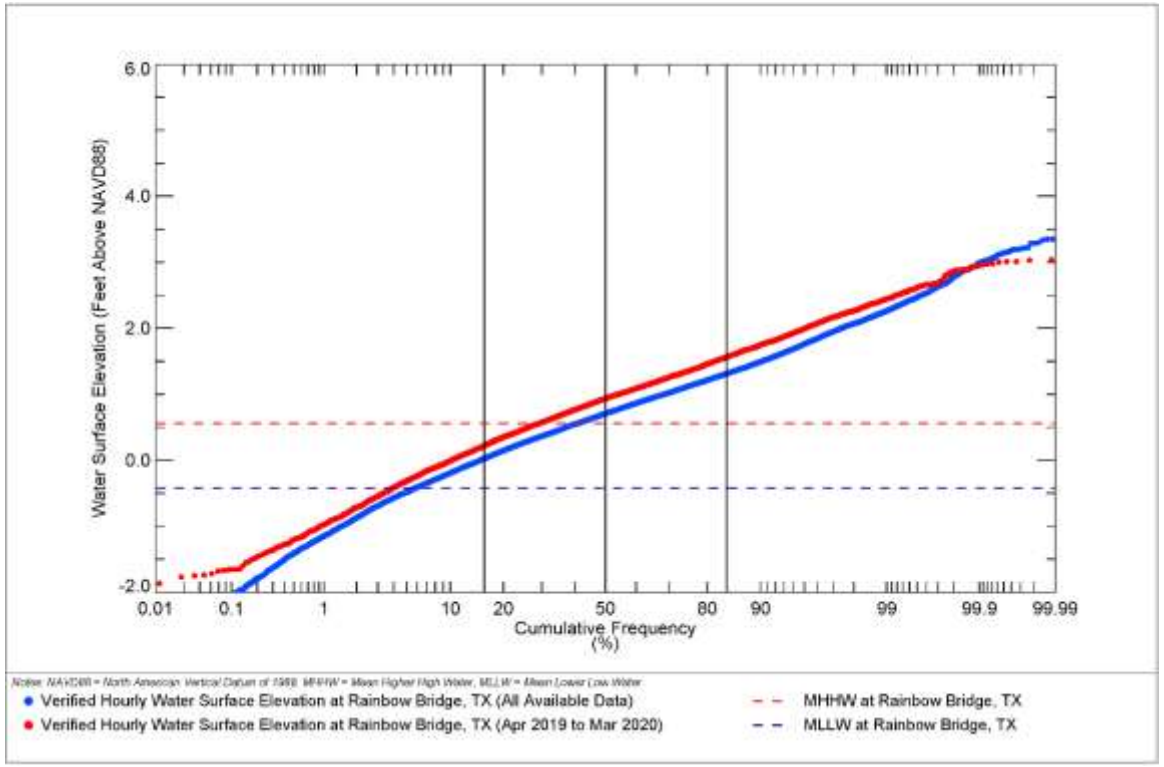
Aerial Imagery Source: 2018 USDA NAIP (USDA 2018)

- Combine open-source LiDAR with field survey data
- Useful to visualize areas of broken marsh and high points
- Used in combination with other data to identify potential placement areas

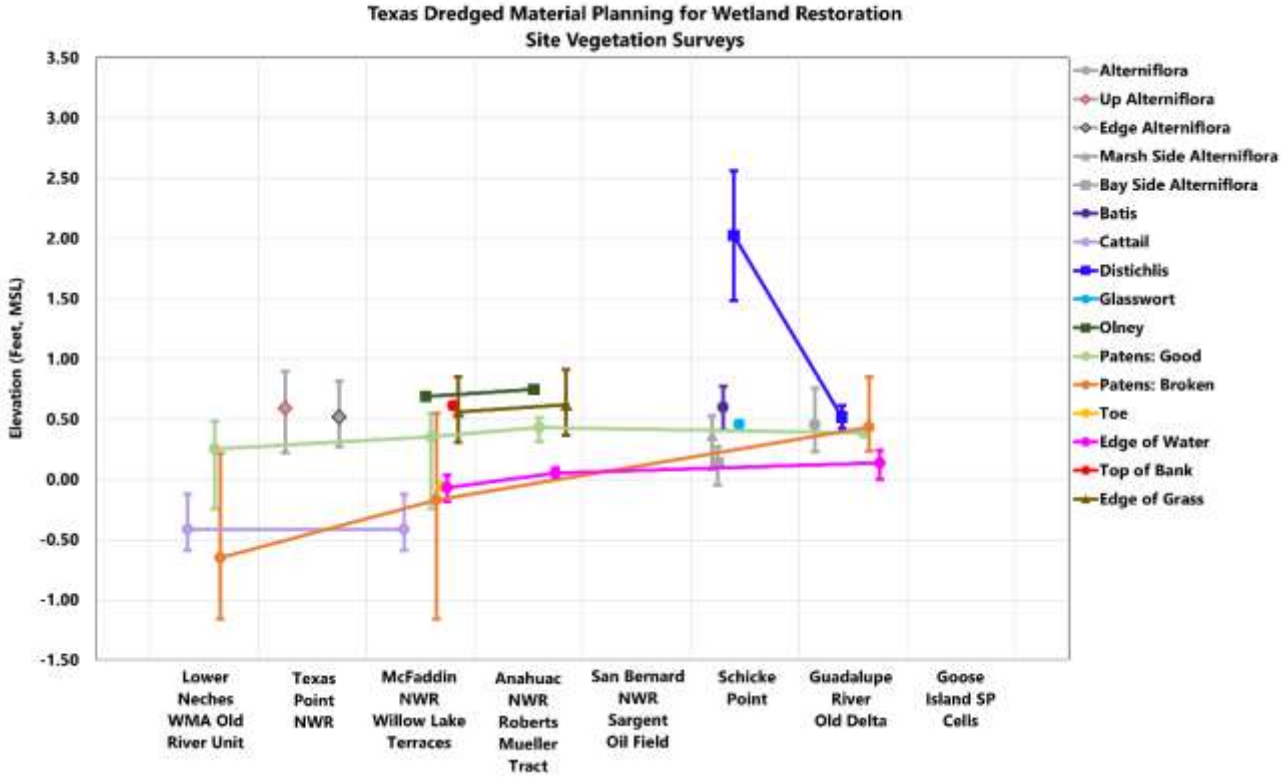
ANCHOR QEA

Data Analysis – Water Surface Elevation Frequency Distribution Curves

- Utilized locally available NOAA tide gauge date
  - Long-term
  - Lots of data points
  - Site-specific (hopefully)
  - Some gauges not tied to NAVD88
  - RLSR trends apparent in many data sets
- Used curves in concert with healthy vegetation surveys to develop proposed top of marsh and subsequent containment elevations



Data Analysis – Healthy Marsh Elevations



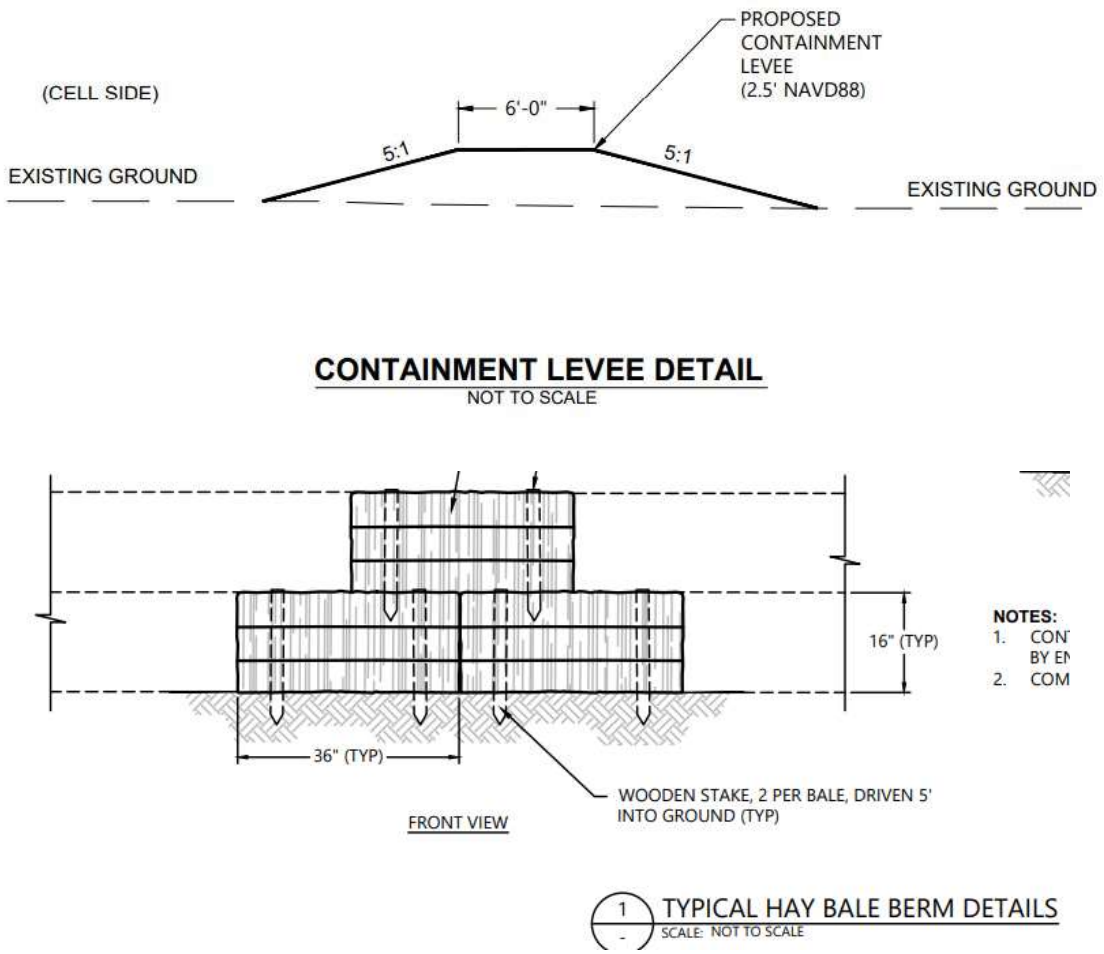
- Used in concert with survey data, WSE, and DEM to develop proposed top of fill and containment elevations
- Some regional variability in the data meaning site specificity important
- Helped to target specific species based on ideal elevation ranges

ANCHOR QEA

BU Material Placement

- Assumed open pipe discharge
- Final desired surface to mimic existing marsh with tidal influence and drainage
- Proposed final placement elevation based on survey data, DEM, WSE analysis, and healthy vegetation surveys
- Placement elevation range of 0.5 to 1.0 ft MSL used for all sites based on data analysis
- Ranges from 0.5 ft up to 1.5 ft NAVD88 were selected for the various sites based on local datum conversions from MSL
- Chose higher end of marsh elevation to accommodate some RLSR effects

Containment Construction

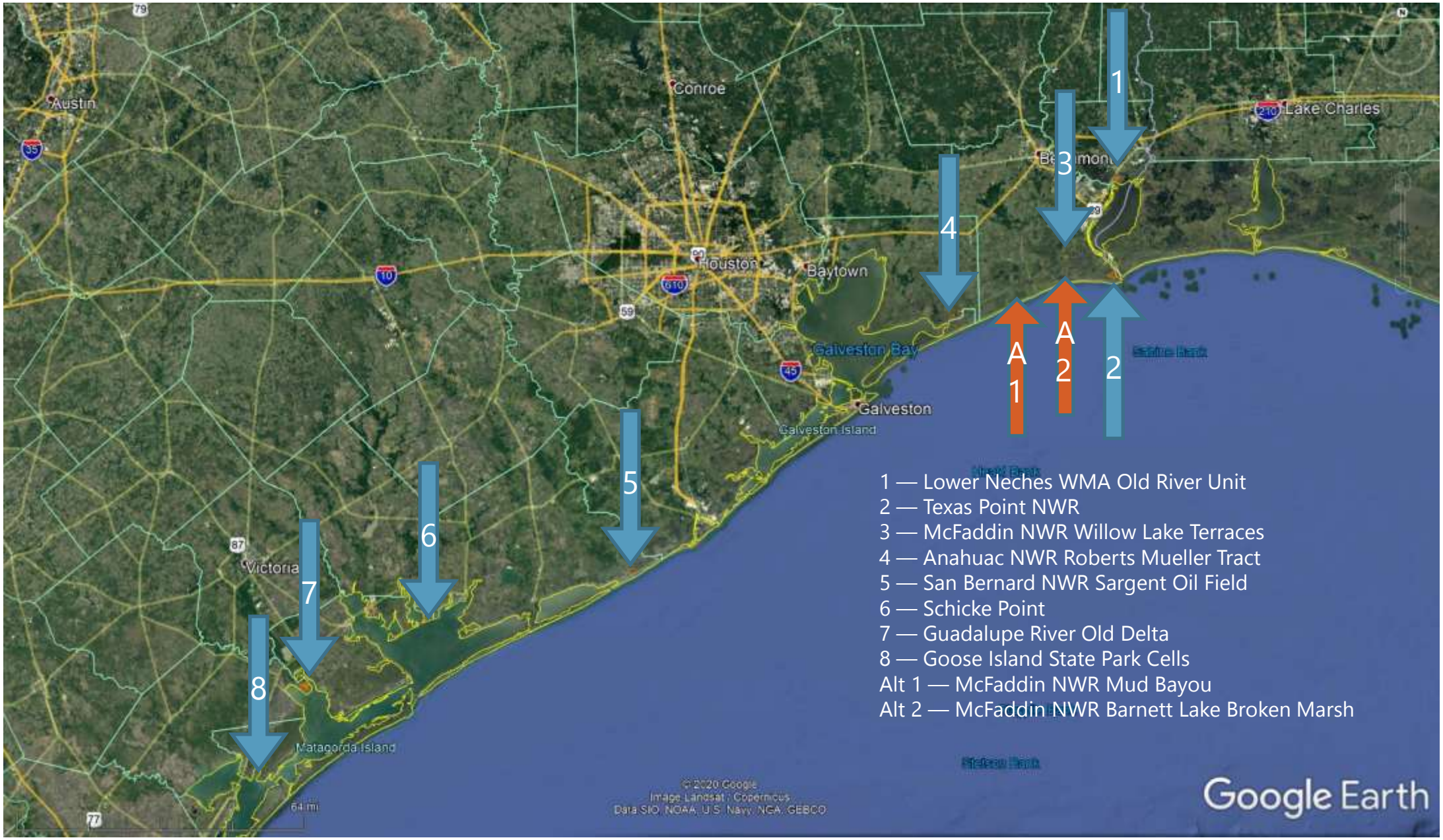


- Typically side-cast from on-site material, if possible
- Other options left open at 60% level to allow for flexibility
  - Hay bale berms
  - Silt fence
  - Dredged material berms
- Due to interior marsh locations, some areas may not need 100% containment

ANCHOR QEA

Site-Specific Cost Estimates

- Cost estimates developed for all sites
- Costs represent incremental cost beyond what USACE pays for dredging and placement
- Included
  - Permitting, design, and engineering costs to move to 100% design
  - Pre-construction surveys
  - Construction
  - Construction Management/Quality Assurance
  - Limited Planting
  - Post-Construction Monitoring
  - 30% contingency


Austin
Conroe
Houston
Baytown
Lake Charles
Galveston Bay
Galveston
Galveston Island
Victoria
Matagorda Island
1
2
3
4
5
6
7
8
A 1
A 2
1 — Lower Neches WMA Old River Unit
2 — Texas Point NWR
3 — McFaddin NWR Willow Lake Terraces
4 — Anahuac NWR Roberts Mueller Tract
5 — San Bernard NWR Sargent Oil Field
6 — Schicke Point
7 — Guadalupe River Old Delta
8 — Goose Island State Park Cells
Alt 1 — McFaddin NWR Mud Bayou
Alt 2 — McFaddin NWR Barnett Lake Broken Marsh
© 2020 Google
Image Landsat / Copernicus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google Earth

Lower Neches WMA Old River Unit

Sediment Source

Sabine Neches Waterway

Project Size

224 acres

Total Volume

~300,000 to 400,000 cy

Cost Estimate

$5.6M

Data Collected

- 1,277 acres of Topo/bathy
- Healthy vegetation

Additional Data

- NOAA shoreline
- Texas Natural Resources Information System (TNRIS) LiDAR
- Existing infrastructure

Identification Criteria

- Elevation
- Drainage
- Infrastructure
- Containment

Challenges

- Potential pipeline conflicts
- Potential right-of-access conflicts
- USACE levee project

ANCHOR QEA

McFaddin NWR Willow Lake Terraces

Sediment Source

Sabine Neches Waterway

Project Size

218 acres

Total Volume

~400,000 to 460,000 cy

Cost Estimate

$6.6 to 8.6M

Data Collected

- 1,065 acres of Topo/bathy
- Healthy vegetation elevations

Additional Data

- NOAA shoreline
- Existing infrastructure
- Existing as-built survey data

Identification Criteria

- Elevation
- Drainage
- Infrastructure
- Containment
- Previous work done

Aerial Imagery Sources: USGS EROS, USDA FSA (NAIP), TNRIS StratMap (TOP)

Challenges

- Project layout requires state and federal access agreements
- Site access

ANCHOR QEA

Guadalupe Old River Delta

Sediment Source

Victoria Barge Canal

Project Size

1,085 acres

Total Volume

~1.5 to 1.9 mcy

Cost Estimate

$19.6M

Data Collected

- 1,430 acres of Topo/bathy
- Healthy vegetation

Additional Data

- TNRIS LiDAR
- Existing infrastructure

Identification Criteria

- Elevation
- Drainage
- Infrastructure
- Containment

Challenges

- Potential right-of-access conflicts
- Private landowner
- Very large project area

ANCHOR QEA

Next Steps

- Project substantially completed and Final Report submitted to TIG
- Future Actions
  - Develop 100% designs
  - Identify dredging projects
  - Implement BU sites along the Texas coast

ANCHOR QEA

THANK YOU

Rick Coupe, PE

Staff Engineer
Anchor QEA, Ocean Springs, MS
rcoupe@anchorqea.com

Texas Point NWR

Sediment Source

Sabine Neches Waterway

Project Size

623 acres

Total Volume

~1.3 to 1.6 mcy

Cost Estimate

$11.4M

Data Collected

- 1,762 acres of Topo/bathy
- Healthy vegetation

Additional Data

- NOAA shoreline
- TNRIS LiDAR
- Existing infrastructure

Identification Criteria

- Elevation
- Drainage
- Infrastructure
- Containment

Challenges

- Potential pipeline conflicts
- Potential right-of-access conflicts
- Very large potential restoration areas
- Deep tidal channels and relatively large tidal exchange

ANCHOR QEA

Anahuac NWR Roberts Mueller Tract

Sediment Source

GIWW

Project Size

552 acres

Total Volume

~575,000 to 640,000 cy

Cost Estimate

$12.6 to 16.4M

Data Collected

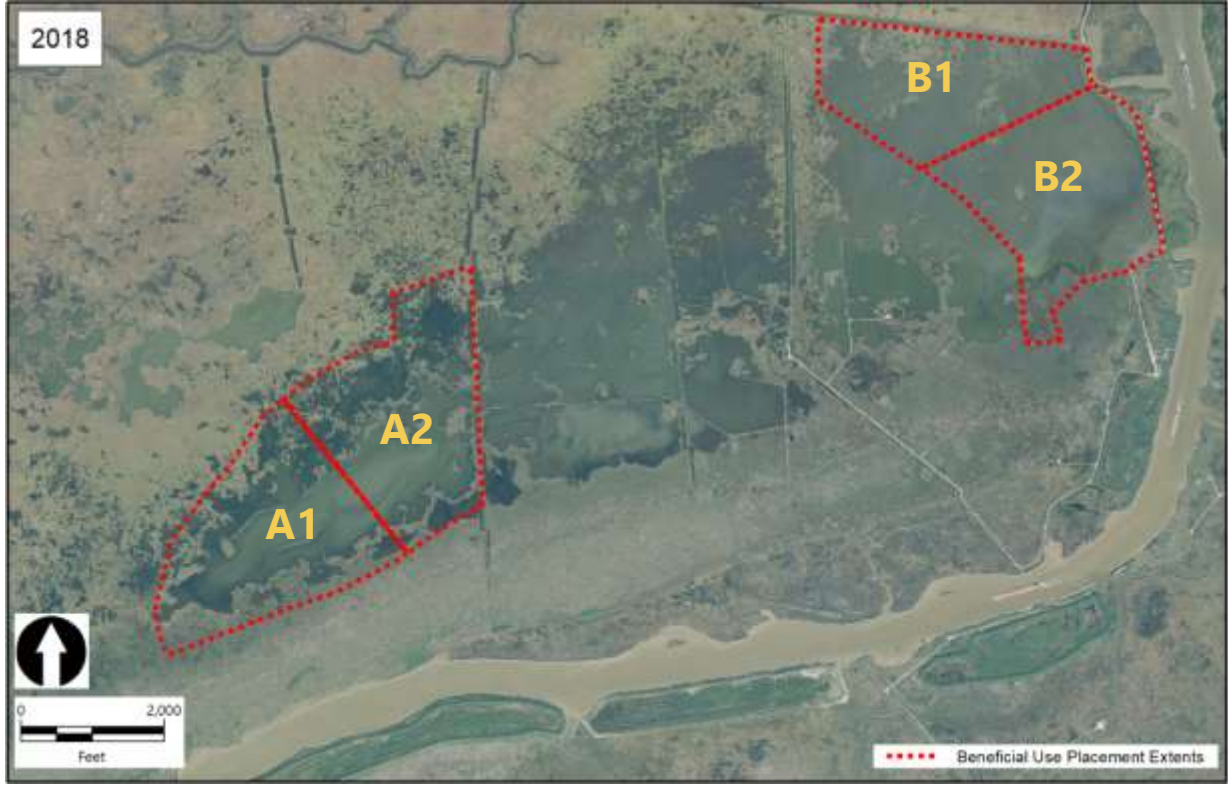
- 733 acres of Topo/bathy
- Healthy vegetation elevations

Additional Data

- NOAA shoreline
- Existing infrastructure
- Existing as-built survey data

Identification Criteria

- Elevation
- Drainage
- Infrastructure (previous work by DU)
- Containment



Challenges

- Potential pipeline conflicts
- Existing infrastructure

ANCHOR QEA

San Bernard NWR Sargent Oil Field

Sediment Source

GIWW

Project Size

201 acres

Total Volume

~80,000 to 115,000 cy

Cost Estimate

$8.5 to 11.0M

Data Collected

- 781 acres of Topo/bathy
- Healthy vegetation elevations

Additional Data

- NOAA shoreline
- Existing infrastructure

Identification Criteria

- Elevation
- Drainage
- Infrastructure
- Containment
- Proximity to GIWW

Challenges

- Potential pipeline conflicts

ANCHOR QEA

Schicke Point

Sediment Source

Palacios Ship Channel

GIWW

Project Size

116 acres

Total Volume

~180,000 to 240,000 cy

Cost Estimate

$5.2M

Data Collected

- 167 acres of Topo/bathy
- Healthy vegetation

Additional Data

- USGS LiDAR
- Existing infrastructure

Identification Criteria

- Elevation
- Drainage
- Infrastructure
- Existing Containment / Protection
- Willing Landowner

Challenges

- Potential right-of-access conflicts
- Distance from sediment source
- Private landowner
- Open water
- Dependent on breakwater constructed by others

ANCHOR QEA

Goose Island SP Existing Beneficial Use Cells

Sediment Source

TBD

Project Size

23 acres

Total Volume

~ 35,000 to 45,000 cy

Cost Estimate

$1.9 to 2.4M

Data Collected

- 30 acres of Topo/bathy
- Reference vegetation elevations

Additional Data

- NOAA shoreline
- Existing infrastructure
- Existing as-built survey data

Identification Criteria

- Existing levees and restoration plan/footprint
- Some material placement historically

Aerial Imagery Sources: USGS EROS, USDA FSA (NAIP), TNRIS StratMap (TOP)

Challenges

- Condition of existing containment levees
- Sediment source identification

ANCHOR QEA