APPENDIX B

ECONOMICS

FINAL REPORT

OKALOOSA COUNTY, FLORIDA
COASTAL STORM RISK MANAGEMENT

Integrated Feasibility Study
With Environmental Assessment

Executive Summary

Okaloosa County is located approximately 40 miles east of Pensacola, Florida and 140 miles west of Tallahassee, Florida. The beaches of Okaloosa County encompass approximately 26 miles of shoreline extending eastward from the Santa Rosa/Okaloosa County line to the Okaloosa/Walton County line. The shoreline is interrupted by East Pass, an opening to the Gulf of Mexico from Choctawhatchee Bay located on the west side of the City of Destin, Florida. The Okaloosa County coastal shoreline includes about 7.3 miles of state-designated critically eroded shoreline. The study area includes the coastal shoreline of Okaloosa County as well as the back bay shorelines along Choctawhatchee Bay. A study was undertaken to assess the feasibility of providing Federal Coastal Storm Risk Management measures to portions of the county's shorelines. In accordance with appropriate Federal guidance, an investigation was performed to estimate the economic benefits of alleviating erosion, inundation, and wave attack damage to coastal infrastructure.

Alternative Evaluation

Upon initiation of a preliminary screening, followed by detailed evaluation of a final array of alternatives, the project delivery team (PDT) has determined a National Economic Development Plan (NED) for reducing risks associated with coastal storm and erosion damage to infrastructure. The evaluation covered the span of a 50-year period of analysis with a base year of 2025. Alternatives were measured against the criteria of efficiency, effectiveness and acceptability as well as being compared to the No Action Plan.

The NED plan includes a proposed action in two of the three planning reaches, Okaloosa Island and West Destin. For Okaloosa Island, the NED plan increases or maintains the dune height to 14 feet and maintains the berm width to 10 feet. For West Destin the NED plan increases or maintains the dune height to 14 feet and a berm width of 30 feet. Table 1 shows benefits and costs for the entire project combined in Average Annual Equivalent (AAEQ) dollars.

Table 1: Economic Summary of the NED Plan (AAEQ)

Economic Summary	Storm Risk Management + Land-Loss Benefits (Primary)	Storm Risk Management + Land-Loss + Recreation
Price Level	FY21	FY21
FY20 Water Resources Discount Rate	2.5%	2.5%
Storm Risk Management + Land-Loss Benefits	$4,159,000	$4,159,000
Recreation Benefits	$0	$2,191,000
Total Benefits	$4,159,000	$6,350,000
Total Cost	$3,625,000	$3,625,000
Net-Benefits	$534,000	$2,725,000
Benefit to Cost Ratio	1.1	1.8

Tabe of Contents

List of Tables

List of Figures

1. Introduction

The U.S. Army Corps of Engineers (USACE), Mobile District has evaluated the feasibility of a coastal storm risk management (CSRM) project in Okaloosa County, Florida. The results of the investigation are presented here and in the accompanying attachments.

1.1 Problem Statement

Damages from erosion, waves and flooding threaten the Okaloosa County shoreline. Portions of the study area have experienced erosion which has resulted in increased exposure and risk of structural damage. The protective dunes are being destroyed by hurricane and storm forces. The impacts of these storms to property and infrastructure are significant and can possibly be reduced through a beach restoration and stabilization project.

1.2 Purpose

The purpose of this Economic Appendix is to document the economic investigations completed to determine the National Economic Development (NED) Plan and to formulate a hurricane and storm damage reduction project for Okaloosa County, Florida, which will reduce the damaging effects of hurricanes and severe storms to properties along the coast and stabilize or restore the shoreline. The project will be constructible, acceptable to the public, environmentally sustainable and justified by an economic evaluation.

1.3 Study Area

Okaloosa County is located approximately 40 miles east of Pensacola, Florida and 140 miles west of Tallahassee, Florida. The beaches of Okaloosa County encompass approximately 26 miles of shoreline extending eastward from the Santa Rosa/Okaloosa County line to the Okaloosa/Walton County line. The shoreline is interrupted by East Pass, an opening to the Gulf of Mexico from Choctawhatchee Bay located on the west side of the City of Destin, Florida. The Okaloosa County coastal shoreline includes about 7.3 miles of state-designated critically eroded shoreline. The study area includes the coastal shoreline of Okaloosa County as well as the back bay shorelines along Choctawhatchee Bay.

1.4 Federal Interest

Congress has authorized Federal participation in hurricane and storm damage reduction projects to prevent or reduce damages caused by wind and tidal generated waves and currents along the Nation’s ocean coasts and Great Lakes shores.

2.0 Existing Condition

A key step in the planning process is to establish the existing condition by developing an inventory and characterizing the critical resources within the project area. The existing condition is also a key component for forecasting the Future Without Project (FWOP) condition.

2.1 Socio-Economic Conditions

2.1.1 Demographics

According to the US Census Bureau, the 2010 population of Okaloosa County was 180,822 with a land estimate of 930 square miles. The population estimate in 2019 was 210,738, indicating growth in the population by 17 percent.

The ethnic nature of Okaloosa County is approximately 78 percent Caucasian, 10 percent African American and all other groups of 12 percent. The median age for residents is 37 and those aged 18 years and over represent 78 percent of the population.

2.1.2 Economic Characteristics

Tourism is a critical component of Okaloosa County. It is home to a variety of activities and several notable attractions. Destin-Fort Walton Beach is considered one of the world's premier beach vacation destinations. Destin Harbor is the hub for almost all the commercial and recreations fishing businesses operating in the area. Choctawhatchee Bay are calm waters great for paddle boarding, kayaking and canoeing. The county has nature preserves and parks for recreations as well, some of which is included in the Gulf Islands National Seashore.

Other drivers of the economy are educational services and health care; professional, scientific, management and administrative services; retail, construction, public administration and manufacturing.

2.2 Study Area

The study area includes the coastal shoreline of Okaloosa County as well as the back bay shorelines along Choctawhatchee Bay. Figure 1 shows a map of the study area.

The total shoreline in the study area is approximately 26 miles with a variety of property ownerships to include government, county and private. However, areas exist that the probability of project implementation are low. These areas include Eglin Air Force base

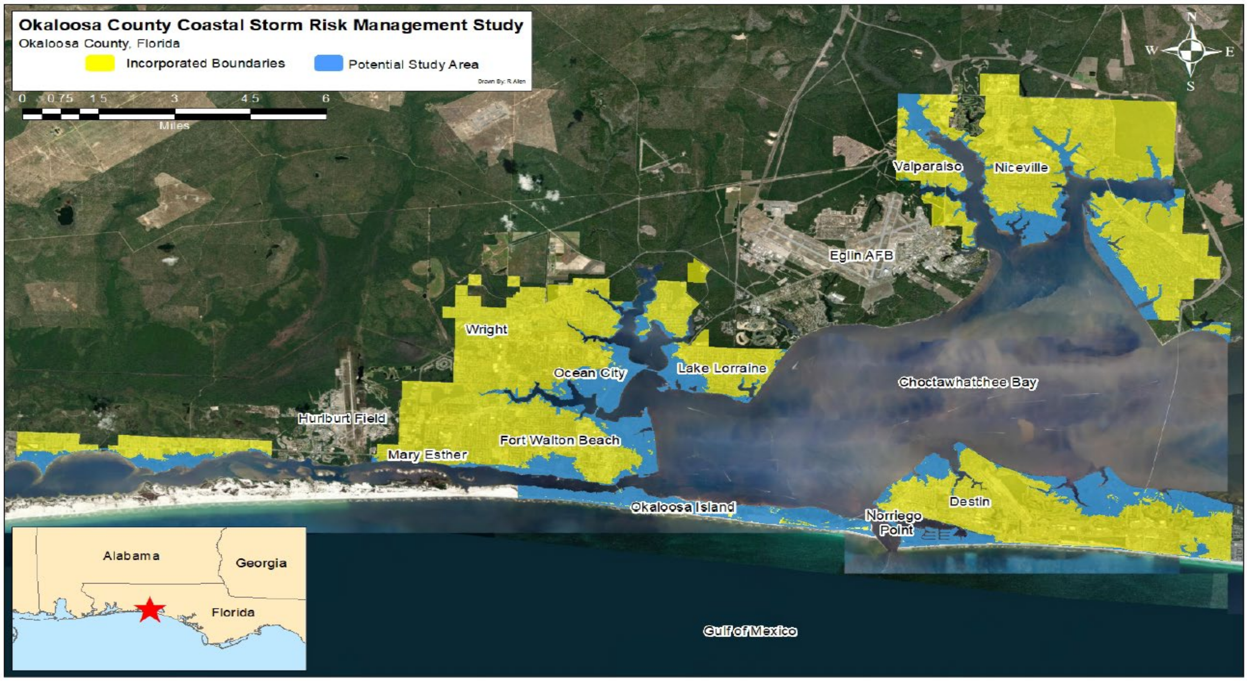

Figure 1: Okaloosa County Study Area

property due to the lack of development and state identified Coastal Barrier Resource Act (CBRA) area classification.

The study area was initially divided into the Back Bay and Front Beach. The Back Bay was evaluated by performing an assessment of coastal storm hazards associated with inundation and screening for potential feasibility of implementing nonstructural measures. The result of this evaluation was no viable effort to implement in this area based on benefits and costs. A white paper discussing the details of this assessment can be found in Attachment 1 of this Economic Appendix.

This left approximately eight miles of front beach as the study area for evaluation. Within this area a final array of alternatives was developed. For detailed alternatives analysis, the coastal shoreline was divided into two developed reaches, Okaloosa Island and Destin. The Destin area was further divided into two reaches, West Destin and East Destin based on beach morphology, environmental considerations, and land use.

2.3 Data Collection

Beach-*fx* was the Coastal Storm Risk Management (CSRM) model used to evaluate and quantify damages. Attribute information for 737 separate damage elements (DE) was populated for economic modeling. The attributes of the structures included geographic location, structure type, foundation type, construction type, width, length, number of floors, depreciated replacement cost and year built. The proximity of these structures to the shoreline makes them potentially vulnerable to erosion, wave attack and inundation. The damage elements include:

- 20 commercial buildings
- 50 Gazebos
- 172 Multi-family Residents
- 134 Pools
- 169 Single Family Residents
- 194 dune walks

Okaloosa Island and Destin consists of 6 representative beach profiles, 48 Beach-*fx* model reaches and 271 lots for economic modeling and reporting purposes. The hierarchical structure is depicted as follows:

Beach Profiles: Coastal beach profile surveys were analyzed by USACE, Mobile District Coastal Engineering personnel and ERDC to develop representative beach profiles that include the dune, berm and submerged portions of the beach. The representative profiles are used for shore response modeling in the SBEACH engineering numerical model and only referred to in this section for informational purposes.

Beach-FX Model Reaches: Quadrilaterals with a seaward boundary that is parallel with the shoreline that contain the Lots and Damage Elements, and that are used to incorporate coastal morphology changes for transfer to the lot level. In this study, the model reaches use Florida Department of Environmental Protection (FDEP) range monuments. Each model reach is approximately 1,000 feet long. Figure 2 shows an aerial view of the Beach-*fx* model reaches.

Lots: Quadrilaterals encapsulated within reaches used to transfer the effect of coastal morphology changes to the damage element.

Damage Elements: Represent a unit of coastal inventory in the existing condition and a store of economic value subject to losses from wave-attack, inundation and erosion damages. Beach-*fx* handles economic considerations at the damage element (DE) level. These considerations include extent of damage, cost to rebuild and time to rebuild. Beach-*fx* uses pre-defined damage functions to calculate the extent of damage. For each damage element, the following information is input into Beach-*fx*:

- Geographical reference (northing and easting of center point)
- Alongshore length and cross-shore width
- Usage (e.g. single family, multi-family, commercial, walkover, pool, gazebo)
- Number of floors
- Construction type
- Foundation type
- Armor type
- First floor elevation
- Value of structure (replacement cost less depreciation)
- Value of contents

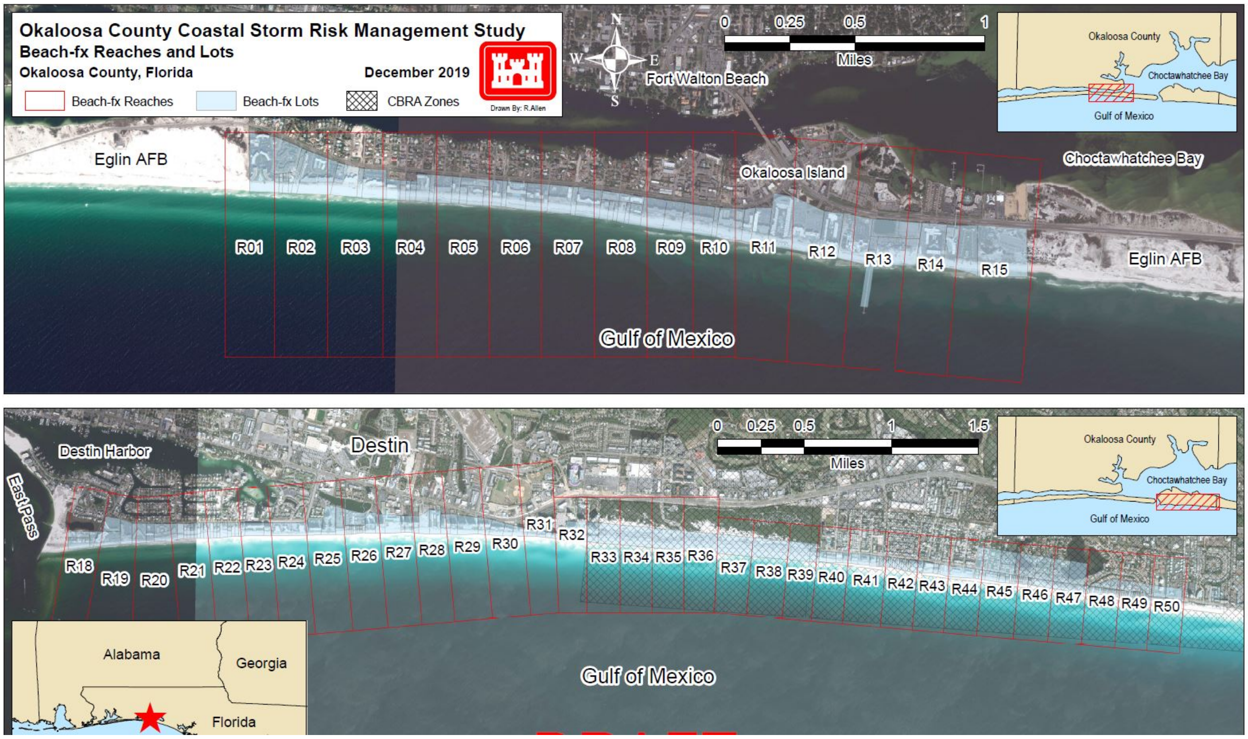

Figure 2: Beach-fx Modeling Reaches

2.4 Existing Condition Coastal Structure Inventory

Information on the existing economic conditions along Okaloosa County coastline was collected for economic modeling purposes. The information on the coastal assets detailed in this section was mainly collected from Okaloosa County. The depreciated replacement cost was estimated using RS Means.

2.4.1 Structure and Content Value

The structure value, as an input for Beach-*fx*, was represented by the depreciated replacement cost associated with the damageable structure in a given study area. The depreciated replacement cost for both residential and non-residential structures was determined using the 2018 RS Means Square Foot Costs Data catalog (henceforth, RS Means). To determine the depreciated replacement cost, the square footage and occupancy type of each structure were identified. Then, for each occupancy type, the average square footage was determined to represent that occupancy category for the purpose RS Means.

The geospatial location and footprint of the damage elements was verified using aerial photography in ArcMap and Google Maps. The construction and foundation type of each damage element was gathered from Okaloosa County information and visual observations by USACE, Mobile District staff. First floor elevations of all damage elements in the study area were surveyed using terrestrial based LIDAR (light detection and ranging). RS Means was used to estimate depreciated replacements costs. The value of contents was assumed to be 50% of the structure value for all habitable structures. Non-habitable structures (dune walkovers, pools and gazebos) had zero contents value.

The economic value of the existing structure inventory represents the depreciated replacement costs of damageable structures and their associated contents within the study area along the coastline. The damage element inventory includes 737 damageable structures with an overall estimated value of $2.3 billion and $1.2 billion in contents. Table 2 provides the distribution of structure and content values broken down by Beach-*fx* reach.

Table 2: Structure & Content Value by Reach

Reach	Structure/Damage Element Total	Structure Value	Content Value	Total Value
1	6	$34,978,000	$17,385,000	$52,363,000
2	28	$104,575,000	$52,120,000	$156,694,000
3	15	$65,832,000	$32,754,000	$98,586,000
4	19	$25,779,000	$12,715,000	$38,494,000
5	19	$43,828,000	$21,744,000	$65,572,000
6	16	$58,194,000	$28,725,000	$86,919,000
7	17	$89,816,000	$44,761,000	$134,577,000
8	19	$15,649,000	$7,642,000	$23,291,000
9	8	$91,111,000	$45,467,000	$136,578,000
10	16	$97,448,000	$48,520,000	$145,968,000
11	16	$180,143,000	$89,651,000	$269,794,000
12	14	$35,013,000	$17,090,000	$52,103,000
13	15	$13,857,000	$6,582,000	$20,439,000
14	12	$27,413,000	$13,354,000	$40,768,000
15	11	$27,624,000	$13,447,000	$41,071,000
18	25	$10,647,000	$5,291,000	$15,938,000

Reach	Structure/Damage Element Total	Structure Value	Content Value	Total Value
19	10	$127,858,000	$47,552,000	$175,410,000
20	12	$93,751,000	$37,201,000	$130,951,000
21	15	$10,676,000	$8,438,000	$19,114,000
22	11	$4,506,000	$2,183,000	$6,689,000
23	10	$67,636,000	$42,677,000	$110,313,000
24	17	$16,776,000	$4,527,000	$21,304,000
25	7	$128,512,000	$40,464,000	$168,976,000
26	27	$29,793,000	$23,931,000	$53,724,000
27	14	$176,034,000	$101,514,000	$277,548,000
28	9	$120,087,000	$52,686,000	$172,774,000
29	8	$186,204,000	$83,320,000	$269,524,000
30	6	$46,009,000	$35,974,000	$81,983,000
31	7	$8,625,000	$5,260,000	$13,885,000
32	10	$98,393,000	$55,010,000	$153,403,000
33	7	$81,488,000	$43,155,000	$124,644,000
34	4	$500,000	$110,000	$609,000
36	6	$669,000	$ -	$669,000
40	9	$17,010,000	$24,756,000	$41,765,000
41	16	$ 23,058,000	$ 22,092,000	$45,150,000
42	27	$39,958,000	$21,010,000	$ 60,969,000
43	13	$17,687,000	$18,067,000	$35,754,000
44	9	$ 13,659,000	$ 6,422,000	$20,081,000
45	30	$24,280,000	$12,639,000	$36,919,000
46	37	$ 13,148,000	$ 6,354,000	$ 19,502,000
47	36	$ 6,407,000	$ 2,903,000	$ 9,309,000

Reach	Structure/Damage Element Total	Structure Value	Content Value	Total Value
48	59	$18,767,000	$ 9,275,000	$28,042,000
49	49	$18,487,000	$10,691,000	$29,178,000
50	16	$33,414,000	$ 8,527,000	$ 41,941,000
Grand Total	737	$2,345,295,000	$1,183,988,000	$3,529,284,000

Figure 3 shows the structure and content values by reach and the damage element distribution. The distribution is relatively uniform, however the values aggregated by reach show significant variation. The variation is due to differentiation between the types of development within the reach.

For modeling and reporting purposes the structure inventory was separated into different structure types. Table 3 provides a summary of these structure types and the associated inventory values.

Table 3: Summary of Structure Types and Inventory Values

Structure Type	Structure Count	% of Total Structure	Structure Value	Content Value	Total
Commercial	20	3%	$20,489,000	$10,245,000	$30,734,000
Gazebo	50	7%	$ 3,397,000	$ -	$3,397,000
Multi-Family Residential (1-2 Floors)	88	12%	$223,682,000	$122,705,000	$346,387,000
Multi-Family Residential (3+floors)	84	11%	$1,991,789,000	$1,003,613,000	$2,995,402,000
Pool	134	18%	$7,786,000	$ -	$7,786,000
Single-Family Residential	167	23%	$94,852,000	$ 47,426,000	$142,278,000
Walkway	194	26%	$3,301,000	$ -	$3,301,000
Grand Total	737	100%	$ 2,345,298,000	$ 1,183,989,000	$ 3,529,284,000

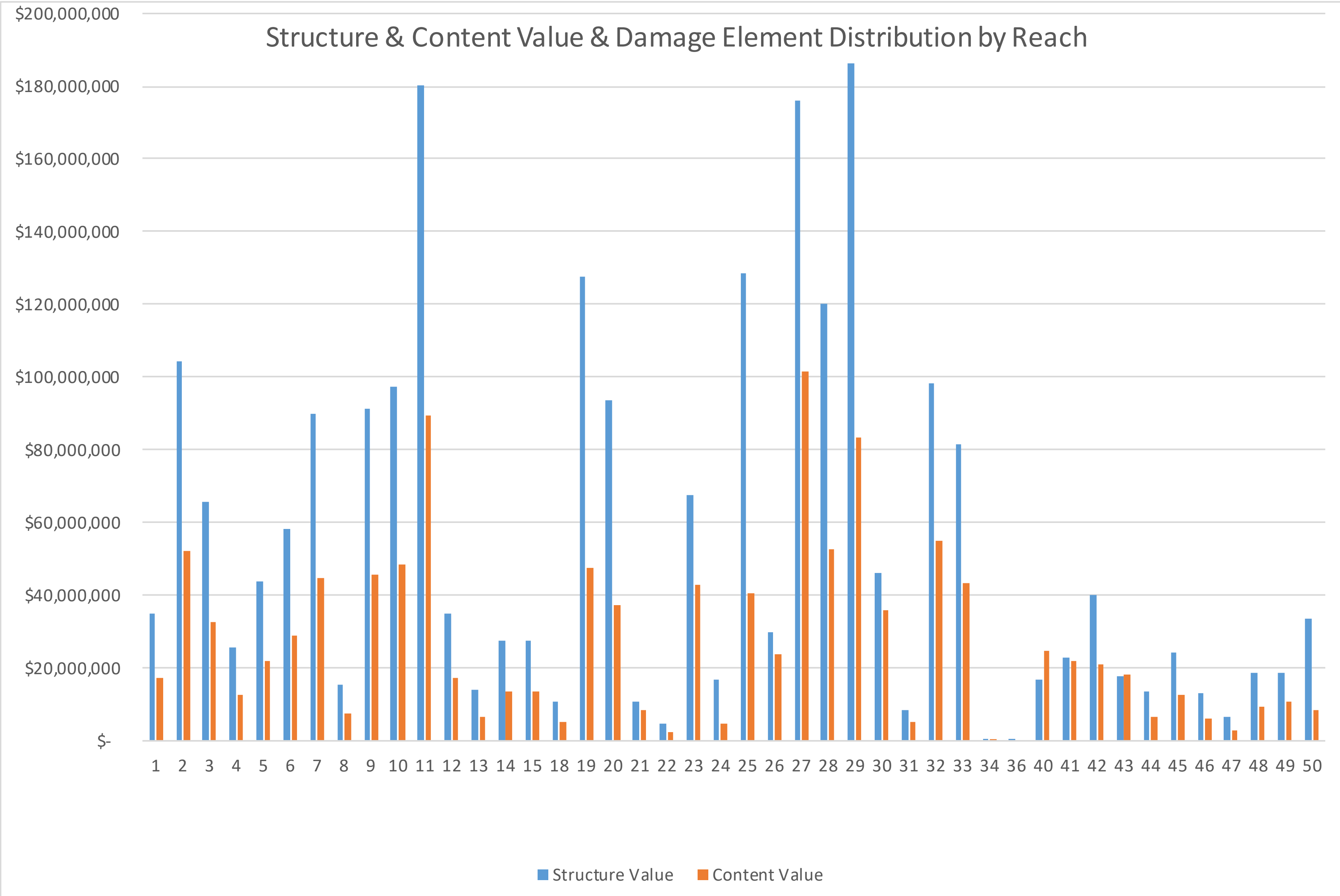

Figure 3: Structure & Content Value & Damage Element Distribution

3. Coastal Storm Risk Management Benefits

The economic benefits are from four categories: storm damage reduction, lost land reduction, elimination of emergency nourishment costs and recreation. The primary benefit category is the storm damage reduction as mandated in ER 1105-2-100, hurricane and storm damage reduction projects are to be formulated to provide for storm damage reduction.

Initial benefit evaluation is stated in constant FY2020 dollars. The period of analysis is 50 years from 2025 through and including all the year 2074, there are five pre-project base years, 2020 through 2024. The base year is 2025. The structure inventory is valued at 2019 dollars.

The approach used to estimate the economic benefits of reducing hurricane and storm related damages in Okaloosa County are described in this section. Initial formulation and the iterative process of preliminary evaluation and screening of alternatives left two alternatives for detailed evaluation: Alternative 1 Beach (berm) nourishment and Alternative 2 Beach (Berm) and Dune nourishment. Please see main report for formulation and screening of prior measure and alternatives. These two alternatives were evaluated using the CSRM model, Beach-*fx*.

3.1 Benefit Estimation Approach using Beach-*fx*

Beach-*fx* was developed by the USACE Engineering Research and Development Center in Vicksburg, MS. The model was certified in April 2009 by the Model Certificate Headquarters Panel based on recommendations from the CSRM Planning Center of Expertise and in accordance with EC 1105-2-412 (Assuring Quality of Planning Models). Beach-*fx* links the predictive capability of coastal evolution modeling with project area infrastructure information, structure and content damage functions and economic valuations to estimate the costs and total damages under various shore protection alternatives. This output is then used to estimate the benefits of each alternative. As an event-based Monte Carlo life-cycle simulation, Beach-*fx* fully incorporates risk and uncertainty. It is used to simulate future hurricane and storm damages at existing and future years and to compute accumulated present worth damages and costs. Storm damage is defined as the ongoing monetary loss to contents and structures incurred as a direct result of waves, erosion and inundation caused by a storm event of a given magnitude and probability. The model also computes permanent shoreline reductions so that land loss benefits can be derived exogenously. These damages and associated costs are calculated over a 50-year period of analysis based on storm probabilities, tide cycle, tidal phase, beach morphology and many other factors.

The future structure inventory and values are the same as the existing condition. This approach neglects any increase in value due to future development. Due to the uncertainty involved in projections of future development, using the existing inventory is preferable and considered conservative for Florida where coastal development has historically increased in density and value in real-dollar terms. However, the study area has approximately two undeveloped lots on Okaloosa Island and approximately 15 undeveloped lots in the Destin area. If these lots are built upon, additional could be introduced into the study area. However, there is too much uncertainty around the timing of building the structure, value, first floor elevation and construction type to establish assumptions regarding future structures.

The future-without project damages will be used as the base condition. Potential alternatives are measured against this base condition. The difference between without and with project damages will be used to estimate project benefits.

Once benefits for each of the alternatives are calculated, they will be compared to the costs of implementing the alternative. The Federally preferred plan is the plan that maximizes net benefits, also termed the National Economic Development (NED) plan. Net benefits are derived by subtracting the cost of any given alternative from the benefits of that alternative (benefits – costs = net benefits).

3.1.1 Model Assumptions

The list of items below presents the modeling assumptions used.

- Start year: The year in which the simulations begin is 2020. This year determines the starting shoreline position which will be impacted by standard erosion and storm forces throughout the period of analysis. It is also the starting point for the sea-level rise projections.
- Base year: The year in which the benefits of a constructed Federal project would expect to being accruing is 2025.
- Period of analysis: 50 years (2025 to 2074)
- Discount Rate: For plan selection, the Fiscal Year 2020 Federal Water Resources Discount rate of 2.75% was used.
- Damage Functions: Damage functions developed by the Institute of Water Resources (IWR) Coastal Storm Damage Workshop, Coastal Storm Damage Relationships based on expert elicitation in 2002 were used in combination with damage functions developed for the North Atlantic Coastal Comprehensive Study.
- Coastal Armoring: No coastal properties are armored or will be armored in the future.
- Number of time rebuilding allowed: 50
- Future development: Future development has not been assumed to occur on currently vacant lots. The damages and benefits are based only on existing infrastructure.

- ❖ Content-to-Structure value ratios: site specific surveys about content values are not available, content values were assumed to be 50% of the structure value for all structure types. This is consistent with other Beach-*fx* analyses along the Gulf Coast in Florida.
- ❖ Sea Level Rise: formulation based on intermediate curve.

3.1.2 Risk and Uncertainty

Uncertainty was quantified for errors in the underlying components of structure values for residential and nonresidential structures, content to structure value ratios for residential and nonresidential structures, depth-percent damage relationship for both residential and nonresidential structures, and first elevations for all structures. Beach fx used the uncertainty surrounding these variables to estimate the uncertainty surrounding the storm-damage relationships developed for each reach in the study area. The list below shows uncertainty parameters around key inputs for the economics.

- ❖ Structure Value: 10 – 15% plus or minus the most likely value
- ❖ Content Value: 10 – 15% plus or minus the most likely value
- ❖ Time to Rebuild: most likely value 1.5 years; minimum 1 year and maximum 2 years.
- ❖ First Floor Elevation: 10% plus or minus the most likely value

As mentioned, RS Means was used to estimate depreciated replacement cost. The minimum depreciated replacement cost is based on the highest depreciation factor; the most-likely depreciated replacement cost is based on the most-likely depreciation factor; and finally, the highest depreciated replacement cost is based on the lowest depreciation factor.

To acquire first floor elevation, terrestrial based LiDAR was used. This method produces imaging in which first floor elevations can be viewed and estimated. This percentage is at least one foot and should account for the uncertainty for errors in estimating the first floor elevations.

3.2 Preliminary Modeling

Preliminary Beach-*fx* modeling was conducted for 50 iterations for initial evaluation of planning reaches. Figure 4 shows the FWOP damages. In terms of planning reaches, Okaloosa Island (R01 – R15) represents 30% of the damages, West Destin (R18 – R32) 66% of the damages and East Destin (R33 – R50) 3% of the damages.

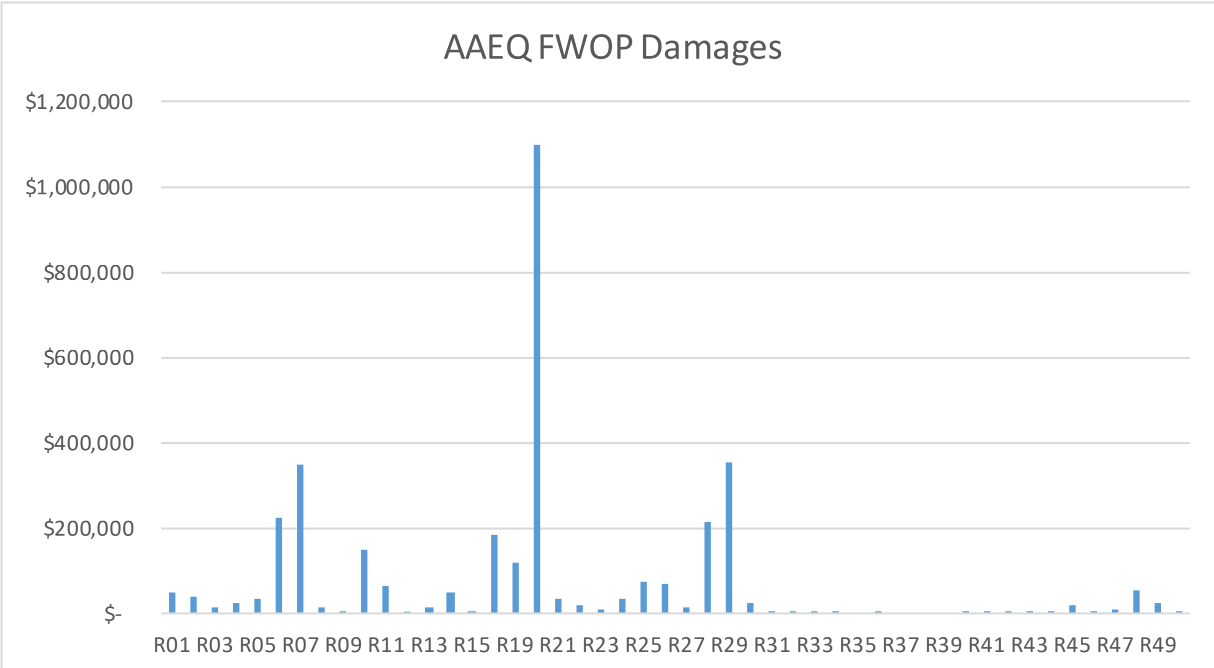

Figure 4: FWOP Damages

Table 4, Table 5, and Table 6 show the preliminary results from the initial analysis using Beach-*fx* for each study reach.

Table 4: Okaloosa Island Beach-fx Results - AAEQ 2.75%

Alternative	Option Number	Dune Height	Dune Width	Berm Width	AA Benefits	AA Cost	AA Net Benefits
2	1	14	10	10	$527,200	$355,800	$171,400
2	2	14	10	20	$536,900	$420,200	$116,700
2	7	15	10	10	$918,700	$575,400	$343,300

Table 5: West Destin Beach-fx Results - AAEQ 2.75%

Alternative	Option Number	Dune Height	Dune Width	Berm Width	AA Benefits	AA Costs	AA Net Benefits
2	1	14	10	10	$1,371,300	$1,340,300	$31,000
2	2	14	10	20	$1,401,200	$1,377,500	$23,700
2	7	15	10	10	$1,504,800	$1,565,900	$(61,100)
2	8	15	10	20	$1,543,000	$1,604,600	$(61,600)

Alternative	Option Number	Dune Height	Dune Width	Berm Width	AA Benefits	AA Costs	AA Net Benefits
2	9	15	10	30	$1,548,100	$1,654,000	$(105,900)
2	11	15	20	30	$1,589,600	$1,749,400	$(159,800)
2	12	15	30	30	$1,681,900	$1,853,900	$(172,000)

Table 6: East Destin Preliminary Beach-fx Results

Alternative	Option	Berm width	Average PV* Total Project Benefits	Average PV* Total Project Costs	Average PV* Net Benefits
1	A	10	$96,000	$4,475,000	($4,379,000)
1	B	20	$890,000	$7,031,000	($6,141,000)
1	C	30	$1,058,000	$9,801,000	($8,743,000)
1	D	80	$1,940,000	$20,694,000	($18,754,000)

*PV=Present Value

As shown in the tables, the Okaloosa Island and West Destin planning reaches had viable projects, while East Destin did not. At this point East Destin was eliminated from further analysis. The East Destin existing profile has naturally high dunes, up to 18 feet and wide berms with minimal erosion. With the relatively low FWOP damages, the risk to the East Destin Planning reach was low and not carried forward in the analysis.

3.3 Future Without-Project Condition (FWOP)

Okaloosa Island and West Destin were carried forward for refinement of the analysis. At this point in the study, a cursory review of engineering and economic model data was conducted. The 120 iterations of the future without-project condition damages for the study area modeled range between $1,102,500 and $647,222,600, with the average being $40,503,300. Based on the iteration.csv file, starting around iteration 62, the moving average ranges between -1% and 0%.

3.3.1 Damage Distribution by Structure Category and Type

Pursuant to estimating future without-project condition damages and associated costs for the Okaloosa County coastal study area, Beach-*fx* was used to estimate damages and costs in the following categories:

- ❖ Structure Damage: economic losses resulting from the structures situated along the coastline being exposed to wave attack, inundation, and erosion damages. Structure damage account for approximately 63% of the total FWOP damages.
- ❖ Contents Damage: The material items housed within the structures that are potentially subject to damage. Content damages make up approximately 37% of total FWOP damages.

Table 7 provides greater detail on the composition of the average FWOP damages by category and damage element type for Okaloosa Island and West Destin. The following tables and sections refer to damages based on 100 iterations instead of the 120 noted in previous section.

Table 7: FWOP Damages by Damage Element Type – AAEQ 2.75%

DE Type	Structure Damage	Content Damage	Total FWOP Damages
Okaloosa Island			
Commercial	$1,000	$100	$1,100
Gazebo	$2,000	$0	$2,000
Multi-Family	$37,000	$15,900	$52,900
Multi-Family 3+ Story	$363,000	$292,100	$655,100
Pool	$14,000	$0	$14,000
Walk	$8,000	$0	$8,000
Total	**$425,000**	**$308,100**	**$733,100**
West Destin			
Commercial	$15,000	$6,500	$21,500
Gazebo	$23,900	$0	$23,900
Multi-Family	$26,600	$10,900	$37,500
Multi-Family 3+ Story	$421,500	$257,000	$678,500
Pool	$45,000	$0	$45,000
Single Family Residence	$49,300	$24,600	$73,900
Walk	$20,100	$0	$20,100

DE Type	Structure Damage	Content Damage	Total FWOP Damages
Total	**$601,400**	**$299,000**	**$900,400**

Commercial structures are those that are restaurants, county buildings, the Gulfarium, Visitor Center, etc. These types of structures account for approximately 0.1% of damages in Okaloosa Island and approximately 2% in West Destin.

Gazebos are considered open structures and account for 0.3% of damages in Okaloosa Island and 3% of damages in West Destin.

Multi-Family structures are classified into two different types based on number of floors for the appropriate use of a damage function. The first type of multi-family damage element are for structure that are one to two floors. These damage elements account for 7% of damages for Okaloosa Island and 4% of damages for West Destin. The second type of multi-family structures accounts for the buildings that are greater than two floors. These damage elements account for 89% of damages for Okaloosa Island and 75% of damages for West Destin.

Pool damage accounts for 2% damage for Okaloosa Island and 5% in West Destin. Single Family Residence account for 8% of damage in West Destin. And the category of Walk are walkovers from the structure across the dune to the beach and account for 1% of damage in Okaloosa Island and 2% of damages in West Destin.

Figure 5 shows damages by Beach-*fx* Reach for Okaloosa Island (R01 – R15) and West Destin (R18 – R32). A great deal of variability in the amount of damage amongst the Beach-*fx* reaches can occur. This is explained by the large number of variables, all of which are accounted for within the model. Examples of variations between the reaches result from density and amount of development, typical size and value of structures, typical distance between structures and mean-high water, size, shape and location of the dunes and coastal morphology, and rate of erosion for each reach. As shown in the figure, damages spike in R07 and R20 which are accounted for by some of the previously mentioned differences among the reaches. Of note, R07 located on Okaloosa Island has one of the largest condominiums with a first floor elevation lower than comparative condominiums in the area. R20 located in West Destin has a complex that the first floor elevations at the various buildings are lower than any in the area and are higher risk of damage.

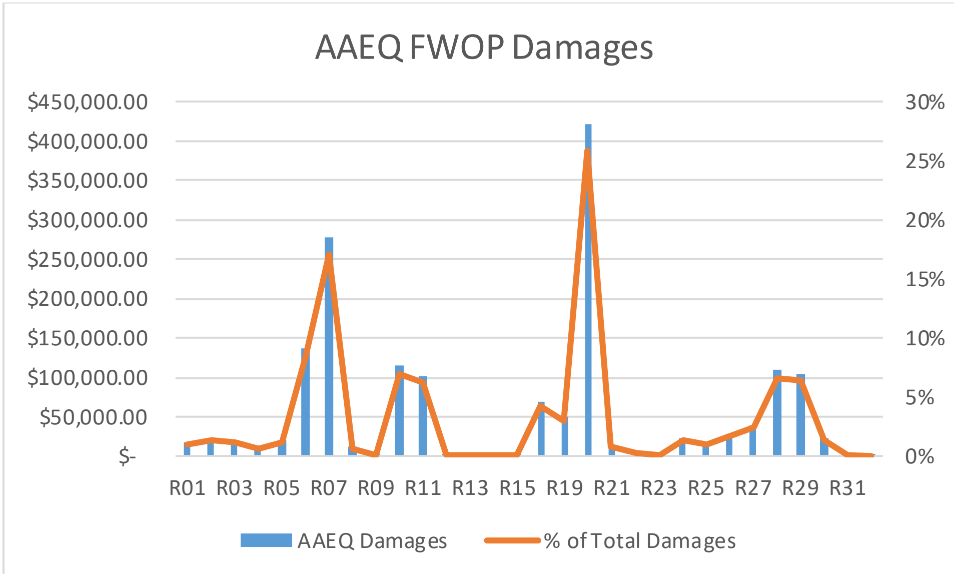

Figure 5: FWOP Damages by Reach – AAEQ 2.75%

3.3.2 Damage Distribution by Damage Driving Parameter

Below is information on the damage driving parameter for Okaloosa Island and West Destin.

Okaloosa Island:

- Inundation: 84%
- Wave Attack: 12%
- Erosion: 4%

West Destin:

- Inundation: 71%
- Wave Attack: 13%
- Erosion: 16%

Most of the FWOP damages are associated with flooding to multi-family structures along the shoreline. The damages are mostly due to lower dunes and lower first floors of these structures.

3.3.3 Emergency Nourishment

In the without project condition, it is assumed that emergency nourishment will be performed as needed. When a disaster is declared for a particular county, the Federal Emergency Management Agency (FEMA) will provide up to six cubic yards (cy) per square foot to mitigate for loss. The non-Federal sponsor indicated that, in the absence of a Federal project, they will acquire funding to pursue the FEMA nourishment action after a significant storm. FEMA has historically replaced material lost after a storm.

Emergency nourishment was triggered various times throughout the lifecycle depending on the reach, but on average Okaloosa Island had 2 emergency nourishment actions with a volume of approximately 86,400 cubic yards at a cost of $1,932,300 PV, $71,600 AAEQ and West Destin had an average of 4 emergency nourishment actions with a volume of approximately 151,600 cubic yards at a cost of $3,125,900 PV, $115,800 AAEQ. These actions are in line with historical completed events.

3.4 Future With Project Condition

This section of the appendix discusses the evaluation and comparison of the Okaloosa County CSRM alternatives.

Management measures were selected to accomplish at least one of the planning objectives for Okaloosa County study. Both structure and nonstructural were initially identified for plan formulation. During the plan formulation process, management measures were screened against six criteria. Details about management measures, screening and alternatives can be found in the main report.

Ultimately most of the management measures and alternatives were screened out and two structural alternatives carried forward to the Beach-*fx* economic modeling stage: beach nourishment and beach nourishment with dune raising and widening, as well as the no-action alternative. The results of these simulations were used to determine the National Economic Development (NED) Plan.

Beach Nourishment: This measure includes initial construction of a beach fill and future periodic nourishments at regular intervals. Periodic nourishment of the beach would be undertaken to maintain the design dimensions.

Beach nourishment and dune raising and widening: This alternative includes raising and widening the dunes and constructing a beach fill with future periodic nourishment at regular intervals.

The dune and beach nourishment alternatives were set up to be modeled in any of the Beach-*fx* reaches for any combinations of a dune height of 0, 14 feet, 15 feet and 16 feet with a dune crest of 10 feet and beach nourishment width of 10 feet, 20 feet, 30 feet and 40 feet. The optimized dune heights and berm widths are considered ‘Options’ of the Alternatives. More information on the development of the shoreline response database and alternative templates can be found in the Appendix A, Engineering. The ‘Planned Nourishment’ inputs were entered into Beach-*fx* for the alternatives. The model was run for the Future With Project alternatives for Okaloosa Island and West Destin. Public access for Okaloosa Island meets USACE policy with an access located every half mile with sufficient parking. West Destin has yet to secure public access and parking, but Okaloosa County continues to work to obtain appropriate parking and access for Federal participation of this planning reach.

Beach-*fx* modeling of the beach profile combinations mentioned above resulted in economically justified plans. Table 8 shows the benefits, cost and net benefits of the beach nourishment plan and dune and beach nourishment plans for Okaloosa Island.

Table 8: Okaloosa Island Beach-fx Results – AAEQ 2.75%

Alternative	Option Number	Dune Height	Dune Width	Berm Width	AA Benefits	AA Cost	AA Net Benefits
2	1	14	10	10	$515,900	$345,200	$170,700
2	2	14	10	20	$543,900	$410,200	$133,700
2	3	14	10	30	$557,400	$464,300	$93,100
2	4	14	10	40	$598,400	$525,000	$73,400
2	7	15	10	10	$727,400	$570,100	$157,300
2	8	15	10	20	$725,800	$667,300	$58,500
2	10	16	10	10	$735,700	$912,100	$(176,400)

(Results do not include recreation and land loss benefits, RE costs, PED, CM or O&M)

Table 9 shows the benefits, costs and net benefits for alternatives and options modeled in Beach-*fx*. For West Desin, the minimum berm width was 30 feet due to constructibility and sustainability reasons. Alternative 2 produced negative results as well, but the PDT decided to carry forward.

Table 9: West Destin Beach-fx Results – AAEQ 2.75%

Alternative	Option Number	Dune Height	Dune Width	Berm Width	AA Benefits	AA Costs	AA Net Benefits
2	3	14	10	30	$667,200	$1,360,700	$(693,500)
2	4	14	10	40	$670,700	$1,393,900	$(723,200)
2	7	15	10	10	$718,000	$1,568,400	$(850,400)
2	8	15	10	20	$738,600	$1,604,300	$(865,700)
2	9	16	10	10	$735,700	$912,100	$(176,400)

3.5 Alternative and Option Comparison

Based on the average annual net benefits of the Alternative 2 Options, Alternative 2, Option 1 produced the highest net benefits for Okaloosa County and Alternative 2, Option 3 produced the highest net benefits for West Destin. Table 10 shows the Alternatives and Options for the Tentatively Selected Plan (TSP). Table 11 summarizes the benefits, formulation cost and net benefits.

Table 10: Average Annual Damages for TSP – AAEQ 2.75%

Planning Reach	Alternative	Option	Beach-*fx* Reaches	FWOP Average Annual Damages	FWP Average Annual Damages	Average Annual Project Benefits
Okaloosa Island	2	1	R01-R15	$803,600	$287,700	$515,900
West Destin	2	3	R18-R32	$1,016,200	$349,000	$667,200

Table 11: Beach-fx TSP Benefits & Costs – AAEQ 2.75%

Planning Reach	Alternative	Option	Beach-*fx* Reaches	Average Annual Benefits	Average Annual Costs	Average Annual Net Benefits	BCR
Okaloosa Island	2	1	R01-R15	$515,900	$345,200	$170,700	1.5
West Destin	2	3	R18-R32	$667,200	$1,360,700	($693,500)	0.5

3.6 TSP Optimization

The TSP was further optimized after identification of the dune height and berm width for the Okaloosa Island and West Destin planning reaches. Planform rates were applied for West Destin and the dune slope changed from a 1V:10H to 1V:5H for both planning reaches. The high sea level curve was also used for further analysis of the TSP. Although the project was formulated on the intermediate curve, it was noted that this area has been tracking on the high curve. In coordinating with the climate change community of practice and the vertical study team, the decision was made to utilize the high curve for further refinement of the TSP. Beach-fx was used to model the high sea level curve and resultant benefits, quantities and costs were used for estimation of the net benefits and benefit to cost ratio (BCR). The structure to content valuation ratio was changed to reflect IWR 96-R-12, IWR Report "Nonresidential Flood Depth-Damage Functions Derived from Expert Elicitation" (2012).

Planform rates are only applied to the West Destin reach in beach-fx as the design berm width for the Okaloosa Island reach is smaller than the existing beach width and any berm width extension in a future condition is expected to behave similar to background erosion rates. The West Destin reach design berm width will extend beyond the existing berm width and is expected to experience shoreline change rates in excess of the background erosion rate.

Another refinement to the TSP is changing the dune slope from 1V:10H to 1V:5H. This dune slope is more consistent with past dune permitting actions. The planform rates and dune slope change information incorporated into Beach-*fx* for modeling are documented in the Appendix A, Engineering.

After identification of the TSP, the Economic Guidance Memorandum, 21-01 was distributed and the Federal Interest Rate is 2.50%. Therefore, Beach-*fx* modeling was conducted again using the FY2021 value for discounting and incorporating the refinements to the TSP as noted above. Table 12 and Table 13 shows the TSP cost, benefits, and net benefits at the high sea level curve.

Table 12: FWOP and FWP Damages

Planning Reach	Alternative	Option	Beach-*fx* Reaches	FWOP Average Annual Damages	FWP Average Annual Damages	Average Annual Project Benefits
Okaloosa Island	2	1	R01-R15	$2,250,000	$955,400	$1,294,600
West Destin	2	3	R18-R32	$1,734,800	$1,061,000	$673,800

Table 13: TSP Cost, Benefits and Net Benefits – AAEQ 2.5%

Planning Reach	Alternative	Option	Beach-*fx* Reaches	Average Annual Benefits	Average Annual Costs	Average Annual Net Benefits	BCR
Okaloosa Island	2	1	R01-R15	$1,294,600	$494,800	$799,800	2.6
West Destin	2	3	R18-R32	$673,800	$2,104,300	($1,430,500)	0.3

Applying plan form rates and changing the dune slope initiated the need for another look at the renourishment cycle. A minimum volume threshold of 80 percent retention was estimated to maintain the dune due to erosion rates. Once the threshold was met, a nourishment event was triggered. A free variable was used to estimate an average number of planned nourishments over the life cycle. This produced an average of 4 planned nourishment events. Next, modeling was performed that set the planned nourishment to a 9-year, 10-year and 11-year cycle to identify the planned nourishment cycle that produced the highest net benefits. The table below shows the average annual benefits, costs and net benefits that resulted from the planned nourishment optimization modeling.

Table 14: Optimized Planned Nourishment Cycle – AAEQ 2.5%

Okaloosa Island			
	AA Benefits	AA cost	Net Benefits
9-year	$1,363,000	$613,000	$749,000
10-year	$1,295,000	$495,000	$800,000
11-year	$1,269,000	$583,000	$686,000
West Destin			
	AA Benefits	AA cost	Net Benefits
9-year	$712,000	$2,314,000	$(1,602,000)
10-year	$674,000	$2,104,000	$(1,431,000)
11-year	$549,000	$2,243,000	$(1,694,000)

3.6.1 Residual Risk

Residual risk is the risk that remains after the proposed coastal storm risk management is implemented. Residual risk includes the consequence of capacity exceedance as well as consideration of project performance, robustness, and resiliency. For the proposed TSP, residual risk remains in that project implementation does not expect to eliminate all damages. Approximately 46% percent of residual risk remains for Okaloosa County and approximately 68% remain for West Destin. Project implementation on Okaloosa Island mainly reduces flooding and project implementation on West Destin reduces flooding and wave attack.

3.7 Land Loss Benefits

The P&G states that erosion protection benefits include loss of land, structural damage prevention, reduced emergency costs, reduced maintenance of existing structures and incidental benefits. The loss of land benefit is measured as the value of near shore upland. Near shore upland is sufficiently removed from the shore to lose its significant increment of value because of its proximity to the shore, when compared to adjacent parcels that are more distant (inland) from the shore.

A hurricane and storm damage reduction project that prevents the loss of land due to erosion accrues benefits to that project alternative. The land lost reduction benefit was calculated for eroding reaches by calculating amount of land that would be lost during the study period times the value of near shore upland.

With a project in place, land that would be lost in the without project future condition would be preserved by a project. The design template that represents the project that provides full benefits to protected properties would be in place for the period of analysis preserved through of process of periodic re-nourishment. This benefit is based upon the value of near shore lands. Normally determinations of the market value for the land losses are based on the value of near shore upland. Near shore upland is sufficiently removed from the shore to lose its significant increment of value because of its proximity to the shore, when compared to adjacent parcels that are more distant (inland) from the shore. The criterion used was near shore lands are those parcels that are sufficiently removed from the shore to lose any direct water frontage value. These parcels have; no Gulf frontage, no view of the water, no access point to the Gulf as part of any deeded subdivision rights. For this project, near shore values were estimated by USACE Real Estate. For this study a value of $33 per square feet was used and was determined to be a reasonable metric based on a real estate market survey performed at the time of analysis.

Prevention of land loss is a component of primary benefits but is not computed within the Beach-*fx* model. Therefore, the calculation of land loss benefits must be completed outside of the model and added to the structure and contents damage storm damage benefits as computed by Beach-*fx* to obtain the total benefits of the project. For land loss benefit estimation, two key pieces of information are needed: the square footage of the land lost each year and the market value of land in the project footprint.

For Okaloosa County, annual reduction in upland width across all Beach-*fx* study reaches was obtained from the Beach-*fx* LandLoss.csv FWOP and FWP high sea level rise output files based on modeled changes to the shoreline. ER 1165-2-130 does not allow land loss benefits be claimed for beach areas subject to temporary shoreline recessions. Thus, changes in the upland width, rather than changes in berm width, are used as the appropriate measure of land loss.

For Okaloosa Island and West Destin, the basis of the annual changes for the upland width calculation is the width in each reach in the model start year (2025), which is the template assumed to be maintained throughout the period of analysis in the FWP. The difference between the constant with-project width and the without-project width in a given year results in the cumulative loss of upland width given the profile of that specific reach. However, for the purpose of calculating land loss benefits, the annual loss of width is needed. This is obtained by taking the cumulative change in width in a given year and subtracting from it from the cumulative change in width from the previous year. This calculation results in the yearly incremental change in dune and upland width for a given reach.

Using the annual decrease in width for a specific reach and the corresponding length of shoreline eligible for land-loss benefits, the total annual square-footage of land lost is obtained on a reach-by-reach basis and then summed across all study reaches for a given project year.

As the second component of the land-loss benefits calculation, ER 1105-2-100 instructs that nearshore land values be used to estimate the value of land lost. SAM Real Estate Department estimated a nearshore land value of $33.00 per square foot for the Okaloosa County front beach study area.

Using the analysis technique described using the high sea level rise files, the total present value of land-loss benefits over the 50 year period of analysis for Okaloosa Island is estimated at $882,000 average annual equivalent (AAEQ) and for West Destin $1,309,000 AAEQ.

3.7 Benefit and Cost Summary

This section shows the three categories of benefits to include storm damage reduction, reduction/elimination of emergency nourishment and reduction in land loss benefits in comparison with the Beach-fx cost. Table 15 summarizes AAEQ benefits of project implementation of dune and beach nourishment at Okaloosa Island and West Destin for Alternative 2.

Table 15: TSP Benefits Summary AAEQ - 2.5%

Benefit Categories	Okaloosa Island	West Destin
Storm Damage Reduction & Reduction in Emergency Nourishment	$1,294,600	$673,700
Reduction in Land loss	$882,000	$1,309,000
Total Benefits	$2,176,600	$1,982,700
Average Annual Cost	$494,800	$2,104,300

Net Benefits	$1,681,800	($121,600)
BCR	4.4	0.9

4.0 The Recommended Plan

Alternative 2 is the Recommended Plan. The project will include a dune feature 14-foot in height and is 10 feet wide at the crest. For Okaloosa Island, the project template will include a 10-foot berm width. For West Destin, the project template will include a 30-foot berm width. After the initial construction, a planned nourishment is scheduled every 10 years, to total four subsequent planned nourishment events.

4.1 Recommended Plan Cost Details

National Economic Development (NED) cost play a critical role in the evaluation and comparison of study alternatives. NED costs include both the financial and economic costs associated with a project throughout its lifecycle. Each of these types of costs and their sources are discussed in this section. For plan selection, fixed unit cost was used in Beach-*fx* modeling as well as mobilization and demobilization. Once the alternatives have been compared and the TSP identified, costs that were used in modeling require refinement.

4.1.1 NED Cost – Financial

Financial costs of the proposed project consist of the construction and mitigation costs accrued during construction of the project and over the lifecycle. More specifically these costs include:

- Land Construction Costs
- Dredging Costs
- Preconstruction Engineering, and Design Costs (PE&D)
- Construction Management
- Contingency Costs
- Mitigation Costs

The USACE, Mobile District Cost Engineering prepared the cost estimate for the proposed beach nourishment and dune raising/widening and beach nourishment. The sum of these costs is used to estimate Interest During Construction (IDC), which represents the economic cost of constructing a project. The next section defines IDC and provides an explanation as to how it is calculated and included in the analysis. Together, these costs represent the estimated first cost of construction.

Another financial cost not included above is the annual cost accrued over the life of a project due to Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) activities that represent an increase over the current OMRR&R costs to maintain the channel. OMRR&R was excluded from the list of financial costs above because it is not included in the calculation of IDC. IDC takes into account only those costs incurred during construction. For this study, OMRR&R was estimated to be $87,480 per year for monitoring and other activities required to maintain the project. Detailed cost tables can be found in Attachment 2 to the economic appendix.

4.1.2 NED Cost - Economic

Interest During Construction (IDC) represents an economic cost of building a project that is considered in the selection of the recommended plan, but does not factor in as a paid cost. IDC is the cost of the foregone opportunity to invest the money required to construct a project for another use. The hypothetical return on another investment, measured as IDC, is counted as an NED cost. As an economic, rather than a financial, cost, IDC is not considered in the determination of cost-sharing responsibilities.

IDC reflects that project construction costs are not incurred in one lump sum, but as a flow over the construction period. This analysis assumes that construction expenditures are incurred at a constant rate over the period of construction, an assumption which is supported by the *NED Manual for Deep Draft Navigation*.

The calculation of IDC is summarized in the *NED Manual for Deep Draft Navigation* as follows.

> If B is the project base year (the year in which construction costs end and the project begins to derive benefits), then the total cost incurred during construction, including actual expenditures and implicit interest payment, is the equivalent lump-sum expenditure in the base year, C_B, which is computed as:
>
> $C_B = \Sigma_{t\,i=1} C_i (1+r)_{t-1}$; where
>
> C_i construction expenditures in period i
>
> r per unit interest rate; and
>
> t number of construction periods up to the year that the project is implemented, which is the start of the period of analysis
>
> Therefore, IDC = C_B – Estimated First Cost of Construction

Four months was assumed for Interest During Construction calculations based on USACE construction duration estimate.

4.1.3 Okaloosa Island Cost Details

The initial construction cost for Okaloosa Island is $8,359,000. The Okaloosa Island planning reach is not estimated to need a planned nourishment until year 2045. The estimated present value cost of planned nourishment for 2045 is $1,673,000, for 2055 is $6,357,000 and for 2065 is $7,145,000. The IDC calculated for four months at the 2.5 % discount rate is $25,900. The total of the nourishments plus IDC and operation and maintenance (O&M) cost total $874,000 average annual equivalent.

Table 16: Okaloosa Island Cost Details

	FY2021 Dollars
2025 Initial Construction	$8,359,000
2035 Planned Nourishment	$0
2045 Planned Nourishment	$1,673,000
2055 Planned Nourishment	$6,357,000
2065 Planned Nourishment	$7,145,000
Total First Cost	$23,535,000
Interest During Construction	$26,000
Total Economic Investment	$23,561,000
Average Annual First Cost	$831,000
Annual O&M	$44,000
Total Average Annual Cost	$874,000

4.1.4 West Destin Cost Details

The initial construction cost for Okaloosa Island is $22,067,000. The estimated present value cost of planned nourishment for 2035 is $10,002,000, for 2045 is $17,304,000, for 2055 is $15,795,000 and for 2065 is $11,532,000. The IDC calculated for four months at the 2.5 % discount rate is $68,000. The total of the nourishments plus IDC and O&M total $2,737,800 average annual equivalent.

Table 17: West Destin Cost Details

	FY2021 Dollars
2025 Initial Construction	$22,067,000
2035 Planned Nourishment	$10,002,000
2045 Planned Nourishment	$17,304,000
2055 Planned Nourishment	$15,795,000
2065 Planned Nourishment	$11,532,000
Total First Cost	$76,701,000
Interest During Construction	$68,000
Total Economic Investment	$76,769,000
Average Annual First Cost	$2,707,000
Annual O&M	$44,000
Total Average Annual Cost	$2,750,000

The table below shows the summary of initial and renourishment fill volume estimates. The quantities increase as overtime existing material is lost and full restoration of the template is required.

Table 18: Summary of Fill Volume Estimate

Recommended Plan Quantities (CY)					
	Year of Nourishment				
	2025	2035	2045	2055	2065
Okaloosa Island 14' 10' 10'					
Subtotal	102,000	-	87,000	828,000	1,383,000
West Destin 14' 10' 30'					
Subtotal	462,000	735,000	2,258,000	2,679,000	2,500,000
Total (CY)	564,000	735,000	2,345,000	3,507,000	3,883,000

4.1.5 Okaloosa County Project Cost

The initial construction cost is $30,426,000 at the FY21 price level. The initial construction is scheduled to take place in 2025 with four subsequent nourishment actions completed in year 2065. The FY2021 cost of the subsequent planned nourishments in present values are $10,003,000 (2035), $18,977,600 (2045), $22,152,000 (2055) and $18,678,000 (2065). Total project first cost including Interest During Construction is $100,331,000. Cost information is summarized in Table 19. Additional project cost details can be found in the Engineering Appendix.

Table 19: Recommended Plan Cost Summary

	FY2021 Dollars
2025 Initial Construction	$30,426,000
2035 Planned Nourishment	$10,003,000
2045 Planned Nourishment	$18,977,000
2055 Planned Nourishment	$22,153,000
2065 Planned Nourishment	$18,678,000
Total First Cost	$100,238,000
Interest During Construction	$93,000

Total Economic Investment	$100,331,000
Average Annual First Cost	$3,537,000
Annual O&M	$87,000
Total Average Annual Cost	$3,625,000

4.2 Benefits of the Recommended Plan

The economic benefits of the plan are generated by reductions in coastal storm damages, reduction of emergency renourishment cost and land loss. The tables below shows modeling reach details for the benefits costs and net benefits by modeling reach for Okaloosa Island and West Destin. The benefits presented below do not include recreation and the cost do not include real estate. Some of the reaches show a negative value on a reach by reach case but remain in the study for completeness of the project.

Table 20: Okaloosa Island Beach-fx Reach Benefits, Costs and Net Benefits

Planning Reach	Beach-fx Reach	AA Benefits	AA Cost	Net Benefits
Okaloosa Island	1	$41,000	$26,700	$14,400
	2	$70,000	$28,900	$41,100
	3	$66,200	$29,800	$36,400
	4	$33,800	$31,400	$2,400
	5	$54,900	$31,500	$23,400
	6	$238,700	$28,600	$210,100
	7	$611,600	$35,400	$576,200
	8	$47,000	$34,600	$12,400
	9	$28,600	$31,100	-$2,500
	10	$82,300	$30,000	$52,300
	11	$205,900	$51,900	$154,000

Planning Reach	Beach-fx Reach	AA Benefits	AA Cost	Net Benefits
	12	$40,000	$54,400	-$14,400
	13	$29,800	$51,400	-$21,600
	14	$34,800	$52,000	-$17,200
	15	$53,700	$63,900	-$10,200

Table 21: West Destin Beach-fx Benefits, Costs and Net Benefits

Planning Reach	Beach-fx Reach	AA Benefits	AA Cost	Net Benefits
West Destin	18	$98,100	$ 192,600	-$94,500
	19	$99,700	$ 170,500	-$70,800
	20	$474,300	$ 164,100	$310,200
	21	$116,200	$ 137,000	-$20,800
	22	$107,700	$ 126,600	-$18,900
	23	$88,200	$ 95,900	-$7,700
	24	$112,000	$ 121,500	-$9,500
	25	$123,700	$ 210,900	-$87,200
	26	$120,900	$ 144,100	-$23,200
	27	$82,200	$ 68,900	$13,300
	28	$118,800	$ 77,400	$41,400
	29	$145,200	$ 82,100	$63,100
	30	$121,000	$ 93,500	$27,500
	31	$87,400	$ 69,900	$17,500
	32	$87,400	$ 76,500	$10,900

4.3 Benefits and Cost Summary

The table below shows the average annual benefits for each planning reach and the planning reaches combined for Okaloosa County. The benefits are do not include recreation benefits.

	Okaloosa Island	West Destin	Okaloosa County
Total Benefits	$2,177,000	$1,980,000	$4,157,000
Average Annual Cost	$874,000	$2,750,000	$3,625,000
Net Benefits	$1,302,000	($768,000)	$534,000
BCR	2.5	0.7	1.8

4.4 Sea Level Rise Considerations

The Recommended Plan is evaluated with three different sea level rise (SLR) curves to show its performance in each scenario. Each of the SLR scenarios are considered equally likely to occur. The project was formulated, evaluated and compared with the intermediate SLC. As previously noted, the project area has recently tracked more in line with the high SLC and was used for optimization and detailed costs as provided in the Total Project Cost Summary (TPCS). The table below shows the Recommended Plan Benefit and Cost for the different SLR scenarios. The TPCS was completed only for the high SLC, therefore the formulation cost that includes a unit cost and mobilization cost produced from Beach-fx based on estimated quantities are used in each scenario below to show the performance of each curve.

Table 22: Recommended Plan SLR Scenarios

Okaloosa Island					
SLR Scenario	AA CSDR Benefits	AA Land Loss Benefits	AA Cost	AA Net Benefits	Benefit to Cost Ratio
Low	$148,300	$245,000	$24,770	$368,500	15.9
Intermediate	$185,350	$344,000	$42,700	$486,600	12.4
High	$1,294,600	$882,000	$494,800	$1,681,800	4.4
West Destin					
SLR Scenario	AA CSDR Benefits	AA Land Loss Benefits	AA Costs	AA Net Benefits	Benefit to Cost Ratio
Low	$301,700	$899,000	$962,700	$238,000	1.2
Intermediate	$417,700	$983,000	$1,217,800	$182,900	1.2

High	$673,700	$1,309,000	$2,104,300	$(121,600)	0.9

As shown, the benefits and cost increase significantly for the high curve for Okaloosa Island. The land loss benefits are the same for Okaloosa Island due to the existing morphology of the beach. West Destin is not as sensitive to SLR as Okaloosa Island.

4.5 Uncertainty and Reliability of the Recommended Plan

Beach-fx is a life-cycle model that outputs a range of possible results from implementing the Recommended Plan. The range of outputs can be used to quantify the uncertainty of associated with the performance of the Recommended Plan as required by ER 1105-2-101. Quantifying this uncertainty allows for a more complete understanding of how the Recommended Plan should be expected to perform, compared to only considering the average results. The benefits in this section do not include recreation benefits and are presented in the high SLR scenario. The cost is from the TPCS and therefore, do not change.

The tables below show the range of possible benefits over the 100 iterations modeled in Beach-fx for Okaloosa Island and West Destin. The figure shows the frequency distribution of net benefits provided by the Recommended Plan over the 100 iterations modeled.

Table 23: Range of Recommended Plan Cost and Benefits – Okaloosa Island

Statistic	Average Annual Benefits	Average Annual Cost	Average Annual Net Benefits	BCR
Average	$2,057,000	$867,000	$1,198,800	2.4
Minimum	$594,900	$867,000	-$272,000	0.7
Maximum	$5,365,450	$867,000	$4,498,500	6.2

Table 24: Range of Recommended Plan Cost and Benefits – West Destin

Statistic	Average Annual Benefits	Average Annual Cost	Average Annual Net Benefits	BCR
Average	$1,982,700	$2,737,800	-$755,100	0.7
Minimum	$153,800	$2,737,800	-$2,584,000	0.1
Maximum	$6,353,300	$2,737,800	$3,615,500	2.3

Figure 7 and Figure 8 shows the frequency distribution of net benefits provided by the Recommended Plan for Okaloosa Island and West Destin over the 100 iterations modeled.

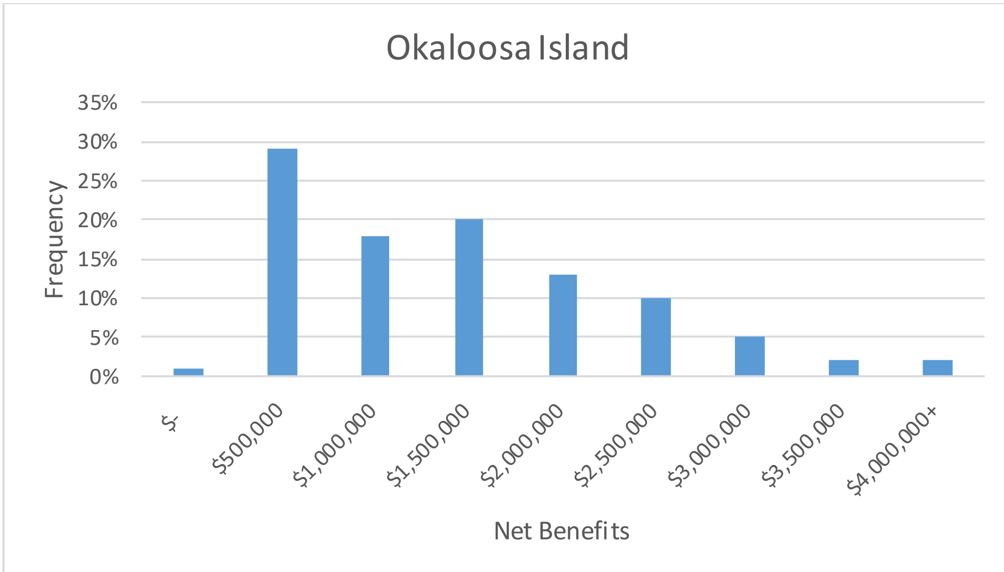

Figure 6: Okaloosa Island Distribution of Net Benefits for Recommended Plan

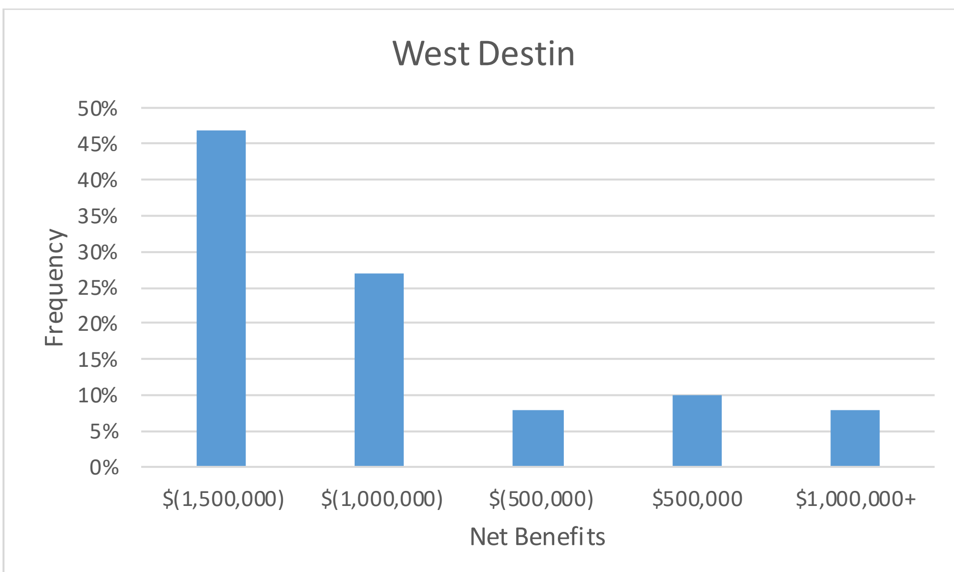

Figure 7: West Destin Distribution of Net Benefits for Recommended Plan

6.0 Recreation

According to ER-1105-2-100, incidental recreation benefits can be calculated in CSRM studies. While recreation benefits cannot make up more than 50% of the total benefits needed for project justification, the guidance states that "if the criterion for participation is met, then all recreation benefits are included in the benefit to cost analysis."

Unit Day Value

ER-1105-2-100 specifies that benefits arising from recreation opportunities created by a project be measured in terms of willingness to pay (WTP). Three acceptable calculation methods are outlined: (a) the travel cost method (TCM), (b) the contingent valuation method (CVM), and (c) the unit day value method (UDV).

The unit day value estimates a user's willingness to pay for a given recreational opportunity by assigning ratings to five criteria designed to measure the quality of the overall recreation experience provided in the project area. According to ER-1105-2-100 Appendix E, UDV may be used to account for visitations of up to 750,000 per year. Data provided by VisaVue estimates about 5.6 million average annual visitors to Destin and Okaloosa Island beaches. USACE guidance Section 8 Benefits Evaluation Procedures: Recreation of the Economic and Environmental Principles and Guidelines for Water and Related Land Resources stipulates the use of a regional model, Contingent Valuation Method (CVM) or Travel Cost Method (TCM) for recreation with visitation over 750,000 annually (U.S. Water Resources Council. 1983). For recreation under this threshold the use of Unit Day Value (UDV) published yearly by USACE-headquarters is appropriate. Typically, when annual visitation exceeds the 750,000 thresholds, economists are required to employ a regional model, CVM and/or the TCM to estimate recreation benefits. But due to cost considerations the UDV method was selected to analyze recreation benefits and visitation was capped at 750,000 throughout the period of analysis. Such a conservative visitation estimate implies that recreation benefits are likely understated.

As mentioned above, the UDV method uses five criteria to gauge the overall quality of the experience, availability, carrying capacity, accessibility, and environment in the project area. Each criterion can be assigned to one of five possible scoring ranges rated from low to high. Within each range a specific point value is also chosen. These point values are summed together and applied a dollar day value based on the current UDV guidance. The current unit day values, provided by USACE Economics Guidance Memorandum #20-03, Unit Day Values for Recreation for Fiscal Year 2020, are presented in Table 25. Linear interpolation was used to estimate the dollar value of point scores not published. For example, a point score of 18 corresponds to a dollar value of $5.42.

Table 25: Current Unit Day Values for Recreation

Point Values	General Recreation Values (FY20)
0	$4.21
10	$5.00
20	$5.53
30	$6.32
40	$7.90
50	$8.95
60	$9.74
70	$10.27
80	$11.32
90	$12.11
100	$12.64

UDV Scoring/Point Assignment

The point assignments are based on qualitative criteria and depend on best professional judgment (also referred to as “judgment criteria”) and knowledge of the project area. In order to learn more about recreation in Okaloosa County, SAC and SAM economists consulted with the non-Federal sponsor to request assistance to facilitate the collection of UDV scores by survey. The non-Federal sponsor sent out a survey to local experts to participate in the assignment of UDV scores for the without and with project conditions. The survey asked local experts to rate the beach on the same scale and criteria that the USACE uses in the UDV analysis.

Two scores were created for the survey:

1. General Recreation **without** project
2. General Recreation **with** project

The five UDV criteria from the guidance, for which points are assigned include, the following items:

- Recreation Experience: Score increases in proportion to the number of available activities at the site

- Availability of Opportunity: score is based on availability of substitute sites; the fewer the sites in the region that offer comparable recreation experience, the higher the score

- Carrying Capacity: score rates level of facilities at the site to support the activities

- Accessibility: score rates ease of access to the site

- Environmental: rates the aesthetic/environmental quality of the recreation site/activities

Point values are summarized in Table 26. For each UDV category the average of eight scores was taken, giving equal weight to each questionnaire. In the sections following the table, the rationale is provided for the point assignments according to the five UDV criteria.

Table 26: Total Unit Day Points Scored Applied to Okaloosa County

UDV Category	FWOP	FWP
Recreation Experience	11.0	23.0
Availability of Opportunity	7.0	11.0
Carrying Capacity	6.0	12.0
Accessibility	7.0	12.0
Environmental Quality	7.0	15.0
Total Points	38.0	73.0
UDV	$7.74	$10.59
FWP vs FWOP Difference	$2.85	

Recreation Experience: A score of 23.0 representing "several general activities: more than one high quality value activity" was assigned to the future with project condition in 2025 (the year the initial beach nourishment) and held constant throughout the remaining period of federal participation (through 2075). In the without project condition, the assigned score starts at 11.0 in the project base year (2025).

In both the future-with and the without project conditions, surfing, paddle boarding, surf fishing, snorkeling, and sunbathing are general activities occurring in the study area. The quality of on-beach activities enjoyed by families, such as sunbathing and playing games is expected to improve in the with project condition compared to the without project condition due to the difference in the size of the sandy beach area available for recreation between the two scenarios..

Availability of Opportunity: Both the with and the without project conditions were assigned scores within the "several within 1 hr. travel time; a few minutes within 30 minutes" because several other beaches with public access are available within close proximity (<30 minutes to 1 hour) of Okaloosa Island Beach and West Destin Beach, including Fort Walton Beach, Pensacola Beach, Panama Beach, Crystal Beach and Navarre Beach, which are all located within Panhandle area..

Carrying Capacity: Okaloosa Island Beaches currently has all of the parking and public access facilities necessary to conduct recreational activities at site potential. Facilities include public restrooms, picnic pavilions, free public parking, and manned lifeguard stations. The Destin Beach area does not meet the parking and access requirements.

Based on the current facilities, the project area was assigned a point value of 12, "optimum facilities to conduct activity at site potential" in the project base year in the with project and 5 in the without project conditions. The FWP rating is expected to be held at 12 throughout the project life as the project will allow for the high-quality current facilities to be maintained. However, over time the FWOP, one would expect at least some public restrooms, pavilions, dune crossovers, and other facilities in the study area to deteriorate due to erosion and associated flooding. Such deterioration affects the quality of the available facilities and could also affect whether the facility can be used at all, resulting in recreation score falling to 5 within the "Basic facility to conduct activity(ies)" category.

Accessibility: Currently, the study area has "good access, good roads to site; fair access, good roads within site" (11 to 14 scoring range). US Hwy 98, Miracle Strip Parkway, provides access to the study area. There is free public parking and dune crossovers that allows public access within the project area.

Environmental Quality: An average rating of 7 out of a total of 20 points was awarded because the current aesthetic value is of average quality. Under the With project condition, it was felt that the additional beach width would result in an increase in esthetic value during peak days. It is expected the aesthetic quality of the beach will be enhanced as a result of the project and will not degrade over time due to erosion as would occur in some areas in the Without project condition and a With project condition value of 15 is applied.

The UDV point totals convert to a recreation value of $7.74 in the Without project condition and the $10.59 in the With project condition per Economics Guidance Memorandum, 20-03, Unit Day Values for Recreation, Fiscal Year 2020. The difference in the Without and With project conditions general recreation values is $2.85. The dollar values for UDV scores of 39 and 73 were obtained by interpolating between 30 and 40 in the Without project condition and 70 and 80 in the With project condition. Table 2 shows the UDV for Okaloosa Island and West Destin Beaches.

In order to verify the reasonableness of the recreation benefits, total projected visitation must be compared to total recreation capacity. In the case of the Okaloosa Island and West Destin Beaches Recommended Plan, total recreation capacity has three key components, (1) parking capacity, (2) residential/hotel capacity within walking distance of the beach, and (3) available space on the beach.

Visitation space on the beach itself was estimated by calculating the square footage of beach and comparing that to daily visitation, assuming that the average visitor needs 100 square feet of space to recreate. Beach space is available to be used by two users per day due to morning/afternoon turnover. Daily visitation numbers were derived from monthly visitation numbers provided by VisaVue. Each Federal holiday within a month is assumed to receive 10% of that month's visitation. 65% of the non-holiday visitation is dispersed equally among weekend days (Friday-Sunday) and 35% to weekdays (Monday-Thursday). Making these assumptions allows the comparison of available beach space (supply) to daily demand.

Using the daily visitation method outlined above, the Recommended Plan was not constrained due to space on the 4^{th} of July and summer weekend days. Furthermore, the FWOP is unconstrained far into the future, even on popular visitation days. That is because the erosion rates are very low; so the beach width does not shrink substantially over time. The conclusion of this analysis is that the recreation benefit is completely attributed to the difference between the UDV dollar value in the FWP and FWOP.

Using these methods and applying the visitation cap results in an estimated total present value of recreation benefits of $2,190,900 in average annual terms (at a discount rate of 2.5%). Recreation benefits are summarized in Table 27.

Table 27: Incidental Recreation Benefit

	Okaloosa	West Destin
Reaches	1-15	18-32
AA Net Benefit (750,000)	$2,190,900	$2,190,900

Parking and Access

The USACE has several requirements that must be met in order to fully cost share in a shore protection project (see ER 1105-2-100 and ER 1165-2-130). One of these requirements is that the beaches must be available for public use. As described in ER 1165-2-130 (Federal Participation in Shore Protection, paragraph 6.h.) public use implies reasonable access and parking.

ER 1165-2-130 stipulates that in order to qualify for Federal cost sharing of Hurricane and Storm Risk Management projects, the local community must, at a minimum, provide public access and parking within a one quarter mile radius of any point of the project. Parking must satisfy the lesser of beach capacity or peak hour demand for that beach community. The peak demand hour had been previously identified as noon on the 4th of July holiday by USACE. Total beach visitation and the associated recreation benefit depend on day trip visitors having adequate available public parking.

Within the project limit, there are 10 access points at Okaloosa Island and 4 access points at West Destin to the coastal shoreline. The access points generally consist of small parking areas and wooden walkways to the beach often supplemented with shoulder parking. At Okaloosa Island, all areas of the project are within .25 miles of a public access area, much of the beach having multiple access points within the .25 mile threshold. Figure 8 and Figure 9 show the current access points for Okaloosa Island and Destin, respectively.

Okaloosa Island has enough public access locations across the project area to satisfy the .25 mile requirement; however, West Destin has limited public access points. Additionally, the number of parking spots must meet the lesser of beach capacity or peak hour demand for that beach community beach. There are a total of 586 parking spots (466 for Okaloosa Island and 120 for West Destin) available among the 22 public access points. Beach capacity peaks directly after a nourishment at 25,430 for

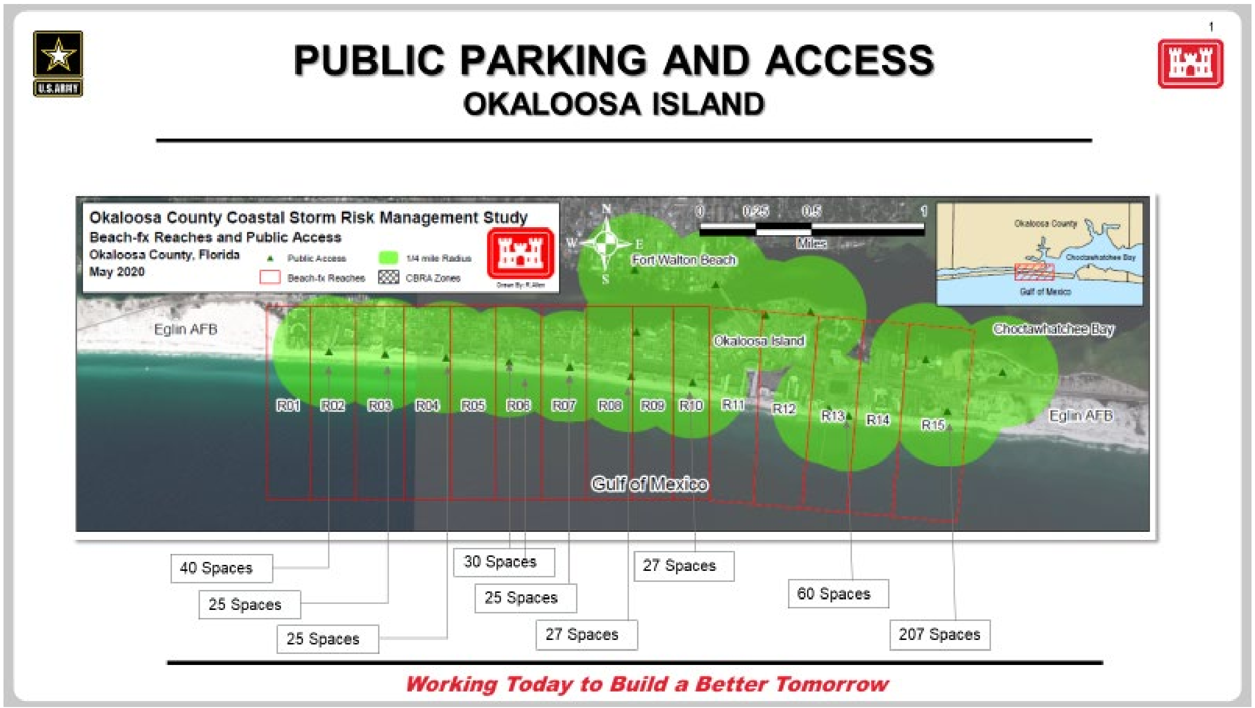

Figure 9: Overview of Public Access Location – Okaloosa Island

Figure *10*: Overview of Public Access Location – West Destin

Okaloosa Island and 14,798 for West Destin. It is possible that peak demand on the 4th will be less. However, it is unlikely that the 120 spots will be adequate to fill the maximum capacity at West Destin Beach.

The local sponsor is aware of parking and access deficiencies at West Destin and will need to address that prior to the signing of the PPA, otherwise total project cost sharing could be adjusted. If the required number of parking spaces cannot be obtained, in some cases a public transportation system adequate for the needs of projected beach users may suffice instead (see ER 1165-2-130, section 6h(2)).

For Federal Projects, public access must be every 1/2 mile and meet parking requirements. Based on current analysis for Okaloosa Island (R01-R15), there is adequate access and parking in this proposed project area. Cost sharing for work in this area is currently estimated at 65/35 (Fed/non-Fed).

Based on current analysis for West Destin (R18-R32), there are only 3 reaches out of 15 with possible adequate access and parking in the proposed project area. Cost sharing for work in those 3 reaches (R30-R32) is currently estimated at 65/35 (Fed/non-Fed). Cost for work in the remaining 12 reaches would be non-Federal. Essentially, 4/5's of West Destin cost would be borne by the sponsor.

7.0 Conclusion

Table 28 provides a summary of the Recommended Plan with the inclusion recreation benefits for the Okaloosa County Coastal Storm Damage Reduction Study.

Table 28: AAEQ Benefits and Cost FY21 - 2.5%

Okaloosa County TSP Costs and Benefits	
Total Project CSRM Benefits	$4,159,000
Total Recreation Benefits	$2,191,000
Total AAEQ Project Benefits	$6,350,000
Total AAEQ Cost	$ 3,625,000
Net Benefits	$ 2,725,000
Benefit to Cost Ratio	1.8

8.0 Regional Economic Development Analysis

Executive Summary

The U.S. Army Corps of Engineers (USACE) Institute for Water Resources, Louis Berger, and Michigan State University have developed a regional economic impact modeling tool, RECONS (Regional ECONomic System), that provides estimates of jobs and other economic measures such as labor income, value added, and sales that are supported by USACE programs, projects, and activities. This modeling tool automates calculations and generates estimates of jobs, labor income, value added, and sales through the use of IMPLAN®'s multipliers and ratios, customized impact areas for USACE project locations, and customized spending profiles for USACE projects, business lines, and work activities. RECONS allows the USACE to evaluate the regional economic impact and contribution associated with USACE expenditures, activities, and infrastructure.

The expenditures associated with OKALOOSA COUNTY SHORELINE PROTECTION, FL are estimated to be $29,865,000. Of this total expenditure, $22,690,085 will be captured within the local impact area. The remainder of the expenditures will be captured within the state impact area and the nation. These direct expenditures generate additional economic activity, often called secondary or multiplier effects. The direct and secondary impacts are measured in output, jobs, labor income, and gross regional product (value added) as summarized in the following tables. The regional economic effects are shown for the local, state, and national impact areas. In summary, the Civil Works expenditures $29,865,000 support a total of 272.1 full-time equivalent jobs, $19,209,402 in labor income, $23,589,903 in the gross regional product, and $35,780,354 in economic output in the local impact area. More broadly, these expenditures support 483.4 full-time equivalent jobs, $36,788,255 in labor income, $48,041,086 in the gross regional product, and $80,327,415 in economic output in the nation. The following information is for the Okaloosa County, Florida.

Project Information	
Project Name	OKALOOSA COUNTY SHORELINE PROTECTION, FL
Project ID	323712
Type of Analysis	Civil Works Budget Data and Work Activities
Year of Expenditure	2025

Economic Impact Area Local	
Local Impact Area	Okaloosa (FL)
Counties included	Okaloosa (FL)

Overall	
Land Area (Sq. Miles):	936
Population:	207,269
Households:	79,057
Total Personal Income:	$ 10,246 M

Number of Industries	270
Total Employment:	134,309
Value Added	
Employee Compensation:	$ 7,355 M
Proprietor Income:	$ 573 M
Other Property Type Income:	$ 3,883 M
Tax on Production and Import:	$ 724 M
Total Value Added:	$ 12,535 M
Final Demand	
Households:	$ 9,146 M
State/Local Government:	$ 1,019 M
Federal Government:	$ 7,813 M
Capital:	$ 1,929 M
Exports:	$ 4,402 M
Imports:	$ 11,410 M
Institutional Sales:	$ 6,456 M
Total Final Demand	$ 12,535 M

Top Ten Industries - By Employment

Implan Code	Implan Sector	Output	Employment (FTE)	Labor Income
543	* Employment and payroll of federal govt, military	$ 2,335 Million	14,955	$ 1,901 Million
544	* Employment and payroll of federal govt, non-military	$ 1,039 Million	6,535	$ 862 Million
509	Full-service restaurants	$ 480 Million	5,751	$ 189 Million
447	Other real estate	$ 929 Million	4,925	$ 94 Million
510	Limited-service restaurants	$ 351 Million	3,886	$ 96 Million
541	* Employment and payroll of local govt, education	$ 270 Million	3,022	$ 222 Million
457	Architectural, engineering, and related services	$ 656 Million	2,781	$ 328 Million
476	Services to buildings	$ 116 Million	2,525	$ 64 Million

411	Retail - General merchandise stores	$ 195 Million	2,357	$ 80 Million
542	* Employment and payroll of local govt, non-education	$ 172 Million	1,821	$ 141 Million

Top Ten Industries - By Output

Implan Code	Implan Sector	Output	Employment (FTE)	Labor Income
543	* Employment and payroll of federal govt, military	$ 2,335 Million	14,955	$ 1,901 Million
449	Owner-occupied dwellings	$ 1,089 Million	0	$ 0 Million
544	* Employment and payroll of federal govt, non-military	$ 1,039 Million	6,535	$ 862 Million
448	Tenant-occupied housing	$ 974 Million	1,102	$ 40 Million
447	Other real estate	$ 929 Million	4,925	$ 94 Million
457	Architectural, engineering, and related services	$ 656 Million	2,781	$ 328 Million
464	Scientific research and development services	$ 613 Million	2,048	$ 245 Million
509	Full-service restaurants	$ 480 Million	5,751	$ 189 Million
510	Limited-service restaurants	$ 351 Million	3,886	$ 96 Million
444	Insurance carriers, except direct life	$ 320 Million	638	$ 24 Million

Top Ten Industries - By Labor Income

Implan Code	Implan Sector	Output	Employment (FTE)	Labor Income
543	* Employment and payroll of federal govt, military	$ 2,335 Million	14,955	$ 1,901 Million
544	* Employment and payroll of federal govt, non-military	$ 1,039 Million	6,535	$ 862 Million
457	Architectural, engineering, and related services	$ 656 Million	2,781	$ 328 Million
464	Scientific research and development services	$ 613 Million	2,048	$ 245 Million
541	* Employment and payroll of local govt, education	$ 270 Million	3,022	$ 222 Million
509	Full-service restaurants	$ 480 Million	5,751	$ 189 Million
483	Offices of physicians	$ 297 Million	1,682	$ 156 Million

459	Custom computer programming services	$ 255 Million	1,537	$ 153 Million
542	* Employment and payroll of local govt, non-education	$ 172 Million	1,821	$ 141 Million
490	Hospitals	$ 317 Million	1,831	$ 131 Million

The following information is for the economic impact area of the state of Florida.

Economic Impact Area - State	
State Impact Area	Florida
State(s) included	Florida

Overall	
Land Area (Sq. Miles):	936
Population:	207,269
Households:	79,057
Total Personal Income:	$ 10,246 M
Number of Industries	270
Total Employment:	134,309
Value Added	
Employee Compensation:	$ 7,355 M
Proprietor Income:	$ 573 M
Other Property Type Income:	$ 3,883 M
Tax on Production and Import:	$ 724 M
Total Value Added:	$ 12,535 M
Final Demand	
Households:	$ 9,146 M
State/Local Government:	$ 1,019 M
Federal Government:	$ 7,813 M
Capital:	$ 1,929 M
Exports:	$ 4,402 M
Imports:	$ 11,410 M
Institutional Sales:	$ 6,456 M
Total Final Demand	$ 12,535 M

Top Ten Industries - By Employment

Implan Code	Implan Sector	Output	Employment (FTE)	Labor Income

447	Other real estate	$ 110,894 Million	562,344	$ 11,351 Million
509	Full-service restaurants	$ 30,148 Million	354,034	$ 12,092 Million
510	Limited-service restaurants	$ 24,839 Million	267,339	$ 7,079 Million
542	* Employment and payroll of local govt, non-education	$ 27,920 Million	233,891	$ 22,971 Million
490	Hospitals	$ 50,875 Million	284,374	$ 21,776 Million
541	* Employment and payroll of local govt, education	$ 21,679 Million	254,346	$ 17,852 Million
476	Services to buildings	$ 10,307 Million	223,893	$ 5,752 Million
483	Offices of physicians	$ 41,782 Million	216,667	$ 23,028 Million
472	Employment services	$ 23,426 Million	203,640	$ 9,449 Million
406	Retail - Food and beverage stores	$ 14,369 Million	174,413	$ 5,806 Million

Top Ten Industries - By Output

Implan Code	Implan Sector	Output	Employment (FTE)	Labor Income
447	Other real estate	$ 110,894 Million	562,344	$ 11,351 Million
449	Owner-occupied dwellings	$ 102,818 Million	0	$ 0 Million
490	Hospitals	$ 50,875 Million	284,374	$ 21,776 Million
444	Insurance carriers, except direct life	$ 45,094 Million	69,826	$ 6,989 Million
483	Offices of physicians	$ 41,782 Million	216,667	$ 23,028 Million
509	Full-service restaurants	$ 30,148 Million	354,034	$ 12,092 Million
445	Insurance agencies, brokerages, and related activities	$ 29,542 Million	131,248	$ 8,415 Million
448	Tenant-occupied housing	$ 28,390 Million	58,068	$ 1,250 Million
542	* Employment and payroll of local govt, non-education	$ 27,920 Million	233,891	$ 22,971 Million
441	Monetary authorities and depository credit intermediation	$ 27,809 Million	100,480	$ 9,178 Million

Top Ten Industries - By Labor Income

Implan Code	Implan Sector	Output	Employment (FTE)	Labor Income

483	Offices of physicians	$ 41,782 Million	216,667	$ 23,028 Million
542	* Employment and payroll of local govt, non-education	$ 27,920 Million	233,891	$ 22,971 Million
490	Hospitals	$ 50,875 Million	284,374	$ 21,776 Million
541	* Employment and payroll of local govt, education	$ 21,679 Million	254,346	$ 17,852 Million
469	Management of companies and enterprises	$ 25,266 Million	136,943	$ 14,048 Million
544	* Employment and payroll of federal govt, non-military	$ 14,630 Million	85,830	$ 12,141 Million
509	Full-service restaurants	$ 30,148 Million	354,034	$ 12,092 Million
455	Legal services	$ 25,815 Million	116,655	$ 11,383 Million
447	Other real estate	$ 110,894 Million	562,344	$ 11,351 Million
462	Management consulting services	$ 17,880 Million	147,354	$ 10,801 Million

Project Expenditure

Business Line	Flood Risk Management
Work Activity	FRM - CWB - General
Year of Expenditure	2025
Current Expenditure	$29,865,000

Spending Profile

	Spending Category	Percentage (%)	Amount
1	Metals and Steel Materials	4%	$1,194,600
2	Aggregate Materials	1%	$298,650
3	Cement Materials	4%	$1,194,600
4	Machinery Materials	1%	$298,650
5	Electrical Materials	2%	$597,300
6	Construction or Major Rehabilitation of Buildings and Structures	1%	$298,650
7	Construction or Major Rehabilitation of Highways, Bridges, and Streets	1%	$298,650
8	Construction or Major Rehabilitation of Water Resources Infrastructure	17%	$5,077,050
9	Construction or Major Rehabilitation of Residential Structures	1%	$298,650
10	Construction or Major Rehabilitation of Utilities and Power Structures	1%	$298,650

11	Construction Equipment	3%	$895,950
12	Architectural, Design, Engineering, and Related Services	14%	$4,181,100
13	Environmental Compliance, Planning, and Technical Services	1%	$298,650
14	Repair and Maintenance of Locks, Dams, and Other Industrial Equipment	6%	$1,791,900
15	Insurance and Bond	1%	$298,650
16	USACE Overhead	10%	$2,986,500
17	USACE Wages and Benefits	20%	$5,973,000
18	Private Sector Labor or Staff Augmentation	12%	$3,583,800
	Total	**100%**	**$29,865,000**

Local Purchase Coefficients

IMPLAN Code	Industry	Expenditure	Local Purchase Coefficients		
			Local	State	US
29	Sand and gravel mining	$164,312	0%	47%	99%
52	Construction of new power and communication structures	$298,650	100%	100%	100%
54	Construction of new highways and streets	$298,650	99%	100%	100%
55	Construction of new commercial structures, including farm structures	$298,650	95%	100%	100%
56	Construction of other new nonresidential structures	$5,077,050	94%	100%	100%
57	Construction of new single-family residential structures	$298,650	100%	100%	100%
203	Cement manufacturing	$938,956	0%	72%	89%
215	Iron and steel mills and ferroalloy manufacturing	$985,608	0%	8%	74%
269	All other industrial machinery manufacturing	$270,577	0%	4%	66%
331	Switchgear and switchboard apparatus manufacturing	$509,497	0%	4%	51%
395	Wholesale - Machinery, equipment, and supplies	$20,906	41%	98%	100%
400	Wholesale - Other nondurable goods merchant wholesalers	$294,236	20%	100%	100%
401	Wholesale - Wholesale electronic markets and agents and brokers	$80,038	35%	71%	100%
414	Air transportation	$3,942	24%	75%	78%

415	Rail transportation	$65,110	12%	67%	100%
416	Water transportation	$2,829	19%	97%	100%
417	Truck transportation	$247,790	33%	93%	100%
444	Insurance carriers, except direct life	$298,650	61%	85%	90%
453	Commercial and industrial machinery and equipment rental and leasing	$895,950	46%	95%	100%
457	Architectural, engineering, and related services	$4,181,100	91%	91%	91%
463	Environmental and other technical consulting services	$298,650	99%	99%	100%
470	Office administrative services	$2,986,500	52%	97%	100%
515	Commercial and industrial machinery and equipment repair and maintenance	$1,791,900	49%	85%	100%
544	* Employment and payroll of federal govt, non-military	$5,973,000	100%	100%	100%
5001	Private Labor	$3,583,800	97%	100%	100%
	Total	**$29,865,000**			

Overall Summary

Area	Local Capture	Output	Jobs*	Labor Income	Value Added
Local					
Direct Impact		$22,690,085	196.1	$15,173,025	$16,213,429
Secondary Impact		$13,090,269	76.0	$4,036,377	$7,376,474
Total Impact	$22,690,085	$35,780,354	272.1	$19,209,402	$23,589,903
State					
Direct Impact		$23,384,370	172.8	$14,561,808	$15,144,726
Secondary Impact		$26,406,314	142.3	$8,453,157	$14,635,647
Total Impact	$26,968,170	$49,790,685	315.1	$23,014,965	$29,780,373
US					
Direct Impact		$28,750,729	249.8	$20,250,429	$19,767,324
Secondary Impact		$51,576,685	233.6	$16,537,825	$28,273,762

Total Impact		$28,750,729	$80,327,415	483.4	$36,788,255	$48,041,086

* Jobs are presented in full-time equivalence (FTE)

Local Impacts

IMPLAN Sectors	Industries	Output	Jobs*	Labor Income	Value Added
	Direct Impacts				
29	Sand and gravel mining	$0	0.0	$0	$0
52	Construction of new power and communication structures	$297,704	1.6	$87,688	$159,464
54	Construction of new highways and streets	$295,279	1.4	$76,116	$140,158
55	Construction of new commercial structures, including farm structures	$282,534	2.2	$114,519	$139,588
56	Construction of other new nonresidential structures	$4,773,377	48.8	$2,653,526	$2,144,774
57	Construction of new single-family residential structures	$298,619	2.1	$110,914	$155,203
203	Cement manufacturing	$0	0.0	$0	$0
215	Iron and steel mills and ferroalloy manufacturing	$0	0.0	$0	$0
269	All other industrial machinery manufacturing	$0	0.0	$0	$0
331	Switchgear and switchboard	$0	0.0	$0	$0

	apparatus manufacturing				
395	Wholesale - Machinery, equipment, and supplies	$8,624	0.0	$2,141	$4,340
400	Wholesale - Other nondurable goods merchant wholesalers	$59,924	0.2	$9,020	$27,167
401	Wholesale - Wholesale electronic markets and agents and brokers	$28,288	0.6	$47,534	$22,818
414	Air transportation	$936	0.0	$293	$685
415	Rail transportation	$7,642	0.0	$2,626	$3,166
416	Water transportation	$533	0.0	$34	$139
417	Truck transportation	$82,701	0.6	$20,879	$25,089
444	Insurance carriers, except direct life	$182,812	0.3	$13,935	$39,287
453	Commercial and industrial machinery and equipment rental and leasing	$412,466	1.2	$85,294	$250,519
457	Architectural, engineering, and related services	$3,805,608	14.0	$1,905,547	$2,440,355
463	Environmental and other technical consulting services	$295,681	2.5	$216,821	$195,568
470	Office administrative services	$1,551,382	22.3	$1,003,193	$511,673

515	Commercial and industrial machinery and equipment repair and maintenance	$874,369	5.6	$407,386	$521,827
544	* Employment and payroll of federal govt, non-military	$5,973,000	34.5	$4,956,950	$5,973,000
5001	Private Labor	$3,458,609	58.3	$3,458,609	$3,458,609
	Direct Impact	$22,690,085	196.1	$15,173,025	$16,213,429
	Secondary Impact	$13,090,269	76.0	$4,036,377	$7,376,474
	Total Impact	$35,780,354	272.1	$19,209,402	$23,589,903

* Jobs are presented in full-time equivalence (FTE)

State Impacts

IMPLAN Sectors	Industries	Output	Jobs*	Labor Income	Value Added
	Direct Impacts				
29	Sand and gravel mining	$76,460	0.3	$16,069	$43,811
52	Construction of new power and communication structures	$298,650	1.6	$90,634	$177,352
54	Construction of new highways and streets	$298,650	1.4	$80,774	$159,018
55	Construction of new commercial structures, including farm structures	$298,650	2.3	$129,060	$160,784
56	Construction of other new nonresidential structures	$5,077,050	51.9	$3,134,739	$2,416,259
57	Construction of new single-family residential structures	$298,650	2.1	$116,397	$169,630
203	Cement manufacturing	$676,904	0.9	$85,029	$255,700
215	Iron and steel mills and ferroalloy manufacturing	$80,912	0.1	$4,517	$23,573
269	All other industrial machinery manufacturing	$10,650	0.0	$2,848	$3,377
331	Switchgear and switchboard apparatus manufacturing	$22,236	0.1	$5,462	$7,753

395	Wholesale - Machinery, equipment, and supplies	$20,454	0.1	$6,237	$11,934
400	Wholesale - Other nondurable goods merchant wholesalers	$293,201	1.1	$72,554	$169,414
401	Wholesale - Wholesale electronic markets and agents and brokers	$57,138	1.2	$96,014	$48,532
414	Air transportation	$2,966	0.0	$928	$2,170
415	Rail transportation	$43,407	0.1	$14,918	$17,982
416	Water transportation	$2,749	0.0	$338	$905
417	Truck transportation	$229,273	1.6	$74,014	$89,178
444	Insurance carriers, except direct life	$253,798	0.5	$39,333	$99,311
453	Commercial and industrial machinery and equipment rental and leasing	$849,745	2.4	$188,666	$549,022
457	Architectural, engineering, and related services	$3,805,608	17.0	$1,905,547	$2,440,355
463	Environmental and other technical consulting services	$295,681	2.6	$216,821	$195,568
470	Office administrative services	$2,886,899	41.4	$2,526,707	$1,144,340
515	Commercial and industrial machinery and equipment repair and maintenance	$1,531,640	9.8	$797,251	$985,757
544	* Employment and payroll of federal govt, non-military	$5,973,000	34.5	$4,956,950	$5,973,000
5001	Private Labor	$0	0.0	$0	$0
	Direct Impact	$23,384,370	172.8	$14,561,808	$15,144,726
	Secondary Impact	$26,406,314	142.3	$8,453,157	$14,635,647
	Total Impact	$49,790,685	315.1	$23,014,965	$29,780,373

* Jobs are presented in full-time equivalence (FTE)

Table 9 - US Impacts

IMPLAN Sectors	Industries	Output	Jobs*	Labor Income	Value Added
	Direct Impacts				
29	Sand and gravel mining	$162,067	0.8	$51,640	$92,864
52	Construction of new power and communication structures	$298,650	1.6	$109,056	$178,771
54	Construction of new highways and streets	$298,650	1.4	$97,087	$159,018

55	Construction of new commercial structures, including farm structures	$298,650	2.3	$144,788	$168,847
56	Construction of other new nonresidential structures	$5,077,050	51.9	$3,929,439	$2,416,25 9
57	Construction of new single-family residential structures	$298,650	2.1	$130,396	$177,586
203	Cement manufacturing	$836,024	1.1	$121,559	$315,808
215	Iron and steel mills and ferroalloy manufacturing	$727,302	0.6	$83,430	$211,893
269	All other industrial machinery manufacturing	$179,412	0.7	$52,460	$72,099
331	Switchgear and switchboard apparatus manufacturing	$257,461	0.6	$63,243	$95,141
395	Wholesale - Machinery, equipment, and supplies	$20,905	0.1	$6,580	$12,503
400	Wholesale - Other nondurable goods merchant wholesalers	$294,236	1.1	$75,359	$170,013
401	Wholesale - Wholesale electronic markets and agents and brokers	$80,038	1.7	$134,495	$70,346
414	Air transportation	$3,092	0.0	$967	$2,262
415	Rail transportation	$65,110	0.1	$22,376	$31,854
416	Water transportation	$2,829	0.0	$415	$932
417	Truck transportation	$247,787	1.7	$99,009	$115,257
444	Insurance carriers, except direct life	$269,885	0.5	$42,429	$124,848
453	Commercial and industrial machinery and equipment rental and leasing	$895,950	2.6	$256,046	$610,695
457	Architectural, engineering, and related services	$3,817,154	17.1	$1,911,328	$2,447,75 9
463	Environmental and other technical consulting services	$298,335	2.7	$233,546	$206,903
470	Office administrative services	$2,972,792	42.7	$3,164,835	$1,350,67 1
515	Commercial and industrial machinery and equipment repair and maintenance	$1,791,900	11.5	$979,197	$1,178,19 5
544	* Employment and payroll of federal govt, non-military	$5,973,000	34.5	$4,956,950	$5,973,00 0
5001	Private Labor	$3,583,800	70.8	$3,583,800	$3,583,80 0
	Direct Impact	$28,750,72 9	249.8	$20,250,42 9	$19,767,3 24
	Secondary Impact	$51,576,68 5	233.6	$16,537,82 5	$28,273,7 62
	Total Impact	$80,327,41 5	483.4	$36,788,25 5	$48,041,0 86

* Jobs are presented in full-time equivalence (FTE)

Sources:

http://www.co.okaloosa.fl.us/ accessed November 2020

American Fact Finder

Doheny, Matt. (Gordian – Construction Publishers and Consultants), Square Foot Costs with RSMeans Data, 2019 40th annual edition.

Attachment 1: Back Bay Screening Approach

Okaloosa County Coastal Storm Risk Management

Purpose

The purpose of the task is to perform a rapid assessment of coastal storm hazards associated with inundation and screening for potential feasibility of implementing nonstructural measures in the back bay areas of Okaloosa County, Florida using existing data sources.

Background

The study area for the Okaloosa County, Florida Coastal Storm Risk Management Study includes the incorporated areas of the county exposed to sea level change and coastal storm damage. The study authority is contained in House Resolution 2758 adopted June 28, 2006 which reads as follows:

“Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, in accordance with Section 110 of the Rivers and Harbors Act of 1962, the Secretary of the Army is requested to review the feasibility of providing shoreline erosion control, beach nourishment, storm damage reduction, environmental restoration and protection, and related improvements in Okaloosa County, Florida, taking into consideration the unique characteristics of the existing beach sand and the need to develop a comprehensive body of knowledge, information, and data on coastal area changes and processes as well as impacts from federally constructed projects in the vicinity of Okaloosa County, Florida.”

Further authorization for this study is provided by the Bipartisan Budget Act of 2018, Public Law 115-123, enacted February 9, 2018

Objective

To determine whether nonstructural buyouts or elevating of existing structures within the back bay area warrant more detailed analysis.

Specific objectives were to:

• Identify structure risk to inundation for a range of return periods and sea level change (SLC) scenarios.

• Identify structures with potential feasibility of implementing nonstructural measures.

• Identify spatial distribution and comparative statistics for a range of return periods and two SLC scenarios.

Assumptions

• Floodplain residents and development will remain constant between scenarios

• Structure inventory values from the existing parcel databases, depth damage functions, structure values and content values are representative estimates for the study area.

• Tax assessor data is an accurate representation of Fair Market Value of land and improvements.

• Damages are defined as the amount of monetary damage that occurs to structures and the content of the structures according to the structure's occupancy type and estimated water levels.

• Primary damages in the back bay are a result of inundation (i.e. no damages for waves or erosion hazards were evaluated).

• Participation rate for elevating structures is assumed 100%

Risk and Uncertainty Factors

Risk and uncertainty are inherent in storm damage analysis. These factors arise due to errors in measurement and from the innate variability of complex physical, social, and economic situations. Key uncertainty in economic variables include building valuations, inexact knowledge of structure type or of actual contents and method of determining first-floor elevations. Other key variables and associated uncertainties include the hydrologic and hydraulic conditions to include future states of sea level. Key uncertainty in costs include fluctuations in Real Estate acquisition costs (appraised Fair Market Value, limited data influencing P.L. 91-646 relocation assistance costs, and administrative costs including uncertainty of condemnation rates). Real estate risks have been deemed acceptable for the purposes of assessment inasmuch as a conservative approach was taken for purposes of analysis of Non-structural features in the back bay areas of Okaloosa County.

Methodology

The back bay structure inundation risk analysis methodology described in the following sections is summarized in the flow chart below. The methodology is tailored to utilize existing data sources and minimal time effort. This approach mimics that used in the North Atlantic Division (NAD) study at Fairfield and New Haven Counties Coastal Storm Risk Management (CSRM) in Connecticut and the Pawcatuck River, Rhode Island CSRM Study in most aspects. The primary difference lies in the identification of the FFE and the probabilistic water level. The FFE used in this analysis is assumed using a logical decision process verses a structure-by-structure identification used in the NAD studies. The probabilistic water level used in this methodology was based on the FEMA Region IV Risk Mapping as opposed to the simplistic bathtub approach using a single site gage record.

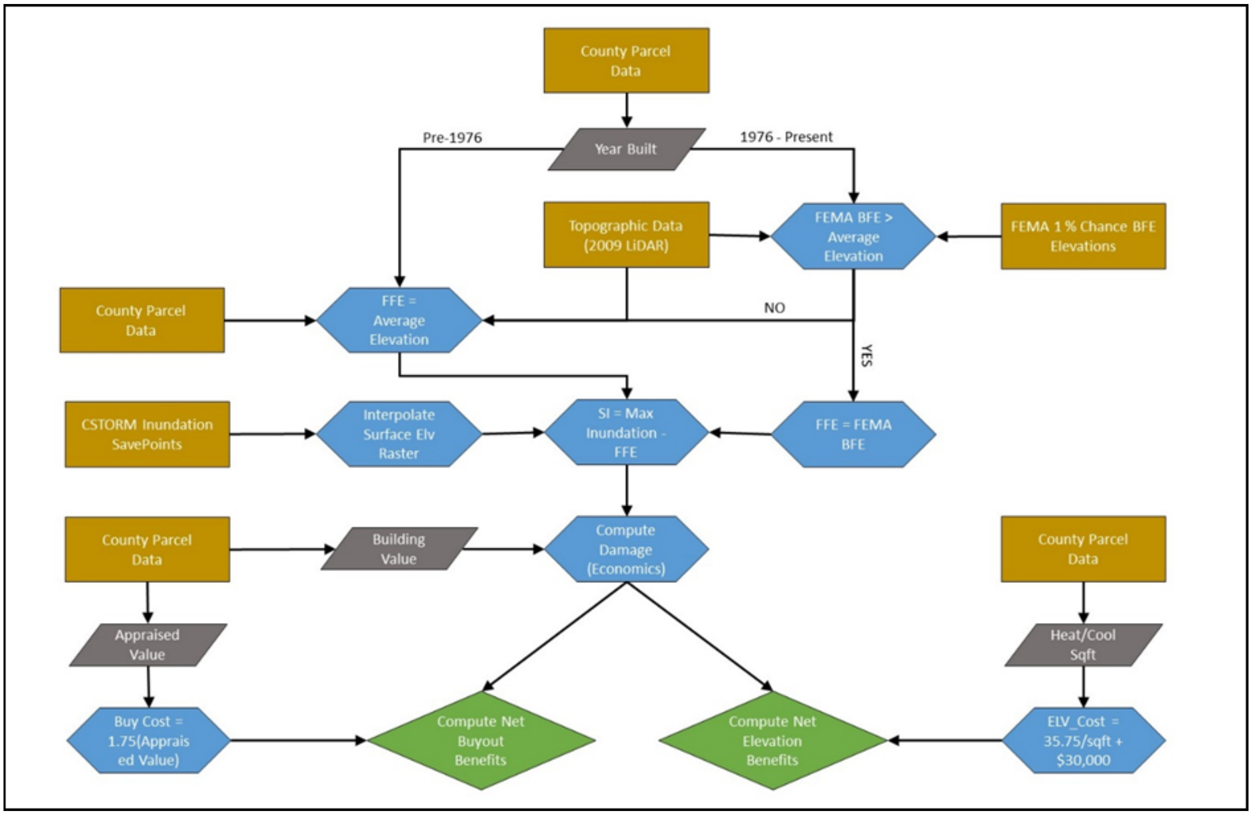

Figure 1: Process flow chart of the rapid structure inundation risk assessment and initial screening for positive net benefits

Inundation Extents

Water Level

Comprehensive coastal storm modeling was completed for the Florida Panhandle under the Federal Emergency Management (FEMA) Region IV's Risk Mapping, Analysis and Planning (Risk MAP) study and Digital Flood Insurance Rate Map (DFIRM) update for the Florida Panhandle and Alabama coasts. The modeling included waves and water levels for 295 synthetic tropical storms that efficiently sampled practical probabilities of storms making landfall in the region. The 295 synthetic tropical cyclone events used for the FEMA Region IV's Risk Map study were derived using a Joint Probability Method of Optimum Sampling (JPM-OS), see (URS/Dewberry 2012). Water levels and waves for the FEMA study were computed using two different models: 1) the SWAN model (http://www.swan.tudelft.nl), used for producing offshore, regional and coastal wave conditions and 2) the Advanced Circulation (ADCIRC) model (ADCIRC 2017, Luettich et al. 1992, Kolar et al. 1994), which was used to simulate two-dimensional depth-averaged surge and circulation responses to the storm conditions.

The FEMA Region IV's Risk Mapping was further expanded to include tides and varying future sea levels with the Engineering Research and Development Center's Coastal Storm Modeling System (CSTORM-MS) in support of various studies under the USACE, Mobile District Coastal Resiliency Program. The numerical models used within the CSTORM modeling system, consisted of the deep water Wave Model (WAM) for producing

offshore wave boundary conditions applied to a nearshore Steady-state Wave (STWAVE) model. The Advanced Circulation (ADCIRC) model was used to simulate two-dimensional depth-integrated surge and circulation responses to the storm conditions. The CSTORM coupling framework (Massey et al. 2011) was used to tightly two-way couple the ADCIRC and STWAVE models in order to allow for dynamic interactions between the surge/circulation and waves, resulting in improved modeling results.

Numerical modeling was completed using present day water levels and four sets of random tide phases computed for each of the 295 synthetic storms and output at over 15,000 save point locations along the Alabama and Florida Panhandle coastline (~600 points within Okaloosa County). JPM-OS was applied to these save points over a range of annualized return periods between 2 and 10,000 years and computed confidence intervals between 2 % and 98%. The structure risk assessment for this analysis assumed the mean confidence interval.

Sea Level Change

Sea level Change (SLC) is incorporated in the analysis using a simplified, spatially homogeneous, depth superimposed on the annualized return periods. Two possible future conditions of sea level rise were calculated using the USACE SLC curve calculator (2017.55) for USACE intermediate and high curves at Dauphin Island and Pensacola gages based on NOAA 2017 local SLC rates. The predicted scenario rise over a 50 year planning horizon equal to approximately 0.5 meters (1.641 feet) and 1.0 meter (3.281 feet) were applicable to this region and sufficient to evaluate sensitivity of structure risk.

Spatial Interpolation

Water surface elevation was interpolated from the save points using a natural neighbor sampling technique then clipped to a 2007 LiDAR bare earth dataset based on the 3-dimensional intersecting limits. This methodology is assumed to be valid with minimal error due to the minor and gradual changes in the water surface profile despite the large spatial distribution among save points. A total of 33 water surface profiles were generated. Figure 2 is a plot of total inundated area vs. return period for each SLC scenario. A representative comparison at the 100 year return period of the water surface profile spatial extent for the existing and two future SLC scenarios within the Okaloosa County CSRM study area is shown in Figure 3.

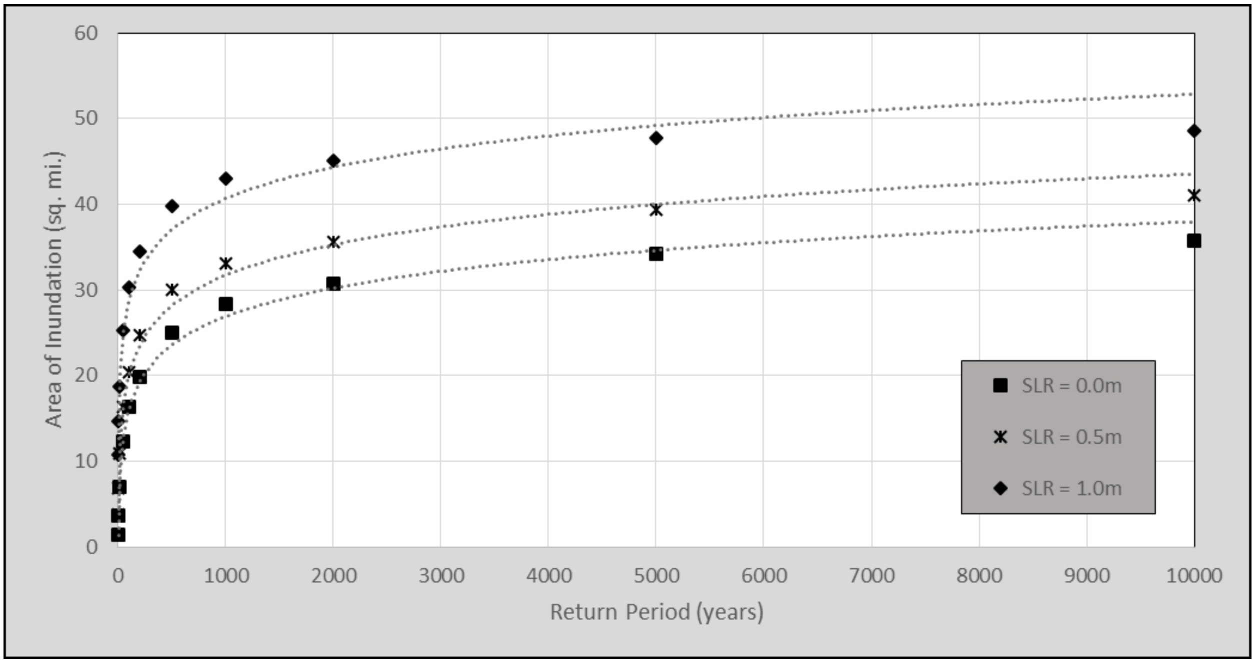

Figure 2: Comparison Plot of SLC for total area of inundation vs. return period

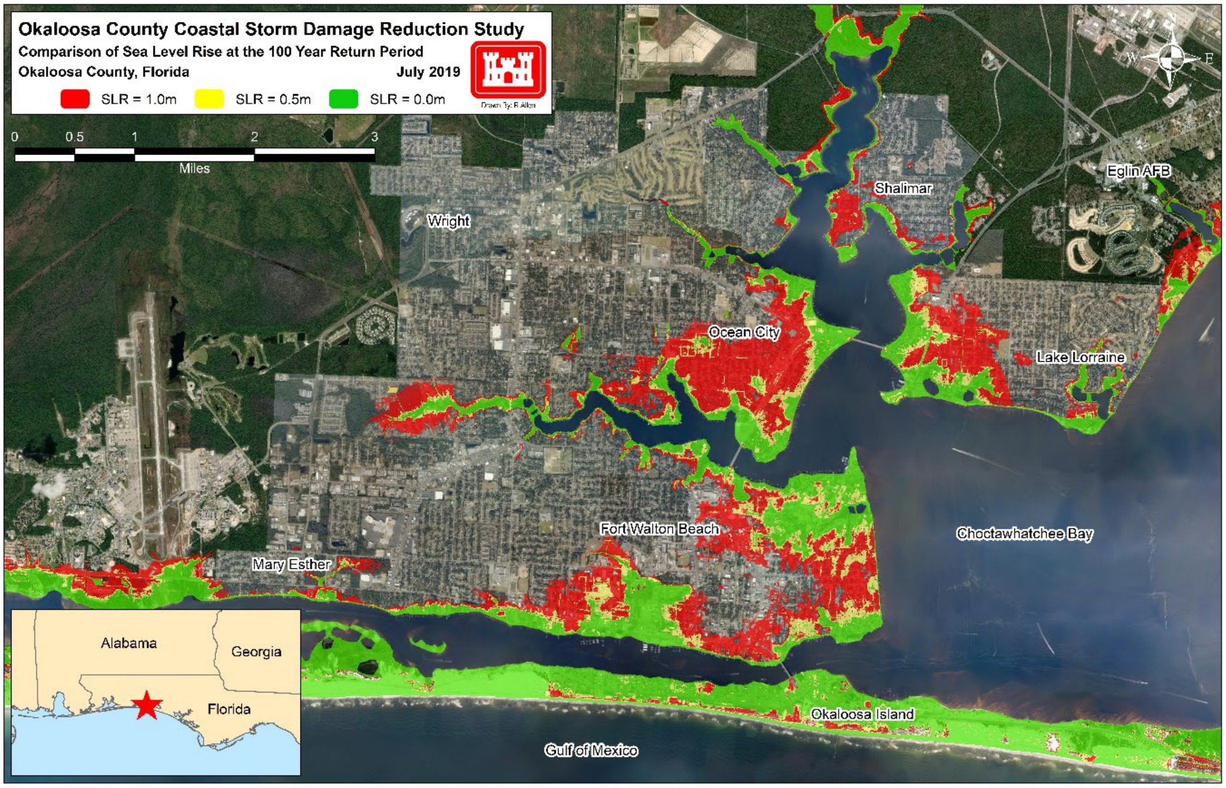

Figure 3: Comparison of sea level change at the 100-year return period

Structure/Parcel Data Inventory

The structure inventory for Okaloosa County relied exclusively on the county tax assessor's parcel data, provided via shapefile. Attributes from the dataset used in the back bay assessment and how they were applied are shown in Table 1.

Table 1: Parcel attributes from tax assessor's database and how each was applied to the back bay analysis

Parcel Attribute	Application
Appraised Value (land + improvements)	Buyout Cost
Building Value	Structure and Content Damage
Affective Year of Construction	First Floor Elevation (FFE)
Heated and Cooled Square Footage	Cost to Elevate Structure
Parcel Use Type	Filtering for Single Family Structures

The parcel dataset included 107,281 parcels within Okaloosa County. The parcels were filtered to include only single family residences and removed parcels along the gulf beach within the Beach-*fx* model domain. Limiting the back bay analysis to single family structures was a decision made by the team to expedite the analysis and reduce errors within other parcel use types such as multi-family, townhomes, condos, and commercial structure types which are also assumed to be impractical for either elevating or buyout. It is noted this decision could lead to missing potential viable coastal storm risk management actions such as flood-proofing; however, flood-proofing was not carried forward in the focused array of alternatives. Removal of the gulf fronting parcels was decided as these parcels will be considered within the Beach-*fx* model as presented during the Alternatives Milestone Meeting (AMM). The filtered parcel counts for each return period and respective SLR scenario are plotted in Figure 4.

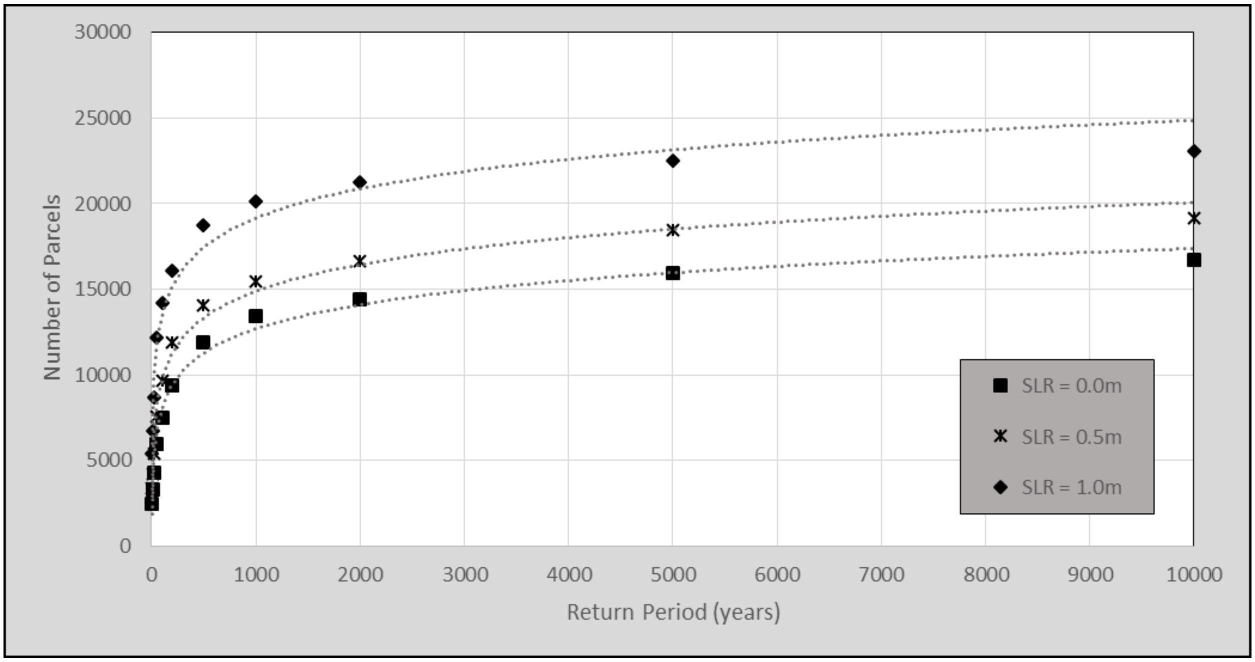

Figure 4: Number of single family residential parcels used in the back bay structure risk assessment vs. the return period and comparatively w.r.t sea level change

First Floor Elevations

First floor elevation (FFE) for each structure was estimated with a logical approach utilizing data readily available for parcel elevations, structure build date, and FEMA base flood elevations (BFE). Obtaining the actual first floor elevation or a visual estimate thereof on a structure-by-structure resolution was impractical given the number of parcels, necessary access requirements, and visibility from the public right-of-way. Structure FFE estimation in this study followed the methodology shown in the flowchart (Figure 1) provided in the Methodology section.

The FFE identification process began with determining the average parcel elevation using a raster of LiDAR bare earth data resampled to a 20 foot grid. Parcel elevation was computed using the zonal statistics toolbox within the ArcGIS environment which computes simple statistics on the aggregate of raster cells within the parcel boundary. Average parcel elevation was chosen based on the assumption a homeowner would more likely than not build on the higher elevation within a parcel but for conservation (more likely to be a viable project) the maximum elevation was not used. Second, the FEMA FIRM BFE polygons were overlaid on the parcel boundaries and the minimum BFE (but greater than zero) was attributed to each parcel. The minimum BFE was used to minimize screening of potential viable structures. It should be noted here, the BFE polygons are w.r.t. the 100 year return period and do not extend beyond this inundation limit which will bias any inundation having limits beyond this threshold. The third step involves applying a logical decision process based on the structures effective build date. The decisional hierarchy first checks if the structure was built prior to the first published FIRM (1976) for the county and if so the FFE is assumed to be equal to the average parcel elevation. If the structure was built after 1976, the parcel has an associated FEMA BFE, and if that BFE is greater than the average parcel elevation then the FFE is assumed to be equal to the BFE; otherwise, the FFE is assumed to be equal to the average parcel elevation.

The methodology used for estimating the structure FFE contains many assumptions and likely errors. However, the decisional logic assumed the lowest FFE (within practical limits) to maximize damages such that these errors would not lead to screening of potentially eligible structures with the understanding this methodology/screening analysis is an interim step and should not be used for a final decision.

Economic Analyses

Engineering provided economics with inundation levels for the 5-year, 10-year, 20-year, 50-year, 100-year, 500-year and 10,000-year return periods for the low, intermediate and high sea level change scenarios based on Census Tracks. The intermediate SLC footprint was used to assess the number of structures that met the criteria of getting at least -1 foot of water. Based on the inundation level of intermediate SLC, the depth damage function for inundation was used to determine damages per event. To estimate inundation damages, the “most likely” values were used. The depth damage functions are a combination of the North Atlantic Coast Comprehensive Study (NACCS) and 2002 Coastal Storm Damage Relationships Based on Expert Opinion Elicitation.

Building value used was provided by Okaloosa County for each parcel with a habitable structure. This value was used for the structure damage assessment and 50 percent of this value was assumed for the content value. It is understood depreciated replacement cost should be used for damage assessment, but for the rapid screening approach the assessed value was used.

The level of sustained damages is generally measured as percent damage-to-structure and percent damage-to-contents. The structure value was multiplied by the damage percent. The content values were multiplied by the damage percent and added together to determine a total damage value by parcel.

Costs

Structure elevating

Structure elevating costs were determined using a fixed cost of $30,000 plus $35.75 per square foot. These values were determined by the Cost Engineer using a variety of sources and are near the minimum actual cost of elevating a structure. The fixed cost is the same as is used from the USACE North Atlantic Coast Comprehensive Study as reported from Appendix C for rehousing and Engineering and design and includes an additional amount for contingency, S&A, and escalation. The Square foot costs were taken from the USACE publication Non-Structural Flood Damage Reduction within the Corps of Engineers and escalated to current price levels. The pricing assumed an ideal situation of the structure to be elevated, resulting in a minimum cost much lower than typical or average costs. This minimum cost was anticipated to be used solely for screening purposes, indicating whether this alternative warranted more detailed analysis. The square footage of the buildings used to calculate elevating costs is the heated and cooled square footage from the county tax assessor's parcel data. Although uncertainty exists throughout this process, the conservative nature of the estimates should prevent any excessive screening of structures that would otherwise be viable candidates for elevating. The elevating costs used are near minimum costs, so any reasonable excesses of square footage used in the calculation would not screen out otherwise viable structures.

Acquisition (buyout)

A simplistic evaluation using a constant multiplier, with sensitivity, applied to the tax appraised value was computed for validation purposes. Initial acquisition costs were assumed to be equal to 1.75 times the tax appraised value of the structure and land. This assumption takes into consideration knowledge of various factors impacting cost including relocation assistance, administrative, and contingency assuming the max statutory relocation assistance benefit for owner occupant, notwithstanding the potential for housing of last resort. For sensitivity additional multipliers of 1.5 and 1.25 were computed.

In consideration of the volume of structures in back bay to analyze, multipliers are preliminary and were based on best professional judgment. Further, a relocation survey to evaluate displaced persons has not been done for subject neighborhoods/communities and is not within the scope of study analysis. Detailed relocation survey is not listed in the feasibility study requirements of ER 405-1-12, Chap. 12, Real Estate Planning & Acquisition for Civil Works Projects.

In addition, an assumption was made that the tax assessor data is an accurate representation of Fair Market Value of land and improvements in lieu of gross appraisal with incremental costs. A Rough Order of Magnitude cost was not calculated on the individual structure basis, or in consideration of site-specific refinements.

There is a great deal of uncertainty in the Administrative costs for the Acquisition/Relocation Assistance due to the scope of the structure buyout and challenges with a large relocation effort in the back bay areas of Okaloosa County.

Preliminary Screening Results

Based on the assumptions mentioned in the previous sections, census blocks with positive damage values compared to the estimated cost to elevate are recommended for further screening and risk assessment. Two census blocks emerged for further evaluation for the 100-year return interval, and the 200-year return interval. Five emerged for the 500-year return interval.

It is recommended to only include structures in the 100-year return interval footprint due to FEMA building requirements and the FEMA Insurance Rate Maps (FIRM) being assessed on the 100-year return interval.

The next step is to sample first floor elevations in the two census tracts with positive damages at the 100-year return interval. Based on further refinement of first floor elevations, damages will be recalculated to determine if the census blocks remain as candidates for structure elevation.

References

ADCIRC (2017). ADCIRC Utility Programs, http://adcirc.org/home/related-software/adcirc-utility-programs/, accessed on Aug. 1, 2017.

Kolar, R. L., W.G. Gray, J.J. Westerink, and R.A. Luettich. (1994). Shallow water modeling in spherical coordinates: Equation formulation, numerical implementation, and application. Journal of Hydraulic Research, 32 (1), 3-24.

Luettich, R. A., Jr., J.J. Westerink, N.W. Scheffner, N. W. (1992). ADCIRC: An advanced three-dimensional circulation model for shelves, coasts, and estuaries. Technical Report DRP-92-6, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Massey, T.C., T.V. Wamsley, and M.A. Cialone. (2011) Coastal Storm Modeling – System Integration. Proceedings of the 2011 Solutions to Coastal Disasters Conference, Anchorage, Alaska, 99-108.

URS/Dewberry (2012). Joint probability analysis of hurricane flood hazards for Gulf, Bay, Walton, Okaloosa, Santa Rosa, and Escambia Counties Florida, and Baldwin and Mobile Counties, Alabama. Report in support of the Federal Emergency Management

Agency (FEMA) Map Modernization program for the Northwest Florida Water Management District (NWFWMD). 69 pages.

Attachment 2: Cost Tables

Table 29: Okaloosa Island Present Value Cost Details

year		cost	PV Factor @0.025	PV
2025	initial construction	$ 8,359,000	1	$ 8,359,000
2026		$ -	0.975609756	$ -
2027		$ -	0.951814396	$ -
2028		$ -	0.928599411	$ -
2029		$ -	0.905950645	$ -
2030		$ -	0.883854288	$ -
2031		$ -	0.862296866	$ -
2032		$ -	0.841265235	$ -
2033		$ -	0.820746571	$ -
2034		$ -	0.800728362	$ -
2035	re-nourishment 1	$ -	0.781198402	$ -
2036		$ -	0.762144782	$ -
2037		$ -	0.743555885	$ -
2038		$ -	0.725420376	$ -
2039		$ -	0.707727196	$ -
2040		$ -	0.690465557	$ -
2041		$ -	0.673624934	$ -
2042		$ -	0.657195057	$ -
2043		$ -	0.641165909	$ -
2044		$ -	0.625527716	$ -
2045	re-nourishment 2	$ 2,741,400	0.610270943	$ 1,672,997
2046		$ -	0.595386286	$ -
2047		$ -	0.580864669	$ -
2048		$ -	0.566697238	$ -
2049		$ -	0.552875354	$ -
2050		$ -	0.539390589	$ -
2051		$ -	0.526234721	$ -
2052		$ -	0.513399728	$ -
2053		$ -	0.500877784	$ -
2054		$ -	0.488661252	$ -
2055	re-nourishment 3	$ 13,335,200	0.476742685	$ 6,357,459
2056		$ -	0.465114815	$ -
2057		$ -	0.453770551	$ -

year		cost	PV Factor @0.025	PV
2058		$ -	0.442702977	$ -
2059		$ -	0.431905343	$ -
2060		$ -	0.421371066	$ -
2061		$ -	0.411093723	$ -
2062		$ -	0.401067047	$ -
2063		$ -	0.391284924	$ -
2064		$ -	0.381741389	$ -
2065	re-nourishment 4	$ 19,185,400	0.372430624	$ 7,145,230
2066		$ -	0.36334695	$ -
2067		$ -	0.354484829	$ -
2068		$ -	0.345838858	$ -
2069		$ -	0.337403764	$ -
2070		$ -	0.329174404	$ -
2071		$ -	0.32114576	$ -
2072		$ -	0.313312936	$ -
2073		$ -	0.305671157	$ -
2074		$ -	0.298215763	$ -

Table 30: West Destin Present Value Cost Details

year		cost	PV Factor @0.025	Present Value
2025	initial construction	$ 22,067,000	1	$ 22,067,000
2026		$ -	0.975609756	$ -
2027		$ -	0.951814396	$ -
2028		$ -	0.928599411	$ -
2029		$ -	0.905950645	$ -
2030		$ -	0.883854288	$ -
2031		$ -	0.862296866	$ -
2032		$ -	0.841265235	$ -
2033		$ -	0.820746571	$ -
2034		$ -	0.800728362	$ -
2035	re-nourishment 1	$ 12,803,700	0.781198402	$ 10,002,230
2036		$ -	0.762144782	$ -
2037		$ -	0.743555885	$ -
2038		$ -	0.725420376	$ -
2039		$ -	0.707727196	$ -

2040		$ -	0.690465557	$ -
2041		$ -	0.673624934	$ -
2042		$ -	0.657195057	$ -
2043		$ -	0.641165909	$ -
2044		$ -	0.625527716	$ -
2045	re-nourishment 2	$ 28,354,300	0.610270943	$ 17,303,805
2046		$ -	0.595386286	$ -
2047		$ -	0.580864669	$ -
2048		$ -	0.566697238	$ -
2049		$ -	0.552875354	$ -
2050		$ -	0.539390589	$ -
2051		$ -	0.526234721	$ -
2052		$ -	0.513399728	$ -
2053		$ -	0.500877784	$ -
2054		$ -	0.488661252	$ -
2055	re-nourishment 3	$ 33,131,400	0.476742685	$ 15,795,153
2056		$ -	0.465114815	$ -
2057		$ -	0.453770551	$ -
2058		$ -	0.442702977	$ -
2059		$ -	0.431905343	$ -
2060		$ -	0.421371066	$ -
2061		$ -	0.411093723	$ -
2062		$ -	0.401067047	$ -
2063		$ -	0.391284924	$ -
2064		$ -	0.381741389	$ -
2065	re-nourishment 4	$ 30,965,300	0.372430624	$ 11,532,426
2066		$ -	0.36334695	$ -
2067		$ -	0.354484829	$ -
2068		$ -	0.345838858	$ -
2069		$ -	0.337403764	$ -
2070		$ -	0.329174404	$ -
2071		$ -	0.32114576	$ -
2072		$ -	0.313312936	$ -
2073		$ -	0.305671157	$ -
2074		$ -	0.298215763	$ -

Table 31: Okaloosa County Present Value Project Cost Details

year		cost	PV Factor @0.025	Present Value
2025	initial construction	$ 30,426,000	1	$ 30,426,000
2026		$ -	0.975609756	$ -
2027		$ -	0.951814396	$ -
2028		$ -	0.928599411	$ -
2029		$ -	0.905950645	$ -
2030		$ -	0.883854288	$ -
2031		$ -	0.862296866	$ -
2032		$ -	0.841265235	$ -
2033		$ -	0.820746571	$ -
2034		$ -	0.800728362	$ -
2035	re-nourishment 1	$ 12,805,000	0.781198402	$ 10,003,246
2036		$ -	0.762144782	$ -
2037		$ -	0.743555885	$ -
2038		$ -	0.725420376	$ -
2039		$ -	0.707727196	$ -
2040		$ -	0.690465557	$ -
2041		$ -	0.673624934	$ -
2042		$ -	0.657195057	$ -
2043		$ -	0.641165909	$ -
2044		$ -	0.625527716	$ -
2045	re-nourishment 2	$ 31,097,000	0.610270943	$ 18,977,596
2046		$ -	0.595386286	$ -
2047		$ -	0.580864669	$ -
2048		$ -	0.566697238	$ -
2049		$ -	0.552875354	$ -
2050		$ -	0.539390589	$ -
2051		$ -	0.526234721	$ -
2052		$ -	0.513399728	$ -
2053		$ -	0.500877784	$ -
2054		$ -	0.488661252	$ -
2055	re-nourishment 3	$ 46,467,000	0.476742685	$ 22,152,802
2056		$ -	0.465114815	$ -
2057		$ -	0.453770551	$ -
2058		$ -	0.442702977	$ -
2059		$ -	0.431905343	$ -

2060		$ -	0.421371066	$ -
2061		$ -	0.411093723	$ -
2062		$ -	0.401067047	$ -
2063		$ -	0.391284924	$ -
2064		$ -	0.381741389	$ -
2065	re-nourishment 4	$ 50,152,000	0.372430624	$ 18,678,141
2066		$ -	0.36334695	$ -
2067		$ -	0.354484829	$ -
2068		$ -	0.345838858	$ -
2069		$ -	0.337403764	$ -
2070		$ -	0.329174404	$ -
2071		$ -	0.32114576	$ -
2072		$ -	0.313312936	$ -
2073		$ -	0.305671157	$ -
2074		$ -	0.298215763	$ -

Attachment 3: Damage Functions

FunctionType Name	Function Description GroupName	FunctionDescriptionGroupDescription	X	YMin	YMost Likely	YMax
ErosionDamage Contents	ERODP1SCON	Erosion/Pile16/SF/Contents	0	0	0	0
ErosionDamage Contents	ERODP1SCON	Erosion/Pile16/SF/Contents	10	0	0	0
ErosionDamage Contents	ERODP1SCON	Erosion/Pile16/SF/Contents	20	0	0	0
ErosionDamage Contents	ERODP1SCON	Erosion/Pile16/SF/Contents	30	0	0	0
ErosionDamage Contents	ERODP1SCON	Erosion/Pile16/SF/Contents	40	0	0	0
ErosionDamage Contents	ERODP1SCON	Erosion/Pile16/SF/Contents	50	0	0	0
ErosionDamage Contents	ERODP1SCON	Erosion/Pile16/SF/Contents	60	0	0	0
ErosionDamage Contents	ERODP1SCON	Erosion/Pile16/SF/Contents	70	0	0	0
ErosionDamage Contents	ERODP1SCON	Erosion/Pile16/SF/Contents	80	0	0	0
ErosionDamage Contents	ERODP1SCON	Erosion/Pile16/SF/Contents	90	0	0	0
ErosionDamage Contents	ERODP1SCON	Erosion/Pile16/SF/Contents	100	0	0	0
ErosionDamage Contents	EROPILECON	Erosion/Pile/Contents	0	0	0	0
ErosionDamage Contents	EROPILECON	Erosion/Pile/Contents	10	0.05	0.2	0.25
ErosionDamage Contents	EROPILECON	Erosion/Pile/Contents	20	0.06	0.4	0.6
ErosionDamage Contents	EROPILECON	Erosion/Pile/Contents	30	0.08	0.6	1
ErosionDamage Contents	EROPILECON	Erosion/Pile/Contents	40	0.1	0.8	1
ErosionDamage Contents	EROPILECON	Erosion/Pile/Contents	50	0.17	1	1
ErosionDamage Contents	EROPILECON	Erosion/Pile/Contents	60	0.32	1	1
ErosionDamage Contents	EROPILECON	Erosion/Pile/Contents	70	0.47	1	1
ErosionDamage Contents	EROPILECON	Erosion/Pile/Contents	80	0.6	1	1
ErosionDamage Contents	EROPILECON	Erosion/Pile/Contents	90	0.7	1	1
ErosionDamage Contents	EROPILECON	Erosion/Pile/Contents	100	0.8	1	1
ErosionDamage Contents	EROSHLCON	Erosion/Slab/Contents	0	0	0	0
ErosionDamage Contents	EROSHLCON	Erosion/Slab/Contents	10	0.05	0.2	0.25
ErosionDamage Contents	EROSHLCON	Erosion/Slab/Contents	20	0.2	0.4	0.6
ErosionDamage Contents	EROSHLCON	Erosion/Slab/Contents	30	0.3	0.6	1
ErosionDamage Contents	EROSHLCON	Erosion/Slab/Contents	40	0.5	0.8	1

ErosionDamage Contents	EROSHLCON	Erosion/Slab/Contents	50	0.7	1	1
ErosionDamage Contents	EROSHLCON	Erosion/Slab/Contents	60	0.8	1	1
ErosionDamage Contents	EROSHLCON	Erosion/Slab/Contents	70	0.9	1	1
ErosionDamage Contents	EROSHLCON	Erosion/Slab/Contents	80	1	1	1
ErosionDamage Contents	EROSHLCON	Erosion/Slab/Contents	90	1	1	1
ErosionDamage Contents	EROSHLCON	Erosion/Slab/Contents	100	1	1	1
ErosionDamage Structure	ERODP1MSTR	Erosion/Pile16/MF/Structure	0	0	0	0
ErosionDamage Structure	ERODP1MSTR	Erosion/Pile16/MF/Structure	10	0.0008	0.0011	0.0014
ErosionDamage Structure	ERODP1MSTR	Erosion/Pile16/MF/Structure	20	0.0018	0.0024	0.003
ErosionDamage Structure	ERODP1MSTR	Erosion/Pile16/MF/Structure	30	0.0029	0.0039	0.0048
ErosionDamage Structure	ERODP1MSTR	Erosion/Pile16/MF/Structure	40	0.0042	0.0055	0.0069
ErosionDamage Structure	ERODP1MSTR	Erosion/Pile16/MF/Structure	50	0.0056	0.0074	0.0093
ErosionDamage Structure	ERODP1MSTR	Erosion/Pile16/MF/Structure	60	0.0071	0.0095	0.0119
ErosionDamage Structure	ERODP1MSTR	Erosion/Pile16/MF/Structure	70	0.0088	0.0118	0.0147
ErosionDamage Structure	ERODP1MSTR	Erosion/Pile16/MF/Structure	80	0.0107	0.0143	0.0178
ErosionDamage Structure	ERODP1MSTR	Erosion/Pile16/MF/Structure	90	0.0127	0.0169	0.0212
ErosionDamage Structure	ERODP1MSTR	Erosion/Pile16/MF/Structure	100	0.0149	0.02	0.0248
ErosionDamage Structure	ERODP1SSTR	Erosion/Pile16/SF/Structure	0	0	0	0
ErosionDamage Structure	ERODP1SSTR	Erosion/Pile16/SF/Structure	10	0.0025	0.003	0.0042
ErosionDamage Structure	ERODP1SSTR	Erosion/Pile16/SF/Structure	20	0.0053	0.007	0.0088
ErosionDamage Structure	ERODP1SSTR	Erosion/Pile16/SF/Structure	30	0.0082	0.011	0.0137
ErosionDamage Structure	ERODP1SSTR	Erosion/Pile16/SF/Structure	40	0.0113	0.015	0.0189
ErosionDamage Structure	ERODP1SSTR	Erosion/Pile16/SF/Structure	50	0.0147	0.02	0.0244
ErosionDamage Structure	ERODP1SSTR	Erosion/Pile16/SF/Structure	60	0.0182	0.024	0.0303
ErosionDamage Structure	ERODP1SSTR	Erosion/Pile16/SF/Structure	70	0.0219	0.029	0.0365
ErosionDamage Structure	ERODP1SSTR	Erosion/Pile16/SF/Structure	80	0.0258	0.034	0.043
ErosionDamage Structure	ERODP1SSTR	Erosion/Pile16/SF/Structure	90	0.0299	0.04	0.0499
ErosionDamage Structure	ERODP1SSTR	Erosion/Pile16/SF/Structure	100	0.0342	0.046	0.057
ErosionDamage Structure	ERO-DPILE-3STORY-STR	Erosion/Pile/Structure/MFR3/COMM3/CSDW function ERODP3MSTR	0	0	0	0
ErosionDamage Structure	ERO-DPILE-3STORY-STR	Erosion/Pile/Structure/MFR3/COMM3/CSDW function ERODP3MSTR	10	0.0011	0.0015	0.0018

ErosionDamage Structure	ERO-DPILE-3STORY-STR	Erosion/Pile/Structure/MFR3/COMM3/CSDW function ERODP3MSTR	20	0.0023	0.0031	0.0038
ErosionDamage Structure	ERO-DPILE-3STORY-STR	Erosion/Pile/Structure/MFR3/COMM3/CSDW function ERODP3MSTR	30	0.0036	0.0048	0.006
ErosionDamage Structure	ERO-DPILE-3STORY-STR	Erosion/Pile/Structure/MFR3/COMM3/CSDW function ERODP3MSTR	40	0.005	0.0067	0.0083
ErosionDamage Structure	ERO-DPILE-3STORY-STR	Erosion/Pile/Structure/MFR3/COMM3/CSDW function ERODP3MSTR	50	0.0065	0.0087	0.0109
ErosionDamage Structure	ERO-DPILE-3STORY-STR	Erosion/Pile/Structure/MFR3/COMM3/CSDW function ERODP3MSTR	60	0.0081	0.0108	0.0136
ErosionDamage Structure	ERO-DPILE-3STORY-STR	Erosion/Pile/Structure/MFR3/COMM3/CSDW function ERODP3MSTR	70	0.0099	0.0131	0.0164
ErosionDamage Structure	ERO-DPILE-3STORY-STR	Erosion/Pile/Structure/MFR3/COMM3/CSDW function ERODP3MSTR	80	0.0117	0.0156	0.0195
ErosionDamage Structure	ERO-DPILE-3STORY-STR	Erosion/Pile/Structure/MFR3/COMM3/CSDW function ERODP3MSTR	90	0.0136	0.0181	0.0227
ErosionDamage Structure	ERO-DPILE-3STORY-STR	Erosion/Pile/Structure/MFR3/COMM3/CSDW function ERODP3MSTR	100	0.0156	0.0209	0.0261
ErosionDamage Structure	ERO-DUNEWALK-STR	Dunewalk Damage Function	0	0	0	0
ErosionDamage Structure	ERO-DUNEWALK-STR	Dunewalk Damage Function	50	0	0.5	1
ErosionDamage Structure	ERO-DUNEWALK-STR	Dunewalk Damage Function	100	0.5	1	1
ErosionDamage Structure	EROPILESTR	Erosion/Pile/Structure	0	0	0	0
ErosionDamage Structure	EROPILESTR	Erosion/Pile/Structure	10	0.05	0.2	0.25
ErosionDamage Structure	EROPILESTR	Erosion/Pile/Structure	20	0.06	0.4	0.6
ErosionDamage Structure	EROPILESTR	Erosion/Pile/Structure	30	0.08	0.6	1
ErosionDamage Structure	EROPILESTR	Erosion/Pile/Structure	40	0.1	0.8	1
ErosionDamage Structure	EROPILESTR	Erosion/Pile/Structure	50	0.17	1	1
ErosionDamage Structure	EROPILESTR	Erosion/Pile/Structure	60	0.32	1	1
ErosionDamage Structure	EROPILESTR	Erosion/Pile/Structure	70	0.47	1	1
ErosionDamage Structure	EROPILESTR	Erosion/Pile/Structure	80	0.6	1	1
ErosionDamage Structure	EROPILESTR	Erosion/Pile/Structure	90	0.7	1	1
ErosionDamage Structure	EROPILESTR	Erosion/Pile/Structure	100	0.8	1	1
ErosionDamage Structure	EROSHLSTR	Erosion/Slab/Structure	0	0	0	0
ErosionDamage Structure	EROSHLSTR	Erosion/Slab/Structure	10	0.05	0.2	0.25
ErosionDamage Structure	EROSHLSTR	Erosion/Slab/Structure	20	0.2	0.4	0.6
ErosionDamage Structure	EROSHLSTR	Erosion/Slab/Structure	30	0.3	0.6	1
ErosionDamage Structure	EROSHLSTR	Erosion/Slab/Structure	40	0.5	0.8	1
ErosionDamage Structure	EROSHLSTR	Erosion/Slab/Structure	50	0.7	1	1

ErosionDamageStructure	EROSHLSTR	Erosion/Slab/Structure	60	0.8	1	1
ErosionDamageStructure	EROSHLSTR	Erosion/Slab/Structure	70	0.9	1	1
ErosionDamageStructure	EROSHLSTR	Erosion/Slab/Structure	80	1	1	1
ErosionDamageStructure	EROSHLSTR	Erosion/Slab/Structure	90	1	1	1
ErosionDamageStructure	EROSHLSTR	Erosion/Slab/Structure	100	1	1	1
InundationDamageContents	1SNBC	Inundation/All	-2	0	0	0
InundationDamageContents	1SNBC	Inundation/All	-1	0.0215	0.0625	0.1125
InundationDamageContents	1SNBC	Inundation/All	0	0.087	0.125	0.1975
InundationDamageContents	1SNBC	Inundation/All	1	0.16475	0.2175	0.2825
InundationDamageContents	1SNBC	Inundation/All	2	0.2425	0.305	0.3675
InundationDamageContents	1SNBC	Inundation/All	3	0.325	0.3875	0.45
InundationDamageContents	1SNBC	Inundation/All	4	0.395	0.4625	0.53
InundationDamageContents	1SNBC	Inundation/All	5	0.4625	0.5325	0.6075
InundationDamageContents	1SNBC	Inundation/All	6	0.5175	0.5975	0.6775
InundationDamageContents	1SNBC	Inundation/All	7	0.575	0.6575	0.74
InundationDamageContents	1SNBC	Inundation/All	8	0.625	0.71	0.795
InundationDamageContents	1SNBC	Inundation/All	9	0.67	0.7575	0.845
InundationDamageContents	1SNBC	Inundation/All	10	0.7125	0.8	0.8875
InundationDamageContents	1SNBC	Inundation/All	11	0.7475	0.835	0.9225
InundationDamageContents	1SNBC	Inundation/All	12	0.78	0.8675	0.955
InundationDamageContents	1SNBC	Inundation/All	13	0.8025	0.89	0.9775
InundationDamageContents	1SNBC	Inundation/All	14	0.8685	0.94	1
InundationDamageContents	1SNBC	Inundation/All	15	0.934	1	1
InundationDamageContents	1SNBC	Inundation/All	16	1	1	1
InundationDamageStructure	1-STR-NULL	NULL	1	0	0	0
InundationDamageStructure	FLD-0-3STORY-STR	Inundation/Structure/All structures up to 3 stories/CSDW function INUNALLSTR	-2	0	0	0
InundationDamageStructure	FLD-0-3STORY-STR	Inundation/Structure/All structures up to 3 stories/CSDW function INUNALLSTR	-1	0	0.02	0.03
InundationDamageStructure	FLD-0-3STORY-STR	Inundation/Structure/All structures up to 3 stories/CSDW function INUNALLSTR	0	0.09	0.1	0.12
InundationDamageStructure	FLD-0-3STORY-STR	Inundation/Structure/All structures up to 3 stories/CSDW function INUNALLSTR	1	0.14	0.28	0.41
InundationDamageStructure	FLD-0-3STORY-STR	Inundation/Structure/All structures up to 3 stories/CSDW function INUNALLSTR	2	0.22	0.38	0.47

InundationDamageStructure	FLD-0-3STORY-STR	Inundation/Structure/All structures up to 3 stories/CSDW function INUNALLSTR	3	0.27	0.43	0.53
InundationDamageStructure	FLD-0-3STORY-STR	Inundation/Structure/All structures up to 3 stories/CSDW function INUNALLSTR	4	0.29	0.46	0.54
InundationDamageStructure	FLD-0-3STORY-STR	Inundation/Structure/All structures up to 3 stories/CSDW function INUNALLSTR	5	0.3	0.56	0.73
InundationDamageStructure	FLD-0-3STORY-STR	Inundation/Structure/All structures up to 3 stories/CSDW function INUNALLSTR	6	0.4	0.59	0.73
InundationDamageStructure	FLD-0-3STORY-STR	Inundation/Structure/All structures up to 3 stories/CSDW function INUNALLSTR	7	0.43	0.61	0.73
InundationDamageStructure	FLD-0-3STORY-STR	Inundation/Structure/All structures up to 3 stories/CSDW function INUNALLSTR	8	0.44	0.63	0.73
WaveDamageContents	WAVENPC	Waves/Slab	0	0	0	0
WaveDamageContents	WAVENPC	Waves/Slab	0.5	0.00055	0.02045	0.0361
WaveDamageContents	WAVENPC	Waves/Slab	1	0.006	0.038	0.058
WaveDamageContents	WAVENPC	Waves/Slab	1.5	0.01235	0.05525	0.0791
WaveDamageContents	WAVENPC	Waves/Slab	2	0.0196	0.0722	0.0994
WaveDamageContents	WAVENPC	Waves/Slab	2.5	0.02775	0.08885	0.1189
WaveDamageContents	WAVENPC	Waves/Slab	3	0.0368	0.1052	0.1376
WaveDamageContents	WAVENPC	Waves/Slab	3.5	0.04675	0.12125	0.1555
WaveDamageContents	WAVENPC	Waves/Slab	4	0.0576	0.137	0.1726
WaveDamageContents	WAVEPC	Waves/Pile	0	0	0	0
WaveDamageContents	WAVEPC	Waves/Pile	0.5	0.01235	0.05525	0.0791
WaveDamageContents	WAVEPC	Waves/Pile	1	0.0196	0.0722	0.0994
WaveDamageContents	WAVEPC	Waves/Pile	1.5	0.02775	0.08885	0.1189
WaveDamageContents	WAVEPC	Waves/Pile	2	0.0368	0.1052	0.1376
WaveDamageContents	WAVEPC	Waves/Pile	2.5	1	1	1
WaveDamageContents	WAVEPC	Waves/Pile	3	1	1	1
WaveDamageStructure	WAVENPS	Waves/Slab	0	0	0	0
WaveDamageStructure	WAVENPS	Waves/Slab	0.5	0.2	0.33	0.5
WaveDamageStructure	WAVENPS	Waves/Slab	1	0.4	0.66	1
WaveDamageStructure	WAVENPS	Waves/Slab	1.5	0.6	1	1
WaveDamageStructure	WAVENPS	Waves/Slab	2	0.8	1	1
WaveDamageStructure	WAVENPS	Waves/Slab	2.5	0.9	1	1
WaveDamageStructure	WAVENPS	Waves/Slab	3	1	1	1
WaveDamageStructure	WAVENPS	Waves/Slab	3.5	1	1	1

WaveDamageStructure	WAVENPS	Waves/Slab	4	1	1	1
WaveDamageStructure	WAVEPS	Waves/Pile	-2	0	0	0
WaveDamageStructure	WAVEPS	Waves/Pile	-1.5	0.02	0.1	0.2
WaveDamageStructure	WAVEPS	Waves/Pile	-1	0.02	0.1	0.22
WaveDamageStructure	WAVEPS	Waves/Pile	-0.5	0.1	0.15	0.22
WaveDamageStructure	WAVEPS	Waves/Pile	0	0.15	0.2	0.3
WaveDamageStructure	WAVEPS	Waves/Pile	0.5	0.3	0.43	0.6
WaveDamageStructure	WAVEPS	Waves/Pile	1	0.5	0.76	1
WaveDamageStructure	WAVEPS	Waves/Pile	1.5	0.8	1	1
WaveDamageStructure	WAVEPS	Waves/Pile	2	0.9	1	1
WaveDamageStructure	WAVEPS	Waves/Pile	2.5	1	1	1
WaveDamageStructure	WAVEPS	Waves/Pile	3	1	1	1
WaveDamageStructure	Wav-Pile-Highrise3-str	Waves/highrise	-1	0	0	0
WaveDamageStructure	Wav-Pile-Highrise3-str	Waves/highrise	-0.5	0	0	0
WaveDamageStructure	Wav-Pile-Highrise3-str	Waves/highrise	1	0.0013	0.0023	0.0025
WaveDamageStructure	Wav-Pile-Highrise3-str	Waves/highrise	1.5	0.00275	0.004953	0.006175
WaveDamageStructure	Wav-Pile-Highrise3-str	Waves/highrise	2	0.0043	0.00736	0.0098
WaveDamageStructure	Wav-Pile-Highrise3-str	Waves/highrise	2.5	0.00595	0.009813	0.013375
WaveDamageStructure	Wav-Pile-Highrise3-str	Waves/highrise	3	0.0077	0.01231	0.0169
WaveDamageStructure	Wav-Pile-Highrise3-str	Waves/highrise	3.5	0.00955	0.014853	0.020375
WaveDamageStructure	Wav-Pile-Highrise3-str	Waves/highrise	4	0.0115	0.012744	0.0238
WaveDamageStructure	Wav-Pile-Highrise3-str	Waves/highrise	4.5	0.01795	0.025473	0.027175
WaveDamageStructure	Wav-Pile-Highrise3-str	Waves/highrise	5	0.0157	0.02275	0.0305
WaveDamageStructure	WAV-STR-NULL	NULL	1	0	0	0