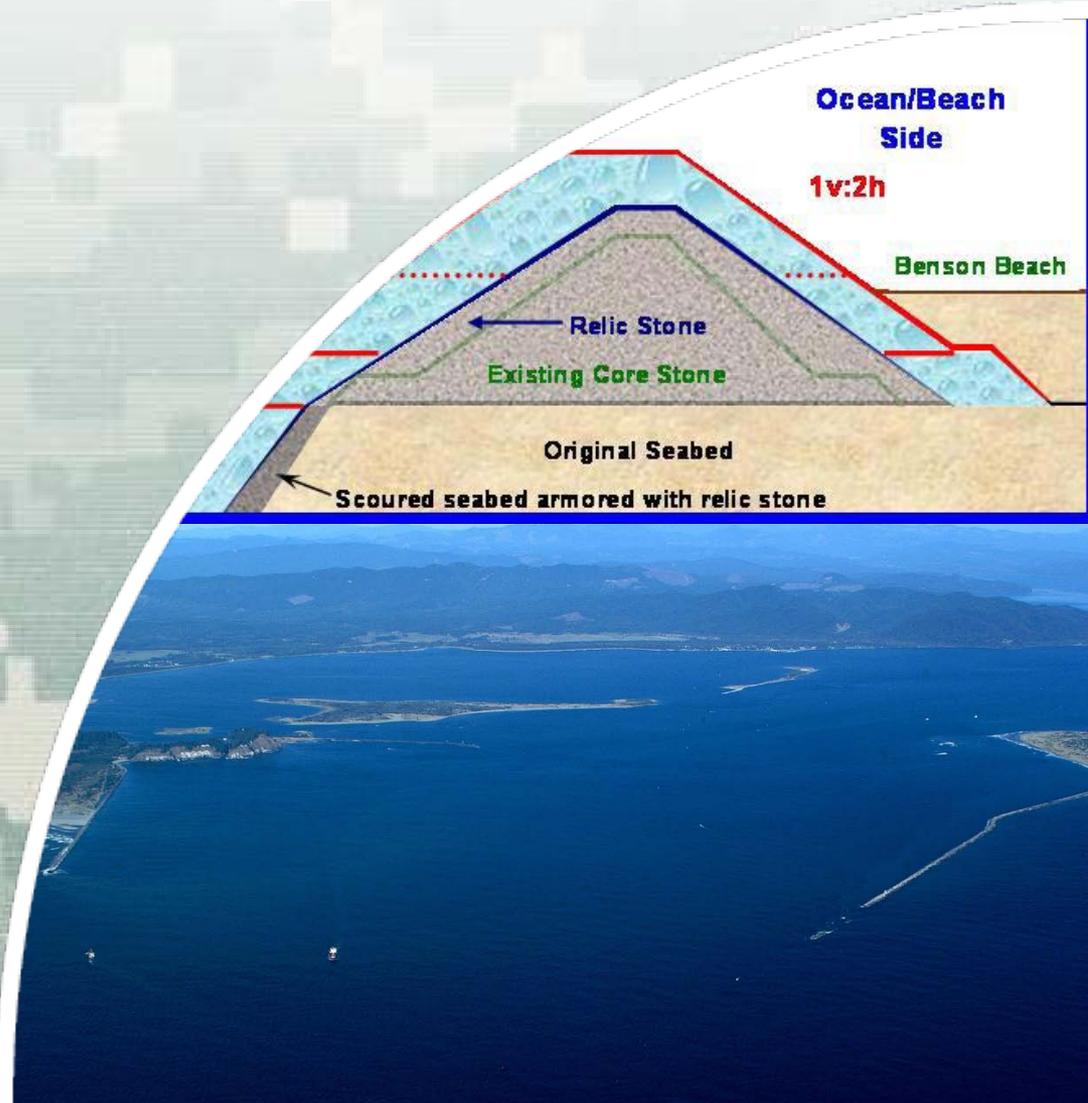


Mouth of the Columbia River Jetties Three-Phase Construction Plan

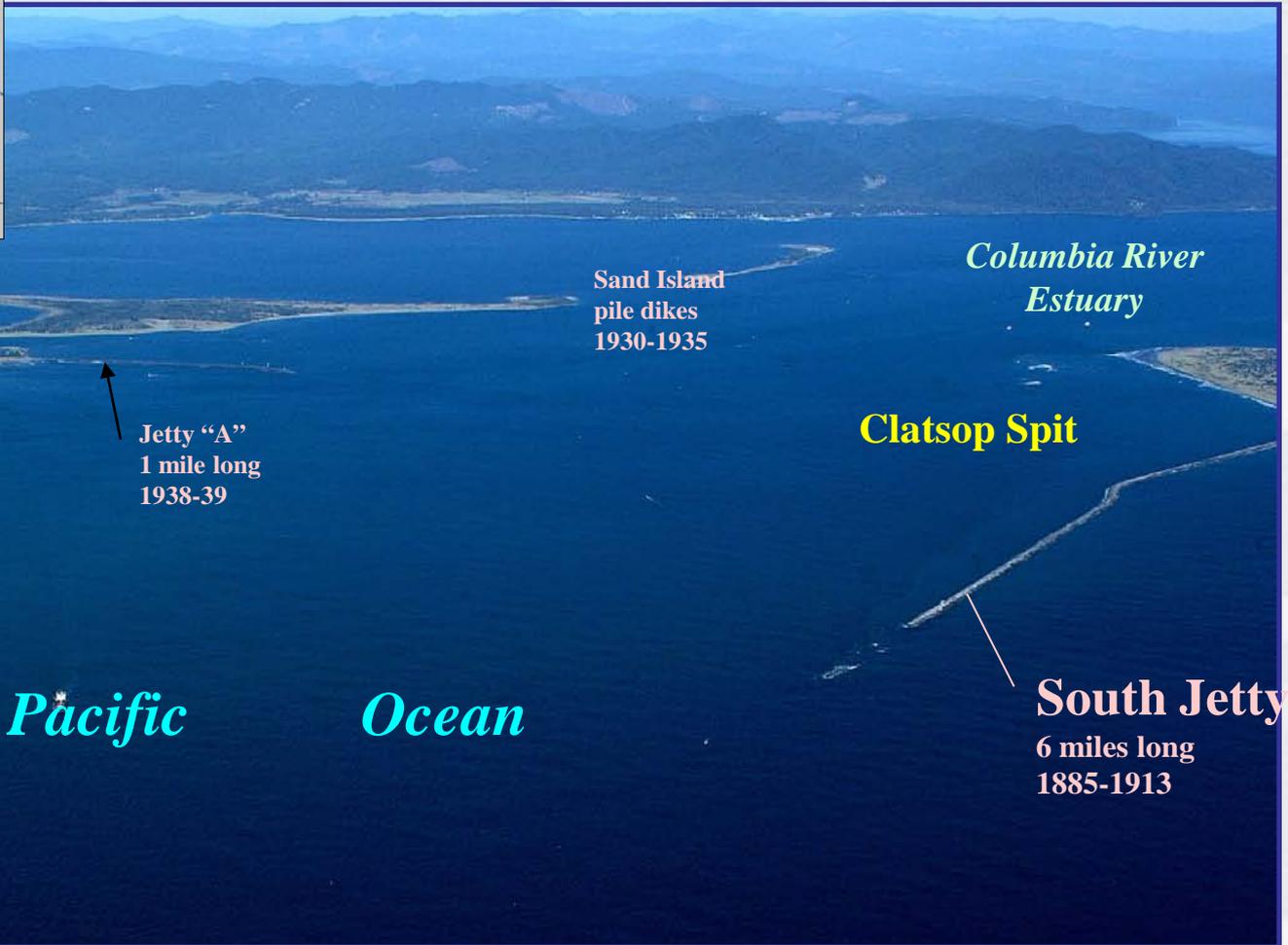
Project Overview

October 9, 2012



US Army Corps of Engineers
BUILDING STRONG®

MCR Jetties Major Rehabilitation



Peacock Spit

North Jetty 2.5 miles long 1914-1917

Jetty "A" 1 mile long 1938-39

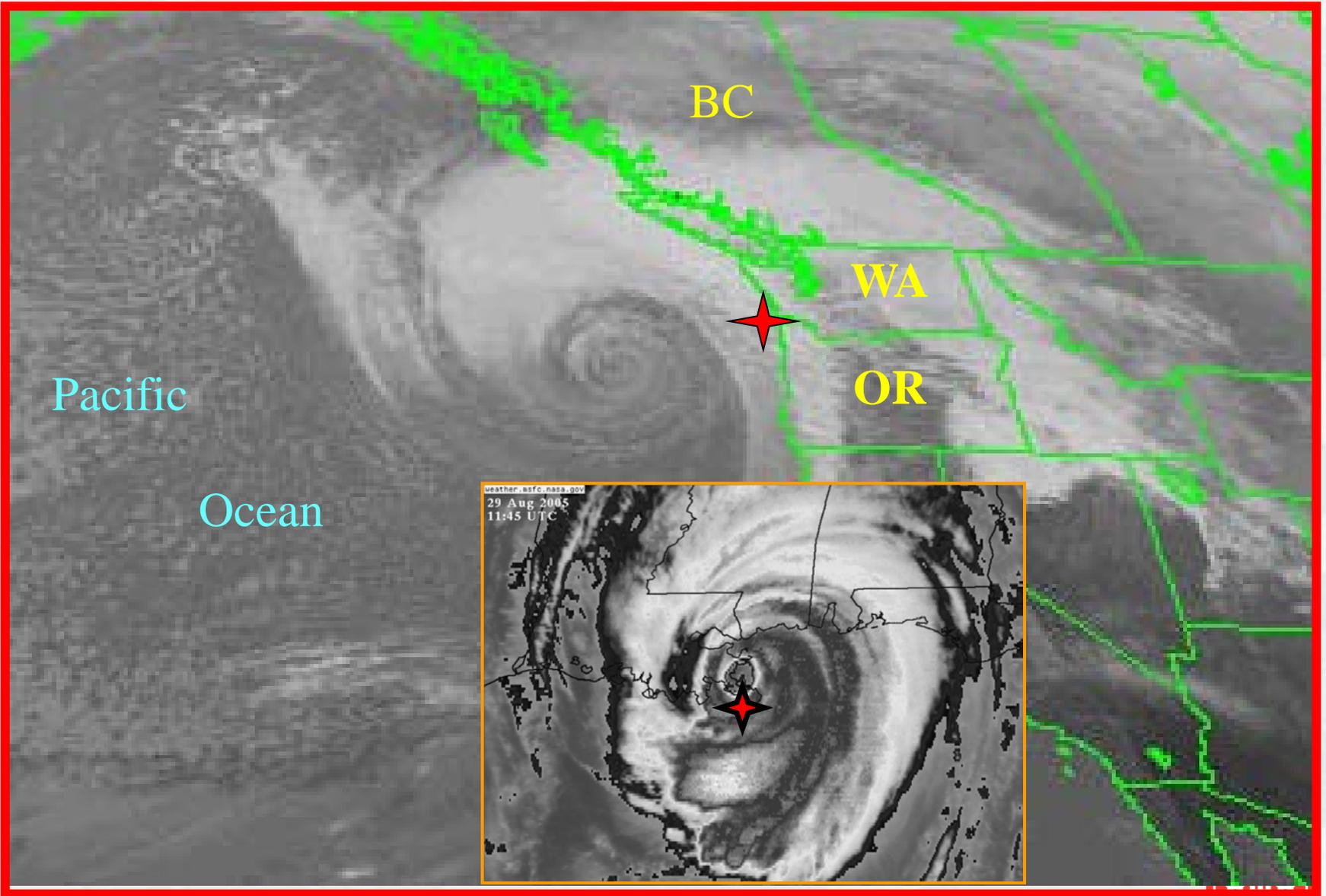
Sand Island pile dikes 1930-1935

Clatsop Spit

South Jetty 6 miles long 1885-1913

Pacific Ocean





3 MAR 1999 - Tropical Storm

29 AUG 2005 - Hurricane



UNIQUE CHALLENGES

for Jetties & Navigation at the Mouth of the Columbia River

MCR is a zone of interaction between severe forces
– regular occurrence

Normal River Flow = 100,000 – 400,000 cfs

Average Tidal Range = 8 ft, occurring 2x daily

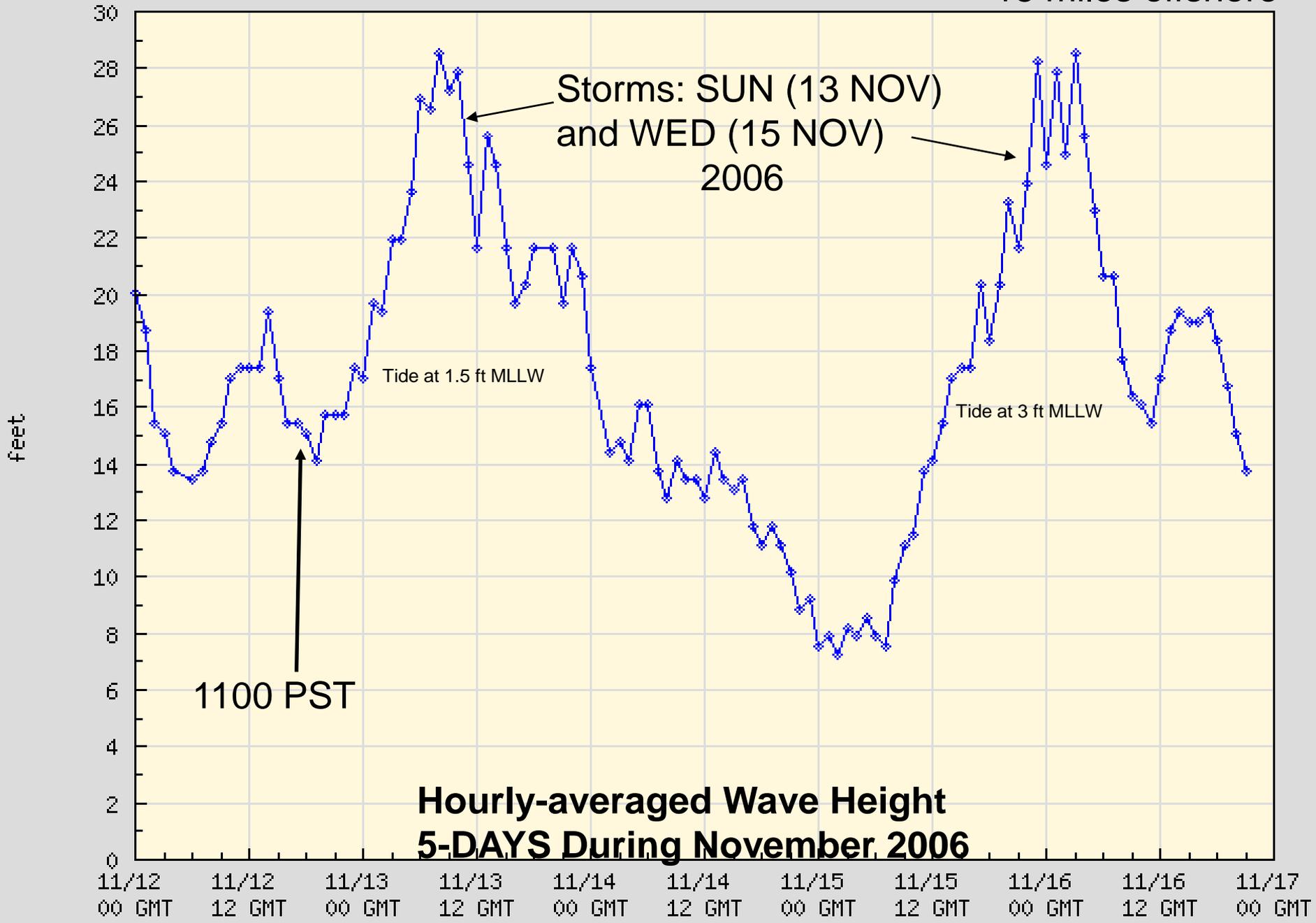
Average Wave Height during Oct. – April = 11 ft

OR-WA coast exposed to an average of 4 hurricane-like storms per year
11 such storms may occur in a given year having waves > 22 ft high

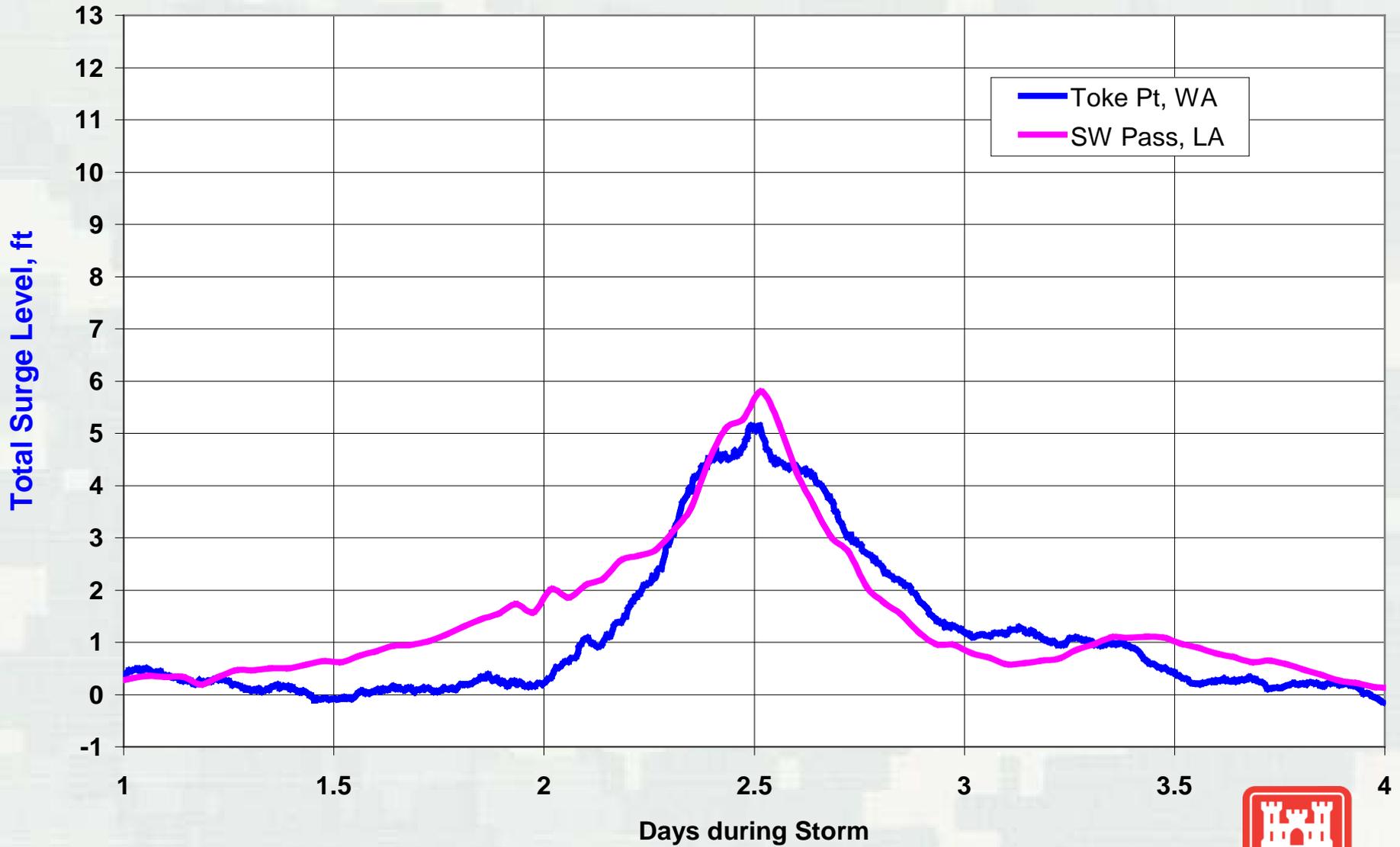
Storm Surge = 3 to 5 ft + *Transient set-up of 2 to 5 ft*



Significant Wave Height at 46029 15 miles offshore



"Open" Coast Storm Surge Comparison Hurricane (GOM) vs. Extr. Low (PacNW)



Pacific

Long Beach

North Head

Ilwaco

Baker Bay

Chinook



Peacock Spit

North Jetty

Jetty "A"

Sand Island

Washington

Channel

Sand Island Pile Dikes

Clatsop Spit

Lower Columbia River Nar Channel

MCR

Navigation

South Jetty

Columbia River Estuary

Ocean

Hammond

Oregon

Astoria



Three-Phase Construction Plan

1. South Jetty dune augmentation/stabilization
2. North Jetty: lagoon fill and critical repairs
3. Major rehabilitation of all three jetties



South Jetty: **The Observed Historic Movement of the Shoreline**



FY 13 (PBUD): South Jetty

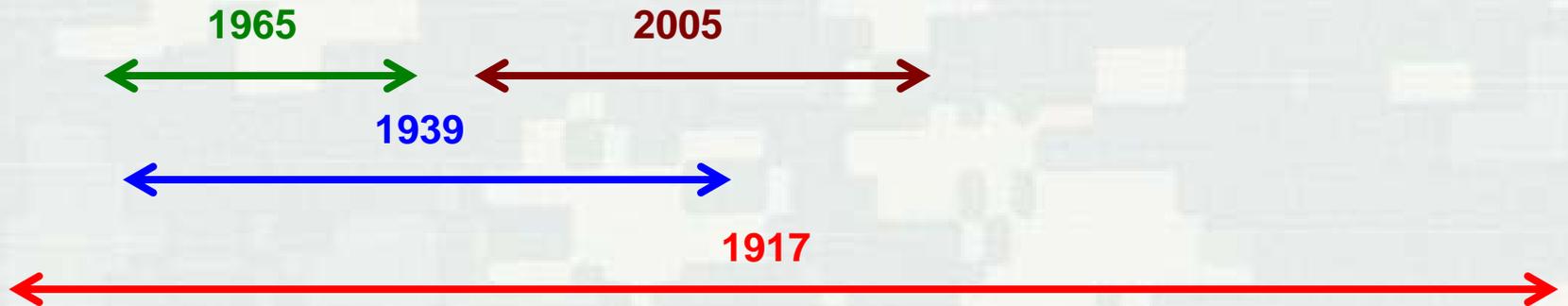
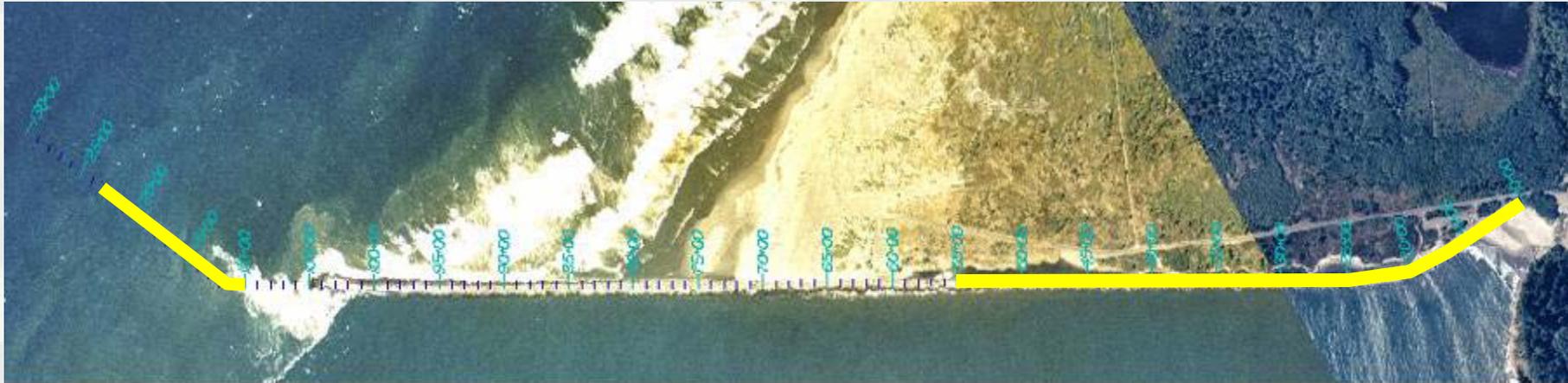
Dune Augmentation/Stabilization

- South Jetty Root & Trestle Bay: \$5.5M
- Letter report, P&S, beach material placement
- Without-project condition (separate from major maintenance and rehab construction)



MCR North Jetty - Construction and Repair History

(Has receded approximately 1800' in length since 1916.)



North Jetty Lagoon Fill



- Losing:
 - 1.14 acres of wetlands
 - 4.71 acres of waters of the U.S.
- Locating, developing mitigation site
- Replacing jetty road culvert
- Redirect stream away from lagoon wetlands
- Redirect overland flow away from jetty root; stabilize foundation



Second Phase of Construction: MCR North Jetty – FY 13 Capability, O&M

Major Maintenance Report supports two separate actions:

- (1) Lagoon Fill: \$10.84M → stabilizes jetty's foundation
- (2) Critical Repairs: \$14.15M → rehabs degraded reach



Critical Repairs
STA 86-99
↔

Lagoon Fill
↔



Major Rehabilitation Plan, CG

- Major Rehabilitation Report (MRR) supported actions for all three jetties
- Based on stochastic, risk-based numerical model using design waves.
- The sequence and magnitude of seven-year rehab plan will be adjusted based on jetty monitoring triggering immediate repairs: 35% remaining x-section above -5 MLLW.
- No spur groins included in the current design—head stabilization for the North Jetty and Jetty A.
- District will obtain environmental permitting per forecasted construction schedule.
- Fully funded, feasibility level design in 2012 dollars: total project costs will be approximately \$257M over a seven-year construction schedule—which is funding dependent—from 2014 through 2020.
- Overall costs are estimated as follows: North Jetty at \$80M; South Jetty at \$147M; and Jetty A at \$30M.



Major Rehabilitation Plan, CG

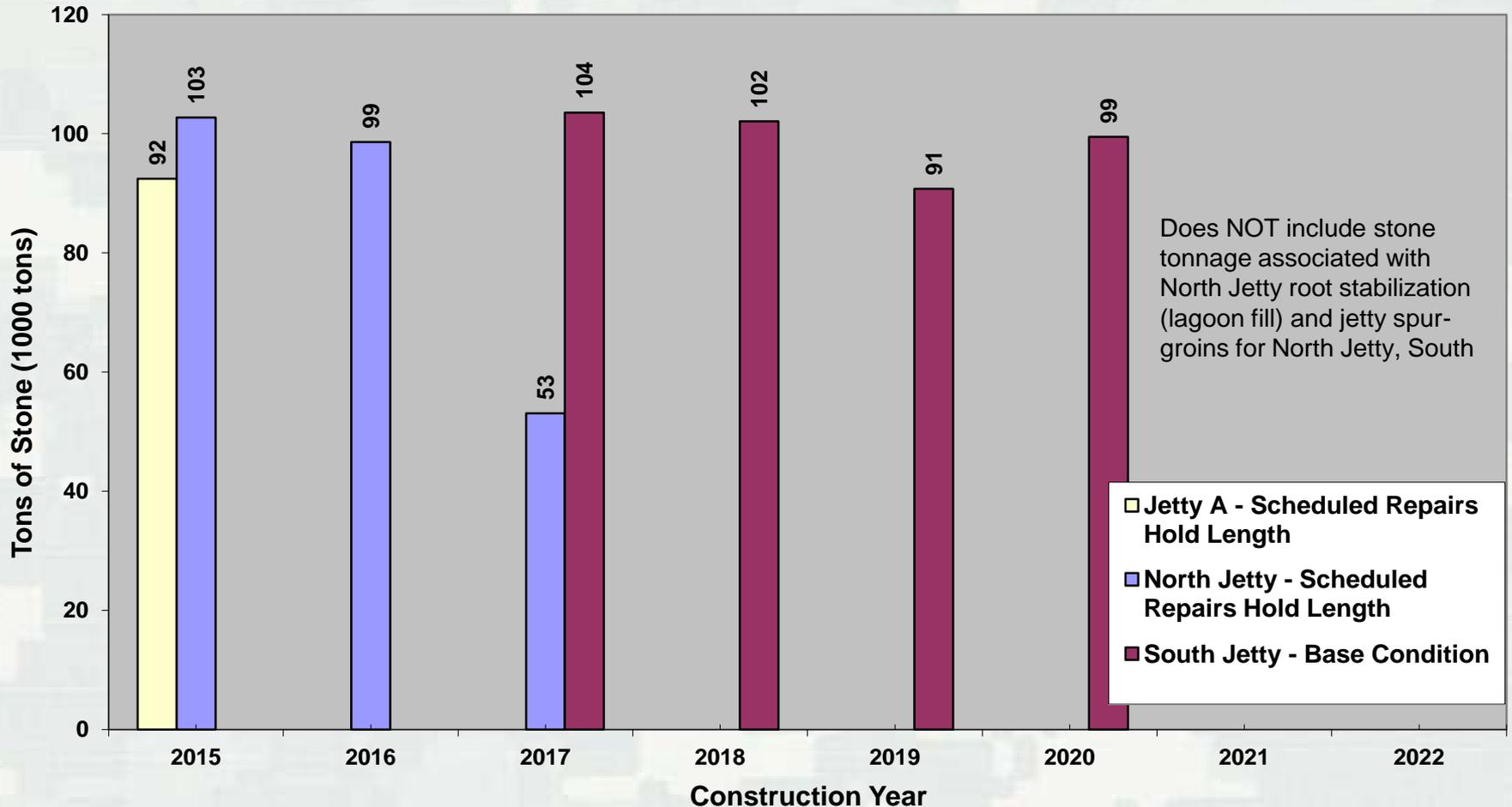
Benefit-to-Cost Ratio (BCR), Major Rehabilitation Report

North Jetty:	1.09		
South Jetty:	1.00	→→→	System BCR: 1.10
Jetty A:	1.42		

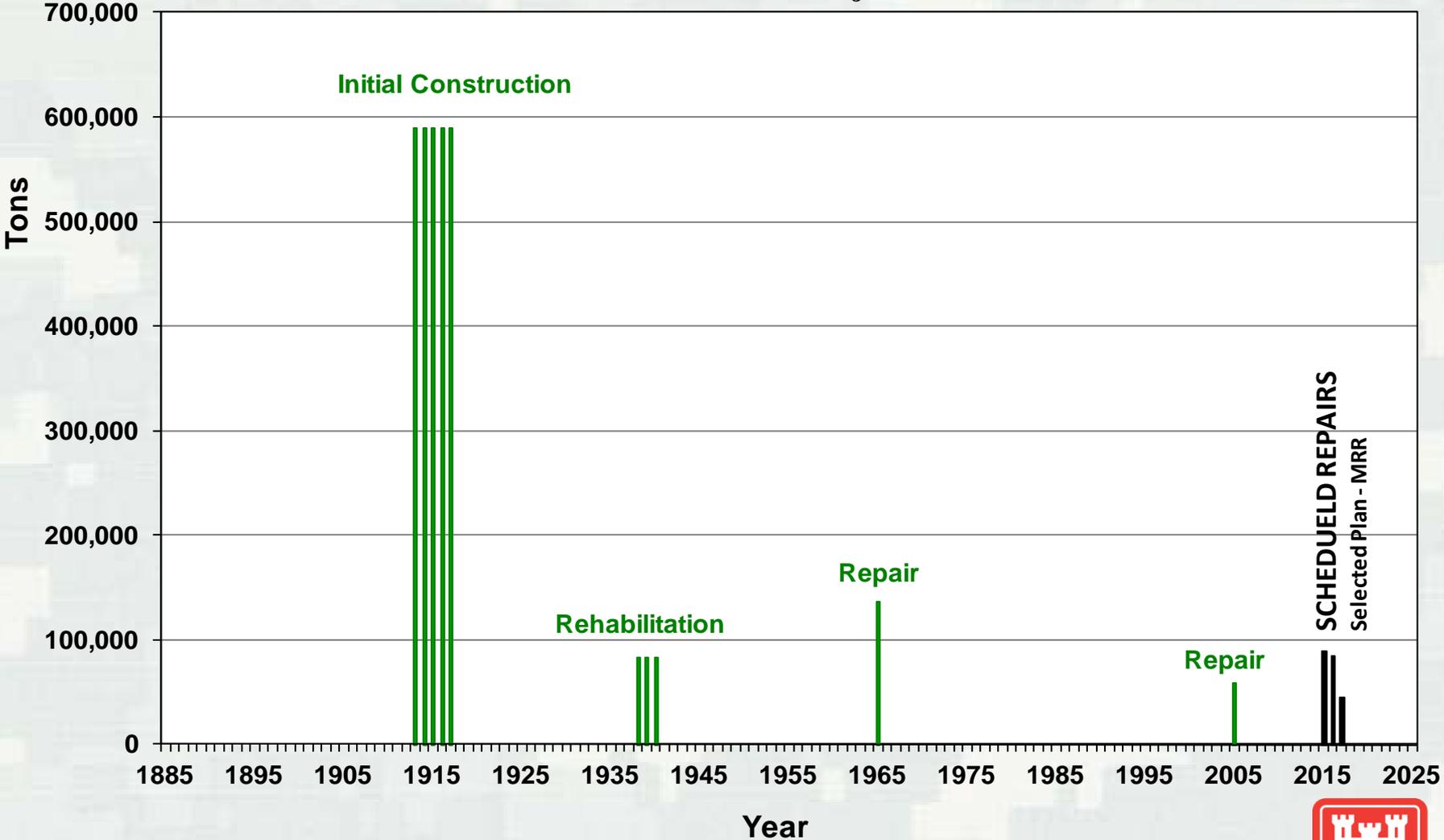
- The project's base condition theoretically prevents a jetty breach ; project navigation benefits aren't at risk.
- The major rehab effort doesn't produce a high benefit-to-cost ratio because the project prevents a jetty breach and sediment from blocking the navigation channel.
- With inclusion of the base condition as the recommended plan for the South Jetty, project feature benefits are essentially treated as equaling costs, despite substantial benefits of maintaining navigation at the project.
- Protecting the Columbia River navigation channel entrance (105 miles, 43 feet deep; \$182M channel-deepening project completed in 2010) and the Columbia/Snake River system is paramount.
- Over \$20B of cargo annually travels through the entrance protected by MCR Jetties; and over \$900M in new infrastructure investment has been made to date in the Pacific Northwest since 2010.



Mouth of the Columbia River Jetty System Rehabilitation - Selected Plan (Construction Schedule: For stone placement on Jetties and existing stone re-work)



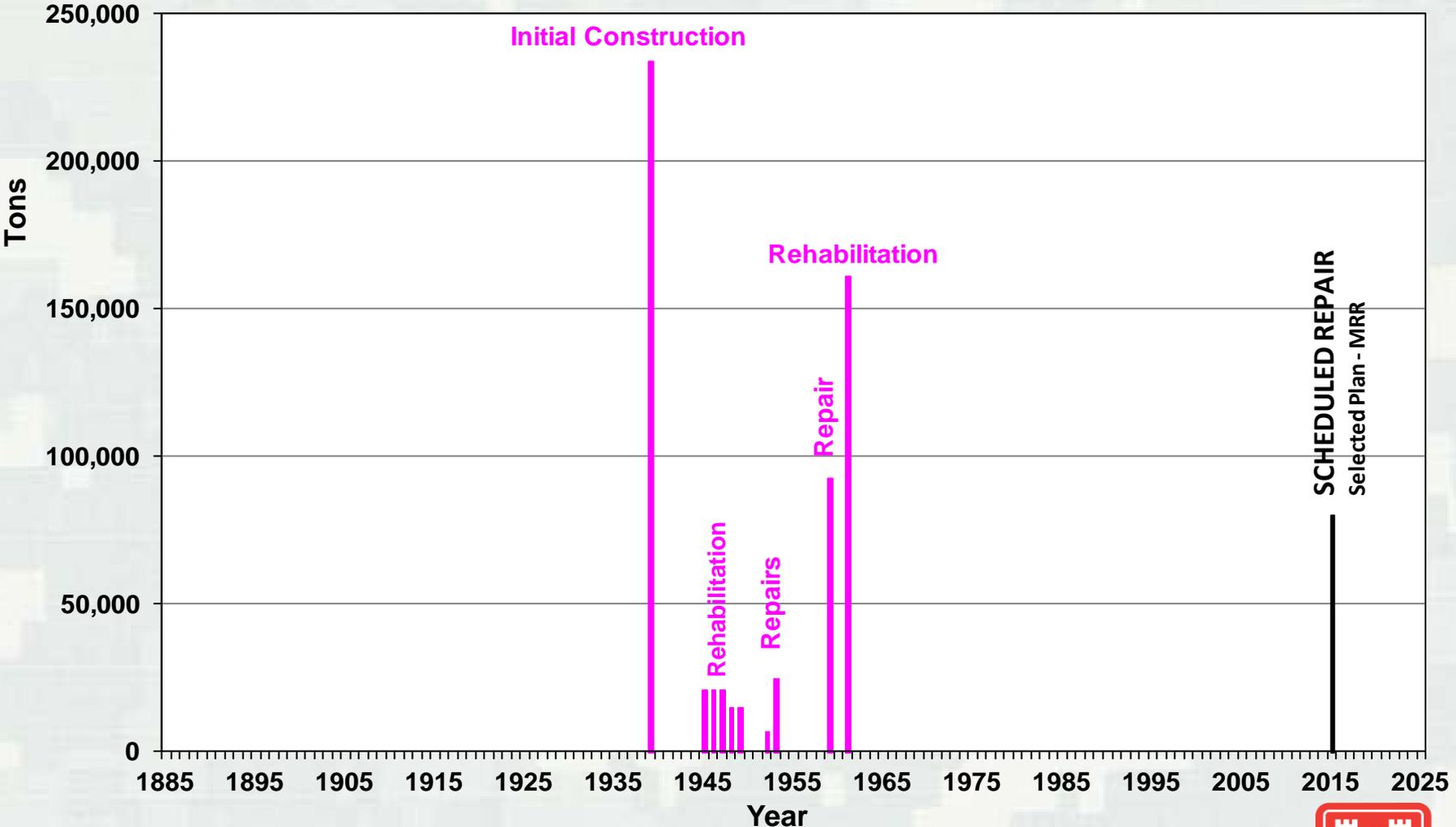
NORTH Jetty
Actual Year by Tons Placed
Previous and Future Project Conditions



JETTY "A"

Actual Year by Year Tons Placed

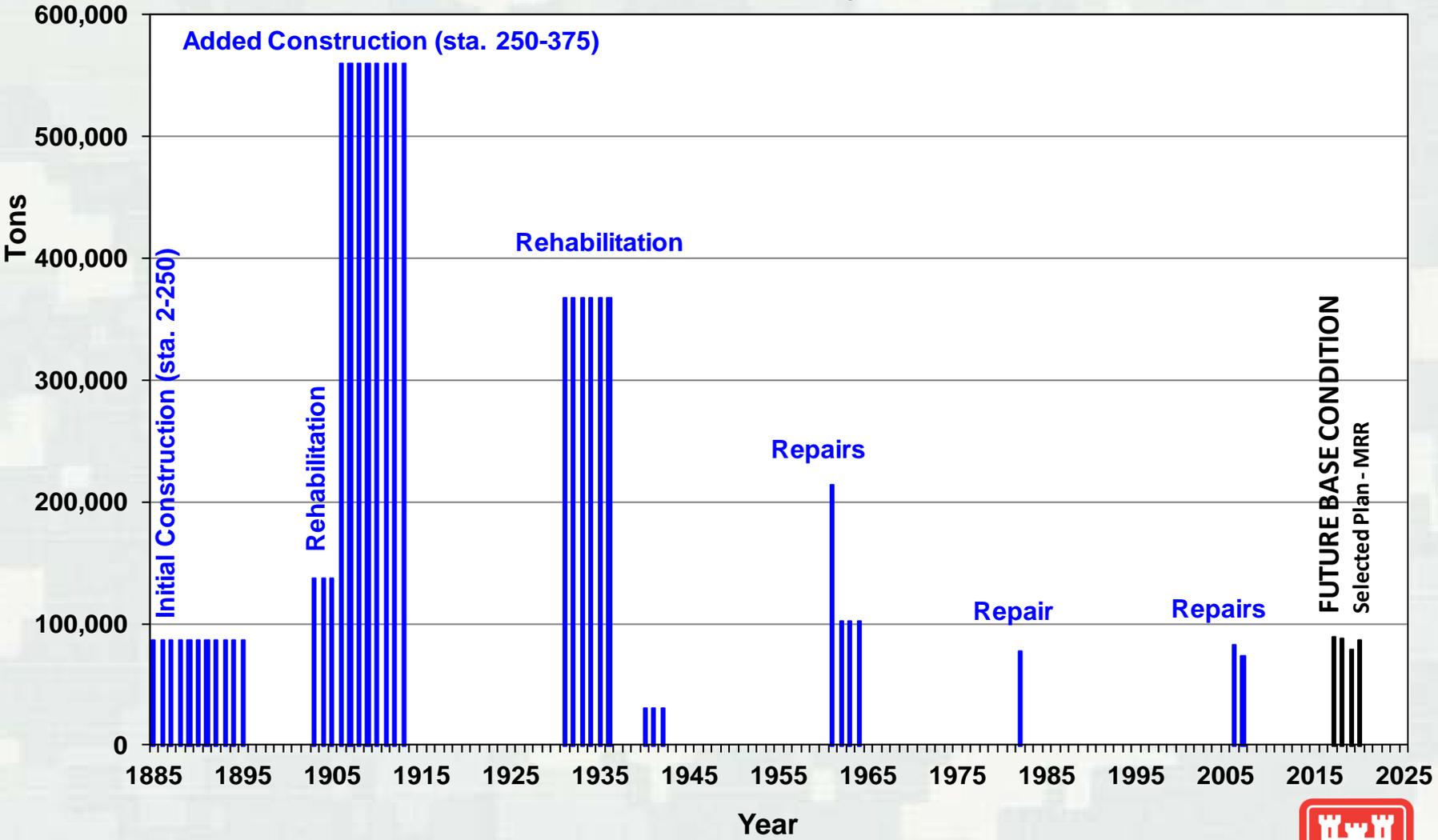
Previous and Future Project Conditions



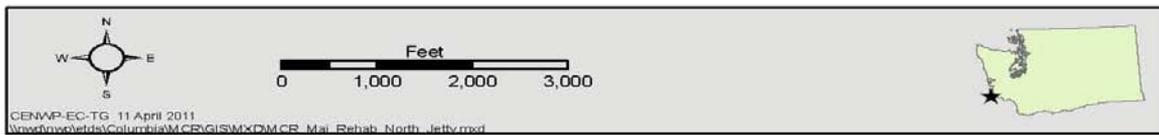
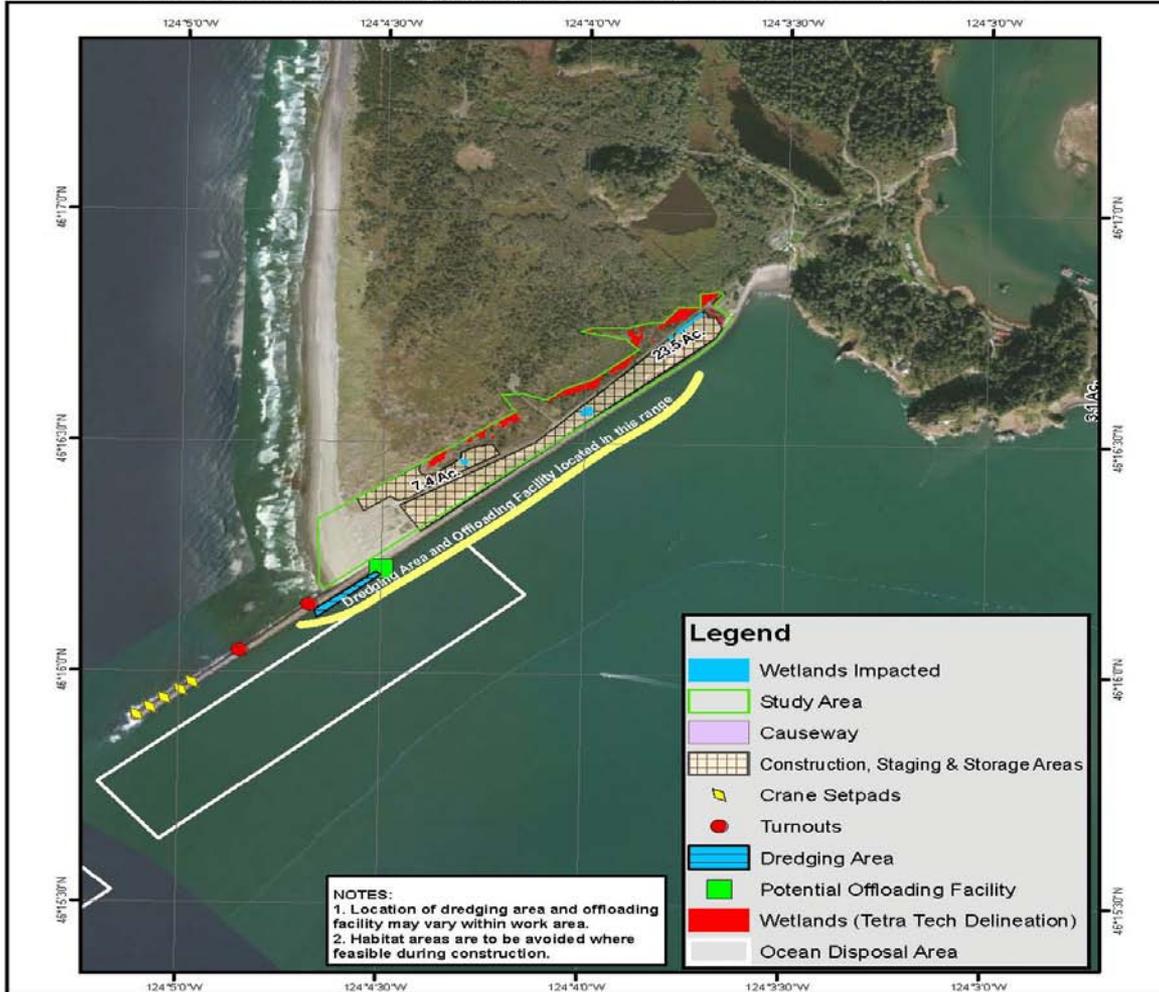
SOUTH Jetty

Actual Year by Year Tons Placed

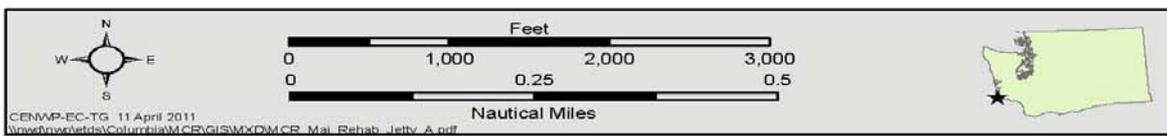
Previous and Future Project Conditions



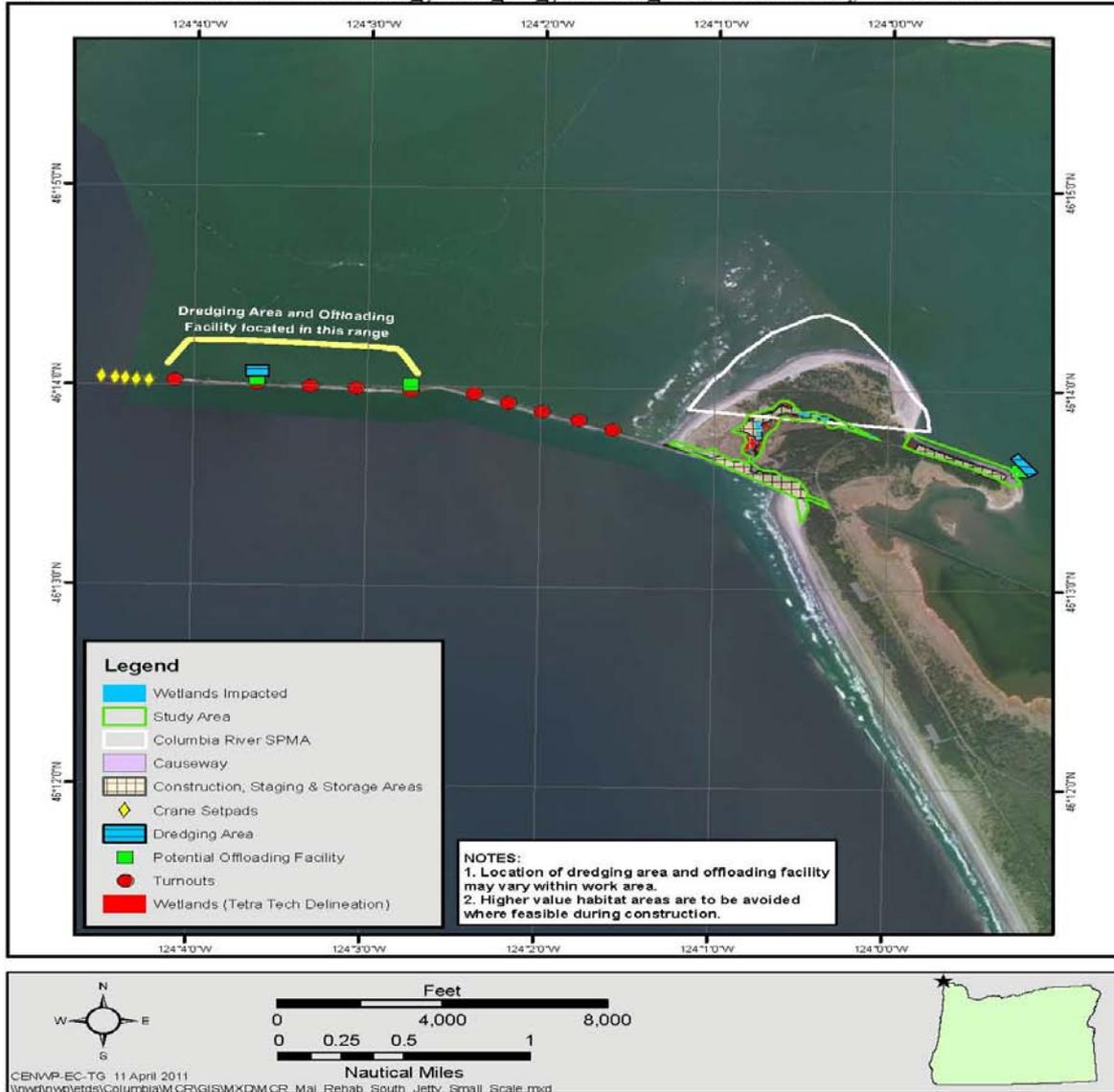
MCR Major Rehab North Jetty, Pacific County, Washington Potential Offloading, Staging, Storage & Causeway Facilities



MCR Major Rehab Jetty A, Pacific County, Washington Potential Offloading, Staging, Storage & Causeway Facilities



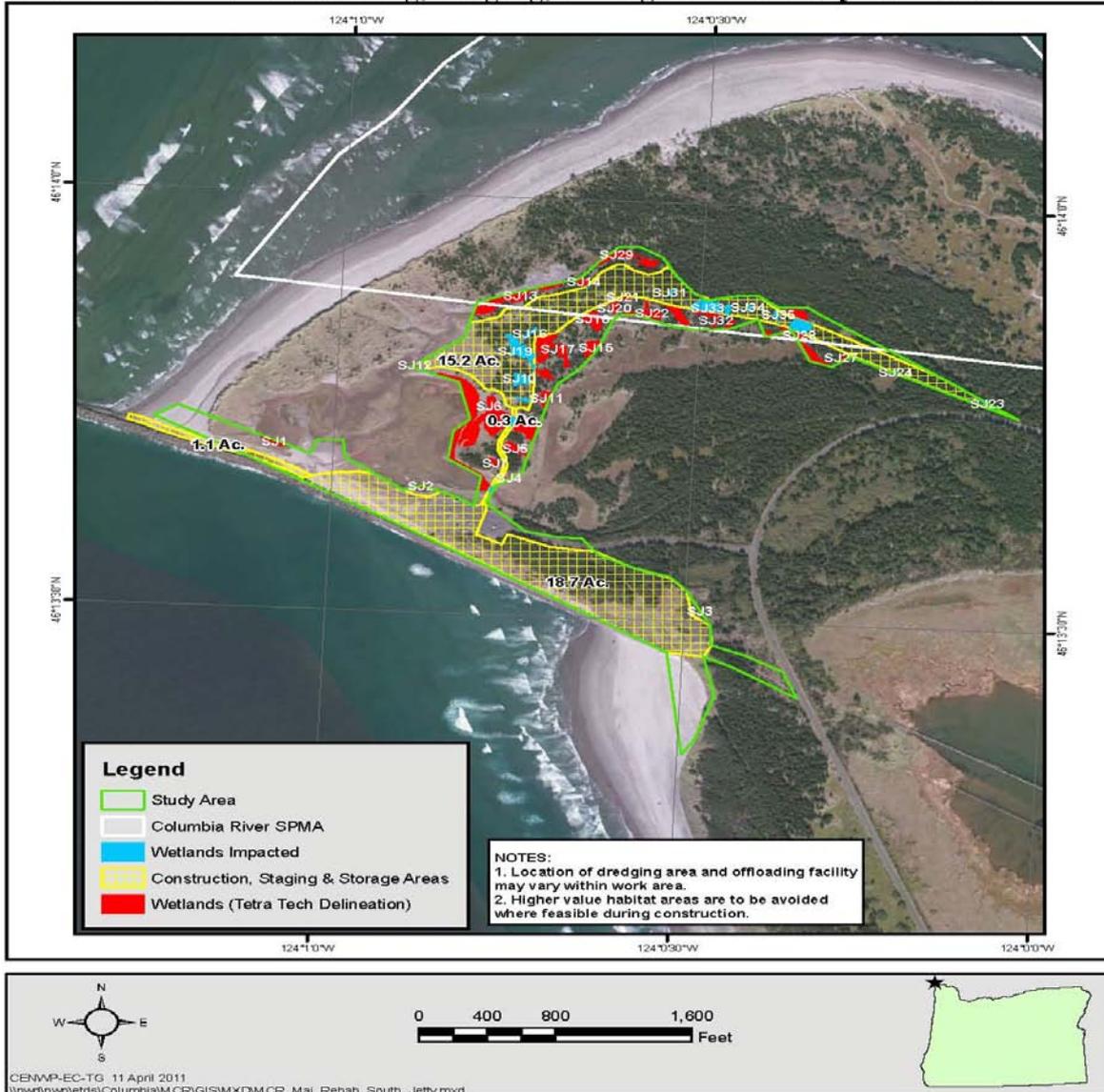
MCR Major Rehab South Jetty, Clatsop County, Oregon Potential Offloading, Staging, Storage & Causeway Facilities



MCR Major Rehab

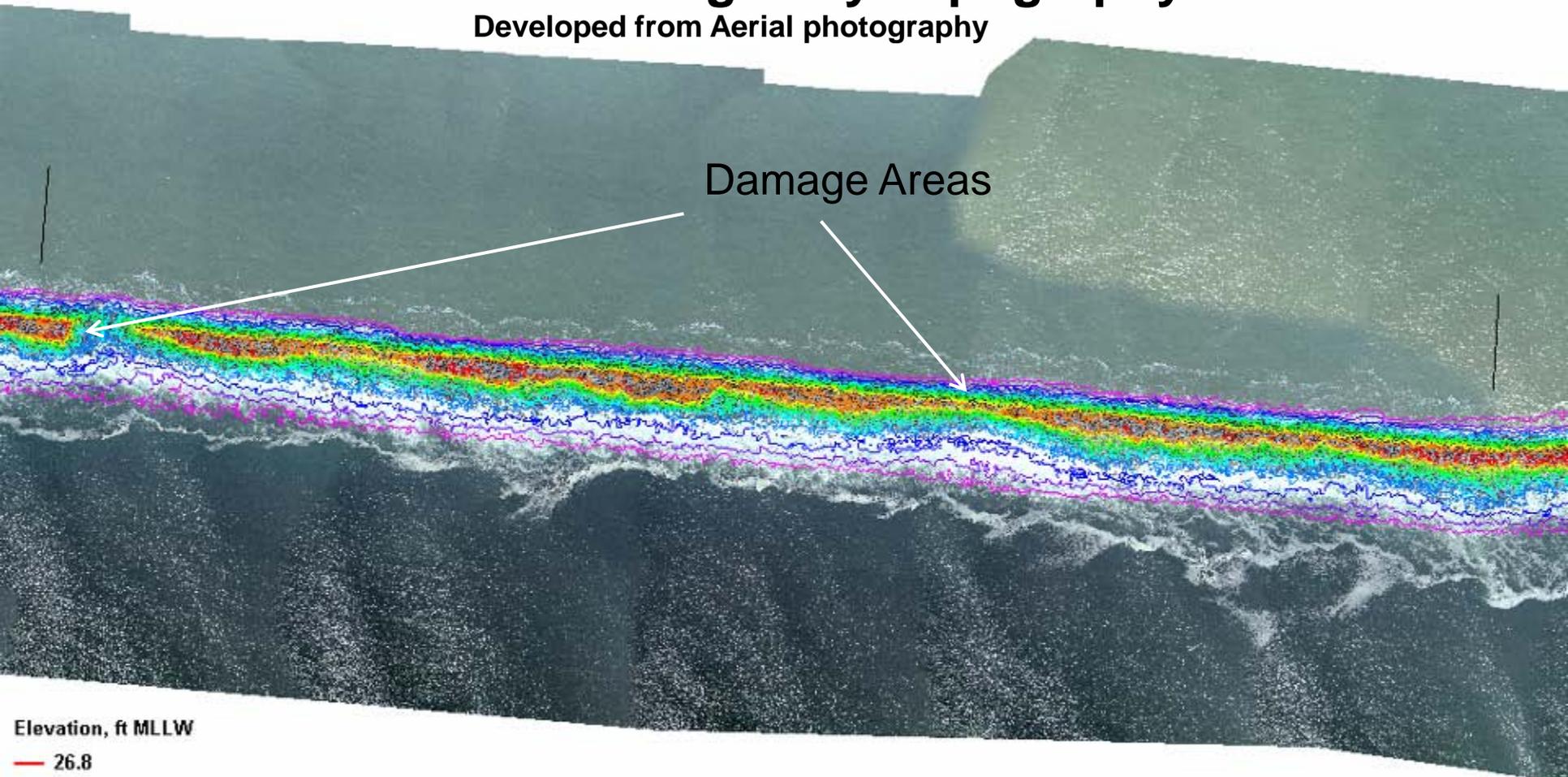
South Jetty, Clatsop County, Oregon

Potential Offloading, Staging, Storage & Causeway Facilities



Jetty Cross-Section Damage Documented Using Jetty Topography

Developed from Aerial photography



Damage Areas

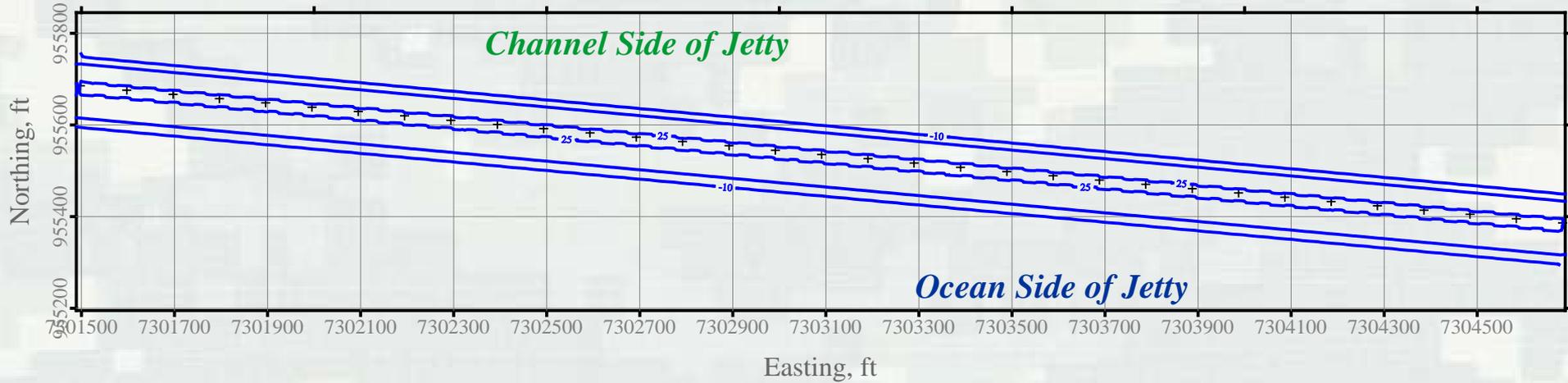
Elevation, ft MLLW

— 26.8
— 23.3
— 19.8
— 16.3
— 12.8
— 9.3
— 5.8
— 2.3
— -1.3
— -4.8
— -8.3

Example for Assessing Condition of MCR Jetties using Survey data:

- Evaluate Need to Initiate Repairs (based on damage threshold)
- Calculate the Amount of Jetty Damage (for Repair Estimate)

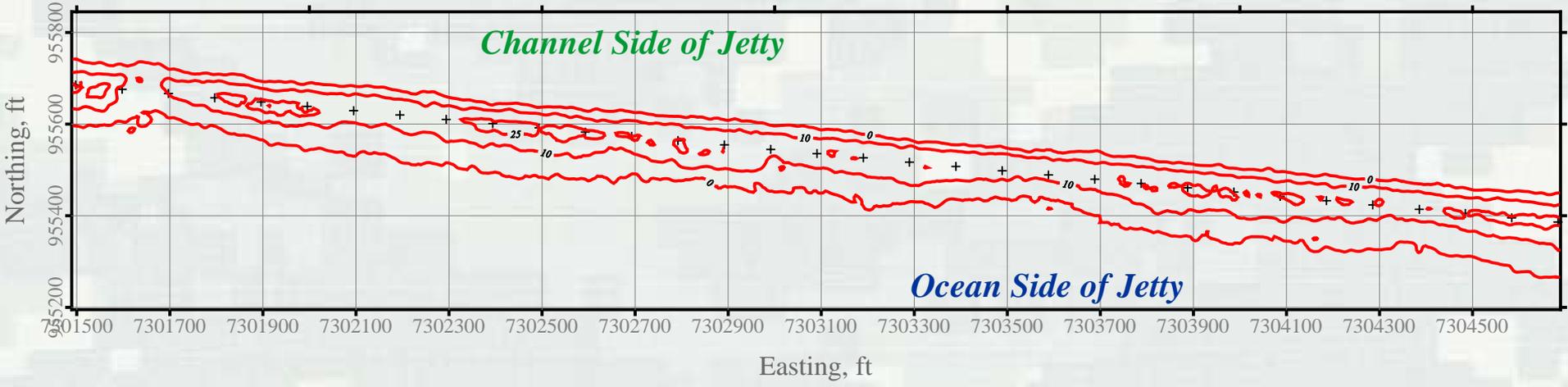
Example of Undamaged Jetty Surface (design template) - Contour Lines Plan View



— BLUE Lines indicate surface elevation of FULL Undamaged Jetty Template for -10 ft, 0 ft, and 25 ft elevation



Example of Damaged Jetty Surface - Contour Lines Plan View

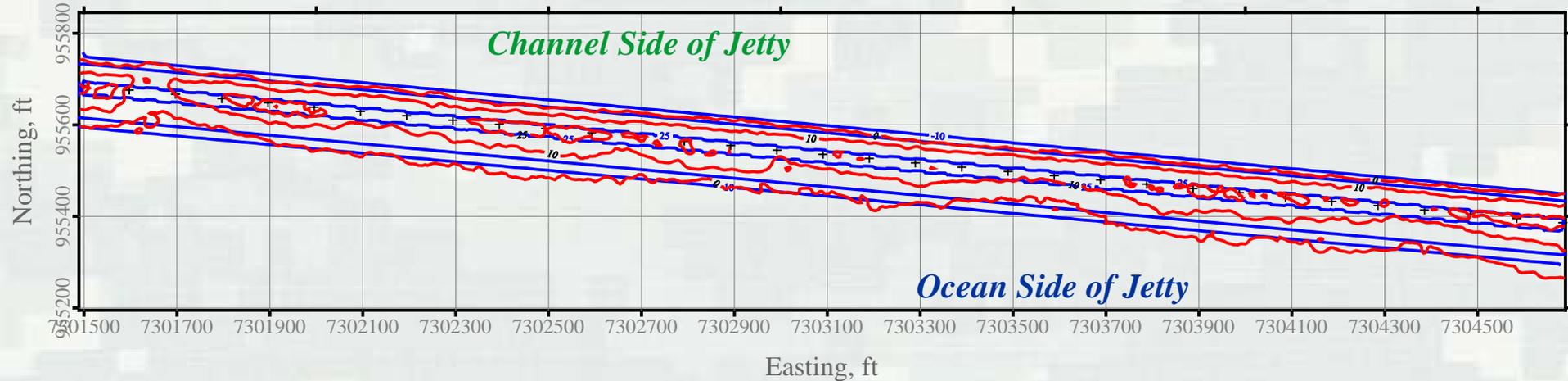


← 3,200 ft →

— RED Lines indicate elevation of DAMAGED jetty surface for 0 ft, 10 ft, and 25 ft elevations



Example of Comparing Undamaged Jetty Surface to Damaged Jetty Surface Contour Lines Plan View



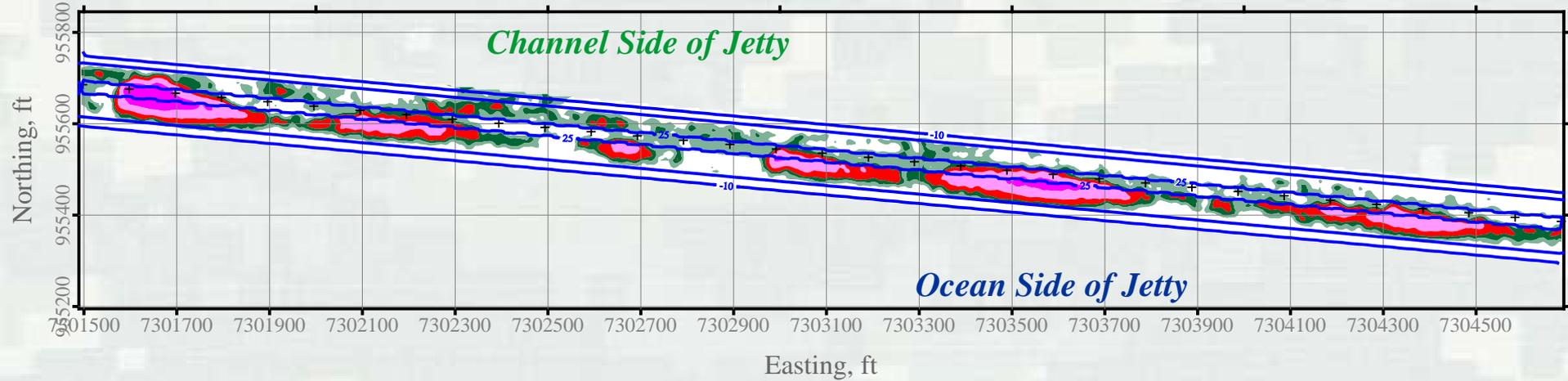
BLUE Lines indicate surface elevation of FULL Undamaged Jetty Template for -10 ft, 0 ft, and 25 ft elevation

RED Lines indicate elevation of DAMAGED jetty surface for 0 ft, 10 ft, and 25 ft elevations



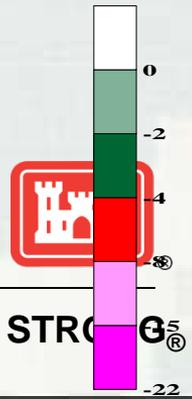
Example of Calculating Damage to Jetty

By subtracting the **Damaged** Jetty Surface from the **Undamaged Condition**
Plan View



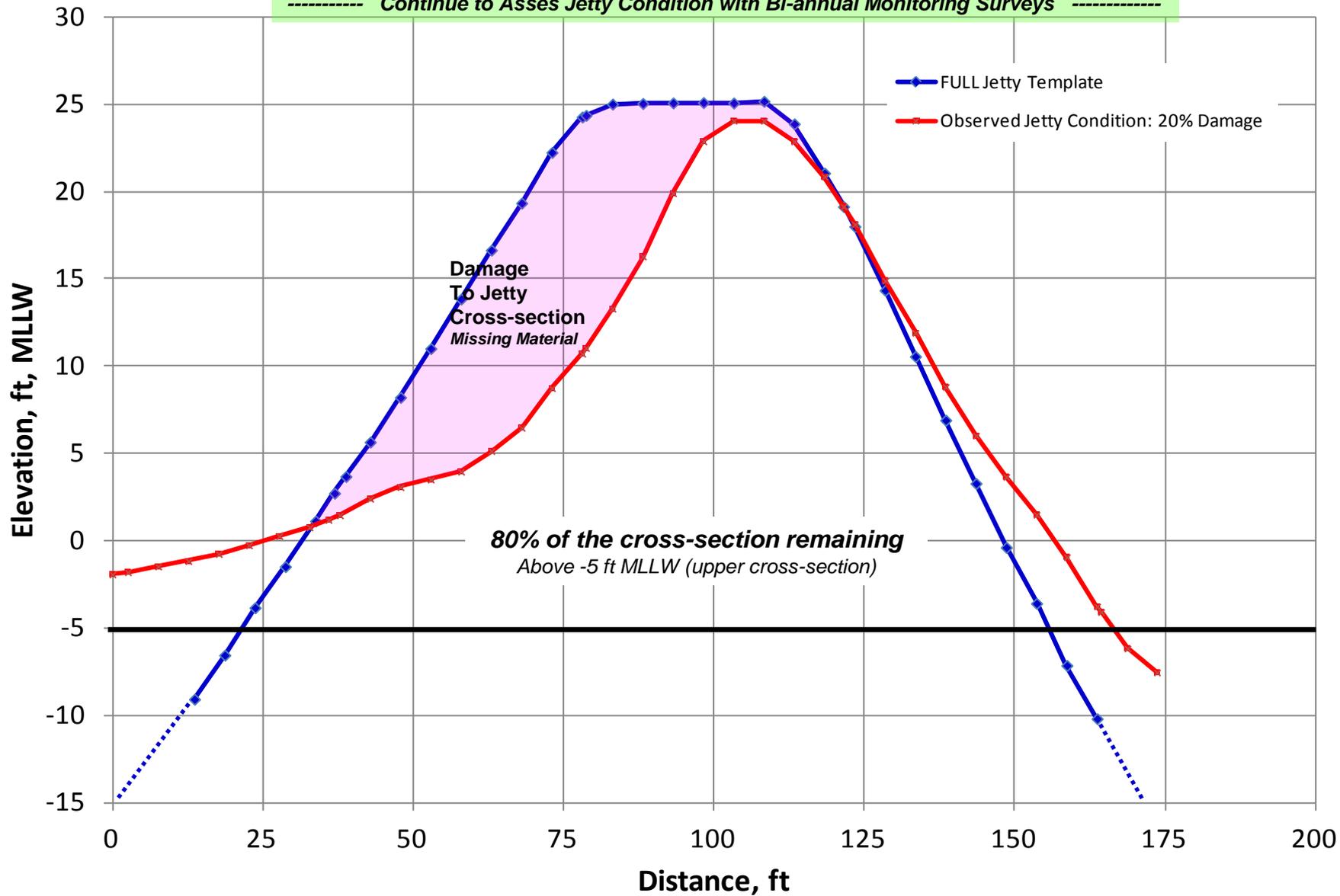
— BLUE Lines indicate surface elevation of FULL Undamaged Jetty Template for -10 ft, 0 ft, and 25 ft elevation

FT Below
FULL Undamaged Template
(damage to repair)



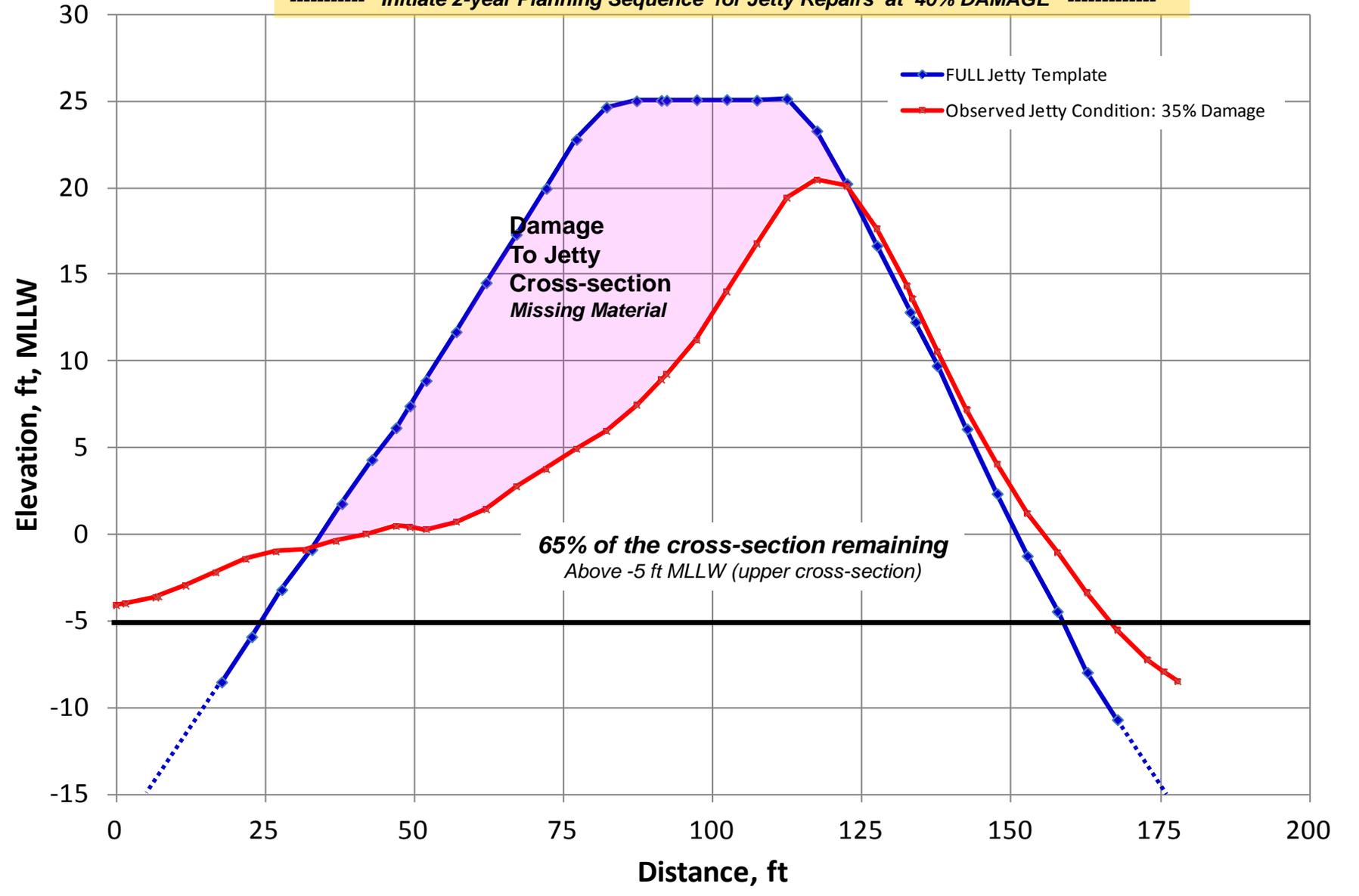
Jetty Cross Section Status **GREEN**

----- Continue to Assess Jetty Condition with Bi-annual Monitoring Surveys -----



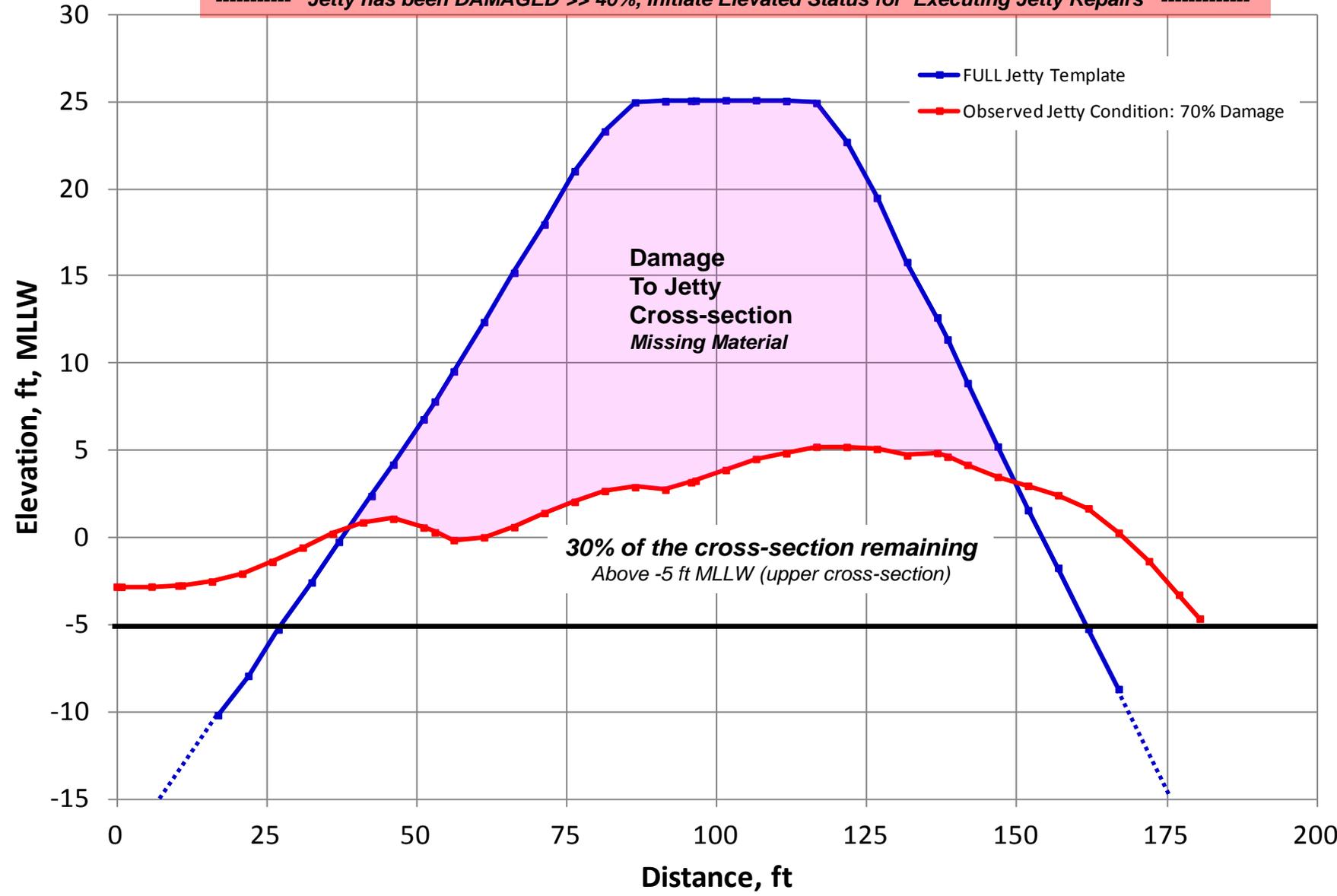
Jetty Cross Section Status **AMBER**

----- Initiate 2-year Planning Sequence for Jetty Repairs at 40% DAMAGE -----

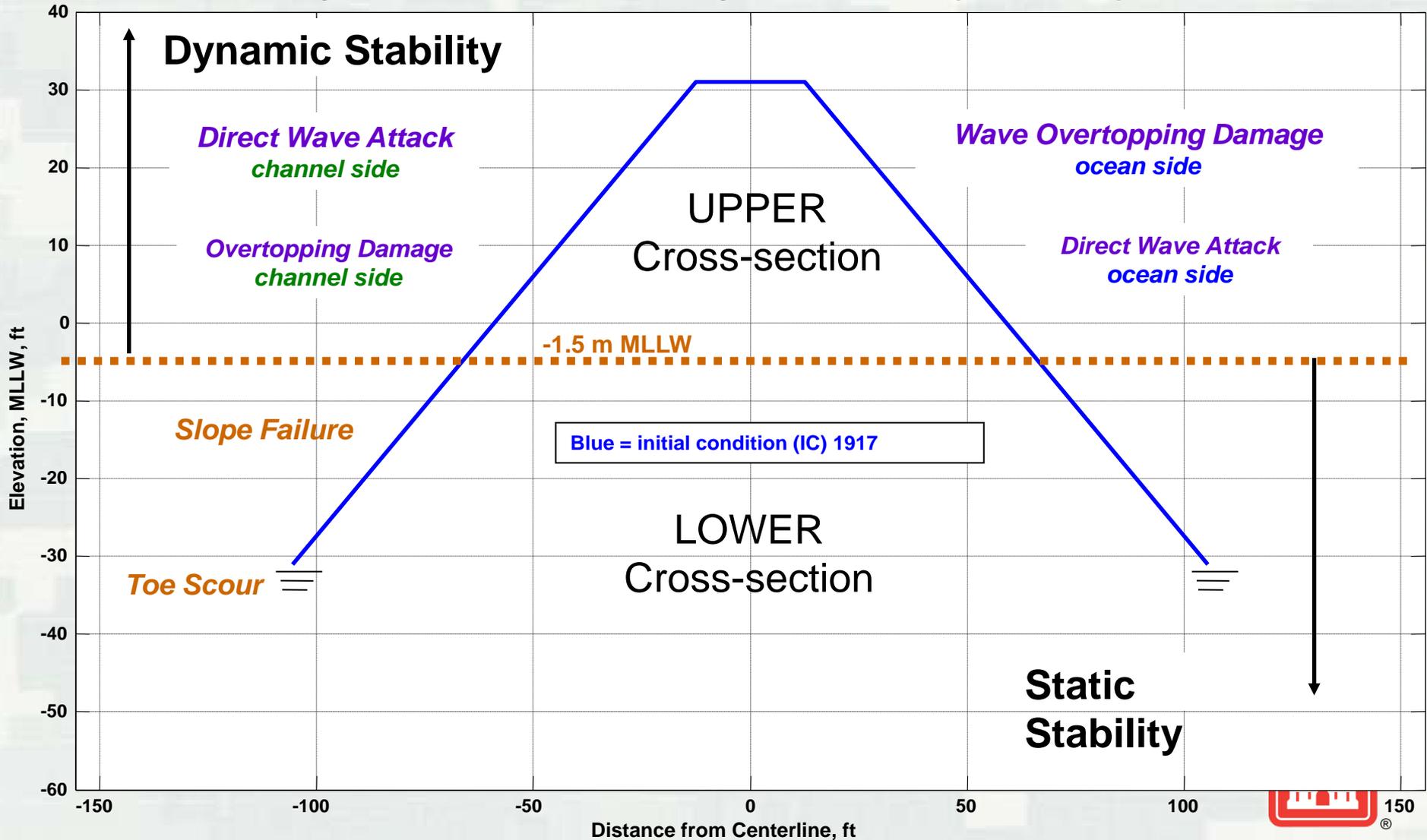


Jetty Cross Section Status **RED**

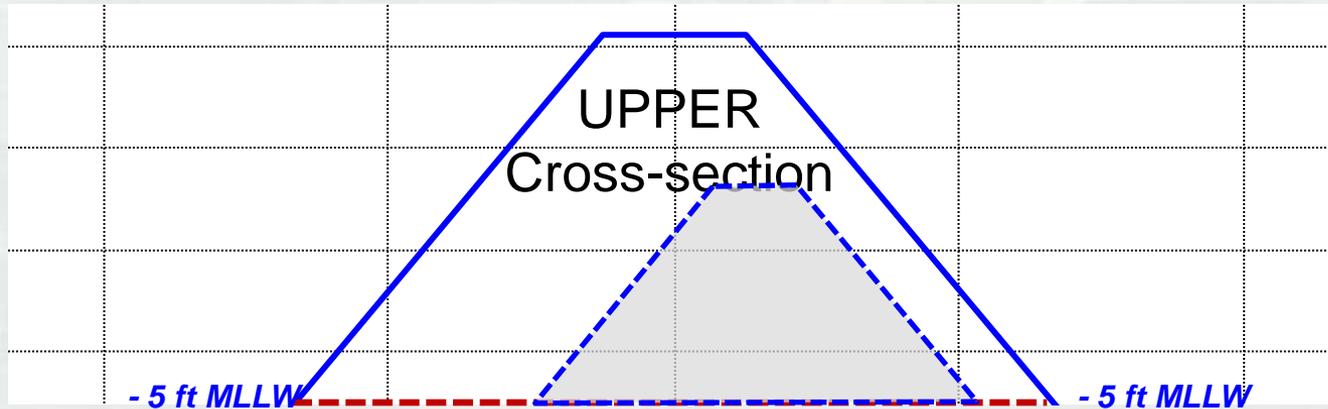
----- *Jetty has been DAMAGED >> 40%, Initiate Elevated Status for Executing Jetty Repairs* -----



North Jetty CROSS SECTION Life-Cycle Evolution (1917-2006) for STA =84.5



Jetty	Template Area* ft ² , above WAV EL = -5 ft	WAV_EL, ft MLLW	Crest Elevation, ft MLLW	Crest Width, ft	Side slope (rise,v : run,h) Channel / Ocean
North Jetty	2250	max(-5 , TE+2)	25	30	1:1.5 / 1:1.5
South Jetty	2475	max(-5 , TE+2)	25	30	1:2 / 1:1.5
Jetty A	1687	max(-5 , TE+2)	20	30	1:1.5 / 1:1.5



Thresholds for Jetty Maintenance – Based on Remaining % of Cross-

Section Area Jetty Maintenance Scenario	Normal Jetty Segment REPAIR			Jetty Segment Hardship	
	UPPER Threshold to Enact Repair	Repair Planning Period	LOWER Threshold to Enact Repair	EXPEDITED Repair Threshold	BREACH THRESHOLD (BT)
Just-in-Time (fix-as-fails)	25 - 30%	n/a	20 - 25%	20 - 25%	15 - 20%
Scheduled – V	Variable (25 – 65%)	4 yrs	n/a	20 - 25%	15 - 20%
Interim Repairs	25 - 40%	n/a	20 – 25%	20 - 25%	15 - 20%
Scheduled – F	62 - 72%	4 yrs	n/a	20 - 25%	15 - 20% [®]



MCR Jetties: Key Messages

(1) FY 13: South Jetty dune stabilization/augmentation; PBUD (O&M) -- \$5.5M

- South Jetty Root & Trestle Bay
- Detailed Design Report, P&S, placement of beach material
- Without-project condition (separate from 7-year construction plan)

(2) FY 13: North Jetty lagoon fill, Capability (O&M) -- \$10.84M

- Stabilizes North Jetty root
- Supported by FY 11 Major Maintenance Report

(3) FY 13: North Jetty critical repairs, Capability (O&M) -- \$14.15M

- Repairs to STA 86 – 99, authorized cross-section
- Supported by FY 11 Major Maintenance Report





MCR Jetties: Key Messages

(4) FY 14: Jetty A Rehabilitation, Capability (CG) -- \$22.90M

- Detailed Design Report, Plans & Specifications, Contract Award
- Construction in FY 15, STA 48-84
- Supported by FY 12 Major Rehabilitation Report

(5) FY 14: North Jetty Rehabilitation, Capability (CG) -- \$23.65M

- Detailed Design Report, Plans & Specifications, Contract Award
- Construction staging and delivery of rock; FY 15-17 construction
- Supported by FY 12 Major Rehabilitation Report

(6) FY 14: Jetty head stabilization, Capability (CG) -- \$550k

- Physical wave tank modeling for optimizing jetty head design
- Supported by FY 12 Major Rehabilitation Report

