Final General Reevaluation Report
and
Final Environmental Impact Statement

on

Hurricane Protection and Beach Erosion Control

WEST ONSLOW BEACH AND NEW RIVER INLET (TOPSAIL BEACH), NORTH CAROLINA

Appendix B

Economic Analysis

Appendix B: Economic Analysis

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1.0 INTRODUCTION.

The total economic impact area for Topsail Beach is significant in size. All of Topsail Island is important because of the transportation system. Residents and visitors must cross over one of two bridges over the Atlantic Intracoastal Waterway (AIWW) to gain access to the Town of Topsail Beach. The first is a swing bridge that provides access near the center of Surf City and NC Highways 210 and 50. The second is a high-rise bridge crossing the AIWW in the northern section of North Topsail Beach for NC Highway 210. The study area for hurricane and storm damage reduction, beach recreation use, and regional economic development (RED) are described in the sections below.

1.01 Hurricane and Storm Damage Study Area.

The town of Topsail Beach, North Carolina is subject to damages from hurricanes and storm related erosion. The study area was limited to the area approximately 500 feet from the shoreline. This area includes commercial and residential structures located on ocean front lots, as well as two or three rows beyond the shoreline. Streets, highways, and utilities are also included in the area threatened by flood, waves, storm erosion, and long-term erosion. The study area begins near New Topsail Inlet and covers a distance of about 4.5 miles, going the full length of the town's shoreline and ending near the Topsail Beach-Surf City town limits. The hurricane and storm damage study area is divided into "reaches" of approximately 1,000 feet as shown in Figure B-1.

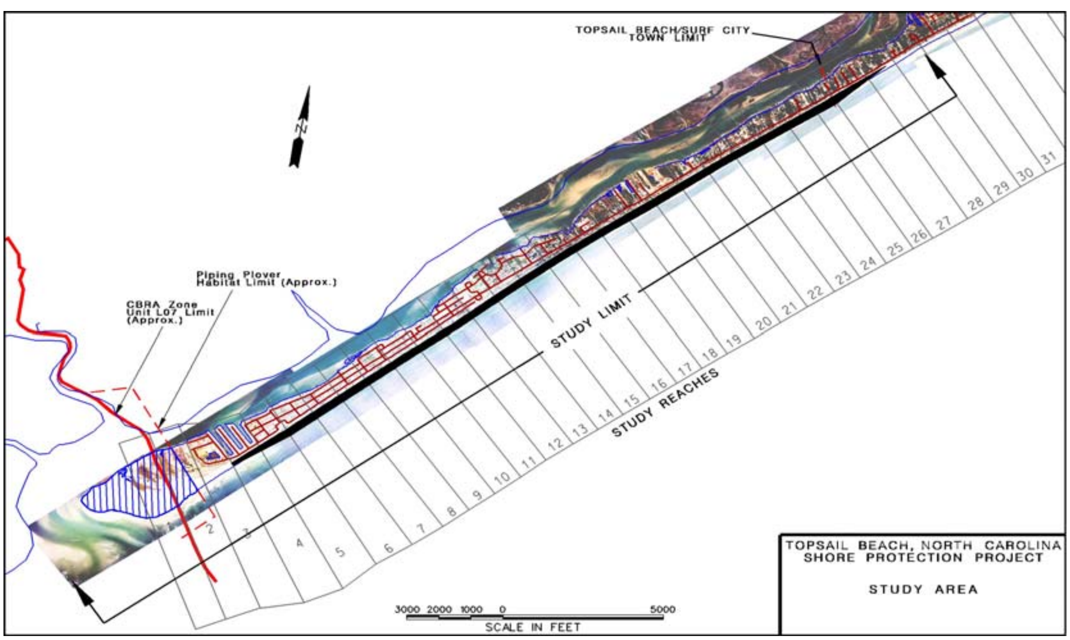


Figure B-1 Hurricane and Storm Damage Reduction Study Area

1.02 Recreation Day User Study Area

Overnight visitors come from as far away as 3,000 miles; however, the 45 counties listed in Table B-1 and shown in Figure B-2 were selected as being within a reasonable driving distance of Topsail Beach. The purpose of the survey of potential day users was to collect data that will show the frequency of visits and the total number of trips to Topsail Beach. It is expected that the analysis will show that persons from nearby counties will visit more frequently than persons from the more distant counties.

Table B-1 - North Carolina Counties within Driving Distance of Topsail Beach, NC

Anson	Edgecombe	Martin	Robeson
Beaufort	Franklin	Montgomery	Sampson
Bertie	Granville	Moore	Scotland
Bladen	Greene	Nash	Stanly
Brunswick	Halifax	New Hanover	Vance
Carteret	Harnett	Northampton	Wake
Chatham	Hertford	Onslow	Warren
Columbus	Hoke	Orange	Washington
Craven	Johnston	Pamlico	Wayne
Cumberland	Jones	Pender	Wilson
Duplin	Lee	Pitt	
Durham	Lenoir	Richmond	

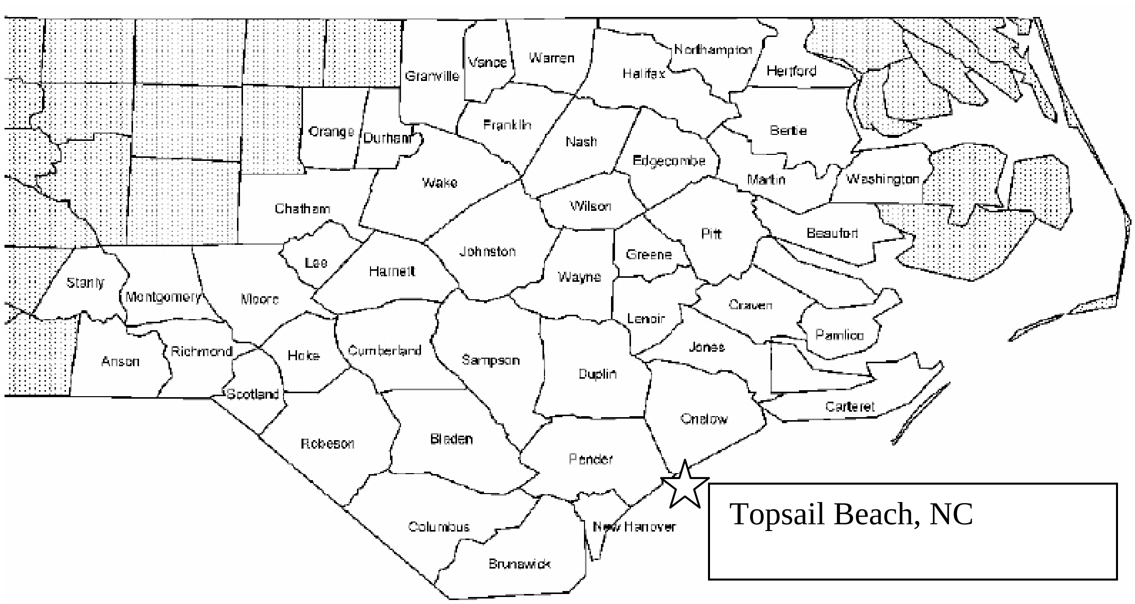


Figure B-2 – Recreation Demand Study Area

The recreation demand and methodology recommended for the beach user benefit analysis are presented in Appendix O –Recreation. According to the U. S. Census the population of the forty-five-county area grew from 3,036,000 in 1990 to 3,686,000 in 2000, an increase of more than 20 percent in the decade.

1.03 Regional Economic Impact Area

The local economic impact area includes all of Topsail Island and the nearby areas of both Pender County and Onslow County, North Carolina. Topsail Island includes not only Topsail Beach on the south end of the island but also Surf City and North Topsail Beach on the north end of Topsail Island. Highways 50 and 210 connect the island to the mainland portion of the two counties. The boundaries of Pender and Onslow counties are shown in Figure B-2.

2.0 EXISTING ECONOMIC CONDITIONS:

2.01 Basic Economic Assumptions

This study is in compliance with the evaluation procedures outlined in the Water Resource Council's Economic and Environmental Principles and Guidelines (P&G) for Water and Related Land Resources Implementation Studies, dated 10 March 1983, and Corps of Engineers policy guidance on shore protection, ER 1105-2-100, dated 22 April 2000. The following basic economic assumptions were used in the analysis of damages, benefits, and costs.

- **Interest rate.** The FY 2009 Federal interest rate is 4.625 percent.
- **Price level.** October 2008 price levels.
- **Period of Analysis.** The analysis is based on a 50-year period.

2.02 Demographics

Demographics for the existing economic conditions for the two-county study area include census data for population, housing, and personal income, which are shown in Table B-2. The full-time resident population was estimated to be nearly 500 in 2005. Estimates of peak season population vary. Topsail Beach 2005 Land Use Plan estimated a peak summer time population greater than 7,000 in 2000 and projected to increase to 9,355 by 2010.

Table B-2 - Population, Income, Housing Summary for 2000

	Pender County	**Onslow County**	**Town of Topsail Beach**
Population year-round (2000 census)	41,082	150,355	471
Population peak season (Estimated)			7,252
Ave. Household size	2.49	2.72	1.87
Housing Units	20,798	55,726	1,149
Occupied year-round	16,054	48,122	252
Seasonal or vacant	4,744	7,604	897
In Labor Force	19,087	85,054	209
Civilian	18,972	52,670	
Unemployed	1,076	3,650	
Armed Forces	115	32,384	
Employment by Leading Industry			
Construction	2,468	5,022	
Manufacturing	2,632	2,682	
Retail trade	2,367	7,496	
Education, health & social services	2,704	10,865	
Per capita & Household Income			
Per capita money income	$17,882	$14,853	$35,838
Median Household Income 1999	$35,902	$33,756	$55,750

Source: U.S. Census Bureau (http://factfinder.census.gov) and U.S. Dept. of Commerce – Bureau of Economic Analysis (http://bea.doc.gov/bea)
Estimated peak population from Topsail Beach 2005 Land Use Plan

2.03 Shoreline Ownership

Public ownership of the shore in the town of Topsail Beach includes dedicated roads and lands below mean high water (MHW) owned by the State of North Carolina. Other parcels are owned by the Town of Topsail Beach, including the following: Coastal Area Management Act (CAMA) public access points, ends of all roads, and six beach front parcels maintained for public use. The primary ownership of the 363 oceanfront parcels is private, including one fishing pier. Other information related to ownership of the shoreline is contained in Appendix M - Real Estate.

2.04 Commercial and Recreational Fishing

The North Carolina Division of Marine Fisheries (NCDMF) reported nearly 600,000 pounds of commercial finfish and shellfish landings in the vicinity of New Topsail Inlet in both 2003 and 2004. Significant shellfish landings included over 200,000 pounds reported from Hampstead and over 100,000 pounds reported from Surf City in 2003. Finfish landings reported from Hampstead exceeded 100,000 pounds in both 2003 and 2004. The commercial value of all finfish and shellfish landings reported in the vicinity of New Topsail Inlet was nearly $800,000 in both 2003 and 2004.

Recreational fishing includes fishing from head boats, charter boats, private boats, piers, and the surf. Fishing from head boats is best in the winter months for snapper and grouper. Fishing from charter boats is excellent for King mackerel and bottomfish during the winter. Offshore, gulfstream species, like yellowfin tuna and Wahoo are available. Inside fishing has been successful for inshore species such as red drum, speckled trout, and flounder.

Private boat anglers can find bluefin tuna in the nearshore area, king mackerel and other bottomfish species in the offshore, and other species such as speckled trout, red drum, and flounder can be found in the inside areas of the creeks and Atlantic Intracoastal Waterway. NCDMF reports that shore fishing activity will be limited in this area.

2.05 Development Added to Existing Condition

The without project structure inventory assumes typical residential structures are built on the 30 suitable vacant first row lots and 127 second-row lots. Based on the established building patterns and the coastal North Carolina real estate market trends, it is expected that these structures will be built by 2012.

The typical residential structure presently constructed on Topsail Island has the following characteristics: two-story, approximately 2,100 square feet of heated space, built on a piling foundation, and includes no more than a small enclosure on the ground level to provide a staircase or elevator for access.

The value of these additional 157 structures is about $294,000 each, totaling approximately $46.2 million. This value is based on a typical residential structure of 2,100 square feet and a construction cost of $140.00 per square foot. It is also assumed that all these structures will meet building codes for piling depth and first-floor elevation. This assumption is consistent with the 2005 Topsail Beach Land Use Plan, which states that the primary type of development over the next ten years will be residential, principally to in-fill on existing lots.

2.06 Storm Related Emergency Costs

Information was collected from the officials of the town, Pender County, state, and federal sources following recent hurricanes and storms. This information indicates that preventable emergency costs would be approximately $87,000 annually.

Emergency costs prevented refer to expected annual expenditures that residents and governments are experiencing under the without project condition that a project would preclude. Other damages prevented include storm damages that are not covered under the National Flood Insurance Program, but represent financial drains on public and private storm victims that could be prevented. The items in this benefit category called emergency costs and other damages prevented include (1) beach scraping/pushing; (2) sandbagging: (3) emergency costs incurred by the North Carolina Department of Transportation; (4) damages to public property like water and electric utility distribution systems and public access walkways; (5) damages to private property other than structures and contents such as walkways, driveways, and cleanup costs; and, (6) post-storm recovery expenses and storm related expenses from increased police patrolling, inspections, and permits. These categories are described in detail below:

2.06.1 Beach Scraping/pushing

Beach scraping/pushing refers to the practice of bull dozing a short dune or small berm in front of a residence or business so that it might offer some measure of protection from erosion. These costs are based on a bulldozer and operator pushing sand during two or three low tides. The practice requires a permit, and these records were used to help quantify these expenditures as project benefits. A large shore protection project would prevent the owners of the residence or business from incurring this expense. Figures B-3 and B-4 show scraping and pushing after hurricane Fran at Topsail Beach in 1996.


Figure B- 3 - Post storm Beach Scraping – Emergency Costs


Figure B-4 - Beach scraping following Hurricane Fran

2.06.2 Sandbagging Structures

Sandbagging structures is another emergency measure that has been fairly commonplace over recent years in this area. An example of sandbagging is shown in Figure B-5. This requires a permit that is only granted if the property is in eminent danger of being lost to erosion.

Figure B-5 - Sandbags in place but threatened February 2005.

2.06.3 NCDOT Emergency Costs

Emergency costs incurred by the North Carolina Department of Transportation (NCDOT) represent the average costs to NCDOT for removing sand from the ocean front roads in the study area following the storms. Bulldozers push the sand overwashed from the storms off the roads and deposit it between the ocean front structures. From there, private home and business owners must pay to have the sand redistributed in front of their properties.

2.06.4 Damage to Public Property

Damages to public property include things like damages to the water and electric utility distribution systems, and public access walkways, bath houses, and parking lots. Since traditional structural and content damage curves do not apply to these types of damages, this damage prevented category is based on interviews with public works officials concerning storm related damages that could have been prevented by a large shore protection project.

2.06.5 Damage to Other Private Property

Damages to private property other than structures and contents include storm damages that are not covered under the National Flood Insurance Program. These include things like water damage to private walkways, driveways, steps, landscaping, automobiles, and private cleanup costs. By preventing ocean overwashes, a large shore protection project would prevent a significant portion of these damages.

2.06.6 Post Storm Recovery Costs

Preventable post-storm recovery expenses are based on data from interviews with public officials regarding preventable debris removal costs incurred over a five-years-period of storms, and storm related expenses from increased police patrolling, inspections, and permits.

2.07 Determination of Structure Values

The value of residential structures is limited to replacement cost less depreciation. Replacement value is the maximum cost to the owner if a structure is destroyed. If a significantly depreciated structure is destroyed and replaced, the difference between the old and new value is a betterment where the additional cost is offset by the additional utility and comfort of the new construction. Other measures of property value include fair market value and the income producing value. These measures are not considered appropriate for National Economic Development benefits to protection of beach property. Fair market value is influenced by proximity to the ocean or sound, corresponding views of the beach and ocean, and short-term fluctuations in the local real estate market. Basing value on income can also produce significantly higher estimates. It is assumed that rental income lost to the owner will be transferred to some other owner in an alternate location. Therefore, the loss of income is considered a regional economic loss and not a loss to the National Economic Development account.

2.07.1 Cost of Residential Construction.

The average cost of residential construction on Topsail Island was determined according to the quality of initial construction. Three quality levels were discussed with local homebuilders. The economy level of quality was estimated to cost $130.00 per heated square foot. Average quality costs approximately $140.00 per square foot. Custom quality costs approximately $190.00 per square foot. No structure was assigned a greater value regardless of the quality. The square footage areas for most structures were available at the Pender County tax office.

2.07.2 Commercial Structure Values.

Values for commercial structures were based on visual surveys and talking to some business managers and owners. Pender County tax data was also used for comparison.
HDR Engineering, Inc. of the Carolinas was contracted to perform additional field inspections and estimated the value of the most significant commercial structures. The contractor also talked to local realtors and town officials with expert knowledge of the structure values.

For example, HDR talked to representatives of Sea Vista Motelominium located in Reach 5 and collected the following information. It was determined that the two structures were built about 1971. The smaller building consist of an office and manager's living quarters on the first floor and two living rental units on the second floor. The larger building contains 18 units with 210 square feet, 6 units with 325 square feet, and 8 units with 415 square feet, for a total of 32 units valued at approximately $1,337,000 for the structures and $585,000 for contents

The Jolly Roger Pier and Inn complex located in Reach 12 consists of a pier, office, and snack bar. The pier is 850 feet in length and is attached to a 2,600-square-foot building. The first building north of the pier is approximately 60 feet by 100 feet and contains a total of 19 room including suites and singles. This building is approximately 50 years old and constructed of concrete block. The next three buildings north of the pier appear to be a single structure but are only connected by a common walkway. There are a total of 47 rooms including suites and singles. Dimensions of the three structures were estimated in feet to be 30 by 160, 30 by 140, and 30 by 145. The observed condition was considered to be good, with an age of 25 years, and consists of wood frame construction.

The Ocean Pier Inn is about 50 years old, located in Reach 12, and considered to be in poor condition. The primary building consists of an office and 15 rental units and has a large deck facing the ocean. The next building south consists of a concrete block garage approximately 12 feet by 45 feet connected to a building with 30 feet by 45 feet dimensions constructed of concrete block and wood. This interior of this structure was renovated in 2003.

The value of the Queens Grant Condominiums located in Reach 19 was based on an average replacement cost of $250,000 per unit after subtracting $5 million for the land. There are a total of 43 condominium units in the Queens Grant development.

Hedgecock Builders Supply consists of one large (15,400 square feet) building located in Reach 11 and a large fenced in material storage yard. Approximately 2,500 square feet of the building is the sales office and tool showroom. The remaining 12,900 square feet of building space houses plumbing supplies, electrical supplies, and a substantial inventory of treated and untreated lumber.

The exterior storage area contains mostly large dimension treated pilings and other large wood products. The age of the structure is approximately 50 years and the condition is judged as fair. The value of the Hedgecock Builders Supply inventory is estimated to be no less than $1 million.

2.07.3 Value of Structures by Reach

The value of structures within the hurricane and storm damage study area is estimated to be $192,218,000 with a total value, including contents, estimated at $270,663,000. The value of structures by reach is shown in Table B-3. The estimated value of residential and commercial contents is discussed in paragraph 5.08.3 under the topic Variables Specific to Structure File. The structure inventory also includes 27 road segments, primarily NC Highway 50, generally one segment for each reach, with Reach 13 has 3 segments including the perpendicular streets.

Table B-3 – Value of Structures by Reach, October 2008 price level

Reach	Structure Value	Content Value	Total Value	Structure Count	Percent by Reach
3.1	$1,985,000	$760,000	$3,970,000	7	1.01%
3.2	$3,659,000	$1,463,000	$7,318,000	15	1.89%
4	$5,383,000	$2,108,000	$10,766,000	28	2.77%
5	$5,090,000	$2,050,000	$10,180,000	19	2.64%
6	$7,162,000	$2,824,000	$14,324,000	27	3.69%
7	$7,642,000	$3,010,000	$15,284,000	36	3.94%
8	$7,847,000	$3,090,000	$15,694,000	35	4.04%
9	$6,654,000	$2,616,000	$13,308,000	33	3.42%
10	$8,140,000	$4,328,000	$16,280,000	39	4.61%
11	$8,377,000	$3,305,000	$16,754,000	35	4.32%
12	$8,001,000	$3,223,000	$16,002,000	33	4.15%
13	$8,257,000	$4,459,000	$16,514,000	30	4.70%
14	$7,592,000	$2,991,000	$15,184,000	27	3.91%
15	$7,043,000	$2,774,000	$14,086,000	27	3.63%
16	$8,418,000	$3,414,000	$16,836,000	28	4.37%
17	$8,758,000	$3,541,000	$17,516,000	34	4.54%
18	$9,684,000	$3,828,000	$19,368,000	36	4.99%
19	$13,126,000	$5,205,000	$26,252,000	38	6.77%
20	$8,892,000	$3,511,000	$17,784,000	20	4.58%
21	$9,707,000	$3,844,000	$19,414,000	43	5.01%
22	$9,598,000	$3,794,000	$19,196,000	34	4.95%
23	$11,445,000	$4,532,000	$22,890,000	41	5.90%
24	$7,496,000	$2,953,000	$14,992,000	33	3.86%
25	$7,480,000	$2,946,000	$14,960,000	38	3.85%
26	$4,782,000	$1,876,000	$9,564,000	27	2.46%
Total	$192,218,000	$78,445,000	$270,663,000	763	100.00%

2.07.4 Value of Structures by Type

When the 27 road segments (Type 64) are excluded, there are a total of 763 structures in the structure damage database, including the 157 structures assumed to be added by 2011. There are 19 structure types, including roads, in the study area; however, only four structure types (Types 55, 56, 59, and 60) equal or exceed 10 percent of the total value. Single story residences on pilings with small or no enclosure (Type 55) account for 113 structures and 9.83 percent of the total inventory value. Two-story residences on pilings with small or no enclosure (Type 56), account for 287 structures and 45.72 percent, including the 157 structures assumed to be added by 2012. Figure B-6 shows four newly constructed type 56 structures. Types 59 (1-story) and 60 (2-story), on pilings with partial to full enclosures, account for 160 (15.69%) and 86 structures (15.06%) respectively.

Descriptions of the four predominant structure types follow in Table B-4. For the complete set of structure type definitions see attachment B-1. The value of structures in the study area is presented in Table B-5 by structure type. Table B-5 shows both the value and number of structures in each type.

Table B-4 – Description of Four Significant Structure Types

Structure Type	Description of Significant Structure Types	Number of Structures	Percent of Total Value
55	Residential – 1-story, raised on pilings, small or no enclosure	113	9.83 %
56	Residential – 2-story, raised on pilings, small or no enclosure	287	45.72 %
59	Residential - 1-story, raised on pilings – partial to full enclosure	160	15.69 %
60	Residential – 2-story, raised on pilings, partial to full enclosure	86	15.06 %
All other types	All other residential and commercial types	117	13.70 %

Figure B- 6 - Four typical new structures (all Type 56) built in 2004 on Topsail Island, NC

Figure B- 7 - Ocean front hotel at Topsail Beach aerial view following Hurricane Bonnie 1998. Note dune scraping following emergency.

Table B-5 – Value of Structures by Type, October 2008 price level

Type	Units	Structure Value	Contents	Total	% of Value	Ave. / Struct.
1	27	$2,964,000	$1,186,000	$4,150,000	1.53%	$109,800
2	44	$9,634,000	$3,853,000	$13,487,000	4.98%	$219,000
4	1	$96,000	$39,000	$135,000	0.05%	$96,000
13	1	$18,000	$7,000	$25,000	0.01%	$18,000
16	11	$2,613,000	$2,173,000	$4,786,000	1.77%	$237,500
20	1	$362,000	$780,000	$1,142,000	0.42%	$362,000
21	1	$60,000	$21,000	$81,000	0.03%	$60,000
24	2	$40,000	$15,000	$55,000	0.02%	$20,000
33	8	$3,177,000	$1,501,000	$4,678,000	1.73%	$397,100
38	1	$443,000	$733,000	$1,176,000	0.43%	$443,000
41	1	$181,000	$95,000	$276,000	0.10%	$181,000
45	6	$106,000	$53,000	$159,000	0.06%	$17,700
53	1	$125,000	$50,000	$175,000	0.06%	$125,000
55	113	$19,004,000	$7,602,000	$26,606,000	9.83%	$168,200
56	287	$88,390,000	$35,356,000	$123,746,000	45.72%	$308,000
57	7	$1,761,000	$704,000	$2,465,000	0.91%	$251,600
59	160	$30,337,000	$12,135,000	$42,472,000	15.69%	$189,600
60	86	$29,111,000	$11,644,000	$40,755,000	15.06%	$338,500
61	5	$1,135,000	$454,000	$1,589,000	0.59%	$227,000
64	27	$2,659,000	$46,000	$2,705,000	1.00%	$98,500
Total	790	$192,218,000	$78,445,000	$270,663,000	100.00%	

2.08 Land Values

Land values in all North Carolina coastal counties are escalating in general due to increased population growth in the U.S. coastal regions. Lot sales in the Topsail Island portions of Pender and Onslow counties are designated as ocean front, second row, and interior lots. To prevent the influence of water view or proximity to the ocean overriding the value, only the interior lot values are used in the analysis. Following hurricane Ophelia in 2005, the town requested approval from FEMA to haul in approximately 22,000 cubic yards (29,000 tons) of sand to distribute over 7,000 linear feet of beach. This is not considered a long term solution or effective measure against long term erosion or hurricane and storm damage. Therefore, it is not practical to equate the cost of fill to the land value lost due to long term erosion. Refer to ER1105-2-100 Appendix E "Civil Works Missions and Evaluation Procedures" SECTION IV – Hurricane and Storm Damage Prevention, para. E-24.f.(2),(f) page E-138.Specific Policies.

"Anticipated damages from land loss due to erosion are computed as the market value of the average annual area expected to be lost. Nearshore land values are used to estimate the value of land lost."

Should first row ocean front lot values be used? SAW does not typically use first or second row values. Specifically at Topsail Beach, lot sales beyond the first and second row or “interior” lots were used. Benefits to prevention of long-term erosion would be higher early in the period of analysis and higher in economic value based on standard discounting of future values to present worth amounts. Losses are computed based on the long term average erosion rates determined by coastal engineer’s examination of the available historical data. Short term losses are assumed to be recoverable through natural shore processes and emergency beach fill or scraping to the extent storm specific losses exceed the long term average annual erosion rates. By limiting land losses to the average annual erosion rate we address the concern that we may overstate land loss damages.

First row lots are estimated to have a value of $70.00 per square foot; therefore, using the present methodology, the land loss prevention benefits would exceed $2.2 million using the first row values.

Second row lost are estimated to have a value of $60.00 per square foot. Using the present methodology and second row values the average annual land loss prevention benefits would equal $1.9 million or 20 percent greater than the proposed method presented in this economic analysis.

Simplification of the assumptions is reasonable since initially 1st row values are the highest on the beach and later at some unknown time the lot can become “unbuildable” using the current CAMA criteria for building setbacks. The analysis does not try to predict the point in time that the lot becomes unbuildable and therefore less valuable.

A summary of values for ocean front lots, second row lots, and interior lots is presented below.

2.08.1 Ocean front lots

Ocean front lots are higher in risk for storm damage and erosion but continue to be highly desirable. Three oceanfront lots sold for prices between $60.00 and $92.00 per square foot in 2005 and 2006. These values averaged $72.00 per square foot but were not used in the land loss estimates.

2.08.2 Second row lots

Only six second row lots were sold in Topsail Beach during 2005 and 2006 ranging from $44.00 to $91.00 per square foot. The average value per square foot based on lots sold was $61.00.

2.08.3 Interior lots

The value and desirability of interior lots vary greatly; however, values based on sold prices, continue to increase. Higher interior lot values may be due to the limited number of all vacant lots in Topsail Beach and the fact that interior lots are less susceptible to storm and erosion damages. This data supports the estimated value of $50.00 per square foot, October 2008 prices. Interior lot values are used to estimate the losses to land caused by long-term erosion. Sales data for interior lots is shown in Figure B-8.

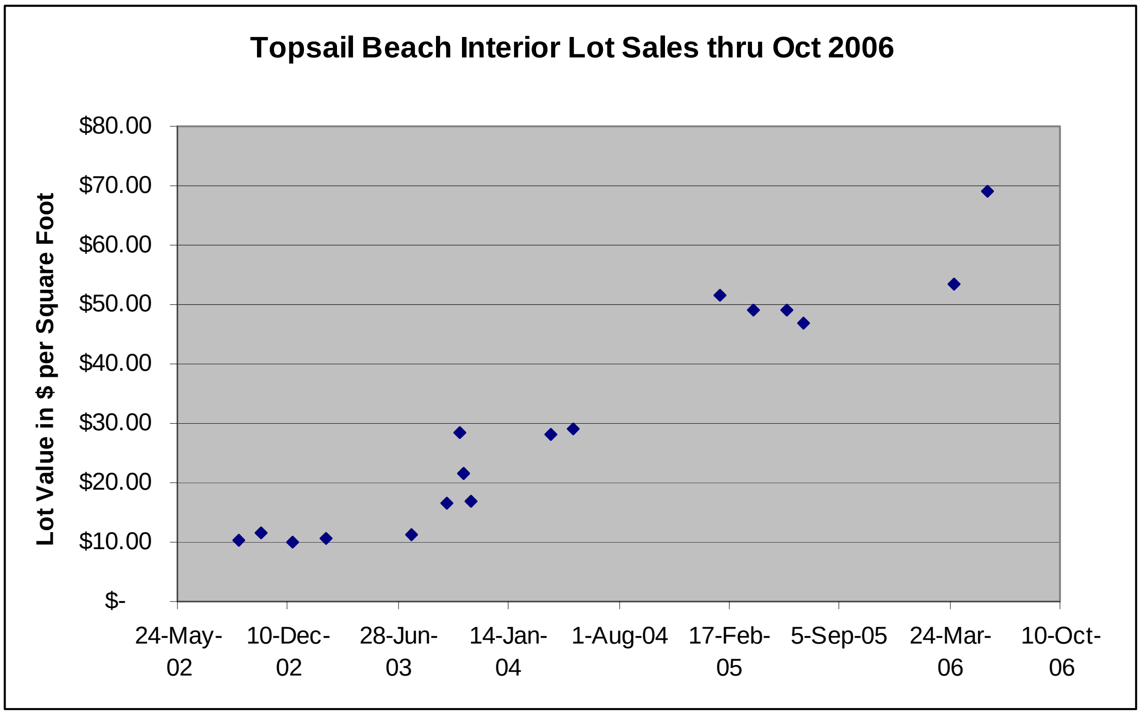


Figure B- 8 - Interior Lot Sales in Dollars per Square Foot

3.0 FUTURE ECONOMIC CONDITIONS (WITHOUT PROJECT)

3.01 Projected Population Growth

Projected population growth for Pender and Onslow counties are found at the North Carolina State Demographer's website. Figure B-9 shows both historical population from 1920 to 2000 and population projections for Pender and Onslow counties through 2029. Since all suitable lots are expected to be developed by the base year 2012, no additional growth in the number of residential or commercial structures is projected for the analysis. The assumptions used for structure replacement could result in fewer structures if storms destroyed a structure following its earlier replacement.

According to the North Carolina demographics office, the population of this 45-county recreation day user demand area is expected to reach 4.3 million in 2010, 5.0 million in 2020, and over 5.6 million in 2029. Therefore it is reasonable to expect recreation visitation at Topsail Beach to increase over the next 25 to 50 years. Projected seasonal peak population for Topsail Beach is estimated to reach 8,300 in 2005 and 9,350 in 2010 based on the Topsail Beach 2005 Land Use Plan.

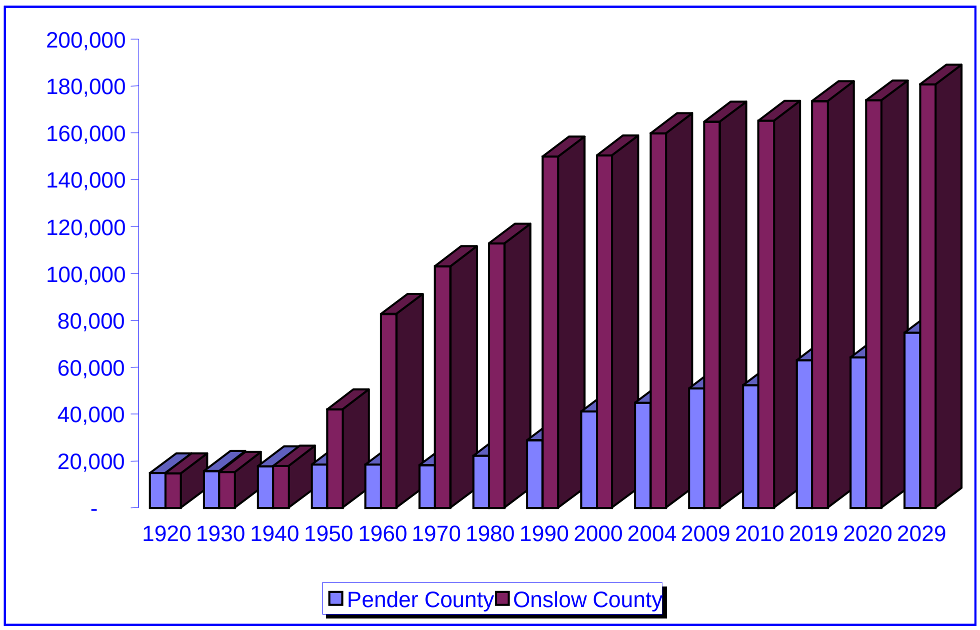


Figure B- 9 – Population Growth - Pender and Onslow Counties Actual 1920-2000 and Projected to-2029

<u>3.02 Assumed Conditions at beginning of Period of Analysis Without Project Condition</u>

The period of analysis begins when the project improvement is in place and the benefits to the public begin to accrue. It is assumed that this condition could occur by FY2012. All suitable vacant lots are expected to be developed by the base year in 2012; however, no additional growth in the number of residential or commercial structures is projected during the period of analysis. For the buildable lots to be developed by the base year 2012, an average of about 26 residential structures in the study area would be required per year. An analysis of building permits from January 2003 to October 2005 show that 92 single family structures were built and 1 multi-family structure for an average of 32 new structures per year not counting the multi-family units. North Carolina CAMA regulations preclude replacement of a structure only after the lot is deemed unbuildable when set back restrictions dictate that structures cannot be put back on the lot. 15A NCAC 07H .2501 allows for a great deal of latitude for meeting rebuilding criteria following damages due to hurricanes or tropical storms. Issuing emergency permits for rebuilding on lots meeting a minimal setback restriction is generally the rule, not the exception in North Carolina. Common practice and historical evidence allow for rebuilding structures lost in storms provided setback restrictions are met. However, the analysis presented in this report limits the number of replacements to one. After long-term erosion has claimed more distance on the oceanfront lot than the building requires to be put back, our storm damage model ceases to reinstate the same property. This assumption will prevent the overestimation of the without project hurricane and storm damages.

3.03 Assumed Replacement of Residential Structures During Period of Analysis

It is assumed that all structures replaced in the study area as a result of hurricane and storm erosion damages will be similar to the existing distribution of residential and commercial use.

It is assumed that residential structures removed by long-term erosion will not be replaced during the 50-year period of analysis. Likewise, it is assumed that residential structures destroyed by wave, flood, or storm erosion will be replaced in the economic damage model (GRANDUC) by a residential structure that meets the following building codes and standards in place by flood plain regulations. This includes a setback requirement of at least sixty feet from the established line of vegetation. A minimum lot depth of 100 feet is required to replace a structure. Because of uncertainty, a structure can be replaced only once in GRANDUC during the period of analysis. Replacement residential structures are assumed to have only parking, storage, and normal provision for access on the ground level. The first living floor will be elevated on pilings, well above the Base Flood Elevation or high enough to accommodate under-house parking, whichever is greater. Pilings for all first row replacement structures will be 16 feet below grade or 5 feet below mean sea level. These replacement structures are assumed to have the same characteristics as the typical house now being built on vacant lots (Figure B-6).

3.04 Assumed Replacement of Commercial Structures During Period of Analysis

Commercial structures that are replaced in the economic damage model during the period of analysis will be identical to the structure destroyed except for the first floor elevation. The first floor elevation of commercial structures will be set at ten feet above “ground” (on-grade) elevation. This assumption incorporates the enforcement of the damage reduction regulations including flood plain management and building codes now in force. When taken out, structure types 5-54 (flood damage curve numbers) are assumed to be replaced by the same type with the same value. These types include apartments (type 5), hotels (type 27), and motels (type 33), Condominiums are assigned to one of these three types. It is assumed that commercial or multi-family zoning will remain the same for the replacement structures.

3.05 Summary of Future Without Project Economic Conditions

In summary, the future economic conditions are assumed to have the same distribution of residential use and commercial development as the existing condition. Structures that are significantly damaged or destroyed are assumed to be replaced by more damage-resistant structures of the same type but replaced no more than one time. All structures not damaged or destroyed are assumed to remain without any modification. No “teardowns” are built into the analysis where older structures are assumed to be torn down/demolished and replaced by more expensive units based on investment speculation related to the high demand for coastal real estate.

4.0 HURRICANE AND STORM DAMAGES WITHOUT PROJECT

The accumulated present value of hurricane and storm damages over the 50-year period of analysis without a damage reduction project totals $179,807,000 in October 2008 price levels. These damages are shown by damage category and reach segment in Table B-6. Average annual damages (average annual equivalent amounts, 50-yrs, 4.625 %) are calculated by using the 50-year interest and amortization factor as shown in Table B-7.

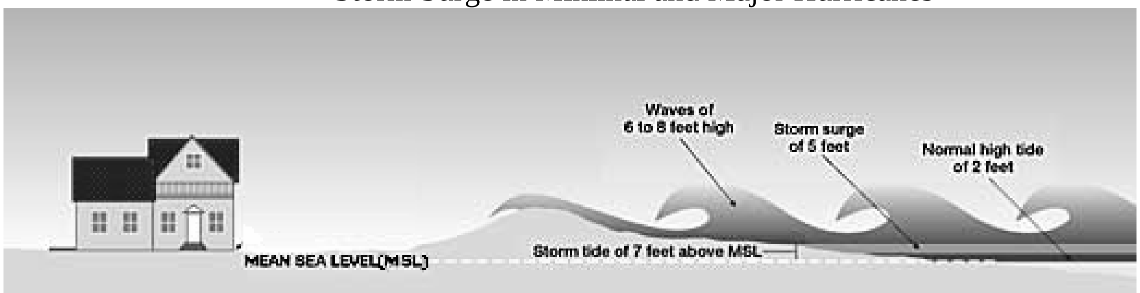
4.01 Damage Categories Defined

Figure B- 10 graphically shows the impact of tides, storm surge, and wave action during minimal and major hurricanes. (USACE, Mobile District, 1999). The present value of damages in each of the four damage categories is presented in Table B-6 and in Figure B-12. Hurricane and storm damages are calculated under with and without project conditions for damages to structures and contents, roadways, and land lost due to long-term erosion.

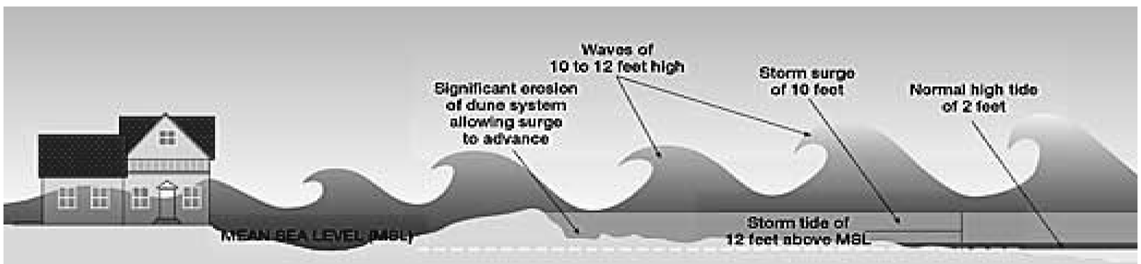
In many cases damages are calculated for more than one category since storms frequently generate flood inundation, waves, and storm erosion simultaneously.

The damage model, GRANDUC, calculates damages in all the appropriate categories and selects the category with the greatest damage and ignores the other damages. This technique prevents the overestimation or double counting of damages.

Storm Surge in Minimal and Major Hurricanes



In a Category I Hurricane, the storm surge will usually cause damage to beach dunes and structures placed on the seaward side of the dune line.



In a Category III Hurricane, the combined wave attack and storm surge erodes the dunes, exposing coastal structures to the most damaging effects of the surge. Although his wind speeds only placed Georges in Category II, the storm surge estimates were in line with Category III.

Courtesy of Escambia County Department of Public Safety.

Figure B-10 – Hurricane Surge and Wave Impacts

4.01 Damage Categories Defined (continued)

4.01.1 Storm Erosion

Storm erosion damages result from the undermining of structure pilings and foundations due to hurricane and tropical storms. Damages due to storm induced erosion are the major damages that are generally computed by the economic damage model. The first element in determining the potential impact of storm induced erosion on the amount of damage to a coastal structure is how much of the protective beach (either existing or projected) remains in front of and under the structure during the storm. If the storm induced erosion only reaches the front of the building, damage due to storm erosion is assumed to be zero and any damage to the structure would be that caused by either wave impact or inundation.

Earlier analyses for previous hurricane and storm damage studies along the coast of North Carolina, predicted that once the 0.5 foot point of erosion reaches the mid-point of the buildings supported on piles, all protective measures fronting the building have been removed exposing the building to the full brunt of the storm including direct wave impact and inundation. Due to the nature of the results obtained from the numerical storm erosion model (SBEACH), the landward extent of the impact of the storm erosion has been interpreted as the landward most point where the storm profile is 0.5 foot below the pre-storm profile. This particular standard for storm induced erosion or zone of influence was established by the developers of the SBEACH (Coastal & Hydraulics Laboratory formerly the Coastal Engineering Research Center) when the model was applied to the formulation of the storm damage reduction project for Panama City Beach, Florida.

The analysis of Topsail Beach is founded on using an erosion indicator of 2.0 feet for both the with and without project beach profiles. The 0.5 foot erosion indicator is used rarely and only for structures with slab foundations or roadbeds.

While the vertical scour around the ocean front piles may not cause the building to collapse, the open exposure caused by the storm induced erosion and lowering of the beach fronting the building is judged to be sufficient to result in complete loss of the economic value of the building even though the building may be left standing. The loss of the economic value of the building may come from the inability of the owner to reestablish a useable sewer system or obtain potable water. In these cases, the building will eventually have to be torn down. The damage associated with this condition has been broadly termed erosion damage, however, as demonstrated by the explanation provided above, the cause of the damage is not limited to erosion, rather it is due to the conditions created by the erosion that exposes the building to the maximum forces of the storm. A typical new structure on the ocean front is required to be built with piling depths 16 feet below the surface of the ground or 5 feet below mean sea level whichever is a greater depth. Oceanfront structures built prior to 1986 are assumed to have piling depths of 8 feet below the ground. The storm damage structure inventory includes 403 homes on short pilings (8-foot depth), 98 homes on long pilings (16-foot depth or –5 feet m.s.l.), and 71 homes on concrete slab foundations.

4.01.2 Flood

Flood damages are caused by inundation related to rises in tide and storm surge. Damages begin when flooding and overwash reaches the structure or enclosure.

4.01.3 Wave

Wave damages result from waves over and above the storm surge making contact with the structures. Waves impacting the structure three feet or more above the first living area elevation are expected to result in total loss of the structure. Figure B-10 illustrates the effect of both flood from storm surge and waves.

4.01.4 Land lost or Long Term Erosion (LTE)

Land losses result from long-term erosion based on the analysis of historical erosion including rises in sea level. Land lost to long-term erosion is computed by multiplying the expected annual loss of land in acres by the value of nearshore interior lots. Fill material was also considered to reduce land losses due to long-term erosion. However, in the formulation of alternative plans, no suitable upland borrow sites were identified. Therefore, the cost of fill is not considered a practical limiting factor or substitute for the value of interior lots in the calculation of land lost or long term erosion.

4.01.5 Summary of Damages

Examples of hurricane and storm erosion damage at Topsail Beach are shown in Figure B-11. The present value of hurricane and storm damages by damage category and reach is shown in table B-6 and figure B-12 for the without project condition.

Figure B-11 - Hurricane and storm damage after Hurricane Fran 1996

Table B-6 – Present Value of Hurricane and Storm Damages (Without Project)

TB BASE (Reaches 3A-26	Oct08 Costs	4.625%	Uncertainty)	#	
Reach	**Total Damage**	**Storm Erosion**	**Flood**	**Wave**	**Land/LTE**
31	$1,396,569	$79,568	$104,569	$959	$1,211,473
32	$2,669,528	$848,912	$109,400	$15,136	$1,696,080
4	$6,449,102	$3,009,979	$77,010	$831,221	$2,530,892
5	$9,388,847	$5,336,721	$114,182	$956,301	$2,981,643
6	$16,327,569	$11,871,208	$41,404	$664,479	$3,750,477
7	$14,946,068	$10,311,881	$134,973	$869,469	$3,629,745
8	$13,303,172	$9,177,056	$96,143	$657,638	$3,372,336
9	$11,189,482	$6,453,298	$97,928	$754,562	$3,883,694
10	$12,617,145	$9,345,976	$182,876	$1,188,247	$1,900,046
11	$4,617,021	$3,384,747	$66,576	$170,002	$995,696
12	$3,846,862	$2,705,169	$470,005	$182,579	$489,109
13	$2,616,522	$2,238,155	$141,072	$11,867	$225,429
14	$3,082,048	$2,682,966	$201,462	$1,579	$196,041
15	$5,582,326	$5,090,697	$253,995	$36,243	$201,391
16	$7,037,415	$6,743,233	$95,725	$3,296	$195,162
17	$3,353,841	$3,141,703	$14,774	$0	$197,364
18	$3,703,790	$3,424,893	$70,860	$9,837	$198,201
19	$11,775,801	$11,408,445	$109,013	$10,495	$247,849
20	$12,950,460	$12,708,913	$344	$0	$241,203
21	$4,856,764	$4,237,352	$412,441	$7,619	$199,351
22	$6,054,545	$5,846,119	$22,952	$0	$185,474
23	$6,096,121	$5,845,277	$39,018	$12,111	$199,715
24	$6,359,086	$6,136,548	$6,854	$8,203	$207,481
25	$5,130,022	$4,720,723	$110,875	$90,661	$207,764
26	$4,457,172	$4,099,760	$16,569	$65,717	$275,127
Totals	$179,807,279	$140,849,297	$2,991,018	$6,548,221	$29,418,743
round	$179,807,000	$140,849,000	$2,991,000	$6,548,000	$29,419,000

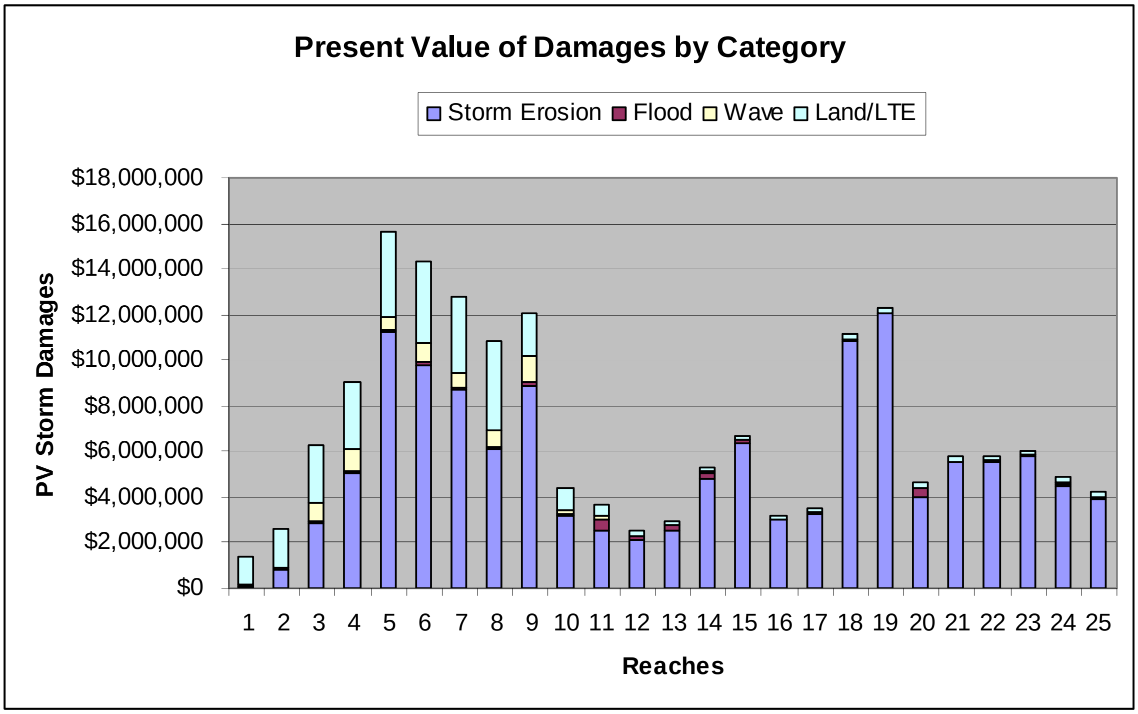


Figure B- 12 - Present Value of Hurricane and Storm Damages by Damage Category – Without Project Condition

Table B-7 – Average Annual Hurricane and Storm Damages (Without Project)

Average Annual Amount	Total Damages	Storm Erosion Damage	Flood	Wave	Land/LTE
R3.1 - 26	$9,284,000	$7,273,000	$154,000	$338,000	$1,519,000

5.0 ECONOMIC VARIABLES, ASSUMPTIONS, AND METHODOLOGY APPLIED IN HURRICANE AND STORM DAMAGE MODEL (GRANDUC)

In the Wilmington District Coastal Hurricane and Damage Model the economic input includes a set of general global data that applies to the entire analysis, the estimated base year when damage reduction measures could be in place, flood damage curves, erosion damage curves, miscellaneous benefits to be included, and the variable inputs for each structure in the structure inventory data base or structure file. More information on the General Risk and Uncertainty – Coastal model (GRANDUC) is presented in Appendix D Coastal Engineering.

5.01 General Global Data

Based on the general economic assumptions, the global values are as follows:

- Interest Rate –4- 5/8 percent.
- Price Level – October 2008 price level.
- Economic Period of Analysis – 50 years beyond the base year.
- Wave damage assumption – waves three feet above the first floor elevation will result in the total loss of the structure.

5.02 Base Year

The Base Year is defined as the first year hurricane and storm damage reduction measures could be in effect. It is expected that damage reduction measures could be implemented by 2012.

5.03 Interior Lot Value per Square Foot

Long term erosion damages or land losses are based on the estimated value of interior lots. The data on lots actually sold support a value of $50.00 per square foot at the October 2008 price level.

5.04 Initial Benefits

The economic damage model (GRANDUC) allows the entry of initial benefits – such as “Benefits during Construction.” Even though winter storms and erosion can occur during the construction period, benefits to hurricane and storm damage reduction, as well as recreation, are expected to be negligible. Therefore, no initial benefits were included in the analysis.

5.05 Other Annual Benefits

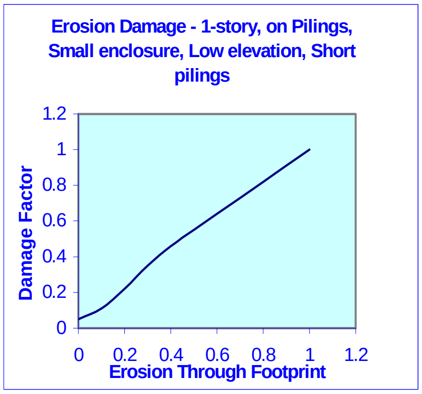
GRANDUC also allows for the addition of other type of NED benefits – such as “Recreation.” The final determination of recreation benefits was not completed in time to include in the model runs. The recreation benefits will be added external to the GRANDUC model calculation. No other “Annual Benefits” for recreation were added to the GRANDUC model. This also supports the formulation of the NED Plan using hurricane and storm damage reduction benefits alone.

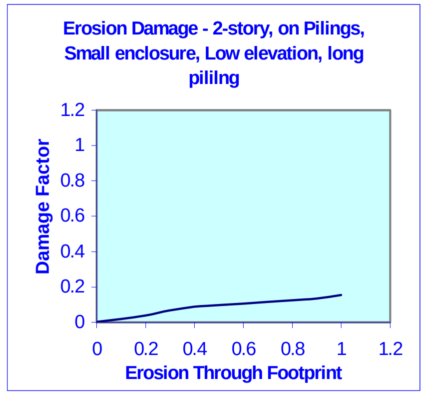
5.06 Flood Damage Curves

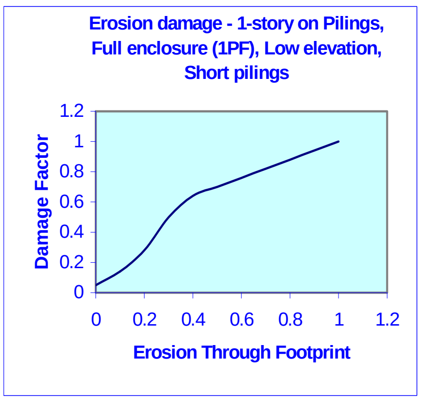
Flood damages due to inundation are determined by the combined height of the storm still water level and a superimposed wave height. Based on the elevation of this combined height and the elevation of the structures first floor, the amount of inundation damage is determined from a standard set of inundation damage curves. Unless the predicted amount of storm induced erosion is sufficient to completely erode the ocean front dune, the residual height of the seaward edge of the beach is generally sufficient to limit the height of the wave that could be transmitted across the beach face without breaking. Accordingly, since the conditions necessary to cause a prediction of significant inundation related damages is rather severe, damages due to the inundation (combined storm still water level and wave height) rarely controls.

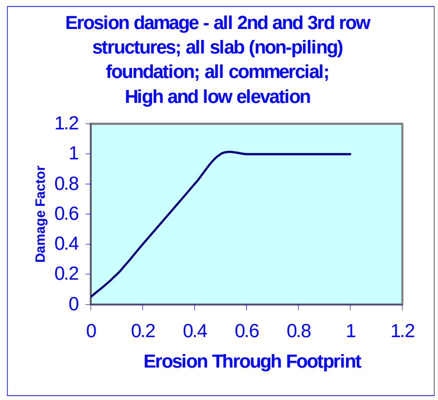
5.07 Erosion Damage Curves

Based on the significant number of first row structures, sample erosion curves are shown by structure type in Figures 13, 14, 15, and 16. A complete set of erosion types and associated erosion curves are found in attachment B-2 to this appendix. The erosion-damage curves used for this analysis are compilations of curves assigned for each part of the structure. The enclosure is given a value of 40 percent of the entire structure and the rest of the structure is given a value of 60 percent of the entire structure value. These percentages were then used to weight the damage curves for the home and the enclosure and derive a composite damage curve.









Figures -13, 14, 15, and 16 Composite Erosion Damage Curves

5.08 Variables Specific to Structure File

Table B- 8 - Sample Structure File

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Reach	ID_USACE	REF-FRNT of LOT	LOT_LENGTH	LOT_WDTH	REF_FRNT of STRUC	STRUC_LENGTH	Attack Angle Ratio	STRUC_TYPE	STRUC_VALUE	CONTENT_VALUE	GRELEV_SUR	FFLOOR_ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
3	003OCEA2103A	0	150	83	247	35		56	$225,000	$90,000	7.4	17.6	1	24	-1	2.0
3	003OCEA2104A	504	150	111	431	35		56	$225,000	$90,000	5.9	18.5	1	31	-1	2.0

The structure file shown in Table B-8 describes the value of each structure, the horizontal and vertical location of the structure within the coastal damage model, and specifies which flood damage curve and erosion damage curve is appropriate for the structure. As illustrated in Figure B-17, the lot distance (Col.

3) and structure distance (Col. 6) are measured from a “Reference Line” established in the coastal storm generation models and incorporated into the GRANDUC model. The structure length (Col. 7) defines the structure footprint used in the storm erosion estimates.

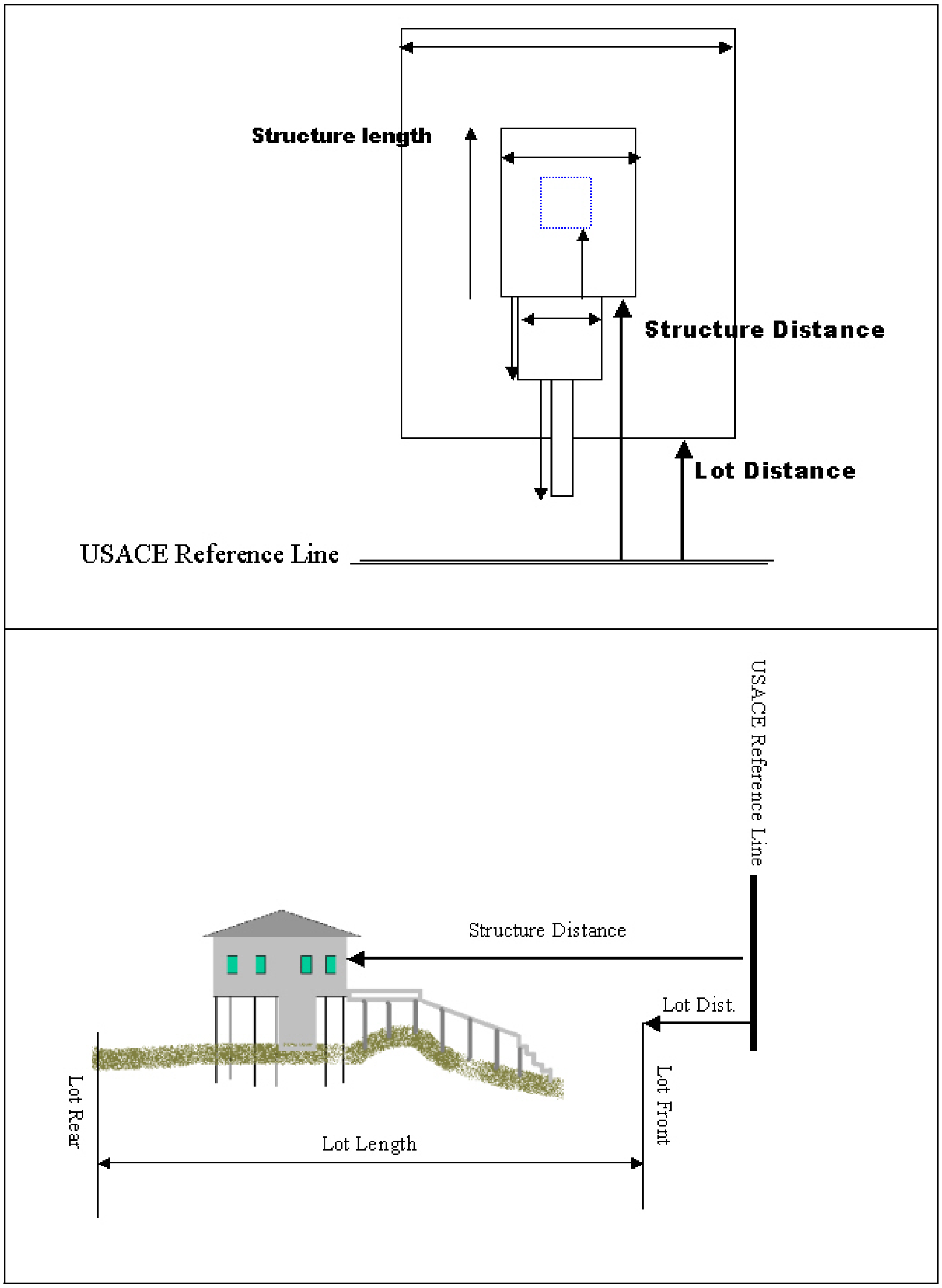


Figure B-17 Illustrations of Structure and Lot Distances Entered into GRANDUC model.

5.08.1 Structure Type – flood damage curve

Structure type denotes the flood damage curve that is to be used with this sturucture. A description of all structure types, both residential and commercial are attached to this appendix, Attachment B-1. Determination of Residential structure values and structure types for selected residential structures was completed by HDR Engineering, Inc. of the Carolinas. Descriptions included the number of levels (1,1.5, or 2 story), type of foundation (P=on pilings, N=not on pilings), if piling foundation what is the size of enclosure (S=small <300SF; P=partial >300SF; F=full; or N=none). The contractor evaluated approximately 135 residential structures and 30 commercial structures in the study area. Commercial business types include hotels, motels, garages, etc. A complete list of the commercial and residential business types used is found in Attachment B-1 to this appendix.

5.08.2 Structure Value

Structure values are entered in dollars based on the replacement cost less depreciation. The HRD contractor also made determinations of commercial structure values and description of the business type. HDR Engineering, Inc. of the Carolinas evaluated approximately 30 commercial structures in the study area. Structure values represent the replacement value less depreciation at the current price levels. The contractor consulted with local real estate agents, appraisers, business owners, and building contractors as needed. While some information on structures was obtained from the Pender County tax office; replacement costs are based on site-specific building cost for Topsail Island.

5.08.3 Content Value

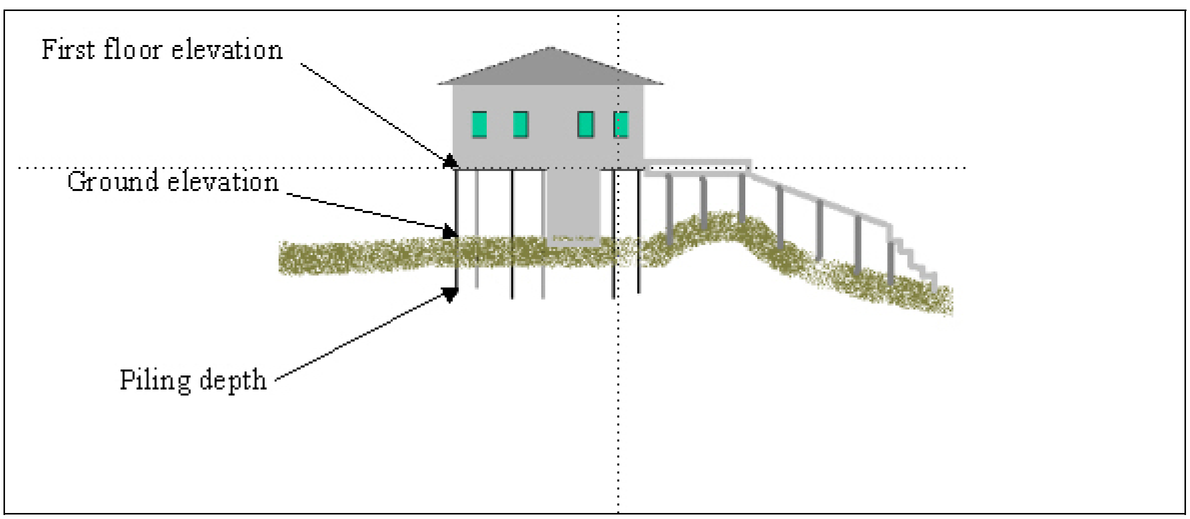
Contents to residential structures include personal possessions, including furniture, clothing, dishes, cooking utensils, linens, jewelry, stereo equipment, etc. For homeowners' insurance coverage, the standard coverage for contents is 50 percent of the dwelling coverage. For beach communities like Topsail Beach, Surf City, and North Topsail Beach, the estimated value of contents of an average residential structure would be less than 50 percent of the value of the structure. The main factor in this conclusion is that nearly 80 percent of the structures are not owner-occupied year round. Many of the seasonal 80 percent are rented to vacationers during the spring and summer beach season. Contents include beds, furniture, reclining chairs, color cable televisions, VCR's and DVD players, microwave ovens, clothes washers and dryers, and telephones. Built-in appliances are included in the value of the structure. Contents for residential structures are estimated to be 40 percent of the structure value. This percentage is consistent with a detailed Residential Flood Damage survey taken in the Northern Gulf Coast (USACE, Mobile District, 1999). This area is similar to Topsail Island and is primarily single-family residential structures. Based on the 1999 survey, content damage was reported in 81 of 192 cases, with a mean content-to-structure damage of about

35 percent. Therefore, the 40 percent used in the case of Topsail Island is considered reasonable.

Estimates of values of contents of commercial structures in the primary study area are based on interviews with businessmen and insurance agents familiar with the Topsail Island oceanfront, as well as empirical data collected for past studies. Businesses are entered into the damage model with a code for type of commercial activity. Each type of business has a unique content factor applied to its structural values. Motels comprise most of the commercial base in the primary study area and these use 50 percent of the structural value for content value. After weighing responses from motel managers and insurance agents in the study area, this is considered appropriate. It is also consistent with the commercial content data that originally came from a Galveston District study but were updated by the Wilmington District to reflect North Carolina beach data. USACE staff economist consulted with the Galveston District (CESWG) and the Institute for Water Resources (IWR) seeking guidance and other sources of empirical data related to the value of residential contents. Galveston District statistician recommended using a model based on selected income data and other demographic information available from the Institute of Water Resources. IWR recommended the approach used by the Mobile District which was based on an extensive on-site survey.

5.08.4 Elevation at ground

Elevations were established by surveys and in some cases were estimated from 2-foot contour maps. The Wilmington District contracted with the engineering and surveying firm of Greenhorne & O'Mara, Inc. to perform survey work on Topsail Island. The field surveys were completed during the week of May 19-23, 2003.



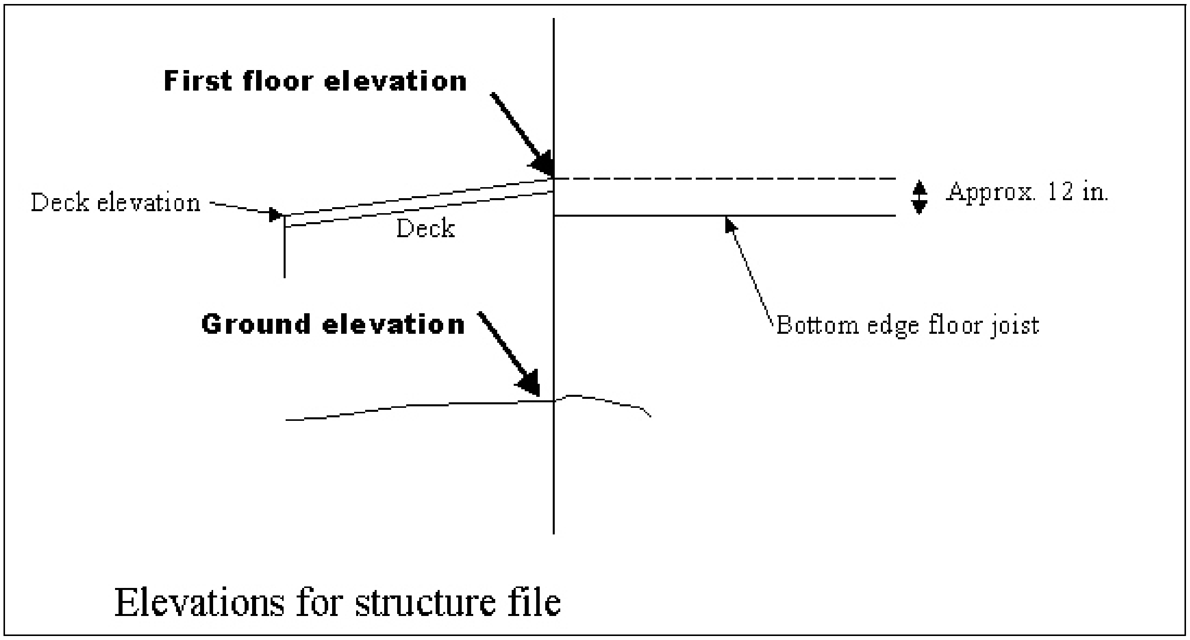


Figure B- 18 - Illustration of Residential Structure Elevations

5.08.5 Elevation at First Floor

First-floor elevations were normally surveyed by the location of the front entry threshold as shown in Figure B-18. First floor elevations were surveyed under contract with the engineering and surveying firm Greenhorne & O'Mara, Inc.for the Topsail Beach study area. Data collected by North Carolina State University students for FEMA following hurricane Fran in 1996 were also compared and used for missing structures. In these cases the first floor elevation was adjusted by one foot to get the top of the floor joist versus the bottom of floor joist measured by NCSU. In a few cases first floor elevations were estimated by adding 10 or 12 feet to the ground elevations. Likewise, this assumption was used to indicate the first floor elevation of all structures replaced during the period of analysis.

5.08.6 Erosion Type

The erosion type in the structure file directs which erosion curve is used to calculate storm erosion damages. Variables include type of foundation, depth of piling penetration, type of shoreline (see Figure B-19), and the size of any enclosures around the piling foundation. The type of foundation on Topsail Island is mostly residential built on pilings. Most commercial and some residential structures are built on a slab foundation.

The historical effects of long-term and storm related erosion on oceanfront structures along the beaches of North Carolina are not well documented. Very little data exists on how these structures react to storm forces of varying degrees of intensity. This lack of data has lead to the designing of erosion-damage curves comprised largely through professional judgment. The state of the art of modeling these relationships is improving, however, following the hurricanes of 1996-1999 along the North Carolina coast. Researchers like Spencer Rogers of North Carolina Sea Grant have begun collecting and analyzing data and publishing papers on this subject. In his report, “Erosion Damage Thresholds in North Carolina,” Mr. Rogers derived storm induced damage curves based on observed changes over time in coastal construction in North Carolina (Attachment B-4).

The curves used in this analysis are derived from these erosion-damage curves and are based on field data including the following structure characteristics:

❶Oceanfront or not
❷Number of stories
❸On piles or not, long or short piles
❹ Type of enclosure (none, finished, unfinished)
❺Size of the under house enclosure (none, small, partial, fully enclosed)
❻High or low existing dune (potential to undermine 1st row structures) see illustration in Figure B-19.
❼Structure type (commercial or residential)

For this analysis, these data were collected for every structure along the oceanfront and first row of development back from the oceanfront, along with their elevation and depreciated replacement value. The following further describes the four-character coding scheme of structure types used for this study, which was originally developed by a North Carolina State University team of researchers including Mr. Rogers. Descriptions included the number of levels (1,1.5, or 2 story), type of foundation (P=on pilings, N=not on pilings), if piling foundation what is the size of enclosure (S=small <300SF; P=partial >300SF; F=full; or N=none) and the quality of the enclosure (F=finished, N-unfinished, “blank”=unknown). These codes are assigned upon field inspection of each structure and matched with both an appropriate erosion-damage curve and an inundation-damage curve. The decision matrix used in the field is included in Attachment B-2.

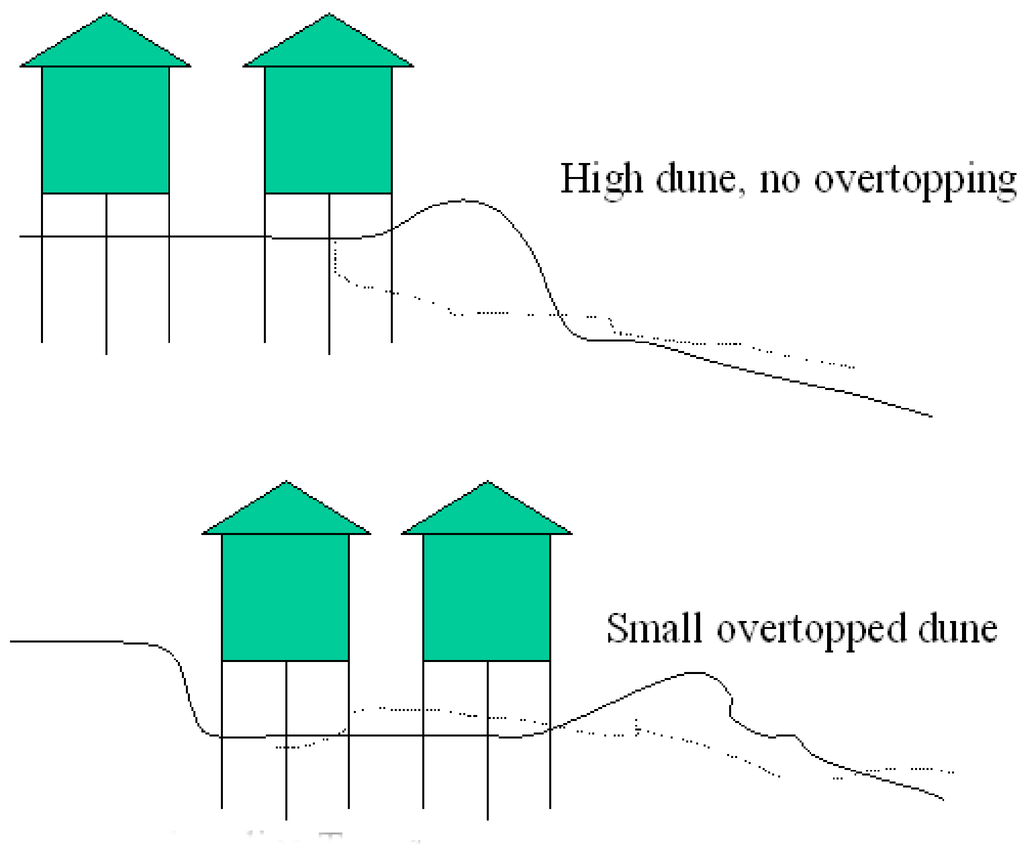


Figure B-19 - Shoreline Types with High and Low Elevation

5.08.7 Erosion Indicator

An indicator of erosion is measured as the vertical distance between the pre-storm and post-storm beach profile as shown in Figure B-20. The erosion damage curves are read based on how far the “erosion indicator” has proceeded through the structure footprint. In this analysis two erosion indicators were used. The most frequently used indicator is the 2-foot indicator. This indicator was chosen after consideration and interpretation of work by Spencer Rogers, North Carolina Sea Grant (Attachment B-4). For a limited number of structures built on concrete slab foundations and all street and roads, an erosion indicator of 0.5 feet was used. The work by Spencer Rogers, North Carolina Sea Grant, also introduces the possible use of a 4-foot erosion indicator. While use of the 4-foot indicator is not considered appropriate for the beach profiles of Topsail Beach, alternative analyses were run and the results are summarized in the Summary of Sensitivity and Uncertainty that follows in table B-18 and Figure B-22.

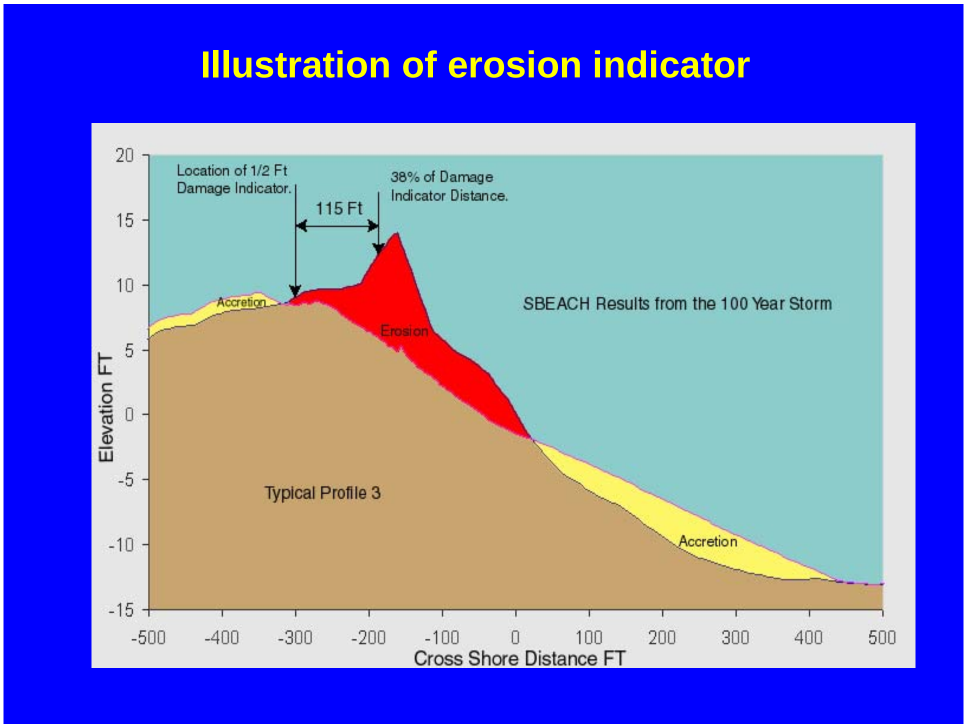


Figure B-20 - Illustration of erosion Indicator

The report "Erosion Damage Thresholds in North Carolina" by Spencer Rogers of the North Carolina Sea Grant is attached to this appendix as Attachment B-4.

6.0 ALTERNATIVES TO REDUCE HURRICANE AND STORM DAMAGES

Expected storm and erosion related damages are first computed for the without project condition, then again for the various plans of improvement over the entire 4.5 miles of the primary study area. Structural, non-structural, and no action alternatives were considered. Structural plans include beach fill plans which have potential to prevent the progressive erosion of the shoreline, reduce damages caused by erosion, flooding, and wave impact during coastal storms, decrease storm related emergency expenditures, and increase the quality of recreational opportunities in the area. No action is also an alternative. However, the no action plan does not preclude emergency measures of dealing with erosion, such as beach scraping and sandbagging, but, in the long run, these emergency measures are assumed to be ineffective.

The costs and benefits described in this section and in Table B-9 were developed during Fiscal Year 2005 and use October 2004 costs and prices and the Federal Water Resources FY 2005 interest rate of 5.375%. This concludes comparative evaluations of the alternatives. From this point forward, base condition damages, remaining damages with a plan, benefits, and costs for the NED plan and the Locally Preferred Plan will be reported at October 2008 costs and prices and the FY2009 interest rate of 4.625%.

6.01 Structural Plans

Structural alternatives evaluated included various combinations of berm and dune heights. For example, Plan 1150 includes a dune height of 11 feet and a berm width of 50 feet. Several plans, including plan 1550, were evaluated with the extension of the transition section on the south end of the plan. For example, plan designated as 1550X indicates that the plan includes an extended transition section. The final array of plans is shown in Table B- 9 below.

The summary of the structural analysis is presented in Table B-9. All beach nourishment plans shown have positive net NED benefits; however, the plan with the greatest net NED benefits is Plan 1550. The NED Plan is defined as the alternative that maximizes net NED benefits. Therefore, Plan 1550 is designated as the NED Plan.

Table B-9 - Economic Comparisons, Average Annual Amounts

October 2004 price level & 5-3/8% interest; in Thousands of Dollars

Plan	Benefits						Costs	Net Benefits
	Storm Erosion	Flood	Wave	Land & Long Term Erosion	Reduced Emergency Costs	Total		
1150	$5,432	$(53)	$68	$850	$87	$6,383	$2,927	$3,456
1150X	$5,437	$(54)	$68	$850	$87	$6,387	$2,943	$3,444
1250	$5,633	$(55)	$69	$850	$87	$6,584	$3,013	$3,571
1250X	$5,638	$(55)	$69	$850	$87	$6,588	$3,027	$3,561
1350	$5,772	$(62)	$128	$850	$87	$6,775	$3,185	$3,590
1350X	$5,781	$(63)	$128	$850	$87	$6,783	$3,204	$3,579
1450	$5,984	$(69)	$150	$850	$87	$7,002	$3,321	$3,681
1450X	$5,995	$(70)	$150	$850	$87	$7,012	$3,337	$3,675
1550	$6,136	$(74)	$168	$850	$87	$7,168	$3,440	$3,728
1550X	$6,149	$(76)	$168	$850	$87	$7,179	$3,463	$3,716
1650	$6,250	$(75)	$189	$850	$87	$7,301	$3,574	$3,727
1650X	$6,263	$(77)	$189	$850	$87	$7,312	$3,596	$3,716
1750	$6,322	$(77)	$204	$849	$87	$7,385	$3,705	$3,680

6.02 Non-structural Plans

The non-structural plans consist of retreats, relocations, and demolitions applied to threatened structures on an individual case-by-case basis. However, none of the non-structural plans were found to be feasible. Figure B-21 shows one of the rare non-structural projects involving the raising of a structure. The non-structural analysis is presented in the main report and Appendix P.

Figure B- 21 Topsail Island home raised on piling foundation 2004.

7.0 ECONOMICS OF NED PLAN (PLAN 1550)

7.01 Economic Damages – remaining with plan

A major consideration in evaluating any plan is the estimated damages remaining with the project plan. The accumulated present value of remaining damages for Plan 1550 is presented in Table B-10 in October 2008 price level. A summary of average annual equivalent remaining damages is shown in Table B-11 in October 2008 price level.

Table B-10 – Present Value of Remaining Damages with NED Plan

Reach	Total Remaining Damages	Storm Erosion	Flood	Wave	Land Lost/LTE
31	$ 139,760	$ 24,495	$ 114,859	$ 406	$ -
32	$ 447,011	$ 313,505	$ 128,432	$ 5,075	$ -
4	$ 1,332,061	$ 553,961	$ 194,927	$ 583,172	$ -
5	$ 1,842,199	$ 1,023,684	$ 220,837	$ 597,678	$ -
6	$ 817,602	$ 391,295	$ 156,591	$ 269,296	$ 421
7	$ 885,387	$ 299,939	$ 313,638	$ 270,794	$ 1,016
8	$ 749,575	$ 283,176	$ 187,080	$ 278,085	$ 1,234
9	$ 650,658	$ 154,138	$ 227,421	$ 268,767	$ 332
10	$ 979,047	$ 252,240	$ 339,284	$ 386,779	$ 745
11	$ 550,634	$ 327,053	$ 157,311	$ 66,269	$ -
12	$ 1,138,215	$ 370,106	$ 629,103	$ 139,006	$ -
13	$ 242,614	$ 236	$ 220,921	$ 21,456	$ -
14	$ 435,602	$ 426	$ 416,025	$ 19,150	$ -
15	$ 400,036	$ 100,503	$ 282,339	$ 17,194	$ -
16	$ 394,236	$ 282,152	$ 108,229	$ 3,856	$ -
17	$ 43,070	$ 24,524	$ 16,765	$ 1,781	$ -
18	$ 92,960	$ 8,437	$ 84,502	$ 21	$ -
19	$ 714,714	$ 605,568	$ 108,626	$ 520	$ -
20	$ 788,903	$ 786,324	$ 1,817	$ 763	$ -
21	$ 443,628	$ 20,314	$ 423,314	$ -	$ -
22	$ 182,668	$ 161,644	$ 20,894	$ 130	$ -
23	$ 1,153,147	$ 1,098,379	$ 49,001	$ 5,767	$ -
24	$ 953,936	$ 932,645	$ 13,572	$ 7,718	$ -
25	$ 925,371	$ 790,948	$ 127,485	$ 6,938	$ -
26	$ 802,606	$ 630,655	$ 137,075	$ 34,875	$ -
Totals	$ 17,105,639	$ 9,436,347	$ 4,680,049	$ 2,985,495	$ 3,748
rounded	$ 17,105,000	$ 9,436,000	$ 4,680,000	$ 2,985,000	$ 4,000

Table B-11 – Remaining Average Annual Hurricane and Storm Damages with Plan 1550 (NED Plan)

Average Annual	Total Damages	Storm Erosion Damages	Flood Damages	Wave Damages	Land Lost/LTE
Damages with 1550	$883,000	$487,000	$242,000	$154,000	$ -

7.02 Economic Benefits

The primary benefits to the NED plan are the hurricane and storm damage reduction benefits. The total damage reduction benefits are computed by subtracting the remaining damages from the total without project damages. Hurricane and storm damage reduction benefits total $8,401,000 and are shown by type in Table B-12.

7.02.1 Hurricane and Storm Damage Reduction Benefits

Table B-12 – Average Annual Hurricane and Storm Damage Reduction Benefits with Plan 1550 (NED Plan)

PLAN	Total Benefits	Reduced Storm Erosion	Reduced Flood Damages	Reduced Wave Damage	Reduced Land Lost/LTE
PLAN 1550	$ 8,401,000	$6,786,000	$(87,000)	$184,000	$1,519,000
Oct 08 & 4-5/8%					

7.02.2 Reduced Emergency Costs Benefits

Average annual emergency costs from hurricanes and storms are estimated to be $87,000, based on records from hurricanes Bertha, Fran, Bonnie, and Floyd. Emergency costs prevented refer to expected annual expenditures that residents and governments are experiencing under the without project condition that a project would preclude. Other damages prevented include storm damages that are not covered under the National Flood Insurance Program, but represent financial drains on public and private storm victims that a large beach nourishment project could prevent. The categories lumped into this benefit called emergency costs and other damages prevented include (1) beach scraping/pushing; (2) sandbagging: (3) emergency costs incurred by the North Carolina Department of Transportation; (4) damages to public property; (5) damages to private property other than structures and contents; and, (6) post-storm recovery expenses.

The expected annual totals of emergency costs and other damages that any of the beach fill plans would prevent for the entire 4.5 miles of beach are estimated at $87,000 for the town of Topsail Beach.

7.02.3 Benefits During Construction

Construction of NED Plan could begin following contract award 30 September 2011. Allowing for environmental constraints, construction could begin in November 2011 and continue for approximately six months. Construction is assumed to be complete prior to 30 April 2012. This construction schedule would provide full benefits from the project in 2012 (the base year). The project would be expected to be complete prior to hurricane season and the peak recreation season. Therefore, benefits during construction are considered insignificant to the economic analysis and justification.

7.02.4 Recreation Benefits

Recreation benefits will be based on the incremental change in demand with varying project conditions. Positive benefits derived from increased recreation visitation or improved recreation experience. The recreation benefit analysis will be presented in Appendix – O.

7.02.5 Commercial and Recreational Fishing Impacts:

The economic impacts of the NED plan or other nourishment plans on commercial and recreational fishing during construction are not expected to be significant. Impacts on shore fishing would be limited to the area where material is being placed on the beach. This localized and temporary impact can easily be avoided by anglers in the area. Nearshore fishing boats can operate around the dredging equipment operating in the area. The beach nourishment plan is not expected to impact inside fishing or the operation of commercial fishing boats operating inside or going through New Topsail Inlet. Unless there is extreme weather, the ocean going dredge will operate continuously. Therefore, the economic impact of commercial and recreational fishing is not expected to change with the project construction.

7.02.6 Summary of Benefits to NED Plan

A summary of the hurricane and storm damage reduction benefits, emergency cost reduction benefits is shown in Table B-13. No benefits during construction were claimed primarily because the plan could be constructed during one dredging window and would be completed prior to hurricane and peak recreation season.

Table B-13 - Summary of Benefits to NED Plan 4-5/8% Oct 2008 price level

Benefit Category	Average Annual Amount in Dollars
Hurricane & Storm Damage Reduction	$8,401,000
Reduced Emergency Costs	$87,000
Benefits during Construction	Negligible / insignificant
Recreation (See Appendix O)	$5,500,000
Total Average Annual NED Benefits	$13,988,000

7.03 Project Costs for NED Plan

Project first costs include the cost of construction, mobilization and demobilization, real estate, planning and engineering studies, supervision and administration, and interest during the five or six month construction period.

Determination of the economic costs of the plan consists of four basic steps. First, project First Costs are computed. First Costs include expenditures for project design and initial construction and related costs of supervision and administration. First Costs also include the lands, easements, and rights of way for initial project construction and periodic nourishment.

7.03.1 First Costs

Total First Costs are estimated to be $50,332,000 as presented in Appendix N Cost Engineering.

7.03.2 Interest During Construction

Construction could begin in November 2011 and be completed on or before 30 April 2012. The interest on expenditures prior to the completion of the plan will be calculated at 4-5/8 percent interest. The expenditures by month, the cost of construction plus interest, and the net interest during construction (IDC) is shown in Table B-14.

Table B-14 Calculation of Interest during Construction for NED Plan (Oct. 2008 price level).

Months	**Interest Factor @ 4 – 5/8%**	Expenditures byMonth	PW AMT. Including interest
1	1.015506023	$13,260,100	$13,465,711
2	1.011607121	$ 8,278,600	$ 8,374,691
3	1.007723188	$ 8,278,600	$ 8,342,537
4	1.003854167	$ 8,278,600	$ 8,310,507
5	1	$12,236,100	$ 12,236,100
	Totals	$50,332,000	$ 50,729,546
Interest During Construction			**$397,546**
		Rounded amount	$398,000

7.03.3 Total Investment Cost

The total investment cost of the NED plan is equal to the initial construction plus interest during construction. Therefore, total investment cost is equal to $38,014,000 as shown in Tables B-15 and B-16. The cost of future nourishment is shown separately.

7.03.4 Present Value of Future Nourishment Costs

The accumulated present value of all nourishment cost is calculated by discounting all cash flows in future years back to the base year 2012 at the appropriate interest rate. The accumulated present worth of all future nourishment is $42,417,000 ($80,431,000 - $38,014,000) as shown in Tables B-15 and B-16.

Table B-15 – Present Value of Initial Investment and Future Nourishment Cost (4-5/8 % and October 2008 price level) for NED Plan.

ANNUAL COSTS			
interest rate =	4.625%	years of analysis =	50
ITEM	YEAR	AMOUNT	PRESENT VALUE, 2011
Total Investment Cost	2011	$50,730,000	$50,730,000
Renourishment	2015	$9,492,000	$7,922,000
Renourishment	2019	$9,492,000	$6,611,000
Renourishment	2023	$9,492,000	$5,517,000
Renourishment	2027	$9,492,000	$4,605,000
Renourishment	2031	$9,492,000	$3,843,000
Renourishment	2035	$9,492,000	$3,207,000
Renourishment	2039	$9,492,000	$2,676,000
Renourishment	2043	$9,492,000	$2,234,000
Renourishment	2047	$9,492,000	$1,864,000
Renourishment	2051	$9,492,000	$1,556,000
Renourishment	2055	$9,492,000	$1,298,000
Renourishment	2059	$9,492,000	$1,084,000
Total Investment Cost, Present Value			$93,147,000
Annual Costs			
Interest & Amortization			$4,810,000
Monitoring			$275,000
OMRR&R			$22,000
Total Annual Cost			$5,107,000

7.04 Average Annual Project Costs for NED Plan

Average annual project costs are comprised of the interest and amortization of both the total investment (including interest during construction) and total accumulated present worth of the future nourishment. In addition to interest and amortization (I&A), annual costs include the operation and maintenance and the required annual monitoring cost.

7.04.1 I&A of Total Investment

Total investment is converted to an average annual equivalent value by amortizing the investment over the 50-year period of analysis. The 50-year interest and amortization (I&A) factor at 4 – 5/8 percent is 0.051635. The annual interest and amortization of the total investment is $4,810,000 as shown in Table B-16.

7.04.2 Annual OMRR&R

The non-Federal average annual repair cost refers to the sponsor's expense of repairing the berm, replacing any destroyed beach access walkways following storms, and replanting and fertilizing dune vegetation as necessary. The annual cost of operation and maintenance is estimated to be $22,000.

7.04.3 Annual Monitoring

Monitoring is an additional annual cost that is estimated to be $275,000.

7.04.4 I&A of Future Nourishment

The accumulated present value of future nourishment is converted to an average annual equivalent value by amortizing the present value over the 50-year period of analysis. The 50-year interest and amortization (I&A) factor at 4 –5/8 percent is 0.051635. The annual interest and amortization of the future nourishment is $2,190,000 as shown in Table B-16.

Table B- 16 - Summary of Initial Construction & Annual Costs - NED Plan
4-5/8% and October 2008 price level

Cost Elements	Cost in Dollars – Oct 2008 price level	
Initial Construction	$50,332,000 (reference Appendix N)	
Interest during Construction	398,000 (Table B-14)	
Total Investment Cost	$50,730,000	
Interest & Amortization 50yr, 4-5/8%	.051635 =	$2,620,000
Present Value Future Nourishment	$42,417,000 (Table B-15)	
Interest & Amortization 50yr, 4-5/8%	.051635 =	$2,190,000
Annual Monitoring Costs		$275,000
Annual OMRR&R		$22,000
PV Initial and Future Construction	$93,147,000	
Total Average Annual Cost		**$5,107,000**

7.05 Benefit/Cost Comparison for NED Plan

Total average annual equivalent benefits to the NED plan equal $8,401,000 excluding recreation benefits. When compared to the average annual cost of $5,107,000, the net benefits over cost equals $3,294,000. The benefit-to-cost ratio is 1.6 to 1.0 as shown in Table B-17.

Table B-17 Annual Benefits, Costs, and Benefit-Cost Ratio – NED Plan October 2008 price level.

NED Plan	Benefits[1]	Costs	Net Benefits	Benefit/Cost Ratio
1550	$8,401,000	$5,107,000	$3,294,000	1.6

8.0 ECONOMICS OF LOCALLY PREFERRED PLAN (LPP) AND RECOMMENDED PLAN

The Town of Topsail Beach has selected Plan 1250X as the Locally Preferred Plan. Plan 1250X consists of a 26,200-foot long dune and berm system to be constructed to a height of 12 feet NGVD fronted by a 7-foot NGVD (50-foot wide) beach berm with a main fill length of 23,200 feet, from a point 400 feet southwest of Godwin Avenue to the Topsail Beach town limit, and having 2,000-foot transition length on the north end and a 1,000-foot transition on the south end.

In some instances there are reasons for selection of a plan other than the NED plan. Recommended projects which are smaller than the NED plan will normally be considered favorable for an exception to the NED requirements. Affordability is a valid reason for selecting a plan smaller (less costly) than the NED plan.

The Locally Preferred Plan, Plan 1250X, is the selected plan for recommendation for Federal action. The LPP is has a dune 3 feet lower and 400 feet longer than the NED Plan. The initial construction cost of the LPP is lower than the NED plan, and the renourishment costs are about the same.

The lower elevation dune of the LPP does not provide as much storm damage reduction as the NED plan. Average annual storm damage reduction benefits as shown in Table B-18 are $8,401,000 for the NED plan and for the LPP are

[1] Hurricane and storm damage reduction benefits, recreation benefits excluded.

$7,742,000, a reduction of $659,000, or 8%. Recreation benefits are the same for both plans.

Average annual costs are $5,107,000 for the NED plan (table B-16) and for the LPP are $4,450,000 (table B-22). The renourishment volumes and cost for both plans are the same, with the cost differences being in the Total First Costs. Total First Costs are $50,332,000 for the NED plan and for the LPP are $37,712,000.

8.01 Selected Plan – Economic Benefits

The total expected annual benefits for the Selected Plan are estimated at $13,329,000 including recreation benefits. An itemized listing of expected annual benefits is presented in Table B-18.

Reaches	Total HSDR Benefits	Reduced Storm Erosion	Reduced Flood Damages	Reduced Wave Damage	Reduced Land Lost/LTE
R3.1-26	$7,742,000	$6,216,000	$ (65,000)	$72,000	$ 1,518,000

Table B-18, Summary of Average Annual Benefits - Compare Selected Plan (LPP) to NED Plan (Plan 1550) 4-5/8% & Oct 2008 price level

Benefit Category	Expected Annual Benefit	
	Selected Plan, LPP	NED
Hurricane and Storm Damage Reduction		
Storm Erosion	$6,216,000	$6,786,000
Flood	$(65,400)	$(87,000)
Wave	$72,000	$184,000
Land and Long Term Erosion	$1,518,000	$1,519,000
Subtotal, rounded	$7,742,000	$8,401,000
Emergency Costs and Other Damage Reduction	$ 87,000	$ 87,000
Recreation	$ 5,500,000	$ 5,500,000
Sub Total Annualized Benefits	$13,329,000	$13,988,000
Benefits During Construction, negligible	$ 0	$ 0
TOTAL EXPECTED ANNUAL BENEFITS, SELECTED PLAN OF IMPROVEMENT	**$13,329,000**	**$13,988,000**

8.02 Selected Plan – Project Costs

First, project First Costs are computed. First Costs include expenditures for project design and initial construction and related costs of supervision and administration.

8.02.1 Selected Plan – First Costs

First Costs also include the lands, easements, and rights of way for initial project construction and periodic nourishment. Total First Costs are estimated to be $37,712,000 at October 2008 price levels as presented in Table B-19.

Table B-19 Project First Costs – Selected Plan, LPP (October 2008 price levels)

ACCT.	ITEM	QUANTITY	UNIT	UNIT	AMOUNT	CONTIN-	TOTAL COST
1	LANDS AND						
	Acquisition				$1,409,000	$211,000	$1,620,000
	Land Payments				$30,000	$4,000	$34,000
	Subtotal						$1,654,000
17	BEACH						
	Mobilization and Demobilization	1	JOB	LS	$3,599,000	$726,000	$4,325,000
	Dredging and	3,223,000	CY	$7.38	$23,785,000	$4,757,000	$28,542,000
	Beach Fill						
12	Dune Vegetation	48	AC	$9,000	$432,000	$65,000	$497,000
23300	Beach Tilling	68	AC	$700	$48,000	$7,000	$55,000
	Public Walkovers	23	EA	$38,000	$874,000	$131,000	$1,005,000
	Subtotal						$34,424,000
30	PLANNING, ENGINEERING, AND DESIGN				$971,000	$194,000	$1,165,000
31	CONSTRUCTION MANAGEMENT				$391,000	$78,000	$469,000
	TOTAL RENOURISHMENT COST						$37,712,000

8.02.2 Selected Plan – Interest During Construction

Second, Interest During Construction is added to the project First Cost. Interest During Construction is computed from the start of PED through the 1 year initial construction period. Interest During Construction for the Selected Plan is estimated to be $302,000.

8.02.3 Selected Plan – Total Investment Cost

The project First Cost plus Interest During Construction represents the Total Investment Cost required to place the project into operation. Total Investment Cost for the Selected Plan is estimated to be $38,014,000 as shown in Table B-20.

Table B-20 - Total Investment Cost – Selected Plan, LPP October 2008 price level.

ITEM	AMOUNT
Total First Cost	$37,712,000
Interest During Construction	$302,000
Total Investment Cost	**$38,014,000**

8.02.4 Selected Plan – Present Value of Future Nourishment Costs

Third, Scheduled Renourishment Costs are computed. These costs are incurred in the future for each renourishment. At this point neither discounting to present value, nor escalation for anticipated inflation is included. Renourishment Costs are estimated to be $113,904,000 as shown in Table B-21.

Table B-21 Renourishment Costs – Selected Plan, LPP October 2008 price level.

Item	Year	Amount	
Total First Cost	2011		$37,712,000
Renourishment	2015		$9,492,000
Renourishment	2019		$9,492,000
Renourishment	2023		$9,492,000
Renourishment	2027		$9,492,000
Renourishment	2031		$9,492,000
Renourishment	2035		$9,492,000
Renourishment	2039		$9,492,000
Renourishment	2043		$9,492,000
Renourishment	2047		$9,492,000
Renourishment	2051		$9,492,000
Renourishment	2055		$9,492,000
Renourishment	2059		$9,492,000
Total Renourishment Cost		$113,904,000.00	

8.03 Selected Plan – Average Annual Costs

Fourth, Expected Annual Costs are computed. These costs consist of interest and amortization of the Total Investment Cost, and the equivalent annual cost of project operation, maintenance, and renourishment. The Expected Annual Costs provide a basis for comparing project costs to expected annual benefits. Expected Annual Costs for the Selected Plan are estimated to be $4,450,000. A summary of the computations involved in each of these three steps is presented in Table B-22. By comparison the Expected Annual Costs for the NED plan are $5,107,000.

Table B-22 Average Annual Project Costs – Selected Plan, LPP, Plan 1250X October 2008 price level.

ANNUAL COSTS			
interest rate =	4.625%	years of analysis =	50
ITEM	YEAR	AMOUNT	PRESENT VALUE, 2011
Total Investment Cost	2011	$38,014,000	$38,014,000
Renourishment	2015	$9,492,000	$7,922,000
Renourishment	2019	$9,492,000	$6,611,000
Renourishment	2023	$9,492,000	$5,517,000
Renourishment	2027	$9,492,000	$4,605,000
Renourishment	2031	$9,492,000	$3,843,000
Renourishment	2035	$9,492,000	$3,207,000
Renourishment	2039	$9,492,000	$2,676,000
Renourishment	2043	$9,492,000	$2,234,000
Renourishment	2047	$9,492,000	$1,864,000
Renourishment	2051	$9,492,000	$1,556,000
Renourishment	2055	$9,492,000	$1,298,000
Renourishment	2059	$9,492,000	$1,084,000
Total Investment Cost, Present Value			$80,431,000
Annual Costs			
Interest & Amortization			$4,153,000
Monitoring			$275,000
OMRR&R			$22,000
Total Annual Cost			$4,450,000

8.04 Selected Plan - Benefit to Cost Ratio

With expected annual benefits of $13,329,000 and average annual costs of $4,450,000 the benefit to cost ratio for the Selected Plan, Plan 1250X, is 3.0 to 1. The annual net benefits are $8,879,000. By comparison, for the NED plan, Plan 1550, the benefit to cost ratio is 2.7 to 1 and the annual net benefits are $8,881,000.

8.05 Selected Plan – Incremental Analysis

Each of the reaches protected by the recommended plan is economically feasible. Virtually all reaches are feasible without the benefits from recreation. Table 23 below compares both the hurricane and storm damage reduction benefits alone to the costs as well as the total benefits to the costs and. Recreation benefits are limited in some cases as required by U.S. Army Corps of Engineers planning policy.

Table B-23 Incremental Analysis of Reaches within the Recommended Plan

Present Value Costs and Benefits, Selected Plan, Plan 1250X October 2006 Price Levels, FY2007 Interest Rate, 4.875%								
Reach	HSDR Benefits	MCACES Cost Prorated by Reach	Net HSDR Benefits	HSDR BCR	Allowable Recreation Benefits	Total Allowable Benefits	Allowable Net Benefits	Total BCR
3.1	$ 1,250,381	$ 1,137,292	$ 113,089	1.10	$ 1,250,381	$ 2,500,762	$ 1,363,470	2.20
3.2	$ 2,289,860	$ 1,053,908	$ 1,235,952	2.17	$ 2,166,633	$ 4,456,493	$ 3,402,585	4.23
4	$ 4,541,587	$ 2,431,273	$ 2,110,314	1.87	$ 4,333,265	$ 8,874,852	$ 6,443,579	3.65
5	$ 6,538,041	$ 2,924,970	$ 3,613,071	2.24	$ 4,333,265	$ 10,871,306	$ 7,946,337	3.72
6	$ 13,813,037	$ 2,751,384	$ 11,061,653	5.02	$ 4,333,265	$ 18,146,302	$ 15,394,918	6.60
7	$ 12,482,436	$ 2,730,606	$ 9,751,830	4.57	$ 4,333,265	$ 16,815,701	$ 14,085,095	6.16
8	$ 11,100,244	$ 2,727,808	$ 8,372,436	4.07	$ 4,333,265	$ 15,433,509	$ 12,705,701	5.66
9	$ 9,457,802	$ 2,760,378	$ 6,697,424	3.43	$ 4,333,265	$ 13,791,067	$ 11,030,689	5.00
10	$ 10,085,323	$ 2,792,948	$ 7,292,375	3.61	$ 4,333,265	$ 14,418,588	$ 11,625,640	5.16
11	$ 3,787,909	$ 2,755,536	$ 1,032,373	1.37	$ 3,787,909	$ 7,575,818	$ 4,820,282	2.75
12	$ 2,450,978	$ 2,787,876	$ (336,898)	0.88	$ 2,450,978	$ 4,901,956	$ 2,114,080	1.76
13	$ 2,107,337	$ 2,814,588	$ (707,251)	0.75	$ 2,107,337	$ 4,214,674	$ 1,400,086	1.50
14	$ 2,343,203	$ 2,846,212	$ (503,009)	0.82	$ 2,343,203	$ 4,686,406	$ 1,840,194	1.65
15	$ 4,583,641	$ 2,870,173	$ 1,713,468	1.60	$ 4,333,265	$ 8,916,906	$ 6,046,733	3.11
16	$ 5,748,611	$ 2,881,972	$ 2,866,639	1.99	$ 4,333,265	$ 10,081,876	$ 7,199,904	3.50
17	$ 2,913,822	$ 2,896,556	$ 17,266	1.01	$ 2,913,822	$ 5,827,644	$ 2,931,088	2.01
18	$ 3,195,452	$ 2,913,315	$ 282,137	1.10	$ 3,195,452	$ 6,390,904	$ 3,477,589	2.19
19	$ 9,498,762	$ 2,947,675	$ 6,551,087	3.22	$ 4,333,265	$ 13,832,027	$ 10,884,352	4.69
20	$ 10,433,358	$ 2,972,598	$ 7,460,760	3.51	$ 4,333,265	$ 14,766,623	$ 11,794,025	4.97
21	$ 3,821,608	$ 2,997,519	$ 824,089	1.27	$ 3,821,608	$ 7,643,216	$ 4,645,697	2.55
22	$ 5,053,500	$ 3,028,500	$ 2,025,000	1.67	$ 4,333,265	$ 9,386,765	$ 6,358,266	3.10
23	$ 4,390,690	$ 3,554,287	$ 836,403	1.24	$ 4,333,265	$ 8,723,955	$ 5,169,668	2.45
24	$ 4,802,128	$ 3,596,107	$ 1,206,021	1.34	$ 4,333,265	$ 9,135,393	$ 5,539,286	2.54
25	$ 3,710,736	$ 3,644,838	$ 65,898	1.02	$ 3,710,736	$ 7,421,472	$ 3,776,634	2.04
26	$ 3,245,090	$ 2,582,682	$ 662,408	1.26	$ 3,245,090	$ 6,490,180	$ 3,907,498	2.51
Totals	$143,645,536	$ 69,401,000	N/A	N/A	N/A	N/A	N/A	

9.0 REGIONAL ECONOMIC DEVELOPMENT (RED) IMPACTS

The following regional economic impacts will be addressed based on the interest of the local sponsor and the surrounding Pender and Onslow counties. Local governments seek to preserve the tax base and encourage the growth in overall property values, to create stability in the labor force and the employment of the labor force. The steady growth of the local community and surrounding region is considered a worthy goal by the state and local governments.

Displacement of people, businesses and farms in the study area is not a desirable outcome that sometimes may result from either continued storm damages or even some types of construction.

9.01 Preserve Tax Base and, Property Values

Real property, including land and structures, in the town of Topsail Beach is subject to property tax by Pender County and the town. The Topsail Beach Land Use Plan 2005 does not promote high-rise or other dense development, but rather favors maintaining the status quo. The tax base and property values will be preserved with implementation of a hurricane and storm damage reduction plan. Land loss and long-term erosion eventually renders lots unbuildable with a significantly lower economic value. Typically, the tax valuation of the ocean front lots is severely reduced to reflect the diminished utility of the land. Lower tax valuations may result in lower county and town tax revenues unless there is offsetting development in other areas**.**

The coastal areas of North Carolina will continue to grow and expand both with and without beach nourishment projects. Therefore, the economic benefit analysis claims no increase in benefits or hurricane and storm damage due to induced development. Development of vacant lots is limited to lots buildable under the regulations set forth by CAMA, flood plain regulations, state and local ordinances, and applicable requirements of the Federal Flood Insurance Program. These regulations include setback distance from the shoreline, setback from the street right-of-way, elevation of the first living level above the Base Flood Elevation; ground-level elevation of residential is limited (parking, storage, access) and depth of pilings. The analysis makes no assumption that damage prone older structures will be replaced by new more valuable damage prone structures. If a new structure can be placed on a lot, the structure will be flood and erosion damage resistant as required by CAMA and Federal Flood Insurance rules.

IWR Report 96-PS-1, FINAL REPORT: An Analysis of the U.S. Army Corps of Engineers Shore Protection Program, June 1996 supports this conclusion as follows. “Corps projects have been found to have no measurable effect on development, and it appears that Corps activity has little effect on the relocation and/or construction decisions of developers, homeowners, or housing investors.” Therefore no changes in land use with a long-term storm damage reduction plan are claimed in this economic analysis. No increase in damages or project induced developments in the Topsail Beach study area are claimed.

9.02 Employment Stability

Tourism is highly valued as a source of employment and income. Employment related to recreation can be less than ideal because of the seasonal nature of recreation and tourism. Increased recreation visitation may improve the income of service industries in the two county study area. It is unlikely that employment will be significantly impacted with or without storm damage reduction measures. Gains or losses in income or employment are considered regional impacts.

9.03 Community and Regional Growth

Implementation of effective damage reduction measures will ensure that the current growth trends in population and recreation visitation will continue. Protection of the streets and highways in the study area preserve community cohesion and encourage the tourism industry on the island, especially the town of Topsail Beach.

9.04 Displacement of People, Businesses, and Farms

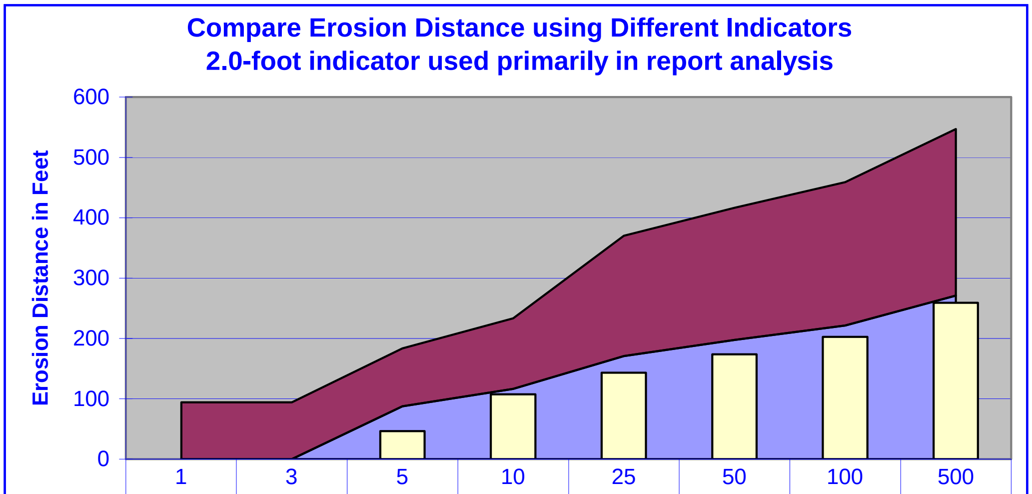
Implementation of damage reduction measures under consideration is not expected to displace people, businesses, or farms.

10.0 UNCERTAINTY AND SENSITIVITY OF ANALYSIS TO VARIATION OF VALUES AND ASSUMPTIONS

10.01 Hurricane and Storm Damage Reduction

10.01.1 Erosion indicators

The effect of using different erosion indicators is shown in Figure B-22 and Table B-24. Previous analyses used the 0.5-foot indicator exclusively. The storm erosion damages presented in this report are based on using the 2.0-foot erosion indicator for 98.5 percent of the structures. The 0.5-foot indicator was used to estimate storm erosion damages to streets, highway, and structures built on concrete slab foundations. The 2.0-foot erosion indicator was used for 597 structures including the 34 commercial structures. Support for this assumption was found in “Erosion Damage Thresholds in North Carolina” (Attachment B-4, pages 12-13) by Spencer Rogers, dated 21 April 2002. An erosion threshold of 2 feet or less may generate more realistic damage estimates than using an erosion threshold of 4 feet when using the SBEACH model. The 0.5-foot erosion indicator was used for 6 single-story homes built on slab foundations, 3 two-story homes built on slabs, and the 27 street segments. Base condition damages, remaining damages and benefits to hurricane and storm damage reduction are shown at 5-3/8% interest and October 2004 price levels in this illustration of sensitivity to alternative erosion indicators.



	1	3	5	10	25	50	100	500
0.5	94	94	95.6	116.54	199.45	219.2	237.25	276.03
2.0	0	0	87.71	116.54	170.78	197.52	221.65	270.91
4.0	0	0	46.31	107.29	143.31	173.94	202.47	259.09

Erosion Distance in Feet - Storm Frequency in Years

Figure B-22 – Compare Erosion Distance using Different Indicators

Table B- 24 – Sensitivity Analysis - Erosion Indicators performed at 5-3/8% and October 2004 price level

	HSDR benefits	Erosion	Flood	Wave	Land	Costs	B/C Ratio
Base Totals	$ 135,347,131	$ 113,186,049	$ 2,282,826	$ 5,214,450	$ 14,663,809	$ -	N/A
Base_4ft_sel	$ 130,866,658	$ 110,113,473	$ 2,129,122	$ 5,203,235	$ 13,420,826	$ -	N/A
Percentage change	3.31%	2.71%	6.73%	0.22%	8.48%	#DIV/0!	
Base_4ft_all	$ 116,875,279	$ 95,403,732	$ 2,240,801	$ 5,910,281	$ 13,320,463	$ -	N/A
Percentage change	13.65%	15.71%	1.84%	-13.34%	9.16%	#DIV/0!	
RemD1550 Totals	$ 13,226,516	$ 7,351,470	$ 3,555,428	$ 2,316,568	$ 3,045	$ 55,892,000	N/A
RemD1550_4ft_sel	$ 12,832,179	$ 7,130,600	$ 3,367,687	$ 2,330,848	$ 3,045	$ 55,892,000	N/A
Percentage change	2.98%	3.00%	5.28%	-0.62%	0.00%	0.00%	
RemD1550_4ft_all	$ 10,798,196	$ 4,810,061	$ 3,450,991	$ 2,534,156	$ 2,990	$ 55,892,000	N/A
Percentage change	18.36%	34.57%	2.94%	-9.39%	1.81%	0.00%	
Benefits1550 Totals	$ 122,120,615	$ 105,834,579	$ (1,272,602)	$ 2,897,882	$ 14,660,764	$ (55,892,000)	2.18
Benefits1550_4ft_sel	$ 118,034,479	$ 102,982,873	$ (1,238,565)	$ 2,872,387	$ 13,417,781	$ (55,892,000)	2.11
Percentage change	3.35%	2.69%	2.67%	0.88%	8.48%	0.00%	
Benefits1550_4ft_all	$ 106,077,083	$ 90,593,671	$ (1,210,190)	$ 3,376,125	$ 13,317,473	$ (55,892,000)	1.90
Percentage change	13.14%	14.40%	4.90%	-16.50%	9.16%	0.00%	

Estimates presented in GRR (2.0 ft indicator with a few 0.5-ft indicators for slab const. and roads)
Assume 4ft erosion indicator for selected structures (1st row post-1986 construction)
Assume 4ft erosion indicator for ALL structures

10.01.2 Erosion Damage Curves

Erosion Damage curves, erosion distance, structure distance, and the erosion damage indicator combine to produce estimates of storm damage erosion. The risk and uncertainty of several parameters is addressed in the GRANDUC modeling procedures and included in Appendix D.

10.02 Other Benefits

Other benefits will include recreation and benefits during construction. With the level of Hurricane and Storm Damage Reduction Benefits presented in this report, recreation is not expected to influence plan formulation or basic economic feasibility. However, recreation benefits are expected to increase the total NED benefits and overall benefit-cost ratio. The magnitude of the projected visitation and recreation benefits is discussed in detail in Appendix O – Recreation. Upon completion of the analysis, visitation may impact on the parking requirements if demand exceeds the existing supply of public parking spaces within reasonable distance, 0.25 miles, from public beach access points. As long as the initial construction falls within the scheduled period, benefits during construction will be minor. Parking requirements are presented in Appendix F. Changes in the construction schedule (one dredging season) are not expected.

10.03 Interest Rate

In compliance with Executive Order 12893, all benefits and costs were computed using a 7.0 percent interest rate for comparison. The results are presented in table B-25. Average annual benefits to the NED plan decrease very slightly to $8,241,000 or less than 2 percent. Average annual costs increase to $6,114,000, resulting in net benefits of $2,127,000 and a benefit-to-cost ratio of 1.6 based exclusively on hurricane and storm damage reduction (HSDR) benefits.

Average annual costs for the Locally Preferred Plan (LPP), the recommended plan equal $5,189,000 at 7.0 percent interest. When compared to the average annual benefits, the resulting net benefits and a benefit-to-cost ratio are $2,406,000 and 1.5 respectively.

Table B-25 – Interest Rate Sensitivity Analysis - Compare Plans 1550 (NED Plan) and 1250X (Locally Preferred Plan) at 7.0 percent interest and October 2008 price level.

1550 Plan (NED Plan)	4.625%	7.000%		% change
HSDR Benefits	$ 8,401,000	$ 8,241,381		-1.9%
Average Annual Costs	$ 5,107,000	$ 6,114,000		16.5%
Net Benefits	$ 3,294,000	$ 2,127,381		-54.8%
BCR (HSDR benefits only)	1.6	1.3		
Recreation Benefits	$ 5,500,000	$ 5,500,000		0.0%
Reduced Emergency Costs	$ 87,000	$ 87,000		0.0%
Total All Benefits	$13,988,000	$13,828,381		-1.2%
Net Benefits	$ 8,881,000	$ 7,714,381		-15.1%
BCR (All benefits)	2.7	2.3		

1250X (Locally Preferred Plan)	4.625%	7.000%		% change
HSDR Benefits	$ 7,742,000	$ 7,594,902		-1.9%
Average Annual Costs	$ 4,450,000	$ 5,189,000		14.2%
Net Benefits	$ 3,292,000	$ 2,405,902		-36.8%
BCR (HSDR benefits only)	1.7	1.5		
Recreation Benefits	$ 5,500,000	$ 5,500,000		0.0%
Reduced Emergency Costs	$ 87,000	$ 87,000		0.0%
Total All Benefits	$13,329,000	$13,181,902		-1.1%
Net Benefits	$ 8,879,000	$ 7,992,902		-11%
BCR (All benefits)	3.0	2.5		

General Reevaluation Report
and
Environmental Impact Statement

on

Hurricane Protection and Beach Erosion Control

WEST ONSLOW BEACH AND NEW RIVER INLET (TOPSAIL BEACH), NORTH CAROLINA

Appendix B - Economic Analysis

Attachment 1 – Description of Structure Types

Structure Type	Building inventory codes	Old Code	Flood Curve Type	Content value factor
COMMERCIAL				
Apartments		001	5	1.4
Appliances		002	6	1.75
Auto Dealership		003	7	1.18
Auto Junk Yard		004	8	6
Auto Parts		005	9	3.33
Bait Stand		006	10	1.67
Bank		007	11	1.39
Barber Shop		008	12	1.118
Beauty Shop		009	46	1.375
Boat Stalls		010	13	2
Book Store		011	14	2.68
Bowling Alley		012	15	1.515
Business, Pole Shed (farm), Garage, Frame Tobacco Barn		013,071, 011A,076	16	2.664,1.5,1.4,1.9
Church		014	17	1.47
Cleaners		015	18	2.385
Cleaners-sub		016	47	3.176
Clinic-medical		017	19	2.5
Clothing		018	50	3.575
Dentist Office		019	51	2.647
Depart.Store		020	20	2.765
Doctor's Office		021	21	1.845
Drug, Super		022	48	2.533
Funeral Home		023	22	1.176
Furniture		024	23	1.946
Garage, Stable, Animal Barn		025,077	24	1.606,1.4
Hall, Organiz, Pool House		026	25	1.176
Hardware		027	26	3.5
Hotel		028	27	2.724
Jewelry, Greenhouse		029,012A	28	8.5, 1.2
Laundry		030	29	2
Liquor		031	30	1.52
Lumber		032	31	2.198
Market, Super, Poultry Houses		033,078	32	2.7,2.8
Market, Drive		034	49	1.923
Motel		035	33	1.5
Newspaper		036	34	3.125
Office Bldg.		037	35	1.588

Structure Type	Building inventory codes	Old Code	Flood Curve Type	Content value factor
Post Office, Fertilizer Tank, Swimming Pool, Tennis Courts		038,075, 013A,014A	36	1.176,1.4,1.15,0
Private Club		039	37	1.32
Restaurant		040	38	2.66
Rest Home		041	39	2
School		042	40	1.294
Service Station		043	41	1.524
Theater		044	42	1.796
Theater, Drive In		045	52	1.376
TV Station		046	43	1.699
Tavern		047	44	1.416
Variety Store, Pierhouse		048	53	2.67
Wash-a-teria (bathhouse)		049	54	2.235
Warehouse, Storage Building (farm&res), Bulk Tobacco Barn (farm)		050,072, 010A,074	45	3.47,1.5,1.5,1.5
Grain Bin		073	65	3.5
RESIDENTIAL				
Res type 1A	1NNN		1	*
Res type 2A	1NF, 2NNN, 2NF, 3PF, 3NN		2	*
Res type 3A			3	*
Res type 4A			4	*
Res type 1H	1PN		55	*
Res type 2H	2PN, 3PN		56	*
Res type 4H&3H			57	*
Res type 1B			58	*
Res type 1HL	1PF, 1PP, 1PS		59	*
Res type 2HL	2PF, 2PP, 2PS, 3PP, 3PS		60	*
Res type 4HL			61	*
5A Mobile Homes			62	*
Upper floors			63	*
Highways			64	

Key to GRANDUC Residential and Highway Structure Types

Structure Types - Coastal Residential

plus Condos upper floors & Highways

Enter Type in Col. 9 of Structure File

Enter GRANDUC Flood Types for Flood Curve Types		Description	Acceptable Floor Elevations
1	⇨	**One story**	0-6 feet
58	⇨	**One story with Basement**	0-9 feet
55	⇨	**One story High-raised**	4-15 feet
59	⇨	**One story High-raised with 1/2 living area below**	0-6 feet
2	⇨	**Two story (essentially 2 full stories)**	0-6 feet
n/a		Two story with Basement	0-9 feet
56	⇨	**Two story High-raised**	4-15 feet
60	⇨	**Two story High-raised with 1/2 living area below**	0-6 feet
3	⇨	**Split level - All space in living area**	0
n/a		Split level - Garage on lowest level	0
n/a		Split level - 1/2 garage 1/2 living area on lowest level	0-4 feet
4	⇨	**1 1/2 story**	0-6 feet
n/a		1 1/2 story with Basement	0-9 feet
57	⇨	**1 1/2 story High-raised**	4-15 feet
61	⇨	**1 1/2 story High-raised with 1/2 living area below**	0-6 feet
62	⇨	**Mobile Home**	0-6 feet
63	⇨	**Residential Condos - upper floors**	
64	⇨	**Highways**	

All residential structures have a set content percentage of 30 %, 40 %, or 50 %.

FLOOD DAMAGE CURVES BY TYPE OF STRUCTURE

Flood Type 1

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-7	0	-1	0
-6	0.005	0	0.112
-1	0.01	1	0.24
0	0.093	2	0.364
1	0.136	3	0.429
2	0.233	4	0.46
5	0.361	5	0.52
10	0.523	10	0.865
15	0.725	15	0.955
16	0.8	16	1
20	0.85	17	1
24	0.85	24	1

Flood Type 2

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-7	0	-7	0
-6	0.003	-1	0
-1	0.006	0	0.073
0	0.07	1	0.178
1	0.091	2	0.259
2	0.145	3	0.303
5	0.25	4	0.4
10	0.36	5	0.5
15	0.54	10	0.58
16	0.57	15	0.82
20	0.675	16	0.86
24	0.765	17	1
		24	1

Flood Type 3

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-7	0	-1	0
-6	0	0	0.034
-1	0	1	0.153
0	0.028	2	0.213
1	0.048	3	0.253
2	0.07	4	0.32
5	0.202	5	0.44
10	0.43	10	0.716
15	0.618	15	0.907
16	0.666	16	0.936
20	0.776	17	0.943
24	0.84	24	1

Flood Type 4

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-7	0	-1	0
-6	0.004	0	0.093
-1	0.007	1	0.21
0	0.079	2	0.312
1	0.109	3	0.366
2	0.18	4	0.43
5	0.29	5	0.51
10	0.42	10	0.8
15	0.5	15	0.87
16	0.505	16	0.88
20	0.595	17	1
24	0.75	24	1

Flood Type 5

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.15
1	0.195
2	0.212
3	0.23
4	0.254
5	0.289
6	0.318
7	0.346
9	0.42
11	0.505
13	0.58
14	0.61
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 6

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.05
1	0.14
2	0.23
3	0.315
4	0.38
5	0.44
6	0.505
7	0.56
9	0.63
10	0.655
12	0.71
14	0.75
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 7

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.035
1	0.064
2	0.091
3	0.135
4	0.195
5	0.292
6	0.428
7	0.575
8	0.675
10	0.777
12	0.866
14	0.94
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 8

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.07
1	0.14
2	0.21
3	0.26
4	0.279
5	0.28
6	0.289
8	0.309
9	0.32
10	0.33
12	0.349
14	0.38
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 9

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.04	24	0.0001
1	0.105		
2	0.19		
3	0.268		
4	0.324		
5	0.369		
6	0.41		
8	0.49		
10	0.55		
12	0.61		
13	0.64		
14	0.667		
24	1		

Flood Type 10

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.06	24	0.0001
1	0.1		
2	0.124		
3	0.16		
4	0.232		
5	0.37		
6	0.54		
7	0.74		
8	0.832		
10	0.9		
12	0.93		
14	0.936		
24	1		

Flood Type 11

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.01
1	0.05
2	0.132
3	0.21
4	0.23
5	0.242
6	0.26
7	0.278
8	0.3
10	0.35
12	0.394
14	0.45
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 12

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.04
1	0.07
2	0.146
3	0.245
4	0.311
5	0.385
6	0.45
7	0.52
8	0.571
10	0.667
12	0.748
14	0.819
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 13

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.05
1	0.09
2	0.13
3	0.17
4	0.21
5	0.26
6	0.32
7	0.37
8	0.425
10	0.521
12	0.6
14	0.655
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 14

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.09
1	0.17
2	0.235
3	0.294
4	0.36
5	0.483
6	0.61
7	0.752
8	0.837
10	0.871
12	0.91
14	0.92
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 15

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.24	24	0.0001
1	0.3		
2	0.327		
3	0.35		
4	0.393		
5	0.461		
6	0.549		
7	0.62		
8	0.681		
10	0.752		
12	0.809		
14	0.851		
24	1		

Flood Type 16

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.037	24	0.0001
1	0.085		
2	0.152		
3	0.216		
4	0.269		
5	0.345		
6	0.444		
7	0.548		
8	0.641		
10	0.768		
12	0.87		
14	0.945		
24	1		

Flood Type	17		
Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.12	24	0.0001
1	0.165		
2	0.19		
3	0.218		
4	0.248		
5	0.28		
6	0.32		
7	0.37		
8	0.425		
10	0.529		
12	0.63		
14	0.73		
24	1		

Flood Type	18		
Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.05	24	0.0001
1	0.11		
2	0.19		
3	0.27		
4	0.39		
5	0.52		
6	0.68		
7	0.841		
8	0.954		
10	0.98		
12	0.982		
14	0.985		
24	1		

Flood Type 19

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.07
1	0.161
2	0.272
3	0.37
4	0.415
5	0.466
6	0.49
7	0.52
8	0.549
10	0.592
12	0.635
14	0.68
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 20

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.15
1	0.201
2	0.286
3	0.366
4	0.435
5	0.495
6	0.552
7	0.615
8	0.666
10	0.751
12	0.84
14	0.973
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 21

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.02
1	0.07
2	0.168
3	0.26
4	0.34
5	0.43
6	0.51
7	0.58
8	0.645
10	0.77
12	0.859
14	0.95
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 22

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.17
1	0.245
2	0.31
3	0.38
4	0.465
5	0.545
6	0.625
7	0.705
8	0.775
10	0.841
12	0.876
14	0.915
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 23

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.147	24	0.0001
1	0.251		
2	0.341		
3	0.4		
4	0.442		
5	0.472		
6	0.497		
7	0.524		
8	0.554		
10	0.622		
12	0.679		
14	0.739		
24	1		

Flood Type 24

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.03	24	0.0001
1	0.072		
2	0.121		
3	0.168		
4	0.202		
5	0.241		
6	0.28		
7	0.32		
8	0.365		
10	0.458		
12	0.545		
14	0.636		
24	1		

Flood Type 25

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.015
1	0.033
2	0.06
3	0.105
4	0.178
5	0.233
6	0.3
7	0.36
8	0.43
10	0.568
12	0.695
14	0.821
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 26

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.04
1	0.103
2	0.185
3	0.248
4	0.288
5	0.327
6	0.37
7	0.415
8	0.465
10	0.548
12	0.638
14	0.724
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 27

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.11
1	0.21
2	0.3
3	0.37
4	0.42
5	0.465
6	0.51
7	0.56
8	0.61
10	0.7
12	0.79
14	0.88
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 28

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.07
1	0.16
2	0.27
3	0.37
4	0.44
5	0.51
6	0.57
7	0.63
8	0.7
10	0.8
12	0.876
14	0.92
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 29

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.05
1	0.12
2	0.204
3	0.29
4	0.37
5	0.45
6	0.52
7	0.598
8	0.65
10	0.732
12	0.816
14	0.899
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 30

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.08
1	0.13
2	0.17
3	0.21
4	0.249
5	0.29
6	0.349
7	0.4
8	0.455
10	0.56
12	0.65
14	0.74
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 31

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.03	24	0.0001
1	0.058		
2	0.081		
3	0.13		
4	0.2		
5	0.28		
6	0.35		
7	0.42		
8	0.498		
10	0.637		
12	0.78		
14	0.92		
24	1		

Flood Type 32

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.06	24	0.0001
1	0.192		
2	0.349		
3	0.482		
4	0.561		
5	0.641		
6	0.72		
7	0.8		
8	0.857		
10	0.901		
12	0.922		
14	0.94		
24	1		

Flood Type 33

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.1
1	0.164
2	0.21
3	0.28
4	0.363
5	0.455
6	0.54
7	0.63
8	0.7
10	0.749
12	0.79
14	0.829
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 34

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.02
1	0.069
2	0.122
3	0.187
4	0.245
5	0.302
6	0.36
7	0.41
8	0.46
10	0.56
12	0.66
14	0.76
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 35

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.26
1	0.349
2	0.41
3	0.48
4	0.545
5	0.604
6	0.66
7	0.714
8	0.763
10	0.825
12	0.879
14	0.932
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 36

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.05
1	0.08
2	0.095
3	0.103
4	0.113
5	0.125
6	0.135
7	0.145
8	0.158
10	0.181
12	0.21
14	0.239
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 37

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.06	24	0.0001
1	0.185		
2	0.334		
3	0.44		
4	0.485		
5	0.53		
6	0.57		
7	0.61		
8	0.66		
10	0.741		
12	0.825		
14	0.905		
24	1		

Flood Type 38

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.08	24	0.0001
1	0.199		
2	0.318		
3	0.43		
4	0.52		
5	0.59		
6	0.66		
7	0.73		
8	0.787		
10	0.86		
12	0.93		
14	0.968		
24	1		

Flood Type 39

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.12	24	0.0001
1	0.205		
2	0.27		
3	0.34		
4	0.413		
5	0.49		
6	0.55		
7	0.62		
8	0.68		
10	0.78		
12	0.88		
14	0.975		
24	1		

Flood Type 40

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.04	24	0.0001
1	0.22		
2	0.29		
3	0.34		
4	0.39		
5	0.44		
6	0.48		
7	0.529		
8	0.573		
10	0.66		
12	0.745		
14	0.83		
24	1		

Flood Type 41

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.065	24	0.0001
1	0.128		
2	0.205		
3	0.278		
4	0.327		
5	0.374		
6	0.42		
7	0.47		
8	0.517		
10	0.614		
12	0.705		
14	0.802		
24	1		

Flood Type 42

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.02	24	0.0001
1	0.075		
2	0.163		
3	0.21		
4	0.221		
5	0.231		
6	0.242		
7	0.25		
8	0.251		
10	0.252		
12	0.261		
14	0.27		
24	1		

Flood Type	43		
Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.03	24	0.0001
1	0.06		
2	0.085		
3	0.11		
4	0.14		
5	0.17		
6	0.2		
7	0.231		
8	0.27		
10	0.338		
12	0.405		
14	0.47		
24	1		

Flood Type	44		
Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.03	24	0.0001
1	0.13		
2	0.455		
3	0.631		
4	0.665		
5	0.679		
6	0.691		
7	0.701		
8	0.715		
10	0.74		
12	0.76		
14	0.781		
24	1		

Flood Type 45

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.04
1	0.12
2	0.23
3	0.336
4	0.43
5	0.51
6	0.59
7	0.68
8	0.741
10	0.801
12	0.86
14	0.905
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 46

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.01
1	0.06
2	0.114
3	0.232
4	0.33
5	0.418
6	0.5
7	0.6
8	0.67
10	0.74
12	0.81
14	0.875
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0.0001

Flood Type 47

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.04	24	0.0001
1	0.059		
2	0.07		
3	0.101		
4	0.22		
5	0.39		
6	0.56		
7	0.75		
8	0.88		
10	0.925		
12	0.941		
14	0.961		
24	1		

Flood Type 48

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.05	24	0.0001
1	0.18		
2	0.36		
3	0.495		
4	0.569		
5	0.635		
6	0.7		
7	0.775		
8	0.826		
10	0.855		
12	0.876		
14	0.901		
24	1		

Flood Type 49

Inundation in feet	Structure Damage		Inundation in feet	Content Damage
-24	0		-24	0
-1	0		0	0
0	0.02		24	0.0001
1	0.14			
2	0.255			
3	0.375			
4	0.495			
5	0.6			
6	0.708			
7	0.828			
8	0.911			
10	0.97			
12	0.98			
14	0.995			
24	1			

Flood Type 50

Inundation in feet	Structure Damage		Inundation in feet	Content Damage
-24	0		-24	0
-1	0		0	0
0	0.05		24	0.0001
1	0.187			
2	0.431			
3	0.595			
4	0.66			
5	0.72			
6	0.773			
7	0.83			
8	0.87			
10	0.911			
12	0.94			
14	0.964			
24	1			

Flood Type 51

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.02	24	0.0001
1	0.05		
2	0.091		
3	0.155		
4	0.245		
5	0.358		
6	0.5		
7	0.662		
8	0.781		
10	0.84		
12	0.865		
14	0.891		
24	1		

Flood Type 52

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-1	0	0	0
0	0.01	24	0.0001
1	0.012		
2	0.019		
3	0.029		
4	0.06		
5	0.091		
6	0.13		
7	0.169		
8	0.21		
10	0.28		
12	0.351		
14	0.421		
24	1		

Flood Type 53

Inundation in feet	Structure Damage		Inundation in feet	Content Damage
-24	0		-24	0
-1	0		0	0
0	0.045		24	0.0001
1	0.106			
2	0.179			
3	0.244			
4	0.295			
5	0.345			
6	0.392			
7	0.433			
8	0.48			
10	0.572			
12	0.66			
14	0.745			
24	1			

Flood Type 54

Inundation in feet	Structure Damage		Inundation in feet	Content Damage
-24	0		-24	0
-1	0		0	0
0	0.06		24	0.0001
1	0.2			
2	0.395			
3	0.524			
4	0.58			
5	0.625			
6	0.67			
7	0.716			
8	0.76			
10	0.835			
12	0.905			
14	0.971			
24	1			

Flood Type 55

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-14	0.01	-14	0.007
-5	0.035	-13	0.008
-1	0.055	-6	0.06
0	0.093	-2	0.125
1	0.136	-1	0.13
2	0.233	0	0.14
3	0.36	1	0.26
4	0.39	2	0.38
5	0.455	3	0.52
10	0.536	4	0.635
15	0.735	5	0.78
16	0.8	10	0.945
20	0.85	14	1
24	1	24	1

Flood Type 56

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-14	0.006	-14	0.011
-6	0.025	-13	0.012
-2	0.033	-6	0.045
-1	0.035	-1	0.094
0	0.07	0	0.101
1	0.091	1	0.187
2	0.145	2	0.286
3	0.229	3	0.38
4	0.253	4	0.45
5	0.29	5	0.534
10	0.369	10	0.633
15	0.548	16	0.86
20	0.675	17	1
24	1	24	1

Flood Type 57

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-14	0.007	-14	0.001
-6	0.03	-6	0.04
-1	0.04	-2	0.082
0	0.079	0	0.093
1	0.109	1	0.21
2	0.186	2	0.312
3	0.28	3	0.43
4	0.302	4	0.54
5	0.336	5	0.673
10	0.431	10	0.81
15	0.503	14	0.86
16	0.505	16	0.88
20	0.595	17	1
24	1	24	1

Flood Type 58

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-7	0.01	-8	0.005
-2	0.05	-3	0.115
0	0.1	-2	0.125
1	0.14	-1	0.13
2	0.223	0	0.2
3	0.258	1	0.34
4	0.278	2	0.48
5	0.327	3	0.52
10	0.536	4	0.635
13	0.632	5	0.78
16	0.8	10	0.945
17	0.835	13	0.992
20	0.85	14	1
24	1	24	1

Flood Type 59

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-6	0.002	-1	0
0	0.007	0	0.021
1	0.035	1	0.112
2	0.055	2	0.157
7	0.165	3	0.198
8	0.2	4	0.243
9	0.208	5	0.282
10	0.317	7	0.322
11	0.421	8	0.377
12	0.452	10	0.542
16	0.61	12	0.717
17	0.625	13	0.82
20	0.677	17	0.952
24	1	24	1

Flood Type 60

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-6	0.001	-1	0
0	0.004	0	0.014
1	0.022	1	0.068
6	0.099	2	0.098
7	0.102	3	0.126
8	0.126	4	0.154
9	0.158	5	0.179
10	0.208	7	0.205
12	0.317	8	0.251
13	0.355	10	0.402
16	0.433	12	0.536
17	0.447	17	0.674
20	0.548	22	0.866
24	1	24	1

Flood Type 61

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-7	0	-1	0
-6	0.002	0	0.016
0	0.005	3	0.148
1	0.027	5	0.211
7	0.125	7	0.241
8	0.152	8	0.282
10	0.27	9	0.343
11	0.346	10	0.444
12	0.37	11	0.54
13	0.406	12	0.625
16	0.49	13	0.73
17	0.513	17	0.85
20	0.567	22	0.895
24	1	24	1

Flood Type 62

Inundation in feet	Structure Damage	Inundation in feet	Content Damage
-24	0	-24	0
-7	0	-1	0
-6	0.005	0	0.06
-3	0.01	1	0.215
-1	0.03	2	0.316
0	0.08	3	0.365
1	0.272	4	0.5
2	0.417	5	0.63
3	0.6	6	0.74
4	0.93	7	0.82
5	0.96	8	1
10	0.978	24	1
11	0.98		
24	1		

Flood Type 63

Inundation in feet	Structure Damage
-24	0
-14	0
-13	0
-2	0
-1	0
1	0
2	0
3	0
14	0
16	0
19	0
21	0
22	0
24	0

Inundation in feet	Content Damage
-24	0
-10	0
-7	0
-3	0
0	0
5	0
7	0
8	0
9	0
12	0
13	0
16	0
24	0

Flood Type 64

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.0065
1	0.013
2	0.023
3	0.033
4	0.038
5	0.042
7	0.052
10	0.066
12	0.077
15	0.095
18	0.113
20	0.125
24	0.15

Inundation in feet	Content Damage
-24	0
0	0
24	0

Flood Type 65

Inundation in feet	Structure Damage
-24	0
-1	0
0	0.028
1	0.085
2	0.152
3	0.216
5	0.345
7	0.548
8	0.641
9	0.708
10	0.768
11	0.826
15	1
20	1
24	1

Inundation in feet	Content Damage
-24	0
0	0
24	0

General Reevaluation Report
and
Environmental Impact Statement

on

Hurricane Protection and Beach Erosion Control

WEST ONSLOW BEACH AND NEW RIVER INLET (TOPSAIL BEACH), NORTH CAROLINA

Appendix B - Economic Analysis

Attachment 2 – Erosion Damage Curves

Attachment B-2 – Erosion Damage Curves

Decision tree for assigning Erosion Curves to Structures

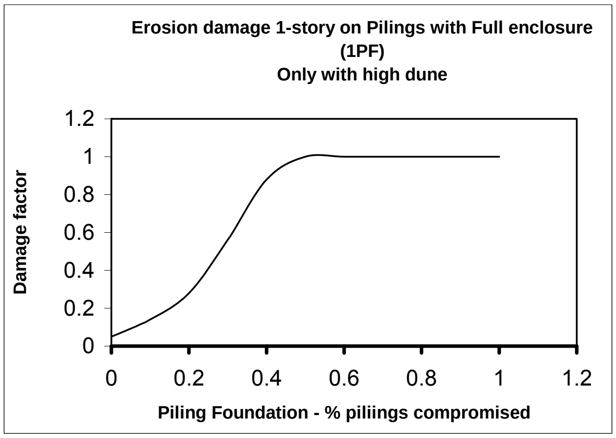
Ocean-front	Building Code	Ground Elevation	Piling Length	Erosion Curve #
		for short pilings high if ≥12 feet NGVD	assume short if building date is prior 1986	
		for long pilings high if ≥16 feet NGVD		
Yes, or 1	1PF	high	both	1
Yes, or 1	1PF	low	short	2
Yes, or 1	1PF	low	long	3
Yes, or 1	2PF	high	both	4
Yes, or 1	2PF	low	short	5
Yes, or 1	2PF	low	long	6
Yes, or 1	3PF	high	both	7
Yes, or 1	3PF	low	long	8
Yes, or 1	3PF	low	short	9
Yes, or 1	1PP	high	both	10
Yes, or 1	1PP	low	long	11
Yes, or 1	1PP	low	short	12
Yes, or 1	2PP	high	both	13
Yes, or 1	2PP	low	long	14
Yes, or 1	2PP	low	short	15
Yes, or 1	3PP	high	both	16
Yes, or 1	3PP	low	short	17
Yes, or 1	3PP	low	long	18
Yes, or 1	1PS	high	both	19
Yes, or 1	1PS	low	long	20
Yes, or 1	1PS	low	short	21
Yes, or 1	2PS	high	both	22
Yes, or 1	2PS	low	short	23
Yes, or 1	2PS	low	long	24
Yes, or 1	3PS	high	both	25
Yes, or 1	3PS	low	long	26
Yes, or 1	3PS	low	short	27
Yes, or 1	1PN,2PN,3PN	high	both	28
Yes, or 1	1PN,2PN,3PN	low	long	29
Yes, or 1	1PN,2PN,3PN	low	short	30
No, or 0	Any	Any	Any	31
Yes, or 1	1NN, 2NN, 3NN, 1NF, 2NF, & all commercial structures	Any	Any	31
Yes, or 1	Upper Floors	any	both	32
Yes, or 1	mobile, utility, pools	any	both	33
Yes, or 1	highways	any	N/A	34

* if dune elevation ≥16 feet do not need to assign long or short pilings because they have the same erosion curve.

1PF high dune Curve #1

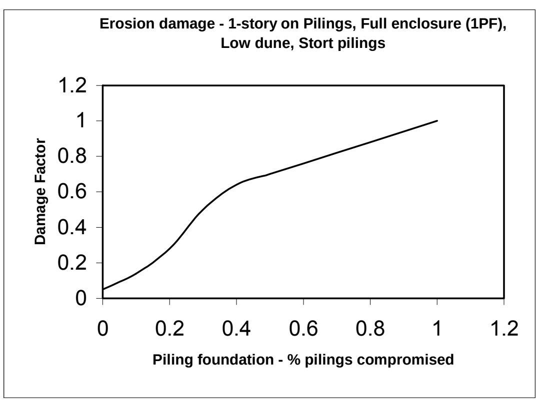
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.4	0.05	0.6	0.05	0.05
0.1	0.4	0.2	0.6	0.1	0.14
0.2	0.4	0.4	0.6	0.2	0.28
0.3	0.4	0.8	0.6	0.4	0.56
0.4	0.4	1	0.6	0.8	0.88
0.5	0.4	1	0.6	1	1
0.6	0.4	1	0.6	1	1
0.7	0.4	1	0.6	1	1
0.8	0.4	1	0.6	1	1
0.9	0.4	1	0.6	1	1
1	0.4	1	0.6	1	1

**Assume high dune Elevation equal or exceed 12 feet above NGVD.



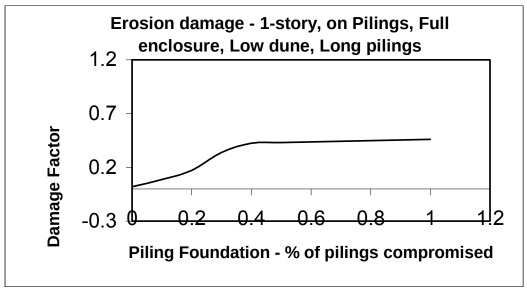
1PF low elevation, short pilings Curve #2

Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.4	0.05	0.6	0.05	0.05
0.1	0.4	0.2	0.6	0.1	0.14
0.2	0.4	0.4	0.6	0.2	0.28
0.3	0.4	0.8	0.6	0.3	0.5
0.4	0.4	1	0.6	0.4	0.64
0.5	0.4	1	0.6	0.5	0.7
0.6	0.4	1	0.6	0.6	0.76
0.7	0.4	1	0.6	0.7	0.82
0.8	0.4	1	0.6	0.8	0.88
0.9	0.4	1	0.6	0.9	0.94
1	0.4	1	0.6	1	1

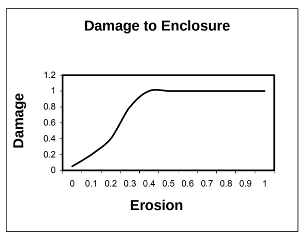


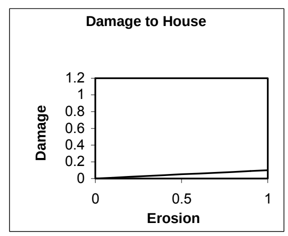
1PF low elevation, long piling Curve #3

Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.4	0.05	0.6	0	0.02
0.1	0.4	0.2	0.6	0.01	0.086
0.2	0.4	0.4	0.6	0.02	0.172
0.3	0.4	0.8	0.6	0.03	0.338
0.4	0.4	1	0.6	0.04	0.424
0.5	0.4	1	0.6	0.05	0.43
0.6	0.4	1	0.6	0.06	0.436
0.7	0.4	1	0.6	0.07	0.442
0.8	0.4	1	0.6	0.08	0.448
0.9	0.4	1	0.6	0.09	0.454
1	0.4	1	0.6	0.1	0.46



*these graphs are for the appendices for the Bogue 933 project.

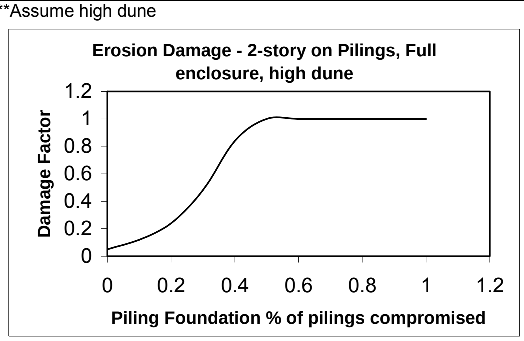




2PF high dune Curve #4

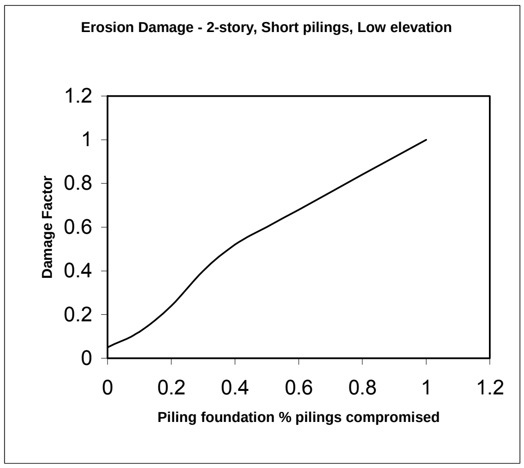
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.2	0.05	0.8	0.05	0.05
0.1	0.2	0.2	0.8	0.1	0.12
0.2	0.2	0.4	0.8	0.2	0.24
0.3	0.2	0.8	0.8	0.4	0.48
0.4	0.2	1	0.8	0.8	0.84
0.5	0.2	1	0.8	1	1
0.6	0.2	1	0.8	1	1
0.7	0.2	1	0.8	1	1
0.8	0.2	1	0.8	1	1
0.9	0.2	1	0.8	1	1
1	0.2	1	0.8	1	1

**Assume high dune



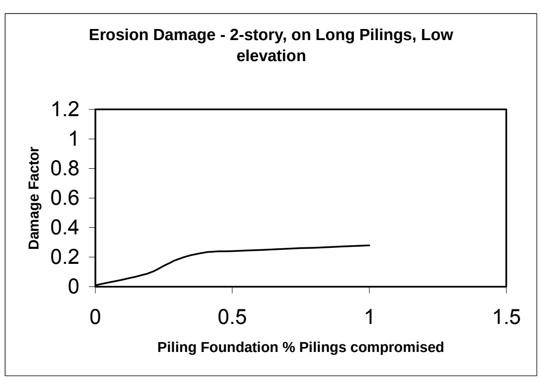
2PF low elevation (<12) and short pilings (<=8 Curve #5

Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.2	0.05	0.8	0.05	0.05
0.1	0.2	0.2	0.8	0.1	0.12
0.2	0.2	0.4	0.8	0.2	0.24
0.3	0.2	0.8	0.8	0.3	0.4
0.4	0.2	1	0.8	0.4	0.52
0.5	0.2	1	0.8	0.5	0.6
0.6	0.2	1	0.8	0.6	0.68
0.7	0.2	1	0.8	0.7	0.76
0.8	0.2	1	0.8	0.8	0.84
0.9	0.2	1	0.8	0.9	0.92
1	0.2	1	0.8	1	1



2PF Low elevation (<16) and long pilings (>=8 Curve #6

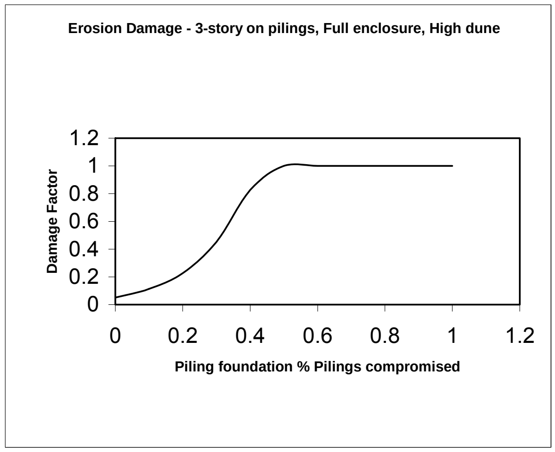
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.2	0.05	0.8	0	0.01
0.1	0.2	0.2	0.8	0.01	0.048
0.2	0.2	0.4	0.8	0.02	0.096
0.3	0.2	0.8	0.8	0.03	0.184
0.4	0.2	1	0.8	0.04	0.232
0.5	0.2	1	0.8	0.05	0.24
0.6	0.2	1	0.8	0.06	0.248
0.7	0.2	1	0.8	0.07	0.256
0.8	0.2	1	0.8	0.08	0.264
0.9	0.2	1	0.8	0.09	0.272
1	0.2	1	0.8	0.1	0.28



3PF high dune Curve #7

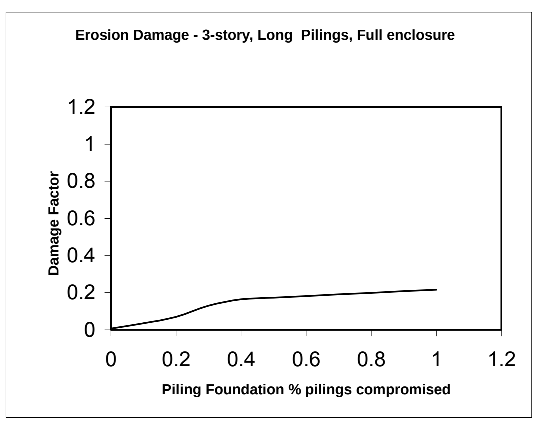
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.13	0.05	0.87	0.05	0.05
0.1	0.13	0.2	0.87	0.1	0.113
0.2	0.13	0.4	0.87	0.2	0.226
0.3	0.13	0.8	0.87	0.4	0.452
0.4	0.13	1	0.87	0.8	0.826
0.5	0.13	1	0.87	1	1
0.6	0.13	1	0.87	1	1
0.7	0.13	1	0.87	1	1
0.8	0.13	1	0.87	1	1
0.9	0.13	1	0.87	1	1
1	0.13	1	0.87	1	1

**Assume high dune



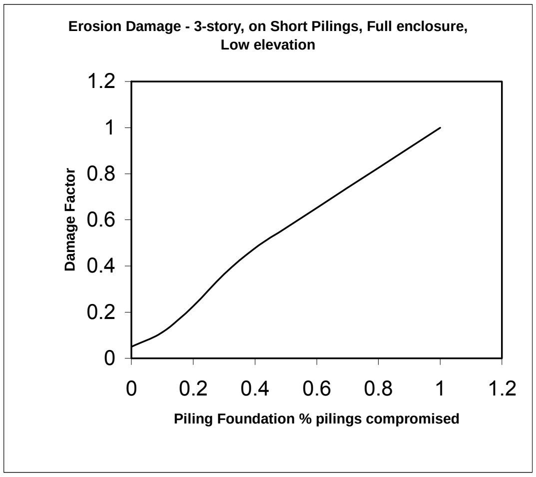
3PF low dune, long pilings Curve #8

Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.13	0.05	0.87	0	0.0065
0.1	0.13	0.2	0.87	0.01	0.0347
0.2	0.13	0.4	0.87	0.02	0.0694
0.3	0.13	0.8	0.87	0.03	0.1301
0.4	0.13	1	0.87	0.04	0.1648
0.5	0.13	1	0.87	0.05	0.1735
0.6	0.13	1	0.87	0.06	0.1822
0.7	0.13	1	0.87	0.07	0.1909
0.8	0.13	1	0.87	0.08	0.1996
0.9	0.13	1	0.87	0.09	0.2083
1	0.13	1	0.87	0.1	0.217



3PF low dune, short pilings Curve #9

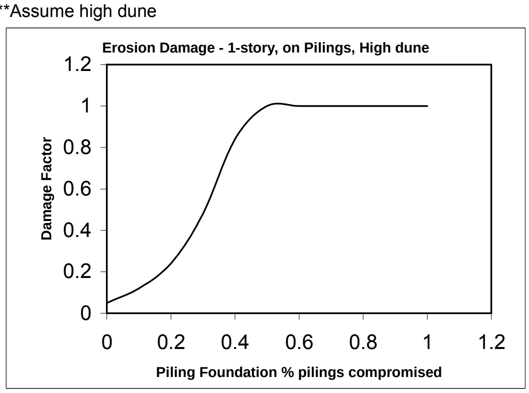
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.13	0.05	0.87	0.05	0.05
0.1	0.13	0.2	0.87	0.1	0.113
0.2	0.13	0.4	0.87	0.2	0.226
0.3	0.13	0.8	0.87	0.3	0.365
0.4	0.13	1	0.87	0.4	0.478
0.5	0.13	1	0.87	0.5	0.565
0.6	0.13	1	0.87	0.6	0.652
0.7	0.13	1	0.87	0.7	0.739
0.8	0.13	1	0.87	0.8	0.826
0.9	0.13	1	0.87	0.9	0.913
1	0.13	1	0.87	1	1



1PP High dune, long or short pilings Curve #10

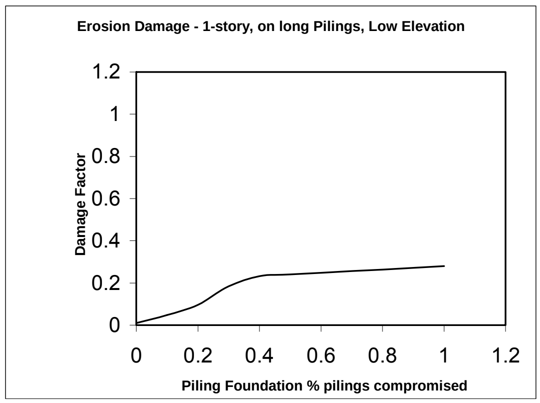
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.2	0.05	0.8	0.05	0.05
0.1	0.2	0.2	0.8	0.1	0.12
0.2	0.2	0.4	0.8	0.2	0.24
0.3	0.2	0.8	0.8	0.4	0.48
0.4	0.2	1	0.8	0.8	0.84
0.5	0.2	1	0.8	1	1
0.6	0.2	1	0.8	1	1
0.7	0.2	1	0.8	1	1
0.8	0.2	1	0.8	1	1
0.9	0.2	1	0.8	1	1
1	0.2	1	0.8	1	1

**Assume high dune



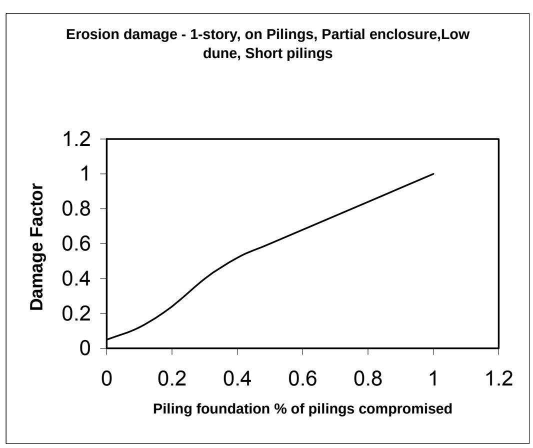
1PP Low elevation and long pilings Curve #11

Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.2	0.05	0.8	0	0.01
0.1	0.2	0.2	0.8	0.01	0.048
0.2	0.2	0.4	0.8	0.02	0.096
0.3	0.2	0.8	0.8	0.03	0.184
0.4	0.2	1	0.8	0.04	0.232
0.5	0.2	1	0.8	0.05	0.24
0.6	0.2	1	0.8	0.06	0.248
0.7	0.2	1	0.8	0.07	0.256
0.8	0.2	1	0.8	0.08	0.264
0.9	0.2	1	0.8	0.09	0.272
1	0.2	1	0.8	0.1	0.28



1PP low elevation, short pilings Curve #12

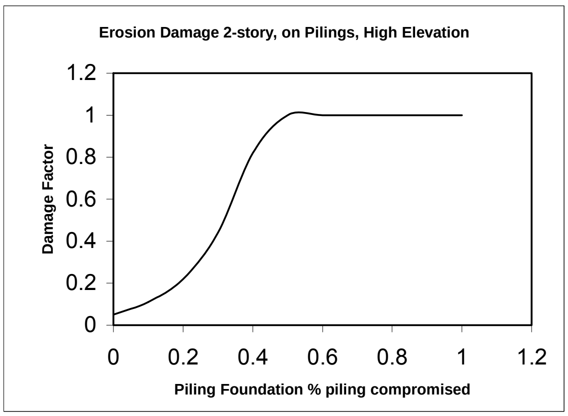
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.2	0.05	0.8	0.05	0.05
0.1	0.2	0.2	0.8	0.1	0.12
0.2	0.2	0.4	0.8	0.2	0.24
0.3	0.2	0.8	0.8	0.3	0.4
0.4	0.2	1	0.8	0.4	0.52
0.5	0.2	1	0.8	0.5	0.6
0.6	0.2	1	0.8	0.6	0.68
0.7	0.2	1	0.8	0.7	0.76
0.8	0.2	1	0.8	0.8	0.84
0.9	0.2	1	0.8	0.9	0.92
1	0.2	1	0.8	1	1



2PP high elevation, short or long piling Curve #13

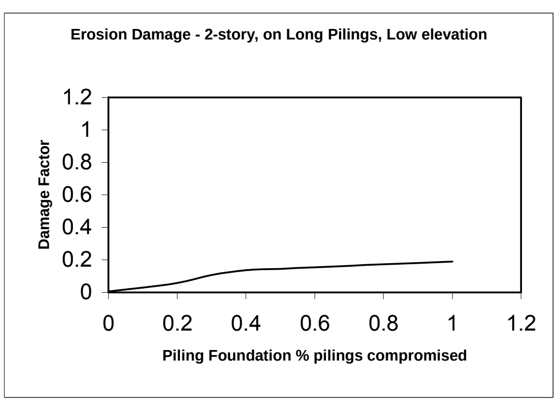
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.1	0.05	0.9	0.05	0.05
0.1	0.1	0.2	0.9	0.1	0.11
0.2	0.1	0.4	0.9	0.2	0.22
0.3	0.1	0.8	0.9	0.4	0.44
0.4	0.1	1	0.9	0.8	0.82
0.5	0.1	1	0.9	1	1
0.6	0.1	1	0.9	1	1
0.7	0.1	1	0.9	1	1
0.8	0.1	1	0.9	1	1
0.9	0.1	1	0.9	1	1
1	0.1	1	0.9	1	1

**Assume high dune



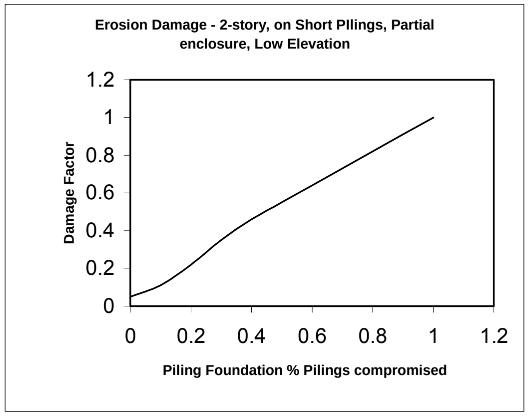
2PP low elevation and long pilings Curve #14

Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.1	0.05	0.9	0	0.005
0.1	0.1	0.2	0.9	0.01	0.029
0.2	0.1	0.4	0.9	0.02	0.058
0.3	0.1	0.8	0.9	0.03	0.107
0.4	0.1	1	0.9	0.04	0.136
0.5	0.1	1	0.9	0.05	0.145
0.6	0.1	1	0.9	0.06	0.154
0.7	0.1	1	0.9	0.07	0.163
0.8	0.1	1	0.9	0.08	0.172
0.9	0.1	1	0.9	0.09	0.181
1	0.1	1	0.9	0.1	0.19



2PP low elevation and short pilings Curve #15

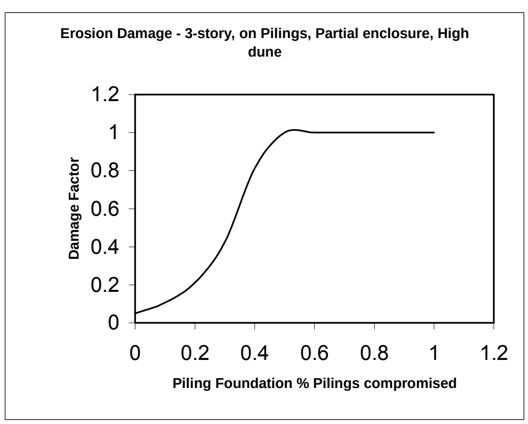
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.1	0.05	0.9	0.05	0.05
0.1	0.1	0.2	0.9	0.1	0.11
0.2	0.1	0.4	0.9	0.2	0.22
0.3	0.1	0.8	0.9	0.3	0.35
0.4	0.1	1	0.9	0.4	0.46
0.5	0.1	1	0.9	0.5	0.55
0.6	0.1	1	0.9	0.6	0.64
0.7	0.1	1	0.9	0.7	0.73
0.8	0.1	1	0.9	0.8	0.82
0.9	0.1	1	0.9	0.9	0.91
1	0.1	1	0.9	1	1



3PP high dune, short or long pilings Curve #16

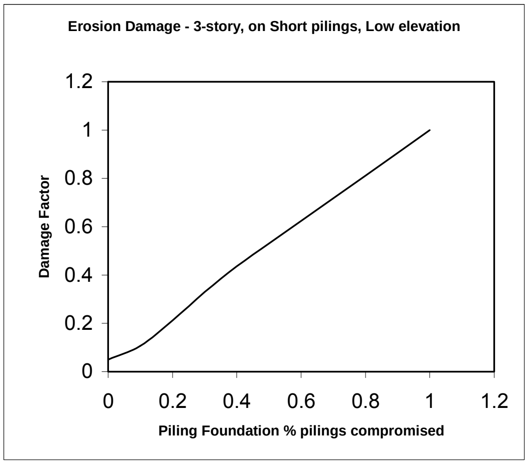
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.06	0.05	0.94	0.05	0.05
0.1	0.06	0.2	0.94	0.1	0.106
0.2	0.06	0.4	0.94	0.2	0.212
0.3	0.06	0.8	0.94	0.4	0.424
0.4	0.06	1	0.94	0.8	0.812
0.5	0.06	1	0.94	1	1
0.6	0.06	1	0.94	1	1
0.7	0.06	1	0.94	1	1
0.8	0.06	1	0.94	1	1
0.9	0.06	1	0.94	1	1
1	0.06	1	0.94	1	1

**Assume high dune



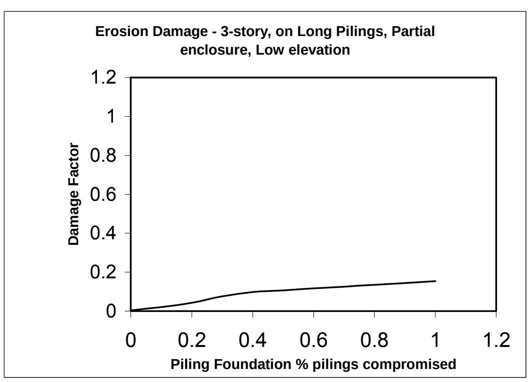
3PP low elevation, short pilings Curve #17

Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.06	0.05	0.94	0.05	0.05
0.1	0.06	0.2	0.94	0.1	0.106
0.2	0.06	0.4	0.94	0.2	0.212
0.3	0.06	0.8	0.94	0.3	0.33
0.4	0.06	1	0.94	0.4	0.436
0.5	0.06	1	0.94	0.5	0.53
0.6	0.06	1	0.94	0.6	0.624
0.7	0.06	1	0.94	0.7	0.718
0.8	0.06	1	0.94	0.8	0.812
0.9	0.06	1	0.94	0.9	0.906
1	0.06	1	0.94	1	1



3PP low elevation, long pilings Curve #18

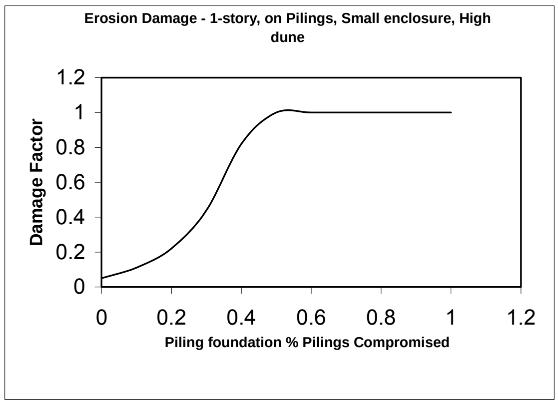
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.06	0.05	0.94	0	0.003
0.1	0.06	0.2	0.94	0.01	0.0214
0.2	0.06	0.4	0.94	0.02	0.0428
0.3	0.06	0.8	0.94	0.03	0.0762
0.4	0.06	1	0.94	0.04	0.0976
0.5	0.06	1	0.94	0.05	0.107
0.6	0.06	1	0.94	0.06	0.1164
0.7	0.06	1	0.94	0.07	0.1258
0.8	0.06	1	0.94	0.08	0.1352
0.9	0.06	1	0.94	0.09	0.1446
1	0.06	1	0.94	0.1	0.154



1PS high dune Curve #19

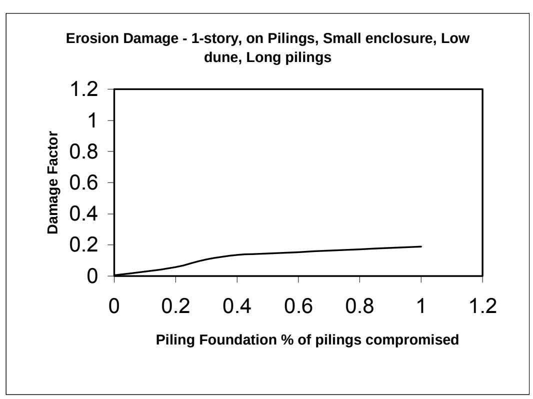
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.1	0.05	0.9	0.05	0.05
0.1	0.1	0.2	0.9	0.1	0.11
0.2	0.1	0.4	0.9	0.2	0.22
0.3	0.1	0.8	0.9	0.4	0.44
0.4	0.1	1	0.9	0.8	0.82
0.5	0.1	1	0.9	1	1
0.6	0.1	1	0.9	1	1
0.7	0.1	1	0.9	1	1
0.8	0.1	1	0.9	1	1
0.9	0.1	1	0.9	1	1
1	0.1	1	0.9	1	1

**Assume high dune



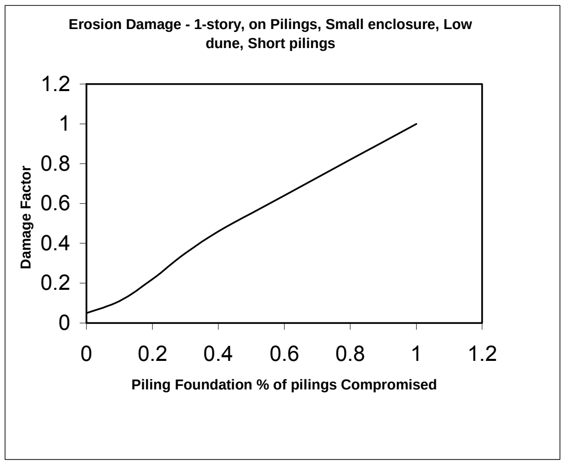
1PS low dune, long pilings Curve #20

Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.1	0.05	0.9	0	0.005
0.1	0.1	0.2	0.9	0.01	0.029
0.2	0.1	0.4	0.9	0.02	0.058
0.3	0.1	0.8	0.9	0.03	0.107
0.4	0.1	1	0.9	0.04	0.136
0.5	0.1	1	0.9	0.05	0.145
0.6	0.1	1	0.9	0.06	0.154
0.7	0.1	1	0.9	0.07	0.163
0.8	0.1	1	0.9	0.08	0.172
0.9	0.1	1	0.9	0.09	0.181
1	0.1	1	0.9	0.1	0.19



1PS low dune, short pilings Curve #21

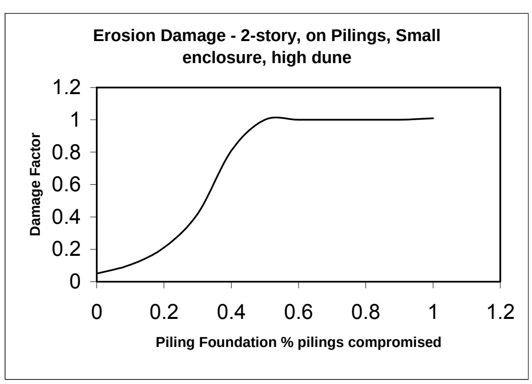
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.1	0.05	0.9	0.05	0.05
0.1	0.1	0.2	0.9	0.1	0.11
0.2	0.1	0.4	0.9	0.2	0.22
0.3	0.1	0.8	0.9	0.3	0.35
0.4	0.1	1	0.9	0.4	0.46
0.5	0.1	1	0.9	0.5	0.55
0.6	0.1	1	0.9	0.6	0.64
0.7	0.1	1	0.9	0.7	0.73
0.8	0.1	1	0.9	0.8	0.82
0.9	0.1	1	0.9	0.9	0.91
1	0.1	1	0.9	1	1



2PS high dune, short or long pilings Curve #22

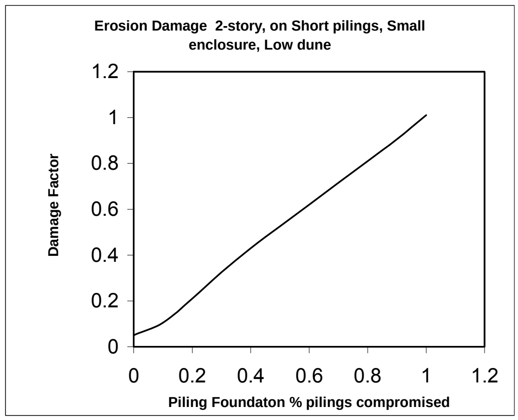
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.05	0.05	0.95	0.05	0.05
0.1	0.05	0.2	0.95	0.1	0.105
0.2	0.05	0.4	0.95	0.2	0.21
0.3	0.05	0.8	0.95	0.4	0.42
0.4	0.05	1	0.95	0.8	0.81
0.5	0.05	1	0.95	1	1
0.6	0.05	1	0.95	1	1
0.7	0.05	1	0.95	1	1
0.8	0.05	1	0.95	1	1
0.9	0.05	1	0.95	1	1
1	0.06	1	0.95	1	1.0

**Assume high dune



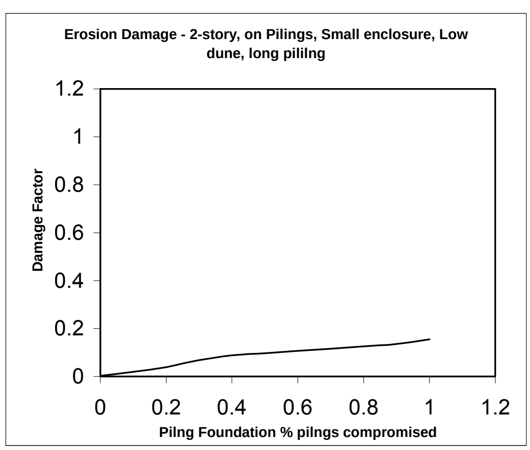
2PS low dune, short pilings Curve #23

Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.05	0.05	0.95	0.05	0.05
0.1	0.05	0.2	0.95	0.1	0.105
0.2	0.05	0.4	0.95	0.2	0.21
0.3	0.05	0.8	0.95	0.3	0.325
0.4	0.05	1	0.95	0.4	0.43
0.5	0.05	1	0.95	0.5	0.525
0.6	0.05	1	0.95	0.6	0.62
0.7	0.05	1	0.95	0.7	0.715
0.8	0.05	1	0.95	0.8	0.81
0.9	0.05	1	0.95	0.9	0.905
1	0.06	1	0.95	1	1.0



2PS Low elevation, long pilings Curve #24

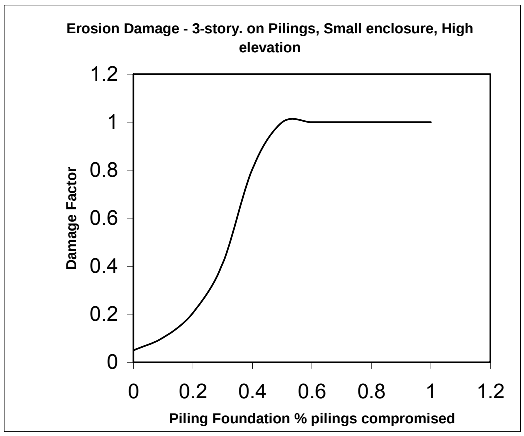
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.05	0.05	0.95	0	0.0025
0.1	0.05	0.2	0.95	0.01	0.0195
0.2	0.05	0.4	0.95	0.02	0.039
0.3	0.05	0.8	0.95	0.03	0.0685
0.4	0.05	1	0.95	0.04	0.088
0.5	0.05	1	0.95	0.05	0.0975
0.6	0.05	1	0.95	0.06	0.107
0.7	0.05	1	0.95	0.07	0.1165
0.8	0.05	1	0.95	0.08	0.126
0.9	0.05	1	0.95	0.09	0.1355
1	0.06	1	0.95	0.1	0.2



3PS high elevation, long or short pilings Curve #25

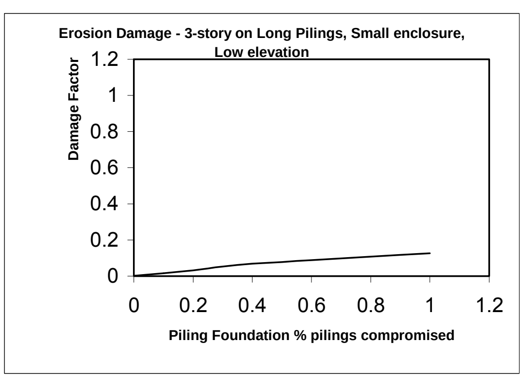
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.03	0.05	0.97	0.05	0.05
0.1	0.03	0.2	0.97	0.1	0.103
0.2	0.03	0.4	0.97	0.2	0.206
0.3	0.03	0.8	0.97	0.4	0.412
0.4	0.03	1	0.97	0.8	0.806
0.5	0.03	1	0.97	1	1
0.6	0.03	1	0.97	1	1
0.7	0.03	1	0.97	1	1
0.8	0.03	1	0.97	1	1
0.9	0.03	1	0.97	1	1
1	0.03	1	0.97	1	1

**Assume high dune



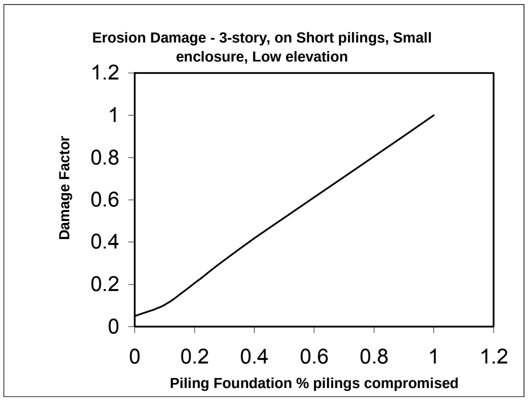
3PS low elevation, long pilings Curve #26

Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.03	0.05	0.97	0	0.0015
0.1	0.03	0.2	0.97	0.01	0.0157
0.2	0.03	0.4	0.97	0.02	0.0314
0.3	0.03	0.8	0.97	0.03	0.0531
0.4	0.03	1	0.97	0.04	0.0688
0.5	0.03	1	0.97	0.05	0.0785
0.6	0.03	1	0.97	0.06	0.0882
0.7	0.03	1	0.97	0.07	0.0979
0.8	0.03	1	0.97	0.08	0.1076
0.9	0.03	1	0.97	0.09	0.1173
1	0.03	1	0.97	0.1	0.127



3PS low elevation, short pilings Curve #27

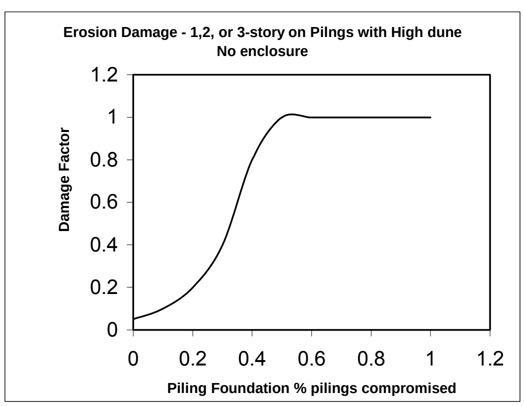
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0.03	0.05	0.97	0.05	0.05
0.1	0.03	0.2	0.97	0.1	0.103
0.2	0.03	0.4	0.97	0.2	0.206
0.3	0.03	0.8	0.97	0.3	0.315
0.4	0.03	1	0.97	0.4	0.418
0.5	0.03	1	0.97	0.5	0.515
0.6	0.03	1	0.97	0.6	0.612
0.7	0.03	1	0.97	0.7	0.709
0.8	0.03	1	0.97	0.8	0.806
0.9	0.03	1	0.97	0.9	0.903
1	0.03	1	0.97	1	1



1PN, 2PN, 3PN on high dune Curve #28

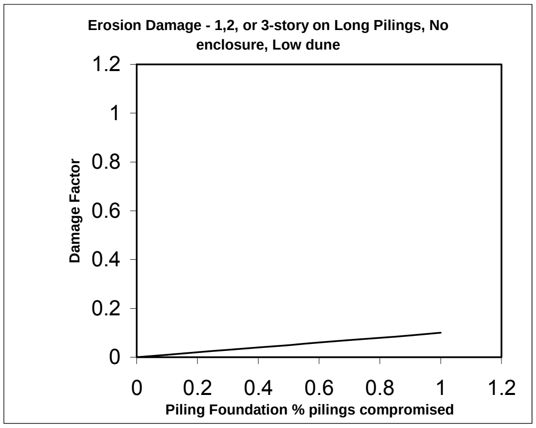
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0	0.05	1	0.05	0.05
0.1	0	0.2	1	0.1	0.1
0.2	0	0.4	1	0.2	0.2
0.3	0	0.8	1	0.4	0.4
0.4	0	1	1	0.8	0.8
0.5	0	1	1	1	1
0.6	0	1	1	1	1
0.7	0	1	1	1	1
0.8	0	1	1	1	1
0.9	0	1	1	1	1
1	0	1	1	1	1

**Assume high dune



1PN, 2PN, 3PN on low dune with long pilings Curve #29

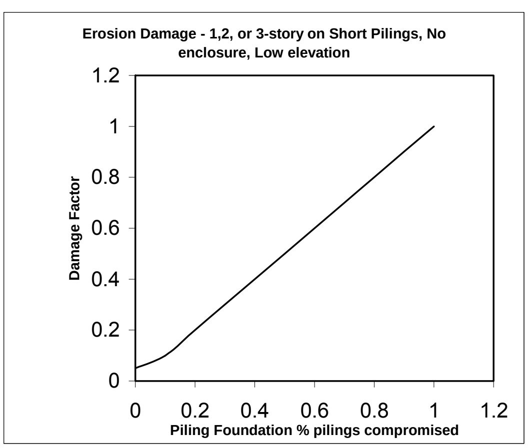
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0	0.05	1	0	0
0.1	0	0.2	1	0.01	0.01
0.2	0	0.4	1	0.02	0.02
0.3	0	0.8	1	0.03	0.03
0.4	0	1	1	0.04	0.04
0.5	0	1	1	0.05	0.05
0.6	0	1	1	0.06	0.06
0.7	0	1	1	0.07	0.07
0.8	0	1	1	0.08	0.08
0.9	0	1	1	0.09	0.09
1	0	1	1	0.1	0.1



Curve #30

1PN, 2PN, 3PN low elevation and short pilings

Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0	0.05	1	0.05	0.05
0.1	0	0.2	1	0.1	0.1
0.2	0	0.4	1	0.2	0.2
0.3	0	0.8	1	0.3	0.3
0.4	0	1	1	0.4	0.4
0.5	0	1	1	0.5	0.5
0.6	0	1	1	0.6	0.6
0.7	0	1	1	0.7	0.7
0.8	0	1	1	0.8	0.8
0.9	0	1	1	0.9	0.9
1	0	1	1	1	1

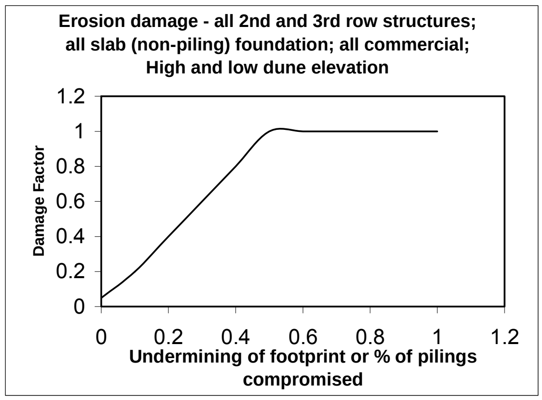


Curve #31

1NN, 2NN, 3NN, 1NF, 2NF, and all 2nd and 3rd row houses and commercial properties

Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0	0.05	1	0.05	0.05
0.1	0	0.2	1	0.2	0.2
0.2	0	0.4	1	0.4	0.4
0.3	0	0.8	1	0.6	0.6
0.4	0	1	1	0.8	0.8
0.5	0	1	1	1	1
0.6	0	1	1	1	1
0.7	0	1	1	1	1
0.8	0	1	1	1	1
0.9	0	1	1	1	1
1	0	1	1	1	1

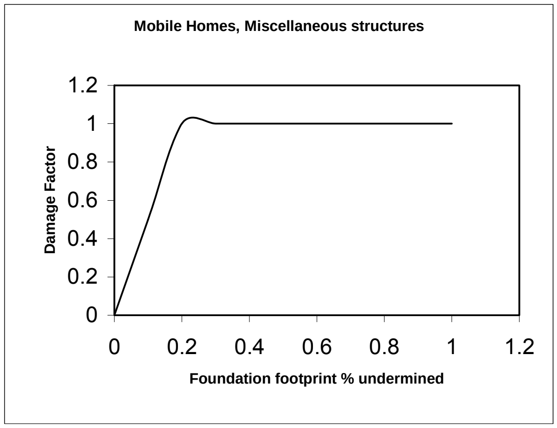
This curve is applied at any elevation



Curve #33

Mobile homes, utility buildings, oceanfront residential decks
detached decks, gazebos, pools, detached garages, buried public utilities

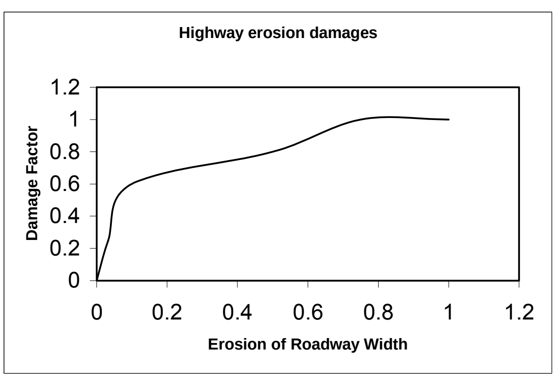
Erosion factor	Value to enclosure	damage to enclosure	value to house	damage to house	composite damage
0	0	0	1	0	0
0.1	0	0	1	0.5	0.5
0.2	0	0	1	1	1
0.3	0	0	1	1	1
0.4	0	0	1	1	1
0.5	0	0	1	1	1
0.6	0	0	1	1	1
0.7	0	0	1	1	1
0.8	0	0	1	1	1
0.9	0	0	1	1	1
1	0	0	1	1	1



Highway erosion damages

Curve #34

erosion	damage
0	0
0.033	0.25
0.1	0.6
0.5	0.8
0.75	1
1	1



General Reevaluation Report
and
Environmental Impact Statement

on

Hurricane Protection and Beach Erosion Control

WEST ONSLOW BEACH AND NEW RIVER INLET
(TOPSAIL BEACH), NORTH CAROLINA

Appendix B - Economic Analysis

Attachment 3 – Structure File

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
31	003OCEA2111A	1	0	150	83	350	35		2PSU	56	$257,175	$102,870	5.8		17.2	1	24	-1	2.0
31	003OCEA2112A	2	504	150	111	515	35		2PSU	56	$257,175	$102,870	5.5		17.8	1	31	-1	2.0
31	003OCEA2113A	1	0	150	83	368	35		2PN	56	$257,175	$102,870	5.9		17.4	1	29	-1	2.0
31	003OCEA2115A	1	0	150	83	391	35		2PSU	56	$257,175	$102,870	5.8		17.9	1	24	-1	2.0
31	003OCEA2116A	2	504	150	111	555	35		2PSU	56	$257,175	$102,870	5.0		18.0	1	31	-1	2.0
31	003OCEA2117A	1	0	150	83	426	35		2PSU	56	$257,175	$102,870	5.8		17.6	1	24	-1	2.0
31	003OCEA2119A	1	0	150	83	472	35		2PSU	56	$257,175	$102,870	6.1		17.7	1	24	-1	2.0
31	003OCEAHWY	1	300	60	750	305	24		Hwy	64	$81,027	$0	5.6		5.6	1	34	-1	0.5
-999																			
32	003GODW0101A	2	504	150	111	390	30		2PPU	60	$211,455	$84,582	6.8		17.1	1	31	-1	2.0
32	003GODW0103A	3	504	150	111	450	35		2PPU	56	$154,305	$61,722	8.0	8.0	16.0	1	31	-1	2.0
32	003GODW0104A	2	504	150	111	380	35		1PPF	59	$268,605	$107,442	9.0	7.0	16.1	1	31	-1	2.0
32	003GODW0106A	4	504	150	111	434	30		1PN	55	$156,591	$62,636	10.0	6.0	15.7	1	31	-1	2.0
32	003OCEA2013A	1	0	150	83	213	25		2PSU	56	$297,180	$118,872	7.8		19.4	1	20	-1	2.0
32	003OCEA2101A	1	0	150	83	225	25		2PN	56	$213,741	$85,496	6.7		17.9	1	29	-1	2.0
32	003OCEA2103G	1	0	150	83	245	30		2PSU	56	$240,030	$96,012	6.3		17.7	1	24	-1	2.0
32	003OCEA2103A	1	0	150	83	247	35		2PSU	56	$257,175	$102,870	7.4		17.6	1	24	-1	2.0
32	003OCEA2104A	2	504	150	111	431	35		2PSU	56	$257,175	$102,870	5.9		18.5	1	31	-1	2.0
32	003OCEA2105A	1	0	150	83	259	35		2PSU	56	$257,175	$102,870	5.6		17.2	1	24	-1	2.0
32	003OCEA2106A	2	504	150	111	456	35		2PSU	56	$257,175	$102,870	5.0		17.1	1	31	-1	2.0
32	003OCEA2107A	1	0	150	83	287	35		2PSU	56	$257,175	$102,870	5.4		17.4	1	24	-1	2.0
32	003OCEA2108A	2	504	150	111	482	35		2PN	56	$257,175	$102,870	4.3		16.6	1	31	-1	2.0
32	003OCEA2109A	1	0	150	83	312	35		2PN	56	$257,175	$102,870	5.3		17.4	1	29	-1	2.0
32	003MCCL0109	4	500	60	100	515	40		2psu	56	$125,730	$50,292	6.0		17.0	1	31	-1	2.0
-999																			
4	004BORK0103A	2	333	100	200	369	30		1.5PSU	56	$122,301	$48,920	7.0	11.0	17.0	1	31	-1	2.0
4	004BORY0104A	2	333	100	200	355	40		1.5PMF	60	$188,595	$75,438	7.0	8.0	14.8	1	31	-1	2.0
4	004BORY0105A	3	387	100	200	415	40		1PSU	55	$182,880	$73,152	6.0	11.0	17.5	1	31	-1	2.0
4	004BORY0106A	3	387	100	200	417	40		1PMF	59	$194,310	$77,724	4.0	11.0	14.6	1	31	-1	2.0
4	004BORY0107A	4	439	100	200	482	35		1PN	55	$170,307	$68,123	8.0	6.0	14.2	1	31	-1	2.0
4	004BORY0108A	4	439	100	200	476	40		1PMF	59	$125,730	$50,292	4.0	10.0	14.3	1	31	-1	2.0
4	004MCCL0103A	2	333	100	200	348	35		2.5PFU	60	$371,475	$148,590	9.0	9.0	18.6	1	31	-1	2.0
4	004MCCL0104A	2	333	100	200	373	40		1PSU	55	$176,022	$70,409	7.0	10.0	16.8	1	31	-1	2.0
4	004MCCL0105A	3	387	100	200	417	30		1PFU	59	$168,021	$67,208	9.0	8.0	17.0	1	31	-1	2.0
4	004MCCL0106A	3	387	100	200	422	40		1.5PSU	56	$240,030	$96,012	8.0	10.0	18.1	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
4	004MCCL0107A	4	439	100	200	470	35		1PSU	55	$123,444	$49,378	9.0	8.0	17.1	1	31	-1	2.0
4	004MCCL0108A	4	439	100	200	474	35		1PSU	55	$118,872	$47,549	8.0	8.0	15.8	1	31	-1	2.0
4	004OCEA1802A	1	267	100	91	273	50		1PFF	59	$91,440	$36,576	6.0		14.8	1	2	-1	2.0
4	004OCEA1804A	1	267	100	91	273	40		1PPF	59	$102,870	$41,148	7.4		16.1	1	12	-1	2.0
4	004OCEA1806A	1	267	100	91	278	40		1PSU	55	$131,445	$52,578	6.7		14.9	1	21	-1	2.0
4	004OCEA1808A	1	267	100	91	283	40		1PSU	55	$102,870	$41,148	6.8		16.1	1	21	-1	2.0
4	004OCEA1902A	1	267	100	91	276	40		2ppu	59	$285,750	$114,300	7.1		18.2	1	14	-1	2.0
4	004OCEA1904A	1	267	100	91	268	35		1PSU	55	$108,585	$43,434	7.0		17.1	1	21	-1	2.0
4	004OCEA1906A	1	267	100	91	285	40		2PN	56	$291,465	$116,586	7.2		17.0	1	14	-1	2.0
4	004OCEA2002A	1	0	100	0	277	35		3N	2	$308,610	$123,444	7.4		7.4	1	31	-1	2.0
4	004OCEA2004A	1	267	100	91	305	35		2PSU	56	$280,035	$112,014	7.7		16.4	1	24	-1	2.0
4	004OCEA2006A	1	267	100	91	292	30		1PSU	55	$102,870	$41,148	7.2		19.3	1	21	-1	2.0
4	004OCEA2008A	2	267	100	91	321	40		1PSU	55	$108,585	$43,434	6.9		16.2	1	31	-1	2.0
4	004OCEA2011A	1	0	100	1000	170	25		2PSU	56	$240,030	$96,012	10.7		20.2	1	23	-1	2.0
4	004TROU0103A	2	333	100	200	348	25		1PSU	55	$89,154	$35,662	5.0	10.0	14.6	1	31	-1	2.0
4	004TROU0105A	3	387	100	200	400	30		1PSU	55	$102,870	$41,148	7.0		14.8	1	31	-1	2.0
4	004TROU0107A	4	439	100	200	452	35		1PSU	55	$154,305	$61,722	7.0		13.9	1	31	-1	2.0
4	004OCEAFF01A	2	253	100	200	284	40		2PS	56	$311,896	$124,758	7.0	12.0	19.0	1	31	-1	2.0
4	004OCEAHWY	1	200	60	1000	205	24		Hwy	64	$108,036	$0	4.5		4.5	1	34	-1	0.5
-999																			
5	005OCEA1521A	1	0	100	1000	97	30		2pnn	33	$1,211,580	$530,000	9.1		17.8	1	15	-1	2.0
5	005OCEA1521R	1	180	100	83	182	35		2nnn	33	$125,730	$55,000	9.1		9.1	1	31	-1	2.0
5	005OCEA1608A	1	262	100	83	294	40		2PSU	56	$230,886	$92,354	7.4		18.1	1	24	-1	2.0
5	005OCEA1610A	1	262	100	83	305	20		2PPF	60	$217,170	$86,868	6.3		15.9	1	14	-1	2.0
5	005OCEA1612A	1	262	100	83	294	40		1PFF	59	$238,887	$95,555	8.4		19.1	1	6	-1	2.0
5	005OCEA1614A	1	262	100	83	299	50		1PSU	55	$179,451	$71,780	6.3		14.8	1	20	-1	2.0
5	005OCEA1616A	1	262	100	83	280	40		2PPU	59	$254,889	$101,956	6.4		18.0	1	14	-1	2.0
5	005OCEA1702A	1	262	100	83	278	40		2PSU	56	$228,600	$91,440	6.4		17.8	1	24	-1	2.0
5	005OCEA1704A	1	262	100	83	282	40		1PPU	59	$205,740	$82,296	6.7		15.5	1	12	-1	2.0
5	005OCEA1706A	1	262	100	83	269	40		1PPF	59	$105,156	$42,062	5.6		14.2	1	12	-1	2.0
5	005OCEA1708A	1	262	100	83	273	35		1PSU	55	$72,009	$28,804	5.7		13.5	1	21	-1	2.0
5	005OCEA1710A	1	262	100	83	278	30		2PSU	56	$233,172	$93,269	5.7		14.0	1	23	-1	2.0
5	005OCEA1712A	1	262	100	83	273	40		2PSU	56	$285,750	$114,300	5.3		15.6	1	24	-1	2.0
5	005SPOT1701A	2	392	100	200	385	45		1PSU	55	$162,306	$64,922	4.0	12.0	16.1	1	31	-1	2.0
5	005SPOT1705A	2	392	100	200	379	50		1PSU	55	$101,727	$40,691	5.0	8.0	13.8	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_LENGTH	LOT_WIDTH	REF_FRNT of STRUC	STRUC_LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_TYPE	STRUC_VALUE_OCT_06	CONTENT_VALUE	GRELEV_SUR	Ft to Fin Floor	FFLOOR_ELEV	ACTIVE	EROSION_TYPE	ARMOR	FLANKING
5	005SPOT1707A	2	392	100	200	400	40		1PMF	59	$185,166	$74,066	4.0	10.0	14.1	1	31	-1	2.0
5	005SPOT1709A	2	392	100	200	388	40		1.5PMF	61	$97,155	$38,862	5.0	8.0	12.7	1	31	-1	2.0
5	005SPOT1711A	2	392	100	200	377	50		1PSU	55	$285,750	$114,300	5.0	8.0	12.7	1	31	-1	2.0
5	005SPOTFF01A	2	357	100	83	385	40		2PS	56	$311,896	$124,758	6.0	10.0	16.0	1	31	-1	2.0
5	005OCEAHWY	1	200	60	850	205	24		Hwy	64	$91,829	$0	3.6		3.6	1	34	-1	0.5
-999																			
6	006OCEA1411A	1	0	120	65	85	50		1PPU	59	$165,735	$66,294	7.6		17.0	1	12	-1	2.0
6	006OCEA1413A	1	0	120	65	92	55		1PPU	59	$205,740	$82,296	7.6		16.4	1	12	-1	2.0
6	006OCEA1414A	2	248	120	65	260	35		2PSU	56	$274,320	$109,728	10.0	10.0	19.6	1	31	-1	2.0
6	006OCEA1415A	1	0	120	65	140	30		2PSF	56	$268,605	$107,442	8.8		18.9	1	24	-1	2.0
6	006OCEA1416A	2	248	120	65	253	35		1PFF	59	$45,720	$18,288	6.5		14.8	1	31	-1	2.0
6	006OCEA1417A	1	0	120	65	141	25		2PSF	56	$297,180	$118,872	8.7		18.2	1	24	-1	2.0
6	006OCEA1418A	2	248	120	65	258	30		2PSU	56	$217,170	$86,868	7.8		16.8	1	31	-1	2.0
6	006OCEA1419A	1	0	120	65	86	45		1PN	55	$68,580	$27,432	7.6		14.6	1	30	-1	2.0
6	006OCEA1420A	2	248	120	65	257	35		1PSF	55	$91,440	$36,576	7.6		15.5	1	31	-1	2.0
6	006OCEA1421A	1	0	120	65	147	25		2PSF	55	$228,600	$91,440	8.3		16.4	1	24	-1	2.0
6	006OCEA1504A	1	248	120	65	261	45		1PSF	55	$251,460	$100,584	8.1		19.0	1	20	-1	2.0
6	006OCEA1505A	1	0	140	65	95	40		2PSU	56	$297,180	$118,872	7.5		15.7	1	24	-1	2.0
6	006OCEA1506A	1	248	120	65	265	40		2PFF	60	$228,600	$91,440	7.6		17.2	1	6	-1	2.0
6	006OCEA1508A	1	248	120	65	266	50		1PPF	59	$171,450	$68,580	7.9		16.9	1	12	-1	2.0
6	006OCEA1511A	1	0	120	65	98	55		2PPU	60	$137,160	$54,864	7.5		15.7	1	15	-1	2.0
6	006OCEAFF01A	1	0	120	65	156	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
6	006OCEAFF02A	1	0	120	65	156	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
6	006OCEAFF03A	2	245	120	65	275	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
6	006OCEAFF04A	2	245	120	65	275	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
6	006OCEAFF05A	2	245	120	65	275	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
6	006OCEAFF06A	1	0	120	65	153	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
6	006OCEAFF07A	1	0	120	65	153	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
6	006OCEAFF08A	1	0	120	65	153	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
6	006OCEAFF09A	1	0	120	65	153	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
6	006OCEAFF10A	1	0	120	65	153	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
6	006OCEAFF11A	2	245	120	65	260	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
6	006OCEAFF12A	2	242	120	65	257	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
6	006OCEAHWY	1	185	60	900	190	24		Hwy	64	$97,235	$0	3.6		3.6	1	34	-1	0.5
-999																			

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_LENGTH	LOT_WIDTH	REF_FRNT of STRUC	STRUC_LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_TYPE	STRUC_VALUE_OCT_06	CONTENT_VALUE	GRELEV_SUR	Ft to Fin Floor	FFLOOR_ELEV	ACTIVE	EROSION_TYPE	ARMOR	FLANKING
7	007OCEA1320A	2	265	150	55	276	40		1PSU	55	$114,300	$45,720	6.6		15.1	1	31	-1	2.0
7	007OCEA1321A	1	0	150	55	146	40		1PN	55	$110,871	$44,348	7.4		16.5	1	30	-1	2.0
7	007OCEA1322A	2	265	150	55	285	35		2PSF	56	$364,617	$145,847	6.0	12.0	18.3	1	31	-1	2.0
7	007OCEA1326A	2	265	150	55	264	40		1PN	55	$91,440	$36,576	8.1		15.7	1	31	-1	2.0
7	007OCEA1327A	1	0	150	55	142	25		2PN	56	$257,175	$102,870	7.8		18.0	1	29	-1	2.0
7	007OCEA1328A	2	265	150	55	261	35		1PN	55	$97,155	$38,862	8.2		14.5	1	31	-1	2.0
7	007OCEA1329A	1	0	150	55	148	25		2PPU	60	$200,025	$80,010	8.1		17.8	1	15	-1	2.0
7	007OCEA1330A	2	265	150	55	261	40		2N	56	$118,872	$47,549	7.5		7.5	1	31	-1	2.0
7	007OCEA1331A	1	0	150	55	108	40		1PPF	59	$131,445	$52,578	6.8		15.1	1	15	-1	2.0
7	007OCEA1332A	2	265	150	55	263	30		1PSU	55	$89,154	$35,662	8.4		15.9	1	31	-1	2.0
7	007OCEA1334A	2	265	150	55	319	45		1PSU	55	$152,019	$60,808	8.9		18.4	1	31	-1	2.0
7	007OCEA1335A	1	0	150	55	150	25		2PSU	56	$260,604	$104,242	7.0	12.0	18.6	1	24	-1	2.0
7	007OCEA1336A	2	265	150	55	330	40		VAC	55	$0	$0	7.6		14.4	1	31	-1	2.0
7	007OCEA1337A	1	0	150	55	107	35		1PSU	55	$124,587	$49,835	8.0	8.0	16.2	1	21	-1	2.0
7	007OCEA1339A	1	0	150	55	115	30		1PFF	59	$171,450	$68,580	8.2		16.8	1	2	-1	2.0
7	007OCEA1340A	2	0	150	55	287	30		2PSU	56	$342,900	$137,160	7.0	12.0	18.6	1	23	-1	2.0
7	007OCEA1341A	1	0	150	55	108	45		1PFF	59	$102,870	$41,148	7.6		15.9	1	2	-1	2.0
7	007OCEA1343A	1	0	150	55	146	25		2PSU	56	$266,319	$106,528	8.0	11.0	19.3	1	24	-1	2.0
7	007OCEA1344A	2	265	150	55	295	40		3nnn	56	$480,060	$192,024	6.0		15.2	1	31	-1	2.0
7	007OCEA1401A	1	0	150	55	107	40		1PN	55	$123,444	$49,378	7.4		17.6	1	30	-1	2.0
7	007OCEA1402A	2	265	150	55	273	40		1PSU	55	$99,441	$39,776	7.2		14.3	1	31	-1	2.0
7	007OCEA1403A	1	0	150	55	157	30		2PSF	56	$268,605	$107,442	8.6		19.0	1	24	-1	2.0
7	007OCEA1404A	2	265	150	55	286	25		2PSU	56	$342,900	$137,160	11.0	8.0	19.4	1	31	-1	2.0
7	007OCEA1405A	1	0	150	55	158	30		2PSU	56	$245,745	$98,298	8.9		18.0	1	23	-1	2.0
7	007OCEA1406A	2	265	150	55	272	50		1PSU	55	$174,879	$69,952	7.6		15.9	1	31	-1	2.0
7	007OCEA1407A	1	0	150	55	105	45		2N	2	$272,034	$108,814	7.6		7.6	1	31	-1	2.0
7	007OCEA1409G	1	0	150	55	158	30		GARAG	24	$22,860	$8,000	7.3	0.0	7.3	1	33	-1	2.0
7	007OCEA1410A	2	0	150	55	271	40		1PSU	55	$107,442	$42,977	9.1		17.9	1	31	-1	2.0
7	007S_AN1325A	3	265	150	55	377	35		1PSU	55	$57,150	$22,860	6.0	10.0	15.8	1	31	-1	2.0
7	007S_AN1401A	3	265	150	55	346	40		1PSU	55	$74,295	$29,718	5.0	9.0	14.2	1	31	-1	2.0
7	007OCEAFF01A	2	264	150	55	276	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
7	007OCEAFF02A	2	266	150	55	295	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
7	007OCEAFF03A	2	266	150	55	295	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
7	007OCEAFF04A	1	0	150	55	159	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
7	007OCEAFF05A	1	0	150	55	159	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
7	007OCEAFF06A	1	0	150	55	159	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
7	007OCEAHWY	1	200	60	1000	205	24		Hwy	64	$108,036	$0	4.3		4.3	1	34	-1	0.5
-999																			
8	008OCEA1209A	1	0	140	75	177	30		2PSU	56	$314,325	$125,730	9.0	9.0	18.7	1	23	-1	2.0
8	008OCEA1210A	2	280	140	67	307	50		1.5PSU	57	$308,610	$123,444	6.0	12.0	18.0	1	31	-1	2.0
8	008OCEA1211A	1	0	140	75	127	40		1PPU	59	$192,024	$76,810	6.9		16.2	1	12	-1	2.0
8	008OCEA1212A	2	280	140	67	293	35		1PSU	55	$94,869	$37,948	7.7		15.3	1	21	-1	2.0
8	008OCEA1213A	1	0	140	75	183	25		2PSU	56	$192,024	$76,810	8.0	13.0	21.0	1	23	-1	2.0
8	008OCEA1214A	2	280	140	67	303	35		2PSU	56	$200,025	$80,010	8.0		17.6	1	31	-1	2.0
8	008OCEA1215A	1	0	140	75	123	50		1PFU	59	$145,161	$58,064	8.1		16.4	1	2	-1	2.0
8	008OCEA1216A	2	280	140	67	299	30		2PPU	60	$225,171	$90,068	8.1		17.6	1	31	-1	2.0
8	008OCEA1219A	1	0	140	75	125	45		1pnn	55	$114,300	$45,720	7.0		14.5	1	30	-1	2.0
8	008OCEA1222A	2	280	140	67	317	30		2PSU	56	$266,319	$106,528	7.0	12.0	18.5	1	31	-1	2.0
8	008OCEA1223A	1	0	140	75	123	40		1PSU	55	$132,588	$53,035	6.9		15.9	1	21	-1	2.0
8	008OCEA1224A	3	250	60	50	280	40		1psu	21	$57,150	$20,000	7.0		19.2	1	31	-1	2.0
8	008OCEA1226A	2	280	140	67	284	50		2PMF	60	$260,604	$104,242	7.0	12.0	19.2	1	31	-1	2.0
8	008OCEA1226A	2	280	140	67	285	35		2psu	60	$257,175	$102,870	7.7		19.6	1	31	-1	2.0
8	008OCEA1227A	1	0	140	75	114	60		2PFF	60	$201,168	$80,467	9.0		19.0	1	5	-1	2.0
8	008OCEA1228A	3	280	140	67	349	40		1PSU	55	$171,450	$68,580	5.0	13.0	17.8	1	31	-1	2.0
8	008OCEA1302A	2	280	140	67	304	40		1PFU	59	$182,880	$73,152	6.0	11.0	17.5	1	31	-1	2.0
8	008OCEA1303A	1	0	140	75	113	40		2N	2	$228,600	$91,440	8.3		8.3	1	31	-1	2.0
8	008OCEA1305A	1	0	140	75	136	30		1PPU	59	$165,735	$66,294	8.5		16.8	1	12	-1	2.0
8	008OCEA1306A	2	280	140	67	311	55		1psu	59	$57,150	$22,860	7.8		17.4	1	31	-1	2.0
8	008OCEA1307A	1	0	140	75	110	40		1PN	55	$314,325	$125,730	9.1		16.6	1	30	-1	2.0
8	008OCEA1307G	2	0	140	75	167	20		2PSU	56	$257,175	$102,870	10.0	11.0	20.3	1	31	-1	2.0
8	008OCEA1308A	2	280	140	67	307	50		1PSU	55	$276,606	$110,642	8.0	10.0	18.1	1	31	-1	2.0
8	008OCEA1310A	2	280	140	67	275	40		1PPF	59	$110,871	$44,348	7.4		15.8	1	31	-1	2.0
8	008OCEA1311A	1	0	140	75	108	40		1PFF	59	$165,735	$66,294	7.8		16.6	1	2	-1	2.0
8	008OCEA1314A	2	280	140	67	273	30		2PPU	60	$220,599	$88,240	7.9		16.9	1	31	-1	2.0
8	008OCEA1315A	1	0	140	75	107	40		1PFU	59	$123,444	$49,378	7.1		15.4	1	2	-1	2.0
8	008OCEA1316A	2	280	140	67	270	30		1psu	59	$97,155	$38,862	7.5		14.7	1	31	-1	2.0
8	008OCEA1318A	2	280	140	67	273	40		1PN	55	$125,730	$50,292	7.2		15.8	1	31	-1	2.0
8	008OCEAFF01A	2	270	140	67	307	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
8	008OCEAFF02A	2	266	140	67	282	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
8	008OCEAFF03A	1	0	140	75	174	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
8	008OCEAFF04A	1	0	140	75	160	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
8	008OCEAFF05A	2	280	140	67	305	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
8	008OCEAFF06A	2	280	140	67	305	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
8	008OCEAHWY	1	210	60	1000	215	24		Hwy	64	$108,036	$0	5.1		5.1	1	34	-1	0.5
-999																			
9	009OCEA1045A	1	0	140	65	166	20		2PSU	56	$253,746	$101,498	12.0	10.0	22.1	1	22	-1	2.0
9	009OCEA1102A	2	282	120	71	306	45		2PSU	56	$267,462	$106,985	8.0		18.2	1	31	-1	2.0
9	009OCEA1105A	1	0	140	65	149	30		2PSU	56	$228,600	$91,440	7.0	11.0	18.1	1	24	-1	2.0
9	009OCEA1107A	1	0	140	65	160	30		2PPU	60	$260,604	$104,242	9.5		18.1	1	15	-1	2.0
9	009OCEA1108A	2	282	120	71	297	35		1PSU	55	$180,594	$72,238	7.9		16.9	1	31	-1	2.0
9	009OCEA1109A	1	0	140	65	153	30		1PSU	55	$165,735	$66,294	9.0		18.5	1	21	-1	2.0
9	009OCEA1111A	1	0	140	65	130	45		2N	2	$186,309	$74,524	6.5		6.5	1	31	-1	2.0
9	009OCEA1112A	2	282	120	71	306	25		2PSU	56	$171,450	$68,580	7.7		17.0	1	31	-1	2.0
9	009OCEA1113A	1	0	140	65	129	30		2PFF	60	$274,320	$109,728	7.9		17.1	1	6	-1	2.0
9	009OCEA1114A	2	282	120	71	299	40		1PSF	55	$225,171	$90,068	7.5		16.4	1	31	-1	2.0
9	009OCEA1115A	1	0	140	65	129	35		1PN	55	$114,300	$45,720	7.1		15.4	1	30	-1	2.0
9	009OCEA1116A	2	282	120	71	298	40		1PSF	55	$117,729	$47,092	6.9		15.8	1	31	-1	2.0
9	009OCEA1117A	1	0	140	65	126	35		1PFU	59	$145,161	$58,064	7.9		16.7	1	2	-1	2.0
9	009OCEA1118A	2	282	120	71	300	35		1PPF	59	$91,440	$36,576	7.7		15.4	1	31	-1	2.0
9	009OCEA1122A	2	282	120	71	301	50		1PSU	55	$85,725	$34,290	7.8		18.1	1	31	-1	2.0
9	009OCEA1120A	2	282	120	71	315	30		2PSU	56	$160,020	$64,008	9.0	10.0	18.5	1	31	-1	2.0
9	009OCEA1121A	1	0	140	65	125	45		1PSU	55	$217,170	$86,868	6.9		17.5	1	20	-1	2.0
9	009OCEA1123A	1	0	140	65	126	40		1PSU	55	$137,160	$54,864	7.2		17.8	1	21	-1	2.0
9	009OCEA1126A	2	282	120	71	290	35		1PN	55	$91,440	$36,576	6.1		14.4	1	31	-1	2.0
9	009OCEA1201A	1	0	140	65	125	40		2PPF	60	$117,729	$47,092	7.4		15.3	1	15	-1	2.0
9	009OCEA1202A	2	282	120	71	305	40		1PFF	59	$200,025	$80,010	6.3		17.4	1	31	-1	2.0
9	009OCEA1203A	1	0	140	65	155	45		1PSU	55	$189,738	$75,895	8.0		15.9	1	21	-1	2.0
9	009OCEA1204A	2	282	120	71	296	30		2PSU	56	$196,596	$78,638	6.8		17.4	1	31	-1	2.0
9	009OCEA1205A	1	0	140	65	122	45		1PSU	55	$171,450	$68,580	7.1		14.2	1	21	-1	2.0
9	009OCEA1206A	2	282	120	71	303	45		1PPU	59	$178,308	$71,323	6.8		14.5	1	31	-1	2.0
9	009OCEA1207A	1	0	140	65	124	45		1PN	59	$165,735	$66,294	6.4		14.8	1	30	-1	2.0
9	009OCEA1208A	2	282	120	71	293	35		2PSU	56	$117,729	$47,092	8.0	12.0	20.4	1	31	-1	2.0
9	009S_AN1101A	2	282	110	71	315	45		1PSU	55	$57,150	$22,860	8.0	9.0	17.4	1	31	-1	2.0
9	009S_AN1102A	2	282	120	50	300	40		2psf	60	$182,880	$73,152	8.0		17.0	1	31	-1	2.0
9	009OCEAFF01A	1	0	120	65	186	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
9	009OCEAFF02A	2	282	120	71	300	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
9	009OCEAFF03A	2	282	120	71	300	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
9	009OCEAFF04A	2	282	120	71	300	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
9	009OCEAHWY	1	0	60	1000	215	24		Hwy	64	$108,036	$0	5.6		5.6	1	34	-1	0.5
-999																			
10	010OCEA1005A	1	0	140	50	124	40		1PFF	59	$137,160	$54,864	8.0		16.3	1	2	-1	2.0
10	010OCEA1006A	2	276	110	63	305	30		1.5PSU	57	$206,883	$82,753	9.0	10.0	19.3	1	23	-1	2.0
10	010OCEA1007A	1	0	140	50	124	50		1PPU	59	$139,446	$55,778	8.6		16.4	1	12	-1	2.0
10	010OCEA1008A	2	276	110	63	272	50		2N	2	$251,460	$100,584	6.7		6.7	1	31	-1	2.0
10	010OCEA1009A	1	0	140	50	124	45		1PN	59	$155,448	$62,179	8.6		17.0	1	30	-1	2.0
10	010OCEA1011A	1	0	140	50	129	30		1PSU	55	$102,870	$41,148	9.2		17.8	1	21	-1	2.0
10	010OCEA1012A	2	276	110	63	346	30		1PSU	55	$102,870	$41,148	6.6		15.1	1	31	-1	2.0
10	010OCEA1013A	1	0	140	50	120	50		1PFF	59	$228,600	$91,440	7.5		16.9	1	3	-1	2.0
10	010OCEA1014A	2	276	110	63	289	40		1PPU	59	$171,450	$68,580	8.3		18.8	1	31	-1	2.0
10	010OCEA1015A	1	0	140	50	129	40		1PFF	59	$138,303	$55,321	8.1		16.8	1	2	-1	2.0
10	010OCEA1017A	1	0	140	50	119	40		1PSU	55	$74,295	$29,718	7.5		16.4	1	21	-1	2.0
10	010OCEA1018A	2	276	110	63	276	50		1PFF	59	$146,304	$58,522	6.8		15.2	1	31	-1	2.0
10	010OCEA1019A	1	0	140	50	125	45		1PFF	59	$219,456	$87,782	8.5		17.0	1	3	-1	2.0
10	010OCEA1021A	1	0	140	50	119	50		2N	2	$204,597	$81,839	8.7		8.7	1	31	-1	2.0
10	010OCEA1022A	2	276	110	63	289	45		1PSU	55	$230,886	$92,354	8.0		17.6	1	31	-1	2.0
10	010OCEA1024A	2	276	110	63	275	40		1PSU	55	$105,156	$42,062	8.3		16.5	1	31	-1	2.0
10	010OCEA1025A	1	0	140	50	116	40		2N	2	$200,025	$80,010	8.1		8.1	1	31	-1	2.0
10	010OCEA1026A	2	276	110	63	286	35		1PSU	55	$314,325	$125,730	8.4		18.2	1	31	-1	2.0
10	010OCEA1027A	1	0	140	50	143	30		2PSU	56	$194,310	$77,724	8.0		17.6	1	23	-1	2.0
10	010OCEA1028A	2	276	110	63	275	35		1PFU	59	$114,300	$45,720	8.3		16.3	1	31	-1	2.0
10	010OCEA1029A	1	0	140	50	115	40		2N	2	$228,600	$91,440	8.6		8.6	1	31	-1	2.0
10	010OCEA1032A	2	276	110	63	275	45		1PPU	59	$152,019	$60,808	9.5		18.5	1	31	-1	2.0
10	010OCEA1033A	1	0	140	50	111	40		1PSU	55	$123,444	$49,378	10.0		19.4	1	21	-1	2.0
10	010OCEA1034A	2	276	110	63	282	25		2PFF	60	$320,040	$128,016	9.6		18.0	1	31	-1	2.0
10	010OCEA1035A	1	0	140	50	122	40		1PSU	55	$132,588	$53,035	10.9		18.9	1	21	-1	2.0
10	010OCEA1036A	2	276	110	63	290	40		1.5PSU	57	$238,887	$95,555	11.0	9.0	19.6	1	31	-1	2.0
10	010OCEA1037A	1	0	140	50	144	25		2PSU	56	$194,310	$77,724	11.0		19.9	1	24	-1	2.0
10	010OCEA1038A	2	276	110	63	298	40		1PSU	55	$118,872	$47,549	9.4		17.5	1	31	-1	2.0
10	010OCEA1039A	1	0	140	50	112	45		1pfu	60	$97,155	$38,862	9.9		18.7	1	6	-1	2.0
10	010OCEA1041A	1	0	140	50	113	40		2N	2	$114,300	$45,720	9.9		9.9	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
10	010OCEA1043A	1	0	140	50	155	20		2PSU	56	$253,746	$101,498	12.0	10.0	22.0	1	22	-1	2.0
10	010S_AN1043A	2	276	110	63	273	50		2N	2	$300,609	$120,244	9.7		9.7	1	31	-1	2.0
10	010S_AN1009A	2	276	110	63	324	30		1PSU	55	$192,024	$76,810	7.0	11.0	18.0	1	31	-1	2.0
10	010S_AB1011A	2	270	110	50	340	30		1psu	55	$102,870	$41,148	8.0		18.0	1	31	-1	2.0
10	010S_AN1020S	3	276	110	63	344	30		STOR	16	$352,044	$1,200,000	7.0		7.9	1	31	-1	2.0
10	010OCEAFF01A	1	0	110	50	170	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
10	010OCEAFF02A	1	0	110	50	170	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
10	010OCEAFF03A	2	276	110	63	293	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
10	010OCEAFF04A	2	276	110	63	293	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
10	010OCEAHWY	1	210	60	1000	215	24		Hwy	64	$108,036	$0	5.3		5.3	1	34	-1	0.5
-999																			
11	011OCEA1001A	1	0	140	60	145	40		2psu	56	$325,755	$130,302	9.0		18.0	1	24	-1	2.0
11	011OCEA1002A	2	301	110	67	306	35		2PPU	60	$314,325	$125,730	8.6		18.0	1	31	-1	2.0
11	011OCEA1003A	1	0	140	60	136	40		1ppu	59	$114,300	$45,720	8.7		16.3	1	12	-1	2.0
11	011OCEA1004A	2	301	110	67	308	40		1.5psf	59	$154,305	$61,722	8.3		18.0	1	31	-1	2.0
11	011OCEA0902A	2	301	90	67	329	45		1PSU	55	$228,600	$91,440	8.9		19.5	1	31	-1	2.0
11	011OCEA0903A	1	0	140	60	155	35		2N	2	$228,600	$91,440	8.4		8.4	1	31	-1	2.0
11	011OCEA0905A	1	0	140	60	160	40		1PPF	59	$274,320	$109,728	7.8		16.4	1	11	-1	2.0
11	011OCEA0906A	2	301	90	67	332	50		1PPU	59	$171,450	$68,580	8.4		17.2	1	31	-1	2.0
11	011OCEA0907A	1	0	140	60	157	50		1PPF	59	$285,750	$114,300	8.2		17.5	1	11	-1	2.0
11	011OCEA0909A	1	0	90	60	160	40		1PSU	55	$194,310	$77,724	8.4		17.1	1	21	-1	2.0
11	011S_AN0909A	2	301	140	67	330	40		2psf	56	$182,880	$73,152	8.0		15.6	1	31	-1	2.0
11	011OCEA0911A	1	0	140	60	155	40		1PFF	59	$146,304	$58,522	8.5		16.6	1	2	-1	2.0
11	011OCEA0913A	1	0	140	60	161	40		2PSU	56	$285,750	$114,300	8.0		19.9	1	24	-1	2.0
11	011OCEA0915A	1	0	140	60	161	30		2N	2	$171,450	$68,580	7.1		7.1	1	31	-1	2.0
11	011OCEA0917A	1	0	140	60	160	30		1PSU	55	$145,161	$58,064	8.1		16.5	1	21	-1	2.0
11	011OCEA0919A	1	0	140	60	195	30		2PFU	60	$325,755	$130,302	9.0	11.0	20.1	1	6	-1	2.0
11	011OCEA0923A	1	0	140	60	149	40		1PFF	59	$166,878	$66,751	9.2		16.8	1	2	-1	2.0
11	011OCEA0925A	1	0	140	60	147	40		1PN	55	$334,899	$133,960	11.3		19.2	1	29	-1	2.0
11	011OCEA0927A	1	0	140	60	150	40		1psu	59	$142,875	$57,150	10.8		19.6	1	12	-1	2.0
11	011OCEA0928A	2	301	100	67	307	40		2PPF	60	$314,325	$125,730	7.6		17.8	1	31	-1	2.0
11	011OCEA0929A	1	0	140	60	160	25		2PFU	60	$251,460	$100,584	13.0	10.0	22.6	1	6	-1	2.0
11	011OCEA0930A	2	301	100	67	308	50		1PPF	59	$154,305	$61,722	10.3		18.5	1	31	-1	2.0
11	011OCEA0931A	1	0	140	60	176	35		1PSU	55	$216,027	$86,411	12.0	11.0	22.9	1	19	-1	2.0
11	011OCEA0932A	2	301	100	67	303	40		1PPU	59	$160,020	$64,008	10.0		18.7	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
11	011S_AN0903A	2	301	90	67	336	40		1PFF	59	$160,020	$64,008	9.0	8.0	16.8	1	31	-1	2.0
11	011S_AN0911A	2	301	90	67	361	30		1NN	59	$97,155	$38,862	4.6	0.5	6.1	1	31	-1	2.0
11	011S_AN0913A	2	301	90	67	331	45		1PFF	59	$251,460	$100,584	9.0	8.0	16.8	1	31	-1	2.0
11	011S_AN0915A	2	301	140	67	324	45		1PFF	59	$228,600	$91,440	8.0	8.0	16.0	1	31	-1	2.0
11	011S_AN0917A	2	301	140	67	325	50		1PFU	59	$171,450	$68,580	9.0	8.0	16.6	1	31	-1	2.0
11	011S_AN0919A	2	301	140	67	321	35		1PPF	59	$149,733	$59,893	8.0	10.0	17.9	1	31	-1	2.0
11	011S_AN0921A	2	301	140	67	351	40		2nnn	59	$194,310	$77,724	7.0	9.0	16.1	1	31	-1	2.0
11	011S_AN0927A	3	350	50	100	360	40		3nnn	60	$320,040	$128,016	7.6		17.8	1	31	-1	2.0
11	011OCEAFF01A	1	0	140	60	192	40		1PS	56	$323,326	$129,330	8.0		20.0	1	31	-1	2.0
11	011OCEAFF02A	2	303	90	67	328	40		1PS	56	$323,326	$129,330	8.0		20.0	1	31	-1	2.0
11	011S_ANFF03A	2	308	90	67	338	40		1PS	56	$323,326	$129,330	8.0		20.0	1	31	-1	2.0
11	011OCEAHWY	1	230	60	1000	235	24		Hwy	64	$108,036	$0	5.2		5.2	1	34	-1	0.5
-999																			
12	012OCEA0707A	1	0	140	77	218	25		2PSU	56	$245,745	$98,298	9.0	12.0	21.0	1	24	-1	2.0
12	012OCEA0708A	2	347	80	83	345	30		1NNN	1	$260,604	$104,242	7.5	2.0	7.7	1	31	-1	2.0
12	012OCEA0709A	1	0	140	77	213	25		2PPF	60	$253,746	$101,498	11.0	10.0	20.9	1	14	-1	2.0
12	012OCEA0712A	2	347	80	83	366	50		1nnn	1	$45,720	$18,288	6.0		6.9	1	31	-1	2.0
12	012OCEA0714A	2	347	80	83	364	30		3N	2	$172,593	$69,037	6.9		6.9	1	31	-1	2.0
12	012OCEA0716A	2	347	80	83	346	25		2nnn	2	$85,725	$34,290	6.7		6.7	1	31	-1	2.0
12	012OCEA0718A	2	347	80	83	350	30		1PN	55	$28,575	$11,430	8.2		10.6	1	31	-1	2.0
12	012OCEA0803A	1	0	140	77	126	30		2NNN	2	$325,755	$130,302	15.2	0.0	15.2	1	31	-1	2.0
12	012OCEA0803P	1	0	140	77	129	50		1nnn	53	$118,872	$47,549	10.0		15.2	1	31	-1	2.0
12	012OCEA0803X	1	0	140	77	189	60		3nnn	16	$644,652	$257,861	10.0		12.0	1	31	-1	2.0
12	012OCEA0803Y	1	0	140	77	182	40		2nnn	16	$966,978	$386,791	10.0		12.4	1	31	-1	2.0
12	012OCEA0803Z	1	0	140	77	181	40		1nnn	16	$22,860	$9,144	10.0		20.9	1	31	-1	2.0
12	012OCEA0807A	1	0	140	77	191	80		2NNN	2	$200,025	$80,010	10.1		10.1	1	31	-1	2.0
12	012OCEA0809A	1	0	140	77	184	45		2nnn	60	$85,725	$34,290	8.0		8.0	1	5	-1	2.0
12	012OCEA0809G	2	0	140	0	246	40		1nnn	24	$15,431	$6,172	7.0		7.3	1	31	-1	2.0
12	012OCEA0811A	1	0	140	77	182	45		2nnn	2	$171,450	$68,580	7.0		7.0	1	31	-1	2.0
12	012OCEA0812A	2	347	90	83	343	50		1nnn	2	$97,155	$38,862	6.7		6.7	1	31	-1	2.0
12	012OCEA0812G	2	0	90	0	394	40		1nnn	16	$51,435	$20,574	7.0		7.4	1	31	-1	2.0
12	012OCEA0813A	1	0	140	77	200	35		2N	2	$228,600	$91,440	6.9		6.9	1	31	-1	2.0
12	012OCEA0815A	1	0	140	77	193	40		1PPU	59	$228,600	$91,440	7.2		17.6	1	11	-1	2.0
12	012OCEA0817A	1	0	140	77	201	30		2PSU	56	$571,500	$228,600	9.1		17.7	1	23	-1	2.0
12	012S_AN0710A	2	347	80	50	362	40		1nnn	1	$74,295	$29,718	7.5		8.5	1	31	-1	0.5

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
12	012S_AN0721A	2	347	80	83	360	55		2nnn	41	$171,450	$90,000	8.0	0.0	8.1	1	31	-1	2.0
12	012S_AN0801A	2	347	90	83	346	45		1N	1	$212,598	$85,039	7.2		7.2	1	31	-1	2.0
12	012S_AN0805A	2	347	90	83	397	25		ARCAD	16	$308,610	$123,444	8.2	0.0	8.2	1	31	-1	2.0
12	012S_AN0805X	2	347	90	83	405	25		2nnn	16	$51,435	$20,574	8.0		8.3	1	31	-1	2.0
12	012S_AN0805Y	2	347	90	83	402	25		1nnn	16	$53,721	$21,488	8.0		8.2	1	31	-1	2.0
12	012S_AN0819A	2	347	90	83	382	50		1PFF	59	$222,885	$89,154	9.0	8.0	17.2	1	31	-1	2.0
12	012OCEAFF01A	2	346	90	83	370	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
12	012OCEAFF02A	2	345	90	83	360	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
12	012OCEAFF03A	2	345	90	83	373	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
12	012OCEAFF04A	2	345	90	83	373	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
12	012OCEAFF05A	2	345	90	83	373	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
12	012OCEAHWY	1	280	60	1000	285	24		Hwy	64	$108,036	$0	5.2		5.2	1	34	-1	0.5
-999																			
13	013MARI0602A	2	319	90	95	322	30		2PFF	60	$385,191	$154,076	9.6		18.7	1	31	-1	2.0
13	013MARI0605A	1	0	220	70	203	50		2PFU	60	$501,777	$200,711	13.0	11.0	23.8	1	4	-1	2.0
13	013MARI0607A	1	0	220	70	184	45		2PFF	60	$581,787	$232,715	12.5		21.5	1	4	-1	2.0
13	013MARI0609A	1	0	220	70	209	35		2PFU	60	$357,759	$143,104	8.0	8.0	17.6	1	6	-1	2.0
13	013MARI0610A	2	319	100	95	322	30		2PFF	60	$405,765	$162,306	9.5		19.1	1	31	-1	2.0
13	013MARI0620A	3	480	110	333	525	30		2psu	56	$325,755	$130,302	7.0	8.0	15.2	1	31	-1	2.0
13	013MARI0624A	3	550	100	100	565	40		3nnn	60	$314,325	$125,730	7.0		15.2	1	6	-1	2.0
13	013OCEA0611A	1	0	200	70	174	40		2N	2	$114,300	$45,720	9.1		9.1	1	31	-1	2.0
13	013OCEA0613A	1	0	140	70	176	35		2N	2	$110,871	$44,348	8.8		8.8	1	31	-1	2.0
13	013OCEA0617A	1	0	140	70	168	60		2nnn	2	$171,450	$68,580	9.2		18.2	1	5	-1	2.0
13	013OCEA0619A	1	0	140	70	180	45		2N	2	$172,593	$69,037	9.2		9.2	1	31	-1	2.0
13	013OCEA0701A	1	0	140	70	177	40		2N	2	$197,739	$79,096	10.4		10.4	1	31	-1	2.0
13	013OCEA0703A	1	0	140	70	177	35		1PFF	59	$112,014	$44,806	8.7		16.7	1	2	-1	2.0
13	013OCEA0705A	1	0	140	70	178	40		2N	2	$150,876	$60,350	8.8		8.8	1	31	-1	2.0
13	013OCEA0706A	2	319	75	95	346	35		2psf	55	$74,295	$29,718	8.2		16.9	1	31	-1	2.0
13	013S_AN0601A	1	0	300	70	193	45		1PFF	59	$228,600	$91,440	9.1		17.8	1	3	-1	2.0
13	013S_AN0603A	1	0	300	70	190	60		1PFF	59	$300,609	$120,244	10.4		19.7	1	3	-1	2.0
13	013S_AN0604A	3	480	140	333	504	35			16	$6,730	$11,200	9.0		9.0	1	31	-1	2.0
13	013S_AN0605A	1	0	300	70	192	50		1PFF	59	$296,037	$118,415	10.4		21.0	1	3	-1	2.0
13	013S_AN0606A	3	480	140	333	520	30		3nnn	56	$294,894	$117,958	9.0		15.6	1	31	-1	2.0
13	013S_AN0607A	1	0	300	70	192	40		1PFF	59	$220,599	$88,240	9.1		16.8	1	2	-1	2.0
13	013S_AN0621A	2	319	70	95	362	30		1NNN	1	$0	$0	1.4	0.4	7.8	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
13	013S_AN0623A	2	319	70	95	355	35		1NNN	1	$77,724	$31,090	8.0	0.4	8.5	1	31	-1	2.0
13	013S_AN0625A	2	319	70	95	332	55		1nnn	20	$342,900	$739,000	10.8	0.3	11.1	1	31	-1	2.0
13	013S_AN0701A	2	319	70	95	331	65		1nnn	38	$419,481	$695,000	8.7	2.0	10.7	1	31	-1	2.0
13	013MARIFF01A	2	287	70	95	335	40		2PS	56	$311,896	$124,758	9.0	12.0	21.0	1	31	-1	2.0
13	013MARIFF02A	2	281	70	95	305	40		2PS	56	$311,896	$124,758	9.0	12.0	21.0	1	31	-1	2.0
13	013MARIFF03A	1	0	70	70	207	40		2PS	56	$311,896	$124,758	9.0	12.0	21.0	1	31	-1	2.0
13	013S_ANFF04A	2	475	70	95	500	40		2PS	56	$311,896	$124,758	9.0	12.0	21.0	1	31	-1	2.0
13	013S_ANFF05A	2	475	70	95	500	40		2PS	56	$311,896	$124,758	9.0	12.0	21.0	1	31	-1	2.0
13	013S_ANHWY	1	400	60	350	405	24		Hwy	64	$37,810	$0	5.6		5.6	1	34	-1	0.5
13	013MARIHWY	1	280	60	200	285	24		Hwy	64	$21,603	$0	5.6		5.6	1	34	-1	0.5
13	013OCEAHWY	1	270	60	400	275	24		Hwy	64	$43,217	$0	5.6		5.6	1	34	-1	0.5
-999																			
14	014S_AN0401A	1	0	300	77	177	45		1PSU	55	$285,750	$114,300	10.5		22.8	1	20	-1	2.0
14	014S_AN0402A	2	429	140	111	431	50		1PFF	59	$112,014	$44,806	9.0	7.0	15.9	1	31	-1	2.0
14	014S_AN0403A	1	0	300	77	180	40		1PSU	55	$91,440	$36,576	9.0		18.2	1	21	-1	2.0
14	014S_AN0404A	2	429	140	111	439	60		2PPF	60	$462,915	$185,166	7.2	10.0	17.2	1	31	-1	2.0
14	014S_AN0405A	1	0	300	77	159	50		1PSU	55	$168,021	$67,208	12.8		24.1	1	19	-1	2.0
14	014S_AN0406A	2	429	140	111	449	25		1PPU	59	$108,585	$43,434	8.0	8.0	16.0	1	31	-1	2.0
14	014S_AN0407A	1	0	300	77	164	35		2N	2	$118,872	$47,549	10.2		10.2	1	31	-1	2.0
14	014S_AN0409A	1	0	300	77	168	50		1PFF	59	$181,737	$72,695	10.9		21.3	1	2	-1	2.0
14	014S_AN0410A	2	429	140	111	451	30		2NNN	2	$114,300	$45,720	8.0	0.2	8.2	1	31	-1	2.0
14	014S_AN0411A	1	0	300	77	173	40		2N	2	$259,461	$103,784	11.2		11.2	1	31	-1	2.0
14	014S_AN0412A	2	429	140	111	451	30		1PPF	59	$74,295	$29,718	8.0	8.0	16.2	1	12	-1	2.0
14	014S_AN0413A	1	0	300	77	174	50		2N	2	$180,594	$72,238	9.0		9.0	1	31	-1	2.0
14	014S_AN0414A	2	429	140	111	447	40		2N	2	$177,165	$70,866	8.5		8.5	1	31	-1	2.0
14	014S_AN0416A	2	429	140	111	458	30		2N	2	$277,749	$111,100	8.0		8.5	1	31	-1	2.0
14	014S_AN0501A	1	0	300	77	177	50		1PFF	59	$297,180	$118,872	10.0		20.3	1	11	-1	2.0
14	014S_AN0503A	1	0	300	77	190	50		2N	2	$228,600	$91,440	9.9		9.9	1	31	-1	2.0
14	014S_AN0505A	1	0	300	77	185	50		2N	2	$276,606	$110,642	9.6		9.6	1	31	-1	2.0
14	014S_AN0507A	1	0	300	77	182	50		3N	2	$800,100	$320,040	8.8		8.8	1	31	-1	2.0
14	014S_AN0508A	2	429	140	111	460	50		1PPU	59	$228,600	$91,440	9.0	8.0	17.0	1	31	-1	2.0
14	014S_AN0509A	1	0	300	77	168	55		1PFF	59	$258,318	$103,327	8.9		17.6	1	3	-1	2.0
14	014S_AN0510A	2	429	140	111	463	50		2.5PFF	60	$514,350	$205,740	6.9		6.9	1	31	-1	2.0
14	014S_ANFF01A	2	419	140	111	452	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
14	014S_ANFF02A	1	0	140	77	188	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
14	014S_ANFF03A	2	437	140	111	452	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
14	014S_ANFF04A	2	437	140	111	452	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
14	014S_ANFF05A	2	437	140	111	452	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
14	014S_ANFF06A	2	437	140	111	452	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
14	014S_ANHWY	1	330	60	1000	335	24		Hwy	64	$108,036	$0	7.3		7.3	1	34	-1	0.5
-999																			
15	015S_AN0209A	1	0	230	71	144	30		2PFF	60	$382,905	$153,162	9.0		15.8	1	6	-1	2.0
15	015S_AN0210A	2	361	150	100	346	35		1PSU	55	$171,450	$68,580	6.0	10.0	16.1	1	31	-1	2.0
15	015S_AN0211A	1	0	230	71	135	35		1PFF	59	$102,870	$41,148	9.5		18.8	1	2	-1	2.0
15	015S_AN0212A	2	361	150	100	354	40		1PN	55	$91,440	$36,576	6.0	10.0	16.0	1	31	-1	2.0
15	015S_AN0213A	1	0	230	71	103	40		1PFF	59	$280,035	$112,014	9.4		19.0	1	3	-1	2.0
15	015S_AN0213G	2	0	60	71	204	40		1N	1	$102,870	$41,148	8.2		8.2	1	31	-1	2.0
15	015S_AN0214A	2	361	150	100	366	40		1PFU	59	$200,025	$80,010	9.0	7.0	16.2	1	31	-1	2.0
15	015S_AN0215A	1	0	230	71	111	40		1PPF	59	$171,450	$68,580	9.6		18.0	1	12	-1	2.0
15	015S_AN0216A	2	361	150	100	371	35		2N	2	$308,610	$123,444	8.1		8.1	1	31	-1	2.0
15	015S_AN0217A	1	0	230	71	129	40		1PFF	59	$266,319	$106,528	9.0		17.7	1	21	-1	2.0
15	015S_AN0218A	2	361	150	100	368	35		1N	1	$121,158	$48,463	7.5	0.5	8.0	1	31	-1	2.0
15	015S_AN0301A	1	0	230	71	144	35		1PSU	55	$261,747	$104,699	8.7		17.0	1	20	-1	2.0
15	015S_AN0302A	2	361	150	100	379	35		1N	1	$121,158	$48,463	7.5	0.5	8.0	1	31	-1	2.0
15	015S_AN0303A	1	0	230	71	129	35		1PFF	59	$281,178	$112,471	10.0		19.3	1	3	-1	2.0
15	015S_AN0305A	1	0	230	71	147	50		1PFF	59	$475,488	$190,195	12.5		22.2	1	3	-1	2.0
15	015S_AN0306A	2	361	150	100	397	35		1.5PSU	57	$352,044	$140,818	10.0	8.0	18.1	1	31	-1	2.0
15	015S_AN0307A	1	0	230	71	136	50		1PFF	59	$180,594	$72,238	10.4		19.8	1	2	-1	2.0
15	015S_AN0308A	2	361	150	100	392	35		1PPU	59	$308,610	$123,444	10.0	8.0	18.1	1	31	-1	2.0
15	015S_AN0309A	1	0	230	71	133	45		1PFF	59	$114,300	$45,720	9.8		19.7	1	2	-1	2.0
15	015S_AN0311A	1	0	230	71	149	60		1PPF	59	$256,032	$102,413	10.8		21.3	1	11	-1	2.0
15	015S_AN0312A	2	361	150	100	407	30		2N	2	$200,025	$80,010	7.0	0.4	7.4	1	31	-1	2.0
15	015S_AN0313A	1	0	230	71	155	55		1PFF	59	$388,620	$155,448	10.3		22.7	1	3	-1	2.0
15	015S_AN0315A	1	0	230	71	145	40		1PFF	59	$209,169	$83,668	10.3		20.7	1	2	-1	2.0
15	015S_AN0316A	2	361	150	100	414	35		2PSU	56	$289,179	$115,672	10.0	8.0	17.9	1	31	-1	2.0
15	015S_ANFF01A	2	375	150	100	400	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
15	015S_ANFF02A	2	385	150	100	416	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
15	015S_ANFF03A	2	380	150	100	407	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
15	015S_ANHWY	1	310	60	950	315	24		Hwy	64	$102,630	$0	7.8		7.8	1	34	-1	0.5
-999																			

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
16	016BANK0001A	2	316	100	111	356	30		2PSU	56	$270,891	$108,356	12.2	8.0	20.2	1	31	-1	2.0
16	016BANK0002A	2	316	90	111	333	40		1PSU	55	$118,872	$47,549	13.0	6.0	19.1	1	31	-1	2.0
16	016BANK0004A	4	316	50	111	408	30		2PFU	60	$293,751	$117,500	8.0	9.0	16.9	1	31	-1	2.0
16	016N_AN1195M	1	0	220	71	118	25		2nnn	33	$685,800	$343,000	14.6		25.7	1	31	-1	2.0
16	016N_AN1195A	2	0	220	83	197	30		1nnn	33	$205,740	$103,000	14.0		14.9	1	31	-1	2.0
16	016S_AN0121A	1	0	220	71	147	50		2nnn	59	$114,300	$45,720	11.8		22.9	1	3	-1	2.0
16	016S_AN0125A	1	0	220	71	158	35		2pnn	56	$314,325	$125,730	12.4		23.8	1	22	-1	2.0
16	016S_AN0125X	1	0	220	71	158	40		2pnn	56	$314,325	$125,730	12.4		23.8	1	22	-1	2.0
16	016S_AN0126A	2	316	130	111	369	30		1N	1	$91,440	$36,576	8.6	0.3	8.9	1	31	-1	2.0
16	016S_AN0127A	1	0	200	71	165	25		1PFF	59	$205,740	$82,296	8.2		20.6	1	2	-1	2.0
16	016S_AN0128A		316	150	111	355	40		1PSU	55	$114,300	$45,720	10.0	6.0	16.2	1	31	-1	2.0
16	016S_AN0129A	1	0	200	71	123	40		2PFF	60	$440,055	$176,022	11.6		20.8	1	6	-1	2.0
16	016S_AN0130A		316	150	111	376	25		2PSU	56	$274,320	$109,728	10.0	8.0	17.6	1	31	-1	2.0
16	016S_AN0131A	1	0	200	71	122	40		3nnn	60	$257,175	$102,870	11.2		20.4	1	6	-1	2.0
16	016S_AN0133A	1	0	200	71	121	45		1PFF	59	$224,028	$89,611	12.1		21.9	1	1	-1	2.0
16	016S_AN0201A	1	0	220	71	151	30		2PFF	60	$417,195	$166,878	9.4		20.3	1	6	-1	2.0
16	016S_AN0203A	1	0	220	71	132	40		2PFF	60	$386,334	$154,534	8.8		23.5	1	6	-1	2.0
16	016S_AN0204A		316	175	111	373	30		2PSU	56	$249,174	$99,670	7.0	7.0	14.3	1	24	-1	2.0
16	016S_AN0205A	1	0	220	83	104	30		2nnn	59	$628,650	$251,460	8.1		24.4	1	2	-1	2.0
16	016S_AN0205G	2	0	220	0	153	15		1nnn	13	$17,145	$6,858	7.0		7.0	1	31	-1	2.0
16	016S_AN0206A	2	316	180	111	372	30		2PSU	56	$197,739	$79,096	7.0		16.8	1	31	-1	2.0
16	016S_AN0208A	2	316	180	111	372	30		1.5PPF	61	$174,879	$69,952	7.0	12.0	16.7	1	31	-1	2.0
16	016S_ANFF01A	2	318	180	111	363	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
16	016S_ANFF02A	2	317	180	111	350	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
16	016S_ANFF03A	2	318	180	111	362	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
16	016S_ANFF04A	1	0	180	71	182	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
16	016S_ANFF05A	2	317	180	111	357	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
16	016S_ANFF06A	2	317	180	111	357	40		2PS	56	$311,896	$124,758	8.0	12.0	20.0	1	31	-1	2.0
16	016S_ANHWY	1	230	60	650	235	24		Hwy	64	$73,655	$0	7.8		7.8	1	34	-1	0.5
16	016N_ANHWY	1	230	60	350	235	24		Hwy	64	$37,810	$0	7.8		7.8	1	34	-1	0.5
-999																			
17	017MONR1155A	2	319	150	143	396	25		2PSU	56	$222,885	$89,154	12.0	10.0	22.3	1	31	-1	2.0
17	017MONR1157A	2	319	170	143	388	40		2PSU	56	$278,892	$111,557	12.3	10.0	22.3	1	31	-1	2.0
17	017MONR1159A	2	319	170	143	396	25		2PN	56	$228,600	$91,440	10.0	10.0	20.2	1	31	-1	2.0
17	017MONR1161A	2	319	170	143	408	35		2PSU	56	$194,310	$77,724	10.0	12.0	21.5	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
17	017MONR1165A	2	319	170	143	390	25		2PSU	56	$228,600	$91,440	13.0	8.0	21.1	1	31	-1	2.0
17	017N_AN1155A	1	0	160	56	202	30		2PFF	60	$249,174	$99,670	17.8		27.3	1	4	-1	2.0
17	017N_AN1157A	1	0	160	56	201	35		2PSU	56	$236,601	$94,640	17.7		26.6	1	22	-1	2.0
17	017N_AN1159A	1	319	160	143	199	40		1PSF	55	$122,301	$48,920	17.0		26.7	1	19	-1	2.0
17	017N_AN1161A	1	0	160	56	199	25		2PSU	56	$257,175	$102,870	18.0		26.4	1	22	-1	2.0
17	017N_AN1163A	1	0	160	56	191	35		2PN	56	$331,470	$132,588	15.5		26.8	1	28	-1	2.0
17	017N_AN1167A	1	0	170	56	187	35		2PSU	56	$261,747	$104,699	14.4		25.0	1	22	-1	2.0
17	017N_AN1169A	1	0	170	56	185	35		2PN	56	$365,760	$146,304	15.1		25.7	1	28	-1	2.0
17	017N_AN1173A	1	0	180	56	187	50		1nnn	1	$91,440	$36,576	14.3		23.1	1	1	-1	2.0
17	017N_AN1175A	1	0	180	56	189	40		1PFF	59	$148,590	$59,436	14.6		24.3	1	1	-1	2.0
17	017N_AN1176A	2	305	170	56	320	40		3nnn	60	$514,350	$205,740	14.0		24.0	1	31	-1	2.0
17	017N_AN1177A	1	0	190	56	187	40		1PSF	55	$109,728	$43,891	13.2		22.6	1	19	-1	2.0
17	017N_AN1179A	1	0	190	56	188	35		1PFF	59	$102,870	$41,148	12.6		21.8	1	1	-1	2.0
17	017N_AN1181A	1	0	200	56	182	40		1PFF	59	$194,310	$77,724	12.0		21.3	1	1	-1	2.0
17	017N_AN1184A	2	319	200	143	377	40		2PFU	60	$334,899	$133,960	9.0	11.0	19.6	1	6	-1	2.0
17	017N_AN1185A	1	0	200	56	161	40		1PFU	59	$171,450	$68,580	19.7		25.0	1	1	-1	2.0
17	017N_AN1188A	2	305	170	56	320	40		3nnn	60	$371,475	$148,590	14.0		21.5	1	31	-1	2.0
17	017N_AN1191A	1	0	210	56	153	50		1N	1	$107,442	$42,977	19.8		19.8	1	31	-1	2.0
17	017N_AN1193A	1	0	210	56	160	40		1N	1	$102,870	$41,148	19.6		19.6	1	31	-1	2.0
17	017N_AN1195A	1	0	220	56	124	30		1nnn	33	$205,740	$103,000	14.5	0.5	15.0	1	31	-1	2.0
17	017N_AN1195Y	1	0	220	56	217	20		2nnn	33	$142,875	$72,000	14.5	0.5	14.9	1	31	-1	2.0
17	017N_AN1195X	1	0	220	56	188	40		1nnn	33	$205,740	$103,000	14.5	0.5	14.9	1	31	-1	2.0
17	017N_ANFF01A	2	312	220	56	356	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
17	017N_ANFF02A	2	312	220	56	356	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
17	017N_ANFF03A	2	312	220	56	356	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
17	017N_ANFF04A	2	312	220	56	356	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
17	017N_ANFF05A	2	322	220	56	388	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
17	017N_ANFF06A	2	322	220	56	388	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
17	017N_ANFF07A	1	0	220	56	201	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
17	017S_AN0110A	2	319	90	143	325	30			33	$228,600	$114,000	14.0		21.4	1	31	-1	2.0
17	017N_ANHWY	1	250	60	1000	255	24		Hwy	64	$108,036	$0	9.8		9.8	1	34	-1	0.5
-999																			
18	018N_AN1114A	3	410	230	77	419	40		2PSU	56	$230,886	$92,354	8.0	8.0	16.2	1	31	-1	2.0
18	018N_AN1115A	1	0	150	53	143	40		1PPU	59	$182,880	$73,152	9.9		19.2	1	12	-1	2.0
18	018N_AN1117A	1	0	150	53	137	40		1PSU	55	$171,450	$68,580	11.9		21.3	1	21	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
18	018N_AN1118A	3	450	220	77	460	30		1.5PSU	57	$284,607	$113,843	8.0	8.0	16.6	1	31	-1	2.0
18	018N_AN1121A	1	0	150	53	162	40		1PSU	55	$157,734	$63,094	12.6		21.9	1	21	-1	2.0
18	018N_AN1122A	3	440	220	77	446	35		2PSU	56	$228,600	$91,440	6.4	10.0	16.4	1	31	-1	2.0
18	018N_AN1123A	1	0	150	53	158	40		1PFU	59	$148,590	$59,436	11.2		20.6	1	2	-1	2.0
18	018N_AN1125A	1	0	150	53	161	40		1PFF	59	$216,027	$86,411	9.9		19.7	1	3	-1	2.0
18	018N_AN1126A	2	315	200	72	322	30		2PPU	60	$313,182	$125,273	9.0	8.0	17.1	1	31	-1	2.0
18	018N_AN1127A	1	0	150	53	166	35		1PFF	59	$160,020	$64,008	8.5		18.8	1	2	-1	2.0
18	018N_AN1129A	1	0	150	53	167	40		1PFF	59	$228,600	$91,440	8.9		18.7	1	3	-1	2.0
18	018N_AN1130A	2	325	120	72	331	40		2PFU	60	$411,480	$164,592	7.0	8.0	15.2	1	31	-1	2.0
18	018N_AN1131A	1	0	150	53	171	35		2PSF	56	$160,020	$64,008	8.7		18.1	1	23	-1	2.0
18	018N_AN1137A	1	0	150	53	176	35		2PPF	60	$200,025	$80,010	15.8		24.8	1	15	-1	2.0
18	018N_AN1141A	1	0	150	53	185	35		2PFF	60	$212,598	$85,039	24.4		33.7	1	5	-1	2.0
18	018N_AN1143A	1	0	150	53	177	40		2PSU	56	$228,600	$91,440	23.1		33.5	1	23	-1	2.0
18	018N_AN1145A	1	0	150	53	180	40		1PSU	55	$253,746	$101,498	21.7		32.3	1	20	-1	2.0
18	018N_AN1147A	1	0	150	53	192	45		1PPF	59	$114,300	$45,720	18.7		28.0	1	12	-1	2.0
18	018N_AN1149A	1	0	150	53	195	40		1PPF	59	$205,740	$82,296	19.1		29.3	1	12	-1	2.0
18	018N_AN1151A	1	0	150	53	204	40		2PSU	56	$123,444	$49,378	16.8		26.2	1	23	-1	2.0
18	018N_AN1153A	1	0	150	53	204	35		2PFU	60	$160,020	$64,008	18.3		29.2	1	5	-1	2.0
18	018N_ANFF01A	2	316	150	72	358	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANFF02A	2	316	150	72	358	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANFF03A	2	316	150	72	358	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANFF04A	2	316	150	72	358	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANFF05A	2	316	150	72	358	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANFF06A	2	316	150	72	358	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANFF07A	2	316	150	72	358	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANFF08A	2	316	150	72	358	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANFF09A	2	316	150	72	358	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANFF10A	1	0	150	53	191	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANFF11A	1	0	150	53	191	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANFF12A	1	0	150	53	191	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANFF13A	2	295	150	72	320	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANFF14A	2	290	150	72	435	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANFF15A	2	290	150	72	435	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
18	018N_ANHWY	1	220	60	1000	225	24		Hwy	64	$108,036	$0	9.8		9.8	1	34	-1	0.5
-999																			

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
19	019CANA1110A	2	340	60	250	334	30		1PN	55	$196,596	$78,638	7.0	8.0	14.8	1	31	-1	2.0
19	019CANA1111A	2	340	90	250	352	30		2PSU	56	$206,883	$82,753	9.5	8.0	17.6	1	31	-1	2.0
19	019CANA1113A	3	400	60	111	399	25		2PSU	56	$208,026	$83,210	6.7	10.0	16.7	1	31	-1	2.0
19	019GAYE0970A	3	340	50	250	311	30		1PFF	59	$125,730	$50,292	10.0	7.0	16.5	1	31	-1	2.0
19	019GAYE0972A	4	360	50	111	358	40		1PFF	59	$205,740	$82,296	7.5	7.0	14.6	1	31	-1	2.0
19	019GAYE0973A	3	340	70	250	323	50		1PSU	55	$130,302	$52,121	12.0	6.0	17.9	1	31	-1	2.0
19	019GAYE0975A	4	390	70	111	393	40		1.5PSU	57	$106,299	$42,520	7.0	10.0	17.1	1	31	-1	2.0
19	019QUEE0001A	1	0	150	77	98	60		4psu	60	$1,375,029	$550,012	15.6		27.5	1	7	-1	2.0
19	019QUEE0002A	1	0	160	77	104	50		3psu	60	$1,223,010	$489,204	15.6		27.5	1	7	-1	2.0
19	019QUEE0003A	2	250	170	333	269	45		3psu	55	$1,223,010	$489,204	13.6		19.5	1	8	-1	2.0
19	019N_AN1001A	1	0	150	77	155	40		1PFF	59	$171,450	$68,580	15.9		25.2	1	1	-1	2.0
19	019N_AN1002A	2	266	70	333	272	30		2PFF	60	$229,743	$91,897	16.6		26.8	1	31	-1	2.0
19	019N_AN1004A	2	266	80	333	271	25		1N	1	$91,440	$36,576	15.8		15.8	1	31	-1	2.0
19	019N_AN1005A	1	0	150	77	157	30		2PFF	60	$427,482	$170,993	15.2		21.3	1	4	-1	2.0
19	019N_AN1007A	1	0	150	77	129	50		2PFF	60	$228,600	$91,440	15.2		23.2	1	4	-1	2.0
19	019N_AN1009A	1	0	140	77	119	40		1PFF	59	$170,307	$68,123	14.8		24.3	1	1	-1	2.0
19	019N_AN1011A	1	0	150	77	134	40		1PFF	59	$237,744	$95,098	16.4		25.6	1	1	-1	2.0
19	019N_AN1101A	1	0	150	77	144	30		2PSU	56	$213,741	$85,496	14.2		23.4	1	22	-1	2.0
19	019N_AN1105A	1	0	150	77	158	40		1PPF	59	$57,150	$22,860	14.0		23.8	1	10	-1	2.0
19	019N_AN1107A	1	0	150	77	136	45		1PFF	59	$189,738	$75,895	13.1		27.9	1	1	-1	2.0
19	019N_AN1109A	1	0	150	77	134	35		2PSF	56	$233,172	$93,269	13.3		25.6	1	22	-1	2.0
19	019N_AN1110A	2	420	210	111	427	25		2PSU	56	$242,316	$96,926	8.5	6.0	14.5	1	31	-1	2.0
19	019N_AN1111A	1	0	150	77	143	40		1PFF	59	$173,736	$69,494	12.7		22.4	1	1	-1	2.0
19	019N_AN1112A	2	385	210	111	389	50		2PSU	56	$443,484	$177,394	8.0	8.0	16.3	1	31	-1	2.0
19	019N_AN1113A	1	0	150	77	151	30		1PFU	59	$285,750	$114,300	12.6		22.3	1	1	-1	2.0
19	019N_AN0926A	4	415	150	111	429	100		1nnn	56	$194,310	$77,724	8.7	10.0	18.7	1	31	-1	2.0
19	019BETHFF01A	2	333	210	111	348	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
19	019BETHFF02A	2	333	210	111	348	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
19	019BETHFF03A	2	391	210	111	405	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
19	019BETHFF04A	2	391	210	111	405	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
19	019CANAFF01A	2	269	210	111	288	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
19	019CANAFF02A	2	269	210	111	288	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
19	019CANAFF03A	2	388	210	111	403	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
19	019CANAFF04A	2	445	210	111	467	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
19	019CANAFF05A	2	445	210	111	467	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
19	019N_ANFF01A	1	0	210	77	159	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
19	019N_ANFF02A	2	265	210	111	288	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
19	019N_ANFF03A	2	258	210	111	295	40		2PS	56	$311,896	$124,758	10.0	12.0	22.0	1	31	-1	2.0
19	019N_ANHWY	1	210	60	1000	215	24		Hwy	64	$108,036	$0	11.0		11.0	1	34	-1	0.5
-999																			
20	020QUEE0004A	1	0	160	100	93	50		3psu	56	$1,223,010	$489,204	15.6		27.5	1	7	-1	2.0
20	020QUEE0005A	1	0	160	100	101	50		3psu	56	$611,505	$244,602	15.6		27.5	1	7	-1	2.0
20	020QUEE0006A	1	0	160	100	112	50		3psu	56	$1,223,010	$489,204	15.6		27.5	1	7	-1	2.0
20	020QUEE0007A	1	0	160	100	118	50		3psu	56	$916,686	$366,674	15.6		27.5	1	7	-1	2.0
20	020N_AN0907A	1	0	170	100	138	50		1PSU	55	$224,028	$89,611	18.0		29.4	1	19	-1	2.0
20	020N_AN0909A	1	0	170	100	130	50		1PPU	59	$114,300	$45,720	17.4		27.0	1	10	-1	2.0
20	020N_AN0910W	3	270	200	1000	390	30			56	$0	$0	17.0		26.0	1	31	-1	2.0
20	020N_AN0911A	1	0	170	100	128	40		1PSU	55	$189,738	$75,895	17.6		27.6	1	19	-1	2.0
20	020N_AN0913A	1	0	170	100	128	40		1PSU	55	$203,454	$81,382	17.0		26.7	1	19	-1	2.0
20	020N_AN0915A	1	0	170	100	135	30		2PFF	60	$496,062	$198,425	17.0		28.6	1	4	-1	2.0
20	020N_ANFF01A	1	0	170	100	165	40		2PS	56	$311,896	$124,758	16.0	12.0	28.0	1	31	-1	2.0
20	020N_ANFF02A	2	262	170	100	285	40		2PS	56	$311,896	$124,758	16.0	12.0	28.0	1	31	-1	2.0
20	020N_ANFF03A	2	262	170	100	285	40		2PS	56	$311,896	$124,758	16.0	12.0	28.0	1	31	-1	2.0
20	020N_ANFF04A	2	262	170	100	285	40		2PS	56	$311,896	$124,758	16.0	12.0	28.0	1	31	-1	2.0
20	020N_ANFF05A	2	262	170	100	285	40		2PS	56	$311,896	$124,758	16.0	12.0	28.0	1	31	-1	2.0
20	020N_ANFF06A	2	262	170	100	285	40		2PS	56	$311,896	$124,758	16.0	12.0	28.0	1	31	-1	2.0
20	020N_ANFF07A	2	262	170	100	285	40		2PS	56	$311,896	$124,758	16.0	12.0	28.0	1	31	-1	2.0
20	020N_ANFF08A	2	262	170	100	285	40		2PS	56	$311,896	$124,758	16.0	12.0	28.0	1	31	-1	2.0
20	020N_ANFF09A	2	262	170	100	285	40		2PS	56	$311,896	$124,758	16.0	12.0	28.0	1	31	-1	2.0
20	020N_ANFF10A	2	262	170	100	285	40		2PS	56	$311,896	$124,758	16.0	12.0	28.0	1	31	-1	2.0
20	020N_ANHWY	1	200	60	1000	205	24		Hwy	64	$108,036	$0	8.4		8.4	1	34	-1	0.5
-999																			
21	021KNIG0807A	3	412	90	500	411	45			56	$114,300	$45,720	10.0		15.4	1	31	-1	2.0
21	020N_AN0798A	2	310	200	70	350	40		3nnn	60	$320,040	$128,016	11.0		22.0	1	31	-1	2.0
21	021N_AN0799A	1	0	170	53	158	30		2PFU	60	$328,041	$131,216	16.7	10.0	26.7	1	4	-1	2.0
21	021N_AN0800A	2	301	80	111	328	30		1PFF	59	$125,730	$50,292	11.5		21.2	1	31	-1	2.0
21	021N_AN0801A	1	0	170	53	154	30		1N	1	$45,720	$18,288	22.6		22.6	1	31	-1	2.0
21	021N_AN0802A	2	301	90	111	319	35		1N	1	$228,600	$91,440	22.6		22.6	1	31	-1	2.0
21	021N_AN0803A	1	0	170	53	159	45		1PFU	59	$171,450	$68,580	18.7		27.5	1	1	-1	2.0
21	021N_AN0805A	1	0	170	53	188	35		1PFF	59	$114,300	$45,720	17.5		26.8	1	1	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
21	021N_AN0807A	1	0	170	53	179	40		1PFU	59	$228,600	$91,440	17.2		27.7	1	1	-1	2.0
21	021N_AN0808A	2	301	90	111	326	35		1PFF	59	$114,300	$45,720	9.3		17.3	1	31	-1	2.0
21	021N_AN0809A	1	0	170	53	178	45		1PSU	55	$196,596	$78,638	16.8		25.2	1	19	-1	2.0
21	021N_AN0810A	2	301	200	111	365	35		1PSF	55	$422,910	$169,164	6.6	6.0	12.6	1	31	-1	2.0
21	021N_AN0811A	1	0	170	53	202	30		1PN	55	$89,154	$35,662	16.2		25.8	1	28	-1	2.0
21	021N_AN0814A	2	301	210	111	352	25		2PSU	56	$328,041	$131,216	10.0		15.3	1	31	-1	2.0
21	021N_AN0815A	1	0	170	53	185	25		2PSU	56	$249,174	$99,670	17.9		30.3	1	22	-1	2.0
21	021N_AN0816A	3	483	220	500	466	40		2PFU	60	$266,319	$106,528	7.2	10.0	17.2	1	4	-1	2.0
21	021N_AN0817A	1	0	170	59	181	30		2psu	56	$182,880	$73,152	17.3		28.1	1	22	-1	2.0
21	021N_AN0818A	2	301	200	111	356	25		1N	1	$57,150	$22,860	7.0	3.0	10.0	1	31	-1	2.0
21	021N_AN0819A	1	0	170	53	191	40		1PFF	60	$83,439	$33,376	16.1		25.4	1	1	-1	2.0
21	021N_AN0820A	2	301	200	111	354	30		1N	1	$317,754	$127,102	7.0	0.3	7.3	1	31	-1	2.0
21	021N_AN0820S	3	0	10	0	452	20		shed	45	$12,573	$6,600	4.6		4.6	1	31	-1	2.0
21	021N_AN0820G	2	0	200	0	389	20		1nnn	45	$57,150	$28,000	6.7		6.7	1	31	-1	2.0
21	021N_AN0821A	1	0	170	53	181	45		1PPF	59	$201,168	$80,467	15.8		24.8	1	10	-1	2.0
21	021N_AN0823A	1	0	170	53	169	50		1PFF	59	$253,746	$101,498	16.4		26.7	1	1	-1	2.0
21	021N_AN0825A	1	0	170	53	162	45		1PPF	59	$228,600	$91,440	16.7		26.5	1	10	-1	2.0
21	021N_AN0826A	2	301	180	111	346	50		2PFU	60	$172,593	$69,037	10.0	8.0	17.9	1	31	-1	2.0
21	021N_AN0827A	1	0	170	53	177	35		2PFU	60	$283,464	$113,386	12.9	10.0	22.9	1	4	-1	2.0
21	021N_AN0828A	2	301	180	111	353	50		2PPU	60	$240,030	$96,012	9.0	9.0	18.0	1	31	-1	2.0
21	021N_AN0829A	1	0	170	53	157	30		2PFU	60	$277,749	$111,100	18.9		29.9	1	4	-1	2.0
21	021N_AN0901A	1	0	170	53	154	40		1PFF	59	$285,750	$114,300	16.5		26.4	1	1	-1	2.0
21	021N_AN0903A	1	0	170	53	152	40		1PPF	59	$203,454	$81,382	16.4		26.0	1	10	-1	2.0
21	021SUNS0800A	3	412	60	500	396	50		1.5N	4	$91,440	$36,576	5.0	4.0	9.0	1	31	-1	2.0
21	021SUNS0832A	4	483	70	500	479	30		1pff	2	$74,295	$29,718	4.4		4.4	1	31	-1	2.0
21	021SUNS0834A	5	520	150	80	550	40		1nnn	59	$85,725	$34,290	7.0		17.0	1	31	-1	2.0
21	021SUNS0836A	5	520	150	80	550	40		2nnn	59	$85,725	$34,290	7.0		17.0	1	31	-1	2.0
21	021SUNS0837A	5	520	150	80	550	40		3nnn	60	$371,475	$148,590	7.0		17.0	1	31	-1	2.0
21	021N_ANFF01A	2	300	150	80	333	40		2PS	56	$311,896	$124,758	7.0	12.0	19.0	1	31	-1	2.0
21	021N_ANFF02A	2	300	150	80	333	40		2PS	56	$311,896	$124,758	7.0	12.0	19.0	1	31	-1	2.0
21	021N_ANFF03A	1	0	150	53	195	40		2PS	56	$311,896	$124,758	7.0	12.0	19.0	1	31	-1	2.0
21	021N_ANFF04A	2	300	150	80	333	40		2PS	56	$311,896	$124,758	7.0	12.0	19.0	1	31	-1	2.0
21	021N_ANFF05A	2	300	150	80	333	40		2PS	56	$311,896	$124,758	7.0	12.0	19.0	1	31	-1	2.0
21	021N_ANFF06A	1	0	150	53	195	40		2PS	56	$311,896	$124,758	7.0	12.0	19.0	1	31	-1	2.0
21	021N_ANFF07A	2	300	150	80	333	40		2PS	56	$311,896	$124,758	7.0	12.0	19.0	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
21	021N_ANHWY	1	240	60	1000	245	24		Hwy	64	$108,036	$0	8.4		8.4	1	34	-1	0.5
-999																			
22	022N_AN0610A	2	287	120	250	300	25		2PSU	56	$283,464	$113,386	13.4		22.9	1	31	-1	2.0
22	022N_AN0611A	1	0	160	56	110	45		1PPF	59	$194,310	$77,724	14.1		23.2	1	10	-1	2.0
22	022N_AN0613A	1	0	160	56	116	40		1PFF	59	$45,720	$18,288	13.0		22.2	1	1	-1	2.0
22	022N_AN0615A	1	0	160	56	115	45		1PSU	55	$192,024	$76,810	14.8		24.8	1	19	-1	2.0
22	022N_AN0616A	2	287	110	250	291	30		2PSU	56	$306,324	$122,530	12.7	8.0	20.7	1	31	-1	2.0
22	022N_AN0617A	1	0	160	56	126	45		2PFF	60	$305,181	$122,072	17.1		26.8	1	4	-1	2.0
22	022N_AN0701A	1	0	160	56	135	45		1PPF	59	$313,182	$125,273	17.6		27.0	1	13	-1	2.0
22	022N_AN0703A	1	0	160	56	147	45		1PFF	59	$228,600	$91,440	17.0		26.7	1	4	-1	2.0
22	022N_AN0705A	1	0	160	56	144	30		2PFF	60	$314,325	$125,730	20.0	8.0	27.8	1	4	-1	2.0
22	022N_AN0710A	2	280	160	71	330	40		2psu	56	$182,880	$73,152	10.0		18.0	1	31	-1	2.0
22	022N_AN0711A	1	0	160	56	176	35		1PN	55	$133,731	$53,492	13.8		23.1	1	28	-1	2.0
22	022N_AN0713A	1	0	160	56	162	30		2PFU	60	$328,041	$131,216	18.0	8.0	26.4	1	4	-1	2.0
22	022N_AN0714A	2	287	160	250	312	30		2PSU	56	$297,180	$118,872	10.0	8.0	18.3	1	31	-1	2.0
22	022N_AN0715A	1	0	160	56	171	25		2PFF	60	$285,750	$114,300	19.2		29.5	1	4	-1	2.0
22	022N_AN0716A	2	280	160	71	330	40		3pfu	60	$285,750	$114,300	10.0		18.0	1	31	-1	2.0
22	022N_AN0717A	1	0	160	56	171	30		2PSU	56	$322,326	$128,930	21.7		32.7	1	22	-1	2.0
22	022N_AN0718A	3	280	160	71	400	40		3pfu	60	$285,750	$114,300	10.0		18.0	1	31	-1	2.0
22	022N_AN0719A	1	0	160	56	179	30		2PFF	60	$246,888	$98,755	21.0		31.3	1	4	-1	2.0
22	022N_AN0720S	3	0	200	56	427	35			16	$6,858	$3,400	15.0		15.0	1	31	-1	2.0
22	022N_AN0721A	1	0	160	56	186	30		3pfu	60	$262,890	$105,156	15.1	10.0	25.1	1	4	-1	2.0
22	022N_AN0722A	3	280	160	71	330	40		3pfu	60	$285,750	$114,300	10.0		18.0	1	31	-1	2.0
22	022N_AN0797A	1	0	160	56	161	50		3pfu	60	$314,325	$125,730	17.7	10.0	27.7	1	4	-1	2.0
22	022NIXO0614A	3	287	80	250	395	40		1PSU	55	$137,160	$54,864	9.0	8.0	17.2	1	21	-1	2.0
22	022N_ANFF01A	1	0	160	56	174	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
22	022N_ANFF02A	2	295	160	71	320	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
22	022N_ANFF03A	2	295	160	71	320	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
22	022N_ANFF04A	2	295	160	71	320	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
22	022N_ANFF05A	2	295	160	71	320	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
22	022N_ANFF06A	2	280	160	71	302	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
22	022N_ANFF07A	2	280	160	71	302	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
22	022N_ANFF08A	2	280	160	71	302	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
22	022N_ANFF09A	2	270	160	71	290	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
22	022N_ANFF10A	2	270	160	71	290	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
22	022NIXOFF01A	2	382	160	71	397	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
22	022N_ANHWY	1	230	60	1000	235	24		Hwy	64	$108,036	$0	9.2		9.2	1	34	-1	0.5
-999																			
23	023N_AN0472A	2	270	220	50	290	40		2nnn	59	$171,450	$68,580	13.0		22.0	1	31	-1	2.0
23	023N_AN0473A	1	0	150	56	125	45		2PFF	59	$171,450	$68,580	14.1		23.3	1	4	-1	2.0
23	023N_AN0474A	3	269	140	200	354	45		2PSU	56	$148,590	$59,436	13.1		24.2	1	22	-1	2.0
23	023N_AN0476A	2	269	100	200	294	30		2PSU	56	$188,595	$75,438	10.4	10.0	20.4	1	31	-1	2.0
23	023N_AN0477A	1	0	150	56	129	25		2PFF	60	$400,050	$160,020	18.9		29.3	1	4	-1	2.0
23	023N_AN0479A	1	0	150	56	134	50		1PFF	59	$0	$0	15.0		23.9	1	1	-1	2.0
23	023N_AN0501A	1	0	150	56	130	45		2nnn	2	$97,155	$38,862	18.0		19.0	1	31	-1	2.0
23	023N_AN0503A	1	0	150	56	140	40		1PPF	59	$258,318	$103,327	14.8		24.0	1	10	-1	2.0
23	023N_AN0505A	1	0	150	56	135	45		2PFU	60	$273,177	$109,271	13.6		24.1	1	4	-1	2.0
23	023N_AN0507A	1	0	150	56	140	30		1PSU	55	$185,166	$74,066	13.8		26.5	1	19	-1	2.0
23	023N_AN0509A	1	0	150	56	151	30		1PSU	55	$219,456	$87,782	14.3		26.7	1	19	-1	2.0
23	023N_AN0511A	1	0	150	56	145	35		2nnn	59	$302,895	$121,158	15.3		27.1	1	1	-1	2.0
23	023N_AN0513A	1	0	150	56	131	30		2PFU	60	$365,760	$146,304	15.1	9.0	24.1	1	4	-1	2.0
23	023N_AN0514A	2	269	200	200	283	30		2PSU	56	$249,174	$99,670	9.0	8.0	17.4	1	23	-1	2.0
23	023N_AN0515A	1	0	150	56	155	40		2PSU	56	$306,324	$122,530	16.4	10.0	26.4	1	22	-1	2.0
23	023N_AN0516A	2	260	220	63	280	40		2psu	56	$302,895	$121,158	9.0		17.0	1	31	-1	2.0
23	023N_AN0517A	1	0	150	56	138	30		2PSU	56	$268,605	$107,442	16.5		27.9	1	22	-1	2.0
23	023N_AN0518A	2	260	220	63	280	40		2pfu	60	$320,040	$128,016	9.0		17.0	1	31	-1	2.0
23	023N_AN0520A	3	450	220	63	475	40		2psu	56	$297,180	$118,872	9.0		17.0	1	31	-1	2.0
23	023N_AN0522A	2	260	220	63	280	40		2psu	56	$274,320	$109,728	9.0		17.0	1	31	-1	2.0
23	023N_AN0601A	1	0	150	56	124	35		1PSU	55	$131,445	$52,578	17.3		26.5	1	19	-1	2.0
23	023N_AN0602A	2	269	200	200	330	30		2PSU	56	$200,025	$80,010	8.4	10.0	18.4	1	31	-1	2.0
23	023N_AN0603A	1	0	150	56	125	40		1PSU	55	$137,160	$54,864	19.4		30.4	1	19	-1	2.0
23	023N_AN0604A	2	269	30	200	345	30		3pfu	56	$320,040	$128,016	10.0		17.8	1	31	-1	2.0
23	023N_AN0605A	1	0	150	56	141	30		2PSU	56	$233,172	$93,269	19.3		28.5	1	22	-1	2.0
23	023N_AN0607A	1	0	150	56	136	30		2PFF	60	$342,900	$137,160	16.7		25.1	1	4	-1	2.0
23	023N_AN0609A	1	0	150	56	120	45		1PSU	55	$205,740	$82,296	16.3		26.3	1	19	-1	2.0
23	023N_ANFF01A	1	0	150	56	164	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
23	023N_ANFF02A	2	270	150	63	320	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
23	023N_ANFF03A	2	270	150	63	320	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
23	023N_ANFF04A	2	270	150	63	320	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
23	023N_ANFF05A	2	270	150	63	320	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
23	023N_ANFF06A	2	270	150	63	320	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
23	023N_ANFF07A	2	270	150	63	320	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
23	023N_ANFF08A	2	270	150	63	320	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
23	023N_ANFF09A	2	270	150	63	320	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
23	023N_ANFF10A	2	270	150	63	320	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
23	023N_ANFF11A	2	412	150	63	423	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
23	023SIDBFF01A	2	420	150	63	436	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
23	023SIDBFF02A	2	365	150	63	377	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
23	023N_ANHWY	1	200	60	1000	205	24		Hwy	64	$108,036	$0	11.1		11.1	1	34	-1	0.5
-999																			
24	024N_AN0433A	1	0	150	65	102	30		1PFU	59	$196,596	$78,638	15.3		24.6	1	1	-1	2.0
24	024N_AN0435A	1	0	150	65	118	20		1PPF	59	$225,171	$90,068	15.7		26.0	1	10	-1	2.0
24	024N_AN0436A	2	240	250	100	260	40		2psu	56	$171,450	$68,580	13.0		22.0	1	31	-1	2.0
24	024N_AN0437A	1	0	150	65	91	45		2nnn	59	$68,580	$27,432	14.1		22.7	1	1	-1	2.0
24	024N_AN0438	2	240	250	50	260	40		2pfu	60	$182,880	$73,152	13.0		22.0	1	31	-1	2.0
24	024N_AN0440A	2	250	175	250	272	40		1N	1	$91,440	$36,576	13.6		13.6	1	31	-1	2.0
24	024N_AN0441A	1	0	150	65	90	40		1PFU	59	$80,010	$32,004	13.1		21.7	1	1	-1	2.0
24	024N_AN0443A	1	0	150	65	95	40		1PFU	59	$114,300	$45,720	13.1		22.1	1	1	-1	2.0
24	024N_AN0445A	1	0	150	65	96	40		2PFF	60	$186,309	$74,524	13.1		23.1	1	4	-1	2.0
24	024N_AN0452A	2	250	270	50	270	40		2pnn	56	$74,295	$29,718	8.0		17.9	1	31	-1	2.0
24	024N_AN0454A	3	250	250	250	380	60		1PFF	59	$240,030	$96,012	7.9	10.0	17.9	1	3	-1	2.0
24	024N_AN0455A	1	0	150	65	111	50		1PFU	59	$160,020	$64,008	15.0		24.6	1	1	-1	2.0
24	024N_AN0457A	1	0	150	65	121	40		1PPU	59	$68,580	$27,432	13.5		21.3	1	10	-1	2.0
24	024N_AN0458A	2	250	100	250	276	40		1PSU	55	$80,010	$32,004	15.1		23.7	1	31	-1	2.0
24	024N_AN0459A	1	0	150	65	122	50		1PPF	59	$114,300	$45,720	13.2		21.9	1	10	-1	2.0
24	024N_AN0461A	1	0	150	65	128	45		1PFF	59	$217,170	$86,868	13.8		22.8	1	1	-1	2.0
24	024N_AN0463A	1	0	150	65	137	30		1PFF	59	$138,303	$55,321	13.2		21.8	1	1	-1	2.0
24	024N_AN0465A	1	0	150	65	135	30		2PSU	56	$228,600	$91,440	17.5		27.3	1	22	-1	2.0
24	024N_AN0466A	2	250	200	250	278	25		1PN	55	$205,740	$82,296	14.3		16.9	1	31	-1	2.0
24	024N_AN0467A	1	0	150	65	132	30		2PFF	60	$250,317	$100,127	17.2		28.3	1	4	-1	2.0
23	023N_AN0470A	2	260	220	50	350	40		2nnn	59	$314,325	$125,730	13.0		22.0	1	31	-1	2.0
24	024N_AN0471A	1	0	150	65	120	45		1PFF	59	$160,020	$64,008	15.0		24.6	1	1	-1	2.0
24	024N_ANFF01A	1	0	150	65	163	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
24	024N_ANFF02A	2	265	150	71	283	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
24	024N_ANFF03A	2	355	150	71	366	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
24	024N_ANFF04A	2	250	150	71	280	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
24	024N_ANFF05A	2	250	150	71	280	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
24	024N_ANFF06A	2	250	150	71	280	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
24	024N_ANFF07A	2	250	150	71	280	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
24	024N_ANFF08A	2	250	150	71	280	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
24	024N_ANFF09A	2	250	150	71	280	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
24	024N_ANFF10A	2	250	150	71	280	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
24	024N_ANFF11A	2	374	150	71	397	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
24	024N_ANFF12A	2	230	150	71	264	40		2PS	56	$311,896	$124,758	13.0	12.0	25.0	1	31	-1	2.0
24	024N_ANHWY	1	190	60	1000	195	24		Hwy	64	$108,036	$0	11.1		11.1	1	34	-1	0.5
-999																			
25	025CATH0437A	3	347	70	200	377	35		2psu	61	$285,750	$114,300	6.9	9.0	15.9	1	31	-1	2.0
25	025CATH0445A	3	320	100	60	335	40		2pff	60	$314,325	$125,730	7.0		16.0	1	31	-1	2.0
25	025CATH0446A	4	390	100	60	410	40		2nnn	2	$68,580	$27,432	7.0		16.0	1	31	-1	0.5
25	025CATH0447A	4	530	100	60	545	40		2nnn	2	$211,455	$84,582	7.0		16.0	1	31	-1	0.5
25	025CATH0448A	4	550	100	60	565	40		3nnn	60	$274,320	$109,728	7.0		16.0	1	31	-1	2.0
25	025CATH0450A	3	450	100	60	465	40		1nnn	1	$85,725	$34,290	7.0		16.0	1	31	-1	0.5
25	025FIEL0404A	3	300	100	60	315	40		1nnn	1	$51,435	$20,574	7.0		16.0	1	31	-1	0.5
25	025FIEL0407A	3	347	100	200	366	30		1nnn	1	$57,150	$22,860	7.5	1.5	9.0	1	31	-1	0.5
25	025FIEL0408A	3	347	50	200	373	20		1nnn	1	$57,150	$22,860	5.2	0.5	5.7	1	31	-1	0.5
25	025FIEL0414A	3	400	50	50	415	40		2pnn	56	$57,150	$22,860	7.0		16.0	1	31	-1	2.0
25	025FIEL0415A	3	400	50	50	415	40		2pnn	56	$57,150	$22,860	7.0		16.0	1	31	-1	2.0
25	025FIEL0421A	4	460	50	50	475	40		2psu	56	$114,300	$45,720	7.0		16.0	1	31	-1	2.0
25	025FIEL0422A	4	460	50	50	475	40		1nnn	1	$62,865	$25,146	7.0		9.0	1	31	-1	0.5
25	025FORE0424A	3	347	110	200	366	70		1PSU	55	$154,305	$61,722	8.5	8.0	16.5	1	31	-1	2.0
25	025FORE0430A	4	470	50	80	490	40		3nnn	60	$400,050	$160,020	7.0		16.0	1	31	-1	2.0
25	025FORE0438A	5	520	50	80	540	40		1psu	55	$97,155	$38,862	7.0		16.0	1	31	-1	2.0
25	025N_AN0309A	1	0	120	100	137	30		1PFF	59	$171,450	$68,580	18.6		28.5	1	1	-1	2.0
25	025N_AN0310A	2	245	150	200	303	30		1.5PSU	57	$171,450	$68,580	11.3	8.0	19.3	1	31	-1	2.0
25	025N_AN0400A	3	347	250	200	346	50		1PPU	59	$210,312	$84,125	5.2	8.0	13.2	1	31	-1	2.0
25	025N_AN0401A	1	0	120	100	143	30		2PPU	60	$396,621	$158,648	18.4		29.7	1	13	-1	2.0
25	025N_AN0402A	2	245	110	200	258	40		1PFU	59	$114,300	$45,720	17.0		20.0	1	31	-1	2.0
25	025N_AN0403A	1	0	120	100	146	30		2PSU	56	$280,035	$112,014	17.6		30.1	1	22	-1	2.0
25	025N_AN0404A	2	245	110	200	266	40		1N	1	$68,580	$27,432	8.9		8.9	1	31	-1	2.0
25	025N_AN0405A	1	0	120	100	139	40		1PN	55	$89,154	$35,662	17.9		20.2	1	28	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
25	025N_AN0407A	1	0	140	0	154	20		2PSU	56	$285,750	$114,300	16.9	10.0	26.9	1	22	-1	2.0
25	025N_AN0409A	1	0	140	100	116	40		2nnn	59	$85,725	$34,290	18.4		27.3	1	1	-1	2.0
25	025N_AN0411A	1	0	140	100	105	35		1PFF	59	$115,443	$46,177	18.2		26.2	1	1	-1	2.0
25	025N_AN0413A	1	0	140	100	95	40		1N	1	$68,580	$27,432	18.7		18.7	1	31	-1	2.0
25	025N_AN0424A	2	245	90	200	245	50		1PPF	59	$160,020	$64,008	11.3		18.9	1	12	-1	2.0
25	025N_AN0426A	2	245	90	200	239	40		2PN	56	$242,316	$96,926	10.2	10.0	20.2	1	31	-1	2.0
25	025N_AN0427A	1	0	140	100	96	40		1PFF	59	$171,450	$68,580	12.6		21.4	1	1	-1	2.0
25	025N_AN0429A	1	0	140	100	88	45		1PFF	59	$228,600	$91,440	12.7		22.2	1	1	-1	2.0
25	025N_AN0431A	1	0	140	100	116	20		2PSU	56	$213,741	$85,496	14.7		25.0	1	22	-1	2.0
25	025N_ANFF01A	2	240	140	100	260	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
25	025N_ANFF02A	2	240	140	100	260	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
25	025N_ANFF03A	2	240	140	100	260	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
25	025N_ANFF04A	2	240	140	100	260	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
25	025N_ANFF05A	2	240	140	100	260	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
25	025N_ANHWY	1	170	60	1000	175	24		Hwy	64	$108,036	$0	14.1		14.1	1	34	-1	0.5
-999																			
26	026HUMP0105T	3	209	400	100	341	40			16	$11,430	$5,700	12.0		13.0	1	33	-1	2.0
26	026HUMP0105S	3	0	400	0	344	10			45	$11,430	$5,700	12.0		12.0	1	33	-1	2.0
26	026HUMP0110A	4	380	50	50	400	40		2nnn	59	$131,445	$52,578	12.0		21.0	1	31	-1	2.0
26	026HUMP0112A	5	450	50	50	470	40		2nnn	2	$91,440	$36,576	12.0		21.0	1	31	-1	0.5
26	026HUMP0113A	5	430	50	50	450	40		1pfn	59	$142,875	$57,150	12.0		21.0	1	31	-1	2.0
26	026HUMP0114A	6	500	50	50	520	40		2nnn	59	$160,020	$64,008	12.0		21.0	1	31	-1	2.0
26	026HUMP0115A	6	550	50	50	570	40		1pnn	55	$102,870	$41,148	12.0		21.0	1	31	-1	2.0
26	026N_AN0101A	1	0	120	200	67	30		2nnn	59	$171,450	$68,580	20.9		30.2	1	1	-1	2.0
26	026N_AN0102A	2	209	175	100	185	45		1nnn	59	$68,580	$27,432	20.8		22.2	1	31	-1	2.0
26	026N_AN0103G	1	0	120	0	83	15			45	$5,715	$2,800	12.0		20.8	1	33	-1	2.0
26	026N_AN0202N	2	209	175	100	196	30			45	$6,858	$3,400	12.0		12.0	1	31	-1	2.0
26	026N_AN0203A	1	0	120	200	96	35		1PSU	55	$125,730	$50,292	19.4		30.2	1	19	-1	2.0
26	026N_AN0206A	2	209	175	100	258	30		1.5PPU	61	$243,459	$97,384	10.1	9.0	19.1	1	31	-1	2.0
26	026N_AN0208A	2	209	175	100	319	40		2psu	60	$342,900	$137,160	10.7		22.5	1	31	-1	2.0
26	026N_AN0208X	3	209	400	100	389	30		1nnn	56	$210,312	$84,125	12.0		26.1	1	31	-1	2.0
26	026N_AN0209A	1	0	120	200	124	35		1PN	55	$125,730	$50,292	24.3		33.2	1	28	-1	2.0
26	026N_AN0210A	2	209	175	100	240	20		2nnn	55	$205,740	$82,296	14.1		17.5	1	28	-1	2.0
26	026N_AN0210Y	2	209	175	100	256	40		1N	1	$116,586	$46,634	13.0	1.0	14.0	1	31	-1	2.0
26	026N_AN0210S	3	0	400	0	353	15			45	$6,858	$3,400	12.0		12.0	1	33	-1	2.0

1	2	Econ	3	4	5	6	7	8	Econ	9	10	11	12		13	14	15	16	17
Reach	ID_USACE	Rows from Ocean	REF-FRNT of LOT	LOT_ LENGTH	LOT_ WIDTH	REF_FRNT of STRUC	STRUC_ LENGTH	Attack Angle Ratio	BLDGCODE	STRUC_ TYPE	STRUC_ VALUE _OCT_06	CONTENT _VALUE	GRELEV _SUR	Ft to Fin Floor	FFLOOR _ELEV	ACTIVE	EROSION TYPE	ARMOR	FLANKING
26	026N_AN0204A	2	209	175	100	236	30		1.5PFF	61	$274,320	$109,728	12.0	10.0	19.7	1	31	-1	2.0
26	026N_AN0301A	1	0	120	200	106	30		1PFF	59	$192,024	$76,810	21.7		30.4	1	1	-1	2.0
26	026N_AN0304A	3	209	400	100	403	55		2N	2	$254,889	$101,956	12.3		12.3	1	31	-1	2.0
26	026N_AN0308A	2	250	270	65	280	40		3nnn	2	$371,475	$148,590	12.0		14.0	1	31	-1	2.0
26	026S_SH3016A	1	0	120	200	46	35		2pff	2	$125,730	$50,292	3.3		3.3	1	31	-1	2.0
26	026N_ANFF01A	2	198	175	100	230	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
26	026N_ANFF02A	2	250	175	100	277	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
26	026N_ANFF03A	2	233	175	100	260	40		2PS	56	$311,896	$124,758	12.0	12.0	24.0	1	31	-1	2.0
26	026N_ANHWY	1	130	60	900	135	24		Hwy	64	$97,235	$0	16.2		16.2	1	34	-1	0.5
-999																			

General Reevaluation Report
and
Environmental Impact Statement

on

Hurricane Protection and Beach Erosion Control

WEST ONSLOW BEACH AND NEW RIVER INLET (TOPSAIL BEACH), NORTH CAROLINA

Appendix B - Economic Analysis

Attachment 4

Erosion Damage Thresholds in North Carolina

By Spencer M. Rogers, Jr.
North Carolina Sea Grant

April 21, 2002

Erosion Damage Thresholds in North Carolina

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INTRODUCTION

As the coast of North Carolina developed over the last century, coastal construction has experienced significant damage from hurricanes and other coastal storms, as well as long-term erosion. Construction practices have evolved due to changes in public perception of storm risk and several construction regulation programs. Several important changes in practice did not occur as a gradual process but instead in a series of identifiable steps in time. Significant events affecting construction practice include: a series of severe hurricanes and coastal storms in the 1950s; the mid-1960s adoption and later revision of the North Carolina State Building Code, the second oldest hurricane-resistant building code in the U.S.; and the 1978 implementation and later revisions of the NC Coastal Area Management Act. The evolution of coastal construction practice and general thresholds for damage has been described by Rogers (2001). This report applies to those observed changes to develop methods to estimate damage to coastal structures due to storm-induced erosion in North Carolina. A comprehensive inventory of building construction details and other structures can be combined with commonly unmeasurable construction details that can be inferred from the construction date and the known evolution of general construction practices.

The effect of construction regulations is always limited by the effectiveness of local enforcement and the speed of adoption as general construction practice. Experience from severe storms and long-term erosion in North Carolina has shown that the building code and regulatory enforcement has been generally good; regulatory compliance in coastal communities has been consistently high; and the adoption of new standards by local contractors timely. The use of construction dates to estimate hidden construction parameters affecting erosion resistance is therefore a reasonable assumption and an improvement over previous methods to estimate erosion damage.

North Carolina's buildings and other development have evolved due to a unique storm and regulatory history. The recommendations in this report will not directly apply to other coastal areas. However, locally-customized construction factors can be developed for any shoreline that could be used to significantly improve erosion damage predictions over previously used methods.

The most accurate method to predict future damage is to perform a building by building damage evaluation of historical severe storms on shorelines with similar development and construction standards. At this time detailed studies do not exist. Therefore, the damage thresholds suggested for North Carolina and the erosion damage curves in Appendix A are based on the opinion of the author, formed over 27 years of building damage evaluations, following most of the worst storms on the East and Gulf coasts, and for most of that time, observations of the North Carolina coast on a daily basis. A resume is included as Appendix B.

GENERAL APPROACH

To improve erosion damage estimates, buildings can be separated into two general classes: small buildings (primarily single family houses) and larger commercial buildings. Each class is further separated by construction details determined by a local building inventory and assumed local construction practice based on construction date. The erosion resistance of a building can seldom be determined by construction details alone. The local ground elevation significantly affects the effectiveness of the construction standards. Local topographical data can be used to separate shorelines into two general types with high or low elevation building sites.

SHORELINE TYPES

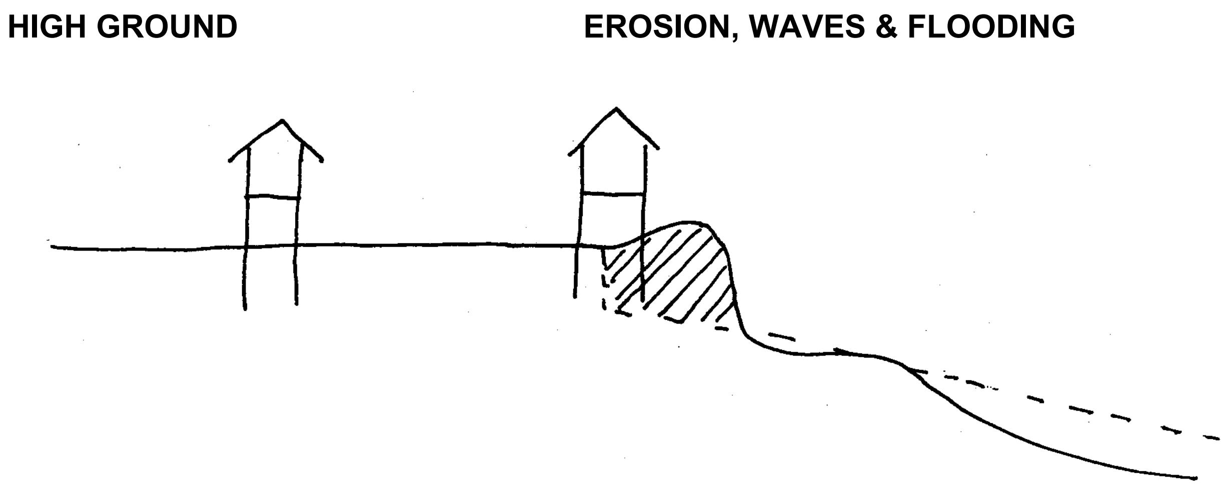
On ocean shorelines, zones of storm damage have been observed that can separated by ground elevation into two types (Rogers, 1990) shown in **Figure 1**. The high elevation type is defined as sufficiently elevated to prevent wave effects unless subject to erosion (**Figure 1-A**). The seaward of two damage zones is defined by the area subject to erosion. Buildings in the erosion zone are subject to combined damage from erosion, wave impacts and flooding. The high elevation of the more landward zone protects the buildings from erosion, waves and flooding. Both zones are subject to storm winds.

Low elevation shorelines with overtopped dunes have four building damage zones (**Figure 1B**). The seaward zone is defined as the area experiencing erosion but also subject to waves, and flooding. The next landward zone is defined as the area subject to breaking waves capable of destroying solid building walls and foundations. It includes the area subject to overwash deposition. The National Flood Insurance Program has traditionally identified the threshold for destructive wave heights as 3 feet (Corps of Engineers, 1975). More recent research indicates that a breaking wave of 1.5 feet will destroy common solid walls and foundations (Tung et al, 1999) . The next landward zone is defined by flooding but no significant wave damage. The landward-most zone has sufficient elevation to avoid erosion, waves and flooding but like the more seaward zones, may be subject to high winds.

Figure 1: SHORELINE TYPES

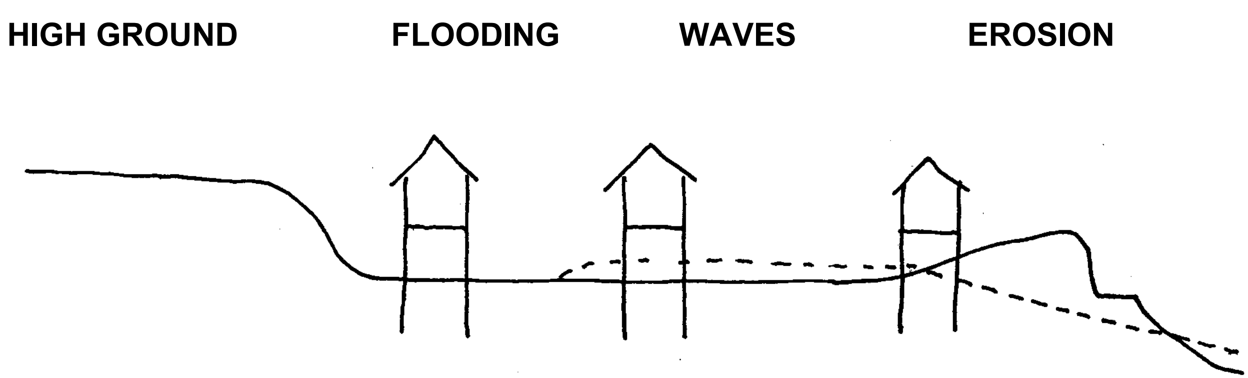
A. High dune, no overtopping

1. Erosion zone with waves and flooding
2. High ground (no erosion, waves or flooding)



B. Small overtopped dune

1. Erosion zone with waves and flooding
2. Waves zone with overwash deposition and flooding
3. Stable ground elevation with flooding
4. High ground: (no erosion, waves or flooding)



CLASSES OF STRUCTURES

To predict erosion damage within the described zones, it is useful to separate structures into several different classes as shown in **Figure 2.** Buildings are separated by general size, typically single-family houses and larger commercial buildings. Both classes of buildings commonly use breakaway walls and enclosures under piling supported, elevated buildings. The behavior of the enclosures is sufficiently different and often independent of the elevated buildings therefore justifying a separate class and damage calculations for the enclosures. A broad class of structures including mobile homes, swimming pools and other expendable structures, including decks seaward of oceanfront houses, are grouped as highly erosion sensitive structures. Dune walkways, roads and erosion control actions are listed as separate classes. It is useful to separate the buildings and several other classes into subclasses, based on similar construction characteristics. Suggested erosion damage tables for Classes 1-5 are included as an appendix.

Class 1: Single-Family Houses

Single-family houses are by far the most common class of buildings along the North Carolina coast. They are used as primary residences, second homes and rental property. The class includes similarly designed small buildings such as duplexes, small condos and some small commercial buildings. The class can be further divided by foundation type, determined by a detailed building inventory and the date of initial construction. Class 1a includes erosion-sensitive foundations including concrete slabs, shallow spread footings and most others not on pilings. Class 1b buildings are constructed on relatively shallow pilings. Building code requirements beginning in the mid-1960s led to the common use of pilings installed to a depth of 8 feet below grade. It includes most non-oceanfront houses up to present and oceanfront houses constructed through 1985. Class 1c consists of oceanfront houses constructed from 1986 to present, following an increase in the piling foundation standard to -5 feet NGVD or 16 feet below grade, whichever is shallower.

The shallow foundations in Class 1a are equally erosion damage prone in both shoreline elevation types. The shallow pilings in Class 1b are ineffective on high elevation, Type A shorelines, and perform like Class 1a (**Figure 3**). At lower ground elevations of Type B a moderate level of erosion resistance is provided (**Figure 4**). For short pilings, +12' NGVD is suggested as an effective ground elevation separation for shoreline type. Shallow piling foundations in Type A shorelines have a piling tip penetration above +4' or slightly above the mean high water elevation, too little embedment to improve the erosion-resistance over Class 1a. Significant damage to deeper imbedded pilings is likely to begin when the erosion depth exceeds 4', half the embedment depth of 8'.

On high elevation Type A shorelines the deeper pilings of Class 1c are limited in effectiveness by the 16' feet below grade requirement. The shoreline types can be separated by a ground elevation of +16' NGVD. On A shorelines, the piling embedment will be no deeper than 0.0' NGVD and can be expected to perform similar to the other grossly eroded foundations in 1a and 1b(A) (**Figure 5**). When piling embedment approaches or exceeds the -5' NGVD piling standard on lower ground elevations (Type B) the erosion resistance of 1986 piling standards proved very effective during Hurricane Fran (FEMA, 1997 and Woodward-Clyde, 1997.) See **Figure 6.** An erosion threshold of 4 feet is suggested.

Figure 2: CLASSES OF COASTAL BUILDINGS AND OTHER STRUCTURES

1. Single-family house (includes duplexes & small condos)
    a. Slab foundation or shallow perimeter footing and interior piers
    b. Shallow piling foundation (~ 8' below grade: oceanfront, 1965 thru 1985 and farther inland, all dates.)
    c. Deeper piling foundation (piling penetration to -5' NGVD or 16' below grade, whichever is shallower, 1986 and later, oceanfront only)

2. Commercial or large multi-family buildings
    a. Slab or other on-grade foundation
    b. Second floor and above piling supported, lowest floor on grade (common in hotel and condos)
    c. Fully piling supported, deep pilings, [some wood-frame, pre-1985 oceanfront condos may have shallow pilings as in 1b above]
    d. Building specific evaluation (fishing piers, etc.)

3. Underhouse enclosures: may be unfinished or finished interior
    Unfinished enclosures have fixed cost per either SF or linear wall footage
    Finished enclosure valued as ratio of total finished floor area
    a. None (parking slab?)
    b. Small (<300 SF)
    c. Partial (>300 SF, < full)
    d. Full enclosure

4. Mobile homes, utility buildings, detached garages, decks seaward of oceanfront houses, gazebos, pools etc

5. Dune walkways
    a. Houses
    b. Public/commercial

6. Paved roads and parking lots
    a. Damage
    b. Overwash excavation
    c. Sand sifting operations

7. Erosion control structures and actions
    a. Beach scraping
    b. Emergency sandbags

Figure 3: Short piling foundation failures (Class 1b) on high-elevation shoreline (Type A). Location: Kure Beach NC after Hurricane Fran.

Figure 4: Short piling foundation (Class 1b) near failure on low-elevation shoreline (Type B). Location: Surf City NC after Hurricane Fran.

Figure 5: House under construction with piling 16 feet below grade (Class 1c) on high-elevation dune (Type A). Dune elevation above +16 feet NGVD makes erosion failure more likely. Location: Emerald Isle NC.

Figure 6: Houses on 1996 pilings (Class 1c) on low-elevation shoreline (Type B). Location: Topsail Island after Hurricane Fran.

Figure 7: Slab foundation failure (Class 1a & 2a) beside commercial/deep-piling structure (Class 2c) on high-elevation shoreline (Type A). Location: Surf City NC after Hurricane Fran.

Figure 8: Piling-supported hotel with lower floor on unsupported slab (Class 2b) on low-elevation shoreline (Type B). Location: Wrightsville Beach NC after Hurricane Fran.

Class 2: Large Commercial Buildings

Figure 9: Piling-supported hotel after failure of unsupported, first-floor slab (Class 2b) on low-elevation shoreline (Type B). Location: Horry County after Hurricane Hugo.

The class of large buildings includes hotels, large condos, restaurants, and most other commercial buildings. These generally larger buildings are constructed to a separate performance building code that does not include the specific piling depth requirements found in Class 1. The large mass of the buildings typically dictates, that where used, piling embedment depths are significantly greater than for small buildings. Class 2a buildings are constructed on shallow, erosion-sensitive foundations, typical of older commercial buildings (**Figure 7**). Class 2c is fully supported on a piling foundation and has an erosion tolerance as good or better than the best small buildings (**Figure 7.)** Class 2b is a hybrid foundation common in hotel construction. All of the building walls and all floors above the first floor are supported on pilings and buried grade beams that are relatively erosion tolerant (**Figure 8**). The lowest finished floor is supported on a slab foundation supported on grade between the foundation pilings **(Figure 9**). The lowest floor is therefore highly erosion sensitive. Wave and erosion damage occurs to the lowest floor where much of the value of the building is concentrated, but higher floors are relatively undamaged. It is suggested that total erosion damage be estimated by treating the lowest floor as a slab (Class 1a and 2a)but weighted for twice the average square-foot value for the building, and added to damage in higher floors as applied in Class 1c and 2c.

Class 3: Under-building Enclosures

Many buildings of all ages enclose part or all of the area under piling-supported elevated buildings. Present regulations allow lower level enclosures for the purposes of parking, storage or access to the elevated building. Any enclosure must be unfinished and include no equipment such as a heat pump, water heater, washer or dryer. In some communities it is common for piling-supported houses constructed prior to adoption of minimum floor elevation requirements, to have fully finished underhouse enclosures supported on a slab foundation. Although prohibited in more recent construction, small finished enclosures and unauthorized equipment are not uncommon. Erosion or waves frequently destroy the lower level and equipment, leaving the elevated floors in place.

Some near-ocean buildings are required to use specific designs for breakaway enclosure walls. More recent research has shown that standard wood framing adequately functions to breakaway from the piling foundation and elevated building, negating the need for a specific breakaway design (Tung et al, 1999). Whether it was designed to breakaway is a moot issue. Waves and/or erosion will predictably cause all enclosure walls to breakaway.

Enclosures are common in both Class 1 and Class 2 buildings. Enclosures are supported on slab foundations that behave quite differently in erosion than the rest of a piling-supported building. Recent building inventory collections have included separate descriptions of the size and finish of the enclosures. Therefore overall damage calculations can be simplified and improved by considering enclosures as Class 4 structures, separate from the rest of the elevated buildings. The National Flood Insurance premium rating system serves to encourage enclosure sizes into four groups as outlined in **Figure 2**. Open buildings with no enclosures may still have parking slabs that are subject to erosion damage. In NFIP V-zones, enclosures smaller than 300 SF can be rated by local flood insurance agents. Larger enclosures must submit information to Washington for rating. Full enclosures are common near some shorelines particularly in A-zones where flood insurance rates are not affected by the size or presence of the enclosures.

The value of the enclosure will vary depending on whether it is finished or unfinished. Finished areas can be reasonably valued at the SF rate of the elevated building. Unfinished enclosures are obviously lower in value.

Class 4: Mobile Homes and Other Expendable Structures

Mobile homes and a group of other expendable structures are highly erosion sensitive, failing quickly after only partial undermining. Mobile homes in this class use shallow, mortarless concrete block piers, tied down with screw anchors. A small number of mobile homes have recently been installed on traditional piling foundations and should be evaluated as Class 1 structures. North Carolina has historically considered expendable structures to include small utility buildings, parking surfaces, gazebos, swimming pools and tennis courts. Also included are the open decks seaward of most oceanfront houses. Building setback lines generally apply to the roofed building, but expendable decks of limited size are allowed to be constructed contiguous to the building, seaward of the setback line. The building code allows the common practice of using short pilings on the decks compared to required depth for the building (FEMA, 1997.) Oceanfront decks are therefore far more erosion-sensitive than the adjacent buildings and are more accurately grouped with Class 4. Detached garages are more common in older development and are affected similarly by erosion.

Class 5: Dune walkways

Dune walkways are permitted as expendable structures and restricted in piling depth to require erosion damage rather than interfering with access along the beach. Walkway damage differs from Class 4 only in the rate that erosion damage progresses. The relatively long, shore perpendicular structures can be assumed to experience a linear increase in damage with the percentage of erosion rather than a quick total loss as in Class 4. Houses and commercial/public walkways differ primarily in value per linear foot of walkway . Commercial/public walkways tend to be a few feet wider and use heavier materials, therefore have a higher value per unit length.

Class 6: Paved Roads and Parking Areas

On-grade paving is destroyed by shallow erosion, requiring replacement and/or relocation. In contrast overwash deposits bury the paving without significant damage. Damage values result from the effort required to excavate the surface, returning it to its intended function. Road repair and replacement costs should be available from the NC Department of Transportation. Overwash excavation costs may also be available from the same source for Highway 12 or from local governments. Most near-ocean overwash deposits that are excavated from roads or developed areas are required to be replaced on or near the beach. In our recent hurricanes, the abundance of construction debris excavated with overwash sand has led to major sand sifting projects before being returned to the beach. The cost of handling has been estimated in some communities to have exceed $15/CY of excavated sand. The cost of past efforts should be available from local governments or NC Emergency Management since they are included in FEMA Public Assistance reimbursements.

Class 7: Erosion control structures and responses

Most erosion control structures on the oceanfront are prohibited by NC regulations. However emergency sandbag revetments and several other practices are pre-authorized by general permits and are in common use. Most permanent structures, including buildings, are eligible for an emergency sand bag permit if erosion moves the vegetation line closer than 20 feet from the building. Roads and septic tanks are included. Mobile homes and detached garages would also qualify but most other expendable structures in Class 4, including oceanfront decks, would not be eligible. The emergency sandbag revetments are limited in time (two to five years, depending on building size, longer if beach nourishment is under study) and in size. The size limit is approximately 6 feet high and 20 feet wide. Typical practice uses bags filled to roughly 2 feet high by four feet wide in a sloping revetment three bags high and three wide for a total of 6 rows of bags. A property owner on Topsail Island recently received three bids of approximately $20 per linear foot of row of bags or $120 per linear foot for a typical 6-bag cross section. Cooperating adjacent owners pay for their oceanfront lot width. Isolated owners must pay for extra bags to protect the one or both sides of their structures.

Beach scraping, excavating sand from the berm or foreshore and pushing it to just landward of the vegetation line or erosion scarp is the most common erosion control response in use on the NC coast. Funding and permitting varies by community. Work is contracted by individual property owners, or in some cases by local government or homeowners associations for longer shorelines under their management. Several research projects have concluded that beach scraping within the limits of the state permit conditions has no significant positive or negative impact on the local erosion rate. Although proven to be of little benefit, beach scraping is a common and real cost, directly by the property owner or indirectly through government or homeowner association assessments. The frequency and cost of beach scraping can usually be determined by contacting the local government or building inspector.

USING SBEACH TO PREDICT BUILDING DAMAGE

SBEACH erosion model was developed to predict two-dimensional beach profile changes with varying storm surge, wave and sediment size conditions. It is intended to predict bar movement, overwash and shoreline recovery better than previously available models. It was not developed to predict erosion damage to buildings and has limitations if directly used for that purpose. Most of the model calibration came from large scale wave tank data and field studies following storms with moderate surge elevations. Calibration for design level storms (50 to 100-year events) appears to have been minimal.

Since SBEACH was designed to better model dune overtopping and overwash deposition it should better represent low elevation shorelines where dunes are flattened and overwash is deposited farther landward. The predicted overwash terrace should provide a better profile for predicting depth limited wave heights around buildings on the second row and farther inland. For predicting erosion threats to typical oceanfront buildings it is suspected that the model underestimates erosion depth. It may not be a significant issue on shallow foundations, such as slabs, but becomes a particular problem when predicting the erosion failure threshold for shallow pilings. Reasonable results are likely to be obtained by using a modeled erosion depth threshold that is shallower (2' maybe?) than observed in the field (on the order of 4' for 8' pilings in severe storms.) Several sections of Topsail Island that lost 150+ similar buildings on short pilings in Fran would be useful area to calibrate SBEACH for the erosion failure threshold for low elevation shorelines with overtopped dunes.

During extreme storms, those most likely to cause erosion damage to buildings, high dunes or unconsolidated bluffs are observed to retreat with near vertical erosion scarps. Slopes steeper than 75 degrees appear common. There is sufficient soil moisture in the dune sands to allow the steep slope to remain stable for a period of days to weeks. Eventually the bluff face will dry and avalanche to a slope flatter than the angle of repose for the sand. The severe erosion depth caused by the retreat of the bluff during the storm places extreme conditions on both shallow and deep piling foundations. However, after the storm there is usually sufficient time to stabilize the top of the bluff, avoiding the additional horizontal erosion that would otherwise occur by avalanching.

In contrast, SBEACH adjusts the erosion scarp by continuously avalanching the eroded scarp (SBEACH Report #1 VI, page 171.) When the slope exceeds 28 degrees the model retreats the top of the erosion scarp and redistributes the sand volume to a slope of 10 degrees at each time step. The assumptions appear to be coded into the software and are not variable parameters. The theoretical slope may approach 28 degrees, much flatter than observed following severe storms. However, a few sample runs in dunes higher than the wave runup limit, consistently resulted in slopes of only 8 to 9 degrees, far flatter than the roughly 75 degrees observed in the field. The model profile output gives the appearance of a steep eroded dune face but is misleading due to the horizontal to vertical distortions in the default profile scales. The affect is not unique to SBEACH. Report #1 VII p. 217-9 indicates the Kriebel model predicts even flatter slopes.

There is no obvious method to adjust SBEACH to generate a more realistic erosion scarp or to adjust the observed erosion threshold depths of the different foundation types to fit the model. Selection of an erosion threshold in the model is necessary to determine the percentage of structure erosion in **Figure 2** before the percentage of damage can be estimated. Calibration tests in SBEACH Report #4 appear to indicate the model underestimates the horizontal dune retreat more often than overestimates. The best vertical erosion depth for the model is likely to be lower than observed for actual damage. For shallow foundation classes an erosion threshold of 0.5' to 1' appears reasonable. For the piling foundation classes, an erosion threshold of 4' is realistic in the field but 2' or less in SBEACH may generate more realistic damage estimates. It may be feasible to calibrate the damage estimates using the high ground elevations of Kure Beach during Hurricane Fran when 15 to 20 building were destroyed. The choice of an erosion threshold depth on the flat eroded dune slope from SBEACH is likely to result in extreme variations in the percentage of damage for each class of structure. It is likely additional calibration will be necessary to select an arbitrary erosion threshold depth for reasonable damage estimates. The selected threshold for piling supported buildings is likely to be considerably different than observed in the field, a necessary correction due to limitations in the model.

SUGGESTED HURRICANE FRAN CALIBRATION AREAS FOR SBEACH

Kure Beach, NC in the vicinity of Avenue E — Figure 3

1226 N. Shore Drive & Jones Avenue, Surf City, NC — Figure 4
Area includes: Severely leaning house on short pilings
Post-1986 house on long piles, undamaged
Multiple pre-1986 houses destroyed.

341 Topsail Road & 11th Avenue, North Topsail Beach, NC — Figure10
Second-row house has been protected by overwash
deposit left in place after Hurricane Fran.

Figure 10: Second-row dune left after Hurricane Fran provided protection during Hurricanes Bonnie, Dennis and Floyd. Location North Topsail Beach after Hurricane Floyd.

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APPENDIX A: Erosion-Damage Curves

Contents damage assumed to be the same curve as structural damage

Class 1 Structures: Single-family residential buildings, duplexes and small condos

Structure Class	1a. Slab	1b. Short Pilings		1c. Long Pilings	
Shoreline Type	A & B All ground elevations	A: High Dune ground el >12' piling tip > el +4'	B: Low Elevation ground el <12' piling tip < el +4	A: High Dune ground el >16' piling tip > el 0	B: Low Elevation ground el <16' piling tip < el 0'
Erosion depth threshold	0.5 feet	4 feet		4 feet	
% Erosion	% Damage				
0	0.05	0.05	0.05	0.05	0
0.1	0.2	0.1	0.1	0.1	0.01
0.2	0.4	0.2	0.2	0.2	0.02
0.3	0.6	0.4	0.3	0.4	0.03
0.4	0.8	0.8	0.4	0.8	0.04
0.5	1	1	0.5	1	0.05
0.6	1	1	0.6	1	0.06
0.7	1	1	0.7	1	0.07
0.8	1	1	0.8	1	0.08
0.9	1	1	0.9	1	0.09
1	1	1	1	1	0.1

Class 2 Structures: Commercial buildings, hotels, large condos

Structure Class	2a non-piling foundation	2b piling foundation lowest floor slab	2c full piling foundation
	Same as 1a	f(# floors) * below	Same as Type B-1c
Erosion depth threshold	0.5 feet	0.5 feet	4 feet
% erosion	% Damage		
0	0.05	*	0
0.1	0.2	*	0.01
0.2	0.4	*	0.02
0.3	0.8	*	0.03
0.4	1	*	0.04
0.5	1	*	0.05
0.6	1	*	0.06
0.7	1	*	0.07
0.8	1	*	0.08
0.9	1	*	0.09
1	1	*	0.1

* Class 2b: % damage = [2 x (% erosion) / (# floors)] + (% damage Class 2c)

Class 3 Structures: Underhouse enclosures below piling supported buildings, equipment, utilities, etc.

Non-piling foundation	Same as 1a
% erosion	% Damage
0	0.05
0.1	0.2
0.2	0.4
0.3	0.8
0.4	1
0.5	1
0.6	1
0.7	1
0.8	1
0.9	1
1	1

Erosion depth threshold = 0.5 feet

Class 4 Structures: Mobile homes, utility buildings, oceanfront residential decks, detached decks, gazebos, pools, detached garages, buried public utilities

	Shallow foundations
% erosion	% Damage
0	0
0.1	0.5
0.2	1
0.3	1
0.4	1
0.5	1
0.6	1
0.7	1
0.8	1
0.9	1
1	1

Erosion depth threshold = 0.5 feet

Class 5 Structures: Dune walkways

	Shallow foundations
% erosion	% Damage
0	0
0.1	0.1
0.2	0.2
0.3	0.3
0.4	0.4
0.5	0.5
0.6	0.6
0.7	0.7
0.8	0.8
0.9	0.9
1	1

Erosion depth threshold = 2 feet

APPENDIX B: BUILDING DAMAGE ASSESSMENT EXPERIENCE

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Association of State Floodplain Managers

REGISTRATIONS: Registered Geologist, State of North Carolina, # 684

APPOINTMENTS:

North Carolina Coastal Resources Advisory Council, 1992 to present.
Representing marine science and technology. The Council advises the NC Coastal Resources Commission on coastal management regulations in North Carolina.

NC Science Panel on Coastal Hazards, 1997 to present.
NC university coastal engineers and geologists advising the NC Coastal Resources Commission on technical issues related to coastal processes.

PERTINENT PUBLICATIONS: 35 selected from 47

Rogers, Spencer M. Jr. and Chris Jones, 2002. “Selecting Erosion Setbacks For Balanced Multi-hazard Risk.” Solutions to Coastal Disasters Conference, San Diego CA, ASCE.

Jones, Chris and Spencer Rogers, 2002. “Establishing Standards for Building Setbacks: Incorporation of Erosion Rate Variability.” Solutions to Coastal Disasters Conference, San Diego CA, ASCE.

Rogers, Spencer, 2001. “Evaluating Potential Hurricane and Erosion Damage to Buildings in Coastal North Carolina.” North Carolina Sea Grant, UNC-SG-01-04.

Rogers, Spencer M. Jr., 2000. "Beach Nourishment For Hurricane Protection: North Carolina: Project Performance in Hurricanes Dennis and Floyd." National Beach Preservation Conference. August 2000.

Kriebel, David, Larry Buss and Spencer Rogers, 2000. "Impact Loads from Flood-bourne Debris" ASCE report for FEMA. Other research on floating debris is in progress.

Rogers, Spencer M. Jr., 1999. "Design and Construction Guidance for Breakaway Walls Below Elevated Coastal Buildings in accordance with the National Flood Insurance Program." FEMA Technical Bulletin, FIA-TB 9-99.

Yeh, S. C., Spencer M. Rogers, Jr., C. C. Tung, and B. Kasal, 1999. " Behavior of Breakaway Walls Under Wave Action." Journal of Structural Engineering. ASCE. October 1999. pp. 1162-1169.

Tung, C. C., B. Kasal, S. C.Yeh, and Spencer M. Rogers, Jr., 1999. "Ultimate Capacity of Nailed Connections for Design of Breakaway Walls." Forest Products Journal. Vol. 49. No. 10. October 1999. pp. 76-81.

Tung, C.C., B. Kasal, Spencer M. Rogers, Jr., and S.C. Yeh, 1999. "Behavior of Breakaway Wall Subjected to Wave Forces: Analytical and Experimental Studies." NC Sea Grant (UNC-SG-99-03). February 2.

Work, Paul A., Spencer M. Rogers, Jr., and Robert Osborne, 1999. "Flood Retrofit of Coastal Residential Structures: Outer Banks, North Carolina." Journal of Water Resources Planning and Management. March/April 1999.

Pratt, Anthony P., Christopher P. Jones, Spencer M. Rogers, Jr., and Darryl J. Hatheway, 1998. "Delaware Coastal Vulnerability and Construction Standards Study." Association of State Floodplain Managers Conference Proceedings.

Rogers, Spencer M., Jr. and Sam Houston, 1997. "Hurricane Surge and Wave Conditions: Research Needs." Waves '97 Conference Proceedings, ASCE.

Jones, Christopher P., Spencer M. Rogers, Jr., and Darryl Hatheway, 1997. "Coastal Vulnerability and Construction Standards Study." Delaware Department of Natural Resources and Environmental Control. Dewberry & Davis. September 17, 1997.

Clark, Walter, and Spencer M. Rogers, Jr., 1996. "Questions and Answers on Purchasing Coastal Real Estate in North Carolina." NC Sea Grant & NC Real Estate Commission. (UNC-SG-96-10).

Rogers, Spencer M., Jr., 1996. "Corrosion Protection for Metal Connectors in Coastal Areas," Technical Bulletin TB 8-96, FEMA.

Rogers, Spencer M., Jr., 1995. "The Effects of Corrosion on Sheet-Metal Connectors in Coastal Buildings: A Summary of Present Knowledge," FEMA.

Rogers, Spencer M., Jr. 1995. "Getting the Most from Oceanfront Setback Lines" Coastal Zone '95, Tampa, FL, ASCE.

Rogers, Spencer, M. 1995. "Preliminary Summary of Conditions and Damages: Hurricane Emily". *Shore & Beach*, Journal of the American Shore and Beach Preservation Association, Berkeley, CA. January 1995.

Rogers, Spencer M. Jr., 1995. "Coastal Hazard Analysis for North Carolina Aquarium/Fort Fisher." NC Sea Grant.

Rogers, Spencer M. Jr., 1994. "Hurricane Andrew & the South Florida Building Code: Relevance to the North Carolina Building Code." NC Sea Grant.

Rogers, Spencer, M. Jr. 1993. "Relocating Erosion-Threatened Buildings: A Study of NC Housemoving". Coastal Zone '93, New Orleans, LA, ASCE.

Rogers, Spencer M. Jr., 1991. "Foundations and Breakaway Walls of Small Coastal Buildings in Hurricane Hugo." Coastal Zone '91, Long Beach, CA, ASCE. Also published in National Hazard Center Quick Response Report, #37.

Rogers, Spencer, M., Jr. 1991. "Flood Insurance Construction Standards: Can They Work on the Coast?". Coastal Zone '91, Long Beach, CA, ASCE, and Natural Hazards Research Center, U. of Colorado, 1990.

Rogers, Spencer M. Jr. 1990. "Designing for Storm Surge and Wave Damage in Coastal Buildings." Coastal Engineering Conference, Delft, The Netherlands, ASCE.

Rogers, Spencer M., Jr., 1990. "Performance of Building Resistance to Water, Waves and Erosion." Proceedings from "Hugo: One Year After." Charleston, SC, ASCE.

Rogers, Spencer M., and Peter R. Sparks, 1991. "Damage to Buildings: Hurricane Hugo". *Shore & Beach*, Journal of the American Shore and Beach Preservation Association, Berkeley, CA. Oct. 1990.

Rogers, Spencer M. Jr., 1990. "The Cost of Oceanfront Erosion in North Carolina: An Analysis of Flood Insurance Claim Payments 1977-1989." NC Sea Grant.

Rogers, Spencer M., Jr., 1986. "Coastal Erosion Issues in Flood Hazard Mapping,". Report to the Coastal Committee, Association of State Floodplain Managers.

Rogers, Spencer M., Jr., Sparks, Peter R. and Sparks, Katharine M., 1985. "A Study of the Effectiveness of Building Legislation in Improving the Wind Resistance of Residential Construction", National Conference on Wind Engineering, Lubbock, TX, Wind Engineering Council.

Rogers, Spencer M., Jr., 1985. "Hurricane Diana: Impact on Coastal Development." Coastal Zone '85, Baltimore, MD, ASCE.

Stutts, Alan T., Chrystos D. Siderelis, and Spencer M. Rogers. 1985. "Effect of Ocean Setback Standards on the Location of Permanent Structures in Coastal North Carolina." Coastal Zone '85, Baltimore, ASCE.

Cox, John W., with Spencer M. Rogers, Jr., 1984. "Performance of Offshore and Coastal Structures During Alicia", Alicia: One Year Later, Galveston, TX, ASCE.

Rogers, Spencer M. Jr., 1982. "Coastal Environment and Site Characteristics." Coastal Residential Construction Workshop. FEMA, Emmitsburg, MD.

Rogers, Spencer M. Jr., 1982. "Coastal Flood Forces", Proceedings from Intergovernmental Seminar on Flood-Loss Reduction Through Improved Building Practices, FEMA, Emmitsburg, MD.

Tayfun, M. Aziz, Spencer M. Rogers, Jr. and Jay Langfelder, 1979. "Delineation of an Ocean Hazard Zone for North Carolina Department of Marine Science and Engineering", NC State University.

POST-STORM BUILDING DAMAGE ASSESSMENTS
(not including northeasters or other storms)

Named Storm	Year	Location	Support
Hurricane Floyd	1999	NC	NC Sea Grant
Hurricane Dennis	1999	NC	NC Sea Grant
Hurricane Bonnie	1997	NC	NC Sea Grant
Hurricane Fran	1996	NC	FEMA Building Performance Assessment Team
Hurricane Bertha	1996	NC	NC Sea Grant
Hurricane Opal	1995	FL	Florida State Emergency Response Team
Hurricane Emily	1993	NC	FEMA Damage Assessment Team
Hurricane Andrew	1992	FL	NC Sea Grant
Hurricane Hugo	1989	SC/NC	Natural Hazards Research Center
Hurricane Gloria	1985	NC	NC Sea Grant
Hurricane Diana	1984	NC	NC Sea Grant
Hurricane Alicia	1983	TX	NC Sea Grant
Hurricane Fredric	1979	AL/MS	NC Sea Grant
Hurricane David	1978	NC	NC Sea Grant
Hurricane Eloise	1975	FL	Florida Bureau of Beach and Coastal Systems

OTHER WORK

Project member for FEMA’s 2001 revisions of the Coastal Construction Manual.

Flood Hazard Committee, HAZUS Flood Loss Estimation Model, National Institute of Building Sciences. Committee is guiding development of a flood damage assessment model to estimate economic losses from future floods.

Member, ASCE Standards Committee: Flood Damage Resistant Design and Construction, 1995 to 1999.

Project committee member, "Compatibility of Flood Loss Reduction Standards of the National Flood Insurance Program with the National Model Building Codes and Standards," National Institute of Building Sciences, Washington, D.C., 1992.

Congressional Testimony, on "Issues Relating to Erosion, Erosion Management and Erosion Insurance H.R. 3456, H.R. 4461 and Managing Coastal Erosion by the National Research Council". Before the Committee on Banking, Finance and Urban Affairs, Subcommittee on Policy Research and Insurance. Rehoboth, DE, July 1990.

Technical Consultant, "Property Eligibility Requirements for Wind Storm Coverage" Property Insurance Underwriting Association, State of New York, 1988. NY now requires existing buildings to be retrofitted to minimum storm resistance standards for coverage through the state-sponsored wind insurance pool for high risk coastal buildings.

Technical Editor, America's Vanishing Coastlines: A New Concern For The Voluntary And Residual Property Insurance Markets, National Committee on Property Insurance, 1988.

Co-author, "Coastal and Flood Plain Construction Standards," NC State Building Code, NC Dept. of Insurance, 1986.