

**Feasibility Report
and
Environmental Impact Statement**

on

Coastal Storm Damage Reduction

**SURF CITY AND NORTH TOPSAIL BEACH,
NORTH CAROLINA**

Appendix P

Nonstructural Alternatives

APPENDIX P

NONSTRUCTURAL ALTERNATIVES

1. GENERAL. The nonstructural alternative that would avoid or delay damage due to erosion involves removal of structures from the hazard area. For this alternative, it is assumed that the first row of structures will be removed to avoid loss. As shown on Table P-2, the first cost of this alternative is around \$520 million. It would require relocation of 289 structures and demolition of 615 structures. The economic analysis of nonstructural measures was conducted at October 2004 price levels with an FY 2005 interest rate of 5.375%

2. EXISTING CONDITIONS.

2.1. ZONING RESTRICTIONS. Zoning presently requires new structures to be located 60 feet landward of the existing oceanfront vegetation line and 15 feet from the street right-of-way. These regulations preclude future development between the strand and the first roadway in some locations. In some areas septic tanks with drain fields are used and zoning requires these to be within the setback as well.

2.2. AVAILABILITY OF REAL ESTATE. An estimate of vacant lots in each reach that may be available for relocation of structures was made based on review of existing aerial photography from May 2003. Due to the current rate of construction on Topsail Island and uncertainty of lot availability, this alternative was developed assuming only one third of these lots would be available as destinations at the estimated year of project construction.

2.3. DEVELOPMENT. The rate and intensity of new construction implies that any suitable ocean front lot will soon be developed before the shore projection project construction begins. The structure file for the without project condition includes structures assumed to be constructed in the near future on these suitable lots. The analysis of the nonstructural alternative includes both costs and benefits for removal of these potential structures.

3. MEASURES. This alternative involves use of one of three different measures on each structure selected.

3.1. RETREAT. Retreat is the relocation of a structure away from the hazard on the same lot. The ideal situation would be to have relatively deep beachfront lots that would allow the structures to be moved back over time as the coastline eroded. Work would include moving the structure to a newly constructed foundation and may also include replacement of the septic system etc. Costs for this measure are lower than for relocation due to the short distance of the move and the lack of associated real estate costs. Where space allows, retreat will be

considered; however, very few existing lots are deep enough to allow retreat. Approximately 125 structures could be moved back on their existing lots.

3.2. RELOCATION. Where retreat is not an option, this measure proposes relocating the structure to another lot. There are about 741 structures that could be relocated; however, it is estimated that only 164 lots would be available in the project reaches. It was assumed that there were four basic types of structures and that relocation of all of these structures would include new site preparation (utilities, new foundation, driveways etc.) and restoration of the existing site by demolition and removal of the foundation, driveways, septic system and utility connections. No attempt has been made to site each building. The selection of which structures would be relocated and which would be demolished was based on the value of the structures, estimated relocation cost and their proximity to suitable relocation sites. Relocation off the island is not considered practical.

3.3. DEMOLITION. When the estimated cost of relocation was greater than the value of the structure or when real estate is not available for relocation, it was assumed that the structure would be demolished and payments equaling the market value of the structure and lot would be made to the owner. Demolition would include removal and disposal of structures, utility connections, septic system etc. and restoration of the site. This measure would be applied to 615 structures. Costs for this plan include not only property acquisition of the structure and oceanfront lot, but also for demolition costs. Demolition would include removal and disposal of structures, utility connections, septic system etc. and restoration of the site. In this analysis the costs for acquisition of oceanfront lots is the roughly estimated market price of \$500,000 per lot. Costs for acquisition of the structure were set to the structure value shown in the structure file.

4 COST. Development of typical cost for the various measures is included in Table P-1. Cost includes construction, real estate, engineering, relocation assistance, construction management and a contingency.

4.1. STRUCTURE MOVE COST. The cost of moving a structure can vary greatly depending on site conditions, structure size, structure relocation type and haul distance. Costs used represent a move of a few blocks. Costs developed for each structure relocation type are as follows:

STRUCTURE RELOCATION TYPE I

These structures are on piles without a closed-in ground floor. They may be one or two story buildings and are typically in the 1500 to 2500 square foot range.

\$92,000 / structure

STRUCTURE RELOCATION TYPE II .

These are similar to structure relocation type I; however, the ground floor has been improved. The ground floor may be either utility/ storage space, garage space or heated living space. For the purpose of this comparison, it is assumed that the ground floor at the new site will be developed as garage space with breakaway walls.

\$107,000 / structure

STRUCTURE RELOCATION TYPE III

These slab on grade structures are typically the older structures. They may be one or two story, of wood or masonry construction and are typically 1000 to 2000 square feet. Moving cost for these structures is typically more than for structures on piles and in most cases relocation could not be justified.

\$133,000 /structure

STRUCTURE RELOCATION TYPE IV .

This includes motels, condominiums and commercial structures. Cost of relocating these will be approximated for each structure using the cost per square foot for structure relocation type III..

4.2. RETREAT COST. For this analysis the cost of retreat was assumed to be the same as for relocation of a similar structure relocation type without the real estate cost.

4.3. DEMOLITION COST. Cost of structural demolition includes removal and disposal of the structure, foundations, paved areas, utilities, and septic systems and grading and planting as needed to restore the site. A cost of \$18,000 / structure was used for a typical structure demolition in this analysis.

4.4. REAL ESTATE COST. Land Cost varies based on proximity to water. Although the lot that the structure is being relocated to may be several rows back, the cost of a typical first row lot is used. A typical cost for a 65-foot wide beach front lot would be \$500,000.

4.5 TOTAL COST. Total costs presented by reach and by type of structure is shown in Table P-2. The total first cost for this nonstructural plan is estimated to be \$520,000,000. This is for practical purposes a present value cost.

5. BENEFITS. As with the beachfill alternatives, benefits were defined as the reduction in storm and erosion damages from the without project condition to the after removal condition. Damages with the nonstructural plan were computed by applying the without project GRANDUC storm and erosion analysis to a modified structure file. The structure file was modified to represent conditions with the nonstructural plan. For demolished or relocated structures, the structure values were set to zero. For the retreat measure the distance from the structure to the seaward reference line was increased. The only residual damages come from the retreated structures, the remaining second or third row structures and from land losses. Benefits estimated from the GRANDUC analysis are estimated to have an effective present value of \$135,000,000.

6. TIMING. If this alternative were chosen, the question of whether the first row structures should be relocated or demolished in the base year or as they become threatened by the retreating shoreline would have to be addressed. It would be reasonable to relocate structures as they become threatened; however, by that time, vacant lots may no longer be available on the island. One possibility would be to purchase lots now for a relocation that may not occur for several years. Likewise, structures that would be demolished could be demolished as they become more threatened, allowing several years of use by the current owners. For this analysis, it was assumed that all costs are incurred at the beginning. The present worth of benefits is computed assuming that annual benefits all start in the first project year, not phased in beginning at some future date.

7. PROCUREMENT OPTIONS. The actions that would be taken to achieve this alternative could include purchase of available interior lots by the Government or sponsor and moving of the structures by a Government contract with the property owner retaining possession of the structure and the new lot but giving up ownership of the old lot. A more likely action would involve Government purchase of the beachfront structure and lot, with or without salvage rights, and payment of damages to the property owner in the form of a buy-out. This would be similar to the hazard mitigation buy-outs of homes in inland river floodplains. If the property owner retains salvage rights they would be responsible for locating suitable real estate and relocating the building. If the Government retained salvage rights the Government could surplus the structures as part of the demolition contract.

8. DISCUSSION

Except for where retreat only is the nonstructural measure, implementation of the nonstructural alternative would result in an undeveloped strip between the beach

and the first roadway. This area could be used for parks, day-use parking, or other public uses until the erosion takes the existing land.

Assuming there is no beach or dune nourishment the dune will eventually fail leaving the roadway and the structures beyond the roadway with no protection against storm surge. Although not reflected in the cost of this alternative, there will likely be attempts to repair the dune as it fails and possibly use of sandbags etc. to protect the roadway. This alternative also would result in a reduction in the tax base and growth potential of the community.

This nonstructural alternative does not reduce damages to the second-row structures and does nothing to prevent loss of the beach for recreation and habitat.

Overall the nonstructural plan has net present value benefits of -\$385,000,000 with a benefit to cost ratio of 0.3 to 1.

Table P-1 Nonstructural costs

STRUCTURE RELOCATION TYPE	DESCRIPTION	CONSTRUCTION COST	E&D (15%)	S&I (15%)	SUBTOTAL	CONTINGENCY (20%)	TOTAL	HOUSING DIFFERENTIAL & MOVING	TOTAL (ROUNDED)
I	RELOCATE BLDG OPEN ON PILES	\$ 56,929	\$ 8,539	\$ 8,539	\$ 74,008	\$ 14,802	\$ 88,810	\$ 3,000	\$ 92,000
II	RELOCATE CLOSE IN FOR GARAGE	\$ 66,757	\$ 10,014	\$ 10,014	\$ 86,785	\$ 17,357	\$ 104,142	\$ 3,000	\$ 107,000
III	RELOCATE SLAB ON GRADE	\$ 83,447	\$ 12,517	\$ 12,517	\$ 108,481	\$ 21,696	\$ 130,177	\$ 3,000	\$ 133,000
I - III	DEMOLITION & DISPOSAL	\$ 9600	\$ 1,440	\$ 1440	\$ 12480	\$ 2,500	\$ 14980	\$ 3,000	\$ 18,000

Table P-2, Nonstructural Summary

REACH	STRUCTURES				COST				TOTAL
	RELOCATIONS	RETREATS	DEMOLITIONS	TOTALS	CONSTRUCTION		ACQUISITION		
					REMOVAL - RELOCATION OR RETREAT	DEMOLITION	STRUCTURE	LANDS	
27	2	5	7	14	\$847,000	\$126,000	\$589,000	\$4,500,000	\$6,062,000
28	1	8	3	12	\$1,055,000	\$54,000	\$245,000	\$2,000,000	\$3,354,000
29	1	0	11	12	\$121,000	\$198,000	\$1,787,000	\$6,000,000	\$8,106,000
30	4	0	13	17	\$484,000	\$234,000	\$2,158,000	\$8,500,000	\$11,376,000
31	4	0	14	18	\$467,000	\$252,000	\$1,765,000	\$9,000,000	\$11,484,000
32	5	0	24	29	\$571,000	\$432,000	\$5,051,000	\$14,500,000	\$20,554,000
33	8	0	6	14	\$951,000	\$108,000	\$551,000	\$7,000,000	\$8,610,000
34	6	0	6	12	\$709,000	\$108,000	\$714,000	\$6,000,000	\$7,531,000
35	6	0	9	15	\$726,000	\$162,000	\$1,014,000	\$7,500,000	\$9,402,000
36	7	0	6	13	\$847,000	\$108,000	\$757,000	\$6,500,000	\$8,212,000
37	6	0	11	17	\$692,000	\$198,000	\$1,561,000	\$8,500,000	\$10,951,000
38	5	0	13	18	\$588,000	\$234,000	\$1,780,000	\$9,000,000	\$11,602,000
39	2	5	10	17	\$860,000	\$180,000	\$2,446,000	\$6,000,000	\$9,486,000
40	2	8	9	19	\$1,223,000	\$162,000	\$1,485,000	\$5,500,000	\$8,370,000
41	4	15	1	20	\$2,299,000	\$18,000	\$120,000	\$2,500,000	\$4,937,000
42	2	11	1	14	\$1,573,000	\$18,000	\$101,000	\$1,500,000	\$3,192,000
43	3	3	11	17	\$726,000	\$198,000	\$2,029,000	\$7,000,000	\$9,953,000
44	2	7	4	13	\$1,089,000	\$72,000	\$444,000	\$3,000,000	\$4,605,000
45	2	1	17	20	\$346,000	\$306,000	\$3,314,000	\$9,500,000	\$13,466,000
46	1	0	15	16	\$151,000	\$270,000	\$3,307,000	\$8,000,000	\$11,728,000

REACH	STRUCTURES				COST				TOTAL
	RELOCATIONS	RETREATS	DEMOLITIONS	TOTALS	CONSTRUCTION		ACQUISITION		
					REMOVAL - RELOCATION OR RETREAT	DEMOLITION	STRUCTURE	LANDS	
47	1	2	19	22	\$363,000	\$342,000	\$2,990,000	\$10,000,000	\$13,695,000
48	2	3	15	20	\$605,000	\$270,000	\$2,207,000	\$8,500,000	\$11,582,000
49	3	0	13	16	\$329,000	\$234,000	\$2,229,000	\$8,000,000	\$10,792,000
50	0	0	12	12	\$0	\$216,000	\$3,412,000	\$6,000,000	\$9,628,000
51	2	0	6	8	\$242,000	\$108,000	\$777,000	\$4,000,000	\$5,127,000
52	6	0	16	22	\$658,000	\$288,000	\$2,166,000	\$11,000,000	\$14,112,000
53	8	0	16	24	\$917,000	\$288,000	\$1,439,000	\$12,000,000	\$14,644,000
54	5	0	11	16	\$605,000	\$198,000	\$1,338,000	\$8,000,000	\$10,141,000
55	5	3	6	14	\$968,000	\$108,000	\$552,000	\$5,500,000	\$7,128,000
56	1	2	16	19	\$363,000	\$288,000	\$1,614,000	\$8,500,000	\$10,765,000
57	0	1	17	18	\$121,000	\$306,000	\$1,715,000	\$8,500,000	\$10,642,000
58	1	8	5	14	\$1,089,000	\$90,000	\$504,000	\$3,000,000	\$4,683,000
59	1	4	6	11	\$605,000	\$108,000	\$611,000	\$3,500,000	\$4,824,000
60	3	0	11	14	\$329,000	\$198,000	\$909,000	\$7,000,000	\$8,436,000
61	5	0	6	11	\$588,000	\$108,000	\$488,000	\$5,500,000	\$6,684,000
62	1	0	19	20	\$121,000	\$342,000	\$3,862,000	\$10,000,000	\$14,325,000
63	5	0	16	21	\$605,000	\$288,000	\$2,939,000	\$10,500,000	\$14,332,000
64	3	0	14	17	\$363,000	\$252,000	\$1,763,000	\$8,500,000	\$10,878,000
65	7	1	14	22	\$968,000	\$252,000	\$923,000	\$10,500,000	\$12,643,000
66	2	0	16	18	\$242,000	\$288,000	\$1,041,000	\$9,000,000	\$10,571,000
67	5	0	9	14	\$605,000	\$162,000	\$1,457,000	\$7,000,000	\$9,224,000
68	2	0	10	12	\$242,000	\$180,000	\$1,040,000	\$6,000,000	\$7,462,000

REACH	STRUCTURES				COST				TOTAL
	RELOCATIONS	RETREATS	DEMOLITIONS	TOTALS	CONSTRUCTION		ACQUISITION		
					REMOVAL - RELOCATION OR RETREAT	DEMOLITION	STRUCTURE	LANDS	
69	5	6	4	15	\$1,314,000	\$72,000	\$444,000	\$4,500,000	\$6,330,000
70	3	1	10	14	\$450,000	\$180,000	\$943,000	\$6,500,000	\$8,073,000
71	0	4	15	19	\$484,000	\$270,000	\$875,000	\$7,500,000	\$9,129,000
72	2	4	12	18	\$692,000	\$216,000	\$862,000	\$7,000,000	\$8,770,000
73	1	6	10	17	\$847,000	\$180,000	\$566,000	\$5,500,000	\$7,093,000
74	0	5	15	20	\$588,000	\$270,000	\$942,000	\$7,500,000	\$9,300,000
75	0	5	11	16	\$605,000	\$198,000	\$1,881,000	\$5,500,000	\$8,184,000
76	1	4	8	13	\$588,000	\$144,000	\$1,093,000	\$4,500,000	\$6,325,000
77	1	2	11	14	\$363,000	\$198,000	\$2,434,000	\$6,000,000	\$8,995,000
78	1	1	17	19	\$242,000	\$306,000	\$1,982,000	\$9,000,000	\$11,530,000
106	0	0	5	5	\$0	\$90,000	\$1,289,000	\$2,500,000	\$3,879,000
107	6	0	7	13	\$709,000	\$126,000	\$655,000	\$6,500,000	\$7,990,000
108	1	0	8	9	\$121,000	\$144,000	\$1,235,000	\$4,500,000	\$6,000,000
114	0	0	0	0	\$0	\$0	\$0	\$0	\$0
115	2	0	18	20	\$225,000	\$324,000	\$2,742,000	\$10,000,000	\$13,291,000
116	0	0	0	0	\$0	\$0	\$0	\$0	\$0
TOTALS	164	125	615	904	\$34,481,000	\$11,070,000	\$85,138,000	\$389,500,000	\$520,189,000