MOTT MACDONALD

North Beach Coastal Protection Project

May 2, 2022

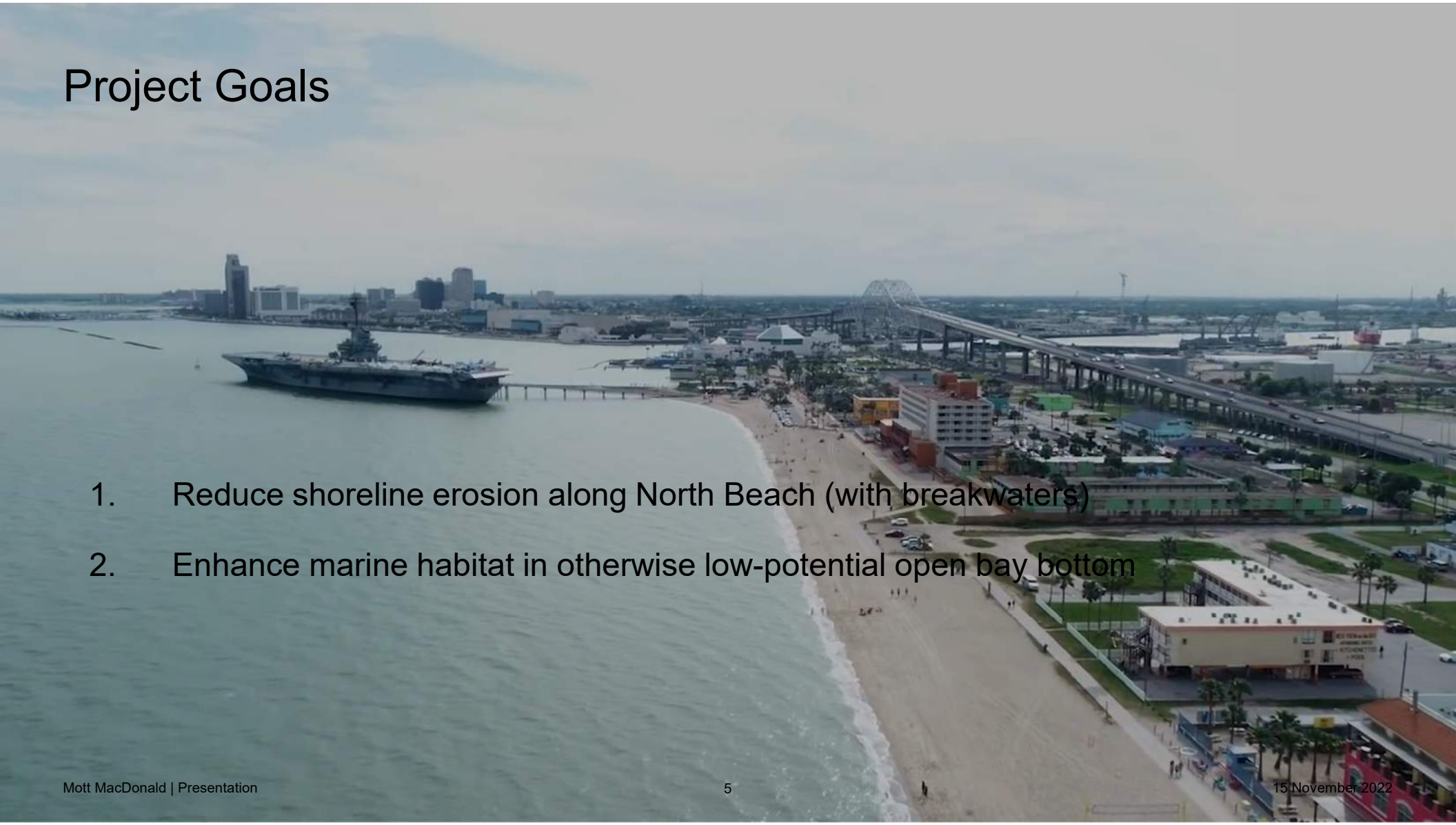
Disclaimer

Project Description and Background

Project Location


Agenda
1
Recap of Project Goals
2
Recap of Engineering Analysis
3
Current Permitting Effort
4
Path Forward

Project Goals



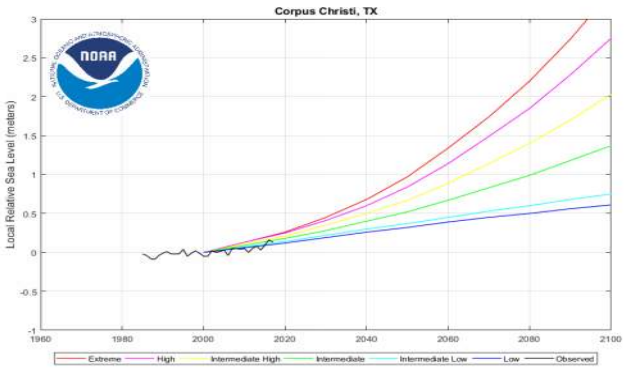
1. Reduce shoreline erosion along North Beach (with breakwaters)
2. Enhance marine habitat in otherwise low-potential open bay bottom

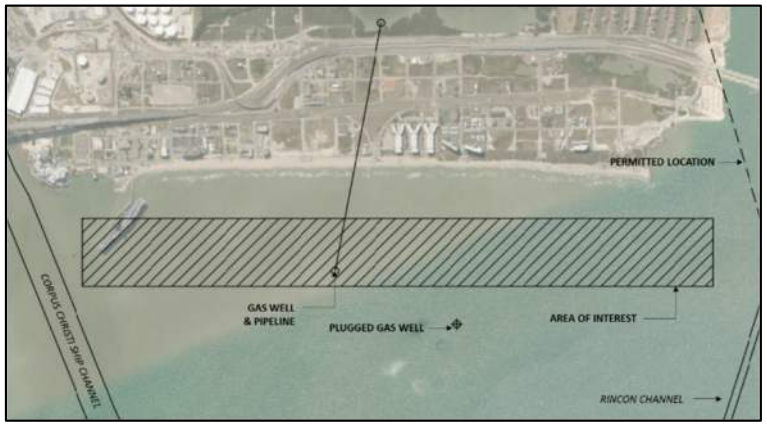
Agenda

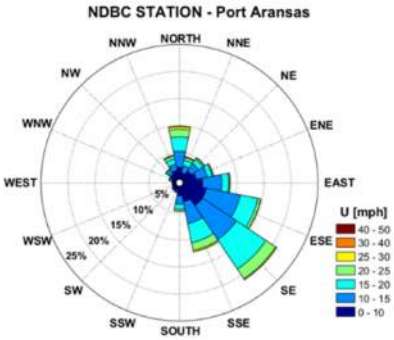
1. Recap of Project Goals and Scope
2. **Recap of Engineering Analysis**
3. Current Permitting Effort
4. Path forward

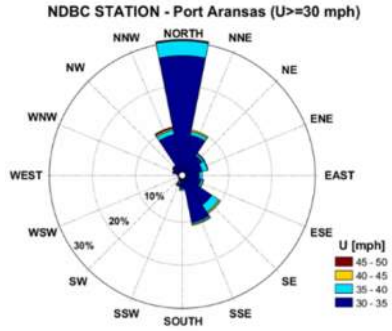
Conditions Assessment

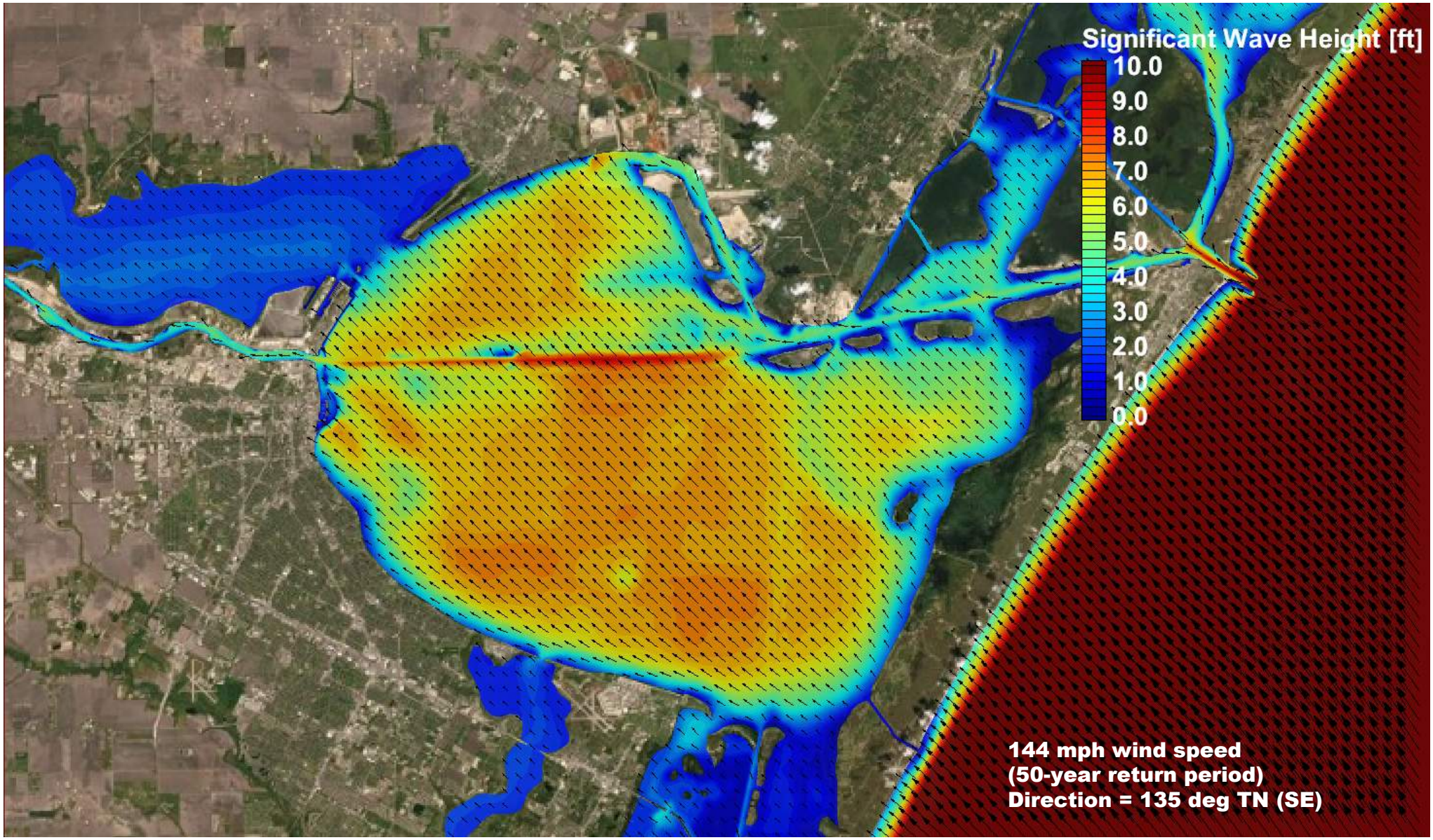
Extremal Analysis		
Return Period (Years)	**Wind Speed (mph)**	**Water Level (Feet)**
1	38.7	2.0
2	38.9	2.3
5	39.8	2.6
10	42.5	2.9
25	91.9	3.3
50	144.3	3.5



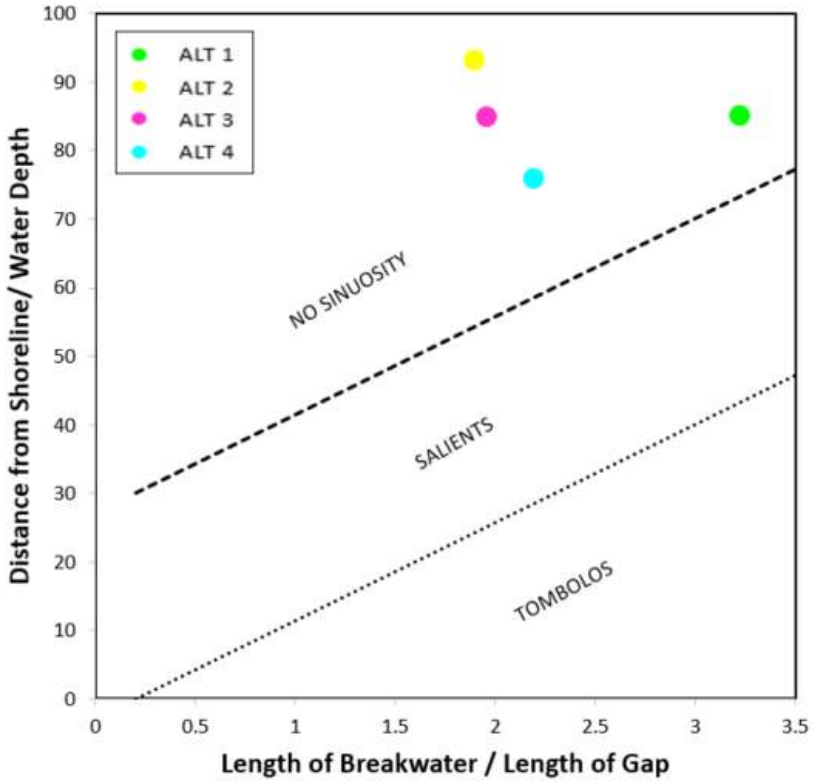


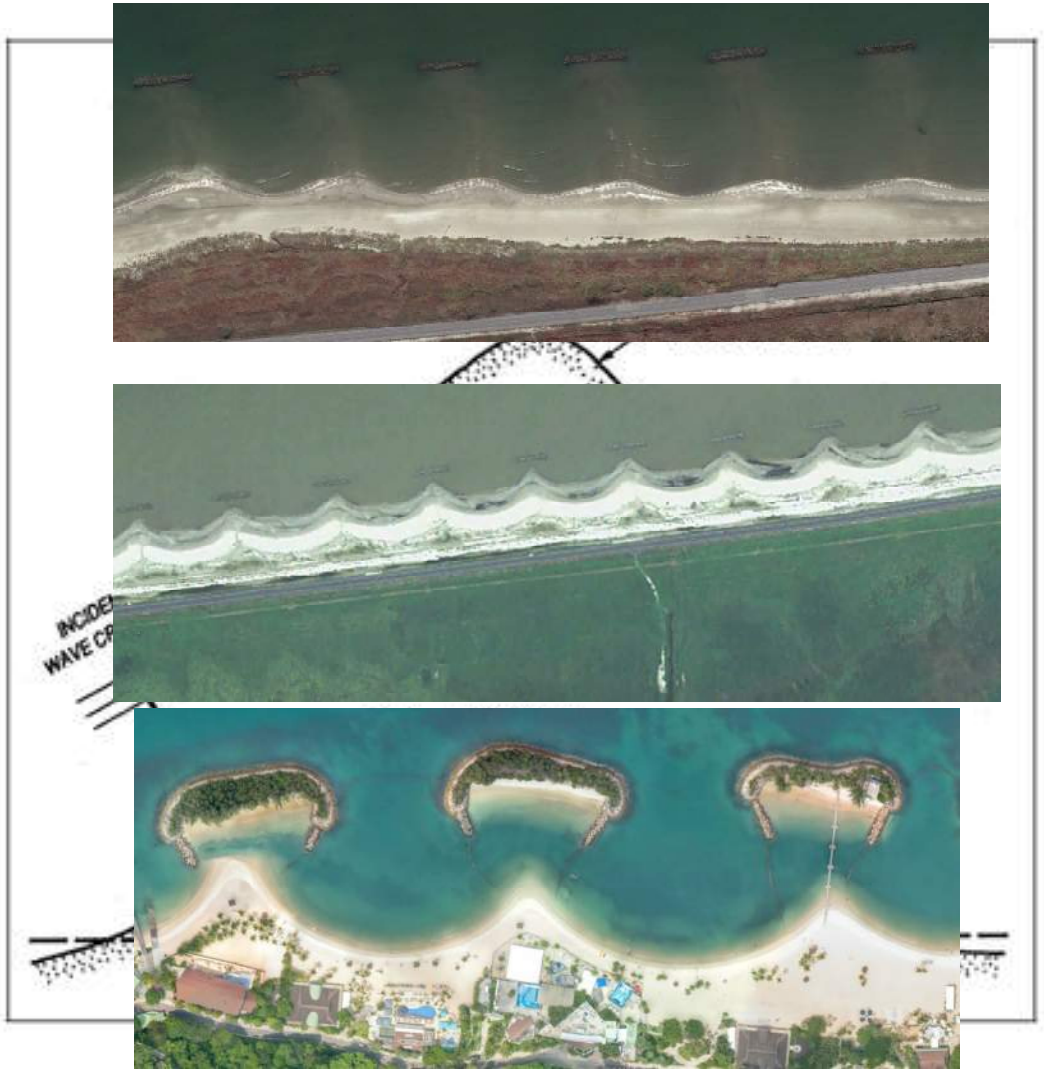


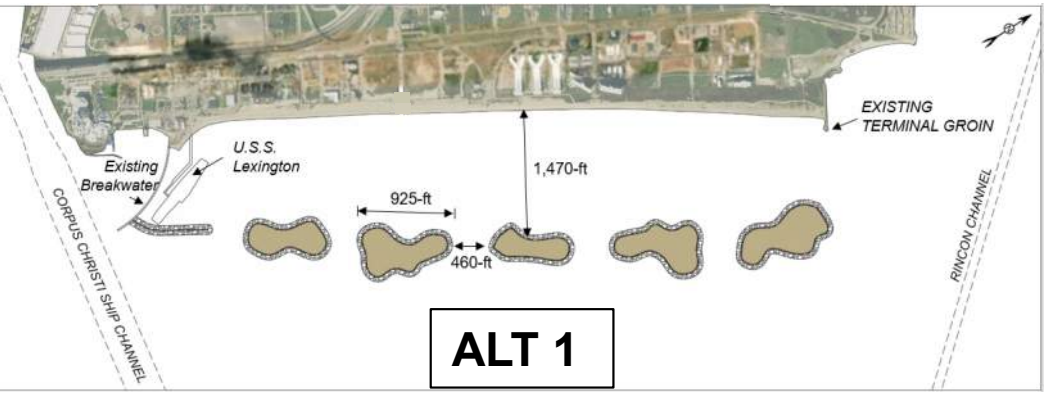



Significant Wave Height [ft]
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
144 mph wind speed
(50-year return period)
Direction = 135 deg TN (SE)

Shoreline Response



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TERMINAL GROIN
U.S.S.
Lexington
Existing
Breakwater
1,470-ft
925-ft
460-ft
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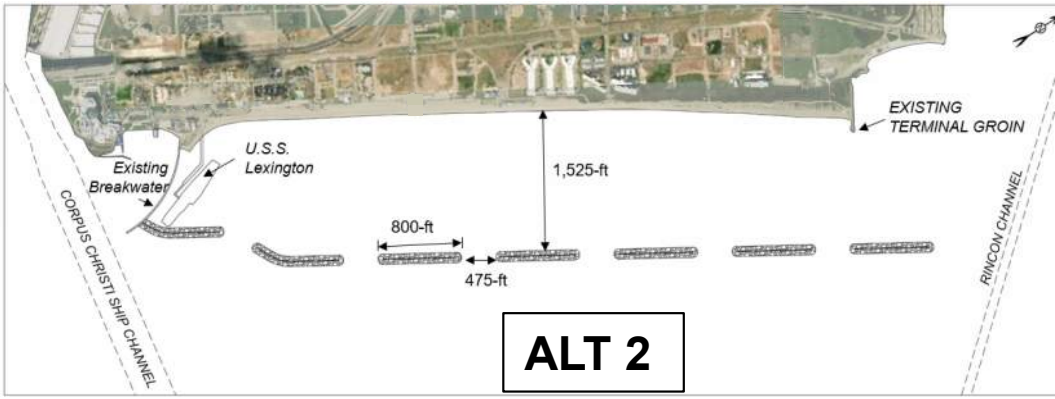
RINCON CHANNEL
ALT 1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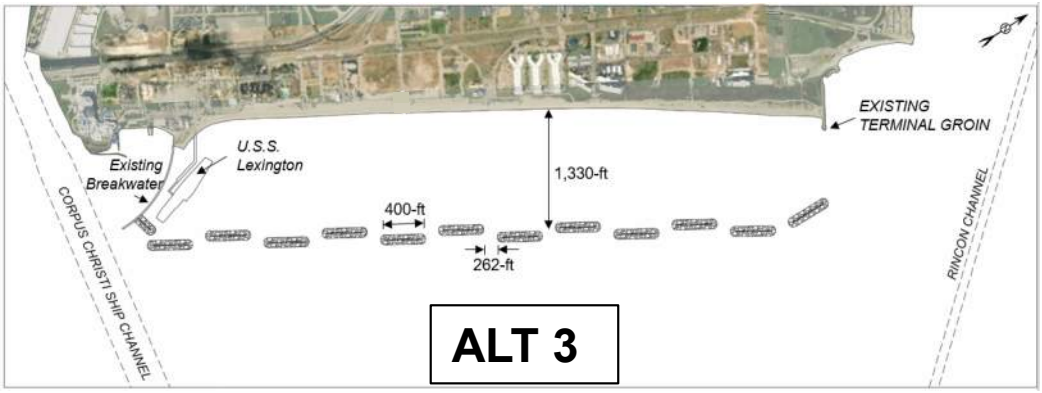
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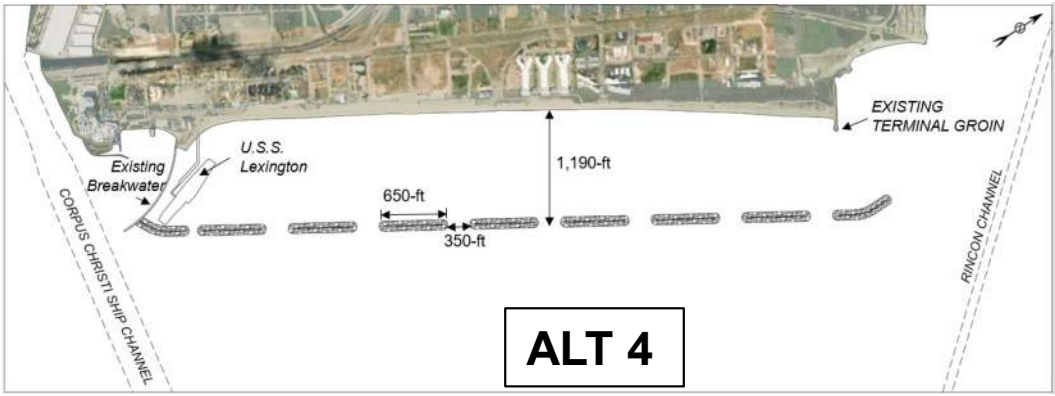
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ALT 4

Prototypes

Prototype Projects

(Source: Orion Construction)

Prototype Projects

La Quinta Channel Extension & Deepening – Beneficial Use Site 6 – Corpus Christi Bay

- Construction 2008 - 2015
- 7.7 Million CY Dredge Material
- Levee ~9.0 ft high and 9,200 ft long
- 200 Acres

Prototype Projects

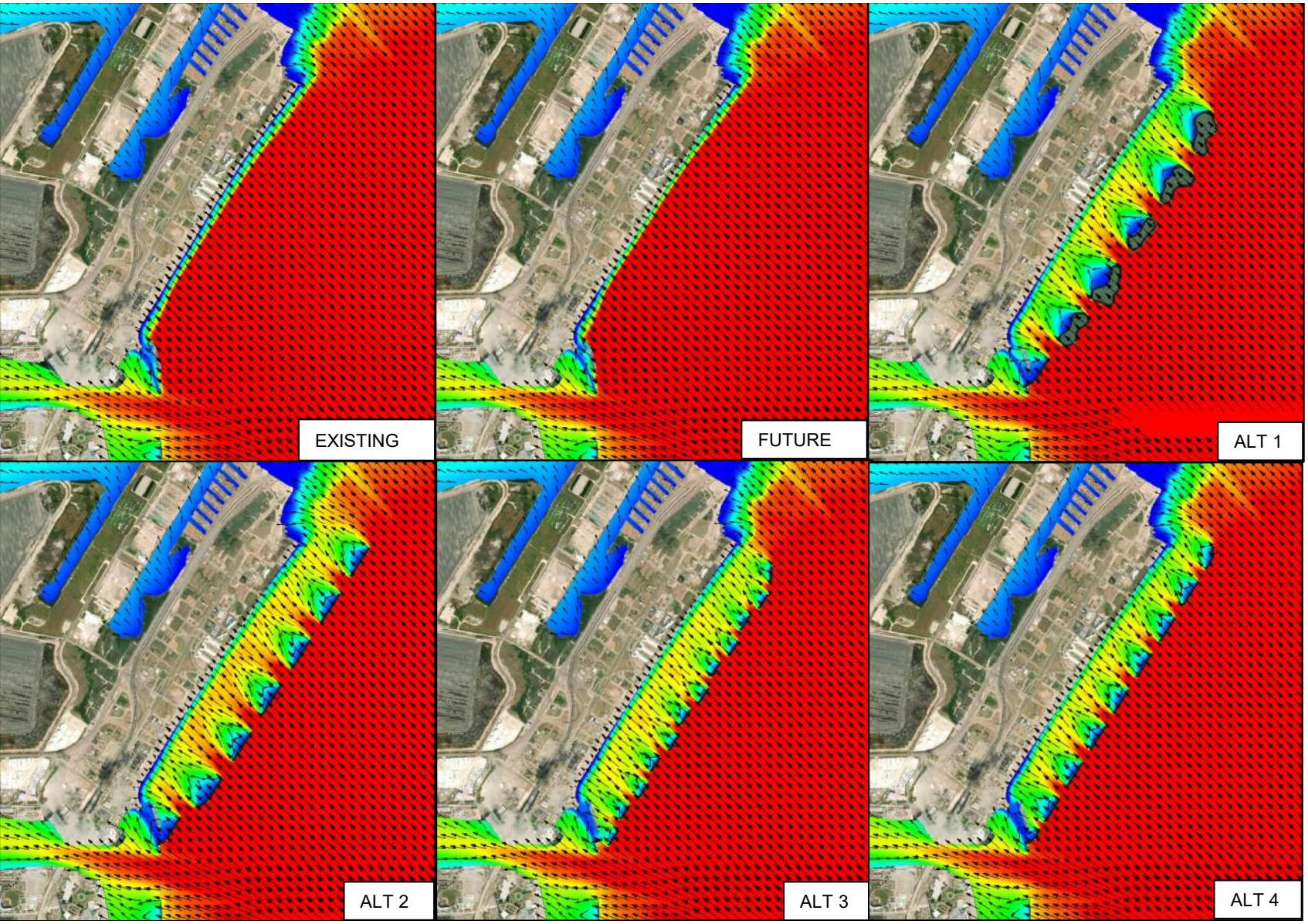
Pulau Sentosa - Singapore

Prototype Projects

Laguna Madre – GIWW spoil islands

Performance

Sedimentation	Beach Response	Passing Vessel	Circulation
Mike21 (by DHI)	Gencade	VHLU	Mike21



Significant Wave Height

(2-year, SE Wind)

Significant Wave Height (ft)

3.0
2.5
2.0
1.5
1.0
0.5
0.0

Velocity Vector

4.0 ft/s

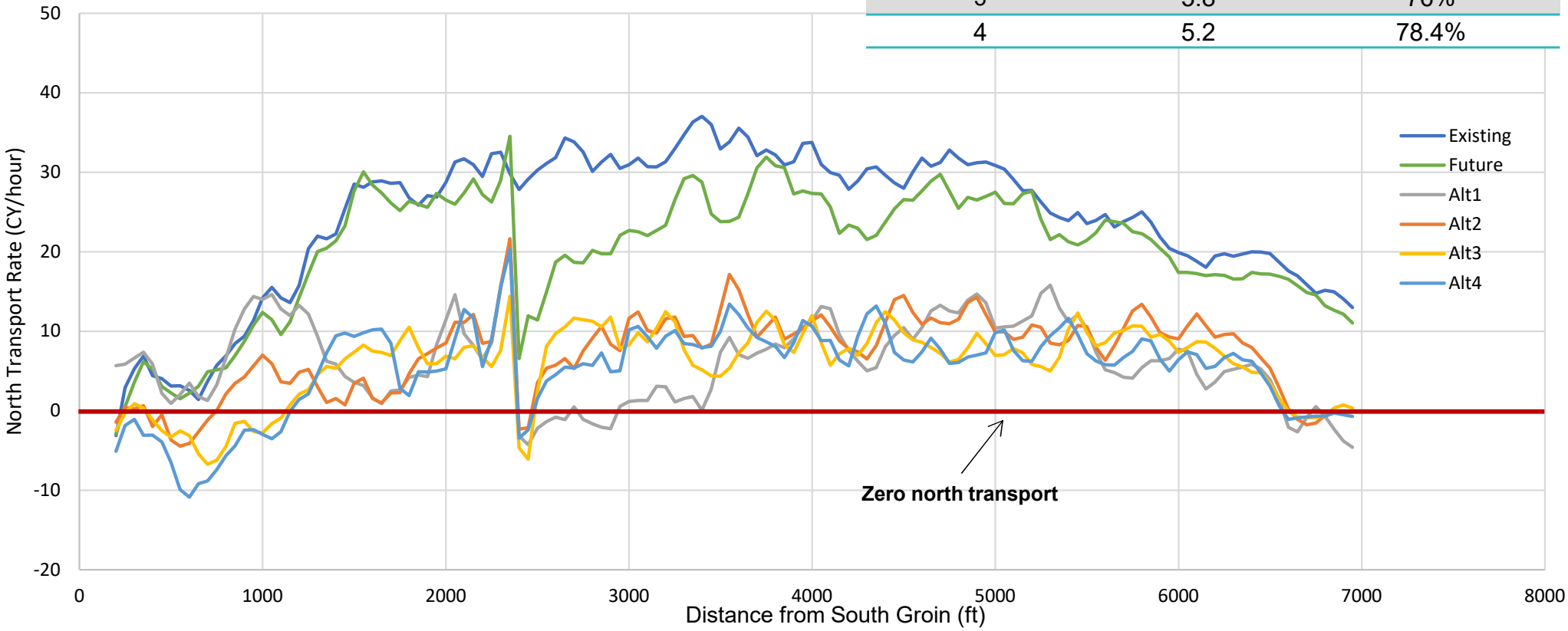
0.0 ft/s

15 November 2022

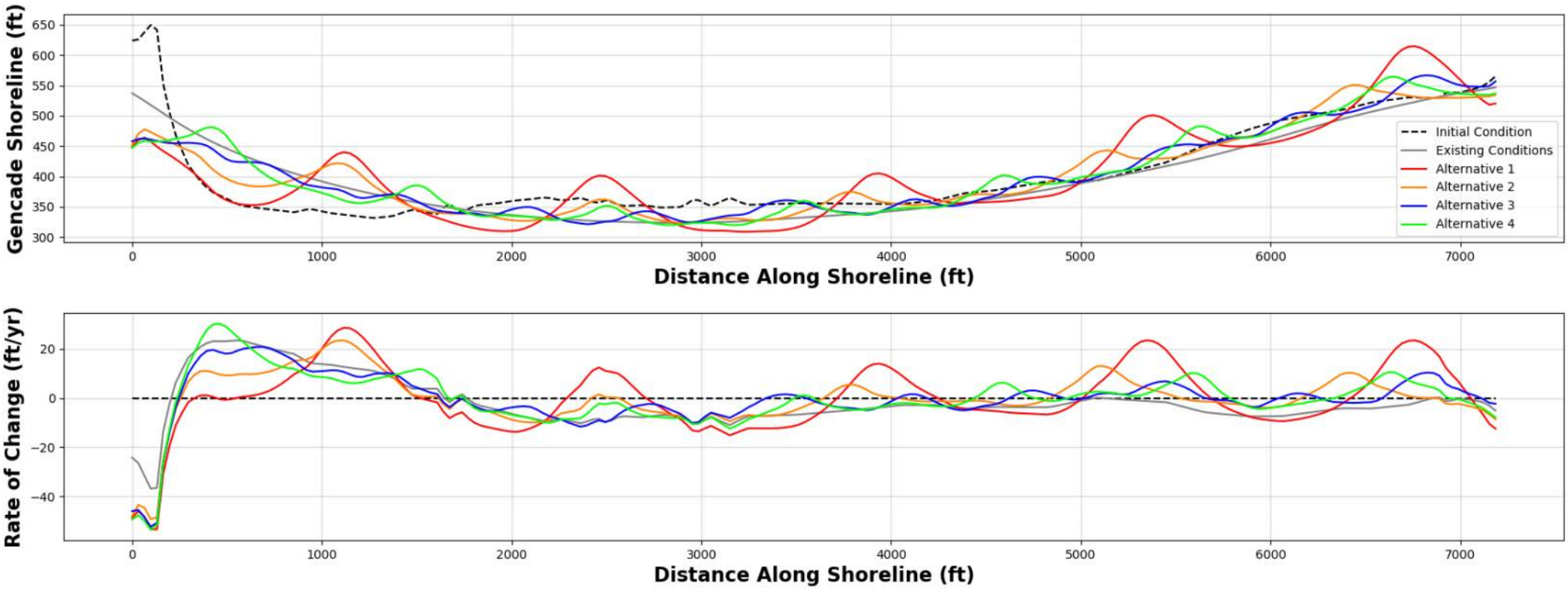
Sediment Transport Rate

2-year, SE wind

Alternative	Average Transport Rate (CY/hour)	% Reduction
Existing	24.2	--
Future	20.2	16.4%
1	6.2	74.4%
2	7.1	70.5%
3	5.8	76%
4	5.2	78.4%

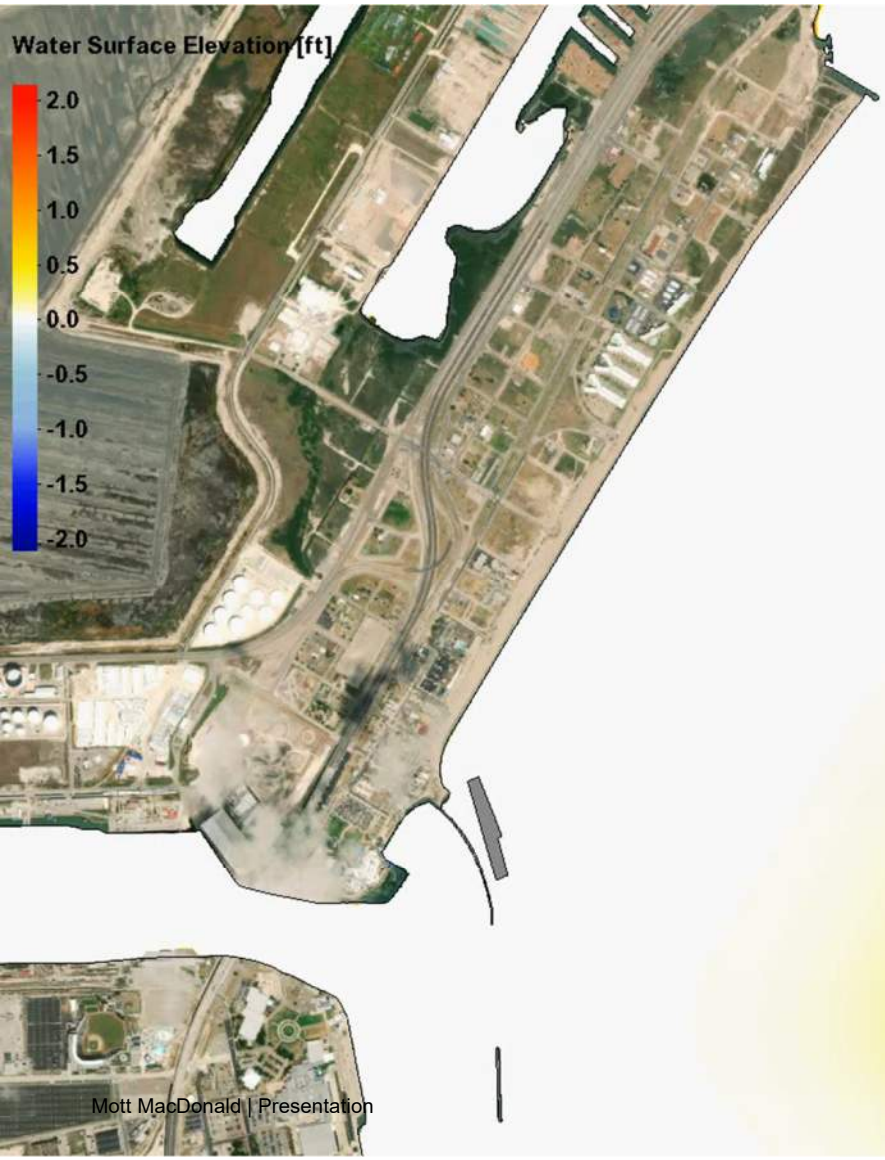


Beach Response

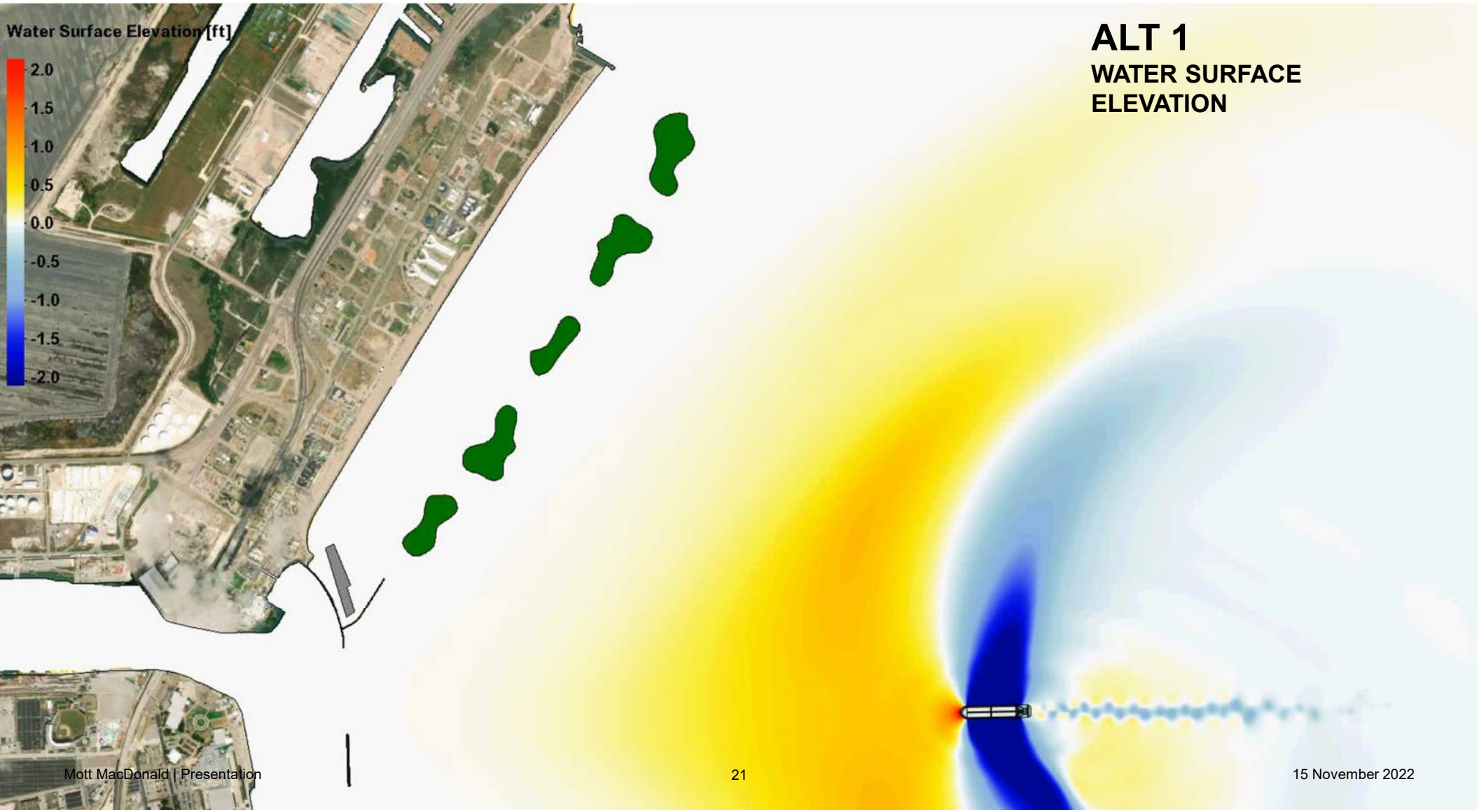


EXISTING CONDITIONS

WATER SURFACE ELEVATION



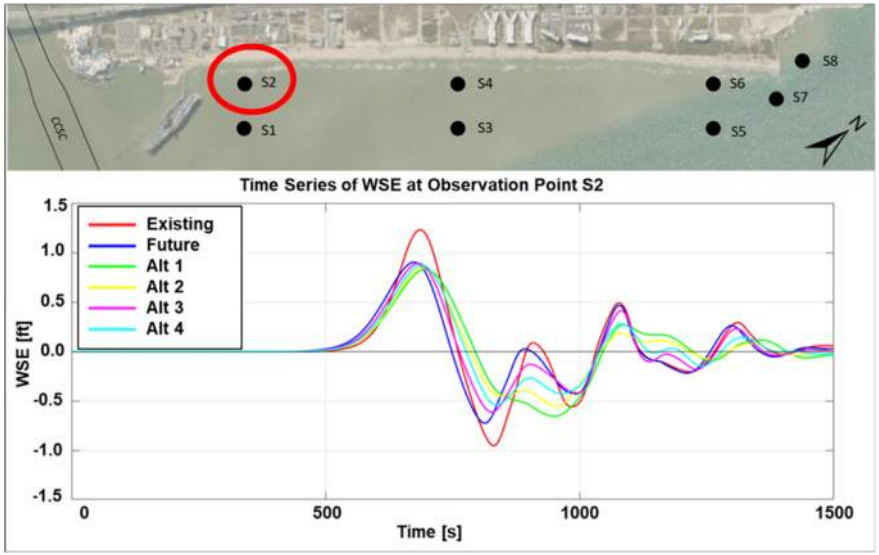
ALT 1
WATER SURFACE ELEVATION

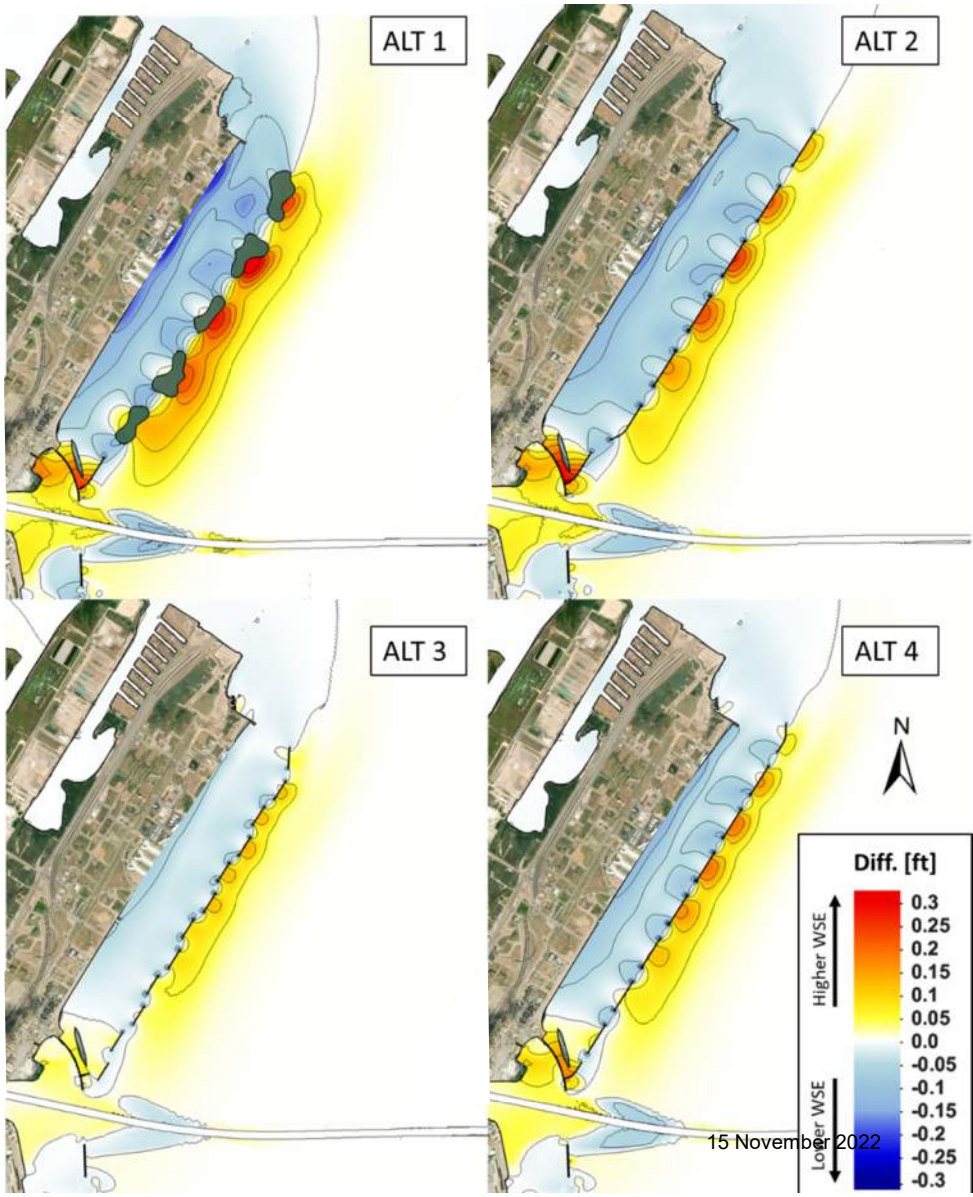


Ship Generated Hydrodynamics

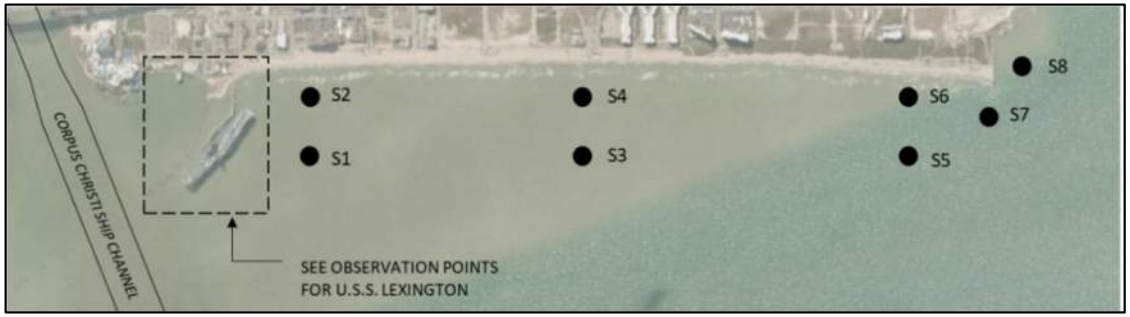
Ef

Hull Type	Length (ft)	Beam (ft)	Draft (existing / future) (ft)	Speed (kts)
Tanker	900	158	45 / 52	10
Bulk Carrier	850	141	45 / 50	10



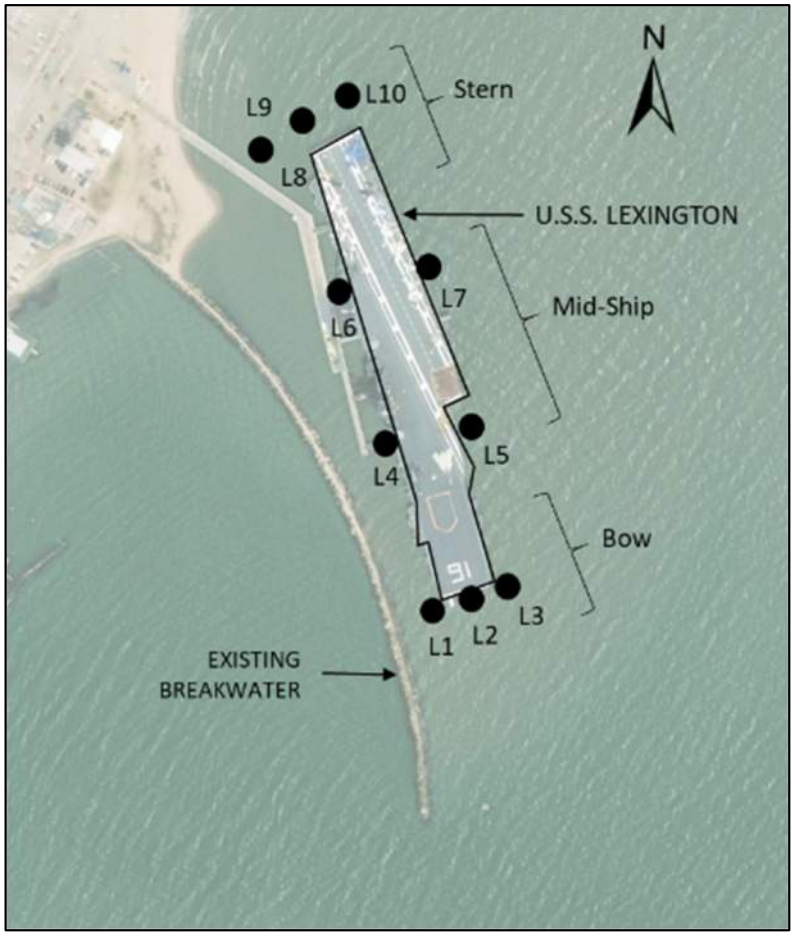


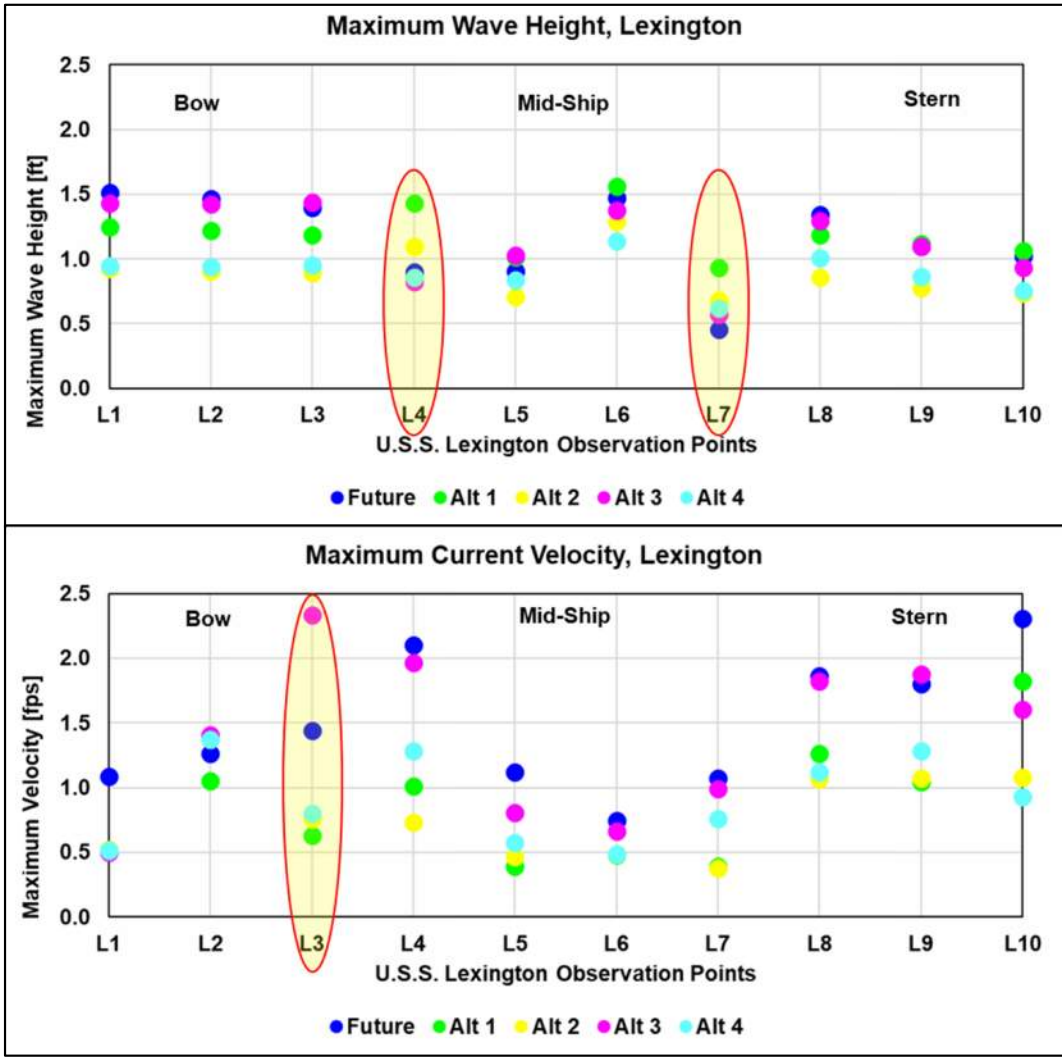
Vessel Induced Hydrodynamics (at Shoreline)



Maximum Nearshore Wave Height and Velocity				
	Wave Height		Current Velocity	
Scenario	Average [ft] (S2, S4, and S6)	Percent Reduction	Average [ft/s] (S2, S4, and S6)	Percent Reduction
Future	1.7	N/A	0.77	N/A
Alt 1	1.3	25%	0.60	23%
Alt 2	1.3	21%	0.66	15%
Alt 3	1.5	12%	0.73	5%
Alt 4	1.4	18%	0.67	14%

U.S.S. Lexington Protection





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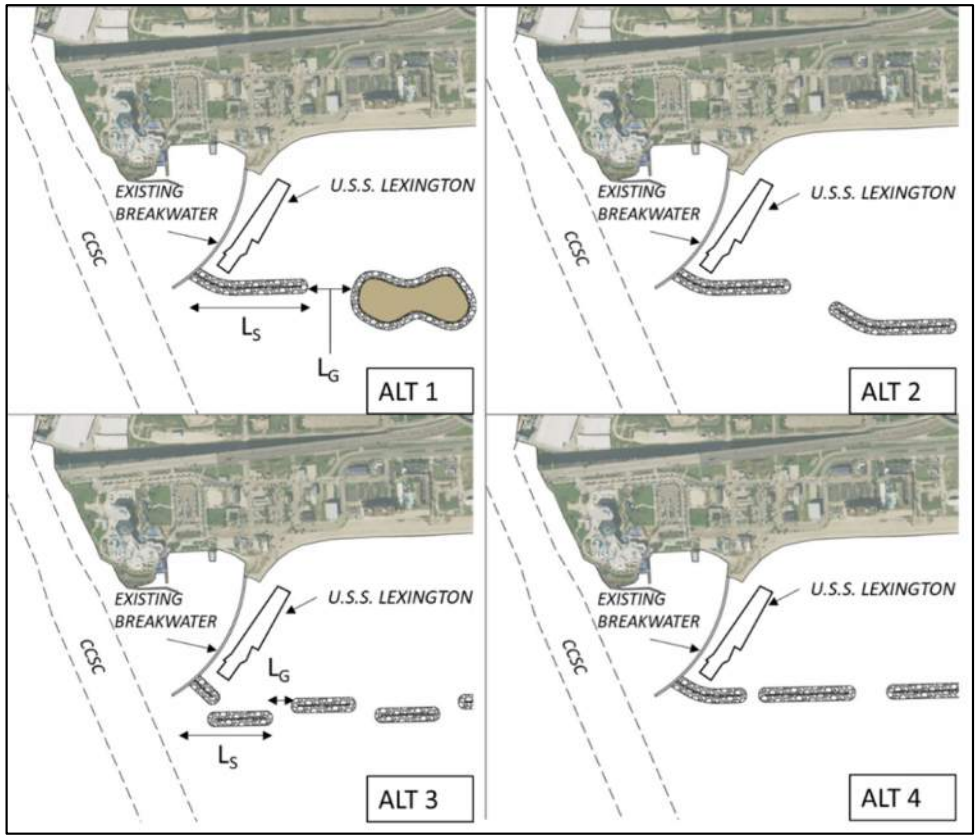
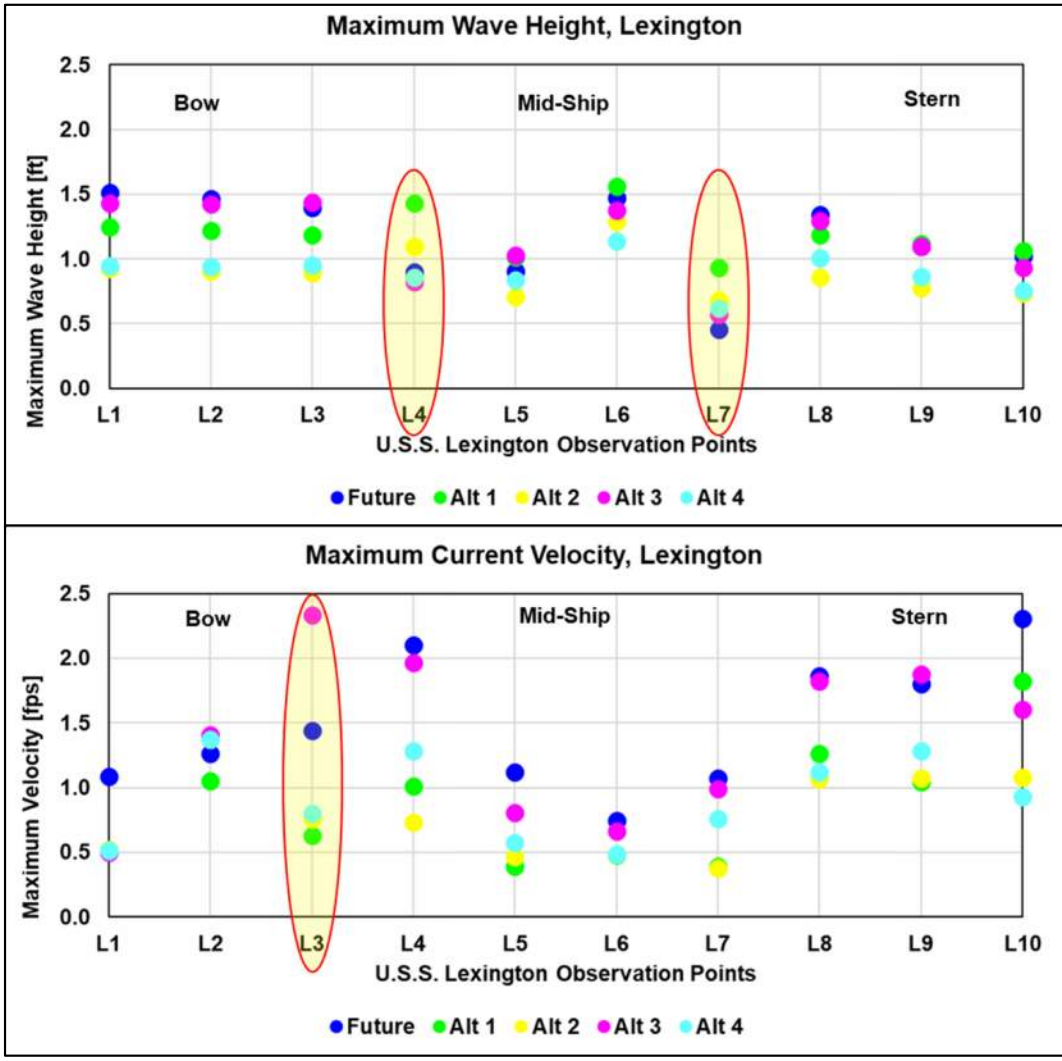




Coastal Processes Conclusions

Sedimentation and Beach Response

- Hydrodynamic and wind-wave growth and transformation
  - alternatives reduce wave heights and current velocities in the nearshore area to a similar degree.
- Sediment transport
  - alternatives decrease longshore northward sediment transport on the beach by 70-78%, with Alternatives 3 and 4 causing the greatest reduction.
- Alternative 1 causes the strongest beach planform changes
  - may not be desirable due to narrowed beach widths
  - expectations of adjacent property owners
  - general aesthetics

Passing Vessel Conclusions

Vessel Induced Hydrodynamics

- CCSC deepening
  - Reduces hydrodynamics the most along the south end of North Beach nearest the ship channel; less towards north
  - Shoreline wave heights and current speeds were reduced by 13% and 10%, respectively.
- Alternative 1
  - Greatest effect on reducing vessel-induced maximum wave heights and current speeds.
- Alternative 3
  - Least reduction in vessel generated impacts at the U.S.S. Lexington region and shoreline region.
- Any of the breakwater alternatives can be optimized
  - Provide more protection for the U.S.S. Lexington against vessel induced scour at the hull and mudline interface (vessel ballasted on bottom).

Water Quality and Circulation

Coastal Process and Passing Vessel

- Alternatives 1 – 4
  - Not expected to negatively affect water quality at the shoreline
- Predominant tidal and wave-induced current speeds
  - Further analysis is recommended to determine anticipated water quality and circulation
  - Determine reduction of vessel generated currents would have a measurable impact on water quality.

Beneficial Use and Construction Phasing

Risks / Opportunities

Risks and Opportunities

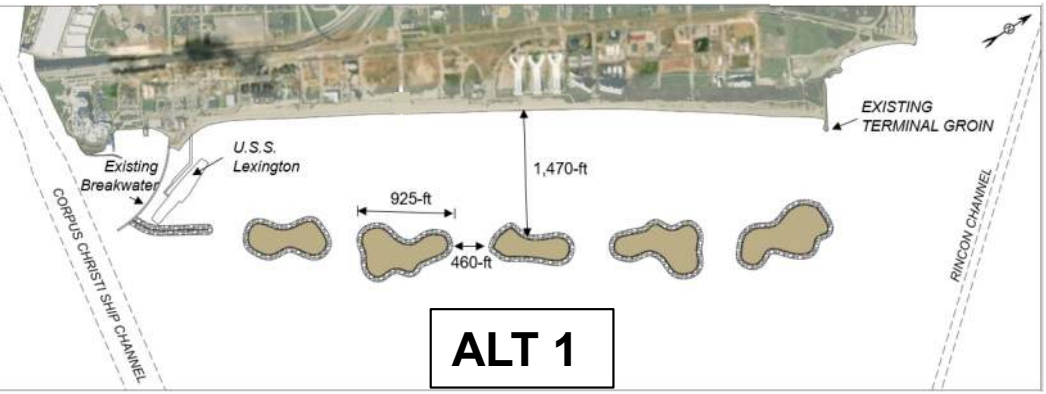
Risks (Challenges)

- Permitting
- USACE Individual Permit
  - Habitat Surveys
  - Cultural Resources Investigation
- GLO Coastal Lease
  - Coastal Boundary Survey
- Constructability
- Contractor Availability
- Construction Methods

Opportunities

- Funding Sources
  - GOMESA
  - CEPRA
  - RESTORE
  - CDBG
- Eligibility
- Shoreline Protection & Restoration
- Ecosystem Restoration
- Habitat Enhancement

Evaluation Matrix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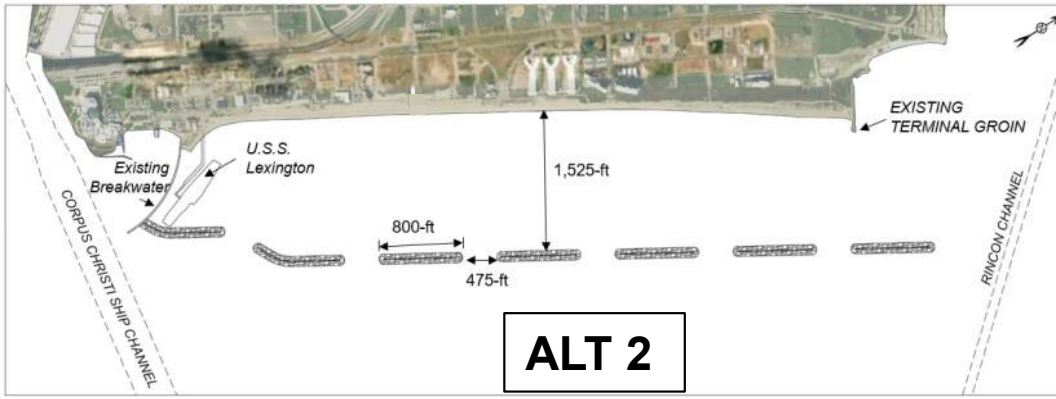
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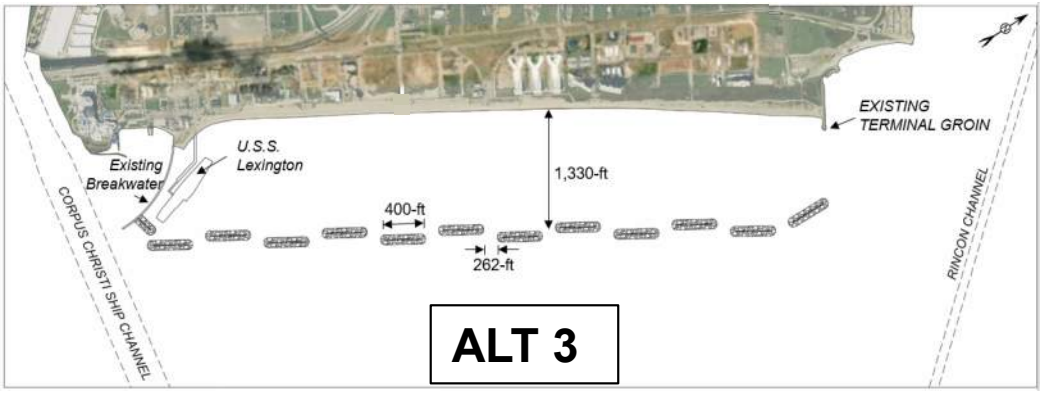
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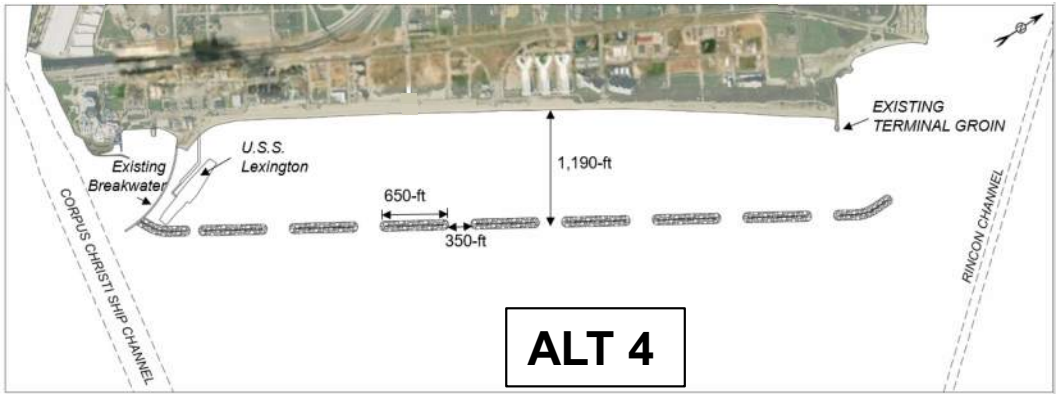
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ALT 4

Alternatives	Criteria	Costs			Environmental Benefits		Recreational Benefits		Resilience	Funding Opportunities	Constructability	Permitting	Shoreline Response		
	Weighted factor:	50%			25%		25%		N/A	N/A	N/A	N/A	N/A		
	Description	Lifetime Costs	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Opportunity		Risk			TOTAL SCORE	Rank
0	Do Nothing (no action)	$46 M	5.0	2.50	0.0	0.00	2.5	0.63	LOW	N/A	N/A	N/A	N/A	3.13	5
1A	Breakwater Islands (fully armored)	$129 M	0.0	0.00	3.3	0.81	2.3	0.56	MEDIUM	HIGH	HIGH	HIGH	SALIENTS	1.38	7
1B	Breakwater Islands (partial perimeter armor)	$103 M	1.6	0.78	5.0	1.25	3.8	0.94	MEDIUM	HIGHEST	HIGH	HIGH	SALIENTS	2.97	6
1C	Breakwater Islands (clay berm & armor revetment)	$83 M	2.8	1.39	5.0	1.25	3.8	0.94	MEDIUM	HIGHEST	HIGH	HIGH	SALIENTS	3.57	1
2	Segmented Breakwaters (long)	$57 M	4.3	2.17	2.3	0.56	2.3	0.56	HIGH	LOWER	LOW	MEDIUM	SUBDUED SALIENTS	3.29	3
3	Segmented Breakwaters (offset)	$55 M	4.5	2.23	2.3	0.56	2.3	0.56	HIGH	LOWER	LOW	MEDIUM	SUBDUED SALIENTS	3.35	2
4	Segmented Breakwaters	$58 M	4.3	2.14	2.3	0.56	2.3	0.56	HIGH	LOWER	LOW	MEDIUM	SUBDUED SALIENTS	3.26	4

Conclusions and Recommendations

- No-Action alternative - lowest-cost alternative $46 million
  - No added environmental benefits and lowest resilience to storm damage.
- Alternative 1C ranked #1
  - Highest ecological and recreational benefits
  - Strongest shoreline response → Potential for optimization to reduce response using low crested sills
- Alternatives 2 or 3
  - Low-cost and low-shoreline response alternatives
  - Similar effectiveness
- All alternatives can be refined to protect the Lexington from hydrodynamic effects of passing vessels

Available funding, timeline to execution, construction materials availability, and agency feedback are anticipated to influence project goals, limitations, and outcomes.

Evaluation criteria, methodology, and weightings are anticipated to be adapted through feedback from stakeholders

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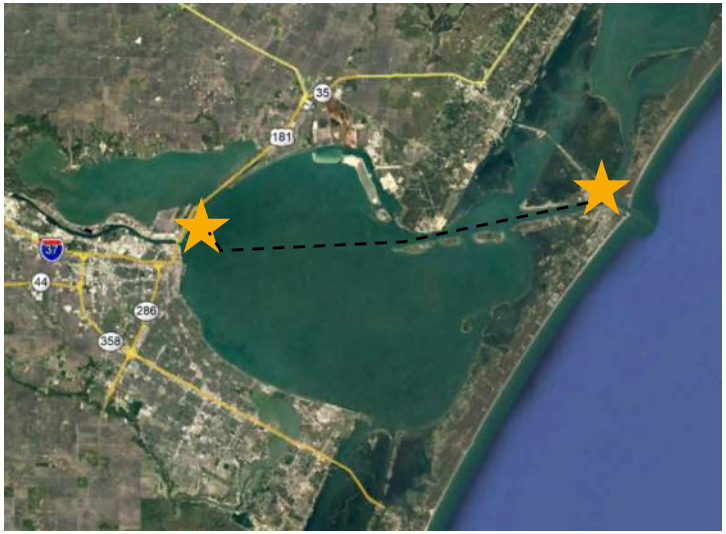
2. Recap of Engineering Analysis
3. **Current Permitting effort**
4. Path forward

Rachal Foundation Donated Materials



Donated Material:

- 170 Concrete Blocks (5'6" x 10' x 12', 50 tons each)

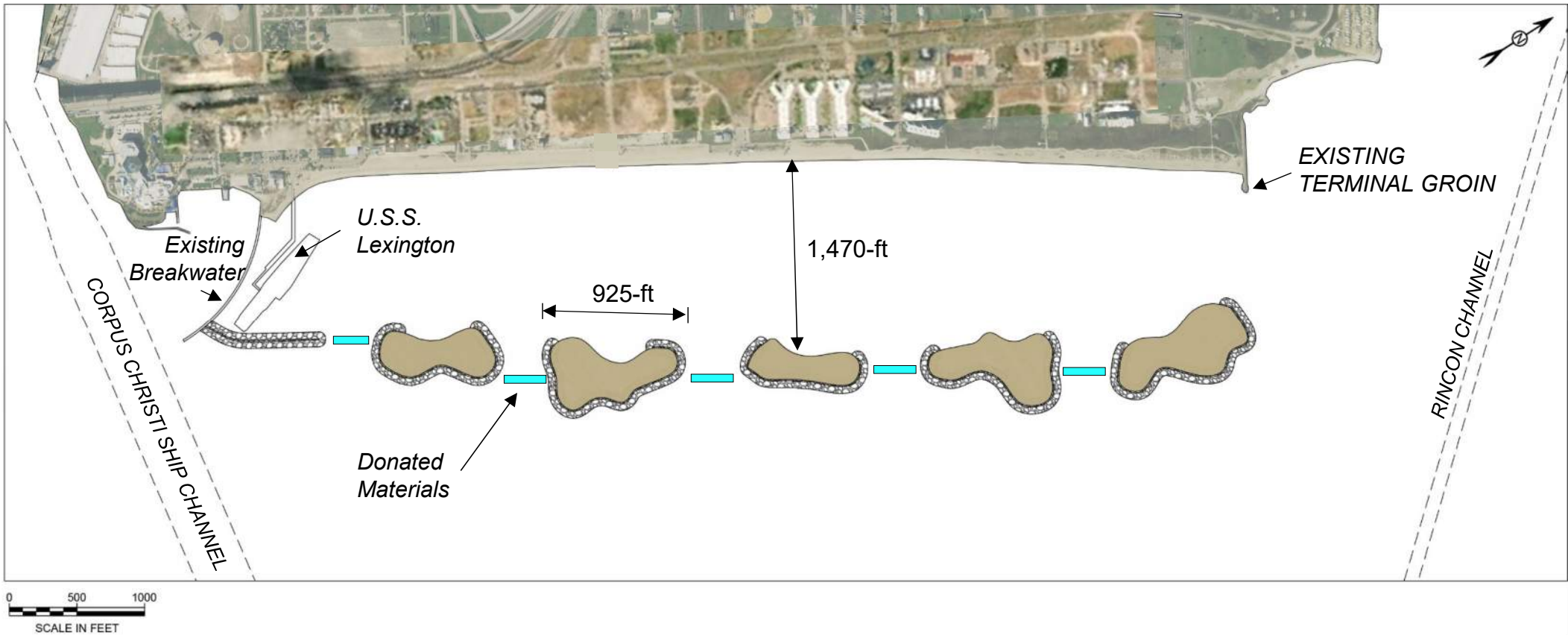
Costs:

- Loading, Transport, Unloading
- 29 Round Trips (40 miles each)
- 15 days to complete + delays

Description	Quantity	Unit Price	Unit	Sub-total
Labor	15	$ 10,000.00	day	$ 150,000.00
Equipment	15	$ 42,000.00	day	$ 630,000.00
Fuel	15	$ 5,000.00	day	$ 75,000.00
			Total Costs	**$ 860,000.00**
			Total Costs (incl. 30% Contingency)	**$ 1,200,000.00**

Rachal Foundation Donated Materials

Breakwater Islands with Low Crested Sills (draft – no evaluation has been conducted)



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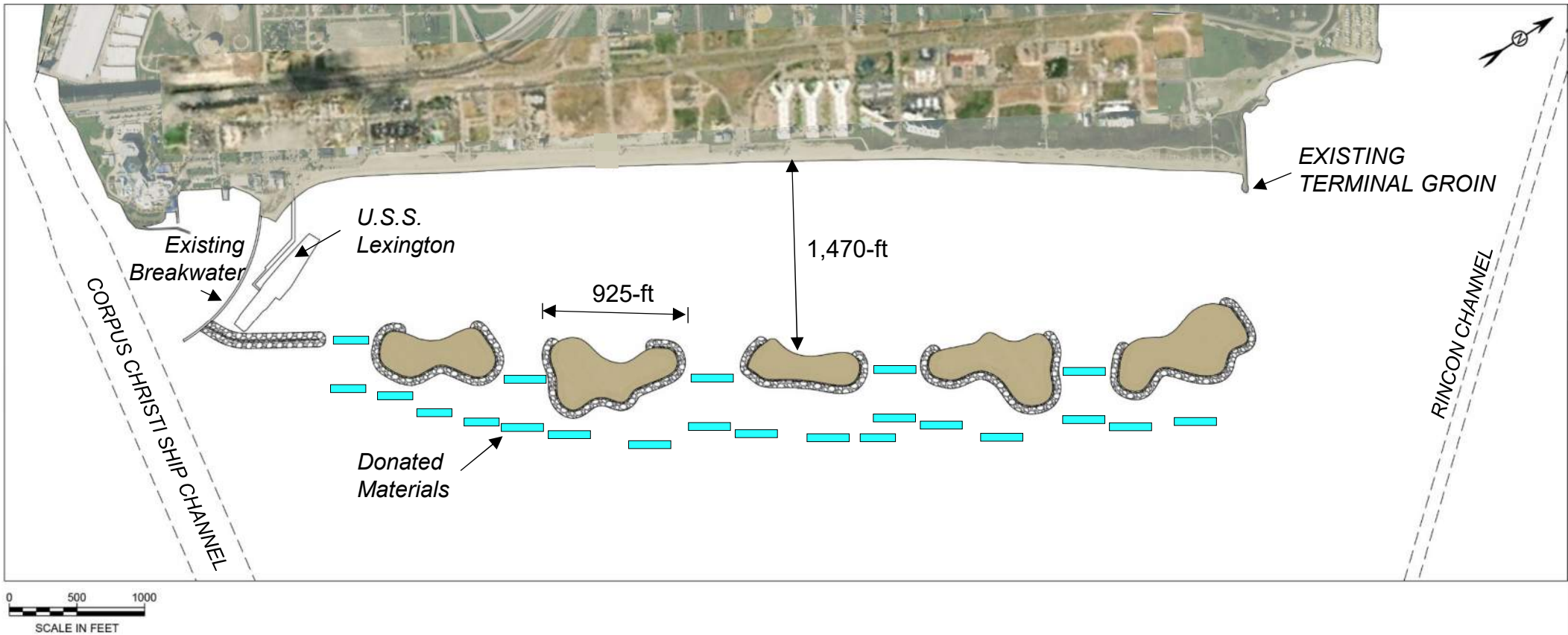

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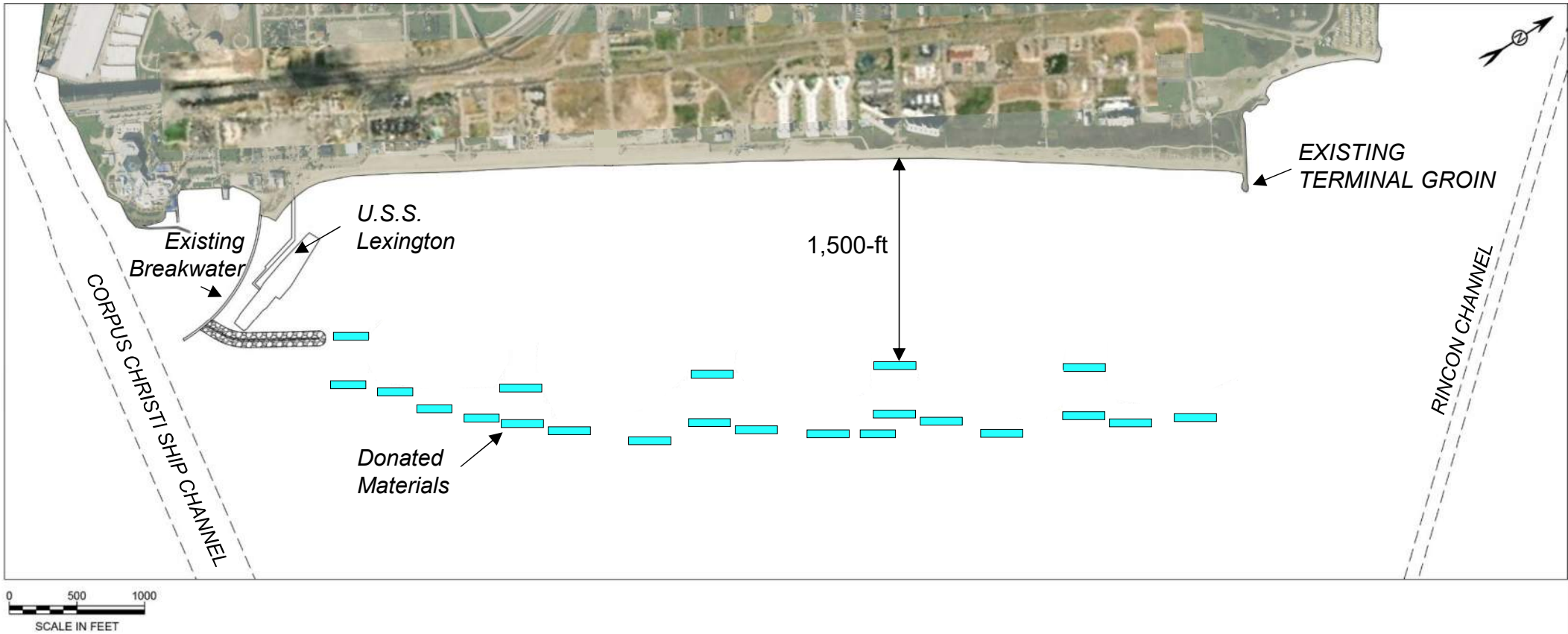


Preliminary Design

Breakwaters

- Alignment, Gap, and Typical Cross Section Optimization
- Stone Sizing (100-year event)
- Source Identification

Dredging (if applicable)

- Sediment Source Identification
- Evaluate Dredging Methods and Project Phasing
- Sediment and Consolidation Analysis

Deliverables

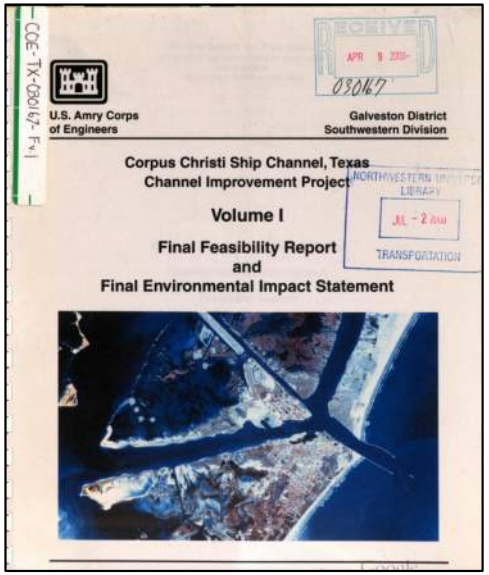
- Basis of Design
- Engineer’s Opinion of Probable Costs
- Preliminary (Permit Level) Drawings

Regulatory Permitting

- Data Collection
- Pre-Application Meeting
- Document Preparation
- Joint Evaluation Meeting
- Permit Procurement

Regulatory Coordination

Local Precedent



USACE concluded, ***"The new BU site will provide additional habitat for life stages of marine species and additional habitat for colonial waterbirds. There are not significant adverse impacts expected for the estuarine ecosystem diversity, productivity and stability, or recreational, aesthetic, and economic values."***

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