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BARRIER ISLAND DEVELOPMENT
NEAR FOUR NATIONAL SEASHORES

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Council on Environmental Quality

Federal Emergency Management Agency,
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and
National Park Service

Department of Commerce,
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By
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Project staff for Sheaffer & Roland, Inc. were: J. David Mullen, Economist; Louis T. Rozaklis, Environmental Engineer; and Penny Wallingford, Planner. H. Crane Miller was the Principal Investigator and is responsible for the technical adequacy of the study. John R. Sheaffer, President, provided overall direction and guidance.

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EXECUTIVE SUMMARY

Introduction

The first line of storm defense for a thousand miles of Atlantic and Gulf coastlines is their barrier islands -- a succession of low-lying, narrow islands, spits, and bay barriers generally located parallel to the mainland coast. These are geologically recent structures formed by interactions of waves, currents, tides, winds, and sediments.

The National Park Service has identified nearly 250 barrier-island units along the two coasts, consisting of single islands or clusters of barrier structures. Barriers generally consist of sands or other kinds of unconsolidated sediments. On their seaward side, the barriers are more often fronted by a beach; on the mainland side, by highly variable zones of wetlands. (See Figure 1.)

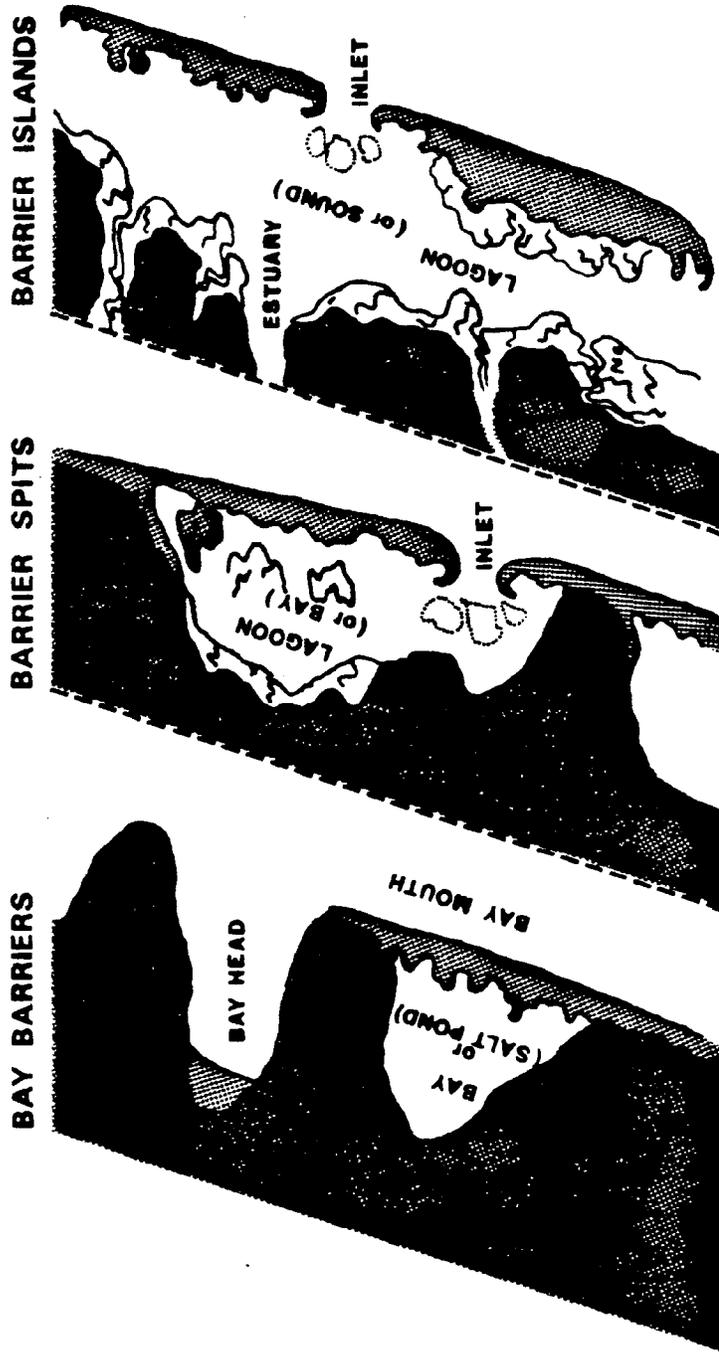
Development on barrier islands is a gamble between time and nature. The islands change position, often very rapidly, in response to storms, changes in water level, and changes in current patterns. The barriers are generally receding toward the mainland, responding to the progressive rise of sea level. Among the hazards are the migration of old inlets, formation of new inlets during storms, and storm overwash that can undermine foundations by liquefying soil. The combination of rising water level, coastal storm surges, wave action, and high winds make development hazardous on many parts of the islands.

Despite the hazards, development on barrier islands has been growing at a rate greater than 6,000 acres per year. That rate, if applied to the remaining undeveloped islands identified by the National Park Service, could consume the developable upland portions of those islands by the year 1995, just 15 years from now. In 1950, only some 90,000 acres were developed; the Department of Interior reported that 228,680 acres were developed by 1973-74, and an estimated 280,000 acres by 1980.

The Study

In recent decades the federal government has acquired several barrier islands and established them as national seashores. This report explores the impact of public land acquisition on land values on adjacent barrier islands and mainland communities. It analyzes the developmental history of communities near four national seashores on the southeast

FIGURE 1.
EXAMPLES OF BARRIER STRUCTURES



Source: *Oceanus*, No. 23, Vol. 4, Winter 1980-81, with permission of Woods Hole Oceanographic Institution.



Atlantic and Gulf of Mexico coasts. Case studies were carried out in the following areas:

<u>State</u>	<u>National Seashore (Authorization Date)</u>	<u>Adjacent Counties, Communities</u>
North Carolina	Cape Hatteras (1938)	Dare County; Nags Head; Kill Devil Hills
Georgia	Cumberland Island (1972)	Camden County; St. Marys; Glynn County; St. Simons Island; Sea Island
Florida, Alabama, Mississippi	Gulf Islands (1971)	Dauphin Island, Alabama; Pensacola Beach, Florida
Texas	Padre Island (1962)	Cameron County; South Padre Island

The study focused on several questions. Had withdrawing the land for national seashores had a significant impact on land values in neighboring communities? How had development in these communities been affected by the accessibility of the community itself or by the accessibility of the national seashore? Had other external factors, including the adequacy of water supply and wastewater treatment and the availability of flood insurance, been a significant factor? Had community development or expansion been influenced by federal assistance programs and policies, and at what cost? Finally, is federal acquisition of national seashores a cost-effective policy for protecting barrier islands from unsuitable development?

Major Findings

Trends in Land Value

Increases in real estate values in communities adjacent to the four national seashores and directly attributable to federal land acquisition were not immediately measurable in communities that had not reached or approached full development.

Impacts on land values in adjacent communities from the

withdrawal of federal lands from the marketplace may be delayed tens or scores of years after seashore acquisition, depending on the rate at which adjacent communities grow. In adjacent communities approaching full development, impacts of federal land acquisition on land values can be identified and measured.

External factors (road access, urban infrastructure and utilities, septic system moratoria, and naval bases) had a more immediate and measurable impact on land values in adjacent communities than did acquisition of the national seashores.

Access

Development on adjacent barrier islands was nonexistent or negligible until vehicular access by road, causeway, or bridge was available. However, convenient access per se did not lead immediately in every case to extensive development in the adjacent communities.

Where no road access exists to the national seashore, development in adjacent communities (whether on the mainland or on adjacent barrier islands) has not been measurably affected by federal acquisition of the national seashore, c.f., Cumberland Island, Gulf Islands (Mississippi islands).

Where road access exists to the adjacent community independent of road access to the national seashore, development and land values in the adjacent community are not measurably affected by seashore acquisition, c.f., Dauphin Island, South Padre Island.

In all instances studied, initial development of road, bridge, or causeway systems was financed by private, local, and state interests. Federal participation came later, through funding the improvement or replacement of existing systems. (The substantial costs of these and other federal assistance programs are discussed in later sections.)

Water Supply

In several adjacent communities that are on barrier islands, increasing density of development caused them to rely on mainland sources for water.

Only two communities studied still obtain 100 percent of their potable water from wells on the island, and these systems are being affected by salt water intrusion and

infiltration and inflow of polluted waters. Both communities have septic system or building moratoria in effect to restrict new development.

Availability of water from island or mainland sources has not been a constraint on development in most of the study areas. An exception is South Padre Island, where the availability and cost of additional water rights are limiting further development.

Federal expenditures (in the form of low interest loans, grants, and donation of federal property) contributed to establishing or upgrading water supply systems in some of the study areas. Community systems in the Nags Head - Kill Devil Hills area and on St. Simons Island benefited from federal loans and sale of excess property, respectively. Expansions of existing systems in South Padre Island and Nags Head - Kill Devil Hills also received federal grants and loans. A currently planned expansion to the facilities at Dauphin Island awaits similar federal aid.

Wastewater Management

In all communities studied, initial development relied primarily on septic systems for disposal of wastewater; as development increased, septic systems tended to exceed the capacity of local soils to assimilate the wastes.

In all study communities, the provision of a complete sewerage system and wastewater treatment facilities has become a requisite for prevention of environmental degradation and for continued development on the islands. Septic system moratoria were in effect in Kill Devil Hills, Dauphin Island, and St. Simons Island, when the case studies were conducted.

In only one of the study communities were federal monies for wastewater management systems expended as part of the initial costs of development of the islands. The original wastewater treatment plant and sewer system on St. Simons Island was built by the U.S. Navy and sold as excess property to Glynn County in 1947.

Federal funds spent so far in connection with wastewater management in the study communities are: 201 planning funds for wastewater treatment facilities and one construction grant (at South Padre Island). The federal contribution is estimated to be \$3.3 million.

Two of the study areas are currently seeking federal construction grants for new or expanded wastewater treatment facilities: Dauphin Island, Alabama (\$3.5 million) and Dare County, North Carolina (\$7.5 million).

Disaster Assistance and Flood Insurance

Federal disaster assistance funds of at least \$43 million will be expended in two of the study communities as a result of Hurricanes Frederic and Allen. Major disasters had been declared in the remaining states studied between 1953 and 1964, but none had been declared in them from 1965 to 1980.

Flood insurance coverage in the study communities currently exceeds \$578 million. Claims totaling \$17.8 million were paid in the study communities in the period January 1978 to November 1980. Sharp increases in the total number of policies and total flood insurance coverage were noted following Hurricanes Frederic and Allen.

Federal Policy Implications

Current federal programs support development, effectively leveraging private development money by shifting to the public sector portions of the costs of bridges, roads, causeways, water supply systems, wastewater treatment systems, shore protection, disaster relief, and flood insurance. Documented federal expenditures in three of the study areas represent an average subsidy of \$25,570 per developed acre in actual dollars expended or obligated, and a total expenditure of more than \$96.7 million for 3,784 developed acres. When restated as 1980 replacement costs, federal subsidies in the three areas averaged \$53,250 per developed acre.

These figures are consistent with estimates made by Sheaffer, Miller and Rozaklis in 1980 of the potential federal costs under current programs if the remaining undeveloped, unprotected barrier islands were to be developed.¹ Those estimates range from \$25,800 - \$26,400 per acre, assuming low developed acreage, to \$43,700 - \$46,700 per acre, assuming high developed acreage. As modified by Miller to the August 1980 National Park Service inventory of undeveloped, unprotected barrier island acreage, the estimated cost to the federal government of funding barrier island development under current programs could range from \$2.46 - \$6.05 billion over the next 20 years.²

If the federal goal is to protect remaining barrier

islands, policy should distinguish between the "noncontiguous" islands, i.e., those barrier islands not contiguous to developed areas and accessible principally by boat (about 138,100 acres) and "contiguous" barrier units, i.e., those barrier islands, barrier spits, and bay barriers immediately adjacent to developed areas and generally accessible by roads, bridges, and causeways (about 138,800 acres).

Protecting Noncontiguous Barrier Islands

The noncontiguous islands present the greatest range of opportunity for protecting and preserving the barrier islands. The opportunity is greatest before development begins; enforcement of strong federal policies on issuance of bridge permits could effectively preclude intense development and protect the noncontiguous islands without public acquisition. Each subsequent stage of development diminishes the effectiveness of federal, state, and local regulations, and increases the federal financial assistance required to mitigate or "correct" adverse conditions.

A Federal protection policy would be enhanced by continuing the historic federal position not to participate in the initial costs of barrier island access and other urban infrastructure.

In almost all study areas, the initial costs of access and other urban infrastructure (e.g., water supply, utilities, wastewater treatment, etc.) were borne by private, local, or state interests, or some combination of this funding. Financing was achieved primarily through sale of local or state revenue bonds, land sales, or private investments. Federal involvement characteristically came at subsequent stages of development. Continuing federal nonparticipation in the initial costs of barrier island access and other urban infrastructure would enhance a protection policy.

The critical focal point for a federal protective policy toward the remaining undeveloped, noncontiguous barrier islands is road, bridge, and causeway access.

Most barrier island development would not have taken place without bridge, causeway, and road access. A federal protective policy toward the remaining noncontiguous islands would logically seek to retain the islands in their natural condition, and prevent or inhibit development through a

variety of actions before initial development. The key to barrier island development is access. Therefore, bridge permits play a pivotal role in the development of the barrier islands.

Development of most undeveloped, noncontiguous barrier islands could be effectively regulated if bridge/causeway permits were (1) denied or (2) granted subject to enforced federal standards and without federal subsidization.

Federal regulatory authority over bridge permits is uniquely strong (by virtue of the navigation servitude under the Commerce Clause of the Constitution). Denial of a bridge permit would effectively preclude most extensive development of barrier islands.

When bridge or causeway permits are approved, development can be limited by requiring compliance with federal standards and permit conditions, and prohibiting federal cost sharing of construction, improvements, repairs, or replacement, except under stringent exceptions. The capital costs of building bridge/causeway systems to federal standards currently range from \$10 - \$30 million per mile. Imposing such costs on the private sector would greatly affect the economics of barrier island development, making much of it economically infeasible. Bridges and causeways are the neck of the funnel leading to and from the barrier islands. Control of the neck of the funnel can effectively determine whether development takes place initially.

Regulating Undeveloped, Contiguous Barrier Units

Access and development cannot be so simply directed on contiguous barrier units. These barrier islands, barrier spits, and bay barriers, are by definition near existing roads and urban infrastructure. Estimates showed that "contiguous" barrier units are, on average, within 0.4 miles of existing road systems on both the Atlantic and Gulf of Mexico coasts.

For readily accessible barrier communities, federal regulations are not designed to and will generally not prevent or inhibit development in the long term, but can reduce or mitigate some potentially adverse consequences.

Regulation of barrier island development generally implies minimum standards for building practices and land uses. The added costs of these regulations cannot be expected to prevent development. They are not designed to do so. Moreover, in the case of flood insurance regulations, property owners and local governments can recover most or all of the costs of complying with elevation requirements through reduced flood insurance premiums and reduced average annual flood losses.

Standards and regulations will not be adequate alone, however, to achieve the recently articulated federal goal "to achieve an absolute decline in communities' average annual flood losses." Design of buildings to minimum standards can only reduce losses up to the design and safety limits of the structures. A storm that exceeds these design and safety limits can then produce catastrophic results. The chances for such a storm over a 50-year building life expectancy are relatively high (1-in-4 for a 200-year storm such as Hurricane Camille). Continued development, even to minimum standards, increases the potential for catastrophic loss in large, rare storms. Moreover, community losses from damage to roads, water systems, and other urban infrastructure can be expected from storms of considerably lesser magnitude, adding to potential disaster relief expenditures.

Removal of federal subsidies for developing contiguous barrier units can be expected to inhibit but not prevent development of those contiguous areas.

Removal of federal subsidies for developing contiguous barrier units would shift significant portions of the costs from the federal to the state, local or private sectors. However, these communities are so near access and urban infrastructure that the capital costs of extending these services would in many instances be economically feasible.

Removal of federal subsidies for access and other urban infrastructure on the undeveloped contiguous barrier units would reduce federal costs, but would not necessarily preclude development. Continued federal expenditures for increased disaster relief and flood insurance can be anticipated, unless federal disaster assistance and flood insurance programs are modified to further mitigate hazards.

Benefits of an Acquisition Policy

A federal protection policy will be strengthened by

authority and appropriations to acquire both undeveloped contiguous and noncontiguous barrier islands. Public acquisition of the islands is cost effective, and the surest means to protect barrier islands from inappropriate development.

Acquisition costs of the National Seashores included in this study ranged from \$75.35 per acre at Cape Hatteras (1950-1954) to \$4,950 per acre at Gulf Islands National Seashore (1970-1974). Using an average purchase price of \$5,000 per acre, recent estimates indicate that acquisition costs could be one-fifth or less of the costs to the federal government of continuing its current development programs on the undeveloped barrier islands.

Even at costs of \$5,000-\$10,000 per acre for the upland portions of contiguous units, acquisition costs are estimated to range no higher than \$275-\$550 million, and for the noncontiguous islands \$185 to \$370 million. Total acquisition costs for all contiguous and noncontiguous undeveloped upland acreage on the barrier islands would range from \$460 to \$920 million. Developing the barrier islands under current federal programs is estimated to range between \$2.46 billion and \$6.05 billion, 2.5 to 5 times the acquisition costs. (See Table 14 of the report.)

Under a public acquisition program, priorities can be divided generally between contiguous and noncontiguous barriers. In many, if not most, instances first priority should be given to purchase of undeveloped contiguous units, based on such objective factors as physical characteristics, resource values, and threats to those resource values (imminent development, pollution, loss of habitat, loss of open space, etc.).

A public acquisition program on the noncontiguous islands would not be required, if the federal government chooses to adopt a more stringent bridge permit program than is now in force, and if such regulations withstood inevitable judicial challenge, extensive development of the undeveloped noncontiguous barrier island would be effectively precluded and acquisition could be directed to contiguous barrier islands.

As with any form of regulation, public acquisition before development takes place would be the most cost effective action. At each incremental stage of access and urban infrastructure development, adjacent land values will

increase. The Government would get the most for its money before such development takes place.

If the history of National Seashore acquisition and the increase of coastal land values is any precedent, costs in the range of \$5,000-\$10,000 per acre will be deemed sound and inexpensive investments not even 10 years from now; not only would they be inexpensive, but they would also be "repaid" in reduced or avoided federal subsidies and disaster relief expenditures.

An acquisition program would effectively avoid or reduce costs to repair, improve, enlarge, upgrade, reconstruct, or replace bridges, roads, causeways, water supply systems, wastewater treatment systems, flood and erosion control structures, or to provide disaster assistance and to subsidize flood insurance for the areas acquired.

Where development in adjacent communities has not reached or is not approaching saturation, federal acquisition of noncontiguous barrier islands would have no measurable effect on land values in those communities. Other factors, especially improved urban infrastructure, will have a more immediate effect on adjacent community land values than public acquisition of the noncontiguous islands.

Undeveloped, contiguous tracts will reflect market values of developed lands nearby. In one instance cited, the asking price for one parcel of land included in the National Park Service inventory of undeveloped barrier units is nearly six times the average estimated present value of remaining undeveloped noncontiguous islands. The smaller the acreage involved, the greater the likelihood of high cost per acre. Nevertheless, viewed as a totality, the average acquisition costs per acre for "bulk" land purchases of uplands, wetlands, and interior waters is expected to fall in the range of \$5,000-\$10,000 per acre.

To the extent that adjacent areas are totally or significantly developed, public acquisition of undeveloped, contiguous parcels would be expected to increase the value of adjacent lands.

Removal of lands from the marketplace near communities that are highly developed was shown in at least one instance in the study to have increased property values in that community. Both the perception and the fact of reduced supply of land will increase the value of the remaining lands

outside the publically-acquired property where development has reached or approaches saturation.

Conclusion

"Protection" measures such as regulations and removal of federal subsidies for access and urban infrastructure may forestall some barrier island development but generally will not prevent development. Among all regulations only a strengthened bridge permit program, coupled with removal of federal bridge construction funds, is likely to protect barrier islands from development, and then only with respect to noncontiguous islands. Regulations on access, urban infrastructure, and building requirements, and removal of federal subsidies are important short-term measures; but their limitations as means to protect barrier islands need to be recognized.

If protection of the undeveloped barrier islands is to be a federal goal and is to be effectively achieved, a program of regulation, removal of federal subsidies for development, and public acquisition would need to be authorized and funds appropriated for that purpose. Such a combined program is the only effective way to protect the islands, and, through acquisition, the only fair way to compensate individual barrier island property owners for taking their right to develop the islands. Of all the available measures, the surest means to protect the undeveloped barrier islands is public acquisition.

INTRODUCTION

The barrier islands are the first line of storm defense for a thousand miles along the Atlantic and Gulf coasts. Development on them is a gamble between time and nature, as evidenced in recent years by Hurricanes Frederic, Camille, and Allen. Yet people continue to be drawn to their sunny beaches and to risk building on the islands.

Development on barrier islands has been growing at a rate greater than 6,000 acres per year. That rate, if applied to the remaining barrier islands, could consume the developable upland portions of those islands by the year 1995, just 15 years from now. By 1980 an estimated 280,000 acres had been developed.

In recent decades the federal government has acquired several barrier islands and established them as national seashores. The report explores the impact of such public land acquisition on adjacent barrier islands and mainland communities.

Purposes of the Study

This study was undertaken as part of the consideration of alternative federal policies for protecting the nation's barrier islands. This report describes and analyzes the developmental history and recent trends affecting economic and environmental conditions in four case study areas of the southeast Atlantic and the Gulf of Mexico coasts adjacent to or near national seashores:

<u>State</u>	<u>National Seashore</u>	<u>Counties, Communities</u>
North Carolina	Cape Hatteras (1938)	Dare County; Nags Head; Kill Devil Hills
Georgia	Cumberland Island (1972)	Camden County; St. Marys; Glynn County; St. Simons Island; Sea Island
Florida, Alabama, Mississippi	Gulf Islands (1971)	Dauphin Island, AL; Pensacola Beach, FL
Texas	Padre Island (1962)	Cameron County; South Padre Island

There are approximately 1.4 million acres of uplands, wetlands, and interior waters included in the federal inventory of barrier structures on the Atlantic and Gulf of Mexico coasts. An estimated 885,000 acres (more than 60 percent) are in public ownership, owned by federal, state, and local governments and protected from development. Nearly 280,000 acres have been developed, about 190,000 within the last 30 years. Somewhat less than 280,000 acres are undeveloped, in private ownership, and potentially subject to development. See Table 1.

Nearly 95 percent of the undeveloped, unprotected barrier acreage is found from Virginia south along the Atlantic coast and along the Gulf coast. More than 40 percent of that acreage is in Texas; another 43 percent is in North Carolina, South Carolina, Georgia, and Florida. Hence, the areas selected for case studies are both representative of and dispersed throughout the geographic area with the greatest remaining undeveloped, unprotected barrier island acreage. The case study method was used to document developmental history within each study area and to discern recent trends affecting those areas.

One purpose of the study was to assess the impact of federal land acquisition on land values in communities adjacent to but outside the boundaries of national seashores. Concern had been expressed that as the supply of land available for development is diminished by federal land acquisition, and demand for land remains steady or increases, the effect of federal land acquisition will be to increase the price of remaining land sharply. The study tested that concern.

A second major purpose of the study was to document federal involvement in development, expansion, and redevelopment of the study communities. The economic feasibility of barrier island development is influenced by a number of factors, including access to the islands, urban infrastructure to support development, and -- ultimately -- shore protection measures to counteract the effects of rising sea level, currents, winds, waves, storms, and erosion.

Extensive barrier island development cannot take place without access, water, and other urban infrastructure to support that development. Access and urban infrastructure are broad areas in which current federal programs can provide substantial direct subsidies to foster development. The study documented the sources and costs for such basic factors

Table 1. Undeveloped, Unprotected Barrier Island Acreage on the Atlantic and Gulf of Mexico Coasts (September 1980).

State	Contiguous Units ¹		Noncontiguous Units ²		State Total
	Uplands ³ (Acres)	Wetlands ³ (Acres)	Uplands (Acres)	Wetlands ³ (Acres)	
Maine	702	136	0	0	838
Massachusetts	3,226	1,447	1,276	1,027	6,976
Rhode Island	777	432	70	0	1,279
Connecticut	72	203	22	29	326
New York	1,327	535	0	0	1,862
New Jersey	60	290	0	0	350
Delaware	156	200	0	0	356
Virginia	0	0	1,786	6,587	8,373
North Carolina	2,608	5,065	1,939	12,235	21,847
South Carolina	6,288	8,915	4,293	21,064	40,560
Georgia	0	0	5,706	23,084	28,790
Florida	14,176	8,174	1,040	3,176	26,566
Alabama	465	1,162	0	0	1,627
Mississippi	0	0	1,970	1,325	3,295
Louisiana	860	4,972	4,151	11,744	21,727
Texas	24,797	51,770	15,459	20,088	112,114
September 1980 Totals	55,514	83,301	37,712	100,359	276,886

¹ "Contiguous Units" are those undeveloped, unprotected barrier structures contiguous to partially or totally developed areas.

² "Noncontiguous Units" are totally undeveloped, unprotected barrier islands not contiguous to partially or totally developed areas, and generally only accessible by boat.

³ Wetland acreages include interior waters.

Source: Sheaffer & Roland, Inc., using:

Summary of the Undeveloped and Unprotected Natural Areas on Barrier Islands Along the Atlantic and Gulf Coasts--U.S. Department of the Interior, National Park Service (Washington, D.C., April 1980).

Table 1, Barrier structures and parts of structures listed in April 1980 National Park Service inventory that have been determined to be protected by existing owners and deleted (revised to Sept. 9, 1980).

Table 2, Other barrier structures or parts of barrier structures deleted from April 1980 National Park Service inventory (revised to Sept. 9, 1980).

Table 3, Barrier structures determined to qualify for addition to the inventory of undeveloped and unprotected barrier structures (revised to Sept. 9, 1980).

as:

- access: bridges, causeways, roads, and airports;
- water supply and distribution;
- wastewater collection and treatment; and
- protection against flood losses.

Each of these categories was assessed separately. Private, local, state, and federal sources of financing were documented where available. Specific development factors were assessed over time by examining building permits, traffic counts, and property transfers and sales. The influence of federal acquisition of the national seashores was measured and evaluated by means of time series analysis. Effects of federal subsidies on land use and value, and on pressures to develop the communities were also assessed by examining changes over time.

In each case study external factors were evaluated to assess their impacts. These external factors included:

- military and naval bases
- adjoining public holdings other than national seashores
- tourist facilities and attractions
- significant nearby development, e.g., major metropolitan areas, and
- offshore oil and gas exploration and exploitation.

To the extent identifiable, the impact of external factors were compared with the impact of the national seashores on development in the adjacent communities.

Data Collection and Evaluation

Each case study focused on the national seashore itself and on private development nearby on the same barrier island, on separate but adjacent barrier islands, or on the mainland. Each was studied separately to determine its developmental history and trends in land use and land value. Available planning and other documents were reviewed; locally influential and knowledgeable individuals were interviewed; and primary data relating to building permits, property sales, and property transfers were collected and analyzed. The urban infrastructure in each case study area was evaluated and, where possible, the costs of building the infrastructure were collected and analyzed.

SYNOPSIS OF CASE STUDIES

Although the developmental history of each study community was unique, some characteristics are typical not only of other study areas but also of other barrier units along the Atlantic and Gulf coasts. For example, Cumberland Island and the Mississippi islands of the Gulf Islands National Seashore have little or no development on them and no road access from the mainland. They share these characteristics with more than 50 undeveloped, privately owned barrier islands comprising about 138,000 acres that are not contiguous to developed areas and are currently inaccessible by road, bridge, or causeway. The Cape Hatteras, Padre Island, and Florida portions of the Gulf Islands National Seashores are accessible by road and contiguous to developed and developing areas. They share these general characteristics with approximately 80 undeveloped, unprotected barrier units comprising about 139,000 acres. Thus, the four national seashores included in the study are broadly representative of the remaining undeveloped, unprotected barrier structures of the Atlantic and Gulf coasts.

This synopsis focuses on a number of the common characteristics of the study areas related to land values, access, urban infrastructure, and external factors affecting development. Each finding is discussed and supported by the data collected, interviews held, and analyses made during the field work for the study.

Trends in Land Value

Increases in real estate values in communities adjacent to the four national seashores and directly attributable to federal land acquisition were not immediately measurable in communities that had not reached or approached full development.

In all of the study areas except Pensacola Beach, Florida, percentages of development and rates of growth were low at the time of acquisition of the adjacent national seashore. Estimated percentages of development at the time of seashore acquisition were:

<u>Community</u>	<u>Seashore Acquisition Period</u>	<u>Percent Developed</u>
Nags Head, NC	(1953-1959)	Less than 15%
Kill Devil Hills, NC	(1953-1959)	Less than 15%
South Padre Island, TX	(1966)	Less than 5%
St. Marys, GA	(1974-1979)	Less than 25%
Dauphin Island, AL	(1972-1979)	Less than 10%
Pensacola Beach, FL	(1972-1979)	About 75%

Source: Sheaffer & Roland, Inc. estimates from planning and building permit data.

Except in Pensacola Beach, development was not proceeding vigorously in the study areas when the national seashores were acquired. The supply of land available for residential and commercial development in the study communities exceeded the demand for such land during the Seashore acquisition period. Hence, acquisition of the Seashores was generally not perceived as putting pressure on development in the adjacent communities or on acquisition of scarce land resources.

Table 2 compares oceanfront land sales in several of the communities adjacent to the four National Seashores with the purchase and condemnation/taking costs of the four Seashores. Readers should note that the land sale data are derived from actual sales, but do not necessarily represent extreme highs and lows for each given five-year period. Also community land sales are based on sales of subdivided, platted lots. Such sales are many times more expensive per acre than "bulk" land sales characteristic of many Seashore acquisitions. Finally, the community land sales shown are the most expensive land in each community studies, i.e., oceanfront land. Depending on the community, interior lot costs ranged from one-third to one-tenth the cost of ocean front lots in the study communities. Nevertheless, the data suggest several conclusions that were corroborated in the study team's interviews.

The community property sales data suggest no immediate, unusual increase in property values that are directly attributable to the Seashore acquisition and not explicable by external factors. Some modest increase is noticeable in the Nags Head - Kill Devil Hills area, but the acquisition period also corresponded with an extensive tourism promotion program by the Outer Banks Tourist Bureau. Increased

Table 2. Oceanfront land Sales in Study Communities - Costs Per Acre.

Period	Kill Devil Hills, Nags Head	St. Simons Is., Sea Island	Dauphin Island	South Padre Island	National Purchase Seashore	Taking (Av. Cost/Acre)	Condemnation (Av. Cost/Acre)
1940-44	\$ 870-\$ 2,600	NA	NA	NA			
1945-49	\$ 870-\$ 2,600	NA	NA	NA			
1950-54	\$ 900-\$ 2,600	NA	NA	\$ 4,400-\$ 4,800	Cape Hatteras	\$75.35	\$268.39
1955-59	\$ 2,600-\$ 12,200	NA	\$ 21,800-\$ 24,000	NA			
1960-64	\$ 6,500-\$ 19,200	NA	NA	\$ 21,300-\$ 22,200			
1965-69	\$ 11,300-\$ 27,400	NA	NA	\$ 12,600-\$ 22,700	Padre Island	--	\$618.70
1970-74	\$ 30,500 ¹	\$207,550	\$ 62,700-\$ 64,500	\$ 7,000-\$ 78,000	Gulf Islands	\$4,949.04	\$19,593 (2.21 Acres)
1975-79	\$174,200-\$283,100	\$398,100-\$430,400	\$ 54,400-\$292,300	NA	Cumberland I.	\$3,327.30	\$21,316 (102.12 Acres)
1980	\$203,400-\$464,800	NA	\$ 13,900-\$204,300	\$202,100-\$332,800			

¹Data include only one transaction.

Source: Sheaffer & Roland, Inc. using: Property Sales Data; Department of the Interior, National Park Service, Division of Land Acquisition, Master Deed Listing, status as of Feb. 29, 1980.

visitations tended to coincide with increased building permit activity in some of the study communities.

The St. Simons - Sea Island and Dauphin Island data suggest that land values were influenced by factors independent of the Seashore acquisitions. St. Simons and Sea Island, located more than 50 miles north of St. Marys, Georgia (the mainland community closest to Cumberland Island) suggest acquisition of Cumberland Island had no measurable impact on land values on St. Simons and Sea Island. Land values on Dauphin Island also have been influenced by external factors. A moratorium on septic systems that has been in effect since 1976 has had a strong impact, particularly on development and land values on the west end of the island. Development difficulties were exacerbated in 1979, when Hurricane Frederic "blew out" the bridge/causeway to the island.

South Padre Island data show a depression in land values during the period that the Padre Island National Seashore was being acquired. Davenport has suggested a cause:effect relationship between the acquisition and the depressed land values in that period.⁵ Before acquisition of the Seashore, a coastal highway was proposed to connect Corpus Christi and South Padre Island, running the length of Padre Island. When the Seashore was authorized and acquired, the coastal highway proposal became inoperative. According to Davenport's sources, land values in South Padre Island that were inflated by speculation that the highway would be built were deflated when the Seashore was acquired.

However, another factor--the high salinity of the water supply from the mainland--may also have had a depressing effect on land values at South Padre Island. Many realtors cited this salinity (1,100 parts per million of total dissolved solids, including 850 - 900 ppm of salt) as a deterrent to further development. Both factors coincided with Seashore acquisition and could have had a combined depressing effect on land values.

The water problem was mitigated in 1966 when the water district serving South Padre Island found a new nonstagnant source of water and installed underground transmission mains from the source to the treatment plant. However, further development is now hampered by the limited availability and high costs of obtaining additional water rights.

Impacts on land values in adjacent communities from the withdrawal of federal lands from the marketplace

may be delayed tens or scores of years after seashore acquisition, depending on the rate at which adjacent communities grow.

Study data suggest that measurable effects of federal land acquisition on adjacent lands are not felt until the adjacent areas reach or approach full development. It may take decades for development in the adjacent communities to reach that point.

As late as 1972, nearly 20 years after acquisition of the Cape Hatteras National Seashore began, land use maps of Nags Head and Kill Devil Hills, North Carolina, showed that only the oceanfront had been extensively developed. Interior lots and lots bordering Roanoke Sound were virtually undeveloped. However, by 1980, Kill Devil Hills was 90-95 percent developed and Nags Head was 50 percent developed. Sharp increases in land values were being experienced as land development approached saturation, and new development was being directed to the north of these communities.

Measurable effects on land values adjacent to Cumberland Island may not be felt for 50 years, according to an official of the Sea Island Company, developers of Sea Island and St. Simons Island, Georgia. Cumberland is adjacent to rural Camden County where the dominant land use is pine forests to support the local paper industries. Should the demand develop, there are ample lands to meet the needs for any foreseeable development of the area immediately adjacent to Cumberland Island on the mainland over the next 25 - 50 years, with no measurable effect on local land values attributable to federal acquisition of Cumberland Island. The same official of Sea Island Company thought that the principal effects of the Cumberland Island National Seashore may be aesthetic, the appreciation of a barrier island in its natural state contrasted to nearby developed areas.

External factors (road access, urban infrastructure and utilities, septic system moratoria, and naval bases) had a more immediate and measurable impact on land values in adjacent communities than did acquisition of the national seashores.

The critical role of road access to the barrier islands in the development of those islands was borne out repeatedly -- on the Outer Banks, at St. Simons Island and Sea Island, at Pensacola Beach and Dauphin Island, and at South Padre

Island. Without road, bridge, or causeway access to the islands, extensive recreational, tourist, and permanent development did not occur. The communities on the Outer Banks and on Dauphin Island were largely fishing villages, accessible only by boat or ferry, before bridges and roads were built.

Dramatic evidence of the effect of inaccessibility and land use regulations was found on Dauphin Island. Table 2 shows the decrease in land values, particularly on the west end of Dauphin Island, after the imposition of a septic tank moratorium in 1976. Building permit data show a sharp decrease in new building starts in 1977, and reduced levels thereafter. Interviews revealed that new buildings are either using holding tanks or remain unconnected, awaiting removal of the septic tank ban. As a result of the moratorium and the destruction of the Dauphin Island Bridge by Hurricane Frederic, some land values are depressed below levels at which the land was first offered in 1955.

In St. Marys, Georgia, on the mainland opposite Cumberland Island, development of the Kings Bay Fleet Ballistic Missile Submarine Support Base has dominated the socioeconomics of the area since July 1, 1978, when the Navy took possession of the Military Ocean Terminal from the Army. Designation of the base as an Atlantic Coast Strategic Submarine Base for one TRIDENT squadron is already having profound impacts in the county, as noted in the Environmental Impact Statement for the base:

"Camden County has become a center of military employment The region's military population has grown by 3,266 persons (including spouses and dependents) since the arrival of the Navy's submarine tender at Kings Bay. . . .

". . . The arrival of military personnel on July 2, 1979, increased the county's 1979 population by 12 percent. This growth, coupled with growth of the county's two largest industrial employers (Union Carbide and Gilman Paper), has resulted in some housing shortages, increased competition for qualified employees, and increased traffic.

"Real estate values in Camden County communities have registered substantial price appreciation in the last two or three years. Homes that sold for \$18,000 in 1976 are now selling for approximately \$30,000; raw land near development areas has posted sharper price appreciation

than homes. . . ."6

With an estimated influx of more than 20,000 people associated with the Kings Bay Support Base by the year 2000, the overwhelming impacts on land values in St. Marys and in Camden County are and will be attributable to the Kings Bay operation for the foreseeable future.

In adjacent communities approaching full development, impacts of federal acquisition on land values can be identified and measured.

Pensacola Beach, Florida, is the only study community that experienced immediate, measurable increases in real estate values after nearby land was acquired for a national seashore. The City of Pensacola Beach is on Santa Rosa Island. The entire island was once federal property administered by the Department of the Interior, but large portions were transferred to Escambia County, Florida, during the Truman Administration. The County set aside a portion of the island for development as Pensacola Beach, and created the county-run Santa Rosa Island Authority to administer the town. It was bounded on the west by Fort Pickens Park and on the east by an 8-mile county park. Development began in the late 1940s after the county built a bridge and water main to the mainland. Under the Santa Rosa Island Authority, land in Pensacola Beach was made available solely by long-term, 99-year leases for development.

When the Gulf Islands National Seashore was established, Fort Pickens State Park was donated by the State to become a part of the Seashore. This had no apparent effect on lease values in Pensacola Beach, although the town was about 75 percent developed. However, the study team was told that when a 7.5-mile stretch of beach east of Pensacola Beach was incorporated into the National Seashore, leases in Pensacola Beach immediately increased in price. The study team could not quantify the increases, for lack of data.

Although the creation of Cape Hatteras had no measurable impact on land values in Nags Head and Kill Devil Hills for almost 20 years, there now is the prospect of immediate, measurable land value increases in these communities. Situated in the middle of Nags Head is a 411-acre undeveloped tract that extends from the Atlantic Ocean to Roanoke sound. Still owned by the family that purchased the land in the late 1930's reputedly for \$4,000 (less than \$10.00 per acre), the

entire tract is now offered for sale for \$12,000,000, or \$29,200 per acre. The tract is included in the Department of the Interior's inventory of undeveloped, unprotected barrier units. Several realtors and local officials were questioned about the potential impact on local land values if the federal government were to acquire the tract. All were unanimous in their opinion that such an acquisition would immediately increase land prices in all nearby communities, because the tract is the last large parcel of undeveloped oceanfronting land for 25 - 30 miles outside the National Seashore. This prospect is consistent with our finding inasmuch as Kill Devil Hills is now estimated to be 90 - 95 percent developed and Nags Head about 50 percent developed. The tract represents a substantial portion of the undeveloped land in Nags Head.

Access

Development on adjacent barrier islands was nonexistent or negligible until vehicular access by road, causeway, or bridge was available.

Uniformly throughout the study communities no extensive development occurred until road, bridge, or causeway access was provided from the mainland. A corollary was that where no such access existed there was no extensive development, c.f., Cumberland Island and the Mississippi islands of the Gulf Islands National Seashore.

In each area, road access was perceived by local officials or developers as the first basic requirement for attracting development. And where roads, bridges or causeways were built, local officials and developers were invariably responsible for initiating the process. Thus, Dare County officials and private investors interested in developing the Dare County beaches initiated measures for bridges across Roanoke and Currituck Sounds in North Carolina. This in turn brought pressure on the State of North Carolina to fund and build Route 158 connecting the two bridges. The original causeway/bridge complex to St. Simons Island was funded by City of Brunswick revenue bonds (1924), and the first 22 miles of roads on St. Simons were constructed by the Sea Island Company and donated to Glynn County. At Pensacola Beach the first bridge was built in 1931 with private funds to provide access solely to a casino; the bridge that immediately preceded efforts to develop Pensacola Beach was funded in 1948 with Escambia County revenue bonds. Railroad access to Dauphin Island was

apparently attempted in 1866, but failed; through the combined efforts of the Mobile Area Chamber of Commerce, Mobile County, and the State of Alabama, the first bridge to Dauphin Island was completed in 1955. Finally, the first causeway to South Padre Island was financed by Cameron County bonds and completed in 1954.

In no instance were the barrier island communities as much as 5 percent developed when the first bridge, road, or causeway was built. In the principal study areas there had been no demand for exclusive development, inaccessible except to those with boats. The study areas did not include Jekyll Island, Georgia, where such demand did arise. A barrier island sandwiched between St. Simons Island on the north and Cumberland Island on the south, Jekyll became the most exclusive resort in the nation in the late 19th Century. It was selected by a team of health experts and developed privately as a winter resort offering complete privacy, beauty, and a fair climate. The Jekyll Island Club operated for about 56 years. The island was purchased by the State of Georgia in 1947, and operated as a resort area (accessible by causeway) by the Jekyll Island Authority.

Elsewhere all development on the barrier islands was dependent upon vehicular access. For those islands no extensive development would, or could, occur without vehicular access.

Convenient access per se did not lead immediately in every case to extensive development in the adjacent communities.

A chronology of vehicular access to the study communities is presented in Table 3. There were some instances where access was followed immediately by development, e.g., St. Simons Island, Sea Island, Pensacola Beach, and Dauphin Island. But at Nags Head and Kill Devil Hills, the Great Depression and World War II intervened before development began in earnest in the 1950s, some 20 years after access opened the area to potential development. Similarly, more than 15 years passed before the first substantial development began on South Padre Island.

In all of the study communities the early years of development were sluggish. At Pensacola Beach, leases were offered at \$5.00 per year as an incentive to attract people to develop on the island. At that price, the Santa Rosa Island Authority was hard pressed to find takers. At Dauphin

Table 3. Chronology of Vehicular Access to Study Communities, Funding Sources, and Periods of Principal Development.

Location	First Bridge/Causeway Year	Funding Source	First Paved Roads	Funding Source	Bridge/Causeway Improvements Repairs	Funding Source	Principal Development Period
<u>North Carolina</u> Roanoke Sound Bridge	1928	Dare County Bonds (Toll)	--	--	1950	NA	Nags Head/Kill Devil Hills - 1950-Present
Wright Memorial Bridge (Currituck Sound)	1930	Privately Financed (Toll)	--	--	1967	Federal/State	
Route 158 (Kitty Hawk) to Nags Head	--	---	1931	State of North Carolina	Route 158 Bypass - 1959	Federal/State	
Bonner Bridge (Oregon Inlet)	1964	Federal/State	--	--	1980	State	
<u>Georgia</u> Brunswick-St. Simons Causeway Bridge	1924	City of Brunswick Bonds (Toll)	1924	Private-Donated to Glynn County	1981 (Est.)	Federal/Local	St. Simons I. 1940-Present; Sea Island - 1926-Present
<u>Florida</u> Gulf Breeze-Pensacola Beach Bridge Causeway	1931	Private (Casino)	1948	Escambia County	1948 1974	Escambia Co. Bonds St. Rev. Bonds	Pensacola Beach 1948-Present
<u>Alabama</u> Dauphin Island Bridge	1955	Mobile County Bonds; State (Toll)	1956-57	State of Alabama	1980	Federal (100%)	Dauphin Island 1956-Present
<u>Texas</u> South Padre Island - Queen Isabella Causeway	1954	Cameron County Bonds (Toll)	1954	Cameron County	1974	Federal State	South Padre Island - 1971-Present

Source: Sheaffer & Roland, Inc. - Case Studies.

Island, the Mobile Area Chamber of Commerce generated great interest in the properties on the island and 2000 lots sold within three days of the initial offering. But fewer than 200 houses had been built by the 1960s.

Then, for reasons not fully known, all of the study communities associated with resort development experienced a surge of interest and growth in the late 1960s and early 1970s. The growth coincided with the early acquisitions of land for Cumberland Island and the Gulf Islands National Seashore, but was clearly unrelated to those events, and was at least regional if not national in scope. A growing awareness of the coast as a desirable place for recreation and development, greater levels of disposable income, and more leisure time than before, all appear to have been contributing factors. Whatever the causes, it was striking that all of the resort areas studied, so geographically dispersed, experienced active growth at roughly the same time. Although the active development also coincided with enactment of the National Flood Insurance Act, the study found that communities were growing before many of them entered the National Flood Insurance Program. This suggests that the availability of flood insurance was not a significant contributing factor at the outset.

Where no road access exists to the national seashore, development in adjacent communities (whether on the mainland or on adjacent barrier islands) has not been measurably affected by federal acquisition of the national seashore, c.f., Cumberland Island, Georgia, and Gulf Islands (Mississippi islands).

Cumberland Island was unique in many respects. Until acquired for the Seashore, much of the island had been held in trust for descendants of Thomas Carnegie, brother of Andrew Carnegie. The island had been deliberately kept undeveloped and secluded, and any disposition of the island was with the desire that it be kept in that condition. Lack of bridge and causeway access effectively reinforced the beneficiaries' privacy. Its continued isolation as a national seashore has resulted in no discernible impact on development in nearby communities.

The Mississippi islands now comprising part of the Gulf Islands National Seashore are even farther from the mainland than Cumberland Island is. The lack of any bridge or causeway access was clearly a contributing factor to the nondevelopment of these remote islands. But a knowledge,

experience, respect, and fear of hurricanes may have been an even greater deterrent. Complete and violent inundation during Hurricane Camille in 1969, severe erosion and overwash, and virtually total destruction of all structures on the islands including a former coastal fort, set the stage for their inclusion in the Seashore little more than two years later.

The study team consulted the appraisers who appraised Cumberland Island and the Mississippi islands for the National Park Service, and who were intimately familiar with land values both on the islands and on the mainland. Both stated unequivocally that sale of the islands to the federal government had no measurable impact on the market on the mainland. Factors cited by Roy Gordon, MAI, of Savannah, regarding Cumberland Island included "remoteness," "isolation," "inaccessibility," and the fact that it was "held in trust for the descendants of Thomas Carnegie." J. Ed Turner, MAI, of Mississippi, cited distance, inaccessibility except by boat, and the vigor of the economies in the adjacent mainland communities as factors.

Where road access exists to the adjacent community independent of road access to the national seashore, development and land values in the adjacent community are not measurably affected by the Seashore acquisition, c.f., Dauphin Island, South Padre Island.

Dauphin Island was selected for case study in part because, as the next island east of the Mississippi islands of the Gulf Islands National Seashore, its development and land values are hypothetically affected by the federal acquisition. However, development on Dauphin antedates acquisition of the Seashore, and its dynamics are wholly independent of the Seashore. Distance from the islands is an apparent factor in that independence. Bridge access is acknowledged as the single most important element affecting potential development on Dauphin. A suit by the Sierra Club and the Natural Resources Defense Council unsuccessfully challenged proposed federal funding of the Dauphin Island bridge. If the challenge had been successful, development on Dauphin would have been sharply curtailed and land values would have continued to be depressed. This impact would have been independent of any effect of federal acquisition of the Seashore.

Principal access to the Padre Island National Seashore is on the north end of the island. No paved road extends the length of the island and most Seashore activity is focused on

the north end. While South Padre Island lies immediately to the south of Padre Island, the two are separated by Mansfield Cut, a ship channel which is unbridged. The northern 29 miles of South Padre Island are undeveloped and without paved roads as of 1980, and as effectively cut off from Padre Island as Dauphin is from the Gulf Islands.

As with Dauphin Island, development on South Padre Island is dependent on causeway access (Queen Isabella Causeway). Development in the 1960s was apparently slowed by local perception of the poor quality (high salinity) of potable water available in South Padre Island. Today, limited availability and cost of water rights are prime deterring factors to development of the north end of the island. These factors are overwhelmingly determinant, not federal acquisition of the Seashore.

In all instances studied initial development of road, bridge, or causeway systems to adjacent communities was financed by private, local, and state interests. Federal participation in the costs of road, bridge, or causeway access, came after private, local, and state commitments and included:

- Improvements and expansion of existing systems
- Replacement of storm-damaged systems

Although the initial development of access was consistently initiated by local governments and developers, there has been substantial federal involvement in funding expansion and improvements of existing access. Examples include: Wright Memorial Bridge across Currituck Sound, Route 158 Bypass through Kill Devil Hills and Nags Head, and Queen Isabella Causeway to South Padre Island as well as the proposal to replace the storm-damaged bridge to Dauphin Island. In addition, the apparently forthcoming expansion of the Torras Causeway to St. Simons Island will use federal Bridge Restoration Funds.

The federal role is explicable historically both in terms of federal strategy and programs. In the cases of the Outer Banks, St. Simons Island, and Sea Island, development began before major federal highway programs were authorized by the Congress. The Federal Aid Highway program is a post-World War II phenomenon. Secondly, federal policy requires state and local initiatives on secondary road systems such as those in the study communities. Hence, as a policy matter federal highway funding would not have been expected in the initial

development of the barrier islands.

Cost information on bridge, road, and causeway systems in the study communities was collected to the extent available from local, state, and federal officials. Those data are displayed in Table 4.

Recent bridge data show sharp increases that not only reflect inflated costs of construction in the 1970s and in 1980, but also different causeway and bridge design. The first bridges across Roanoke Sound and Currituck Sound, and to Pensacola Beach, were wooden. The bridge to Dauphin Island was reinforced concrete with a lift span at the Intracoastal Waterway. The causeways to St. Simons Island and to Sea Island are earth berm construction, with a lift span bridge across the Intracoastal Waterway.

Both state and federal standards now generally require coastal bridges and causeways to be elevated on piers to minimize adverse impacts on wetlands. Moreover, in lieu of drawbridges, bridges crossing the Intracoastal Waterway are being elevated to permit vehicles to cross unimpeded by vessel traffic, and vice versa, and to reduce labor and maintenance costs associated with lift bridges. The bridge at South Padre Island is elevated to an 85-foot minimum vertical clearance above mean sea level. The proposed Dauphin Island Bridge is also designed for 85-foot vertical clearance, rising from a 21-foot high prestressed concrete roadway elevated on piers.

Contemporary design standards result in significantly more costly bridges and causeways than were initially built by local and private interests. For instance, if the Dauphin Island Bridge is completed for the current contract amount, the cost will exceed \$10 million per mile, or 10 times the costs per mile of the first bridge completed in 1955. Such costs imply that future bridge and causeway construction, built to current design standards, may require federal funding of a major share. This conclusion was supported explicitly by a developer and a realtor.

Dewey Benefield, Vice President of the Sea Island Company, stated that such costs "render economically infeasible development of any barrier island that does not already have a causeway." More than any other development group interviewed, the Sea Island Company has assumed privately the costs of roads, causeways, utilities, and urban infrastructure to develop St. Simons Island and Sea Island. However, Mr. Benefield stated that under today's conditions

Table 4. Costs of Access to Study Communities

Location	First Bridge/ Causeway		First Paved Roads		Bridge/Causeway Expansion, Repairs		Purpose of Work
	Cost (Year)		Cost (Year)				
<u>North Carolina</u> Roanoke Sound Bridge	\$140,000 (1928)	NA	NA	NA	NA	NA	New Bridge
Wright Memorial Bridge	NA	NA	NA	\$3,350,000 (1967)			New Bridge
Route 158	--	NA	NA	NA	NA		Improved access, highway safety
Bonner Bridge	\$4,151,000 (1964)	--	--	\$4,000,000 (1980-1981)			Repairs; structural support
<u>Georgia</u> Brunswick-St. Simons (Tortas Causeway)	NA	NA	NA	NA	NA		Expansion to four lanes and elevation proposed
<u>Florida</u> Gulf Breeze- Pensacola Beach	NA (1931) NA (1948)	NA	NA	\$5,000,000 (1974)			New Bridge
<u>Alabama</u> Dauphin Island Bridge	\$3,000,000 (1955)	\$900,000 (1955)		\$40,051,500 (1980-81)			New Bridge
<u>Texas</u> South Padre Island	\$8,598,447 (1954)	NA	NA	\$21,361,242 (1974)			New Bridge
Total	\$15,889,447			\$73,762,242			

Source: Sheaffer & Roland, Inc. - Case Studies.

no public or private corporations or individuals will fund causeways.

Smith Pickett, Jr., whose realty firm specializes in Dauphin Island properties, was asked whether Dauphin Island development could be financed and accomplished by private and local interests as it was 25 years ago, but at today's standards. He responded that the island could be developed without a bridge, but would have to cater to very exclusive development, with access by yacht or private airplane. He doubted that private and local interests would put in a bridge without federal help, and asserted that there is "no way to repeat what is there now" without a bridge, because of the cost.

Water Supply

In several adjacent communities that are on barrier islands, increasing density of development has caused them to rely on mainland sources for water.

Only two communities studied still obtain 100 percent of their potable water from wells on the island, and these systems are being affected by salt water intrusion and infiltration and inflow of polluted water. Both communities have septic system or building moratoria in effect to restrict new development.

Although the original development of each of the case study areas relied upon on-site wells or cisterns for water supply, as development intensified there was a tendency to replace on-site water supply sources with mainland sources via transmission mains built along the islands' causeways and bridges. A corollary to this is that mainland source water supplies were not tapped until automobile access had been provided via bridges and causeways.

The need for off-island water supplies is based upon the limitations of the islands' aquifers and soils to supply fresh water and to absorb septic wastes. Early developments on the islands, prior to automobile access, consisted of sparse and scattered residences, fishing shacks, small resorts and military installations. The low density nature of these developments enabled them to use shallow wells on the islands. In addition, there was enough undeveloped land to allow for wastewater disposal via individual septic systems without risk of water supply pollution. This

arrangement continued until the provision of access to the islands.

After construction of bridges and causeways for automobile access to the islands, development has increased to the point where both the water supply capacity and the waste assimilating capacity of the islands have been exceeded. Thus, it can be argued that the provision of access not only spurs island development but also virtually necessitates the eventual provision of off-island water supply.

On South Padre Island, the limited nature of the islands' fresh water sources resulted in the construction of a mainland water supply source when the first causeway was built to the island in 1952. In Dare County, North Carolina, automobile access preceded the building of an off-island water supply by more than 40 years, reflecting the rather slow development of Nags Head and Kill Devil Hills, and the relatively larger water supply capacity of the area. Nevertheless, by 1977, increased development demands for fresh water, coupled with local pollution of water supply sources, required construction of a regional water supply system using off-island sources.

In the cases of Dauphin Island and St. Simons Island, water supply sources on the islands are still in use. However, these systems use relatively deep aquifers that are not as susceptible to surface pollution as other areas. In addition, the level of development on these islands is still fairly low. Nevertheless, there are already reported deficiencies in both existing water supplies related to salt water intrusion, declining water levels, and surface pollution. Both communities have sewer or septic system moratoria in effect until additional waste treatment capacity or water supply capacity can be obtained.

Availability of water from island or mainland sources has not been a constraint on development in most of the study areas. An exception is South Padre Island where the availability and cost of additional water rights are limiting further development.

In each case study area, water supply was a critical requirement for development and was, consequently, provided to whatever degree necessary in the course of each island's development. The Mobile Area Chamber of Commerce provided funds from the original sale of lots on Dauphin Island for

construction of a water supply system in 1955. This system had adequately served the island until 1979, when capacity problems and hurricane damages were encountered. The Dauphin Island Water & Sewerage Board has proposed system expansions to meet these deficiencies.

Similarly, the communities of Nags Head and Kill Devil Hills met their water supply needs after individual wells became inadequate before 1962. In 1962 the communities built a joint municipal system using both surface and groundwater sources. In 1977, Dare County constructed a regional water supply system which replaced the municipal supply sources, in response to further development pressures in the communities.

The South Padre Island water supply facilities were provided both by the island's developer and by a local water district in several stages. The island is currently served by a transmission main from the mainland which conveys water from the Lower Rio Grande. River water was obtained as a source through purchase of water rights. Current water rights have been judged adequate only for modest future growth. The cost of obtaining additional water rights is considered to be high enough to hinder further development.

Federal expenditures, in the form of low interest loans, grants, and sale of excess property, contributed to establishing or upgrading water supply systems in some of the study areas. Community systems in the Nags Head - Kill Devil Hills area and on St. Simons Island benefited from federal loans and sale of excess property, respectively. Expansions of existing systems in South Padre Island and Nags Head - Kill Devil Hills also received federal grants and loans. A currently planned expansion of the facilities at Dauphin Island awaits similar federal aid.

In the communities studied, federal government assistance has been significant in establishing and upgrading water supply systems. These effects are not due to any one federal program, however. The water supply system installed by the U.S. Navy on St. Simons Island in the 1940s was sold as excess property to the local county government in 1947 and served as the first municipal water supply system for development on the island. The same system is in use today, although state funds will be used for its expansion in the near future.

The communities of Nags Head, Kill Devil Hills, and South

Padre Island obtained federal assistance under two separate programs. The adjacent Outer Banks communities obtained a low-interest, long-term loan from the Farmers Home Administration (FmHA), under the Rural Communities Water & Waste Disposal Systems Program, to finance the communities' first water supply systems jointly. Fifteen years later Dare County took advantage of the same program to obtain both an FmHA grant and loan to finance a regional water supply system; the system was designed primarily to serve the same two communities.

South Padre Island was an unincorporated development when its first water supply system was constructed without federal aid in 1952. After the island was incorporated, a major expansion and upgrading of the water system was carried out in 1977, with partial funding by an Economic Development Administration grant.

Dauphin Island developed its first community water supply system with funds obtained through land sales on the island. To repair damages the system sustained during Hurricane Frederic in 1979, more than \$250,000 in disaster relief funds from the Federal Emergency Management Agency were approved. Realtor Smith Pickett, Jr. noted that further development on the island will require either a mainland fresh water source, or desalination of water. The Dauphin Island Water & Sewerage Board has applied for Department of the Interior funding of a demonstration desalination plant to serve as an expansion to its existing water system.

The case studies show that the pattern of federal assistance to communities for water supply, while not representative of any single or coordinated program, is nevertheless significant for the number of programs through which funding assistance has been available. Cost information on water supply systems in the study communities is presented in Table 5. Of costs totaling \$14.3 million, the federal share was \$2.3 million.

Wastewater Management

In all communities studied, initial development relied primarily on septic systems for disposal of wastewater; as development increased, septic systems tended to exceed the capacity of local soils to assimilate the wastes.

In all study communities, the provision of a complete sewerage system and wastewater treatment facilities

Table 5. Water Supply System Costs in the Study Communities.

Location	Type of Facility	Total Cost Attributable to Study Communities	Federal Share	Federal Agency
North Carolina Kill Devil Hills - Nags Head	Municipal water supply - ground water	\$ 4,073,500 - Guaranteed Loan		FmHA ¹
Georgia	Regional water supply	\$ 4,886,950 - Guaranteed Loan	\$806,350-Grant	FmHA
Alabama Dauphin Island - 1955	Wells, storage tank, distribution lines	\$ 625,000	--	---
- 1980	Proposed expansion	\$ 1,178,000	--	---
- 1980	Proposed desalination plant	\$ 849,000	\$849,000	DOI ²
Texas South Padre Island - 1954	Water Main	\$ 200,000	--	---
- 1954	Water distribution lines, storage tank	\$ 300,000	--	---
Fresh Water District #1 - 1955	Acquisition of water system	\$ 100,000		---
South Padre Island - 1966-1972	Water main installation	\$ 200,000	--	---
Fresh Water District #2 1973	Water system expansion	\$ 1,911,000	\$723,330	EDA ³
Total		\$14,323,450	\$2,378,680	

¹ Farmers Home Administration, Department of Agriculture.

² Department of the Interior.

³ Economic Development Administration, Department of Commerce.

Source: Sheaffer & Roland, Inc. - Case Studies.

has become a requisite for prevention of environmental degradation and for continued development on the islands. Septic system moratoria were in effect in Kill Devil Hills, Dauphin Island, and St. Simons Island when the case studies were conducted.

Early development in the study communities was of very low density and the vast majority of the individual homes, businesses, and resorts used septic systems to treat wastewater. Under the circumstances, septic systems were the least expensive and most trouble-free method of wastewater treatment available. Small package plants with limited sewer systems provided service to a small number of homes on Dauphin Island, a county park facility on South Padre Island, and some of the early residences on St. Simons Island.

As communities became more easily accessible, an increasing number of lots were developed, and seasonal population increased. The rather low waste assimilating capacity of the sandy island soils was eventually exceeded in all of the study communities. Occurrences of surface flows of untreated wastes, groundwater pollution from septic wastes, and migration of wastes into prime coastal waterways became more frequent.

Eventually each of the study communities began to install sewer systems. Several of the larger hotels on South Padre Island installed private "package" wastewater treatment plants. In 1977, a complete sewer system and wastewater treatment plant to serve the entire town was installed with the help of Environmental Protection Agency's Wastewater Treatment Facilities Construction Grant funds.

On the Outer Banks, only private package plants serving small subdivisions or motels are currently in use other than septic systems. Consequently, septic system effluents have been polluting Roanoke Sound. A septic system moratorium is in effect in portions of Kill Devil Hills while a regional sewerage plan to serve both Kill Devil Hills and Nags Head is reviewed for approval and funding by the Environmental Protection Agency.

At St. Simons, a small wastewater treatment plant was installed to serve the Naval Air Base on the island, and also served a small portion of the community outside the base. Following World War II the base was closed, and the treatment plant was declared excess and sold to Glynn County in 1947. St. Simons Island has expanded this sewer system to serve

most of its development. However, the present system has operational difficulties and an upgrading of both the sewer system and the treatment plant is under way with Environmental Protection Agency funding anticipated.

Dauphin Island, currently served primarily by septic systems, is under a septic system moratorium due to septic pollution of the waters of Mississippi Sound. In late 1980, the Water & Sewerage Board had pending Environmental Protection Agency funding of a major expansion of its sewerage system. The federal share would be \$3.5 million; a balance of \$5.6 million is expected to be paid by assessing each lot on the island.

In only one of the study communities were federal monies for wastewater management systems expended as part of the initial costs of development of the islands. The original wastewater treatment plant and sewer system on St. Simons Island was built by the U.S. Navy and sold as excess property to Glynn County in 1947.

Much of the development in the study communities antedated federal water pollution control programs. Also, characteristic development patterns for barrier islands made them ineligible for federal assistance in the initial costs for wastewater management. Federal monies for sewers and wastewater treatment facilities are available for meeting the 20-year needs of existing communities (EPA Facilities Construction Grants), for providing initial facilities to existing incorporated rural communities (Farmers Home Administration) or urban communities (Department of Housing & Urban Development), and for providing new or expanded facilities in areas of pressing economic need (Economic Development Administration). Thus, federal programs are structured to aid only existing communities.

In contrast, development of barrier islands typically began as private residential or resort areas, physically isolated from nearby communities. These developments are therefore not viewed as expansions or annexations of existing developed areas and are not generally eligible for federal wastewater funds. Once established, however, barrier island developments soon grow to the point where increased densities, the need for a centralized sewerage system, and political incorporation tend to occur concurrently. Federal assistance to these communities tends to follow soon thereafter.

Federal funds spent so far in connection with wastewater management in the study communities are: 201 planning funds for wastewater treatment facilities and one construction grant (at South Padre Island). The federal contribution is estimated to be \$3.3 million.

Two of the study areas are currently seeking federal construction grants for new or expanded wastewater treatment facilities:

- Dauphin Island, Alabama \$3.5 million
- Dare County, North Carolina \$7.5 million

Although some degree of coastal surface water and groundwater pollution (attributable to failed septic systems) occurred in some of the study areas before the 1970s, none of the communities perceived that they had a pollution problem which required immediate action. Development of water quality standards and enforcement measures under Federal Water Pollution Control Act Amendments of 1972, and planning efforts under the Coastal Zone Management Act, resulted in recognition of pollution problems by state and federal agencies. Subsequent pressure and incentives induced communities to address these problems.

In 1975 South Padre Island began to plan for installation of sewers and treatment facilities. By 1978 the remainder of the study communities were actively involved in the wastewater facilities planning process. Thus, all of the current wastewater planning and construction activities in the study areas have occurred while the Environmental Protection Agency's Wastewater Facilities Planning and Construction Grant programs have been in effect.

Most of the study community leaders did not object to federal and state pressures to upgrade wastewater treatment. However, some community leaders objected to federal emphasis on centralized sewer systems and an insensitivity to the relationship between such systems and local growth. In communities attempting to control development, control over water supply and wastewater management are powerful tools for local officials to use in directing the course of development. Installation of centralized wastewater treatment facilities removes one of the potential controls, and was cited in at least one community as a negative factor inducing unwanted growth.

Costs of wastewater facilities built or planned in the study communities, with estimated levels of federal participation, are shown in Table 6. The federal share represents almost half of the total costs of \$29.5 million.

Disaster Assistance

Federal disaster assistance funds of at least \$43 million will be expended in two of the study communities as a result of Hurricanes Frederic and Allen. Major disasters had been declared in the remaining states studied between 1953 and 1964, but none were declared in those states from 1965-1980.

Federal disaster assistance programs surveyed in the course of the study provide a limited measure of federal involvement in this area. All Presidential declarations of major disasters were reviewed from May 1953 (the inception of the federal disaster assistance program) to present. Data on the Presidential declarations were divided into two periods: (1) from May 1953 to December 1964 the disaster funding list reported by state as the smallest political unit; and (2) from December 1964 to present, the data are reported and available by state, county, local community, and funding category.

During the period May 1953 - December 1964, there were five disaster declarations involving coastal storms in study communities in North Carolina and Georgia. These included four hurricanes and one major storm in North Carolina, and one hurricane in Georgia. Federal disaster assistance payments to the state and communities totalled \$9,690,946 in North Carolina and \$1,309,782 in Georgia:

	<u>Declaration Date</u>	<u>Presidential Fund Expenditures</u>	<u>Type Storms</u>
<u>North Carolina</u>	Oct. 17, 1954	\$1,290,939	Hurricane
	Aug. 13, 1955	\$5,254,396	Hurricanes
	Oct. 1, 1958	\$ 846,588	Hurricane
	Sept 12, 1960	\$1,209,420	Hurricane Donna
	Mar. 16, 1962	<u>\$1,089,604</u>	Northeastern (Ash Wednesday Storm)
	Total	\$9,690,946	
<u>Georgia</u>	Sept.10, 1964	\$1,309,782	Hurricane Dora

Table 6. Costs of Wastewater Facilities in Study Communities.

Location	Type of Facility	Total Cost Attributable To Study Communities	Federal Share	Federal Agency
<u>North Carolina</u>				
Ocean Acres Subdivision, Kill Devil Hills	Small sewer system and package plant for subdivision	--	NA	NA
Dare County	Regional sewerage and treatment system to serve both Kill Devil Hills and Nags Head	\$10,198,150	\$ 5,716,000	EPA
<u>Georgia</u>				
St. Simons Island	U.S. Naval facilities	--	100%	U.S. Navy
St. Simons Island	Package plant addition	\$ 845,000	0	NA
St. Simons Island	Sewer system and treatment plant expansions	\$ 4,535,000	\$ 1,200,000	EPA
<u>Alabama</u>				
Dauphin Island	Small sewer system and package plant	--	NA	NA
Dauphin Island	Repairs to existing system	\$ 250,000	\$ 250,000	FEMA
Dauphin Island	Sewer system and treatment plant expansions	\$ 9,242,918	\$ 3,512,000	EPA
<u>Texas</u>				
South Padre Island	Small sewer system and package plant	--	NA	NA
Cameron County	Regional sewer system and treatment plants	\$ 4,400,000	\$ 3,300,000	EPA
Totals		\$29,571,068	\$13,978,000	

Source: Sheaffer & Roland, Inc. - Case Studies

Note that the damages in North Carolina were incurred before the major development of the Outer Banks. Storms of those magnitudes today would cause significantly greater damage.

After December 1964 the survey revealed no major flood disasters in Dare County, North Carolina or in Glynn and Camden Counties, Georgia. This reflects a remarkably quiescent 16-year period in major storm activity in this area. Major disasters have been declared in the two Gulf of Mexico study areas during that same period, associated with Hurricanes Camille (August 1969), Frederic (September 1979), and Allen (August 1980).

Information on these three hurricanes was available from the Corps of Engineers for Hurricane Camille, and the Federal Emergency Management Agency for Hurricanes Frederic and Allen. The study team was unable to obtain physical disaster loan data from the Small Business Administration, nor data from other agencies which may have expended funds following Hurricane Allen. As a result, the materials available only partially reflect the total federal expenditures for these storms in the study areas.

In the aftermath of Hurricane Camille (one of the most severe storm ever to strike the continental United States), major disasters were declared covering counties in Louisiana, Mississippi, and Alabama. Although Mississippi bore the principal damage, at Dauphin Island the storm barely qualified as a hurricane. Nevertheless, gusts of minimal hurricane force (75 mph) and tides of 5 - 9 feet caused light to moderate damage. The After-Action Reports of the Corps of Engineers estimate that nearly 2,800 acres of the island were flooded. Available reports tended to estimate dollar damages, and only a few reported federal dollars expended. The Corps reported that nearly \$21,000,000 was spent for debris removal in all counties, including \$48,800 spent for all of Mobile County. The Corps also reported a cost of \$21,200 to clear obstructions and remove shoals in Dauphin Island Bay. While the data available are not specific to Dauphin Island, the study team concluded that less than \$100,000 in federal funds was expended on Dauphin following Hurricane Camille.

Hurricane Frederic passed over the west end of Dauphin Island near midnight, September 12 - 13, 1979, inflicting severe flooding and wind damages on the island. There was

severe destruction and damages were experienced as far east as Gulf Shores, Alabama, and light-to-moderate flooding and damages in Pensacola Beach.

Federal reimbursements identifiably applicable to Dauphin Island from the Federal Emergency Management Agency totaled \$1,182,427. These included expenditures for debris clearance, protective measures, water control facilities (e.g., seawalls), public buildings, public utilities, and miscellaneous utilities and services. They are detailed in Table 7.

Expenditures on Dauphin Island for sand removal, repairs to county roads, and resurfacing of local streets were included in overall Mobile County applications for debris removal and road systems. The county engineer of Mobile County provided estimates of these costs allocable to Dauphin Island:

Sand removal	\$ 719,000
County road repairs	\$ 842,450
Resurfacing local street	<u>\$ 210,800</u>
Total	\$1,772,250

An additional \$51,500 was expended for repairs to the airport on Dauphin Island, reimbursed from Federal Emergency Management Agency funds.

The overwhelming public expense on Dauphin is the cost of the storm-damaged Dauphin Island bridge and causeway. These costs, 100 percent of which are being funded by the Federal Highway Administration, are estimated to be:

Demolition and removal of bridge	\$ 5,000,000
Construction of new bridge	\$33,000,000
Temporary ferry service	<u>\$ 2,000,000</u>
Total estimated cost	\$40,000,000

Hurricane Allen, the first hurricane of the 1980 season, struck the Texas coast on Padre Island, north of South Padre Island. That landfall placed South Padre Island on the left side of the storm, fortunately reducing the damages that they most assuredly would have experienced if the storm had struck south of the city. Nevertheless, the city applied for nearly \$400,000 in disaster relief funds, three-quarters of which was reimbursed by the Federal Emergency Management Agency,

Table 7. Federal Funds for Disaster Response and Recovery, Bridge Construction, and Airport Repairs - Hurricanes Camille, Frederic, and Allen.

Purpose of Expenditure	Hurricane Camille		Hurricanes Frederic and Allen			
	Funding Agency	Mobile County	Dauphin Island	Mobile County (Dauphin Is.)	South Padre Island	
Bridge Demolition and Clearance	COE ²	0	\$ 5,000,000	0	0	0
Bridge Construction	COE	0	33,000,000	0	0	0
Airport Repairs	COE	0	51,500	0	0	0
Ferry System	COE	0	2,000,000	0	0	0
Debris Clearance	COE	\$ 48,000	315	\$ 719,000	\$	48,287
Protective Measures	COE	0	75,388 ⁵	0	0	37,683
Road Systems	COE	0	0	1,053,250	0	244,259
Water Control Facilities	COE	NA	0	18,000 ⁵	0	59,562
Public Buildings	COE	5,000	57,438	544,094 ⁶	0	4,565
Public Utilities	COE	4,900	487,282	0	0	0
Other	COE	21,200	0	0	0	1,459
Subtotal Application	COE		\$1,182,427	\$1,172,250		395,815
Total Approved	COE	\$100,000	\$41,233,927	\$1,172,250		\$296,861 (75%)

¹Portion of disaster funds approved for Mobile County and allocable to Dauphin Island, according to County Engineer, Mobile County.

²Corps of Engineers, Department of the Army.

³Federal Highway Administration, Department of Transportation.

⁴Federal Emergency Management Agency, Federal Insurance Administration.

⁵Includes protective measures for damages sustained by Marine Environmental Science Consortium.

⁶Damage to water and sewer systems.

Source: Data for Hurricane Camille from Corps of Engineers; data for Hurricanes Frederic and Allen from Federal Emergency Management Agency, Office of Disaster Response and Recovery; other agencies, such as the Small Business Administration, may have expended funds after Hurricane Allen, but these data were not available.

under the newly instituted cost-sharing policy of the Agency. Distribution of the costs is displayed in Table 7.

Flood Insurance

Flood insurance coverage in the study communities currently exceed \$578 million. Claims totalling \$17.8 million were paid in the study communities in the period January 1978 to November 1980. Sharp increases in the total number of policies and total flood insurance coverage were noted following Hurricanes Frederic and Allen.

Flood insurance is perceived in most of the study communities as a positive force in obtaining financing where it is needed. Only at Sea Island was flood insurance perceived as insignificant in financing, largely because of the wealth of most individual property owners.

Five of nine communities or counties studied are in the regular program of the National Flood Insurance program. In these five communities, new construction appeared to comply with the Program's first floor elevation requirements for a 100-year storm surge level.

The study communities' status in the National Flood Insurance Program, including total number of policies and total amount of insurance is depicted in Table 8. As of November 1, 1980, 11,812 flood insurance policies (under the regular program or the emergency program) were in force in the nine communities and counties. Coverage totaled \$578.56 million. The average policy amount is \$48,981 for the nine communities.

Claims payment data for the years 1978 - November 1980 are also depicted in Table 8. In that roughly three-year period more than 1,800 claims were paid in the total amount of \$17.81 million, for an average claim of \$9,850. Approximately 98 percent of those claims related to damages incurred in Hurricanes Frederic (1979) and Allen (1980). When all other claims payments are removed from the data, the average claim payment was \$10,075; all other claims averaged just one-half of that, or \$5,023.

Data presented in Table 9 compare communities in the regular and emergency programs with national experience in the National Flood Insurance Program between January 1978 and April 1980. Although strictly coastal data could not be

Table 8. Flood Insurance in Force and Claims Paid in Study Communities (As of Nov. 1, 1980).

Community	Program ¹ Status	Number of Policies	Amount of Insurance	Year of Flood	Claims Paid	Amount Paid	Average Claim
Dare County, NC	R	2,252	\$107,475,700	1978	9	\$ 5,053	\$ 561
				1979	1	502	502
				1980	15	71,259	4,751
Kill Devil Hills, NC	R	1,214	67,486,100	1978	7	2,760	394
				1979	0	0	0
				1980	11	39,529	3,594
Nags Head, NC	R	1,298	79,804,700	1978	0	0	0
				1979	0	0	0
				1980	15	271,336	18,089
St. Matys, GA	E	57	1,856,400	1978	0	0	0
				1979	0	0	0
				1980	0	0	0
Camden County, GA (1/31/80)	E	31	1,005,500	1978	0	0	0
				1979	0	0	0
				1980	0	0	0
Glynn County, GA	E	2,018	83,303,800	1978	0	0	0
				1979	0	0	0
				1980	0	0	0
Pensacola Beach, FL	R	1,419	92,818,700	1978	1	1,146	1,146
				1979	550	3,862,328	7,022
				1980	1	1,471	1,471
Mobile County, AL	R	2,441	97,706,800	1978	5	3,849	770
				1979	861	10,763,918	12,502
				1980	42	342,980	8,166
South Padre Island, TX	E	1,082	47,107,400	1978	5	3,031	606
				1979	1	860	860
				1980	283	2,440,543	8,624
Total		11,812	\$578,565,100		1,807	\$17,810,605	\$9,850

¹ National Flood Insurance Program Status: E = Emergency Program; R = Regular Program

² Payments related to Hurricane Frederic: Pensacola Beach, 538 payments totaling \$3,849,644.

³ Payments related to Hurricane Allen: Mobile County, 836 payments totaling \$10,718,059.

Source: Federal Emergency Management Agency, Federal Insurance Administration, Washington, D.C.

Table 9. Comparison of National Flood Insurance Experience with Experience in Study Communities Between 1978 and April 1980.

	National Flood Insurance Experience ¹ (1/1/78 - 4/23/80)		Experience in Study Committee ² (1/1/78 - 3/31/80)	
	Zones A1-30, V ³ , V ⁴	V Zones	Regular Program	Emergency Program
Number of Policies	578,845	56,401	7,577	2,700
Total Insurance in Force	\$26,945,323,000	\$3,557,353,900	\$335,967,200	\$99,400,000
Average Policy in Force	\$46,550	\$63,072	\$44,340	\$36,015
Total Paid Claims	24,967	2,199	1,518	6
Total Claims Payment	\$184,959,850	\$23,526,261	\$15,366,151	\$3,911
Average Claim Payments	\$7,408	\$10,698	\$10,123	\$652

¹ Columns headed "Zones A1-30, V" and "Emergency" contain both coastal data (an estimated 10 percent) and riverine data (about 90 percent). Strictly coastal data could not be separated. The only purely coastal data under "National Experience" are "V Zones."

² The "Regular Program" data under "Experience in Study Communities" include both "A Zone" and "V Zone" data which could not be separated.

³ "Zones A1-A30" are areas of special flood hazards with base flood elevations determined. Zones assigned according to flood hazard factors.

⁴ "V Zones" are coastal high hazard areas with high wind velocity that are inundated by tidal floods. Zones assigned according to flood hazard factors.

⁵ Study community emergency data do not include Hurricane Allen data; Allen occurred in August 1980, after the time period of this comparison. Statistics with Hurricane Allen coverage included are: Total Claims paid, 289; Total Claims Payment, \$2,444,454; Average Claim Payment, \$8,458.

Source: Data for national experience from Federal Emergency Management Agency, Federal Insurance Administration, "Loss & Expense Experience, January 1, 1978 - April 23, 1980, Exhibit II, Sheet 1." Data for study communities from Federal Emergency Management Agency, National Flood Insurance Program. Compiled by Sheaffer & Roland, Inc.

separated (see note to table), average Policy In Force data strongly suggest that buildings in the regular program communities were underinsured when compared to the national experience in V Zone areas (coastal high hazard areas with high wind velocity, vulnerable to inundation by tidal floods). The average claim payments in the regular program communities were also comparable to national V Zone experience. Thus, although the study communities contain both V Zone areas and areas of less hazardous flood conditions (A Zone areas), their damage experience approaches the purely V Zone experience on a national level. In view of the long history of coastal storms in the study communities in the regular program, one would anticipate that flood insurance coverage would be higher than it is. In South Padre Island, the data on the average policy in force in the emergency program reflect an unusually high number of condominiums and commercial structures (486) in comparison to single family dwellings insured.

The regular program communities (Kill Devil Hills, Nags Head, Dare County, Pensacola Beach, and Mobile County) had average claims payments experience slightly less than the national average for V Zones. They included claims for damage from Hurricane Frederic in Mobile county (\$12,502 average claim) and Pensacola Beach (\$7,022 average claim) and damage from a northeaster that struck the North Carolina coast in the winter of 1980, destroying three homes in Nags Head and resulting in average claims of \$18,089 in that community.

The inclusive date of Table 9 stopped four months before Allen occurred. Average claims experience with Allen included in the emergency program data is \$8,458, nearly 75 percent greater than the national emergency program experience.

Sharp increases in the number of policies in force and total flood insurance coverage were noted in the study communities that had experienced major storms. Flood insurance data immediately preceding Hurricanes Frederic and Allen were collected for Mobile County, Pensacola Beach, and South Padre Island, and are compared to the November 1, 1980 flood insurance data in Table 10.

Combining the three communities, the number of policies increased 34 percent and policy coverage increased 56 percent after the storms. The largest gains were in Mobile County, where Hurricane Frederic amply demonstrated the need for more widespread coverage; the number of policies increased by 57

percent (888 new policies), but the average policy amount increased only \$1,875, or less than 5 percent, in Mobile County. The Pensacola Beach and South Padre Island data indicate nearly total penetration of the market in number of policies, but structures are distinctly underinsured. Of the three communities, Pensacola Beach registered the highest increases in average policy amounts, with policies increasing nearly \$18,300 or 38 percent. Average policy amounts for the three communities combined increased 16 percent from \$41,283 to \$48,084.

IMPLICATIONS FOR FEDERAL POLICY

The insights gleaned from this study have a number of implications for federal policies toward development or protection of barrier islands. For comparison purposes, it is helpful to juxtapose a "protection" policy against a "development" policy. The study offered insights into the costs of a federal development policy in three of the study areas, corroborating at least in these instances estimates previously made of the costs of current federal programs projected to development of the remaining undeveloped, unprotected barrier islands.

Development Policy

Current federal programs can be characterized as part of a federal development policy. They support development, effectively leveraging private development money by shifting to the public sector portions of the costs of bridges, roads, causeways, water supply systems, wastewater treatment systems, shore protection, disaster relief, and flood insurance. The dimensions of that support are suggested in three of the study areas where federal expenditures were documented: Nags Head and Kill Devil Hills, Dauphin Island, and South Padre Island. When federal expenditures are distributed according to developed acreage in the study communities, the federal expenditures represent an average subsidy of \$25,570 per acre in actual dollars expended over a number of years. (See Table 11.) When restated in terms of 1980 replacement costs, the federal subsidy in the three study areas amounts to \$53,250 per developed acre.

The sample area from which the federal expenditures have been drawn may or may not be representative of coastal communities similarly situated. However, the figures are consistent with estimates prepared by Sheaffer, Miller, and Rozaklis in their 1980 testimony before the House of Representatives and the U.S. Senate on then pending barrier island legislation.⁸ The subsidy estimates also are consistent with Miller's subsequent modifications to reflect the reduction in undeveloped, unprotected barrier island acreage in the National Park Service's August 1980 inventory.⁹

Table 12 shows estimates of the potential costs of developing remaining barrier islands, based on the present worth of current federal programs. It uses the National Park

Table 11: Federal Expenditures in Three Study Areas (Nags Head and Kill Devil Hills, NC; Dauphin Island, AL; and South Padre Island, TX) in Relation to Developed Acreage

Purpose of Federal Expenditures	Amount of Expenditures
Bridge/causeway expansion, repairs	\$33,710,742
Water supply systems	2,378,680
Waste water Management	13,978,000 ¹
Disaster response & recovery	43,403,038 ²
Flood insurance subsidy	<u>3,283,736</u>
<u>Total Federal Expenditures</u>	\$96,754,196
Total developed acreage	3,784 ³
Average federal expenditure per developed acre	\$25,570

¹ Includes \$40,051,500 attributable to Dauphin Island Bridge/Causeway.

² The flood insurance claims totaled \$17,810,605 in the study communities. Federal subsidy is based on an average subsidy of \$278 per policy experienced nationwide during the period 1978 - 1980, times 11,812 policies in force in the study community.

³ Study community developed acreage:

Nags Head, NC	1,095
Kill Devil Hills, NC	900
Dauphin Island, AL	289
South Padre Island, TX	<u>1,500</u>
Total developed acreage	3,784

Source: Compiled by Sheaffer and Roland, Inc. using expenditure data from Tables 4 through 9.

(M)

Table 12. Estimated Potential Costs of Developing Barrier Islands in April 1980 Inventory,
Based on Present Worth of Current Federal Programs.

Federal Assistance Programs	Low Development Case ¹		High Development Case ²	
	Estimated Federal Costs (\$ Billion)	Percent of Federal Costs	Estimated Federal Costs (\$ Billion)	Percent of Federal Costs
Sewers and Wastewater treatment	\$1.20	29	\$3.61	32
Water supply	.68	16	2.00	18
Roads, bridges, causeways	1.11	27	2.77	25
Disaster relief	.42	10	1.31	12
Flood insurance	.25	6	.79	7
Shore protection, maintenance, flood control	.47	11	0.72	6
Total	\$4.13	100	\$11.20	100

¹ Assumes development related to the 160,000 acres of undeveloped uplands in the National Park Service's April 1980 Inventory of Undeveloped, Unprotected Barrier Islands.

² Assumes development related to all undeveloped acreage (about 480,000 acres of uplands, wetlands, and interior waters) in the April 1980 Inventory.

Source: High estimates -- "Barrier Islands Purchase: A Cost-Effective Approach to Management." Testimony of John R. Sheaffer and Louis Rozaklis before the House Committee on Interior and Insular Affairs, Subcommittee on National Parks and Insular Affairs, on HR 5981, March 27, 1980.

Low estimates -- Statement of John R. Sheaffer, H. Crane Miller, and Louis Rozaklis, Sheaffer & Roland, Inc., before the Committee on Energy and Natural Resources, United States Senate, concerning S. 2686, June 12, 1980.

Service's April 1980 inventory, showing 480,000 acres of undeveloped, unprotected barrier units, consisting of uplands, wetlands, and interior waters. The estimates assume the development of the upland portions of the island and the dredging and filling of as much as 60,000 acres of wetlands for development purposes. The low estimates assume development of 160,000 acres of uplands only, and omit wetlands and interior waters from the calculations.

Since the analyses for Table 12 were prepared, the National Park Service revised its April 1980 inventory of barrier islands. The August 1980 inventory removed nearly 200,000 acres (almost 43 percent) from the undeveloped, unprotected category. Approximately 108,000 acres in Texas and 39,000 acres in Louisiana formerly included in the category did not fully fit the definition of a barrier structure. Another estimated 45,000 acres were found to be in a protected status, and about 4,300 acres were reclassified as being developed land.

Table 13 shows Miller's adjusted estimates reflecting the reduction in unprotected, undeveloped acreage. The estimated cost to the federal government of funding barrier island development under current programs could range from \$2.46 to \$6.05 billion over the next 20 years.

Protection Policy

A fairly wide range of "protection" strategies, of varying cost and effectiveness, are available to the federal government. Under a protection policy, it would be necessary to distinguish between two distinct status quo conditions:

1. "Noncontiguous" barrier islands that are totally or almost wholly undeveloped, that are not immediately adjacent to developed areas, and that are accessible principally by boat (an estimated 138,100 acres);
2. "Contiguous units" -- undeveloped barrier units immediately adjacent to totally or partially developed areas, and generally accessible by roads, bridges, or causeways (an estimated 138,000 acres).

Another 885,000 acres are currently in the public domain and are considered "protected" from development, and an estimated 280,000 acres are totally or partially developed. The acreage in the public domain are excluded from these policy

Table 11. Estimated Potential Costs of Developing Barrier Islands in August 1980 Inventory,¹
Based on Present Worth of Current Federal Programs.

Federal Assistance Programs	Low Development Case ²		High Development Case ³	
	Estimated Federal Costs (\$ Billion)	Percent of Federal Costs	Estimated Federal Costs (\$ Billion)	Percent of Federal Costs
Sewers and wastewater treatment	\$.70	29	2.03	34
Water supply	.40	16	1.13	19
Roads, bridges, causeways	.86	35	1.50	25
Disaster relief	.25	10	.73	12
Flood insurance	.15	6	.45	7
Shore protection, maintenance, flood control	.10	4	.21	3
Total	\$2.46	100	\$6.05	100

¹ August 1980 National Park Service Inventory of Undeveloped, Unprotected Barrier Islands; in this revision of the April 1980 Inventory, total acreage classified as undeveloped and unprotected was reduced by about 200,000 acres. (See text.)

² Assumes development related to the remaining 90,000 acres of undeveloped uplands in the August 1980 Inventory.

³ Assumes development related to all remaining undeveloped acreage (about 277,000 acres of uplands, wetlands, and interior waters) in the August 1980 Inventory.

Source: H. Crane Miller, "Federal Policies in Barrier Island Development," OCEANUS, Vol. 23, No. 4, Winter 1980-81, Woods Hole Oceanographic Institution.

considerations.

Federal policy to protect the barrier islands must evolve from the starting position of current programs weighted by subsidy and financial assistance toward development, but somewhat offset by federal standards and regulations that attempt to mitigate known hazards and environmental problems.

Undeveloped, noncontiguous barrier islands present the greatest range of opportunity for protecting and preserving the islands: (1) by regulation of access; (2) by withdrawal of federal subsidies; and (3) by public acquisition. The opportunity to protect is greatest before development begins; enforcement of strong federal policies on issuance of bridge permits could effectively preclude extensive development and protect the noncontiguous islands without public acquisition. Each subsequent stage of development diminishes the potential effectiveness of federal, state, and local regulations and increases the federal financial assistance and subsidy to the community that would be required to mitigate or to "correct" adverse conditions. Hence, a critical focal point for a federal protection policy toward the remaining undeveloped barrier islands lies with the undeveloped, noncontiguous barrier islands.

Protecting Noncontiguous Barrier Islands

The critical focal point for a federal protective policy toward the remaining undeveloped, noncontiguous barrier islands is road, bridge, and causeway access.

Low-lying and vulnerable to complete inundation from storm surge, assaulted by wave action, storm scour, long-term erosion, as well as by high winds, barrier islands can be hostile environments for human settlements. The natural dynamics of barrier islands, particularly on the ocean front, directly oppose the human need for stability to protect property. Thus, a federal protective policy toward the remaining undeveloped, noncontiguous barrier islands would logically seek to retain the islands in their natural condition, and to prevent or inhibit development. Taking effective action before development begins can make the difference between a protection policy that is both cost-effective and environmentally-effective, or a policy that espouses protection but is coupled with development that inexorably draws increased federal involvement and cost.

The experience of the study communities demonstrates that without road access little or no development took place.

With road access the opportunity to develop opened, and development followed. Once a commitment was made to a bridge or causeway, whether funded privately, locally, or by the state, and once development reached a level wherein issues of safety, environmental degradation, and public health became paramount, federal involvement was virtually foreordained and politically irresistible. The scenario was repeated on the Outer Banks, at Dauphin Island, at South Padre Island, and is in process at St. Simons Island. The key is access.

A Federal protection policy will be enhanced by continuing the historic federal position of not participating in the initial costs of barrier island access and other urban infrastructure.

Until the current federal subsidy programs were enacted in the post-World War II era, particularly during the decade of the 1970s, initial development costs on barrier islands were borne by private interests, local or state governments, or combinations thereof. This was the case in each of the study communities which had acquired bridge or causeway access: Kill Devil Hills and Nags Head, St. Simons Island and Sea Island, Pensacola Beach, Dauphin Island, and South Padre Island. Local or state revenue bonds, land sales, private capital, or other financing measures were used to finance the initial access and urban infrastructure required to support development. The lack of federal assistance in those years was not a constraint; building costs were lower than today and building requirements not as stringent.

The amount, density, and types of development in the study communities and prevalent along the Atlantic and Gulf of Mexico coasts could not have taken place without bridge, causeway, and road access. Except for very limited amounts of exclusive development accessible only by boat or private airplane, development on the barrier islands is characterized by the ease of access by automobile.

Development of most undeveloped, noncontiguous barrier islands could be effectively regulated if bridge/causeway permits were (1) denied or (2) granted subject to enforced federal standards and no federal subsidization.

Since each bridge/causeway complex that crosses navigable

waters of the United States is subject to a bridge permit from the U.S. Coast Guard, issuance of bridge permits has played a pivotal role in the development of the barrier islands. Federal regulatory authority over bridge permits is uniquely strong, by virtue of the navigation servitude under the Commerce Clause of the Constitution of the United States. Denial of a bridge permit would effectively preclude most extensive development of barrier islands. Conditions on Dauphin Island since Hurricane Frederic are dramatic evidence of the dependence of most beach resort development upon bridge and causeway access. However, permit denial may well be a politically unpalatable or untenable option, in which case a grant of permit subject to federal standards and conditions could also be effective in controlling development.

Federal policy on bridge and causeway permits could require compliance with federal standards and permit conditions, and prohibit federal cost sharing of construction, improvements, repairs, or replacement except under stringent exceptions.

Federal standards now require elevation of a prestressed concrete roadway across wetlands and a single high span across the Intracoastal Waterway. The capital costs of building this type of bridge/causeway system currently range from \$10 - \$30 million per mile. Since the noncontiguous islands range an average of 2.5 to 5.3 miles from the nearest mainland road system on the Atlantic and Gulf of Mexico coasts respectively, the costs of access by bridge or causeway add several tens of millions of dollars to any potential development. Imposing bridge/causeway costs on the private sector would greatly affect the economics of barrier island development, making much of it on the noncontiguous islands economically infeasible. Few municipalities or states would fund such facilities at such costs without federal funding assistance or assurance of revenues from the resort far greater than could be generated by the typical beach resort with single family cottages, motels, and a seasonal, tourist-dependent economy. Relatively few of the remaining noncontiguous islands would be suitable for intensive, high-rise development, gambling facilities a la Atlantic City, or other intensive, revenue-producing development. Thus, in a great majority of the cases, imposition and enforcement of stringent federal standards for bridge/causeway design and construction and withdrawal of federal highway and bridge funds could be effective as a protective policy.

It is self-evident that bridges and causeways are the

necks of the funnels leading to and from the barrier islands. From a regulatory perspective, control of the neck of the funnel can effectively control whether development takes place initially.

Regulating Contiguous Barrier Units

Along the Atlantic and Gulf Coasts there are about 139,000 acres of undeveloped uplands, wetlands, and interior waters contiguous to totally or partially developed areas. These contiguous units -- by definition -- are near existing roads and urban infrastructure. Recent estimates by Sheaffer & Roland, Inc., show existing roads within an average of 0.4 miles of the undeveloped lands along both coasts, with more than 40 of the 85 units surveyed having access immediately adjacent to or through the undeveloped property. These conditions imply effective loss of the federal regulatory tool potentially most effective to control development on the barriers -- control of bridge and causeway access.

The study communities show a propensity for development to the greatest extent possible, pushing road systems, water supplies, and wastewater management to their limits. Federal involvement tends to increase with population densities and with each program that increases the capacity of individual systems to accommodate growth. Enlargement of a road system to accommodate traffic induces housing development, which in turn must be accommodated with increased water supply and wastewater management capacity. Ensuing development tends to exceed the built capacity of the infrastructure, leading to another round of expansion, upgrading, replacement, and reconstruction. Where the first round of development was characterized by single family dwellings, the second round tends to be characterized by higher density uses -- motels and condominiums, c.f., Pensacola Beach, Florida. Each successive round increases potential federal costs under current programs.

On undeveloped contiguous barrier units, federal regulations will generally not prevent or inhibit development in the long term, but can reduce or mitigate some potential adverse consequences.

In the case of contiguous barrier units, regulation implies minimum standards for development, e.g., property elevation requirements of the National Flood Insurance Program, and temporary curtailment of development where health, safety, or other standards are not met, e.g., septic

system moratoria at Dauphin Island and St. Simons Island. Emphasis, nevertheless, is upon development; exercise of the police power to regulate building practices and land uses is not intended to and will rarely prevent development.

On the noncontiguous barrier islands, imposition of federal bridge standards and removal of federal highway and bridge funds could effectively prevent development of most of the noncontiguous islands. The rationale is predominantly economic -- added capital costs of access, built to federal standards without federal subsidy, will make most beach resort developments economically infeasible. In the contiguous areas that powerful rationale has been removed to a large extent -- by definition, access and other urban infrastructure to support development are near at hand, reducing substantially the costs necessary to initiate development in those areas.

What of the added costs imposed by regulations? Regulations such as those of the National Flood Insurance Program unquestionably add to the capital costs of insurable structures to the extent that local building practices do not meet the Program's minimum standards. However, the experience of the Program shows that its current regulations do not prevent development, and that in many areas people's expectations with respect to beach houses and oceanfront construction includes structures elevated on pilings, if not for reduced flood hazards, then for such aesthetics as a clear view of the ocean. As the Program gains more experience with the dynamics of coastal systems--high storm surge, wind-driven waves, storm scour, long-term erosion, high winds, and battering by debris -- its regulations will necessarily become more stringent. But the added costs imposed by the regulations cannot be reasonably expected to prevent development. They are not designed to do so.

In the case of regulations requiring elevation of structures to the wave crest level in coastal high hazard areas, it has been shown that the most or all additional capital costs to comply can be recovered by reduction of flood insurance premiums and by reduced average annual flood losses. For instance, elevation of houses to the wave crest level will increase piling, bracing, and other costs of oceanfront properties, but will result in significantly lower flood insurance premium costs than would have to be charged actuarially if the houses were elevated only to the 100-year storm surge level. Moreover, the added capital costs of the flood insurance regulations (e.g., \$3,000 - \$8,000 estimated for a 2,000 sq. ft., one story, single family house,

depending on the foundation and bracing system chosen} decrease in significance as property values escalate.¹⁰

From a national perspective, the importance of the minimum federal standards is their potential of reducing average annual flood losses. Properly managed, barrier islands can play an important role both in contributing to reduction of flood losses and in the federal policy of encouraging wise use of the nation's flood plains. Federal standards are an integral part of the effort to minimize flood losses to the extent practicable and to restore and preserve the natural and beneficial values served by flood plains. If the goal "to achieve an absolute decline in communities' average annual flood losses due to unwise flood plain use" is to be achieved,¹¹ federal standards and regulations, such as those of the National Flood Insurance Program are essential. But it should also be recognized that those standards and regulations will not be adequate alone to achieve "an absolute decline in communities' average annual flood losses".

Implementation of federal regulations such as those of the National Flood Insurance Program can significantly reduce flood losses below those that would be experienced if the standards were not applied. Throughout the study communities there was strong evidence of the positive impact of the elevation requirements of the National Flood Insurance Program. As no other program, the National Flood Insurance Program has succeeded in making communities, financial institutions, building officials, developers, and consumers aware of flood hazard potentials. However, design to the 100-year storm event can only reduce building losses for storms up to the design and safety limits of the structures. For example, a house built in a coastal high hazard area and elevated to the wave-crest level associated with a 100-year storm (as much as 55 percent higher than the storm surge level associated with such a storm) should be protected against wave forces to that height. But assuming a 50-year life expectancy for a coastal home, there is a relatively high possibility of a greater storm during that period (1-in-4 possibility of a 200-year event, that is, slightly greater than Hurricane Camille). A storm that exceeds the design limits of the structures then can produce catastrophic results.

The problem presented by the undeveloped contiguous barrier structures is that their development, even to federal standards, increases the potential for catastrophic loss in storms that exceed the design and safety limits of the

structures. In addition, their development implies losses to their supporting urban infrastructure, probably from storms of lesser magnitude than the 100-year storm. Such losses may more than offset the otherwise beneficial effects of the regulations, and lead to the conclusion that the regulations alone are not adequate to produce an absolute decline in average annual flood losses.

Removal of federal subsidies for contiguous barrier units development can be expected to inhibit but not prevent development of those contiguous areas.

The availability of federal subsidies for access and urban infrastructure can enhance any development, and in certain instances can be the difference between an economically feasible project or one that is not. Removal of the federal subsidies will have the effect of shifting significant portions of development costs from the federal to the state, local, or private sectors, and could radically alter the economic feasibility of a given project. This will be especially so for the undeveloped noncontiguous barrier islands.

The undeveloped contiguous barrier structures present a different problem. In some instances, such as the 411-acre undeveloped Epstein tract in Nags Head, roads and municipal services run through the property, and major capital costs for infrastructure have already been expended. In other communities, the road and water supply system may need only to be extended, e.g., the north end of South Padre Island, or the north end of St. Simons Island. In such instances the removal of federal subsidies may inhibit or curtail development for a time, but is not expected to be a protective device in the long-term. Because these areas are so near to access and urban infrastructure, the capital costs of extending these services for development purposes are significantly less than for the initial development of a noncontiguous area. In most such instances it will be economically feasible for developers to provide the local streets and to extend water and electrical service to permit development. Streets will in most cases be donated to the local government in return for the local government's assumption of the costs to repair and maintain the roads.

Thus, the principal effect of removal of federal subsidies on the undeveloped contiguous barrier structures is expected to be a reduction in federal costs for expansion, upgrading, replacement, and reconstruction of access and urban infrastructure. But because development can be

expected to continue despite withdrawal of the federal funds, increased disaster relief and flood insurance costs are anticipated unless these programs are modified and their hazard mitigation aspects strengthened.

Benefits of an Acquisition Policy

A federal protection policy will be strengthened by authority and appropriations to acquire both undeveloped contiguous and noncontiguous barrier islands. Public acquisition of the islands is cost-effective, and the surest means to protect barrier islands from inappropriate development.

The estimated costs of current federal development policies for the remaining undeveloped barrier islands range from \$25,800 - \$26,400 per acre for the low acreage to \$43,700 - \$46,700 for the high acreage. In contrast, the acquisition costs of the National Seashores included in this study ranged from a low average purchase cost per acre of \$75.35 at Cape Hatteras between 1950 and 1954, to \$4,950 per acre at the Gulf Shores National Seashore between 1970 and 1974. Using an average acquisition cost of \$5,000 per acre, Sheaffer, Miller, and Rozaklis estimated that the cost to the federal government to continue its current development programs on the undeveloped barrier island would be more than five times greater than the costs of public acquisition of those islands. (See Table 14.)

Under a public acquisition program, priorities can be divided generally between contiguous and noncontiguous barriers. In many, if not most, instances, first priority should be given to purchase of undeveloped contiguous units, based on such objective factors as physical characteristics, resource values, and threats to those resource values (imminent development, pollution, loss of habitat, loss of open space, etc.). Moreover, noncontiguous units are less likely than contiguous units to be developed without federal bridge permits and federal assistance for bridge/causeway access and other urban infrastructure.

A public acquisition program on the noncontiguous islands would not be required, if the federal government chooses to adopt a more stringent bridge permit program than is now in force. If such regulations withstood inevitable judicial challenge, extensive development of the undeveloped noncontiguous barrier island would be effectively precluded and acquisition could be directed to contiguous barrier islands.

Table 14. Comparison of Estimated Potential Costs of Public Purchase of Barrier Islands Versus Estimated Potential Costs of Current Federal Program to Support Island Development

Policy Option	Land in April 1980 Inventory		Land in August 1980 Inventory	
	Low Case ¹ (\$ Billion)	High Case ²	Low Case ¹ (\$ Billion)	High Case ²
Estimated cost of public purchase	\$.80	\$ 2.02	\$.46	\$ 1.16
Estimated cost of pursuing current federal programs	\$ 4.13	\$ 11.20	\$ 2.46	\$ 6.05
Ratio of program costs to public purchase costs	5.2:1	5.5:1	5.3:1	5.2:1

¹Low case cost estimates based on purchasing or developing only uplands. The National Park Service's April 1980 Inventory included about 160,000 acres of undeveloped, unprotected uplands; its August 1980 inventory included about 90,000 acres in this category.

²High case estimates based on purchasing or developing both uplands and wetlands. The April 1980 inventory included about 480,000 acres of uplands, wetlands, and interior waters; the August 1980 Inventory included about 277,000 acres in this category.

Source: H. Crane Miller, OCEANUS, cited in Table 13.

Judicial challenge would pit the federal government's authority to withhold bridge permits pursuant to the navigation servitude under the Commerce Clause against barrier island property owners' Fifth Amendment rights against the taking of their property without just compensation. Should property owners prevail, a public acquisition program on noncontiguous islands threatened with development would be a cost effective course and equitable to property owners. As with any form of regulation, public acquisition before development takes place would be the most cost effective action. At each incremental stage of access and urban infrastructure development, adjacent land values will increase. The government would get the most for its money before such development takes place.

In national terms the cost of a public acquisition program would be small compared to the federal costs of participating in barrier island development. Present "bulk" land purchase costs for the national seashores included in the study averaged less than \$5,000 per acre. Agencies that rely more on voluntary land sales and less on condemnation procedures than the National Parks Service find average acquisition costs in coastal areas less than \$5,000 per acre in 1980 dollars. These averages include parcels that may be as high as \$85,000 per acre, but which represent small portions of the total acreage to be acquired; as acreage is subdivided in anticipation of development, the cost per acre increases.

The per-acre cost of acquiring undeveloped land in both contiguous islands and noncontiguous barrier units is estimated to fall in a range of \$5,000 - \$10,000 per acre (1980 dollars). When applied only to the upland portions of contiguous units, the estimated acquisition costs are \$275 million to \$550 million, and for the noncontiguous islands, \$185 million to \$370 million. Total acquisition costs for all contiguous and noncontiguous undeveloped upland acreage on the barrier islands would range from an estimated \$460 million to \$920 million. If the history of National Seashore acquisition and the increase of coastal land values is any precedent, costs in the range of \$5,000 - \$10,000 per acre will be deemed sound and inexpensive investments not even 10 years from now. Not only would they be inexpensive, but they would also be "repaid" in reduced or avoided federal subsidies and disaster relief expenditures.

The study showed that the federal government characteristically incurs costs on the barrier islands to

repair, improve, enlarge, upgrade, reconstruct, or replace bridges, roads, causeways, water supply and distribution systems, wastewater treatment systems, and flood and erosion control structures, or to provide disaster assistance and to subsidize flood insurance. An acquisition program of both contiguous units and noncontiguous units would effectively avoid or reduce those costs, and in that respect could be considered self-liquidating.

What of the impacts of federal land acquisition on land values in adjacent communities? Acquisition of the noncontiguous barrier islands should have little, if any, measurable impact on land values in adjacent mainland or island communities under certain conditions. Development in the adjacent communities can be expected to continue without dependence on the noncontiguous islands so long as there is no bridge or causeway access to the islands, and so long as full development in a broad regional context has not been reached or approached. Other factors, especially improved urban infrastructure, will have a more immediate effect on adjacent community land values than public acquisition of the noncontiguous islands.

To the extent that adjacent areas are totally or significantly developed, public acquisition of undeveloped, contiguous units would be expected to increase the value of adjacent lands. Examples were found in the study at Pensacola Beach, Florida, where lease values were reported to have increased when land on both sides of the City was acquired for the Gulf Islands National Seashore. In an area such as the Outer Banks of North Carolina, if the Currituck National Wildlife Refuge and the 411-acre Epstein tract in Nags Head were publically acquired, land values in the adjacent communities would be expected to increase. Under those circumstances, the towns of Nags Head, Kill Devil Hills, Kitty Hawk, and Southern Shores would be close to fully developed, and land prices would escalate accordingly.

Conclusion

"Protection" measures such as regulations and removal of federal subsidies for access and urban infrastructure may forestall some barrier island development but generally will not prevent development. Among all regulations only a strengthened bridge permit program, coupled with removal of federal bridge construction funds, is likely to protect barrier islands from development, and then only with respect to noncontiguous islands. Regulations on access, urban infrastructure, and building requirements, and removal of

federal subsidies are important short-term measures; but their limitations as means to protect barrier islands need to be recognized.

If protection of the undeveloped barrier islands is to be a federal goal and is to be effectively achieved, a program of regulation, removal of federal subsidies for development, and public acquisition would need to be authorized and funds appropriated for that purpose. Such a combined program is the only effective way to protect the islands, and, through acquisition, the only fair way to compensate individual barrier island property owners for taking their right to develop the islands. Of all the available measures, the surest means to protect the undeveloped barrier islands is public acquisition.

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