ST. LUCIE COUNTY, FLORIDA

COASTAL STORM RISK MANAGEMENT PROJECT

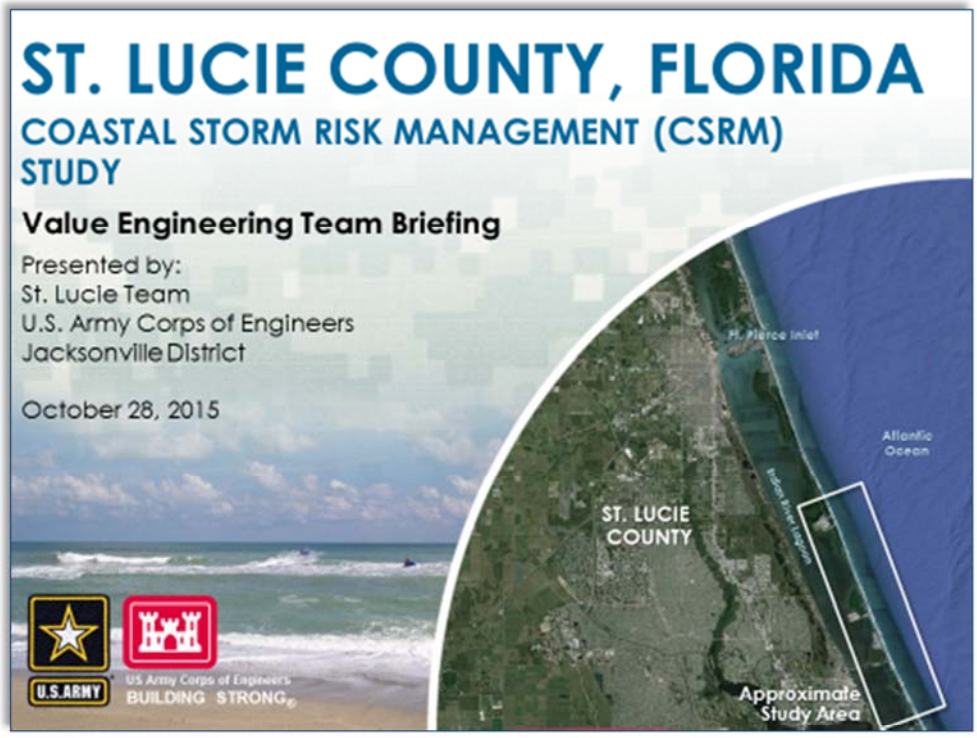
DRAFT INTEGRATED FEASIBILITY STUDY AND ENVIRONMENTAL ASSESSMENT

APPENDIX I
Value Engineering

APRIL 2016

US Army Corps
of Engineers
Jacksonville District

U.S. ARMY CORPS OF ENGINEERS
JACKSONVILLE DISTRICT



112339 ST. LUCIE COUNTY, FL
COASTAL STORM RISK MANAGEMENT PROJECT
DECISION DOCUMENT
VALUE ENGINEERING REPORT

31 December 2015

DOD SERVICE: USACE **VALUE ENGINEERING OFFICER:** Autumn N. Ziegler, PE, AVS
CONTROL NO: SAJ-VE-2016-002C

REPORT INFORMATION

VALUE ENGINEERING FIRM: U. S. Army Corps of Engineers
Jacksonville District
701 San Marco Blvd
Jacksonville, FL 32207

VALUE ENGINEERING WORKSHOP CONDUCTED: 28-30 October 2015, Subsequent Job Plan Phases conducted during additional team meetings and sub-team work times.

VALUE ENGINEERING STUDY TEAM LEADER: Jimmy Matthews, PE, CVS

VALUE ENGINEERING STUDY TEAM MEMBERS: Team member names and contact information are in Appendix B.

POINTS OF CONTACT: Autumn N. Ziegler, PE, AVS
Value Engineering Officer
Jacksonville District
701 San Marco Blvd
Jacksonville, FL 32207
(904) 232-1956

STUDY RESULTS:

Evidence of Creativity: 27 ideas generated; several ideas combined into single proposals or comments
Number of Recommendations: 13
Number of Recommendations Accepted: 5 adopted or partially adopted for future consideration
Cost Avoidance Potential: $1,609,450
Cost of VE Study: $30,000
Return on VE Study Investment: Cost Avoidance/Cost of VE Study = $53 for each $1 invested

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INTRODUCTION

This Value Engineering (VE) Report documents the completion of the St. Lucie County Coastal Storm Risk Management Study, St. Lucie County, Florida Value Analysis. The current phase of the decision document is between the Alternatives Milestone and the Tentatively Selected Plan (TSP) milestone. The feasibility study is being conducted in accordance with the USACE SMART Planning Process. This VE study scope is for this point in time for the project and is being conducted with the schedule constraint that the authorization timeline is not flexible. The VE Study team was comprised of USACE employees from the Jacksonville District and other USACE attendees on an as-needed basis.

PROJECT DESCRIPTION ON DATE OF VE STUDY

The purpose of the decision document is to study the feasibility of providing hurricane and storm damage reduction within the southern five miles of the St. Lucie County, Florida, coastline. Alternatives considered will include: no-action, non-structural measures (flood proofing, relocation, retreat, land acquisition, etc.), shore protection with hard structures (seawalls, revetments, groins, etc.), shore protection with soft structures (beach nourishment, geotubes, etc.), combinations of the above, and others.

The scope of this study has been severely limited by the presence of a large Coastal Barrier Resource Act (CBRA) unit within the study area from R77 to R103, with three relatively small gaps, or excluded areas, at approximately R80-84, R88.5-90, and R98-101. Of the approximate 7.2 miles of shoreline within the study area, roughly 3.4 miles of shoreline are in the CBRA zone. The three excluded areas have a total length of about 1.5 miles of shoreline. The non-CBRA affected shoreline is the southernmost part of St. Lucie County and stretches 2.3 miles from approximately R103 to the St. Lucie/Martin County line at R115. All together, the CBRA affected land comprises about 42% of the study area.

The four study reaches are, from north to south:

- North Hutchinson Island: R77 to R80 (0.57 miles)
- Power Plant Area: R80 to R90 (1.9 miles)
- Narrows of Hutchinson Island: R90 to R98 (1.5 miles)
- South Hutchinson Island: R98 to R115 (3.4 miles)

R-monuments refer to Florida Department of Environmental Protection (FDEP) survey monuments used for geographic reference. The boundaries of all of the subject reaches and FDEP R-monuments are illustrated in Figure 1.

Figure 1: Study area map with key boundaries and reference points.

VALUE METHODOLOGY

This report documents the VE workshop conducted 28-30 October 2015 and related follow up value analyses. The workshop was conducted using the six-phase Value Engineering Job Plan as sanctioned by USACE and the Society of American Value Engineers International (SAVE). The VE Workshop culminated in the development phase where ideas were captured and refined into recommendations. Appendix E contains the related documentation.

VE Scope of Work for the Job Plan

The job plan was used to scope the VE and to determine the appropriate team members to address desired outcomes or success. The plan was developed with input from project team members and the project manager. The plan addressed the following objectives.

- Develop the scope and objectives for the Value Study (Define the end product and how it will be used. What is success?) The Value Engineering process can assist with the following items during the workshop:
    - Identify any potential new combinations of solutions which would provide incremental benefits, to possibly include the publicly-owned parks.
    - Investigate Beach-fx files in more depth to understand not just the average damages reported by the model, but to better understand extreme high (and low) damages which may better "tell the story" for formulation choices, or refine choices.
    - Work with plan formulation process to use critical thinking when looking at the Final array of alternatives to choose the Tentatively Selected Plan (TSP).
    - Success will be measured by PDT understanding of the issues, critical thinking to ask all needed questions, a thorough look at all choices, and moving forward with a TSP (with potential refinements).

- Identify and prioritize strategic issues of concern.
    - Low damages in upper area of the reach; high damages in lower area of the reach; ensure a solution is developed that is policy compliant and makes sense for the whole reach, if possible.
    - Use extreme storms and damages from Beach-fx model (rather than just the averages which it reports) and use the information to better understand solutions.

- Identify Value Team members (the following is a list if team members from the Job Plan)
    - Stacey Roth – Planning Technical Lead
    - Shelley Trulock – Project Manager
    - Jim Lagrone – Engineering Technical Lead
    - Lori Hadley – Coastal Modeler
    - Chris Graham – Economist

- Colin Rawls – Economist
- Sophia Bryant – Cost Engineer
- Paul DeMarco/Aubree Hershorin – NEPA specialist
- Tamela Kinsey – Permitting/Compliance

Special Attendees (USACE) (to attend for certain time frames):

- Mark Gravens or other Beach-fx model specialist (4 hrs.)
- Jason Engle – Chief, Coastal Engineering Section (4 hrs.)
- Matt Schrader – Coastal Technical Expert (4 hrs.)
- Rep from National Non-structural flood proofing committee

Six-phase Value Engineering Job Plan

Information Phase. At the beginning of the study, the project team presented current planning and design status of the project. This included a general overview and various project requirements. Report details were presented as appropriate. Discussion with the VE Team enhanced the value team's knowledge and understanding of the project.

Function Analysis Phase. For this study, team members used the NASA Functional Analysis Module Space Systems Engineering, version 1.0, to create the report's functional architecture. The architecture was input into a functional block diagram (Task- Oriented FAST Diagram). This approach developed the top-down definition of feasibility report and project functions. A function list and outline were developed by the team and input into the diagram. The function analysis is located in Appendix C.

Creativity Phase. The Creativity Phase involved identifying and listing creative ideas. During this phase, the team participated in a brainstorming session to identify as many means as possible to provide the necessary project functions. Judgment of the ideas was not permitted in order to generate a broad range of ideas. The creative phase continued through the other phases and often can create other ideas.

Evaluation Phase. The purpose of the Evaluation Phase was to systematically assess the potential impacts of ideas generated during the Creativity Phase relative to their potential for value improvement. Each idea was evaluated in terms of its potential impact to cost and overall project performance. Once each idea was fully evaluated, it was given a rating to identify whether it would be carried forward and/or developed as a recommendation, combined with other ideas, presented as a design suggestion, dismissed from further consideration or that it is already being done by Project Delivery Team. Appendix D lists those ideas with their evaluation disposition. The appendix tables also display the evolution of ideas from creation through their embodiment into recommendations.

Development Phase. During the Development Phase, evaluated ideas were expanded and developed into recommendations. The development process considered such things as the impact to performance,

cost, constructability, and schedule of the alternative concepts relative to the baseline concept. This analysis was prepared as appropriate for each recommendation, and the information includes an initial cost and/or life cycle cost comparisons if applicable. Each recommendation or idea describes the baseline concept and proposed changes and includes a technical discussion. The related documentation is located in Appendix E.

Presentation Phase. The VE Workshop concluded with a preliminary presentation of the value team's assessment of the project and value recommendations and ideas. The presentation provided an opportunity for the owner, project team, and stakeholders to preview the recommendations and develop an understanding of the rationale behind them. The presentation was also used to refine recommendation justification to include the corporate perspective.

STUDY RESULTS AND RECOMMENDATIONS

During the course of the VE study, the value team developed recommendations that warrant more detailed investigation. Appendix E contains the related documentation.

This VE study will be supplied to the PDT at the start of each of the subsequent project phases. The PDT will incorporate the results of this VE Study and determine if additional VE recommendations appropriate. Related cost avoidance will be developed for awarded contract(s) and reported into the Value Engineering Reporting System (VERS). Should ideas/comments result in additional quantifiable cost avoidance, those ideas/comments will be documented as recommendations and appended to this report.

The following recommendations have been evaluated by the PDT and the action noted as adopted, not adopted or partially adopted. Also noted is whether the recommendation will be addressed in the report, the Preconstruction, Engineering and Design Phase (PED) or both.

	RECOMMENDATIONS	PROPOSED SAVINGS	ADOPTED OR NOT ADOPTED	PROJECT PHASE
1	Strategically Place Breakwaters/Groins to Reduce Nourishment Cycle	N/A	Not Adopted	N/A
2	Create Multi-Purpose Breakwater/Nearshore Habitat	N/A	Not Adopted	N/A
3	Apply Erosion Measures Uniformly Across the Project Study Area	N/A	Adopted	Feasibility
4	Use Sheetpile Wall Along High Damage Areas Along Dune Profile	N/A	Not Adopted	N/A
5	Options to Reinforce Dunes	N/A	Not Adopted	N/A
6	Strategic Buyout	N/A	Not Adopted	N/A
7	Apply Adaptive Management for Intermediate and High Sea Level Rise (SLR) Scenarios	N/A	Adopted	Feasibility and PED
8	Contracting Strategies to Reduce Construction Cost for Dredging	$1,609,450	Adopted	PED
9	Reconsider Beach-Fx Results/Reliability Analysis to Determine If a More Resilient and Cost Effective Plan Can Be Developed Based on More Extreme Event Percentiles	N/A	Not Adopted	N/A
10	Specialized Truck Haul for Narrow Beach and Dune Gaps	N/A	Not Adopted	N/A
11	Withdrawn	N/A	N/A	N/A
12	Coordinate with National Floodproofing Committee	N/A	Adopted	PED
13	Account for National Environmental Restoration Benefits related to Sea Turtle Nesting	N/A	Adopted	Feasibility
14	Coordinate with ERDC Programmatically for Modeling of Artificial Reefs, Groins, etc.	N/A	Not Adopted	N/A

APPENDIX A: WORKSHOP AGENDA

VALUE ENGINEERING WORKSHOP AGENDA
HURRICANE AND STORM RISK REDUCTION
ST. LUCIE COUNTY, FL
28 & 29 OCT 2015

Meeting Location:
28 Oct – EN Conference Room, 381, 4E
29 Oct – PD Conference Room, 539, 5W
Call-in and Web Meeting Number:
USA Toll-Free: (877)873-8017
Access Code: 4591724
Security Code: 1234
Web Meeting Address:
https://www.webmeeting.att.com
* The first time you use the Web Meeting Service, you will need to download the client software. Web Meeting HELP & Software Downloads can be found at: https://www.webmeeting.att.com*

28OCT15:

0925-0930	**Attendees Call In and Establish Web Meeting Connections**
0930-0935	Introductions and Web Meeting Rules
0935-1000	Workshop Purpose and VE Scope and Activities – Jimmy Matthews
1000-1100	Report and Project Overview – PDT
	Break as needed
1100-1200	Function Analysis – Autumn Ziegler & Jimmy Matthews
1200-1245	Lunch
1245-1345	Creativity Phase – VE Team, Autumn Ziegler
1345-1500	Evaluation Phase and Day 1 Wrap-up – VE Team

29OCT15:

0900-0930	Complete Evaluation Phase – Autumn Ziegler
0930-1130	Development Phase (Assignments & Work Session) – VE Team
1130-1215	Lunch
1215-1400	Complete Development Phase – Autumn Ziegler
1400-1500	Workshop Wrap Up and Completion Schedule - J Matthews & Autumn Ziegler
TBS	Complete the Presentation Phase & VE Report – VE Team
	Break as needed

APPENDIX B: WORKSHOP PARTICIPANT ROSTER

Value Engineering Workshop - St. Lucie County, FL, HSRRP 28-29 October 2015				Attendance	
Name	**Office**	**Phone**	**E-mail (@usace.army.mil)**	**28-Oct-15**	**29-Oct-15**
Jimmy Matthews	CECO-C-RAO	(904)232-2087	Jimmy.D.Matthews@usace.army.mil	X	X
Autumn Ziegler	CESAJ-EN-Q	(904)232-1956	Autumn.N.Ziegler@usace.army.mil	X	X
Sheldon Shuff	CESAJ-OC	(904)232-1635	Sheldon.G.Shuff@usace.army.mil	X	
Shelley Trulock	CESAJ-PM-WN	(904)232-3292	Shelley.F.Trulock@usace.army.mil	X	
Paul Stodola	CESAJ-PD-EC	(904)232-3271	Paul.E.Stodola@usace.army.mil	X	
Paul DeMarco	CESAJ-PD-EC	(904)232-1897	Paul.M.DeMarco@usace.army.mil	X	
Kelly Legault	CESAJ-EN-WC	(904)232-1861	Kelly.R.Legault@usace.army.mil	X	
Gina Ralph	CESAJ-PD-PN	(904)232-2336	Gina.P.Ralph@usace.army.mil	X	X
Meredith Moreno	CESAJ-PD-ES	(904)232-1577	Meredith.A.Moreno@usace.army.mil	X	
James LaGrone	CESAJ-EN-DW	(904)232-2437	James.W.LaGrone@usace.army.mil	X	
Sophia Bryant	CESAJ-EN-TC	(904)232-2919	Sophia.L.Bryant@usace.army.mil	X	X
Stacey Roth	CESAJ-PD-PN	(904)232-1055	Stacey.L.Roth@usace.army.mil	X	X
Troy Mayhew	CESAJ-EN-GG	(904)232-1140	Troy.A.Mayhew@usace.army.mil	X	X
Colin Rawls	CESAJ-PD-D	(904)232-1652	Colin.D.Rawls@usace.army.mil	X	X
Lori Hadley	CESAJ-EN-WC	(904)232-1386	Lori.L.Hadley@usace.army.mil		X

APPENDIX C: FUNCTION ANALYSIS

FUNCTION LIST

Plan Project

Address Issues

Protect Environment

Understand Issues

Coordinate with Sponsor

Determine Damages

Gather Data

Maintain Consistency

Evaluate Risk

Address Resiliency

Address Sea Level Rise

Provide Protection

Authorize Project

Document Rationale

Ensure Environmental Compliance

Provide Protection

Address Low Nourishment Rate

Engineer and Design Project (PED)

Manage expectations

Obtain Permit

Minimize Impacts

Communicate with PDT

Ensure Compatibility

Address Permit Compliance

Avoid Scope Creep

Avoid Rocks

Maximize Fill Density

Construct Project

Monitor Contractor

Meet Design Intent (ECI)

Respond to Construction

Address Weather

Monitor Environmental Impacts

Communicate with Resource Agencies

Perform OMRR&R

Monitor Beach

Document Lessons Learned

Address outyear monitoring

Implement adaptive management options

Implement after action plan

Update DDR

Capture Lessons Learned

Control Cost Growth

Coordinate cycle with Martin County

Address RSM

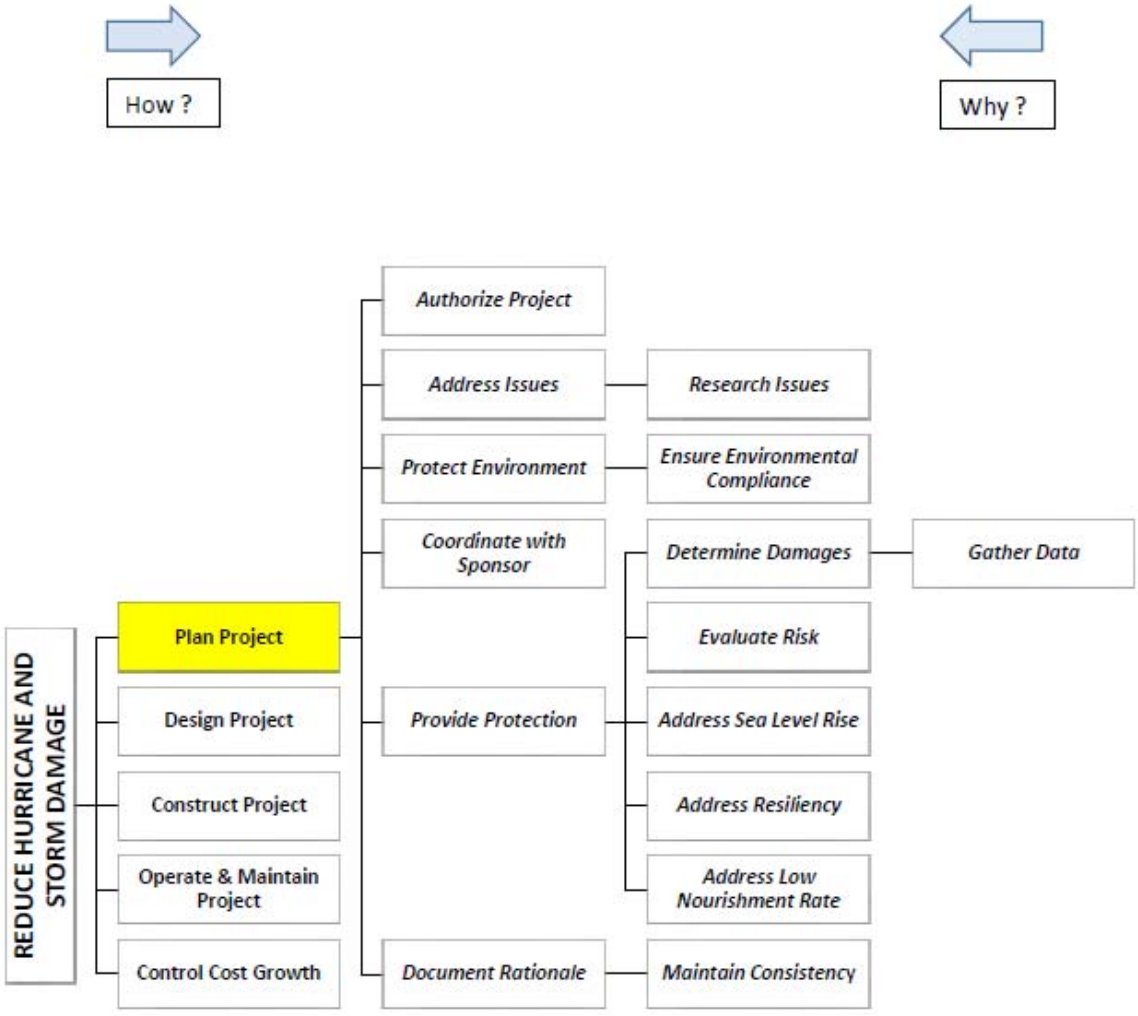
Address Acquisition Strategy

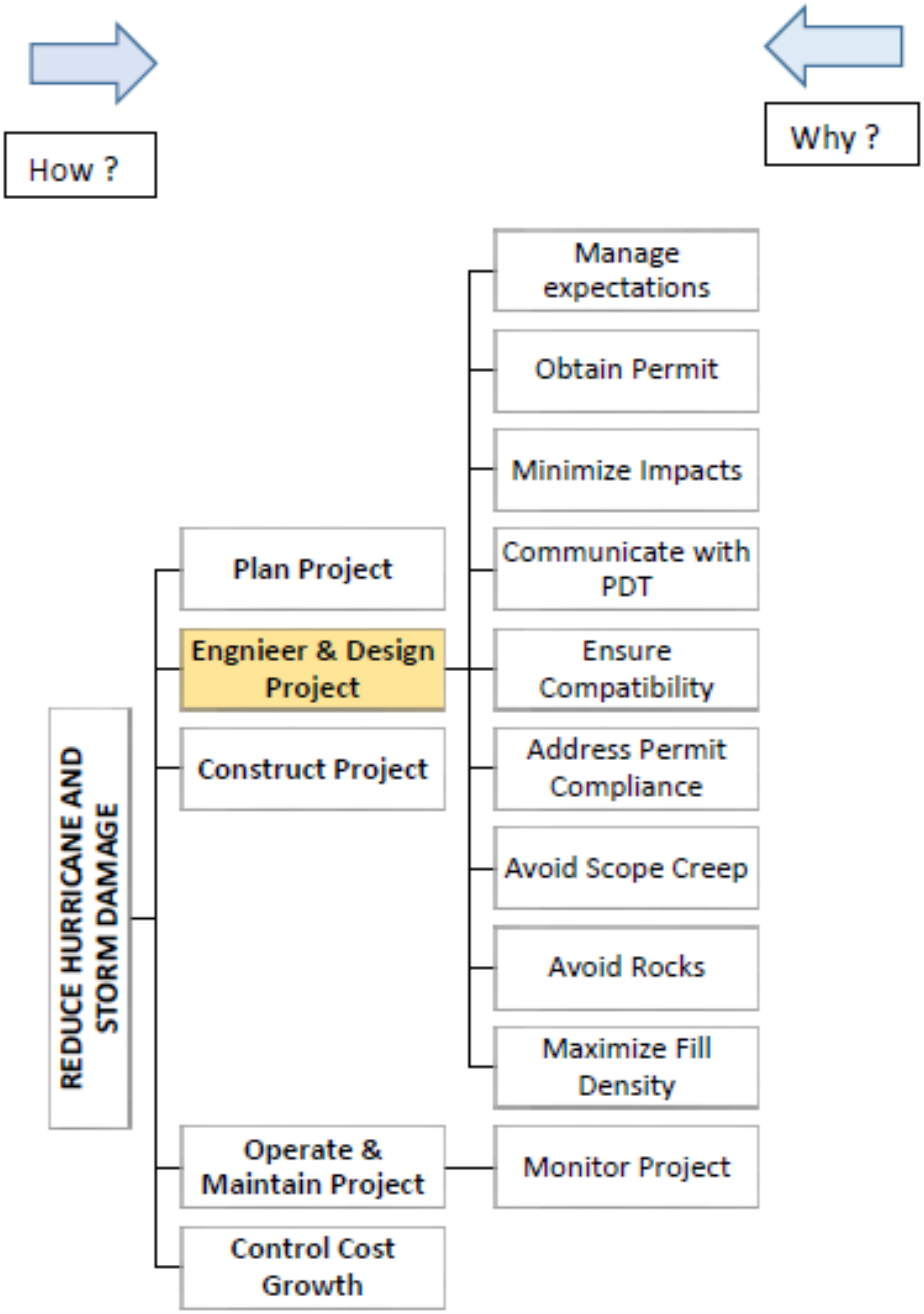
Minimize modifications

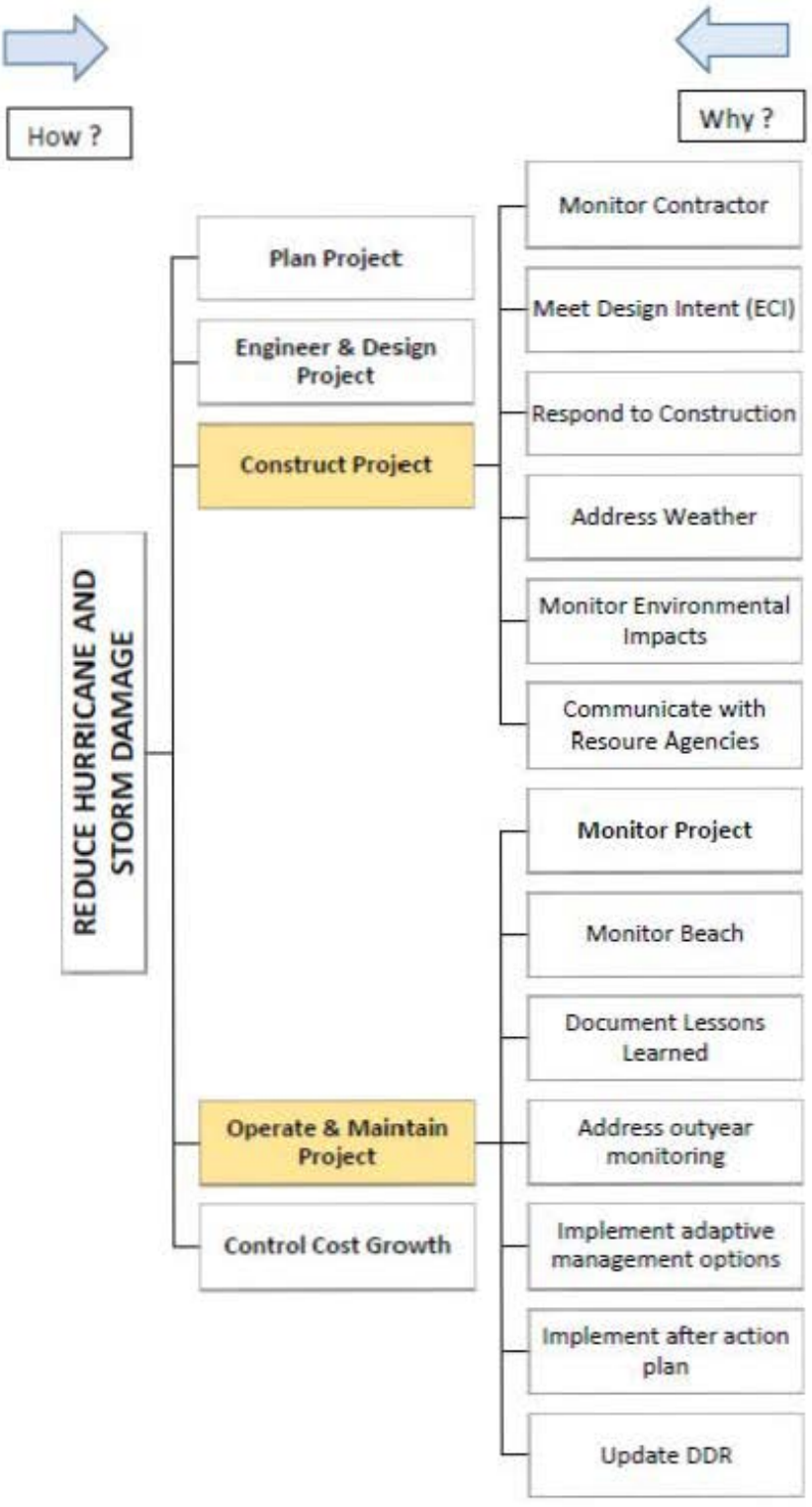
Encourage Innovation

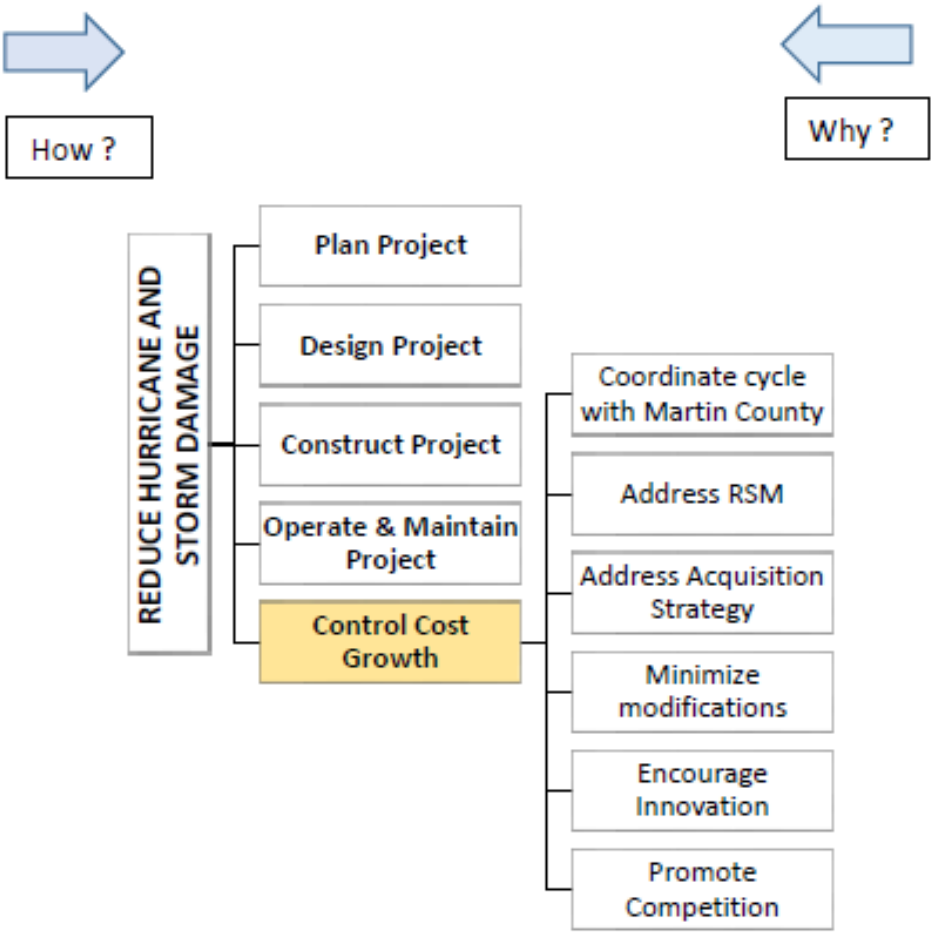
Promote Competition

FAST DIAGRAMS




How ?
Why ?
REDUCE HURRICANE AND STORM DAMAGE
Plan Project
Engnieer & Design Project
Construct Project
Operate & Maintain Project
Control Cost Growth
Manage expectations
Obtain Permit
Minimize Impacts
Communicate with PDT
Ensure Compatibility
Address Permit Compliance
Avoid Scope Creep
Avoid Rocks
Maximize Fill Density
Monitor Project


How ?
Why ?
REDUCE HURRICANE AND STORM DAMAGE
Plan Project
Engineer & Design Project
Construct Project
Operate & Maintain Project
Control Cost Growth
Monitor Contractor
Meet Design Intent (ECI)
Respond to Construction
Address Weather
Monitor Environmental Impacts
Communicate with Resoure Agencies
Monitor Project
Monitor Beach
Document Lessons Learned
Address outyear monitoring
Implement adaptive management options
Implement after action plan
Update DDR


How ?
Why ?
REDUCE HURRICANE AND STORM DAMAGE
Plan Project
Design Project
Construct Project
Operate & Maintain Project
Control Cost Growth
Coordinate cycle with Martin County
Address RSM
Address Acquisition Strategy
Minimize modifications
Encourage Innovation
Promote Competition

APPENDIX D: CREATIVITY AND EVALUATION

St. Lucie Co. VE - Created Ideas			
Idea	Idea Group	Action	Created Ideas
1			Develop NER plan for sea turtle nesting area
2			Use breakwaters along certain reaches to reduce the renourishment cycle
3			Create nearshore low profile habitat/mitigation
4			Use low profile groins
5			Use oblique groins
6			Enhance worm rock
7			Apply erosion measures uniformly across project
8			Use buried geotubes along the fronting dune line
9			Use sheetpile wall along high damage areas along dune profile
10			Build vegetated dune at the natural grade levels
11			Use sand fencing as sand sink/dune stacking
12			Combination of small geotubes and dune stacking
13			Buyout bottom floors of Turtle Reef Club (R-113)
14			Apply adaptive manaement for intermediate and high SLR
15			Avoid borrow areas with rock
16			Combine mob with Martin Co SPP
17			Combine mob with Ft Pierce SPP
18			Look at Beach-fx results/reliability analysis
19			Maximize the dredging window (Environmental and Operational)
20			Develop a defined acquisition strategy
21			Truck Haul
22			Specialized Truck Haul for narrow beach
23			Use St. Lucie dredged material in 1st nourishment
24			Coordinate with National Floodproofing Committee
25			Strategic Buyout

St. Lucie Co. VE - Evaluated and Grouped Ideas			
Idea	Idea Group	Action	Already Being Done or Eliminate, Idea Group = 0.00; Keep Idea, Idea Group = Number; Combine into another idea, Idea Group = N.ii
1	0.00		Develop NER plan for sea turtle nesting area
15	0.00		Avoid borrow areas with rock
8	0.00		Use buried geotubes along the fronting dune line
21	0.00		Truck Haul
2	2.00		Use breakwaters along certain reaches to reduce the renourishment cycle
4	2.04		Use low profile groins
5	2.05		Use oblique groins
3	3.00		Create nearshore low profile habitat/mitigation
6	3.06		Enhance worm rock
7	7.00		Apply erosion measures uniformly across project
9	9.00		Use sheetpile wall along high damage areas along dune profile
10	10.00		Build vegetated dune at the natural grade levels
11	10.11		Use sand fencing as sand sink/dune stacking
12	10.12		Combination of small buried geotubes and dune stacking
13	13.00		Buyout bottom floors of Turtle Reef Club (R-113)
25	13.25		Strategic Buyout
14	14.00		Apply adaptive management for intermediate and high SLR
16	16.00		Combine mob with Martin Co SPP
17	16.17		Combine mob with Ft Pierce SPP
19	16.19		Maximize the dredging window (Environmental and Operational)
20	16.20		Develop a defined acquisition strategy
18	18.00		Look at Beach-fx results/reliability analysis
22	21.22		Specialized Truck Haul for narrow beach and dune gaps
23	23.00		Use St. Lucie Inlet dredged material in 1st nourishment
24	24.00		Coordinate with National Floodproofing Committee
26	26.00		Account for NER benefits
27	27.00		Coordinate with ERDC on broad measure (e.g. artificial reefs, groins)

St. Lucie Co. VE - Recommendations				
Idea	Idea Group	Recom. No.	Created Ideas	POC
2	2.00	R1	Use breakwaters along certain reaches to reduce the renourishment cycle	Jim/Kelly
4	2.04		Use low profile groins	
5	2.05		Use oblique groins	
3	3.00	R2	Create nearshore low profile habitat/mitigation	Jim/Paul
6	3.06		Enhance worm rock	
7	7.00	R3	Apply erosion measures uniformly across project	Kelly/Lori
9	9.00	R4	Use sheetpile wall along high damage areas along dune profile	Jim
10	10.00	R5	Build vegetated dune at the natural grade levels	Jim/Kelly
11	10.11		Use sand fencing as sand sink/dune stacking	
12	10.12		Combination of small buried geotubes and dune stacking	
13	13.00	R6	Buyout bottom floors of Turtle Reef Club (R-113)	Stacey
25	13.25		Strategic Buyout	
14	14.00	R7	Apply adaptive management for intermediate and high SLR	Paul/Gina
16	16.00	R8	Combine mob with Martin Co SPP	Stacey/CT
17	16.17		Combine mob with Ft Pierce SPP	
19	16.19		Maximize the dredging window (Environmental and Operational)	
20	16.20		Develop a defined acquisition strategy	
18	18.00	R9	Look at Beach-fx results/reliability analysis	Colin/Lori
22	21.22	R10	Specialized Truck Haul for narrow beach and dune gaps	Lori
23	23.00	R11	Use St. Lucie Inlet dredged material in 1st nourishment	Stacey/Troy
24	24.00	R12	Coordinate with National Floodproofing Committee	Stacey/Shelley
26	26.00	R13	Account for NER benefits	Paul
27	27.00	R14	Coordinate with ERDC on broad measures (e.g. artificial reefs, groins)	Stacey

APPENDIX E: RECOMMENDATIONS DOCUMENTATION

RECOMMENDATION NO. 1 (2.0, 2.04, 2.05): Strategically Placed Breakwaters/Groins to Reduce Nourishment Cycle

PROPOSED DESIGN: This idea is to focus on the sub-reaches within the South Hutchinson Island reach which have the most damages (R111-R115, as shown in Figure E-1), in areas and place breakwaters, low-profile groins, or oblique groins to reduce wave energy and also trap sand.

a. Breakwaters – an offshore structure parallel to the shore
b. Low-profile groins - perpendicular to the shore
c. Oblique groins - at an angle to the shore

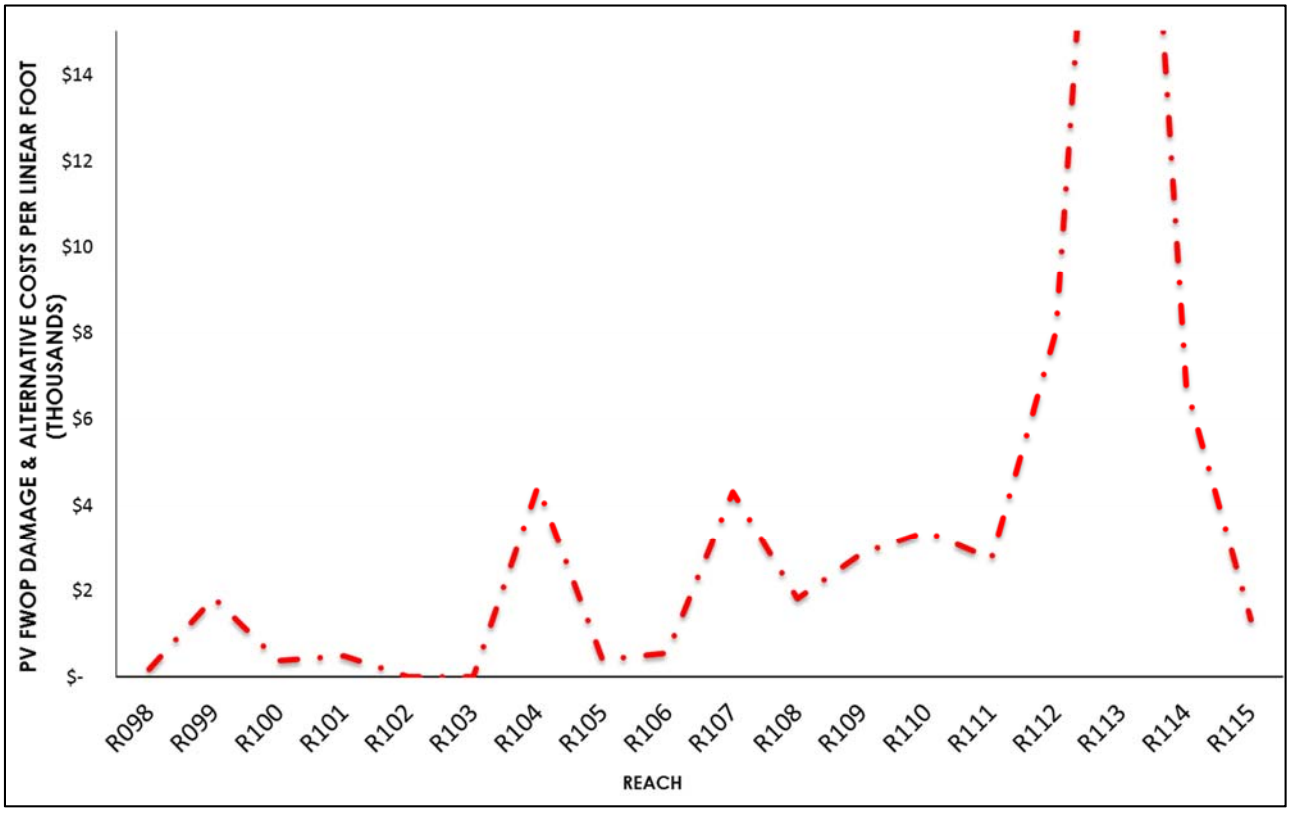


Figure E-1: FWOP damages compared to Reach

ADVANTAGES:

a. Breakwaters:
    1. Would break wave energy in specific areas and may or may not trap sand in specifically desired areas. This could extend the nourishment cycle.
b. Low-profile groins (perpendicular to shore)
    1. Would trap some sand in currently erosional areas. The low-profile nature would allow some sand to be trapped, but still allow transport to down-drift areas. This could extend the nourishment cycle.
c. Low-profile oblique groins (at an angle to the shore)
    1. The slanted nature of these groins would break wave energy and also trap sand. This could extend the nourishment cycle.

DISADVANTAGES:

a. Breakwaters:
    1. A breakwater could be unfavorable to the community, which currently does not have any structures along the beach.
    2. The erosion rate in this area is fairly uniform, and applying structures in a specific area could negatively alter the natural forces and erosion rates in adjacent areas.
b. Low-profile groins (perpendicular to shore)
    1. Groins could be unfavorable to the community, which currently does not have any structures along the beach, as well as potentially negative impacts to sea turtle habitat.
    2. The erosion rate in this area is fairly uniform, and applying structures in a specific area could negatively alter the natural forces and erosion rates in adjacent areas.
c. Low-profile oblique groins (at an angle to the shore)
    1. Groins could be unfavorable to the community, which currently does not have any structures along the beach, as well as potentially negative impacts to sea turtle habitat.
    2. The erosion rate in this area is fairly uniform, and applying structures in a specific area could negatively alter the natural forces and erosion rates in adjacent areas.

ACTIVITIES TO IMPLEMENT:

Discuss more as a team to better understand dynamic physical processes.

DETERMINATION:

This recommendation was not adopted by the PDT. The nourishment cycle could potentially be extended by the ability of these structures to trap sand in strategic areas. However, these structures have disadvantages which could be non-implementable.

RECOMMENDATION NO. 2 (3.00, 3.06): Create Multi-Purpose Breakwater/Nearshore Habitat

PROPOSED RECOMMENDATION: This idea would be to build a structure which could break wave energy (Figure E-2) and provide a hard substrate (hard ground) which would tie into the existing hard ground (worm rock, Figure E-3), for the added benefit of environmental habitat. The structure could be a series of concrete balls, etc and would likely be from R111-R115+1000 feet.

Figure E-2: Proposed Breakwater/Habitat Tie-in to Existing Hardground

Figure E-3: Existing Wormrock in St. Lucie Project Area

ADVANTAGES:

- The breakwater would break wave energy in certain locations, reducing potential for damages caused by wave attack.
- The hard substrate would "extend" existing habitat.

DISADVANTAGES:

- A breakwater could be unfavorable to the community, which currently does not have any structures along the beach.
- The erosion rate in this area is fairly uniform, and applying structures in a specific area could negatively alter the natural forces and erosion rates in adjacent areas.
- This idea could be potentially costly which might not be able to be supported by the benefits (similar to artificial reef idea which was screened out due to high cost during preliminary planning screening).

ACTIVITIES TO IMPLEMENT:

Discuss more as a team to better understand dynamic physical processes.

DETERMINATION:

This recommendation was not adopted by the PDT. It was determined to be too expensive and could lead to additional mitigation requirements.

RECOMMENDATION NO. 3 (7.0): Apply Erosion Measures Uniformly Across the Project Study Area

PROPOSED RECOMMENDATION: This idea is to apply erosion alternatives uniformly across the study area, due to the fact that erosion rates are fairly uniform. Accordingly to Figure E-4, erosion rates only vary by -1.8 to +0.6 feet per year in the entire study reach (R77 to R115 + 1000 feet), which is considered a small fluctuation. While there are areas of erosion and accretion there are no "hot spots" of high erosion that would need to be addressed with a specialized measure over a limited scale. Although the project has been de-scoped at this point to R98 to R115+1000 (the area shown in the green box), it is important to understand the reach as an entire system. Altering the natural forces in one area without a significant need could negatively impact adjacent shorelines.

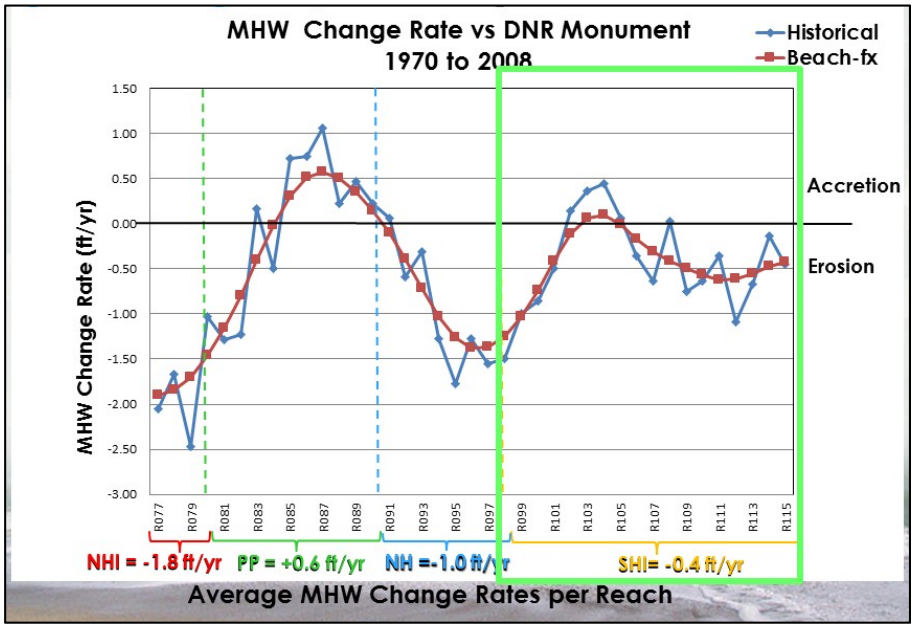


Figure E-4: MHW Change Rate vs. DNR Monument 1970 to 2008

ADVANTAGES:
This idea will ensure that structural measures function across the system, rather than just for a small area which could negatively impact other adjacent areas.

DISADVANTAGES:
There are no known disadvantages to this idea.

ACTIVITIES TO IMPLEMENT:
Discuss more as a team to better understand dynamic physical processes.

DETERMINATION:
This idea is important to convey in the Feasibility Report/Appendices and make the team aware of during continued plan formulation. Therefore, this recommendation was adopted by the PDT and will be presented in the Feasibility Report/Appendices.

RECOMMENDATION NO. 4 (9.0): Use Sheetpile Wall Along High Damage Areas Along Dune Profile

PROPOSED RECOMMENDATION:
This idea is to install a sheetpile wall as extra stabilization/protection along the toe of the dune along high damage areas, which correlates approximately to R111 to R115+1000 feet.

ADVANTAGES:
This idea could potentially ensure that the dune is not washed out during high energy storm events, and provides protection to the existing condominium and associated structures behind it.

DISADVANTAGES:
This idea would incorporate an additional cost to a dune feature, depending on how long and deep the sheetpile needs to be. This could be difficult to permit in light of recreation and turtle nesting habitat; however, if the sheetpile is buried sufficiently, it might not be a problem.

ACTIVITIES TO IMPLEMENT:
This idea could be modeled, if current modeling of dunes (underway) shows that some damages are still occurring in a particular area.

DETERMINATION:
This recommendation was not adopted by the PDT. St. Lucie County does not allow armoring.

RECOMMENDATION NO. 5 (10.0, 10.11, 10.12): Options to Reinforce Dunes

PROPOSED DESIGN:
This idea is to consider options that relate to reinforcing dune features. See Figure E-5.

a. Use sand fencing technique as a sand sink/dune stacking (fore dune/rear dune)
b. Combination of small buried geotubes and dune stacking

ADVANTAGES:

a. This would be a relatively easy and inexpensive way to incorporate an additional ability for the dune to "trap sand" while providing protection.
b. Geotubes would be relatively inexpensive to provide extra stability to dunes, and the dune stacking would be a relatively easy and inexpensive way to incorporate an additional ability for the dune to "trap sand" while providing protection.

DISADVANTAGES:

a. Construction may need to be more specific and technical in order to create the rear and fore dune.
b. Geotubes are generally used less for long term projects and used more for temporary projects, as they tend to degrade in the short term and are also more prone to being tampered with. Construction may need to be more specific and technical in order to create the rear and fore dune.

ACTIVITIES TO IMPLEMENT:
The idea of dune stacking, with or without geotubes, could be potentially modeled, if current modeling of dunes (underway) shows that some damages are still occurring in a particular area.

DETERMINATION:
This recommendation was not adopted by the PDT due to the disadvantages cited.

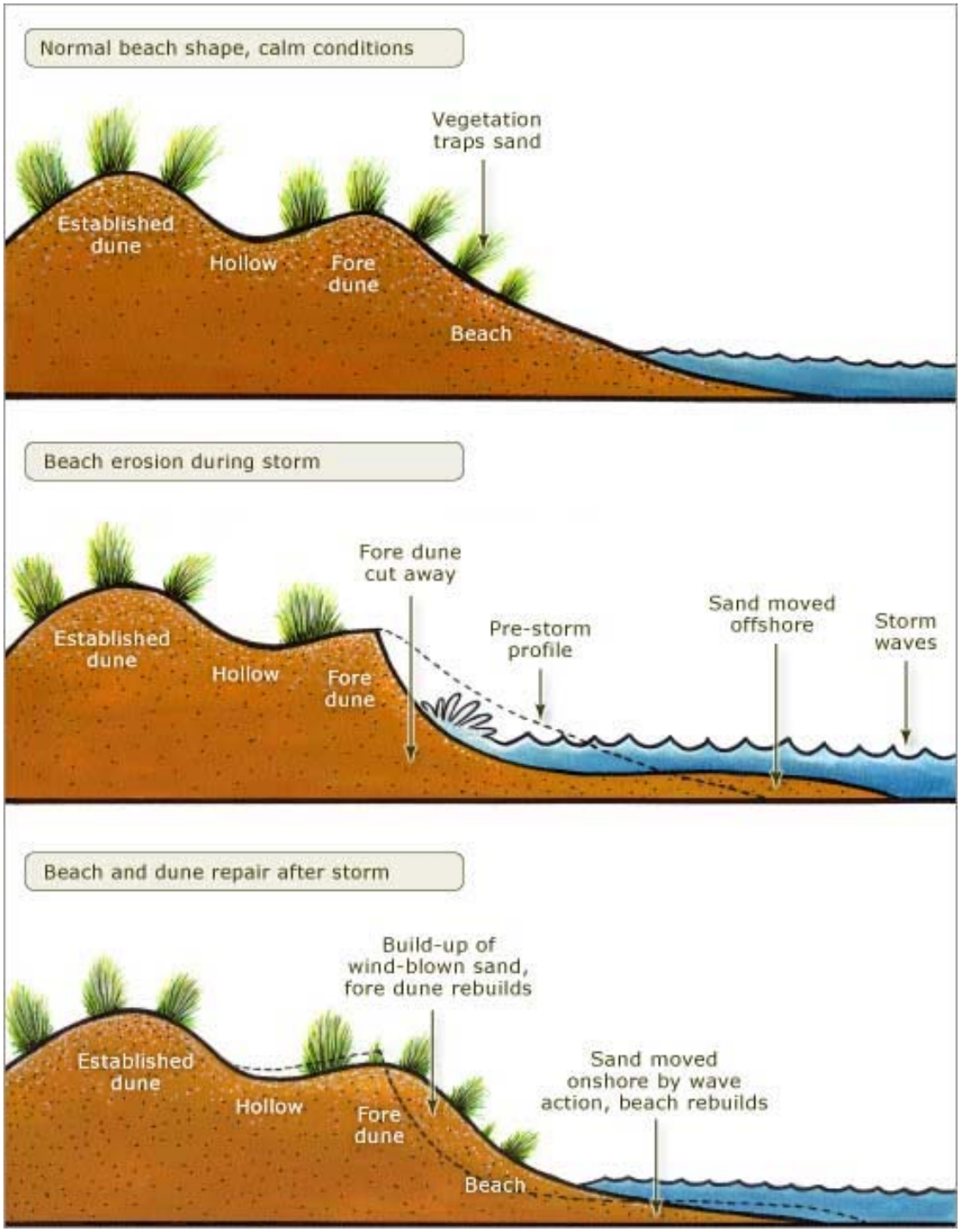


Figure E-5: “Dune Stacking” - Rear and Fore Dune Concept

RECOMMENDATION NO. 6 (13.00, 13.25): ***Strategic Buyout***

ORIGINAL DESIGN:
The study area contains condominiums, rather than individual residential homes. Therefore, the buyout option will likely be even more expensive than a typical buyout approach. This idea was screened from the initial project measures.

PROPOSED DESIGN:
A strategic buyout idea would focus on the area "hot spots", where damages would be most likely. In this case, two condominiums (Turtle Reef Club and Vistana's Beach Club) are slab on grade construction, and are therefore more vulnerable to flood inundation damage than other condominiums on pile foundations (as currently shown in the future without-project damages in the Beach-fx model). Therefore, a buyout for all or some portion of these condominiums could potentially reduce the risk of flooding to the residents.

a. One idea could be to buy out one or both condominiums.
b. Another idea would be to buy out just the first few floors of each condominium, which would then have to be gutted and re-habilitated into empty space with piles, so that any flooding that occurred would not impact residents, residential space, or the structural integrity of the building.

ADVANTAGES:

a. A buyout of these full condominiums could potentially reduce some of all of the flood damages with a non-structural measure.
b. A buyout of the first few floors would allow most residents to continue to live in their homes, and could potentially reduce some of all of the flood damages with a non-structural measure.

DISADVANTAGES:

a. This option is potentially very costly. A cursory buyout analysis performed by SAJ Real Estate showed an estimate of $18,358,800 for buyout and demolition of Vistana's Beach Club Resort and $8,595,000 for buyout and demolition of Turtle Reef Club Resort. This option also has potential to be very unpopular with the owners and residents.

b. This partial buyout has potential constructability concerns, if the bottom floors would need to be re-habilitated and the foundation replaced with piles. It also has legal implications that would need to be addressed (such as which entity owns the empty space and foundation and who is responsible for maintenance).

ACTIVITIES TO IMPLEMENT:

a. The real estate estimate for buyout (full condominiums) will be reviewed by the team, and can be compared to the future with-project costs once the Beach-fx model is run with the alternatives. If the buyout option continues to look potentially justified and a contender with the other alternatives, it may be run in the Beach-fx model to assess reduction in damages.

b. The real estate estimate can be pro-rated for buyout of the lower floors, with the understanding that construction specific information such as rehabilitation cost estimates will be roughly assumed from the previous estimate's demolition cost but are likely not an accurate representation of the true cost for rehabilitation as needed. It can also be modeled if the team assesses it has merit, once a cost and comparison is favorably made against the current alternatives.

Figure E-6. Turtle Reef Club and Vistana Beach Club at R113 (slab on grade foundation)

NOTES AND CALCULATIONS:

Estimated cost for buyout of Turtle Reef Club Resort and Vistana's Beach Club Resort = $26,953,800

**Excerpt from St. Lucie County Beach Restoration, Estimated Buy-out and Relocation Cost of Selected Damage Elements (November 2015).*

Vistana's Beach Club Resort

This facility is part of the Starwood worldwide corporate family of hotels and resorts. The professionally managed resort benefits from the Starwood reservation system. The facility is also required to maintain a higher level of maintenance and quality that is associated with the Starwood brand. Accordingly, this hotel benefits from better occupancy rates and a higher Average Daily Rate (ADR) than independently operated competitors experience. Accordingly, the valuation model associated with this facility is as follows:

Room Nights sold	21,637
ADR	$155
Estimated room revenue	$3,353,735
Other income @3.5%	$ 120,000
Total revenue	$3,473,735
Operating expenses @70%	$2,431,614
Net operating income @30%	$1,042,121
Capitalized at 6% OAR	$17,368,683
Rounded	$17,500,000

The indicated capitalized value of $17,500,000 is equivalent to approximately $230,000 per unit or $209 per sq. ft. assuming all units contain 1,100 square feet of living area. This is supported by a pending sale of a unit at The Princess condominium located at 9650 S. Ocean Drive that is under contract for a reported $267,500 for the 1,346 sq. ft. unit or $198 psf. A unit at Sand Dollar Shores condominium located at 7400 S. Ocean Drive is currently for sale by owner at a price of $249,999 for the 1,115 sf. Dwelling or $224 psf.

Legal fees associated with the Buy-Out of this property are estimated at $2,500 per unit or $190,000. Relocation costs do not apply, as there are no permanent residents in the facility. Demolition costs are estimated at approximately $8.00 per sq. ft or $668,800.

Based on the forgoing analysis, the total estimated Buy-Out and Relocation cost associated with the Vistana's Beach Club Resort is approximately **$18,358,800.**

Turtle Reef Club Resort

This facility is not flagged with any national franchise and is managed and operated by an independent company, Defender Resorts, Inc. headquartered in Myrtle Beach, South Carolina. Defender Resorts, per their web page, manages a number of resorts in Florida, the Carolinas, Maryland, Massachusetts, Delaware and the Caribbean. The facility does not benefit from a central reservation system. Rooms are booked directly on the Turtle Reef Club website or with various web based platforms such as Orbitz, Expedia, etc. While professionally managed, the facility is not held to as high a standard such as the Vistana's property next door. Cursory research on the internet indicates many customer reviews panning the property as old, outdated and in need of significant repair of deferred maintenance. Accordingly, this hotel does not benefit from improved occupancy rates and a higher Average Daily Rate (ADR) associated with nationally flagged competitors. Accordingly, the valuation model associated with this facility is as follows:

Room Nights sold	12,811
ADR	$135
Estimated room revenue	$1,729,485
Other income @3.5%	$ 60,500
Total revenue	$1,789,985
Operating expenses @70%	$1,252,989
Net operating income @30%	$ 536,996
Capitalized at 7.0% OAR	$7,671,371
Rounded	$7,700,000

The indicated capitalized value of $7,700,000 is equivalent to approximately $142,592 per unit. This is supported by unit #106 that sold in January 2015 in the Oceana South condominium located at 10600 S. Ocean Drive for $155,000.

Legal fees associated with the Buy-Out of this property are estimated at $2,500 per unit or $135,000. Relocation costs do not apply, as there are no permanent residents in the facility. Demolition costs are estimated at approximately $8.00 per sq. ft. or $760,000.

Based on the forgoing analysis, the total estimated Buy-Out and Relocation cost associated with the Turtle Reef Club Resort is: **$8,595,000**

a. Turtle Reef Club ~ 6 floors high. Estimate buyout of bottom 2 floors. Using $8,595,000 and pro-rating it for just two floors = $2,865,000. This is a very rough number and does not account for any rehabilitation that would need to occur to those 2 floors, or the building(s) for structural stability.

   Vistana's Beach Club ~ 9 floors high. Estimate buyout of bottom 2 floors. Using $18,358,800 and pro-rating it for just two floors = $4,079,733. This is a very rough number and does not account for any rehabilitation that would need to occur to those 2 floors, or the building(s) for structural stability.

DETERMINATION:

This recommendation was not adopted by the PDT due to the disadvantages cited.

RECOMMENDATION NO. 7(14.00): Apply Adaptive Management for Intermediate and High Sea Level Rise (SLR) Scenarios

PROPOSED RECOMMENDATION:
Implement an Adaptive Management and Monitoring Plan to address coastal resiliency in light of projected sea level rise scenarios. The Adaptive Management Plan provides strategies to address sea level rise uncertainties that will be faced throughout the project's 50-year life cycle. Each strategy follows a scientific approach that uses performance measures, monitoring, triggers and/or thresholds to inform project resiliency and support decisions regarding the need to adjust management measures to improve performance.

Background and Definitions.

Adaptive Management – A scientific process for continually improving management policies and practices by learning from their outcomes; Adaptive Management links science to decision making to improve restoration performance, efficiency, and probability of success.

Uncertainty – A question faced during planning or implementation regarding the best actions to achieve desired goals and objectives within constraints, which cannot be fully answered with available data or modeling.

Management Options – Potential structural, non-structural, and operational alternatives to be undertaken to improve design performance. In the planning process, management actions are grouped into alternative plans. Adaptive management plans contain potential management actions "options" that may be taken to improve performance if project/program goals and objectives are not met.

Strategies – A plan to address one or more uncertainties identified in the adaptive management Plan. The adaptive management strategies fit into the following approaches:

Active Adaptive Management (See Figure E-7) – Multiple pilot projects or design tests are implemented to test designs or operational criteria to achieve desired goals and objectives. Each design or operational action is monitored, assessed, and results are used to inform implementation of the best design for project component or operations. Pilot projects or design tests are usually conducted before implementing the full project component that they are intended to inform.

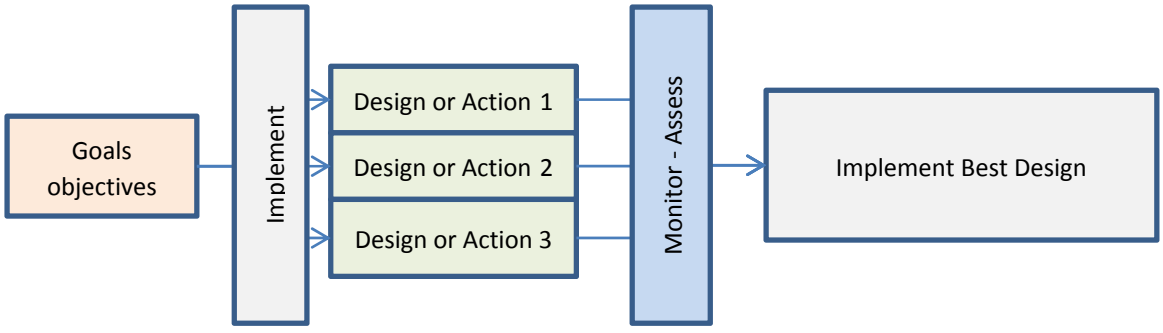


Figure E-7: Active Adaptive Management

Project goals and objectives are evaluated to determine multiple designs or management actions to test by implementing them with associated monitoring, assessing results, and determining the best design of a particular project component to move forward.

Passive Adaptive Management (See Figure E-8) – Most of the proposed St. Lucie County Adaptive Management Plan strategies are considered passive adaptive management approaches. One project component or set of operational criteria is implemented to test its ability to achieve desired goals and objectives. Results are monitored, assessed and communicated to implementing agencies and the appropriate participating agencies to determine how best to adjust project component designs, operations, contingency options, or inform future projects.

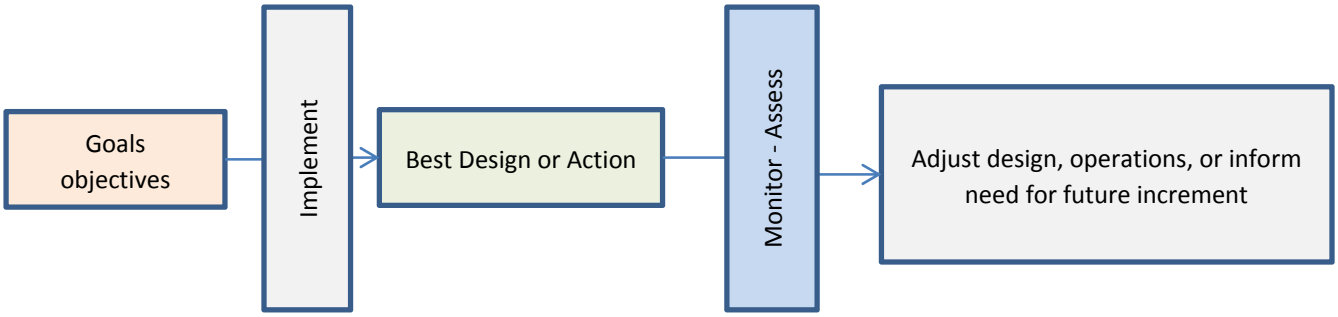


Figure E-8: Passive Adaptive Management

Diagram illustrates that the best design or management action is implemented to achieve project goals and objectives with associated monitoring and results are assessed to adjust other project component designs, adjust operations, and inform the need for a future increment.

ADVANTAGES:
Through inclusion of adaptive management options within the Feasibility Study design it negates the need for future Limited Reevaluation Reports or General Reevaluation Report as uncertainties will be addressed within the Adaptive Management Plan with associated monitoring, options to address the uncertainties and associated costs.
It would comply with guidance to incorporate AM into Project Life Cycles.
It could reduce the need for future Post Authorization Reports and related schedule impacts.

DISADVANTAGES:
There could be report schedule impacts.

ACTIVITIES TO IMPLEMENT:
Related activities will need to be scheduled and funded.

DETERMINATION:
This recommendation was adopted by the PDT and will be presented in the Feasibility Report and further developed during PED phase.

RECOMMENDATION NO. 8 (16.00, 16.17, 16.19, 16.20): Contracting Strategies to Reduce Construction Cost for Dredging

ORIGINAL DESIGN:
The St. Lucie Coastal Storm Risk Management project is nearby two other Federal projects: Ft. Pierce Shore Protection project to the north and Martin County Shore Protection project to the south (See Figure E-9).

PROPOSED DESIGN:
The idea is that these existing Federal projects have existing re-nourishment schedules and that the potential St. Lucie project could share a mobilization and demobilization (mob/demob) cost with either of these projects, assuming the St. Lucie tentatively selected plan includes nourishment. The Fort Pierce project has a 2-year renourishment cycle; the Martin County Shore Protection Project has a 7-year nourishment cycle.

ADVANTAGES:
Mob/demob costs for these types of projects is generally around $3.2 million. This costs accounts for generally equipment setup and shutdown, but also takes into account where a dredge is traveling from. Therefore, if a dredge is already in a location near to the project to which it is traveling, the mob/demob cost could be smaller. Therefore, planning timing of dredging could be beneficial to both the St. Lucie project sharing the mob/demob cost with another Federal project (cutting the mob/demob potentially in half to $1.6 million). Additionally, having the dredge at a nearby location prior to the St. Lucie project construction could also potentially decrease mob/demob costs.

DISADVANTAGES:
Timing of the nourishment cycle between projects can be difficult, and the timing of funding streams add complexity.

ACTIVITIES TO IMPLEMENT:
This idea could be investigated further during the PED, when all information about the recommended plan is known and when timing of the initial nourishment could be better estimated in comparison to the Ft. Pierce and Martin County Shore Protection projects and a contract acquisition strategy could be developed with Contracting. Maximizing the dredging window could also be investigated during this time to see if doing so is 1) permitted and 2) allows more efficiency's to be shared among the Federal projects.

DETERMINATION:
If the difficulties of funding stream and project nourishment timing could be overcome, this proposal could potentially reduce the project construction cost. Therefore, this recommendation was adopted by the PDT and will be further developed during PED phase.

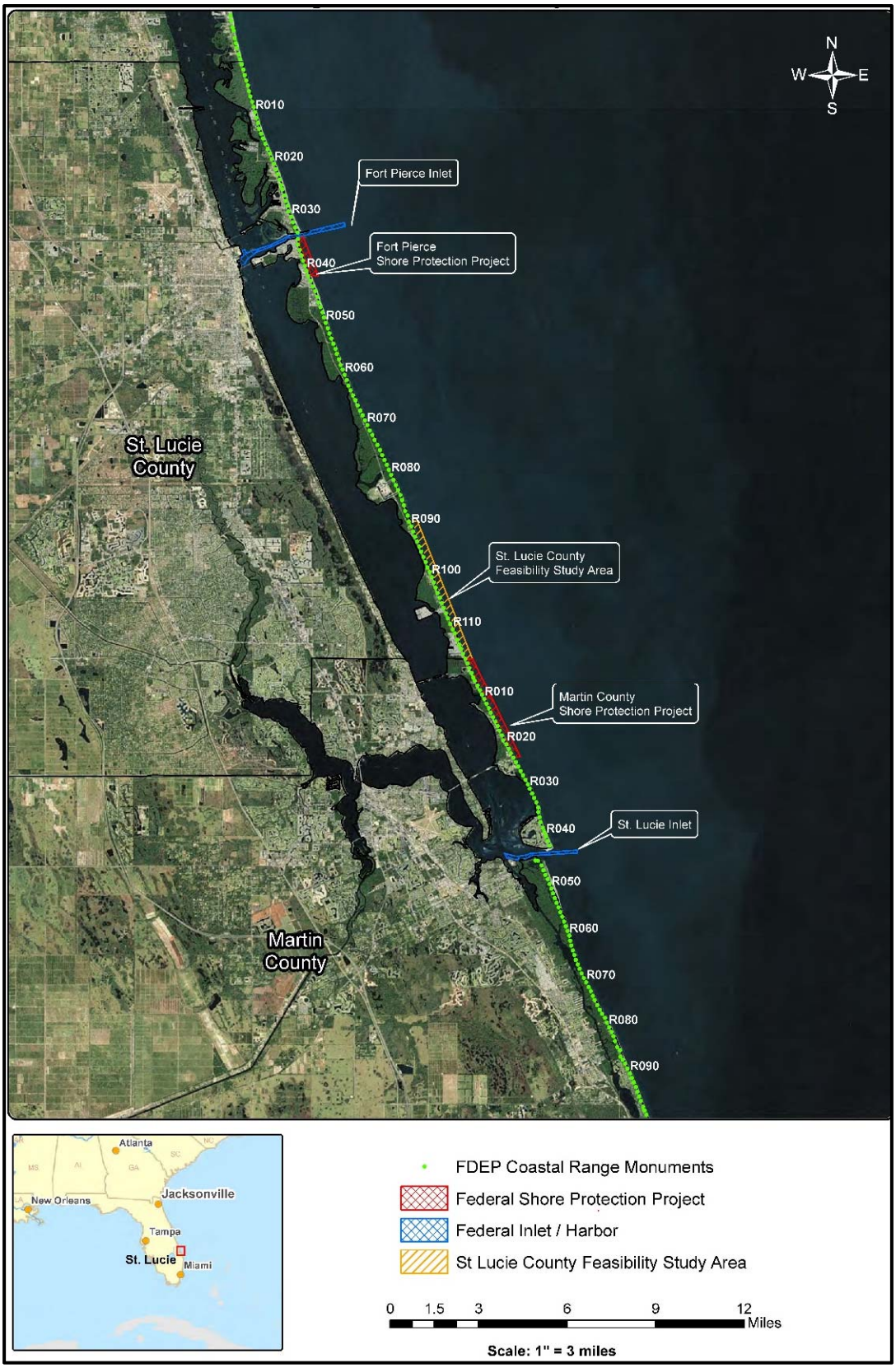


Figure E-9: St. Lucie Potential Project is nearby Ft. Pierce and Martin County projects

**Mobilization/Demobilization amount of $3,218,900 taken from ROM costs from 9/9/2015 estimate by EN-TC, and should be used only for order of magnitude concept.*

COST ESTIMATE WORKSHEET				
PROPOSAL NO. 8				
Title: Contracting Strategies to Reduce Construction Cost for Dredging				
DELETIONS				
ITEM	**UNITS**	**QUANTITY**	**UNIT COST**	**TOTAL**
Mobilization/Demobilization	each	1	$3,218,900.00	$3,218,900
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
==========	==========	==========	==========	==========
		Total Deletions		**$3,218,900**
ADDITIONS				
ITEM	**UNITS**	**QUANTITY**	**UNIT COST**	**TOTAL**
Shared Mobilization/Demob	each	1	$1,609,450.00	$1,609,450
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
==========	==========	==========	==========	==========
		Total Additions		**$1,609,450**
	Net Cost Decrease/Increase			**$1,609,450**
	Mark-ups	**0.00%**		**$0**
	Total Cost Decrease/Increase			**$1,609,450**
			Rounded:	

RECOMMENDATION NO. 9 (18.0): Reconsider Beach-Fx Results/Reliability Analysis to Determine If a More Resilient and Cost Effective Plan Can Be Developed Based on More Extreme Event Percentiles

PROPOSED RECOMMENDATION:
This proposed recommendation includes several ideas for looking at Beach-fx model outputs in different ways, with the goal of designing a project that is more resilient and (possibly) more cost effective over the life cycle of the project.

The Beach-fx model, being used to calculate without project damages and project benefits, is a lifecycle model that generates a range of results and outcomes for any given alternative. Standard practice has been to present only the average from the range of outputs for alternative selection and justification. Presenting the benefits for a certain percentile of the range of outcome could potentially show that a project would have more benefits than is captured by only looking at the average. Specifically, if the expected damages are not normally distributed, a slightly larger or smaller project could be recommended. If, for example, some iterations of the model showed very large spikes in damage, the recommended plan could perhaps be larger in order to provide resiliency. Also, it may be possible to use the Beach-fx results to modify the recommended renourishment interval. The typical beach nourishment project has a renourishment interval between of 5-10 years. This idea here would be to use a renourishment interval in the 25-50 year range. Much more volume would need to be placed at each event, but there could potentially be a life-cycle cost savings based on reduced mobilization costs.

ADVANTAGES:
This recommendation could potentially provide decision makers with a more complete understanding of the possible range of outcomes associated with the recommended plan. This might make the report more approvable. Also, a larger project (with a smaller number of renourishment) could result in a direct project cost savings by reducing the number of times that mobilization is needed over the 50-year period of the project. Finally, this recommendation could make the project more resilient over a range of different plausible storm events.

DISADVANTAGES:
This recommendation could potentially confuse decision makers by providing a more complex picture of damages and benefits. This might result in more questions being asked than answers provided. The results of this analysis could also be neutral as far as making an alternative look better or worse. Finally, the recommendation could lead to selection of plan that may not be policy compliant. The selected plan should be the plan that maximizes the net benefits (based on expected annual damages in the with and without project condition). A different plan might be inconsistent with policy and precedent.

ACTIVITIES TO IMPLEMENT:
This recommendation would require additional analysis time and study funds to examine the range of results provided by Beach-fx. An additional week of labor and funding would probably be needed. Depending on the results of this analysis, a different plan could be selected for the TSP. This might add additional work for the study team, including the PTL and the cost estimator.

DETERMINATION:
An analysis and discussion of the full range of model results and variability will be included in the report. This is generally good practice for a coastal risk management study. Depending on the results of the analysis, it may seem prudent to modify the recommended plan. However, the team is unlikely

recommend a different plan because it probably would not be policy compliant. Therefore, this recommendation was not adopted by the PDT.

RECOMMENDATION NO. 10 (21.22): Specialized Truck Haul for Narrow Beach and Dune Gaps

PROPOSED RECOMMENDATION:
Use beach compatible sand from various upland sources (via truck haul rather than offshore dredging) to fill in low areas and gaps in the St Lucie County dune system within the project area in order to minimize flooding and reduce damages due to storm tides.

ADVANTAGES:
Minimizing flooding by eliminating gaps and low areas in the dune may significantly reduce storm damages due to storm surge (flooding and erosion) without the need for additional flood management measures. Truck haul contracts have lower mobilization costs than dredging. Using sand from a DMMA would create capacity within the DMMA for new dredged material and provide beneficial use of the previously dredged material.

DISADVANTAGES:
Additional flood management measures may be required to supplement the protective measure in the event of sea level rise and/or increased storm intensity. Truck haul contracts have high unit prices (whether off-loading a DMMA or purchasing sand from a mine). Trucks cause increased noise and additional traffic/delays on highway systems.

ACTIVITIES TO IMPLEMENT:
A dune survey must be completed to determine the location and extent of gaps and low areas. Acceptable sand source(s) must be located. All viable sand sources must be tested for compatibility.

DETERMINATION:
This recommendation was not adopted by the PDT due to the disadvantages cited.

RECOMMENDATION NO. 12 (24.00): Coordinate with National Floodproofing Committee

PROPOSED RECOMMENDATION:
During the course of producing an estimate for initial screening of alternatives in the Feasibility Phase, it was determined that there may be problems with pursuing one of the alternatives. Specifically, the floodproofing alternative (meant to be combined with a small, one-time beach nourishment event) seemed to be potentially problematic. After presenting findings to the PDT, the team collectively decided to eliminate the whole alternative. Details of the findings can be found in the document written by CESAJ-EN-TC entitled "Draft Write Up – Eliminate Floodproofing".

Flood shields (considered to be dry floodproofing) were the floodproofing measure most appropriate, since it would be cost prohibitive and structurally difficult to use wet floodproofing measures (ie: elevate the condominiums in the area). In general, the analysis found that per FEMA "Design Considerations for Floodproofing" and FEMA "ASCE 24 design standard" Section 6.2.1, dry floodproofing of buildings is not permitted in Coastal High Hazard Areas (Zone V), where the study area is classified as Zone VE (included within V), shown in Figure E-10. Therefore the alternative containing this measure was screened out and eliminated from further analysis.

During the VE workshop, the proposal was created to coordinate with the USACE National Floodproofing Committee. They would review the findings of the team on dry floodproofing, and provide feedback as to whether this alterative was rightfully ruled out, and any other floodproofing options that may exist.

ADVANTAGES:
This expert feedback would provide the team with valuable insight on floodproofing from a national perspective.

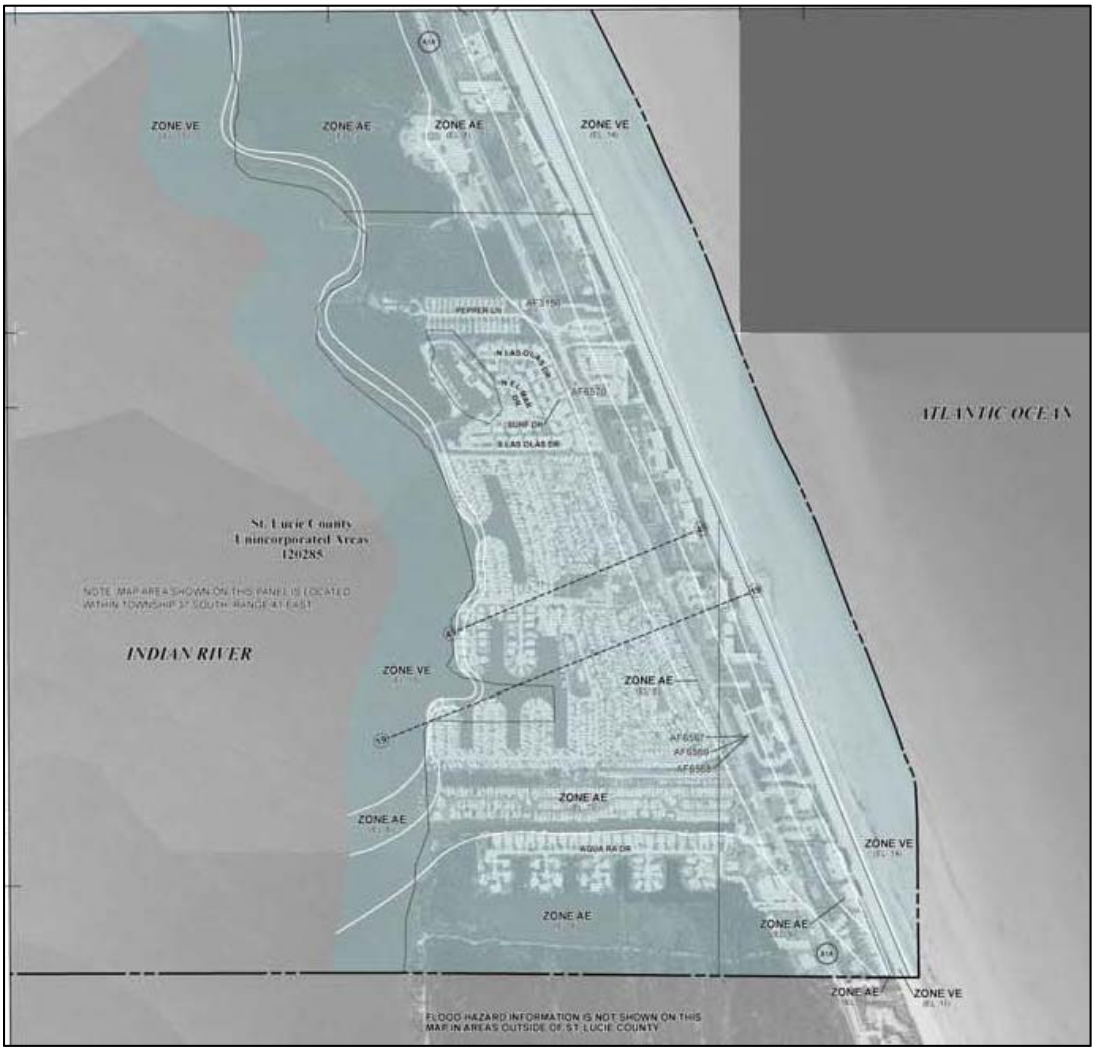
DISADVANTAGES:
This effort would be a small additional cost to the project.

ACTIVITIES TO IMPLEMENT:
Planning Lead and Project Manager will coordinate with the USACE National Floodproofing Committee on funding and scope needs.

JUSTIFICATION:
Implementation of this recommendataion would have a small cost to the project but would give the team valuable national feedback on the dry floodproofing findings to date.

DETERMINATION:
This recommendation was adopted by the PDT and will be further developed during PED phase.

Figure E-10: St. Lucie Study Area in Coastal High Hazard Area Zone VE (FIRM MAP, Panel 0314, 2012)



RECOMMENDATION NO. 13 (26.00): Account for National Environmental Restoration Benefits related to Sea Turtle Nesting

PROPOSED RECOMMENDATION:
The idea is to calculate National Environmental Restoration (NER) benefits for this coastal storm management risk project related to areas of high sea turtle nesting. Specifically from 2000-2009, State nesting data shows the project beach supported an average of 2367 loggerhead, 181 green, and 45 leatherback sea turtle nests (FWC INBS zones P-Z [St. Lucie R-84 to Martin R-7]).

Although NER benefits cannot be used to justify a project that is for coastal risk management (previously hurricane and storm damage reduction), they can be calculated and put in the report.

ADVANTAGES:
NER benefits could help to tell the story of the shoreline's importance to habitat, as well as to protection of man-made structures.

DISADVANTAGES:
Calculating NER benefits would take some amount of additional time and cost and would likely not help justify parts of the project.

ACTIVITIES TO IMPLEMENT:
Scope and funding requirements to calculate NER benefits should be discussed with the environmental lead and project manager for potential incorporation into the report.

DETERMINATION:
This recommendation was adopted by the PDT and will be presented in the Feasibility Report.

RECOMMENDATION NO. 14: ***Coordinate with ERDC Programmatically for Modeling of Artificial Reefs, Groins, etc***

PROPOSED RECOMMENDATION:
Typically the preliminary array of alternatives for coastal projects includes a vast array of measures, such as artificial reefs, groins, etc. Measures are screened out or carried forward based on their own merit. If one of these types of measures is carried forward, then modeling of these alternatives in beach-fx takes significantly more time and effort than a project alternative concerning only dunes or nourishment. A 3-year study under the 3x3x3 paradigm is extremely time sensitive. This idea would be to reach out to ERDC programmatically to consider the idea of having them model more complicated and time consuming alternatives and possibly parallel to our own modeling of other alternatives.

ADVANTAGES:
This would allow more time intensive alternatives that made it through screening to be modeled without potentially delaying a project schedule.

DISADVANTAGES:
The cost to involve ERDC could be expensive, and it is uncertain if they have the modelers to accommodate a request such as this.

ACTIVITIES TO IMPLEMENT:
Discuss further to see if there is a need programmatically. If so, arrange a meeting with ERDC to discuss these types of capabilities.

DETERMINATION:
This recommendation was not adopted by the PDT due to the disadvantages cited.