

WESTERN DREDGING ASSOCIATION VIRTUAL DREDGING SUMMIT 2022

Condition Assessment Tool for the Texas Gulf Coast Intercoastal Waterway Dredged Material Placement Areas

Nina Reins, PhD, PE, PMP¹
Courtney Corso, PE¹
Anthony Risko, PE¹
Emily Hampton²

Matthew Mahoney, PG²
Juan Moya, PhD, PG³
Kelly Gonzales Brezovar, PWS⁴
Ray Devlin, PE⁵

July 26, 2022

Presented by Tony Risko, PE

¹Freese & Nichols, ²TxDOT-MRD, ³Stantec, ⁴Hollaway Environmental + Communication, and ⁵Moffatt & Nichol

Background

TEXAS GULF COAST INTERCOASTAL WATERWAY (GIWW-T)

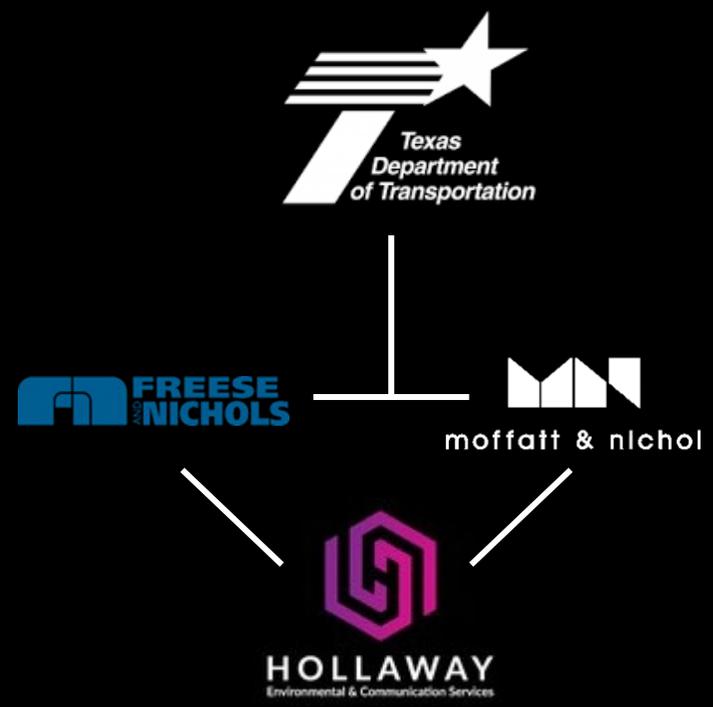
- Constructed in the 1940s
- Main Stem – **379 Miles** of Shallow Draft Navigation Channel
- Extent – Sabine River to Brownsville, Texas
- **Over 200** Dredged Material Placement Areas (DMPA)
- USACE Galveston Performs Routine Maintenance Dredging
- **TxDOT Provides DMPAs** for the Dredged Sediments

PURPOSE, NEED AND OBJECTIVE

- Main Stem DMPAs are Degraded or **Reaching Capacity**
- Acquiring Property for New DMPA Sites is Problematic
- **Extend** the “At-Risk” Existing DMPA **Service Life** (Purpose)
- Identify the Most Functionally **“At-Risk”** Existing DMPAs (Need)
- Perform a **Condition Assessment** of the DMPAs (Objective)

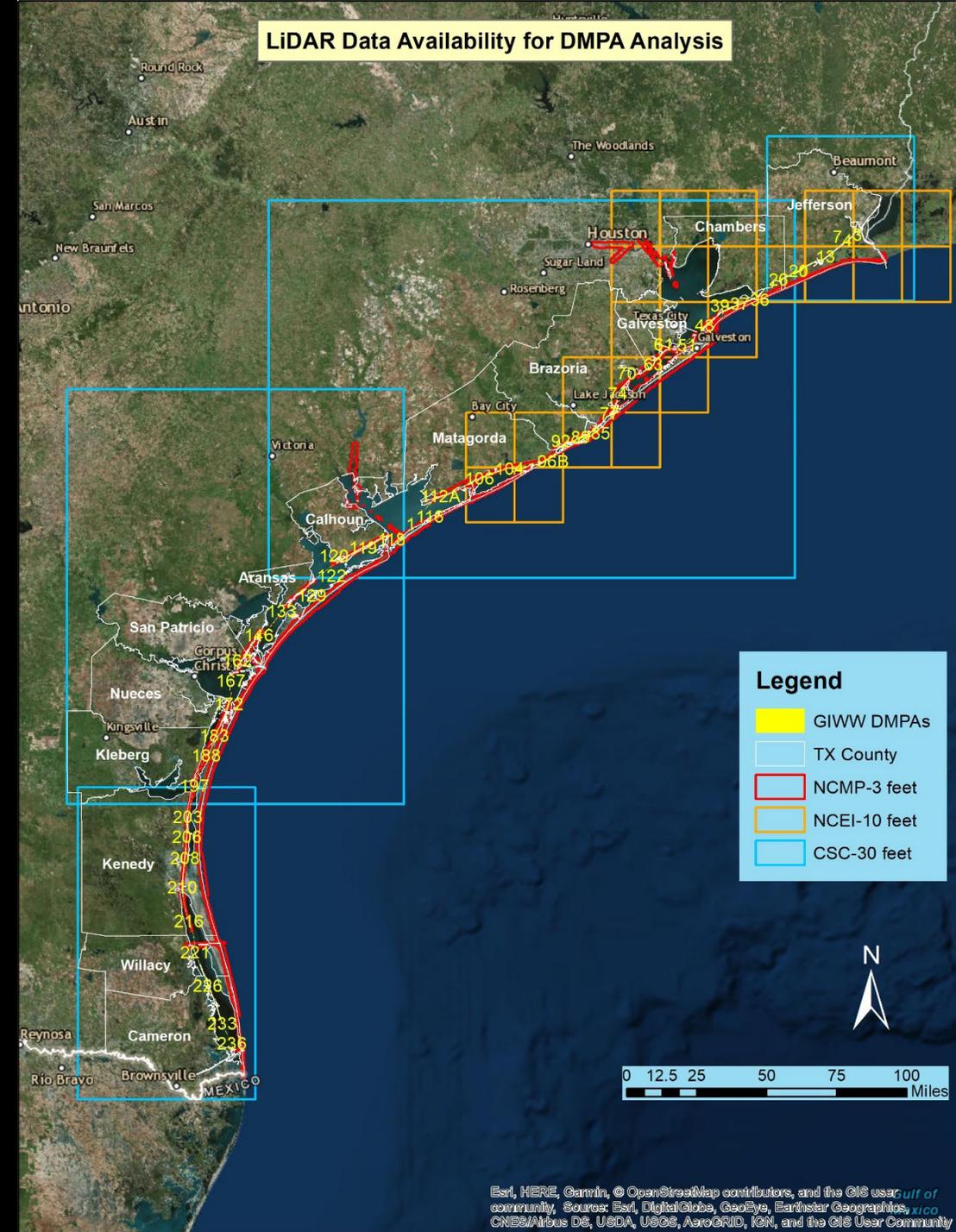


DMPA Condition Assessment



DMPA Condition Assessment

- **STEP 1:** INVENTORY GIWW-T DMPA ATTRIBUTES
- **STEP 2:** DEVELOP CRITERIA FOR DMPA CONDITION ASSESSMENT
- **STEP 3:** CONSTRUCT AN AUTOMATED CONDITION ASSESSMENT DECISION SUPPORT TOOL
- **STEP 4:** RECOMMENDATIONS TO EXTEND SERVICE LIFE
- **STEP 5:** DEVELOP SUMMARY COST ESTIMATES FOR DMPA IMPROVEMENTS



Step 1

DMPA Inventory

Step 1: DMPA Inventory

PROPERTY OWNERSHIP & PROPERTY BOUNDARIES

- Tax Assessor & Appraisal Districts Records
- Online Searches and In-Office Visits

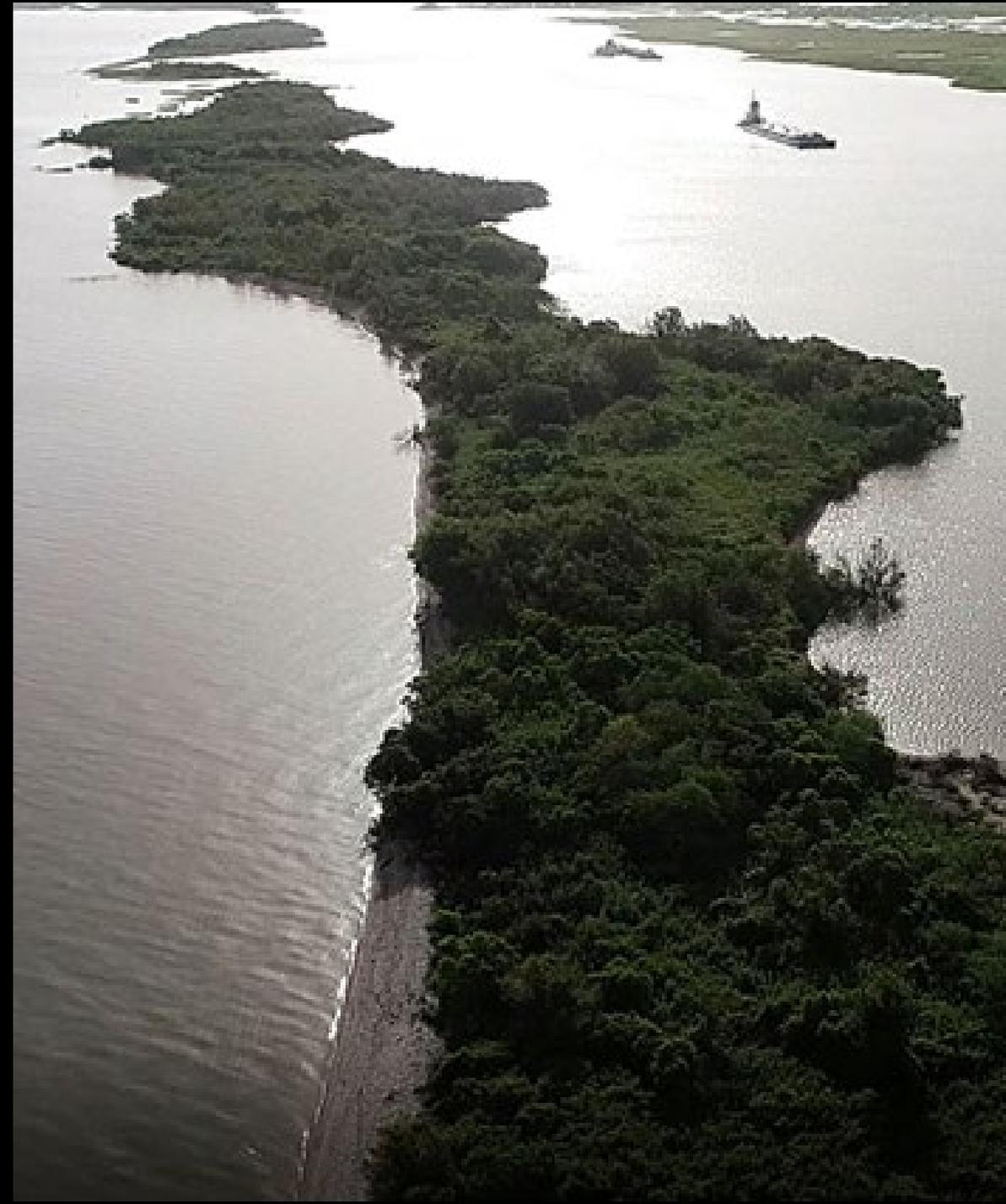
PHYSICAL ATTRIBUTES

- Size & Capacity
- Legal Descriptions

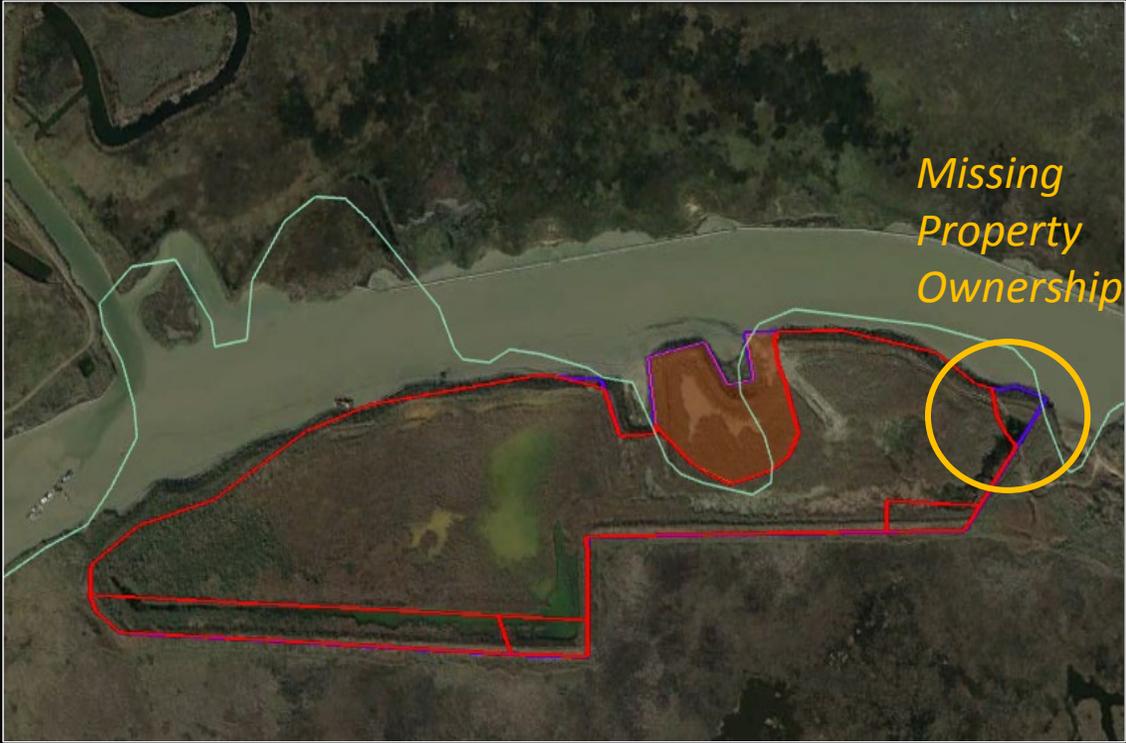
OTHER ATTRIBUTES

- Levee or Berm Conditions
- Drainage Conditions

COMPILE INTO DATABASE



Step 1: DMPA Inventory (Property Ownership Data)



PROPERTY OWNERSHIP BREAKDOWN

- **62% privately owned**
- **36% are publicly owned**
- **2% unknown ownership = 428 acres**

- Total of **253 DMPAs** along the main stem of the GIWW-T were part of this study.
- Data was obtained from:
 - **County Tax Assessor** offices.
 - **USACE Galveston** Real Estate Division
- No county had a complete property ownership data set.
- No or very limited data available online for Kenedy, Willacy, Calhoun, and Cameron counties.
- Six (6) DMPA's lacked ownership data for at least one parcel.

Step 1: DMPA Inventory (Physical & Other Attributes Data)

ASSESSED DMPA LIDAR DATA SETS

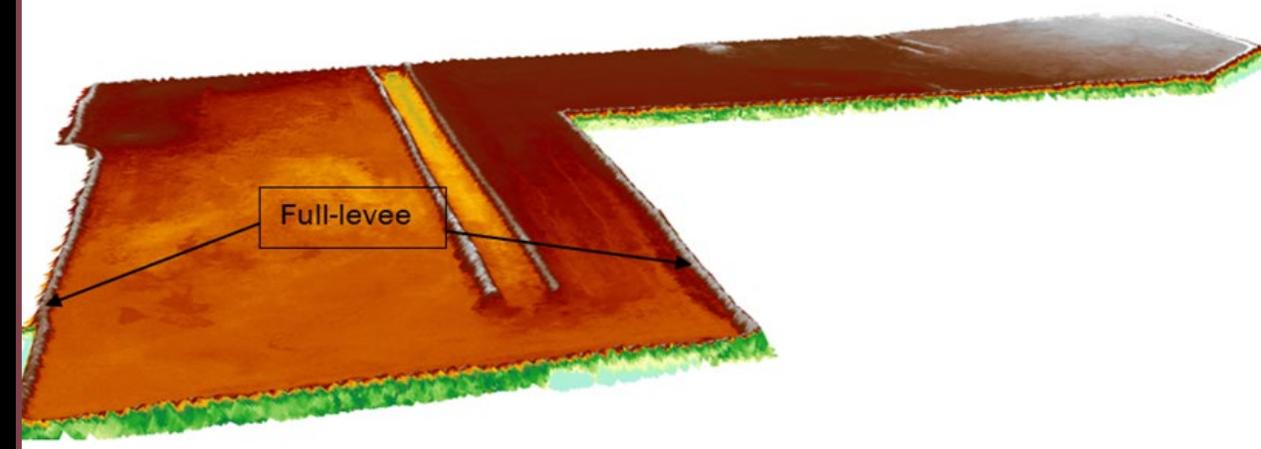
THE DATA SOURCES

Source	Year Completed	Horizontal Reference	Horizontal Resolution	Vertical Reference	Vertical Resolution
1) CSC	2012	NAD83	30 feet	NAVD88	0.32 foot
2) NCEI	2014	NAD83	10 feet	NAVD88	1.64 feet
3) NCMP	2016	NAD83	3 feet	NAVD88	0.32 foot

- 1) NOAA's COASTAL SERVICES CENTER (CSC)
- 2) NOAA's NATIONAL CENTER FOR ENVIRONMENTAL INFORMATION (NCEI)
- 3) USACE's NATIONAL COASTAL MAPPING PROGRAM (NCMP)

MAPPING & CAPACITY CALCULATION

- Generated **Elevation Maps** for all DMPAs.
- Determined Levee Presence (Full, Partial, or No Levee).
- Identified DMPA Max & Min **Levee Elevations**.
- Performed DMPA **Capacity Calculations** and Functionality Assessments.



Step 2

Condition Assessment Criteria

Step 2: Condition Assessment Criteria

IDENTIFIED PRIMARY CRITERIA

- Property Ownership
- Property Lease Life
- Functionality
- Condition

DEVELOPED CRITERIA-BASED SCORING METHOD

- Primary Criteria Weight Factors
- Primary Sub-Criteria Types
- Primary Sub-Criteria Weight Factors

IDENTIFIED SECONDARY CRITERION

- Rehabilitation or Improvement Cost
- Developed Secondary Criterion-based Scoring Method



Step 2: Condition Assessment Criteria (Primary Criteria Definitions)

PROPERTY OWNERSHIP

- The data collected for property ownership of the DMPAs includes several attributes such as the owner type (public, private, mixed), the ownership type (owned/leased), ownership duration, agreements of use, and any disputes identifying the potential conflicts associated with the property acquisition.
- The ease of land acquisition is dependent, in part, on whether the **property is owned by a single public owner or multiple private owners.**

FUNCTIONALITY

- The functionality of the DMPA sites is defined as the remaining useful life for operating the DMPA site before it is out of volume. The ability of the DMPA site to accept placement is important and anything that impacts the level of service will increase the risk profile of the DMPA.
- The **useful life for dredge material placement is a function of the remaining capacity** and the average annual volume of dredge material placed in the DMPA site.

PROPERTY LEASE LIFE

- A lease that is about to expire in the near future indicates that the state of the property ownership is uncertain and therefore increases the risk of the operational availability. Conversely, a remaining long-standing lease agreement suggests clarity on the property ownership and therefore deems the DMPA site operationally less at risk.
- The **remaining duration of the lease agreement was the most critical attribute** affecting the risk profile of the DMPA site for this criterion.

CONDITION

- A DMPA's structural integrity is intact if a levee system is maintained at the highest elevation. However, degradation in the levee elevation indicates physical defects requiring rehabilitation, since the available capacity is limited by the lowest levee elevation within the system.
- Defining and comparing the DMPAs' levee elevations helped to evaluate and categorize the DMPA sites between low- and high-risk categories **based on the range of levee elevation within the levee system.**

Step 2: Condition Assessment Criteria (Primary Sub-Criteria Definitions)

PROPERTY OWNERSHIP (SUB-CRITERIA)

- The **low-risk** scenario is when the entire DMPA site is owned by **one** property owner.
- The **medium-risk** scenario is when DMPA site is owned by **2 to 5** property owners.
- The **high-risk** scenario is when the DMPA site is owned by **more than 5** property owners.

PROPERTY LEASE LIFE (SUB-CRITERIA)

- The **low-risk** scenario is when the property lease duration is **greater than 30** years.
- The **medium-risk** scenario is when the property lease duration is equal or less than **30 years but greater than 10 years**.
- The **high-risk** scenario is when the property lease duration is equal to or **less than 10** years.

FUNCTIONALITY (SUB-CRITERIA)

- The **low-risk** scenario is when the useful life of the DMPA is **greater than 30** years.
- The **medium-risk** scenario is when the useful life of the DMPA is equal or **less than 30 years but greater than 10 years**.
- The **high-risk** scenario is when the useful life of the DMPA is equal to or **less than 10 years**.

CONDITION (SUB-CRITERIA)

- The **low-risk** scenario is when a levee height of the DMPA is equal to or **less than 2 feet below** the DMPA's highest levee height.
- The **medium-risk** scenario is when a levee height is **less than 5 feet** but **greater than 2 feet below** the highest levee height.
- The **high-risk** scenario is when a levee height of the DMPA is **greater than 5 feet below** the DMPA's highest levee height

Step 2: Condition Assessment Criteria (Primary Scoring Methodology)

Criteria	Criteria Type	Criteria Weights (%)	Sub Criteria Priority Description	Sub Criteria Type	Sub Criteria Weights (%)	PA1*
1.1	Property Lease Life	30	Low	Lease greater than 30 years	10	0
			Medium	Lease less than or equal to 30 years but greater than 10 years	20	100
			High	Lease equal to or less than 10 years	70	0
<i>Property Ownership Scoring</i>						20.0
1.2	Functionality	20	Low	Useful Life greater than 30 years	10	100
			Medium	Useful Life less than or equal to 30 years but greater than 10 years	20	0
			High	Useful Life equal to or less than 10 years	70	0
<i>Functionality Scoring</i>						10.0
1.3	Condition	20	Low	Levee is equal to or less than 2 feet below maximum elevation	10	73.2
			Medium	Levee is less than or equal to 5 feet but greater than 2 feet below maximum elevation	20	26.7
			High	Levee is greater than 5 feet below maximum elevation	70	0.1
<i>Condition Scoring</i>						12.7
1.4	Property Ownership	30	Low	1 property owner	10	100
			Medium	Between 2 to 5 property owners	20	0
			High	More than 5 property owners	70	0
<i>Property Ownership Scoring</i>						10.0
\sum Criteria 1.1 to 1.4 = 13.5						13.5
PRIMARY EVALUATION PRIORITIZATION SCORE FOR PLACEMENT AREA SELECTION						13.5

$10\% \times 73.2 = 7.32$
 $20\% \times 26.7 = 5.34$
 $70\% \times 0.10 = 0.07$
12.73

Step 2: Condition Assessment Criteria (Primary Scoring Methodology)

PRIMARY RANKING

All four criteria were considered to compute the score, irrespective of the completeness of the data.

This was termed as the Primary score and the DMPA rank based on this as the **Primary rank**.

NORMALIZED RANKING

Only the criterion for which data was available was considered to compute the scores.

This was termed as the Normalized score and the DMPA rank based on this score as the **Normalized rank**.

Step 2: Condition Assessment Criteria (Secondary Scoring Methodology)

Criteria	Criteria Type	Criteria Weights (%)	Sub Criteria Priority Description	Sub Criteria Type	Sub Criteria Weights (%)	PA1*
2.1	Rehabilitation Cost	100	Low	Cost of repairs is equal to or less than \$0.5 Million	10	0
			Medium	Cost of repairs is less than or equal to \$2 Million but greater than \$0.5 Million	20	100
			High	Cost of repairs is greater than \$2 Million	70	0
<i>SECONDARY EVALUATION PRIORITIZATION SCORE FOR PLACEMENT AREA SELECTION</i>						20

REHABILITATION COSTS (SUB-CRITERIA)

- The **low-risk** scenario is when the DMPA levee can be repaired at a cost equal to or **less than \$0.5 million**.
- The **medium-risk** scenario is when the DMPA levees can be repaired at a cost less than **or equal to \$2 Million but greater than \$0.5 Million**.
- The **high-risk** scenario is when the DMPA levees repair costs are **greater than \$2 million**.

Step 3

Condition Assessment Decision Support Tool

Step 3: Condition Assessment Decision Support Tool

DMPA DECISION SUPPORT TOOL

- MS Access Database
- Sync - ArcGIS Online Program

DMPA DATABASE FORMS

- Master Data Table
- Filter By User Input
- Scoring Detail
- Ownership Detail
- Property Parcel Number
- Useful Life Remaining

CUSTOMIZED DATABASE

- Client Specific Interface
- Inclusion of Data Source Information

DMPA Master Data Table 1

Select DMPA [v]
Data compiled on: 7/11/2019

Attribute	Value	Data Source / Analysis Method	Date Updated
General Information			
Position (north to south)	1	simplified numbering from north to south	4/5/2019
Priority Site?	Non Priority	TxDOT review	4/5/2019
Number of associated "remaining useful life" records	0	Texas GIWW Master Plan 2014	
Est. Cost to Repair/Improve			
Remarks on Cost Estimate			
Location			
County	Jefferson	county Central Appraisal District data	5/22/2019
Side of Channel		review of DMPA location	
North or south of GIWW		review of DMPA location	
Physical Attributes			
Confined?	Confined	LIDAR data analysis	6/14/2019
Category	Full levee (upland)	LIDAR data analysis	6/14/2019
Est. Available Capacity (cubic yards)	57,345	ArcMap Surface Volume tool analysis of LIDAR	6/14/2019
Area (acres)	308.55	ArcMap an	
Alternate area (acres)	309	ArcMap ge	
Finest Horizontal Resolution Availability (ft)	10	CSC, NCEI,	
Coarse Horizontal Resolution Availability for Missing Area (ft)		CSC, NCEI,	
Number of Dewatering Cells		USACE GIW	
Property Ownership			
Percent of Property Ownership Data Obtained	100.00%		

DMPA Ownership Detail

Search by DMPA Number [v]

DMPA Number 1 County Jefferson Category Full levee (upland) Confined? Confined

Non Priority Ownership Private # Private Owners 2 North or South of GIWW

Rank Score # Public Owners 0 Land or Bay Side

Primary Score 62 6.0% Level of Cost Cost

Normalized Primary Score 23 20.0% Warning Unverified link of DMPA to parcel number

Remarks_USACE

Ownership Data Attachments

Lease Information

ID 15

Land Owner JOE J. REISS

Row Csj No 70130101

Parcel No 1

County MATAGORDA

Instrument In File DEED 02/1990

Property Acquired FEE - 0.199 ACRE TRACT

Transfer To COE Date

Type of Transfer to COE UNKNOWN IF ANY TRANSFER EXECUTED

Minute Order No UNKNOWN

Transfer Expiration Date

USACE Property Owner Data

GIWW_T 1

Fee Owner PREMCROR REFINING GROUP INC 1 Owner Type Private

Deed Number Deed Date

Legal Description TRACT 21 73.896 AC VALERO ACCOUNTS PAYABLE

Address_1 PO BOX 690110

Address_2

Property ID 264179 Address_3

Area (sq. ft) Address_City SAN ANTONIO

Address_State TX

Address_Zip 78269

Notes

Database entry date 5/17/2019 Data Source USACE

Remarks on data source provided by Crouch on 5/16/19

Fee Owner PORT ARTHUR LNG HOLDINGS LLC Owner Type Private

Deed Number Deed Date

Legal Description TR 1 488 T&NO 259.380 (PT TR 1 ON DEED) %SEMPRA ENERGY

Address_1 ATTN: STATE AND LOCAL TAX

Property ID 140878 Address_3 488 8TH AVENUE HQ08NI

Step 3: Condition Assessment Decision Support Tool

(Ranking Results of Primary Scoring)

Filter DMPAs by User Input Categories

Confinement:
 Ownership:
 County:
 Priority:

Update DMPA List

Number of DMPAs: **253**

Matching DMPAs, listed by Primary Score from high to low

PA_No	Priority	RankNorm	ScoreNorm	Rank	ScorePrimary	Warning	Cost	ScoreCost	LeaseLife	Functionality	Condition	Owners	Confinement	Ownership	Side	NS_o
86/87	High Priorit 2	1	59.8%	1	59.8%				70.0%	70.0%	19.2%	70.0%	Confined	Private and Public	Landside	South
147A	Priority 1	2	42.0%	2	42.0%				70.0%	70.0%	70.0%	70.0%	Unconfined	Private and Public	Landside	South
88	Priority 14	3	35.7%	3	35.7%	Lease is Expi			70.0%	20.0%	38.6%	10.0%	Confined	Public	Landside	South
89	Priority 3	4	50.4%	4	35.2%					20.0%	51.2%	70.0%	Confined	Private and Public	Landside	South
81	Non Priorit 1	5	70.0%	5	35.0%					70.0%	70.0%	70.0%	Unconfined	Private and Public	Landside	South
80	Non Priorit 1	5	70.0%	5	35.0%					70.0%	70.0%	70.0%	Unconfined	Private and Public	Landside	South
104A	Priority 9	6	37.7%	6	30.1%				70.0%		15.7%	20.0%	Confined	Private and Public	Landside	North
105A	Priority 13	7	36.6%	7	29.2%				70.0%		11.2%	20.0%	Confined	Private and Public	Landside	North
58A	Priority 19	8	28.3%	8	28.3%				70.0%	10.0%	11.7%	10.0%	Confined	Public	Landside	North
40	Priority 8	9	39.4%	9	27.6%					10.0%	23.0%	70.0%	Confined	Private	Bayside	North
100	Non Priorit 6	10	45.0%	10	27.0%				70.0%		20.0%	20.0%	Partially Confine	Public	Landside	North
99	Priority 17	11	32.7%	11	26.1%				70.0%		10.6%	10.0%	Confined	Public	Landside	North
39	Priority 10	12	37.2%	12	26.1%					10.0%	15.3%	70.0%	Confined	Private and Public	Bayside	North
37	Priority 11	13	37.2%	13	26.0%					10.0%	15.2%	70.0%	Confined	Private and Public	Bayside	North
36	Priority 12	14	36.8%	14	25.8%					10.0%	13.9%	70.0%	Confined	Private	Bayside	North
106	Priority 4	15	49.1%	15	24.6%						17.8%	70.0%	Confined	Private and Public	Bayside	South
29	Priority 16	16	33.9%	16	23.7%					70.0%	18.7%	20.0%	Confined	Private	Landside	South
92	Priority 5	17	46.9%	17	23.5%						12.3%	70.0%	Confined	Private and Public	Landside	North
30	Priority 18	18	32.4%	18	22.7%					70.0%	13.4%	20.0%	Confined	Private and Public	Landside	South
118	Priority 1	19	70.0%	19	21.0%						70.0%	70.0%	Partially Confine	Private and Public	Bayside	South
77	Priority 1	19	70.0%	19	21.0%						70.0%	70.0%	Partially Confine	Private and Public	Landside	North
63	Priority 1	19	70.0%	19	21.0%						70.0%	70.0%	Unconfined	Private and Public	Bayside	South
62A	Priority 1	19	70.0%	19	21.0%						70.0%	70.0%	Unconfined	Private	Landside	North
38	Priority 1	19	70.0%	19	21.0%						70.0%	70.0%	Unconfined	Private and Public	Bayside	North
41	Priority 1	19	70.0%	19	21.0%						70.0%	70.0%	Partially Confine	Private and Public	Bayside	North
62	Priority 1	19	70.0%	19	21.0%						70.0%	70.0%	Partially Confine	Private and Public	Bayside	South

Placement Area	Primary Score	Primary Rank	Normalized Score	Normalized Rank
DMPA-86/87	59.85%	1	59.85%	2
DMPA-147A	42.00%	2	70.00%	1
DMPA-88	35.71%	3	35.71%	14
DMPA-89	35.25%	4	50.35%	3
DMPA-81	35.00%	5	70.00%	1
DMPA-80	35.00%	5	70.00%	1
DMPA-104A	30.14%	6	37.67%	9
DMPA-105A	29.25%	7	36.56%	13
DMPA-58A	28.33%	8	28.33%	19
DMPA-40	27.60%	9	39.43%	8
DMPA-100	27.00%	10	45.00%	6
DMPA-99	26.13%	11	32.66%	17
DMPA-39	26.05%	12	37.22%	10
DMPA-37	26.05%	13	37.21%	11
DMPA-36	25.79%	14	36.84%	12
DMPA-106	24.57%	15	49.13%	4
DMPA-29	23.73%	16	33.90%	16
DMPA-92	23.47%	17	46.94%	5
DMPA-30	22.67%	18	32.39%	18
DMPA-62	21.00%	19	70.00%	1
DMPA-97	21.00%	19	70.00%	1
DMPA-105	21.00%	19	70.00%	1
DMPA-96B	21.00%	19	70.00%	1
DMPA-62A	21.00%	19	70.00%	1
DMPA-107	21.00%	19	70.00%	1
DMPA-112A	21.00%	19	70.00%	1
DMPA-118	21.00%	19	70.00%	1

- Tool Rankings Provide Only a Starting Point
- Institutional Review Required to Ground Truth Priorities

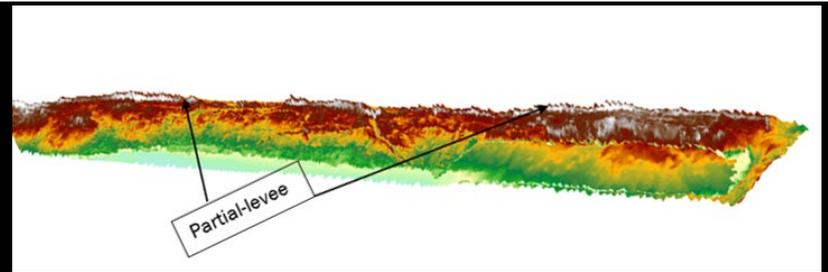
Step 4

DMPA Extend Service Life Recommendations

Step 4: DMPA Service Life Extension (Typical Rehabilitation/Improvement Options)

REHABILITATE LEVEES

- Repair or Rehabilitate Existing Levees
- Increase Levee Height



SHORELINE PROTECTION

- Detached Breakwaters / Living Structures
- Shoreline Revetments / Articulated Concrete Blocks



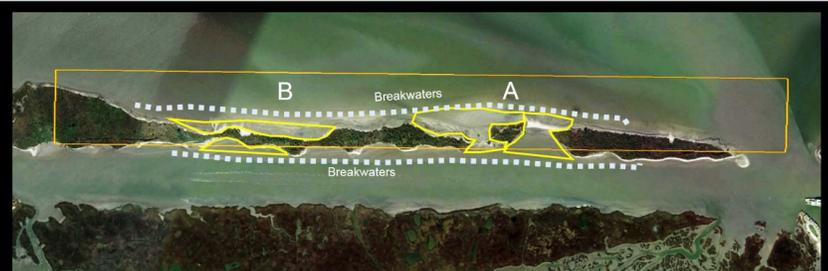
CONFINEMENT IMPROVEMENT

- Property Acquisition for DMPA Expansion
- Sediment Harvesting / Borrowing



FACILITATE BENEFICIAL USE PLACEMENT

- Expanded DMPA Footprint for BU
- Install Physical Features to Retain/Protect BU Material



Step 5

Summary Cost Estimates For DMPA Improvements

Step 5: DMPA Improvements Summary Cost Estimate

(Examples – Summary Rehabilitation/Improvement Costs)

DMPA / Option	Base Cost Estimate	Total Cost Estimate (including Overhead / Profit / Mob)	Recovered Capacity (cy)	New Capacity (cy)
38 / Option 1 (Localized Levee Raising)	\$109,150	\$181,000	N/A	60,000
38 / Option 2 (BU Site Creation)	\$28,780,000	\$38,850,000	N/A	150,000
38 / Option 3 (BU Site Creation)	\$41,400,000	\$55,500,000	N/A	420,000
43 / West (Confining Levee Construction)	\$341,350	\$545,000	N/A	150,000
43 / East (Confining Levee Construction)	\$481,500	\$769,000	N/A	203,000
Ranked: 86/87 #1P/#2N (Levee Rehabilitation)	\$439,600	\$745,000	1,100,000	3,100,000
92 / Option 1 (Levee Rehabilitation)	\$464,200	\$717,000	422,000	2,000,000
92 / Option 2 (Levee Raising)	\$1,165,600	\$1,906,000	N/A	2,800,000
106 / Option 1 (Limited Shoreline Protection)	\$5,476,200	\$7,617,000	2,000,000	6,300,000
106 / Option 2 (Extensive Shoreline Protection)	\$18,937,500	\$25,770,000	2,000,000	6,300,000

Conclusions / Acknowledgements

Conclusions

- The DMPA Condition Assessment Decision Support Tool was Customized for TxDOT – MRD
- Criteria & Weight Factors were Subjectively Determined
- Tool Provides Objective Scoring using the Applied Criteria & Weight Factors
- Institutional Review of DMPA Scores is Required to Ground Truth the “At-Risk” Priorities

Acknowledgements

*Spandana Tummuri, PhD, PE
Jacobs, Vice President
Coastal Operations Leader*



TxDOT - Maritime Division



USACE Galveston District

*Brian King, GISP, RPA, CFM
Freese & Nichols, Inc.
Senior Geospatial Analyst*

QUESTIONS?

Tony Risko, PE
Freese & Nichols, Inc.
512.617.3185
anthony.risko@freese.com

Nina Reins, PhD, PE, PMP
Freese & Nichols, Inc.
504.478.1065
nina.reins@freese.com