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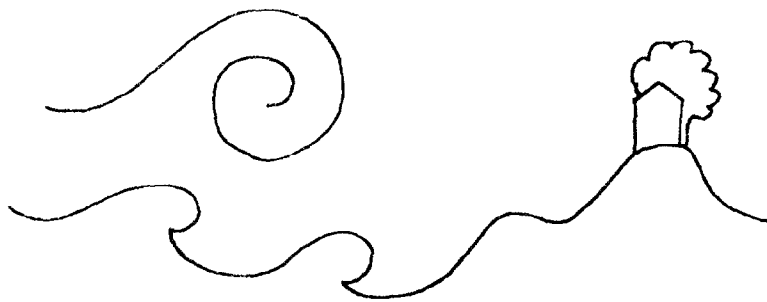
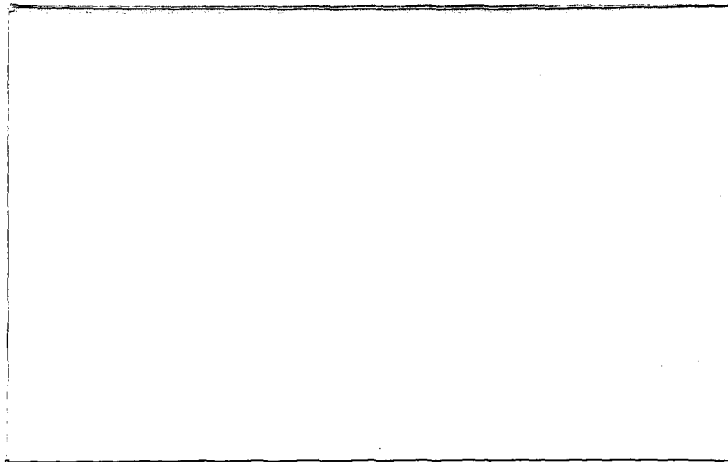
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# COASTAL FLOODPLAINS

COASTAL ZONE  
INFORMATION CENTER

JAN 1 1977

Physical Resources, Federal Programs,  
State and Local Management



Foundation

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Review of Federal Programs; Selection of  
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Submitted to  
Council on Environmental Quality

By  
The Conservation Foundation

William K. Reilly  
President

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## PART I

### FEDERAL PROGRAMS AND THE COASTAL FLOOD PLAIN

Of the Federal programs that have ties to flood plain management, five of particular importance are the Flood Insurance Program, administered by the Federal Insurance Administration in HUD; the Coastal Zone Management Program, administered by the Office of Coastal Zone Management in the Department of Commerce; the management of navigable waters, carried out in large part by the Army Corps of Engineers; the administration of the Federal Water Pollution Control Act Amendments of 1972, carried out principally by EPA; and fish and wildlife management and monitoring, carried out by the Fish and Wildlife Service in the Department of the Interior. Responsibilities are shared in many cases, such as with the Corps of Engineers and EPA for dredge and fill permits; or the Fish and Wildlife Service which must comment on other Federal activities which threaten wildlife and its habitat.

All of these programs have important roles for state and local government and also require public participation. The particular relationship varies, from consultative in dredge and fill permitting, to direct Federal-local regulatory links such as those established between flood insurance and local flood plain development standards. The questions of inter-governmental links are issues regarding the levels of government. There are also substantial program overlaps--a question of the subject matter addressed by each program. The brief introductions that follow outline important segments of these programs.

## Federal Flood Insurance Program

Until very recently, the nation's answer to flood damage has been structural: levees, dams and stream channelizations. Still the damage payments mount, with claims of \$2.2 billion for the calendar year 1975. In response, Congress in 1973 passed the Flood Disaster Act and began the process of finding non-structural and land-use-related responses to floods. (Even this Act, however, does not place any constraints on Federal actions in the floodplain.)

Under the new Federal program, the insurance rates for buildings already in the flood plain are reduced substantially through Federal subsidy. Earlier federal flood insurance was available only at actuarial rates, which were much too high for most builders. In return for reduced insurance rates for existing development, coastal communities will have to develop land use regulations for the floodplain, which, in turn, are expected to reduce the amount of damage from floods. New development will then pay actuarial rates for insurance.

The first order of business is to produce reliable maps of each community's floodplain. This process has been begun by the Federal Insurance Agency (FIA) within HUD. At this point, of the 22,000 American communities in the floodplain, 700 have been mapped and 2300 maps are in progress under contract with various agencies. By its 1983 cutoff date, FIA estimates 1500 communities will be left to be mapped. Of the 22,000 floodplain communities, between 1,000 and 2,000 of them are coastal.

The Act placed a deadline of July, 1975 by which time any community which had not joined the program, and thereby committed itself to land use regulation at least sometime in the future, would be ineligible for federal money, including federal mortgage assistance for building in the flood plain. However, that deadline has been extended.

FIA recognizes two basic categories of community participation: the regular program and the emergency program. Those in the regular program have either received their rate maps or have their own adequate delineation of their floodplains. The date of entry into the regular program determines the date after which new development must pay actuarial rates. Those in the emergency program are those who are cooperating but for whom no definite floodplain has been delineated. For the latter group only general flood hazard maps are available. These maps have no flood elevations, no coastal high hazard areas delineated, and no velocity zones. For these communities, there are few Federal incentives to enact land use regulations to protect the floodplain any time soon, although this is the *raison d'etre* of the Flood Disaster Act. Having joined the emergency program, they are able to get limited floodplain insurance at subsidized rates, even for new buildings in the floodplain, while still avoiding the hard choices that are required in enacting the land use regulations on the floodplain.

## The Office of Coastal Zone Management

CCZM was created by the Coastal Zone Management Act in 1972 as a part of the Commerce Department. It had another major infusion of money in Amendments adopted by Congress in the summer of 1976. The Office's purpose is to help coastal states develop and implement land use plans in their coastal zones. First, it grants money to the states for their coastal planning. All 30 coastal states have now signed up for these grants, but only Washington State has gotten to the point of implementing its plan. A state's plan under the 1972 Act must include:

- 1) The boundary of the coastal zone.
- 2) Permissible uses within the coastal zones.
- 3) Areas of special environmental concern.
- 4) Definition of beaches and public resources.
- 5) Planning processes for energy facilities and shoreline erosion.
- 6) The state's manner of exercising control over uses in the zone.

Before the plan can actually be approved, the state must have the power to enforce it. The 1976 amendments added requirements for energy facilities planning and elaborated other conditions.

Second, the Coastal Act requires that Federal actions be consistent to "the maximum extent practicable" with a state's approved coastal plan. Federal agencies are allowed to comment

on the plan before it is approved, and if there is a dispute between a Federal agency and the state, the Act calls for mediation between the Secretary of the Commerce and the Executive Office of the President (which has yet to occur). Once the plan is approved the Federal agency must try to conform with it, and any individual attempting to get a permit from that federal agency must begin by supplying a certificate of compliance with the state coastal plan. These "consistency" regulations have proved a sore point in the implementation process.

OCZM has signed cooperative agreements with HUD and EPA to make its planning consistent with the planning under planning programs sponsored by those agencies. HUD's 701 program has been a long standing influence on land use and development planning throughout the country. The 208 program at EPA is of more recent origin, created in the 1972 Federal Water Pollution Control Act. It calls for water basin planning, now underway in selected regions of the U.S.



The U.S. Army Corps of Engineers: Dredge and Fill

The Army Corps' authority over dredge and fill stems from Section 10 of the Refuse Act of 1899 and Section 404 of the Federal Water Pollution Control Act of 1972. On the upland side of high tide, Section 404 is the only authority for Corps action. The two come together and are jointly administered on the seaward side of the mean high tide line. The procedures and standards under which the two acts are applied are exactly the same.

An applicant for a dredge and fill permit in U. S. waters takes the following steps:

- 1) He submits certain drawings and information to the Corps. If the Corps feels it is necessary, he also adds an environmental assessment or an environmental impact statement.
- 2) The Corps sends a public notice soliciting comment on the application to state, local and all interested federal agencies including HUD, EPA, Interior and OCZM. Interested individuals and conservation groups are included in this mailing.
- 3) Section 404 also requires "an opportunity for public hearing". That however is not to say that the District Engineer must hold a hearing. If he finds that a hearing would be repetitious, he need not hold one.  
(The "Rehash Rule.")

The standards which the District Engineer uses in deciding whether to grant a permit are:

- 1) the permit's effect on navigable waters including environmental effects.
- 2) whether the state has denied a permit for the same activity.
- 3) whether a state water certification has been denied.
- 4) whether the application is consistent with the state OCZM Plan, as evidenced by a certification of compliance (today only the State of Washington has had its plan approved and is affected).

Beyond this, the controversial nature of the project is key. If it is non-controversial, raises no overriding national interest, and has already received a state permit, then the District Engineer is quite likely to approve the permit, and so ends the matter. Even if the State has denied the permit, the District Engineer is obliged to treat it as a Federal matter and decide its desirability at the Federal level.

Having attempted to resolve objections at his own level, if the District Engineer is still faced with federal objection or a direct objection from a state governor, he passes it up to the Division Engineer (there are ten Division Engineers in the Corps). This occurred in 77 cases last year.

The Division Engineer likewise tries to resolve the differences. If there is no unresolved Federal objection, he can authorize the District Engineer to grant the permit. If there is a Federal objection, he directs the federal agency to write a letter and bring it to the attention of its Washington, D.C. staff within 30 days. If so, the matter comes to the attention of the regulatory group within the Washington office of the Corps.

By a Memorandum of Understanding that was entered into in 1967 with the Department of the Interior, its Fish and Wildlife Service has special power. If dredging and filling is concerned, the Fish and Wildlife Service can object at any level and at any point in the Corps proceeding. In that event, the Corps has no choice but to send the matter directly to Washington. And if the Washington office is not able to resolve the matter, it goes to the Secretary of the Army's office. The Secretary of the Army has the power to decide whether or not to grant the permit, but he is legally bound to discuss the matter with the head of the Department of Interior. Often, the Secretary of Interior maintains his Department's objection.

Twenty-five or thirty permits per year get to the Washington level, largely because of the Fish and Wildlife Memorandum of Understanding. Those twenty-five permits are out of a total of 15,000 issued per year or slightly over one-tenth of one percent of the total.

EPA has a more basic effect on the Corps' deliberations in the sense that it and the Corps, under Section 404, have jointly arrived at a set of guidelines under which the permit is to be judged. Also under Section 404, EPA has veto power, although it has never been exercised. Since no guidelines for the exercise of the EPA veto have been developed, use of this power is not likely on a large scale in the foreseeable future. Still EPA threatens the Army Corps from time to time with a draft of such guidelines and indeed in an extreme situation, could quickly develop guidelines and could veto thereafter. In all but the cases of national importance, all EPA does is file comments. Recommendations for denial are not unusual, but veto remains highly improbable.

## The Environmental Protection Agency

EPA's programs of primary concern for flood plain management are Sections 404 and 208 of the Federal Water Pollution Act Amendments of 1972.

### Section 404 - Permits for Dredged or Filled Material

The object of the 404 program is to protect water supplies, shellfish beds, fishing areas (including spawning and breeding areas), wildlife, and recreational areas and navigable waters. The Act allows the Army Corps of Engineers to grant permits for dredge and fill. It does so under guidelines developed by the EPA Administrator and the Corps regulations. These guidelines were actually promulgated in 1975. The Act gives the Administrator the power, not yet explained in regulations, to veto dredge and fill sites.

A project applicant applies to the Corps' District Office for a permit. The Corps then notifies EPA at its regional level, as well as the Fish and Wildlife Service, state agencies, and other interested groups. To date, EPA has used its persuasive power to cajole the Corps into turning down particular projects, or to persuade the Corps to add conditions when granting permits. The manpower which EPA has assigned to the 404 program is strictly limited, therefore, it analyzes only selected permit applications. In the event that EPA agrees with the granting of the permit, it returns a note of no objection to the Corps. Failure to notify the Corps has the same effect as sending a note of no objection.

EPA's goal in its administration of the 404 program has been to leave the main permitting power with the Corps.

Section 208 - State and Areawide Water Quality Planning

Under Section 208, also a section of the 1972 amendments to the Water Quality Act, the object is to prepare and implement plans for state or areawide treatment of water pollution from all sources. The objective is the Act's 1983 goal of swimmable, drinkable water.

These plans are due by December 1, 1978 at the latest. They are to specify anticipated needs for municipal and industrial treatment works over the next 20 years and establish construction priorities. They must also recommend any necessary land use controls. The agency in charge of the planning is areawide such as the Association of Bay Area Governments (ABAG) in the San Francisco area, or statewide.

As of June 30, 1976, 176 planning areas in 49 states have been designated. EPA estimates that 100 additional areas have the potential for designation. Financial support for fiscal year 1977 grants is \$15 million, which will be available to cover 75% of the costs.

The resulting plans are to be coordinated with those of OCZM, HUD (701), Fish and Wildlife, and the Corps of Engineers.

The Fish and Wildlife Service, Department of the Interior

The Fish and Wildlife Service was created in 1956. Its activities now include:

- 1) The improvement and maintenance of fishery resources,
- 2) The planning and management of national wildlife refuges and water fowl protection areas,
- 3) Other water-based conservation activities.

Another activity, which is of most importance here, is to assess the impact on fish and wildlife of projects along ocean coasts and rivers.

This power was given to the FWS by the Fish and Wildlife Coordination Act. The Act requires other agencies to consult with FWS in order to insure "the conservation of wildlife resources" whenever the waters of a stream or other body of water are proposed to be impounded, diverted, channelized, or otherwise modified by any federal agency or by any public or private agency under federal permit. The only exception to this power is that the federal agencies have the right to undertake projects on their own lands without checking with FWS.

Of primary concern here are the dredge and fill permits the Army Corps grants. The FWS uses its basically defensive power to add conditions to these permits. And in particularly egregious cases where it feels compromise is impossible (an

average of 25 per year), it forces consultation between the Department of the Interior and the Corps in Washington--a time-consuming process.



### Levels of Government

Among the five programs described here, only the Federal Insurance Administration deals directly with local government in the implementation of flood plain management regulations. The Corps of Engineers may also aid in the preparation of local regulations, but on a case-by-case contract basis. For the most part, other program contacts are through regional or state agencies.

For example, the Office of Coastal Zone Management has a statutory mandate to work with a state agency designated by the governor. Through this agency it may deal with local coastal zone planning where local government is an integral part of the implementation process, such as in California.

Regional water quality planning under Section 208 also is accomplished through a state or a state designated regional agency. The Office of Coastal Zone Management is in the process of coordinating Section 208 planning and planning funded under the Coastal Zone Management Act within the coastal zone.

Dredge and fill regulatory programs have been traditional areas of Federal jurisdiction, and although recent legislation has expanded the permit area, they are still largely a matter of Federal concern, with state and local government and the public in consultative roles. Because of overlapping permit procedures, there is increasing interest in joint permit considerations that combine federal and state or regional reviews and allow them to use a common information base.

The Fish and Wildlife Service works closely with state technical agencies under the Fish and Wildlife Coordination Act. In its consultative capacity, it also influences Corps and other agency decisions that may overlap local regulatory authority.

#### The Subject Matter of Federal Programs

In the coastal flood plain, all five of these programs apply to varying degrees depending on the terrain. They apply for differing objectives. In many ways, the Federal Insurance Administration has the narrowest mandate--provide flood insurance for buildings that meet certain minimum standards. However, the standards it enforces are closely related to standards required under other authorities--including coastal zone management and the environmental elements of the dredge and fill program--and it should be possible for each to work to the other's mutual advantage.

The scope of an agency's activities in the coastal flood plain are determined by statute. Some agencies, such as the Corps of Engineers, have a broad advisory role along with specific regulatory authority. The Corps also conducts its activities with a large measure of independence, compared to the other Executive Branch agencies, because of its special statutory and budget authorizations. They have been drawn into close relationships with agencies like the Fish and Wildlife Service through the Fish and Wildlife Coordination Act and the Environmental Impact Assessment process managed by the Council

on Environmental Quality. Interagency agreements such as the agreement with the Fish and Wildlife Service aid in settling differences that relate to areas of shared interest.

Other agencies depend heavily on state-federal cooperation to develop program implementation standards. Much of EPA's authority and the Office of Coastal Zone Management's effort both depend heavily on state programs for air and water quality, and coastal zone planning respectively. Interagency agreements again reduce duplication. Depending on the state, there are further opportunities for cooperative effort at the state and local level.

Federal regions play an important role in this process for the EPA, the Fish and Wildlife Service, and the Corps. In routine cases, substantial regional discretion permits differences to be ironed out and a relatively small percentage of decisions are actually made in Washington.

The largest opportunity for improving these relationships lies in articulating the ways in which flood hazard management may further environmental quality objectives, while environmentally sound development decreases flood disaster risks. The potential exists with all five programs although no particular statute brings them together to this end.

## PART II

### SELECTION OF COASTAL FLOODPLAIN COMMUNITIES FOR FIELD INVESTIGATION

Approximately 35 coastal communities were selected by CF and its consultants for field investigations. Communities were selected based on characteristics familiar to CF or its consultants--either previous management history, involvement in a current federal program of interest, or natural system or development characteristics important to the study. The list of communities was revised after comparison with a conceptual framework for classifying the communities. Federal agencies with important programs, such as EPA's 208 program, supplied lists of participating communities. Selected communities include at least one location where each major federal program is active. The conceptual framework and brief profiles of each candidate community are presented below.

Coastal floodplains pose a number of management concerns for state and local government. These concerns include physical resource management; hazard recognition; management authority, capability and history; and rate of and pressures for change. The relationship among these concerns varies greatly in different regions of the country. The selection of communities reflects both common combinations of concerns and the relative importance of concerns in different coastal regions.

"Unique" communities that have a singular relationship among the concerns can also be identified, for example the Florida Keys. However, these communities offer fewer examples of general interest and application, and have been avoided in the selection process.

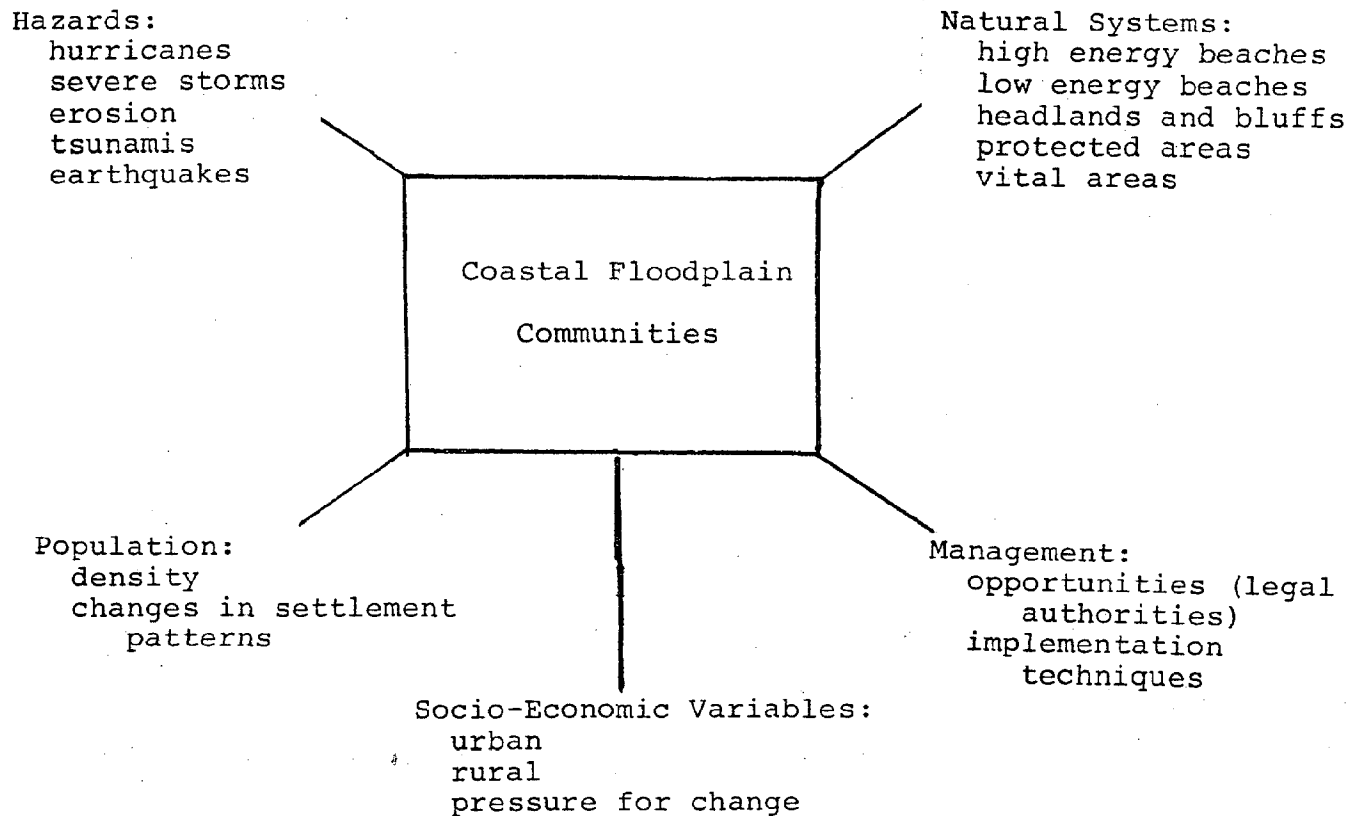
ASPO will use this list to initiate field investigations. Experience may dictate selection of an alternative community in particular cases. Suggested changes will, of course, be subject to the approval of the Conservation Foundation.

#### A Concept for Selecting Communities

Characterizing coastal floodplain communities can require consideration of many variables. Factors of greatest importance are illustrated in Figure 1 on the next page. The specific nature of each factor--natural systems, hazards, population, socio-economic variables, and management authority and tools--is an important influence on the approach any community selects for managing its coastal floodplain. Each factor is discussed below.

Natural Systems are the component ecosystems of the coastal floodplain. The location and relative abundance of types of ecosystems exhibits considerable regional variation. The natural systems may be grouped as: high energy beaches (including barrier islands and spits), low energy beaches, headlands and bluffs, areas protected from direct oceanic influences such as lands surrounding bays and estuaries, and specific vital

Figure 1. Important Considerations in  
Selecting Communities to Participate in  
the Coastal Floodplains Project.



areas such as wetlands. Certain ecosystems, such as wetlands, are vital to natural productivity in the coastal flood plain.

Coastal Hazards consist mostly of hurricanes, other severe storms, and erosion, but also include tsunamis and earthquakes in certain areas. The key concern with hazards is a combination of intensity and frequency. Some major hazards such as tsunamis occur infrequently, and are therefore not considered a significant hazard by individuals and managing authorities. By contrast, erosion can be a persistent and continuous process, requiring constant attention. The main hazard concern for most areas is hurricanes and major storms, which also cause erosion, wave and wind damage, as well as flood water damage.

Population is the single variable for which nationwide uniform data is available at the community level, although data for the coastal floodplain portion of communities is usually not available. Two useful characteristics of population are density of settlement patterns and changes in settlement patterns. Density exhibits distinctive variations and is indicative of the level of past pressures for development. Communities with high densities already occupying their coastal floodplain have a more limited range of management options. Changes in settlement patterns, may be estimated through changes of density for each census. Rapid change is a good indicator of growth pressure, whether associated with a waterfront industrial facility, or high-density shorefront recreational development.

Socio-economic Variables describe the general development of an area. Places can be classified as urban or rural. These two categories, as used here, are qualitative, but are probably a more accurate expression of community characteristics than the quantitative division used by the U.S. Census Bureau to distinguish urban and rural places. This qualitative framework takes into account the variation in "urban" between the Gulf States and New England, for example. The urban-rural dicotomy alone is an insufficient expression of socio-economic variation, because pressure for change can cause a rapid change in land values, settlement patterns, and community structure. Pressure for change has two sources: a major new facility such as a power plant, or the more uniform and constant pressure associated with recreational development. Generally, communities under recreational pressures have a higher regard for coastal resource values which is manifested in their approach to coastal floodplain management.

Management includes both the legal authority vested in the community and the techniques actually used to regulate development in the coastal floodplain. Legal authorities can be organized according to state laws and constitutions. Localities with constitutional or charter home rule may have substantial freedom in their approach to coastal floodplain and ecosystem management. A majority of communities do not



have this authority and their programs are dictated by state statutes that vary widely. Actual implementation techniques require careful evaluation in the field, although some elements of local programs are systematically reported to the Office of Coastal Zone Management by state coastal zone planners to meet federal requirements.

#### Sample Communities

The Conservation Foundation, assisted by its consultants, prepared a list of potential communities for field study. Separate lists were prepared for four coastal regions of the United States; the North Atlantic between Maine and Virginia, the South Atlantic and Gulf Coasts, the West Coast, and the Great Lakes. This division recognizes major coastal variations in natural systems, intensity and frequency of hazards, and different development patterns.

Within each region, communities are divided into urban and rural categories. These categories provide a basis for generalizing about past development patterns and reactions to future growth pressures. Communities with substantial second home and related amenity development were considered as rural unless the residential development was accompanied by substantial shorefront commercial development. For example, the Cape Cod towns of Falmouth, Hyannis and Provincetown are urban, while the remaining Cape townships, which have retained their general country character even with active coastal development, are considered rural. This division is useful for

locating communities with greater professional capability and more sophisticated planning tools. Additional field contact will be required before CF is able to determine if the spectrum of commonly used management techniques in coastal communities has been covered. Figure 2, on the next page lists the selected communities and Figure 3 locates these communities on an outline map of the nation.

The map illustrates the dominance of communities in North Atlantic (13) and South Atlantic and Gulf (14) regions. Emphasis in these areas reflects the location of more frequent and severe hazards, a concentration of threatened vital coastal habitat, and many active federal coastal management programs. These two regions, therefore, tend to have a more complex array of coastal floodplains concerns, and should include communities where imaginative solutions have been developed.

The communities could be placed in additional categories to segment them by any specific topic of the project, such as frequency of hazard, type of ecosystem, active federal program, or local professional capability. Additional detail seemed to confuse, rather than clarify, the selection process. Therefore, more detailed information useful in characterizing the particular aspects of each community are presented in each profile.

Following the map, a short profile of each selected community is presented. Each profile includes a brief

NORTH ATLANTIC:  
MAINE TO VIRGINIA

URBAN

New Bedford, Mass.  
Warwick, R.I.  
Suffolk County, N.Y.  
Atlantic City, N.J.  
Rehoboth Beach, Del.  
Norfolk, Va.

RURAL

Bar Harbor, Me.  
Barnstable, Mass.  
Charlestown, R.I.  
Stonington, Conn.  
Cape May, N.J.  
St. Mary's County, Md.  
Northhampton County, Va.

URBAN

Charleston, S.C.  
Palm Beach, Fla.  
Mobile, Ala.  
Biloxi, Miss.  
Morgan City, La.  
Corpus Christi, Tx.

RURAL

Dare County, N.C.  
Onslow County, N.C.  
McIntosh County, Ga.  
Lee County, Fla.  
Franklin County, Fla.  
Jackson County, Miss.  
Terrebonne Parish, La.  
Rockport, Tx.

WEST COAST:

WASHINGTON TO CALIFORNIA

Santa Barbara, Ca.  
Long Beach, Ca.

Whatcom County, Wash.  
Tillamook County, Ore.  
Crescent City, Ca.

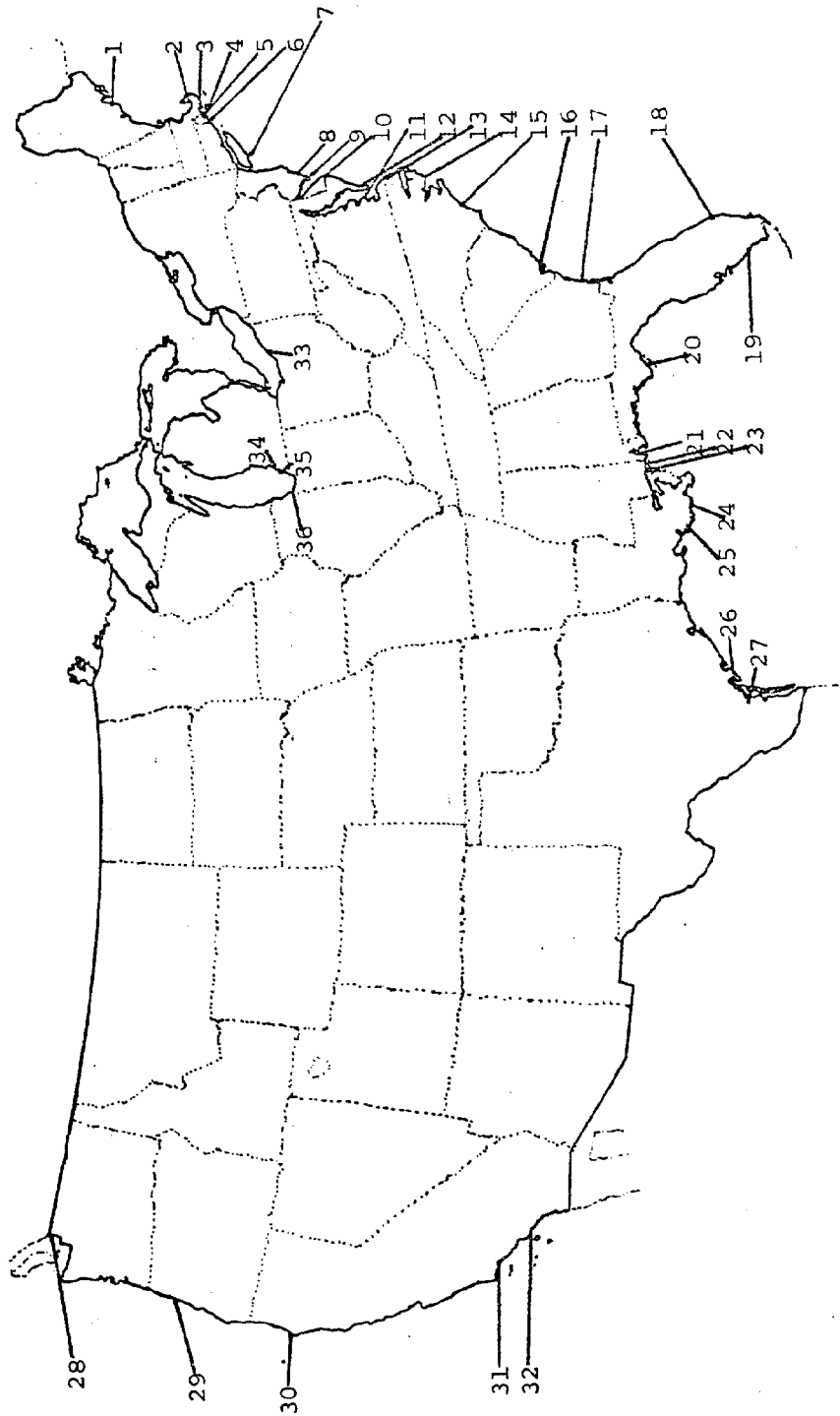
GREAT LAKES:

MINNESOTA TO NEW YORK

East Lake, Oh.  
Calumet City, Ill.

Lincoln Township, Mich.  
New Buffalo, Mich.

Figure 2. SELECTED COMMUNITIES



1. Bar Harbor, Me.
2. Barnstable, Mass.
3. New Bedford, Mass.
4. Charlestown, R.I.
5. Warwick, R.I.
6. Stonington, Conn.
7. Suffolk County, N.Y.
8. Atlantic City, N.J.
9. Cape May, N.J.
10. Rehoboth Beach, Del.
11. St. Mary's County, Md.
12. Northampton County, Va.
13. Norfolk, Va.
14. Dare County, N.C.
15. Onslow County, N.C.
16. Charleston, S.C.
17. McIntosh County, Ga.
18. Palm Beach, Fla.
19. Lee County, Fla.
20. Franklin County, Fla.
21. Mobile, Ala.
22. Jackson County, Miss.
23. Biloxi, Miss.
24. Terrebonne Parish, La.
25. Morgan City, La.
26. Rockport, Tx.
27. Corpus Christi, Tx.
28. Whatcom County, Wash.
29. Tillamook County, Ore.
30. Crescent City, Cal.
31. Santa Barbara, Ca.
32. Long Beach, Ca.
33. East Lake, Oh.
34. Lincoln Township, Mich.
35. New Buffalo, Mich.
36. Calumet City, Ill.

Figure 3. LOCATION OF SELECTED COMMUNITIES

description of the location and physical characteristics of the community, prevalent and unusual coastal natural systems, population, and a general discussion of interesting aspects of the local coastal floodplain or its management programs. These profiles will be useful to ASPO in initiating their field investigations. In addition, they provide ASPO with additional data for selecting the approximately 20 communities that will actually be visited for in-depth investigations.

No. 1

Bar Harbor, Maine

Bar Harbor is a wealthy resort community with a winter population of 3,700 expanded to approximately 15,000 in the summer. The community faces north in a partially protected harbor. The community is dependent on tourism and the "rural downeast" atmosphere of the community.

The town was selected because it participates in a 208 program, is under constant recreation development pressure, and has a local planning program that recognizes coastal values.

Its Coast:

Bar Harbor is located on the rocky shores of Maine's coast. All beaches are cobble, except for a small sand beach less than 100 yards long. The floodplain is restricted in area and the community lies on relatively flat land. The few salt water wetlands and bays in the community are small.

Its Hazards:

The main hazard is the "noreaster" storms which occur frequently. The most recent storm to cause damage in the community was in February, 1976. Damage is primarily wind-related, as flooding is restricted to a small area around the harbor. Hurricanes are an infrequent threat along this portion of the nation's coastline.

Its Responses to the Hazards:

Development is controlled by local zoning, which includes setbacks and lot size limitations. The state has a minimum standards program. The harbor is protected by a breakwater, which the community hopes to extend in the near future.

Barnstable, Massachusetts

Barnstable is a colonial community along Massachusetts Bay, on the north shore of Cape Cod with a population of 26,000 in 1976. It is best known as the home of the Sandwich Glass Factory. The central community has changed little, but outlying areas near the coast have come under increased development pressures.

Barnstable was selected primarily because of extensive wetlands, and the State of Massachusetts programs of both wetlands management and coastal zone management. In addition, these wetlands are separated from the bay by extensive dunes and a barrier spit. Barnstable participates in a regional 208 program.

Its Coast:

Barnstable lies on the outwash plain of a terminal moraine, along the southern shore of a large shallow bay that opens to the north. The town has extensive wetlands, dunes and a barrier spit.

Its Hazards:

Noreaster storms, striking directly on this coast with a fetch from the open ocean and with waves building as they cross a shallow bay, can cause considerable damage, especially along the barrier beach. In 1975, a severe noreaster caused extensive damage to the dunes.

Its Response to the Hazards:

The town has wetlands zoning bylaws that augment the state wetlands program. Development in unvegetated dune areas is prohibited and public ownership within the dune and wetland areas is slowly increasing.

New Bedford, Massachusetts

New Bedford is a small city (1978 population - 100,000) along the southwestern shore of Buzzards Bay covering an area of 20 square miles. It is an old city that prospered in the period of whaling and early textiles. It has more recently experienced declining employment, as the major remaining industry, commercial fishing, has continued to be a marginal enterprise.

New Bedford was selected because it is a low-lying urban area protected by a flood barrier. In addition, the coastal floodplain has been extensively modified and many structures, primarily commercial and industrial lie within the floodplain. The community participates in a 208 program.

Its Coast:

Very little of the original coastal floodplain remains as the harbor bulwarks are surrounded by fills and the barrier has increased pressure for development upstream. The few wetlands are small, intermittent systems, and the beaches, backed by riprap, barriers or other structures, are largely cobble and gravel. The tidal shore line is 11.4 miles in length.

Its Hazards:

The main hazard is hurricanes, which do not occur frequently. Greatest recorded property damage occurred during storms in 1954 and 1938. Noreasters can also occur, but cause less damage.

Its Response to the Hazards:

The flood barrier has been a constraint to city planning to protect against flooding, although the city now participates in the regular flood insurance program.



Charlestown, Rhode Island

Charlestown, Rhode Island, in Washington County, is an isolated town along the southern Rhode Island coast. It has less than 3,000 people. It has two plants, uranium and textile. A number of its citizens work elsewhere, such as in Groton, Connecticut. Charlestown offers a look at a rural New England town which is exposed to hurricanes and which is located in a state with active coastal planning.

Its Coast:

Charlestown is located on an estuary protected by a long sand spit and barrier beach from the Atlantic Ocean. The southern part of town is directly on the ocean and has numerous second home sites.

Its Hazards:

Hurricanes commonly cause the evacuation of the low-part of town, most recently in September 1976. Particularly damaging was the hurricane of 1954.

Its Response to the Hazards:

Changes in its building code have allowed the town to qualify for the Federal Flood Insurance regular program. Also, the state coastal zone legislation requires permits for development, such as a dock, and Charlestown is allowed to comment on such permits.

Warwick, Rhode Island

Warwick is an urban suburb of Providence located along the western shore of Narragansett Bay. The 1970 census recorded a population of 84,000.

This community was selected because it initiated the first floodplain ordinances in the country in 1958. This long standing ordinance has affected growth patterns in this rapidly-growing suburban area.

Its Coast:

Warwick has a protected rocky shoreline, typical of glacial moraine deposits and associated outwash areas. The present coastline has been modified by extensive fills and barriers.

Its Hazards:

The primary hazard is hurricanes, and resultant storm surge up the funnel-shaped Narragansett Bay.

Its Response to the Hazards:

The city of Warwick adopted the nation's first floodplain in 1958. It is now participating in the regular federal insurance program.

Stonington, Connecticut

The town of Stonington, Connecticut is a rural community with a population of 16,000 in the southeastern corner of the state. It is located across the Race from the eastern tip of Long Island. Many of the residents work in nearby industrial communities, such as Groton and New London.

The community was selected because of coastal zone management issues, some erosion problems, and development pressures on its recreational harbor and adjacent wetlands.

Its Coast:

Stonington has a sandy beach front, with a large area and adjacent wetlands.

Its Hazards:

The primary hazard is hurricanes.

Its Response to the Hazards:

This community participates in the emergency floodplain program.

Suffolk County, New York

Suffolk County is a suburb of New York City, with a population of 1,117,000 and an area of 929 square miles. It includes a number of incorporated municipalities. It was selected because of the typical urban hazard exposure; coastal zone management issues and a concern over potential future OCS-related development.

Its Coast:

Suffolk County is characterized by a complex estuarine ecosystem along the western shore of the Long Island and Long Island Sound. It includes both protected and exposed shoreline.

Its Hazards:

The primary hazard is hurricanes. Ocean front erosion poses a secondary risk.

Its Response to the Hazards:

Atlantic City, New Jersey

An aging resort community of 48,000 people, Atlantic City is located in southern New Jersey. It sits on a group of barrier islands fronting the Atlantic Ocean. For the benefit of this study Atlantic City is a densely-populated resort town which should be spurred to sudden new growth by the opening of gambling casinos.

Its Coast:

Atlantic City has a boardwalk and other buildings built up to and over the beach.

Its Hazards:

Atlantic City is subject to moderately severe hurricanes.

Its Response to the Hazards:

Atlantic City has qualified for the regular program under the Federal Flood Insurance Act.

Cape May, New Jersey

Cape May is a small beach town at the tip of New Jersey. It sits on a point which forms the northern mouth of Delaware Bay where the Bay opens into the Atlantic Ocean. The town has less than 5,000 residents. Cape May offers a look at a small Mid-Atlantic community's hurricane and beach erosion problems.

Its Coast:

The beach at Cape May has a number of long jetties, which have not prevented severe beach erosion.

Its Hazards:

Like most of the New Jersey coast, Cape May is subject to hurricanes and beach erosion.

Its Response to the Hazards:

Cape May has qualified for regular status in the Federal Flood Insurance program.

Rehobeth Beach, Delaware

Rehobeth Beach is a medium-sized resort community located in southern Delaware on the Atlantic Ocean. Its interest for this study lies in its susceptibility to hurricanes and its active participation in the Federal Flood Insurance program and the Section 208 planning program.

Its Coast:

As its name indicates, Rehobeth Beach is fronted by a long, wide, sandy beach. Immediately below is Rehobeth Bay with its marshlands broken by narrow beaches.

Its Hazards:

Rehobeth Beach is subject to hurricanes.

Its Response to the Hazards:

Rehobeth Beach is enrolled in the Federal Insurance Agency's regular program and is part of an Environmental Protection Agency Section 208 planning effort.

St. Mary's County, Maryland

St. Mary's County is located on the western shores of Chesapeake Bay on the Potomac River. It has 47,000 people in 373 square miles. It will be the only place in this study located so far from the ocean and as such, offers a different perspective.

Its Coast:

St. Mary's coast is broken by numerous inlets, creeks and salt-water marshes.

Its Hazards:

St. Mary's is subject to the flooding from hurricanes.

Its Response to its Hazards:

St. Mary's County has joined the emergency part of the Federal Flood Insurance Program.



Northhampton County, Virginia

Northhampton County is the most southernly county of Virginia's Eastern Shore. It has a population of 14,000, and Eastville is the county seat. On the bay side of the county, Brown and Root is building an offshore drilling platform, and El Paso Natural Gas is preparing a site for processing of liquid gas expected from the OCS energy development. It offers a special opportunity to review the effects of single project large-scale development on a rural town.

Its Coast:

All of Northhampton County is flat, with its highest point being only 48 feet above sea level. On the ocean side, there are a series of barrier islands and, on the bay side, sandy beaches interspersed with inlets and necks.

Its Hazards:

Northhampton County is subject to flooding caused by hurricanes from both the bay and ocean sides. The worst hurricane on record was in 1933.

Its Response to Hazards:

The county has created a Coastal Wetlands Committee under Virginia State enabling acts. No development in the wetlands is allowed below 1-1/2 feet above mean sea level, and above there, a permit from the Commission is necessary. The county is a participant in the Regular Federal Flood Insurance Program.

Norfolk, Virginia

Norfolk is the largest city in Virginia and the hub of the Hampton roads area. Its population, over 300,000, is largely involved in shipping and shipbuilding and the military. Norfolk's interest for this study lies in its size and its location at the mouth of the Chesapeake Bay.

Its Coast:

Norfolk's coast, which includes many bays and inlets, is largely developed.

Its Hazards:

Norfolk is susceptible to flooding caused by hurricanes.

Its Response to Hazards:

Norfolk is enlisted in the Federal Flood Insurance emergency program.

Dare County, North Carolina

Dare County has a permanent population of only 7,000. However, in the height of the summer season, 100,000 vacationers join them. The County faces the Atlantic Ocean on North Carolina's Outer Banks. It is more water than land. On the mainland there are only two small towns. Tourism is now the county's largest source of revenue, but the long-awaited Wanchee Harbor is now near realization. The harbor will be a port for fishing vessels and have processing plants for their catch. For now, Dare County is the archetypal tourist community, located on a barrier island, and subject to severe hurricanes.

Its Coast:

Dare County has a long barrier island which fronts on both the Atlantic Ocean and various sounds. The entire county is very flat.

Its Hazards:

Both the mainland and the barrier island are subject to flooding from hurricanes. The worst hurricane in recent memory was on Ash Wednesday of 1962. Another bad hurricane hit in February of 1973. It caused erosion along the coast between Kitty Hawk and Cape Hatteras.

Its Response to the Hazards:

Dare County has joined the Federal Flood Insurance regular program, and requires that the occupancy for any building be 9 feet above sea level. Also the county requires that any support piling be driven into the ground at least 8 feet deep. The county also has a dune protection ordinance which requires no building within 150 feet of the mean high water line and, beyond that, requires a permit which regulates the amount of sand removed and requires revegetation.

Onslow County, North Carolina

The county has a population of 103,000 including the county seat, Jacksonville. It is the site of a major military facility and is presently without a professional planner.

The County was selected because of its undeveloped coastline, barrier islands and large Federal facilities.

Its Coast:

The coast is made up of barrier islands and beaches. Approximately 12 miles of coastline is not in Federal ownership and is open for development.

Its Hazards:

The primary hazard for this section of the coast is hurricanes.

Its Response to the Hazards:

A local planning board recommends approval or denial to the County Commission for building applications. The County is presently without a professional planner.

Charleston, South Carolina

Charleston is a city of 60,000 located on a peninsula between the Cooper and Ashly Rivers. Its harbor opens into the Atlantic Ocean. Charleston's industries include tourism and military bases.

Charleston's interest arise from its size: it is the largest metropolitan area on the coast between Norfolk, Virginia and Jacksonville, Florida. Also among all the cities on the eastcoast, Charleston is the one most endangered by earthquakes.

Its Coast:

The city's coast has been largely diked and build upon.

Its Hazards:

Charleston is subject to the hurricane flooding usual to the South Atlantic and to an earthquake danger which is unique. An earthquake in 1884 was devastating.

Its Response to the Hazards:

Charleston is enrolled in the regular program of the Federal Flood Insurance.

McIntosh County, Georgia

McIntosh County lies on the north central Georgia coastline. It is a rural county with no large communities and a total population of 7,000 occupying 426 square miles. The economic activity of the county is focused on basic resources, such as agriculture and fishing.

McIntosh County was selected because it has extensive wetlands, marshes and tidal flats, and one large barrier island, Sapelo Island which has been a major field experiment location for coastal ecology studies in southern wetlands.

Its Coast:

The county includes extensive wetlands, marshes, tidelands and a barrier island which have been reported in detail in scientific papers prepared through the Georgia Institute of Ecology.

Its Hazards:

The major hazard is hurricanes, although erosion is a problem in certain beach areas.

Its Response to the Hazards:

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Palm Beach, Florida

Located north of Miami, Palm Beach is a city of 350,000 residents. Residential development is concentrated in a strip of land along the coast.

The town was selected because of its barrier beach characteristics and low average elevation.

Its Coast:

The coastline in Palm Beach consists of a long high-energy barrier beach.

Its Hazards:

Hurricanes pose the primary hazard with the last major hurricane in 1949, with the worst storm of record in 1929.

Its Response to the Hazards:

Palm Beach enforces a 150' setback measured from the bulkhead line. A minimum elevation of 7 1/2 feet above mean sea level is required for living space.

Lee County, Florida

Lee County is in southwest Florida, and its main city is Ft. Myers. The county has over 100,000 people and stretches from Boca Grande Island south to Bonita Springs and includes Sanibel Island. Its only incorporated areas are Sanibel, Ft. Myers and Cape Coral. According to its local planner, this SMSA of which Lee County forms a part is the fastest growing in the United States. The county contains condominium, medium high rises, rental apartments and mobile homes. It is suburban and urban with only its southeastern portion still in agriculture.

For the purpose of the study, Lee County offers its west coast of Florida location, its rapid growth, its low elevation which would make an extremely severe hurricane a disaster.

Its Coast:

Its coast contains barrier islands, estuaries and mangrove swamps.

Its Hazards:

Lee County is subject to hurricanes. A recent one struck old Ft. Myers Beach and did extensive damage to homes that had been built to the ground.

Its Response to the Hazards:

Buildings now being built along the Lee County coast are being built on pilings, usually 8 or 9 feet above sea level. Also condominiums commonly use their lower floor for parking. Although Lee County was registered in a Federal Flood Insurance regular program, it has been dropped until elevations and setback lines are revised.



Franklin County, Florida

Franklin County, with its county seat, Apalachicola, has a population of 7,000 and a size of 536 square miles. It is the heart of a thriving oyster aquaculture industry and subject to growing development pressure for recreational homes and large scale agriculture.

The county was selected because of the presence of a large scale coastal agriculture/dredge and fill issue; Forest Service interests adjacent to important wetlands, and the interest of a small group of local oyster men in maintaining their livelihood.

Its Coast:

The coast is made up of low energy ocean front with mangrove and salt marshes. A barrier island protects the Bay and the mouth of the Apalachicola River.

Its Hazards:

The predominate hazard is hurricane flooding, aggravated by estuarine and riverine conditions.

Its Response to the Hazards:

The County is making an effort to implement land use regulations for recreational development, though the County has limited staff available to manage them.

Mobile City, Alabama

Mobile lies at the head of Mobile Bay, in southern Alabama. It is a major urban center, with a population of 190,000 (1970) and covering an area of 123 square miles. It is a major port for the central Gulf and has several large shipbuilding facilities.

It was selected because it is participating in a 208 program, has extensive wetlands resources within the city limits, and has three mechanisms for controlling floodplain development.

Its Coast:

The city lies at the head of Mobile Bay, approximately 30 miles from the coast. It has extensive tidelands in brackish waters, and provides extensive habitat for waterfowl.

Its Hazards:

While hurricanes have landed in nearby coastal areas, the last severe storm causing major property damage in Mobile occurred in 1916. There are also erosion problems along some portions of the western shore of Mobile Bay.

Its Response to the Hazards:

The city participates in the 208 program, and has subdivision regulation, zoning ordinances and a floodplain ordinance to control development in the coastal floodplain. The Corps of Engineers has proposed deepening the channel and harbor improvements.

Jackson County, Mississippi

Jackson County, with a population of 88,000, and covering an area of 736 square miles, lies in the southwest corner of Mississippi. The cities of Biloxi and Pascagoula are located within the county. The lengthy coastline, with wide sand beaches and one bay was devastated by at least one recent hurricane.

The county was selected because it participates in the regular floodplain program, has been recently hit by a major hurricane, and is oriented to coastal and waterfront development.

Its Coast:

The county has broad, sandy beaches and a low, flat elevation. Pascagoula Bay is a small estuary supporting a commercial fishery. Barrier islands offshore protect portions of the coast.

Its Hazards:

Hurricanes are a major hazard, with flood and storm surge damage being severe.

Its Response to the Hazards:

The county participates in the regular floodplain program.

Biloxi, Mississippi

Biloxi is an urban center on the Gulf Coast with a population (1970) of 48,000. The town fronts the Gulf, with development concentrated along the coastal shorefront.

It was selected because it is in the regular floodplain program, was devastated by a recent hurricane, and is oriented to shore front tourist and related commercial development.

Its Coast:

Biloxi has a wide, sandy beach front with flat lands of low elevation adjacent.

Its Hazards:

The hazard is hurricane, with damages resulting from flooding, surges and wind.

Its Response to the Hazards:

Biloxi participates in the regular flood insurance program.

Terrebonne Parish, Louisiana

Terrebonne Parrish lies along the Gulf Coast west of the main portion of the Mississippi River delta. It has a population of 76,000 (1970) and an area of 1,368 square miles. The one large community in the parrish, Houma, is a major oil industry offshore support base. The economy of the county is otherwise based on basic extractive industries, such as fur, commercial fishing and shellfishing, and agriculture.

Terrebonne Parish was selected because it is predominantly wetlands, interspersed with cheniers. The floodprone area is extensive and severe flooding can be frequent. The U.S. Army Corps of Engineers has constructed a number of structures in the delta area which control and alter waterflow patterns. Numerous permanent and temporary channels have a similar effect.

Its Coast:

Terrebonne parish lies west of the Mississippi River on an accreting delta and is characterized by large wetlands interspersed with low uplands or cheniers.

Its Hazards:

The major hazard is hurricanes. Erosion is a problem in small areas and does not affect human settlement.

Its Response to Hazards:

Terrebonne is in the regional flood insurance program. Corps of Engineers and private alterations of wetland by dredging channels and construction water flow structures have altered flood patterns.

Morgan City, Louisiana

Morgan City is located in the bayou country of Louisiana, southwest of New Orleans. It is one of the largest onshore support bases for offshore oil activity in the world, with a population of 17,000. It is located on a maintained channel, approximately 35 miles from the ocean.

Morgan City was selected because it is continually threatened by flooding, lies within productive and valuable wetlands, and is surrounded by dikes.

Its Coast:

The city lies on filled wetlands and natural uplands. Water flow patterns have been altered, affecting vegetation and habitat.

Its Hazards:

Flooding is a constant threat. The 1973 flood was the most severe in terms of damage to property. The greatest threat comes from hurricanes and associated storm surge.

Its Response to the Hazards:

Morgan City has no flood control zoning. The dikes are the main protective devices. A combination of dikes and structures has altered flood patterns in the past and will greatly influence the effects of future events.

Rockport, Texas

Rockport is a town located on the Gulf Coast of Texas, above Corpus Christi. It is in Aransas County and lies behind St. Joe Island. Less than 4,000 people live in Rockport, mainly retirees and fishermen. Rockport offers of interest here, the flooding problem in its own downtown and the regional problem of how to evacuate barrier islands.

Its Coast:

Rockport is typical of small towns along the Texas coast, and sits behind a series of barrier islands.

Its Hazards:

Severe hurricanes have struck Rockport in 1919, 1957, 1961. The 1961 hurricane, Carla, left the downtown under three feet of water.

Its Response to the Hazards:

Rockport has qualified for the regular Federal Flood Insurance program. In its "A zone," any new building needs an elevation certificate which shows that it is eight feet above sea level. The rehabilitation of existing buildings requires a certificate if more than 50 percent of its cash value is redone. Also the Army Corps of Engineers is attempting to stop the channelization for retirement homes that has been going on nearby. Finally, Rockport is part of a 16 county COG which deals with OCZM.

Corpus Christi, Texas

Corpus Christi, the largest city on the Texas coast with over 200,000 residents, fronts the west and south shores of Corpus Christi Bay. Corpus Christi is an important seaport and industrial center for oil and agriculture and is also a major tourist and convention center. Its importance for this study lies in its size, industrialization and its nearby oil and gas fields.

Its Coast:

Corpus Christi's coast is about 16 miles of highly developed and densely populated urban area.

Its Hazards:

Corpus Christi is subject to flooding from hurricanes.

Its Response to the Hazards:

Corpus Christi has qualified for Federal Insurance Agency's regular program and is participating in a regional Section 208 program.



Whatcom County, Washington

Whatcom County, located in northwest Washington on Puget Sound, has a population of 42,000 and covers 1,167 square miles.

This county was selected because of coastal erosion concerns, an approved state coastal zone management plan, and a substantial commercial fishing and aquaculture industry.

Its Coast:

A rocky, irregular coastline with cobble and gravel beaches, and extensive tidal flats in protected areas. Some of the larger tidal areas have been diked or filled.

Its Hazards:

The main problems are erosion and coastal slides, although flooding associated with small streams draining from the Cascade Mountain is a problem in localized areas.

Its Response to the Hazards:

The county has an active coastal zone management program, tied into the approved state plan. The United States Army Corps of Engineer is considering several new or improved structures along the county's coastline to control erosion.

Tillamook County, Oregon

Tillamook County is located in the northwestern section of Oregon and is sparsely populated. It has 18,000 people in 1,115 square miles of area. Most of these are located on the coast. The County is on the ocean side of the coastal range and 90 percent of it is forested and rugged, with Tillamook its largest city. Its industries include cheese from local dairies, fishing, forestry, and tourism. Tillamook's interest lies in its rugged, isolated northwest location and the variety of hazards which plague it.

Its Coast:

Its coast has one large bay, Tillamook Bay, and six other estuaries. It features three major headlands and between them, sandy and sometimes rocky, beaches 4 or 5 miles long with offshore rocks.

Its Hazards:

The county's main hazards are cumulative -- from the sedimentation of the coastal estuaries which is caused by logging. Also in the early 1960's, a Columbus Day tsunami hit Tillamook County, and in 1972 it was flooded as the result of a severe storm. Finally, landslides are a constant problem.

Its Response to the Hazards:

Most of Tillamook County's responses are still in progress: it expects to qualify for the regular part of the Federal Flood Insurance program and for section 306 money, along with the rest of the Oregon coast, within a year. However, Tillamook County is not participating in EPA's section 208 program, apparently because it is too costly. Finally, the Army Corps of Engineers is active in Tillamook Bay and is now deciding whether to extend the levee which protects the harbor and whether to dredge the harbor again.

Crescent City, California

Crescent City is on California's north coast near the Oregon border. It is home for 2,500 people. South of Crescent City is the Redwood National Park. Crescent City is the U.S. city most susceptible to tsunamis.

Its Coast:

Crescent City is located on a small natural harbor with a sand beach. The city is beyond the beach to the north. The other side of town is on the Pacific Ocean.

Its Hazards:

Crescent City has a history of tsunamis. The most recent, in 1964 was also one of the most devastating. It was a 100-year event and rose to 19 feet above sea level. The main damage was not from the water itself, but from the redwood logs which the waves picked up from nearby beaches and sent washing into town.

Its Response to the Hazards:

Crescent City has now placed trees along its beach to prevent a repeat of the damage from debris. Beyond that, it has turned most of the area which was flooded in 1964 into a city park. The city has emergency status in the Federal Flood Insurance program. The Army Corps of Engineers recently suggested a 25 foot high dike to protect the city from future tsunamis. However, the city turned it down because of its unsightliness and chose to rely instead on land use measures.

Santa Barbara County, California

Santa Barbara County has a population of 264,000 spread over 2,773 square miles. The Sierra Madre mountains run through the westerly part of the county. The city of Santa Barbara itself is a tourist attraction with broad white beaches. Santa Barbara's interest for this study lies in its offshore oil wells located in the Santa Barbara channel, its danger from locally - generated tsunamis, and the earthquake hazard.

Its Coast:

Santa Barbara County coast is typical of Southern California with rocky headland interspersed with sandy beaches.

Its Hazards:

Santa Barbara is threatened by tsunamis which can be generated in the Santa Barbara channel, a situation unique on the West Coast. Added to this is the earthquake danger which Santa Barbara shares with the rest of California.

Its Response to the Hazards:

Santa Barbara has participated in the California State Coastal Plan, which was approved by voters for permanent adoption recently and has qualified for emergency status in the Federal Flood Insurance program.

Long Beach, California

Long Beach is a city of almost 400,000 located in the greater Los Angeles area. It is situated on San Pedro Bay which gives into the Pacific Ocean. Long Beach is heavily industrialized and densely populated. Its interest for this study is its dense population as well as its subceptibility to earthquakes and subsidence.

Its Coast:

Long Beach's coast is intensely used. These uses range from the Long Beach Navy Shipyard to several beaches and a large marina. San Pedro Bay is protected from the ocean by a long breakwater.

Its Hazards:

Long Beach like all the other communities in Los Angeles is subceptible to earthquakes. Also it has a history of subsidence.

Its Response to the Hazards:

Long Beach cooperated in the state Coastal Zone Planning effort and has qualified for emergency status in the Federal Flood Insurance Program.

Eastlake, Ohio

Eastlake is a town of 20,000 on the shore of Lake Erie. It was selected because of interest in local planning controls, and a history of erosion control efforts predating the 1972 WRC study.

Its Coast:

Eastlake has approximately 6 miles of shoreline along Lake Erie, including the mouth of the Chagrin River.

Its Hazards:

The primary hazard is erosion, associated with both the river mouth and the general shoreline.

Its Response to the Hazards:

The community has applied for help from the Corps of Engineers and has recognized erosion hazards in its zoning ordinance.

Lincoln Township, Michigan

Lincoln Township is a rapidly growing suburb of St. Joseph Michigan located on the Southeastern shore of Lake Michigan. With a population of 9,900 in 1970, the population has nearly doubled in 1976, to 16,000 (est.) or an average population density of approximately 1.6/acre.

The community was selected because of severe erosion problems, high growth pressure along the coast, and a high degree of awareness of possible solutions.

Its Coast:

The coastline of Southwest Michigan is characterized by relatively stable dune systems. Recent shifts in Lake Michigan water levels have left narrow beaches.

Its Hazards:

Erosion is the prime hazard. Northwest winds and high lake levels create severe erosion.

Its Response to the Hazards:

Lincoln township has a permit program complementing the Corps 404 permit program. It also implements a state slope setback program. They exercise state general zoning powers as well. Coastal Zone planning is being carried out by the Southwest Michigan Regional Planning Commission under contract with the state.

New Buffalo, Michigan

New Buffalo is a rural/recreational community on the Southeastern tip of Lake Michigan with a 1970 population of 2784 on 1,130 acres.

Large Corps of Engineers investments, a feeder beach project and a recreational harbor combine to illustrate a number of problems common to smaller lakefront communities.

Its Coast:

The coast of Southwest Michigan is made up of relatively stable dune systems broken by harbors such as the recreational harbor in New Buffalo.

Its Hazards:

Erosion poses the single greatest coastal hazard in New Buffalo.

Its Response to the Hazards:

New Buffalo is the site of Corps of Engineers improvement including a breakwater. It also exercises zoning, subdivision and building code authority under state statutes.



Calumet City, Illinois

Calumet City is an urban suburb of Chicago on the Calumet River. With a population of 40,000 it experiences many of the problems of older Chicago suburbs adjoining lake front industrial areas. It was selected because of its interest in the Great Lakes Coastal Zone Management Program.

Its Coast:

Calumet City is on the Calumet River, immediately upstream from the Calumet Harbor of the City of Chicago.

Its Hazards:

Riverine flooding poses the most severe hazard to the city,

Its Response to the Hazards:

### PART III

#### SELECTED REFERENCES

Selected references in two subject areas, hazards and management, are included in the following lists. Each list will be revised as research for the tasks of Phase I continues. References concerning natural systems are not included. Present holdings at CF include more than two thousand titles in this subject area that potentially apply to aspects of the project. Material in these sources will be reviewed and utilized as CF continues to investigate the tasks that require this information.

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