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Proceedings
of the Second
New England Coastal Zone
Management Conference

PROCEEDINGS
OF THE SECOND
NEW ENGLAND COASTAL ZONE MANAGEMENT CONFERENCE
September, 1971

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The New England Council, Inc.

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Warren R. Healey, Editor
Dayle Reynolds, Assistant Editor

The New England Council, Inc.
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PREFACE

New England has a long tradition as a region with a close affinity and reliance on the marine environment. Multiple demands are projected for this environment such as mining, petroleum exploration, aquaculture, and others. In most instances a key to development remains a link to the shore--the coastal zone. Provisions must be made now to insure the orderly and reasonable development of an irreplaceable resource in such a way that the benefits will inure to the citizens of the New England region.

In 1970, the first New England Coastal Zone Conference sought to call attention to the growing concern of both the public and the private sectors. It was aimed at defining the problem, identifying the state of the art as related to that problem, and hopefully initiating a cooperative regional effort in coastal zone resource planning.

The papers that follow provide an update on what has been happening since September, 1970, and what might be expected in the very near future.

Warren R. Healey
Director, Marine Resource Development
The New England Council

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Keynote Address by R. Frank Gregg, Chairman
New England River Basins Commission

Second New England Coastal Zone
Management Conference

Durham, New Hampshire

It has been almost three years since the Stratton Commission report, "Our Nation and the Sea", and the flurry of activity which followed it seemed to promise a new era of interest and public dollars in oceanic and coastal zone programs. In the intervening years, euphoria has dissipated and, for many, has changed to frustration.

Hopes for a new Federal department for marine concerns have been only partially satisfied by establishment of the National Oceanic and Atmospheric Administration in the Department of Commerce. Federal research and development dollars have been appropriated at a pace considerably short of the gold rush many had hoped for. The prospect of a substantial Federal grant program for State coastal zone planning and management -- once apparently imminent -- seems to remain always just out of reach. Hopes in individual States for new organizations and new resources to focus on marine and coastal problems have not been realized fully. And finally, a new national concern for land use planning and control throughout the nation -- not exclusively on its maritime frontier -- has seemed to divert, to some degree, the attention of conservation advocates, government officials and the Congress from coastal issues.

My purpose in thus assessing the mood of many who are interested in coastal resources is not to depress my fellow conferees. On the contrary, my purpose is to acknowledge a mood that others have expressed or reported upon ^{1/} to suggest that the record of the recent past is more constructive than we may think; and to suggest that the near future looks reasonably bright.

It is clear, in retrospect, that the peculiar fascination which the sea and its environs holds for many of us lead to some unrealistic expectations in what we expected of government. And as you will recall, our expectations were hardly modest.

We wanted independent status in the Executive Branch for a super-agency to deal with marine affairs. The proposal made sense to us. But it came at a time when the proliferation of agencies and responsibilities in the Federal government clearly demanded consolidation. From the standpoint of the President, the organization of the Executive Branch was and is a nightmare. The basic principle of accountability of an elected executive to the people he serves is made nearly impossible.

Furthermore, the question of separate status for marine affairs came at a time when -- in the broader field of environmental and natural resource concerns -- it became clear that government must organize itself to understand and act upon environmental concerns in the context of ecological, social, political and economic systems of the nation. This concept has pushed us in the direction of an integrated Federal

^{1/}

See "New Dimensions of U.S. Marine Policy", by Norman J. Padelford and Jerry E. Cook, recently published by MIT's Sea Grant program.

natural resources structure with a Council on Environmental Quality assessing conditions and trends and advising on new directions and policies; a Department of Natural Resources incorporating most Federal resource management activities and associated research, planning and technical and financial assistance programs; and an Environmental Protection Agency concentrating primarily on environmental pollution. The still new NOAA, President Nixon has proposed, would become an agency of the Department of Natural Resources but would also and obviously have close relationships with CEQ and EPA.

There is no question that the vigor of federal leadership in specific marine and coastal programs has suffered somewhat as agency heads struggle with organization charts instead of program administration -- that was inevitable. We can reasonably expect bolder leadership from NOAA in the months and years ahead. With a solid organization, NOAA can function effectively in Commerce, or in a new Department of Natural Resources.

In short, we have a focal point for marine affairs. It is going to get stronger in its present location in Commerce; it may become even more effective as a part of a unified natural resources agency.

Perhaps our most intense frustration has been the series of near-misses in Congressional approval of a new national coastal zone program. We've looked to such a program for a number of things, and especially for financial support to assist the states in developing and effectively implementing plans to manage coastal zone resources in the public interest. Even on this issue, the situation has improved substantially over the last few years. There no longer seems to be any serious

question that such a program will be authorized and funded. The issue at present is whether the program should be authorized and administered within the framework of a nationwide program designed to stimulate and assist the states in land use planning and control generally, or whether the program should be authorized and administered as a distinct thrust for the coastal zone.

Other speakers, I'm sure, will argue this issue -- presumably on behalf of a separate program for the coastal zone. I emphasize, however, that there is near-unanimous agreement in Washington on the need for development of comprehensive state plans for preservation, management, development and utilization of coastal land and water areas.

The choices facing us on this issue seem to me to be more tactical than substantive. Most Washington-watchers will agree that a program of federal support for state coastal zone activities could be most quickly authorized and funded if the Congress were to act on this program separately. Both the Senate and the House have held hearings on the issue for the last three or four years. The Senate Commerce Committee, I'm told, is clearly determined to report a bill this fall; to act on it this fall, if possible; and if not, to bring it to the floor early after Congress reconvenes in January. In the House, I understand that one or two additional days of hearings will probably be held in October to invite additional testimony on the unique characteristics of coastal zone resources and problems which justify a separate act for a national coastal zone program. The Committee on Merchant Marine and Fisheries apparently has little hope of House enactment this session, but is determined to bring a bill to the floor early next session.

The Administration, as you know, takes the position that a federal program to assist and stimulate state leadership in planning and management of coastal resources can be best accomplished through a national land use policy and program. A central thesis here is that decisions about the use and management of coastal resources must be made within the context of the landward ecological, political, social and economic systems. Should the Congress opt for this approach, it seems clear that an act built around overall land use as a critical influence on resource management would identify the coastal zone as an area of special concern, and would most likely urge appropriate priorities to the coastal zone in the development of statewide land use plans and implementation programs. Pending land use bills include such provisions.

Administrators of broad natural resource agencies at federal and state levels may come to find the Administration's approach most attractive, since it offers the prospect of integrating seaward and landward problems under cohesive leadership. Those with special interest in coastal resources, problems and uses will, I am confident, instinctively prefer the distinctive coastal zone program -- at least until they are fully satisfied that a national land use policy and program is conceptually, organizationally, and financially capable of meeting the unique needs of the coastal zone.

In any event, a Congressional decision on separate coastal programs may -- one more time -- be imminent. The current revision of the Senate bill -- S.582 -- is sharply improved over previous versions, especially in new language directing the thrust of state management programs toward coastal areas of special value or sensitivity, toward control of major

developments, and toward regional needs. This emphasis on unique coastal zone characteristics, as distinct from a uniform concern with all land and water uses, is consistent with the Administration's approach in its land use bill, is more likely to focus attention on critical coastal issues, and is more likely to win support of local governments nervous about general state control of local land use decisions.

It seems to me that the Congress could perform a great mercy to all of us by prompt resolution -- either by choosing not to bring the coastal zone bills to the floor (which seems extremely unlikely), or by doing so at the earliest possible date, and voting them up or down. Without attempting to change the minds of those who are strongly committed to a separate coastal zone bill, I would urge strong support for a clear Congressional decision soon. And if the judgment of the Congress should be adverse, I would assume and hope that the coastal zone community would turn en masse to vigorous support for the broader land use approach.

While we have all been obsessed varying degrees with the federal organization issue and the federal coastal zone program issue, the prospects for effective management of the coastal zone have been significantly altered by changes in a number of specific federal programs, and by new initiatives in the individual states. However one looks at these changes, it becomes clear that the resources now available for effective management of coastal resources are substantially strengthened than they were a few years ago.

We may take the Sea Grant program as a first illustration. When the Stratton Commission reported in 1969, the appropriation level for

the program was \$6 million. The appropriations level for FY 1972 is approximately \$17.7 million -- below the optimum funding level recommended in the National Science Foundation's 5-year program, but a substantial increase in the light of domestic expenditures generally.

Federal tools for dealing with oil spills have been sharpened and resharpened during this same period, and will be further strengthened by legislation now before the Congress.

The Corps of Engineers has completed an initial study of beach erosion problems and has provided a basis for strengthening federal support for dealing with erosion problems.

Consideration of environmental effects in granting or denying permits for dredging in navigable waters -- a program administered by the Corps of Engineers with the cooperation of the Department of the Interior -- has been affirmed as lawful and proper by the Federal Courts.

Federal funding for construction of municipal waste treatment facilities -- a critical factor in the usability of the coastal lands and waters -- have increased four-fold in the last few years. And the resurrection of the 1899 refuse act as a device for controlling industrial discharges -- an Environmental Protection Agency-Corps of Engineers program -- may prove particularly important to coastal and estuarine waters, where so much of our industry is concentrated.

Funds available under the Land and Water Conservation fund have sharply increased. The President's budget request for appropriations from the fund for Fiscal Year 1972 is \$380 million, of which \$280 million is for grants to state and local governments for acquiring and developing outdoor recreation areas. The comparable figures in Fiscal Year 1969

were \$161 million and \$45 million respectively. The coastal zone can expect to make a claim on a good chunk of these monies. It is also significant to note that the Bureau of Sport Fisheries and Wildlife -- which may receive appropriations from the fund to acquire wildlife refuge areas -- is now participating more fully than it has in the past, and a significant amount of lands acquired by BSF&W are coastal wetlands.

The Administration has tightened controls over ocean dumping under executive authority. The Council on Environmental Quality has proposed additional legislation, and appropriate Congressional committees are now working diligently to report legislation to the floor.

Pending proposals for legislation to assure effective consideration of both environmental and energy needs in power plant siting -- such as H.R. 5389, the Administration bill introduced by Representative Ford -- would provide a specific vehicle for considering the special implications of thermal power plant siting in the coastal zone.

My point in this recitation is obvious: the rules of the game in the coastal zone have changed -- and have changed for the better. We have been disappointed in the pace and scale of federal response on certain proposals focused specifically on the coastal zone; we may not fully appreciate the additional tools that have been made available for use in the coastal zone, although not so labeled.

So far, I've tried to assess the state of the coastal zone effort in terms of federal policy and programs, including programs designed to help state and local governments. There is also cause for some satisfaction in the initiatives that have been taken by the individual states and by groups of states.

The development of the Coastal States Organization provides a vehicle for interstate consultation on common problems, and for the coordinated expression of state viewpoints relative to federal policy.

States as widely scattered as Washington, California, North Carolina, and Maine have faced the difficult questions of coastal planning and resource allocation, or state organization, or both. The special concern for coastal wetlands -- first attacked in an organized way in Massachusetts a few years ago -- has spread around the nation's shoreline.

In New England, the State of Maine has made solid progress toward a coastal development plan, and through legislation establishing the Environmental Improvement Commission, now has authority to issue or deny permits for major development proposals which would significantly influence the use and value of the state's resources, including coastal resources. An application for a petroleum refinery in Casco Bay was denied under this authority, and while I'm not informed as to the status of subsequent judicial action, it is clear that a new tool for channelling coastal development programs is available.

Massachusetts is assembling detailed information on the characteristics and value of coastal marshes, and is proceeding in the "zoning" of coastal wetlands instead of waiting for permit applications to pose the issue of development vs. preservation. The State Legislature has appropriated \$3 million for acquisition of the Boston Harbor Islands.

Rhode Island has secured -- after two legislative sessions -- a state coastal zone authority -- an accomplishment Dan Varin will undoubtedly report on as soon as I permit him to do so by completing these remarks.

The Governor of Connecticut has recently appointed a task force chaired by State Senator George Gunther to organize and coordinate the state's efforts to plan for management of its coastal resources.

New Hampshire, not without difficulty, has entered the field of regulating the use of coastal marshes, and has enacted a State power plant siting statute which should strengthen the hand of the state in considering thermal power plant locations on the state's short coastline.

Regional organizations have also been responsive. The New England Council and the League of Women Voters have sponsored -- with this meeting -- three regionwide conferences on coastal problems and ways of dealing with them.

The New England Regional Commission -- a joint federal-state agency -- has supported Maine's coastal development plan financially. And in the current year, it is providing financial help to each of the coastal states in the region to help them think through the kinds of legal and institutional arrangements that the state should have for coastal zone planning and management. A meeting of key state officials squarely on this topic is being held in Maine next week.

The New England Marine Resources Information Program --NEMRIP-- operated out of the University of Rhode Island with Sea Grant support is doing a good job of keeping us posted on new developments, problems and opportunities.

My own Commission, the New England River Basins Commission, is engaged now in two major planning programs which are designed to produce joint federal-state management plans for key reaches of the coastal zone. The Southeastern New England Study covers substantially the entire coastal

zone of Massachusetts and Rhode Island, as well as the tributary rivers, and is funded in the current fiscal year at a level of \$840,000. A study management team composed of professional staff from NERBC, from the states of Massachusetts and Rhode Island, and appropriate federal agencies is now at work. The states are participating enthusiastically within the limits of their technological and financial resources. Should federal funding be made available to strengthen state resources for coastal zone planning and management, we stand an excellent chance of making SENE a model for joint state-federal coastal zone planning and management.

The States of Connecticut and New York have also joined the Commission in developing a comprehensive program for Long Island Sound. This study is apparently funded for the current fiscal year at around \$350,000, and is presently scheduled to function at a level in excess of \$1 million in Fiscal Year 1973. The Long Island Sound Study is characterized by intense interest on the part of citizens and local governments and may well become a testing ground for a unique level of public participation in coastal zone planning.

In short, through the River Basins Commission, a very substantial federal investment is being made available for joint state-federal planning for the coastal zones of Massachusetts, Rhode Island, Connecticut, and the north shore of Long Island. It is my earnest hope that the level of state and local government participation in these studies can be sharply accelerated by a new federal program of grants to the states, as provided under both the pending coastal zone bills and the land use bills.

The Commission has considered, in concert with state officials of New Hampshire and Maine, their special needs for intensified coastal zone planning. At this moment, it is our collective judgment -- in part imposed

by federal funding realities -- that coastal zone planning for these states should be organized under the leadership of the individual states and funded primarily through federal coastal zone planning grants, and required state matching monies. It is also our hope that we can make use of the Commission to organize appropriate federal assistance and participation in development of these state coastal zone plans, so that state, regional and national perspectives can be simultaneously considered in planning for management of the coastal zone of the entire region.

I will conclude with three observations.

First, I would like to note my own conviction that the coastal resources of the United States are of such profound importance to the entire nation that the job of planning for and managing these resources should be a joint enterprise of all levels of government, and of the complex of interests we call the private sector. We have tried dilligently, in the River Basins Commission, to find ways to make real the leadership role that each of the coastal states should play in making decisions about the use of coastal resources. We will continue to do so, in the conduct of the Southeastern New England and the Long Island Sound studies, and in other Commission activities as well. At the same time, we are, I believe, agreed that there are important regional and national considerations to be taken into account in developing and implementing management programs for the coastal zones of individual states. The River Basins Commission is a vehicle for applying all these perspectives during the course of the planning process. We are convinced, in short, that joint planning for the coastal zone, under state leadership but with regional and national participation, is more likely to produce a firm basis for resource management

that individual state coastal plans which are reviewed and criticized after the fact by a distant federal officialdom.

Second, I want to foreswear any pollyannish label that might attend my assertion that we are making reasonable progress in fashioning tools for effective coastal zone management. We've some serious disappointments as well. My point is that, on balance, we are moving ahead.

Finally, I hope that we will apply energies during the months and years immediately ahead to using the tools now at hand for effectively managing the coastal zone, as we deal -- hopefully briskly -- with the unresolved federal policy questions. Each state needs an institutional structure for thinking and acting in coherent ways on the coastal zone -- quite apart from any prospect of federal assistance. For planning purposes, we can draw immediately -- even in the current fiscal year -- upon federal assistance from a variety of sources, such as the "701" comprehensive planning program, planning funds from the Land and Water Conservation Fund, planning funds authorized by the Water Resources Planning Act, program grant funds under the Federal Water Pollution Control Acts, etc. A determined state administrator, with the support of his Governor and an informed constituency, has a fair shot at initiating a solid state coastal zone planning program under the current rules of the game. Furthermore, there are tools available to implement important parts of the plan. While most states do not yet have the kinds of authorities for land and water use regulation in the coastal zone required by the pending coastal zone bills, there are federal financial aids and specific state authorities which can be applied now in a systematic way to coastal zone management -- to restoring water quality, to acquiring and protecting scenic, scientific,

recreation and conservation areas, to constructing needed facilities, to preventing erosion, and a variety of other purposes.

We have much to do. This conference directs your attention both to broad questions of policy and to specific handholds for action on specific problems.

Let's get on with both.

Mr. John W. Lebourveau
Manager of Environmental Research
New England Power Service Company

THE DEMAND FOR ENERGY AND ELECTRIC POWER FOR NEW ENGLAND

Long-range projections of energy use are subject to substantial uncertainties as a result of technological changes and political -- economic factors. As a result, one is forced to rely on historical trends as a basis of extrapolations into the future, modified by judgment and knowledge of technical developments which promise to become important.

The use of energy and present sources are summarized for the year

1970 in the following table (1):

<u>Sources of Energy</u>		<u>Uses of Energy</u>	<u>Total</u>	<u>Electric Included</u>
Nuclear	0.2	Household & Commercial	15.8	2.9
Hydro	2.7	Industrial	20.7	2.3
Natural Gas & Liquids	24.3	Losses in Electric Generation & Transmission	11.8	--
Petroleum	23.9	Transportation	16.3	--
Coal	<u>13.5</u>		<u> </u>	<u> </u>
	64.6		64.6	5.2

All Units are $(10)^{15}$ Btu per year.

About $17.0 (10)^{15}$ Btu/yr. or 26% of total energy was used in generation of electric power and the thermal efficiency of the electric system was 31%.

In order to establish the rates at which this energy flow is changing on a long-range basis, the following tabulation compares the 1950 and 1970 data with projections to 2000.

UNITED STATES ENERGY USE--UNITED OF $(10)^{15}$ BTU/YR.

	<u>1950</u>	<u>1970</u>	<u>2000</u>
Population	150 $(10)^6$	200 $(10)^6$	320 $(10)^6$
Energy per capita Btu/yr.	2.1 $(10)^8$	3.2 $(10)^8$	4.7 $(10)^8$
Total Energy Btu/yr.	34 $(10)^{15}$	65 $(10)^{15}$	150 $(10)^{15}$
Electric Generation Btu/yr.	--	5.2 $(10)^{15}$	39 $(10)^{15}$
Electric Sales Btu/yr.	--	4.7 $(10)^{15}$	35 $(10)^{15}$
Electric Sales kWh/yr.	.30 $(10)^{12}$	1.39 $(10)^{12}$	10.3 $(10)^{12}$
kWh/Capita Year	2,000	7,000	32,000

These data are based on references 1, 2 and 3. The projections for Electric Generation and Sales for 2000 are based on a 7% growth rate which McGraw-Hill forecasts for the period 1970-1990.

The corresponding figures for New England have been assembled to bring the subject into focus on a regional basis. This also leads to an estimate of the number of new generating sites which will be required.

	<u>1950</u>	<u>1970</u>	<u>2000</u>
Total Population	9.3 (10) ⁶	11.7 (10) ⁶	17.5 (10) ⁶
Electric Generation Btu/yr.	55 (10) ¹²	210 (10) ¹²	920 (10) ¹²
kWh/yr.	16.2 (10) ⁹	60.9 (10) ⁹	260 (10) ⁹
kWh/Capita Year	1,650	5,200	14,800

The New England Council published in 1954 a report on energy use in New England (4). This presented data for 1949, which showed the total energy input from all sources to be 1 (10)¹⁵ Btu/year. Of this amount, 180 (10)¹² Btu or 18% was used as primary energy for electric power generation. Corresponding figures for total energy input in New England are not presently available for 1970.

From the above, the demand for electric power is placed in perspective in relation to total energy supply. It appears that not only is electric power itself increasing in terms of present forms of use, but it can be expected to account for a larger proportion of total energy.

The conversion from kWh consumption to kilowatts or megawatts of generating capacity is based on load factor and required reserve over annual peak load. Load factor is defined as actual kilowatt hour generation per year divided by the product of capacity in kilowatts and 8760 hours per year. The total load factor was 55% in 1950 and 60% in 1970. The estimate for 2000 also assumes a load factor of 60%.

Actual reserve in 1950 was 15% over peak demand. Reserve for 1970 has been projected at 18% based on all presently scheduled new capacity being available. Estimates for 2000 are also based on 18% reserve.

For the year 2000 a low estimate and a high estimate of kWh generation are presented. The lower kWh Figure represents a 5% rate of growth over 1970 while the higher figure reflects a 7.5% growth rate. These are believed to bracket the most probable growth to be expected.

			2000	
			<u>Low Estimate</u>	<u>High Estimate</u>
Generation kWh/yr.	16.2 (10) ⁹	60.9 (10) ⁹	260 (10) ⁹	520 (10) ⁹
Load Factor	55%	60%	60%	60%
MW Peak Load	3.37 (10) ³	11.6 (10) ³	49.5 (10) ³	85 (10) ³
Reserve Margin	15%	18%	18%	18%
MW Capability	3.86 (10) ³	13.6 (10) ³	58.2 (10) ³	100 (10) ³

If the average of 2000 year figures is taken as 80,000 MW, one can estimate the number and types of generation which might meet this need. This will require base load generating plants, cycling or medium hour generation, pumped hydro and peaking units. If estimates are made of probable average size of each station, one can then estimate the number of sites required.

NEW ENGLAND GENERATING STATIONS--YEAR 2000

	<u>Locations</u>	<u>Average Station Size</u>	<u>Total Capacity</u>
Base Load	8	3,000 MW	24,000 MW
Cycling Steam	26	1,000	26,000
Pumped Hydro	20	500	10,000
Peaking	--	200	<u>20,000</u>
			80,000

The peaking units, probably diesel or gas turbines, will be located in many locations including presently utilized sites, sites included in the tabulation above and some in new property.

Base load plants include both coal, oil and nuclear generation. Cycling steam plants will be principally fueled by coal, oil or gas.

Not only are a considerable number of new sites involved, but the average size of generating capacity at each site is larger than we are accustomed to at the present time. For this reason, environmental factors become increasingly important. Clearly this will indicate a need for early identification and coordinated land use planning to assure an adequate supply of electric power as it is needed.

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Mr. Daniel W. Varin
Chief, Rhode Island Statewide Planning Program
Providence, Rhode Island

LEGISLATIVE ACTIVITIES - REGIONAL

In mid-July the Rhode Island General Assembly ended its 1971 regular session. This was the longest legislative session in this century. While hundreds of bills were considered, two topics stand out as areas of primary concern, and as causes of this marathon performance. First was the state's financial crisis, a situation common to virtually all states. Second, and almost as important when measured by the number of major bills considered, by the extent and scope of committee hearings and floor debate, and by the progress made, was recognition of the need to protect and improve the state's natural environment.

The passage of legislation designed to:

. . . preserve, protect, develop, and where possible, restore the coastal resources of the state for this and succeeding generations through comprehensive and coordinated long-range planning and management . . .

was one of the most important actions taken by the Rhode Island General Assembly in 1971. For this workshop, I would like to do three things: first, to briefly review the activities which lead up to this legislation. Second, to summarize the key provisions of the act. And third, to outline some principles which emerged from this work.

It is impossible to do more than summarize the long and involved series of activities which lead up to this legislation in the time available here. Those interested may wish to consult the published

proceedings of the first New England Coastal Zone Management Conference for a more detailed description.

Briefly, Rhode Island's efforts to pass coastal resources management legislation began with a report by the Natural Resources Group, a private citizen-interest group, to Governor Frank Licht in January, 1969. This report pointed out the importance of the coastal region and the lack of mechanisms for managing this resource. The report asked the Governor to prepare and sponsor legislation filling this critical gap.

The Governor responded to this report by appointing a committee of representatives of his office, state agencies, and the University of Rhode Island to undertake this work. This committee held meetings, prepared technical studies, and made its recommendations to the Governor in March, 1970. This 144 page report reviewed the activities and programs of governmental agencies in the coastal region. Current and potential users of the region were described. Problems and conflicts in the region were identified and dimensioned within general problem areas. The need for a coastal resources management mechanism was established, and alternative organizations were explored. The report proposed creation of a Coastal Zone Council with adequate authority to meet this need.

Legislation based on this report was immediately drafted and introduced into the 1970 General Assembly session, but did not pass. Its failure can be ascribed to lack of knowledge about the bill in the part of some legislators, due to its relatively late introduction, and to objections to some provisions of the bill. The three most serious and most frequently voiced objections were:

- 1) Encroachment on local powers, and particularly on local zoning authority;

- 2) Two facilities for storage of liquified natural gas were proposed for other locations on the bay.
- 3) Plans of the Narragansett Electric Company to build a nuclear power plant on the bay were advanced.

These proposals, and others to dredge or fill wetlands or make other significant modifications in the coastal environment, made many people realize that the state had no effective way of protecting the broad public interest in the coastal region. The decision in each case was the sole responsibility of a single municipality. There was no requirement, and no other impetus, to consult other communities affected by proposals of the magnitude of those made during 1970.

In response to this situation, Governor Licht expanded his Committee on the Coastal Zone, and charged it to prepare new recommendations for management of the state's coastal resources. This enlarged committee had 75 members, representing every municipality, the General Assembly, and the state agencies and private organizations interested in the coastal region. Two regional and four federal agencies and the University of Rhode Island's Marine Advisory Service served in an advisory capacity.

The committee held its first meeting in December, 1970. It met frequently over the next two months to set goals, explore issues, identify problems, and analyze objections.

In its work, the committee decided to utilize all of the technical studies done as background to the first attempt to obtain legislation. Updating of these studies was done where necessary. This approach permitted the committee to focus its efforts on the organizational aspects of coastal resources management. Consequently, the committee was able to complete its work and submit recommendations to the Governor on

March 1, 1971.

These recommendations were translated into draft legislation and introduced into the General Assembly early in April. Following committee hearings the bill was passed, with minor amendments, on July 14. It was immediately signed into law by the Governor, and is now in effect.

The act creates a Coastal Resources Management Council as:

. . . the principal mechanism for management of the state's coastal resources.

The council has 17 members, who are appointed to represent a variety of areas and interests:

- 7 members are appointed by the Governor. 4 of these are local officials, 3 representing coastal cities and towns. The other 3 are public members, all representing coastal municipalities.
- 2 Senators, both representing coastal communities, are appointed by the Lieutenant Governor.
- 6 members are appointed by the Speaker of the House of Representatives. 2 of these are members of the House, of which at least 1 must be from a coastal community. The other 4 are public members. 2, serving 3 year terms, must be from coastal communities. The remaining 2, serving 2 year terms, can be from any community.
- 2 members serve exofficio: the directors of Natural Resources and Health.

This rather complex membership should insure that diverse viewpoints are represented on the council. At least 11 of the 17 members must represent coastal cities and towns, but no more than 2 can come from the same municipality. Advisory members can also be invited to serve by either the Governor or the council, to represent interests or agencies not otherwise represented.

The council has authority in four areas: First, planning and management; second, implementation; third, coordination; and fourth, operations. Each of these four broad areas carries with it specific powers and duties.

Planning and management of coastal resources are the primary responsibilities of the council. The basic phases of the resources management process are spelled out in the act. Standards and criteria are provided for the development of resource management programs. One of these standards is consistency with the state guide plan.

To implement its resource management programs, the council is authorized to formulate and adopt administrative regulations which have the force of law. This authority applies primarily to that water area extending from the mean high water mark, seaward to the extent of state jurisdiction. This area of jurisdiction also includes the lands beneath this water area, and the air space above it.

Within this area, any person, firm, or governmental agency proposing any development or operation must demonstrate that its proposal will not do three things:

- 1) Conflict with any resources management plan or program.
- 2) Make any area unsuitable for the uses to which it is allocated by a resource management plan or program.
- 3) Significantly damage the environment of the coastal region.

This provision clearly places the burden of proof on the party proposing to use our coastal resources. The council may approve, modify, set conditions for, or reject any proposal which it receives.

The council has more limited implementing authority over land areas. The council must approve the location, design, construction, and operation of specific activities, when there is reasonable probability of conflict with a resources management plan or program, or damage to the coastal environment. There are six activities over which the council can exercise

this authority:

- 1) Power generating and desalination plants.
- 2) Chemical or petroleum processing, transfer, or storage.
- 3) Minerals extraction.
- 4) Shoreline protection facilities.
- 5) Intertidal salt marshes.
- 6) Sewage treatment and disposal and solid waste disposal.

The Coordinating powers and duties of the council include acting as binding arbitrator in any dispute involving public agencies and coastal resources, consulting with other public agencies at all levels and the private sector, and conducting or sponsoring research related to its mission.

The council also has operating functions. These include issuing permits for any work or activity under its jurisdiction, licensing the use of coastal resources and charging fees for their private use, and establishing pierhead, bulkhead, and harbor lines. The council is also authorized to investigate complaints of violation of laws or regulations governing tidal waters.

This is a broad grant of authority to manage the state's coastal resources. It is accompanied by the power to issue cease and desist orders and to prosecute violators in court.

The Coastal Resources Management Council is provided with a staff arm to assist it in carrying out its responsibilities. This staff has been created as a division of the Department of Natural Resources, replacing the former Division of Harbors and Rivers and receiving the staff and budget and some of the duties of that division. From this

position, the staff can readily obtain the assistance of other agencies in the Department of Natural Resources, such as the Planning and Development and Enforcement Divisions. An additional appropriation has also been made to expand the staff of the new Division of Coastal Resources, so that it can meet its new responsibilities.

This legislation is the product of more than two years of intensive work. Several principles have emerged from this study, which should be of use to other states engaged in this process. These also bear directly on the coastal resources management bills now being considered by Congress.

First, the mechanisms which the states must establish must reflect the form of governmental organization and the specific needs and traditions of each state, as well as a variety of localized short-term considerations, if they are to be accepted by the state legislatures and if they are to operate successfully. A wide range of approaches to this problem are feasible, and each state must have maximum flexibility in designing an approach which meets its own needs. Each state will respond to this problem in a somewhat different way.

Second, strong reluctance will be encountered to the further extension of the authority to acquire land, to construct and operate facilities, and to incur debt, to new agencies. Each state has these basic governmental powers, and has developed methods of using these powers. The states can employ these powers in managing their coastal resources without specific delegation of full authority in all cases to the agency responsible for coastal resources management. In many instances, this agency will be more effective through coordination of the actions of others, who already have these powers, than through direct action on its own.

Third, there is equally strong resistance by local governments to dilution of their authority to regulate land development and use in favor of a coastal resources management agency at the state level. This authority has been vested in local governments for approximately fifty years by virtually every state. This pattern will not easily be reversed, or even modified to any significant extent, no matter how worthy the objective of such changes. It is evident that a more rational approach to the control of land use requires action at a level other than the purely local one. A joint or multi-layered approach by state governments or regional agencies and local governments is probably required. But this re-alignment of a basic power of local government will be achieved, if at all, only through intensive study and careful development, extending over a period of many years.

Finally, the tactical details are important. As an example, we found that the terminology "coastal zone", which is used in the title of this conference, and in all of the pending federal legislation, is highly inflammatory. It is knowingly misused by the opponents of coastal resources management. For these reasons, the word "zone" does not appear in the 1971 recommendations of the Governor's Committee, or in the legislation which was just enacted.

Through the enactment of legislation creating a Coastal Resources Management Council, Rhode Island has taken a major step toward effective protection and proper utilization of a region which is frequently referred to as our greatest natural resource. But this step is incomplete. Coastal resources management in Rhode Island cannot be fully effective until comparable steps are taken by our neighboring states. The rivers

which feed into Narragansett Bay, the Blackstone, Ten Mile, and Taunton, all rise and run most of their courses in Massachusetts. The Pawcatuck River and Little Narragansett Bay form part of the Connecticut-Rhode Island boundary.

Perhaps this conference will lead to the kind of action by all three states which will permit really comprehensive management of the resources of our coastal region.

Mr. J. Leslie Goodier
Arthur D. Little, Inc.
Cambridge, Massachusetts

RECLAIMING SAND AND GRAVEL FROM THE SEA

The coastal states of the United States are experiencing a shortage of sand and gravel. Presently available reserves will be depleted in about 16 years. Additional reserves must be located before the advent of the depletion date. Geographically, the coastal states are in a position to tap the underwater sand and gravel resources that have accumulated as a thick veneer on the Continental Shelf. There is a need to determine the availability, quality, and quantity of offshore sand and gravel deposits and to develop technical capabilities for the recovery of such deposits without detrimentally disturbing the natural environment. In general, this paper could apply to any one of the coastal states, but

for the objectives of this meeting it has been focussed on the situation existing in the New England area.

WHY RECLAIM MARINE SAND AND GRAVEL?

The average national consumption of sand and gravel, as estimated by the National Sand and Gravel Association, is running at a rate of 6 percent of available reserves per year. The depletion date of 1988 is, therefore, rapidly approaching. Prompt action is needed to initiate a series of investigations of offshore reserves since the regulatory bodies do not move with the speed required to correct the situation. The hope of acquiring additional land reserves is becoming increasingly remote due to urban expansion, restrictive zoning, and the fact that the economic breaking point for transporting sand and gravel in bulk quantity is only 50 miles. Most sand and gravel is used only 25 miles from its point of production. Outside this radius, the cost per cubic yard becomes prohibitive. However, we may well have to suffer prohibitive prices unless we turn to the sea. Normally, when one thinks of the resources of the sea, visions of gold, silver, and rare gems immediately come to mind. Though no such treasure, let it be understood that sand and gravel are no mundane resource. In the United States, the sand and gravel industry has developed into a \$1,115,705,000 annual business with some 6000 active sand and gravel producers sharing the proceeds.

The 1970 New England sand and gravel production figures just compiled but not yet published, by the U.S. Dept. of the Interior, Bureau of Mines, are as follows:

<u>State</u>	<u>Quantity (Thousand Short Tons)</u>	<u>\$ Value (Thousands)</u>
Maine	12,971	6,888
Vermont	4,046	4,122
New Hampshire	6,529	4,753
Massachusetts	17,925	22,244
Rhode Island	2,387	2,913
Connecticut	6,765	9,202
	<hr/>	<hr/>
	50,623	\$50,122

Most of the New England states are beginning to feel the sand and gravel shortage. Massachusetts, in particular, has developed demands that exceed the available supply. An extension to Boston's Logan Airport must of necessity proceed seaward, creating a demand for millions of cubic yards of fill material. If this were shipped from New Hampshire by rail, the final phase of the journey would warrant about 1000 truckloads of material daily. Anyone familiar with Boston's traffic can appreciate the problems of having 1000 sand and gravel trucks passing to and from the city daily.

Connecticut used 13.62% of its available sand and gravel reserves in one year and many sand and gravel producers across the Long Island Sound have gradually phased out of business due to depleted reserves--the situation is becoming acute. With tidal shore line lengths* and multiplying by with width of the territorial sea, the New England coastal states own and control 17,109 square miles of seafloor, more or less. The detrital sediments that have accumulated on the seafloor are known to be extensive.

* Provided by the Environmental Science Service Administration.

They originated from rock disintegration, glacial drift (Figure 1), land erosion (Figure 2), and the fact that the submerged land was the original coastline until it was inundated under a theorized 200 feet of water at the termination of the glacial period.

In view of the impending needs, therefore, we must reclaim the marine sand and gravel deposits that were once part of the earth's land surface. The word reclaim or reclamation is used since it should "please" rather than raise the ire of the conservationist.

UTILIZATION OF MARINE SAND AND GRAVEL

About 96 percent of mined sand and gravel is used for building and highway construction. The specifications for the material are quite rigid and tests are required for soundness, angularity, cohesion, size gradation, and--among other requirements--freedom from organic impurity. Surficial seafloor sand would naturally have a heavy organic content and would thus require washing and screening prior to use. However, gravitational settling, to a certain extent, would improve the quality of the deeper deposits to the extent that extensive processing might not be required. When used in a bituminous paving mix, for example, the marine sand actually enhances the mix by cushioning expansion and contraction, and thereby reducing surface heave.

For sanding the icy New England roadways during the winter months, salt encrusted sand from a natural marine source would make an ideal surface treatment. In some of the exceptionally cold northern states, salt has even been added to batches of concrete to retard freezing and permit a longer pouring period. Unfortunately many marine deposits have become "water-worn" from continual movement on the seafloor, and this has rendered the

material worthless for construction and even land-fill purposes. For this reason sand and gravel inventory surveys are warranted in each coastal state. Such surveys would delineate useable sand from that considered worthless. This action would permit charting of prospective mining areas and permit a careful evaluation of recovery techniques. The effect on the surrounding water and land areas could then also be assessed.

Current offshore mining regulations in New England are either vague or non-existent. Connecticut, Rhode Island, and Massachusetts, for example, have no actual laws or regulations, although Connecticut is prepared to issue permits for the removal of sand and gravel from tidal and coastal waters. The State of Maine, as of 1969, prohibits all offshore sand and gravel mining, contending that the benefits might be outweighed by harmful side effects. New Hampshire does have quite specific exploration and mining laws; however, the State has only some 81 miles of underwater land, most of which would be less than three miles from recreational beach facilities.

MAINTAINING ENVIRONMENTAL BALANCE DURING SAND AND GRAVEL RECOVERY

The mining of onshore sand and gravel deposits should first be described in the true perspective before marine recovery is discussed.

Land production facilities are not famous for good housekeeping. Rusted and broken equipment and empty oil drums strewn across the landscape are par for the course. There are a few exceptions, but one would have to search extensively to locate such facilities. Steel towers, elevating conveyors and hoppers, and open stockpiles mar the natural landscape. During rainy periods, the run-off from open stockpiles always finds its way into the nearest water body, with the water quality suffering accordingly. The noise of moving machinery and heavy trucks disturbs both man and beast for

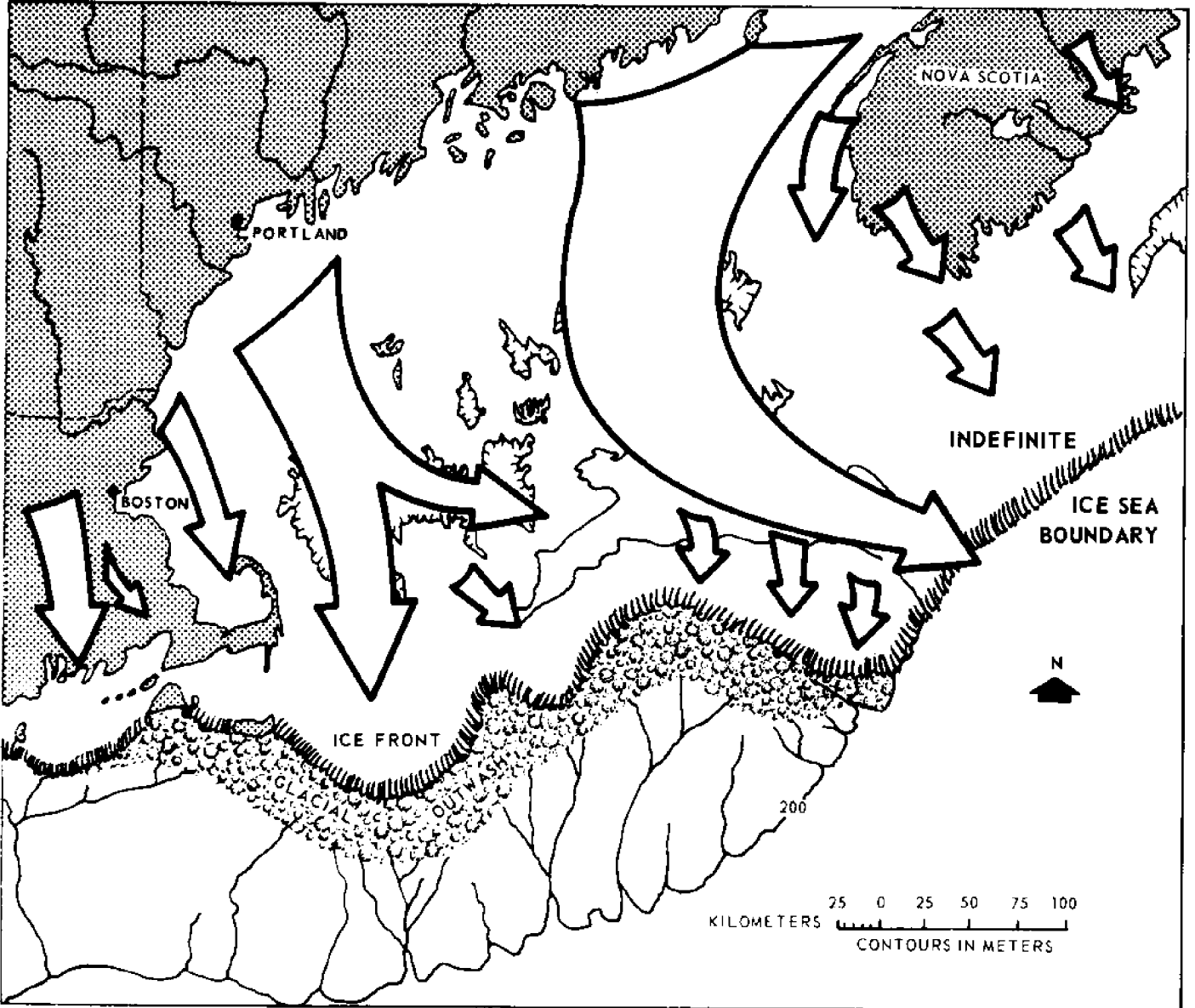
a considerable radius from the center of such operations.

Finally, when the deposit is depleted or the water table is reached, a large water-filled pit remains as an attractive nuisance for the neighborhood youngsters. The newspapers attest to frequent drownings in the deep, unattended, unbeautified pits.

To proceed to the marine environment. The seafloor is dynamic, and even though some may think differently, it is not the permanent home of any flora or fauna. On the Cape, beaches come and go with the season. In Pass-a-Grille, Florida, an entire beach vanished over night. Fish tend to utilize the shallow coastal waters as a breeding ground and nursery, but during migration periods the shallow waters are largely dormant, and sand and gravel could be recovered with a minimum of environmental imbalance. Investigations of fish migration habits in the Chesapeake Bay have determined the months when dredging can be conducted with a minimum of ecological damage. This type of information is needed for each of the coastal states.

The problem that remains is one of maintaining good water quality in the dredging area. The selection of the recovery system can aid in this respect. The operation of bucket ladder and wire line dredges can only create a turbid water condition. The bucket's impact on the seafloor raises mud clouds, and the fact that the dredged materials "boil out" during the trip to the surface should exclude the use of these dredges. Suction dredges, especially hopper type (Figure 3), should aid in maintaining a satisfactory water quality. With engineering revision the waste water discharge from suction dredges could be screened more finely to reduce the quantity of "fines" returned to the sea. Confining dredging operations to outgoing tides and banning sand and gravel recovery in recreational, commercial, and sport

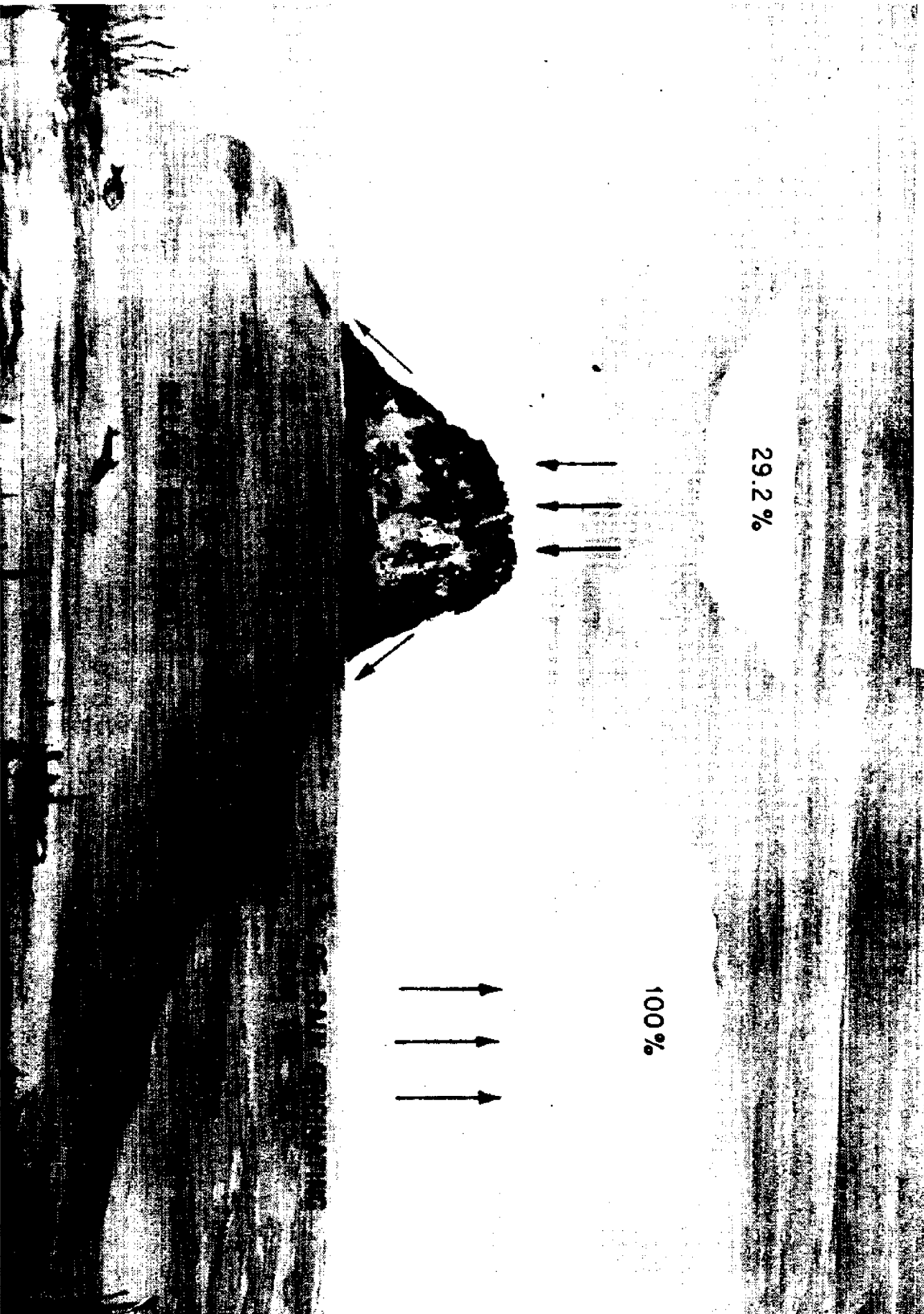
NEW ENGLAND GLACIAL DRIFT



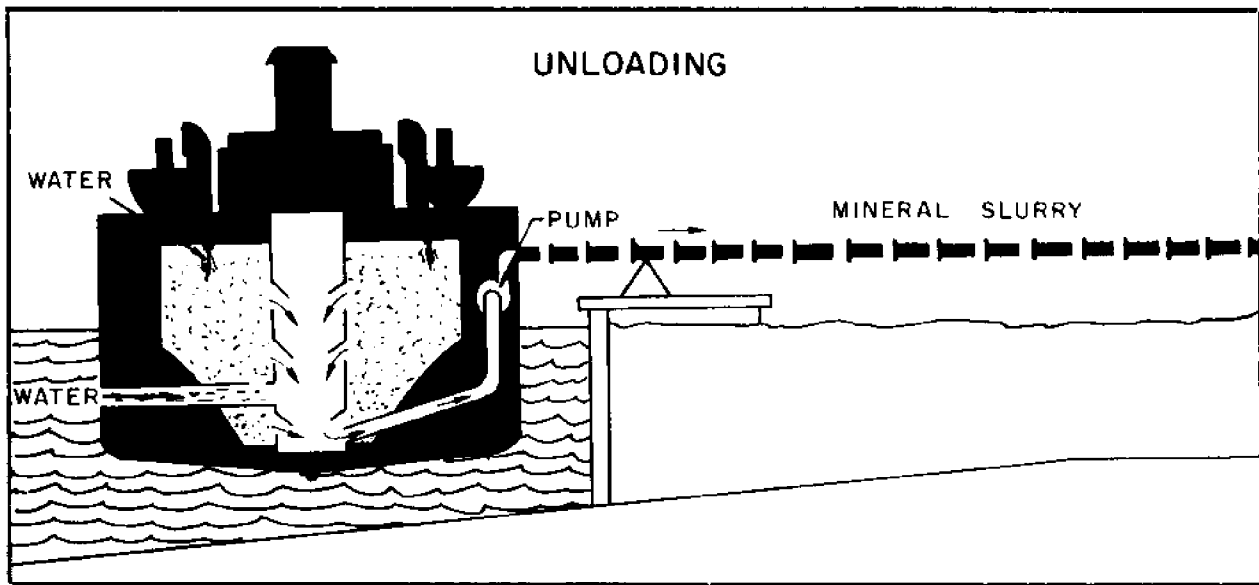
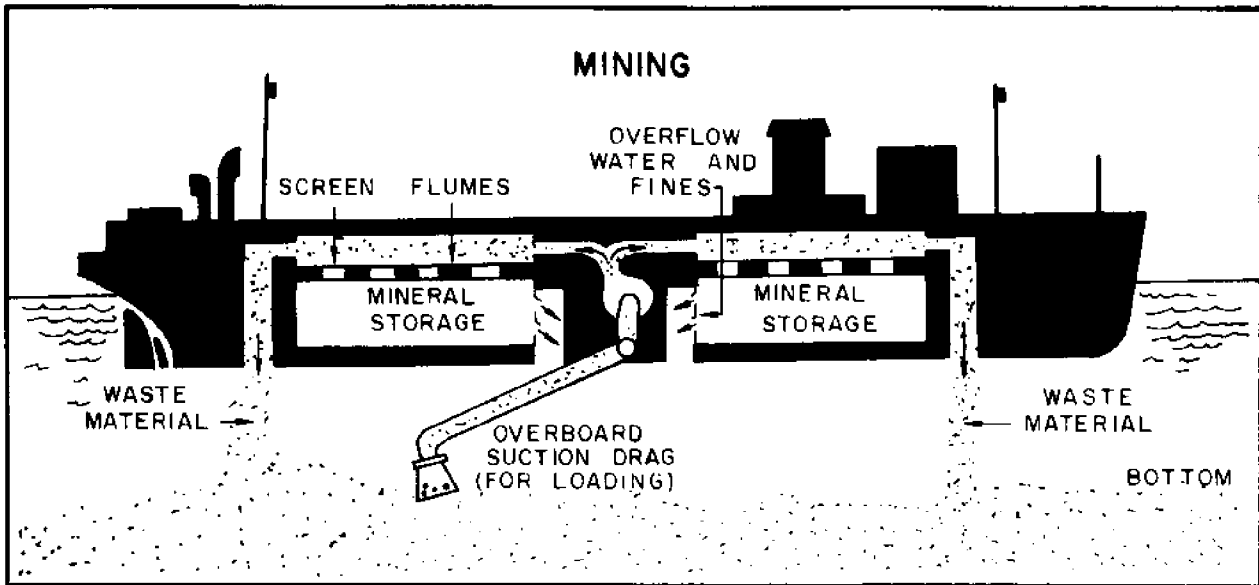
FROM U.S. GEOLOGICAL SURVEY WOODS HOLE, MASS.

THE EARTH'S EROSIIVE RAIN CYCLE

FIG. 2



HOPPER DREDGE FOR MARINE MINING USE



ILLUSTRATIONS COURTESY OF CONSTRUCTION AGGREGATES CORPORATION, CHICAGO, ILLINOIS

fishing areas could further control the situation.

In some cases, offshore dredging may even benefit the environment by creating upwellings that raise nutrients from the bottom to attract fish, as is the case in the Grand Banks fishing area. At inshore locations, dredging can be used as a means of removing the thick layer of organic silt that has accumulated on our very doorstep.

CONCLUSION

It is not a case of how or where, but when offshore sand and gravel dredging will commence. The New England states should commence preparing for the event with intelligent legislation, the development of strict environmental controls, a series of offshore surveys that will determine the distribution, quantity and quality of available sand and gravel deposits in state-owned submerged land, and fishlife migration studies.

Mr. John M. Hunt
Woods Hole Oceanographic Institution
Woods Hole, Massachusetts

ENERGY REQUIREMENTS - OFFSHORE PETROLEUM

The energy crisis which you have heard so much about is an enormously complicated problem which over the years has involved shifts in energy requirements from coal at the beginning of the century to oil and gas and now nuclear fuels. Superimposed on these shifts is the new requirement for clean fuels and the resulting shortage of these fuels. Today I plan to discuss the trend of oil and gas requirements for the United States and what this means to our New England coastal zone during the next 30 years. The questions I will specifically try to answer are:-

- 1) What are the energy requirements of the U.S. to the year 2000?
- 2) To what extent will offshore drilling and the importation of petroleum satisfy these needs?
- 3) How can we preserve our coastal environment and still meet our energy needs?

Table I shows the energy consumption in the United States for 1970 and estimates for the years 1985 and 2000. These data are taken from published estimate (1,2,3,8) plus some revision based on population and energy use trends. Some estimates of energy requirements show the total almost tripling by the year 2000. I believe there will be a noticeable decrease in the growth of energy consumption particularly near the end of the century. Energy requirements are due to an increase in population and gross national product (output of goods and services). Although our GNP will continue to rise, there is no question that the U.S. population curve is turning down. The U.S. Census Bureau reported a 15% decrease in pre-school children during the last decade, the largest drop in 120 years. Because of this trend, which I think will continue, our energy requirements will probably only double by the year 2000.

Now looking at individual sources of energy we find that hydropower will increase very little because of natural limitations on the number of dams that can be built. Nuclear power, which does not pollute the atmosphere like the fossil fuels, will increase possibly seven-fold by the year 2000. It is limited, however, because of its inefficiency. Most people don't realize that only 30% of the heat in a nuclear power plant is converted to electricity. Most of the other 70% becomes waste heat in the cooling water. Unless we develop more efficient nuclear plants it has been estimated that by the year 2000, one-third of the average

daily run-off of fresh water in the United States will be required to cool nuclear power plants. Furthermore, constructing nuclear plants poses a problem in disposing of the radioactive wastes which will have to be trucked to disposal sites. Because of these problems, I have estimated that nuclear power will not contribute more than 15% of the total power in the year 2000 even though others have estimated as high as 18% (4).

Now turning to the fossil fuels, we find that in the year 2000, coal, oil and gas will be providing 83% of our energy needs compared to about 96% today. There will be a significant difference, however, in the relative proportions of these fuels. The use of gas, which is the only clean fossil fuel, will more than double by the year 2000 assuming enough gas can be found, whereas coal and oil will only increase about 50%. In fact, some of the increase in the use of coal during the end of this century will be in coal gasification, that is, the production of gas from coal.

Why do I feel that gas will eventually dominate the energy market? Table II lists the average composition of fossil fuels. Although individual oil and coal samples show some variability it is obvious that the quantities of sulfur and nitrogen in these materials produce atmospheric pollutants on combustion as compared to gas. As most communities in the U.S. intensify the battle for clean air, there is a steady and continual switch by industrial plants, hospitals, schools and other public buildings from burning coal and fuel oil to burning natural gas. The Federal Power Commission has tried to hold back too rapid an increase in the use of gas because the immediate supply is limited and the demand is forcing up

prices. However, if the ecologists have their way, gas consumption will increase because it is the only fossil fuel which adds virtually no pollutants to the atmosphere. The burning of oil and coal not only contributes destructive sulfur and nitrogen compounds to the atmosphere, but also adds unburned hydrocarbons and particles of carbon black. Gas, because of its high hydrogen content, burns cleanly and completely. If present trends continue, the year 2000 may well see most of our steam generating plants powered by either gas or nuclear energy. In addition, many automobile fleets of both government and industry are being converted to burn compressed or liquified gas rather than oil.

An unknown factor in our energy consumption, which is not shown in Table I, is the small but increasing use of waste products for fuel. For example, garbage, coffee grounds, sawdust, peanut shells, paper mill by-products, etc. are not economic fuels by themselves, but when you add the cost of disposal it becomes economic to burn them to generate power. Next year, St. Louis will have a pilot plant generating electricity from the burning of garbage, and several manufacturing plants in the U.S. already utilize waste products for fuel. This could reduce fossil fuel requirements by 10 to 15% by the year 2000.

Now what does all this mean in regard to planning for the New England coast? Looking at Table III you will notice that our current reserves of oil and gas are only about one-fourth of the anticipated consumption in the 30 years from now until the year 2000. This means that we will have to discover and import large amounts of crude oil and gas. I have made my own evaluation of existing reports (2,5) of the estimated discoveries up to the year 2000. Between one-half and two-thirds of these discoveries will be made offshore on the Continental shelf, slope, and rise. The

emergent land of the United States has been heavily drilled except for Alaska and it is doubtful if very many major fields will be discovered except in some untapped very deep pay horizons. Today, most major companies are concentrating their drilling in the more lucrative offshore areas.

What are the hazards of offshore drilling to the environment? There will always be some kind of oil spills associated with a drilling operation. The potential for spills, however, can be greatly reduced by sound practices, regulations, and state and federal supervision. It is interesting to note that out of 9,000 wells drilled on the outer continental shelf of the United States, only 25 experienced blowouts and only 3 produced spills that represented a serious pollution threat. Recently, both state and federal governments have taken up legislation aimed at banning or severely limiting drilling off the coast of the United States. There is a real question as to whether some of these legislators have considered the alternatives. For example, if we cut the discoveries of oil and gas in Table III in half we will have to raise the imports an equivalent amount to meet the required consumption. Imports are raised primarily through tankers and tankers to date have posed a much greater pollution threat than drilling on the Continental shelf and conveying the oil to market through pipelines.

In regard to drilling off the New England coast, Figure I shows a favorable area for petroleum which was published a few years ago by Dr. Emery of W.H.O.I. (6). Recently, Mobil Oil discovered gas and condensate in a well on Sable Island off Nova Scotia. Sediment thickness offshore is about 4 kilometers around Grand Banks and up to 2 1/2 kilometers off the Massachusetts coast. This is more than enough sediments to contain

valuable oil and gas deposits.

Even if properly regulated drilling is allowed along the entire coast of the United States, we would still have to import more oil and gas during the coming decades to meet our energy needs. Figure 2 shows the estimated increase in imports as a percent of total consumption. As you can see the biggest increase will occur with gas, although, by the year 2000 we will be dependent on other countries for about two-thirds of both our oil and gas consumption.

Also, there will be competition for this gas in the free world and we may be burying from the Russians before the year 2000. For example, the discovery of the giant Groningen gas field off the coast of Holland has caused the Dutch to shift many of their power plants to gas. Since this field is estimated to have a life of only 18 years, the Dutch will be competing with everyone else for gas after about 1985. Likewise, the North Sea gas fields which are causing Great Britain to shift to gas have life expectancies of about 20 years. Meanwhile, the Russians have discovered enormous reserves of oil and gas in Western Siberia. The potential petroleum area there is larger than Alaska, so it is probable that the Russians will market some of their oil and gas.

Now I would like to devote the remainder of my talk to answering the question - How can we as New England citizens protect our coastal environment and still meet our energy needs? First, I think we should try to educate state and federal officials on the importance of increasing exploration for gas and increasing the supply of gas to the New England market. As previously mentioned, gas is the cleanest of the fossil fuels and it comes closest to letting us have our energy while still preserving

the environment. The problem in New England today is that more power plants are shifting to gas and this will undoubtedly increase in the future, but the gas is just not available because we haven't emphasized the supply. Unfortunately, most of the federal government activities in the past decade have tended to decrease rather than increase the availability of gas. Government regulation of gas prices has caused companies to explore for oil and not emphasize potentially good gas areas. It has been estimated that we might discover as much as 1100 trillion cubic feet of gas onshore and offshore U.S. if we really intensified our gas exploration effort (5). We need incentives for companies to look for gas.

Also, we need more gas transmission pipelines into New England from other parts of the U.S. and Canada. The problem is complex because those other areas are also increasing their use of gas and are naturally reluctant to give us more of their supply, until additional reserves are discovered.

Two things have happened in recent years that have greatly increased the potential of obtaining gas by tankers from abroad. First, the majority of the producing countries have passed legislation to stop the flaring of gas at the wellheads. For decades it has been the practice of oil companies to burn gas at the oil site because there was no means of disposing of it. Now they will be forced to either reinject gas into the field, or store it, or transport it to consumer countries. Second, the world's first fleet of tankers have been successfully operated containing liquified natural gas (LNG). For those of you who are unfamiliar with the terminology, liquified natural gas is largely methane (CH_4) with small amounts of ethane. Methane comprises the gascap of many oil fields and

in some gas areas it is the only hydrocarbon produced. It must be cooled to -160°C (-256°F) in order to transport it as a liquid. Liquefied petroleum gas (LPG) is primarily propane (C_3H_8) and butane (C_4H_{10}), which are refinery products. These hydrocarbons can be liquified under pressure and it is common to use LPG as a source of gas on small farms and communities. The Sable Island discovery is largely LNG and LPG.

Tankers to carry LNG are currently about 800ft. length with a draft of 31ft. and a load of 440,000 barrels of LNG (7). This is equivalent to 1.5 billion cu.ft. of gas. They boil off about 0.2% of their cargo per day, which is used to fuel the tankers. Tankers are currently operating between Algeria and Great Britain, and between Libya and Spain and Italy. Venezuela is in the process of developing export facilities.

LNG tankers and port facilities represent a far less hazard to the environment than oil. In general, the LNG tankers have much stricter safety design features than oil tankers, and they do not have the frequent low level spills typical of many oil ports. If citizens of New England coastal towns want to preserve their environment and still have industrial development, they should seriously consider setting up LNG tanker port facilities. Currently LNG import costs are high, but these will undoubtedly come down as more tanker fleets go into service. By 1980, our New England states could be importing up to 5 trillion cu.ft./yr. of LNG valued at \$0.5 billion if we really emphasize this fuel for our energy requirements.

I also feel that if we are to keep from being entirely dependent on imports we will need to allow development of offshore oil and gas fields with proper regulation of the industry. New England must have increasing amounts of fossil fuels in the years ahead. In terms of damage to the

environment the drilling of offshore fields and the importation of gas both by pipeline and tanker represents a far less hazard than bringing in giant tankers along our rocky coast loaded with oil.

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TABLE I

ESTIMATED U.S. ENERGY CONSUMPTION
(in quadrillion BTU's)

	<u>1970</u>	<u>1985</u>	<u>2000</u>
Hydropower	2.7 (4)*	3 (2)	4 (2)
Nuclear	0.3 (0.5)	14 (13)	21 (15)
Coal	13 (19.5)	20 (19)	21 (15)
Gas	23 (34)	35 (33)	54 (39)
Oil	28 (42)	35 (33)	40 (29)
	<hr/>	<hr/>	<hr/>
	67 (100)	107 (100)	140 (100)

*Percent of total.

TABLE II

CHEMICAL COMPOSITION
OF FOSSIL FUELS

	<u>GAS</u>	<u>OIL</u>	<u>COAL</u>
Carbon	76	84	81
Hydrogen	24	13.5	5
Nitrogen	0	0.5	1
Oxygen	0	0.5	10
Sulfur	0	1.5	3
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	100	100	100

FIGURE 1

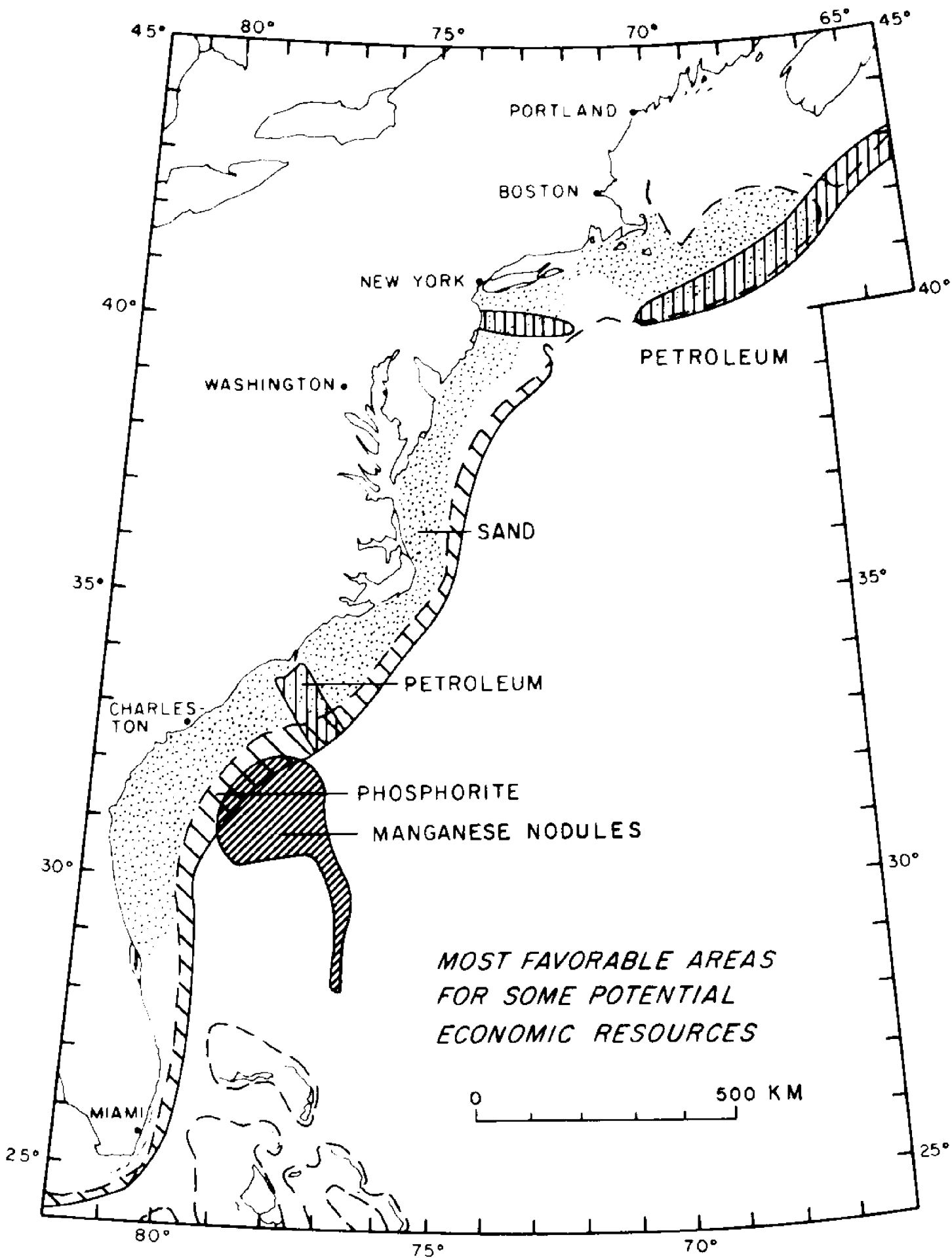


FIGURE 2

ESTIMATED INCREASE IN PETROLEUM IMPORTS TO U.S.

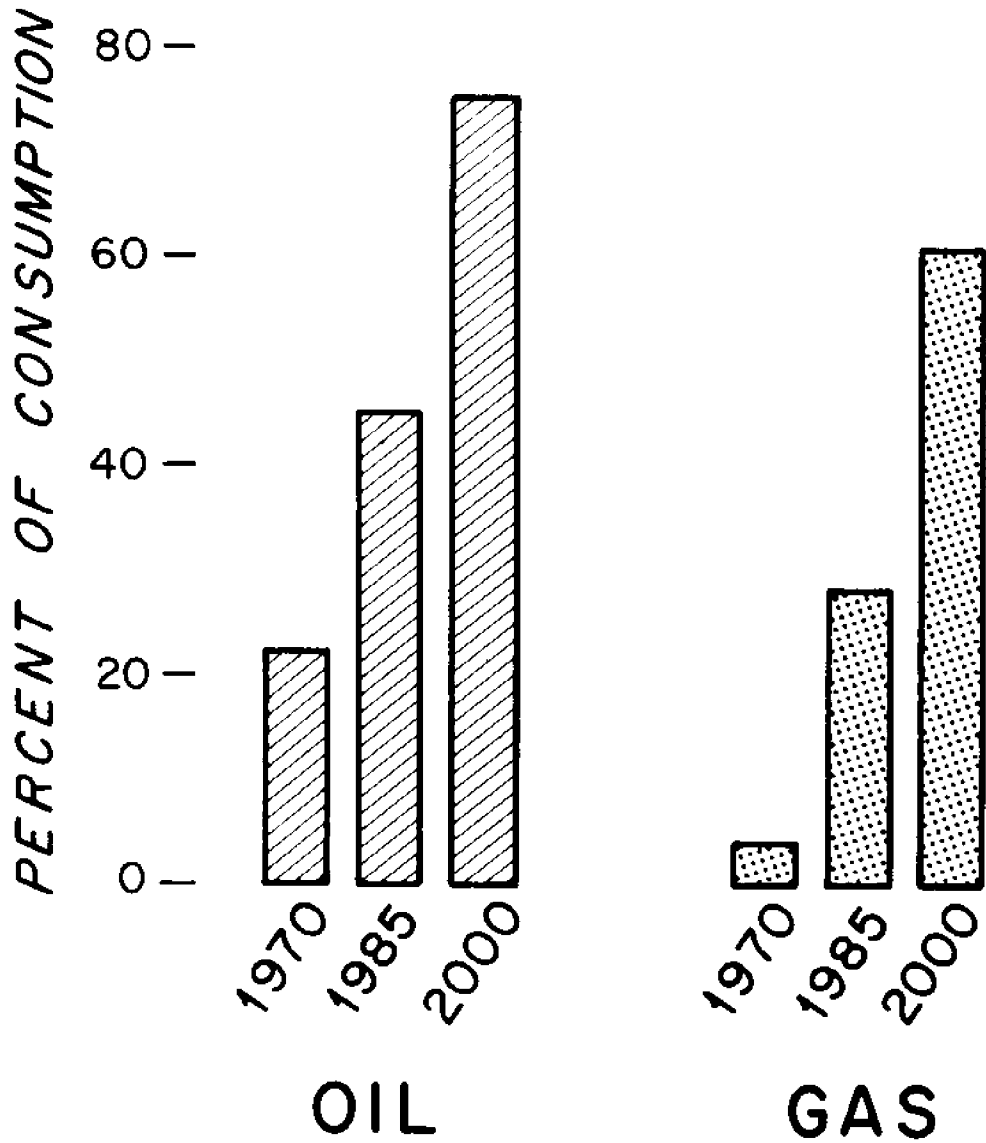


TABLE III

ESTIMATED U.S. OIL AND GAS RESERVES
vs. CONSUMPTION
30 years (1970-2000)

	<u>CRUDE OIL</u> (billions of barrels)	<u>NATURAL GAS</u> (trillions of cu. ft.)
Reserves	50	300
Discoveries	60	600
Imports	80	300
	—	—
Consumption	190	1,200

Mr. John H. Clotworthy
Director, Office of Congressional
and Legislative Affairs
National Oceanic and Atmospheric
Administration
Washington, D.C. 20230

CONGRESSIONAL LEGISLATIVE ACTIVITIES

The seriousness of the problem that confronts the coastal states is one that is plainly evident to each of you. A quotation from the August 1971 Conservation Foundation Newsletter sets it forth quite succinctly. It said "Some dramatic changes have taken place in the last few weeks to block economic development for environmental reasons." The Newsletter states further: "Perhaps the most stunning (change) occurred at the end of June, when Delaware, a renowned corporate haven, enacted the Coastal Zone Act of 1971 which flatly prohibits construction of new 'heavy industry' -- such as oil refineries, chemical plants, steel manufacturing industries and pulp paper mills -- along a one to six-mile-wide strip down

the state's 125-mile bay and ocean coastline. Also barred is construction of any bulk offshore transfer facilities. The reasons given for this are that such developments would be incompatible with the protection of the natural environment and that the coastal area should be safeguarded for recreation and tourism."

Other areas of the Nation, while not enacting blocking legislation, were nonetheless foreclosing industrial development for the time being by one means or another. In earlier actions this year, Sears Island, Maine, through the State's Environmental Improvement Commission; Tiverton, Rhode Island, and Hilton Head Island, South Carolina, similarly "bit the bullet" and turned down new job opportunities, capital investment, and new tax sources in the interest of an environmental status quo in the coastal zone. Peter Brandford, former aide to Maine Governor Ken Curtis, in a letter published in the July 30 Maine Times, characterized the Delaware legislation as a "suburbanite's response to a potentially undesirable neighbor" and he suggested that while it might suit our sense of poetic justice, it was nevertheless inconsistent with our simultaneous needs for more oil and less environmental degradation.

The problem then is how to have the best of both possible worlds. Those of you who have tried to rationalize Coastal Zone Management questions know that the best of both worlds is Utopian and unreachable for the present. There isn't anything that man does by way of using his environment that doesn't result in some kind of alteration to the natural state.

The question then becomes whether the price is consistent with the gain and I suspect that the most taxing problem that any of us will face is attempting to make a valid cost/benefit judgment when the variables

are as equatable as apples and oranges. The social value "apples" standing for recreational open spaces or some amenity of society are not comparable to the "oranges" of living standard and the hard substance of economic growth. The "apples" are a qualitative measure and the "oranges" quantitative. Unfortunately for the governmental unit in the position of having to make decisions, the best EDP installation is of little value. The socio-economic transform function is missing.

It is against this background of recent happenings at the local level and the dilemma of social versus economic interest that face everyone concerned with coastal and estuarine zone management that we should examine proposed legislation at the national level. Failing to do so we run the risk of viewing legislation as a panacea--a tempting escape in view of the magnitude of the problem.

Legislation at the national level can be conveniently divided into two categories: (1) measures dealing with the coastal and estuarine zone, and (2) measures dealing with general land use, a constituent of which is the coastal and estuarine zone. A listing of the principal legislative initiatives in both categories, together with their principal sponsor, follows.

COASTAL ZONE LEGISLATION

- HR 2492-Lennon "To provide for the effective management of the Nation's coastal and estuarine areas."
- HR 2493-Lennon "To assist the States in establishing coastal and estuarine zone management plans and programs."
- HR 3615-Dingell "To amend the Act of August 3, 1968, relating to the protection and restoration of estuarine areas, to provide for the establishment of a national policy and comprehensive national program for the conservation, management, beneficial use, protection, and development of the land and water resources of the Nation's estuarine and coastal zones."

- HR 9229-Lennon "To establish a national policy and develop a national program for the management of the Nation's coastal and estuarine zones."
- S 582-Hollings "To establish a national policy and develop a national program for the management, beneficial use, protection, and development of the land and water resources of the Nation's coastal and estuarine zones."
- S 638-Tower "To assist the States in establishing coastal zone management plans and programs."

LAND USE LEGISLATION

- HR 4332-Aspinall "To establish a national land use policy; to authorize the Secretary of the Interior to make grants to encourage and assist the states to prepare and implement land use programs for the protection of areas of critical environmental concern and the control and direction of growth and development of more than local significance." (HR 4337, 4569, 5504 are identical) and HR 2449 is similar).
- S 632-Jackson "To amend the Water Resources Planning Act (79 Stat. 244) to include provision for a national land use policy by broadening the authority of the Water Resources Council and river basin commissions and by providing financial assistance for statewide land use planning. (HR 2173 is the same).
- S 992-Jackson "To establish a national land use policy; to authorize the Secretary of the Interior to make grants to encourage and assist the States to prepare and implement land use programs for the protection of areas of critical environmental concern and the control and direction of growth and development of more than local significance."

At this time, the professional staff of the House Committee on Merchant Marine and Fisheries is rewriting legislation based on the public hearings that were held earlier this year, and it is unlikely that any of the listed measures will emerge. The Committee may hold additional hearings, probably late October or November, but the prospects for coastal zone legislation this session are not bright because the Chairman of the Rules Committee has stated that no additional Rules will be granted after October 1. This situation could change should the Senate act first and send to the House

their legislation on the subject. The Senate Commerce Committee is expected to hold Executive sessions on coastal zone legislation next week, but the consensus of observers is that we will not see any coastal zone legislation during this session.*

The Administration has not favored legislation dealing with the coastal zone, as such, but has, instead, advocated the enactment of general land use legislation. H.R. 4332 and S. 992 are companion bills with Administration backing. Senator Jackson has also introduced his own bill, S. 632, which, while directed toward the concept of land use planning, reaches that end by amending the Water Resources Planning Act to include provisions for a national land use policy. These measures have been referred to the House and Senate Interior and Insular Affairs Committees.

In both categories of legislation, the federal government's role is limited to the granting of funds to the states for the planning and management of land use or coastal zone regimes and the establishment of criteria which must be met by the states in carrying out the legislative intent.

Neither House is expected to act on a land use or coastal zone bill in this session.

We will come back to the legislation during the discussion to follow but before doing so I would like to advance a couple of thoughts. The federal legislative activity, while terribly important as a "climate setting" device for state or regional action, is of no value if we fail to recognize the dimensions of the management task at the state level and the really spectacular demands to be placed on the scientific, business, and political institutions of the Nation.

*Note: Since the presentation of this paper, the Senate Commerce Committee has reported out favorably, amended S. 582 (Hollings).

This can be demonstrated best by focusing on a couple of fallacies that are presently lurking in our contemporary thinking about coastal and estuarine zone management.

The first is that once federal legislation is enacted and funds begin to flow to the state, that grand solutions to the management dilemma will materialize. Nothing could be further from the truth. The enormity of the research task alone is staggering and even though federal money has already begun to flow into colleges and universities for coastal zone research, this contribution, via the Sea Grant Program and other agencies, is but a small beginning. The physical, chemical, and biological processes of the local marine environment must be understood and at this juncture we are a long way from having that in hand, much less the ability to predict the effects of change through the non-uniform interactive natural systems. But even with the desired level of understanding, we would have still to contend with the web of industrial, commercial and recreational use forces in the coastal zone which, in turn, react with a complex of economic legal, and technical constraints. Research institutions are just beginning to look into means for modeling these socio-economic elements so that alternative plans can be evaluated through computer simulations. I do not believe that it is an overstatement to suggest that the research and development task before us in the intelligent use of the coastal zone is consistent with some of our most ambitious national R&D efforts in terms of the demand on our supply of money and talent.

Another fallacy which disturbs me is the thought that no constructive action can begin at the state or regional level until the federal government moves. Granted that the prospects of federal funding suggest this as a

course of least resistance, the problems are such that they can't wait. Obviously, a number of states aren't waiting, even though recent actions have been largely of a "blocking" nature. States which have not begun to plan constructively should wait no longer, for the essential ingredients of any federal legislation relating to the coastal zone are apparent in the draft bills. While there are some federal jurisdictional unknowns, it is quite apparent in all of the suggested legislation that the action lies at the state level--where it should be for matters such as these.

A final fallacy that I find disturbing is the preoccupation with the extrapolation of population forces on the coastal zone without a concomitant extrapolation of scientific understanding and technological competence to deal with the resultant problems. If we increase our understanding of the natural processes and develop means for assessing the effects of planned change then we are bound to exercise our innovative talents and turn what are presently adverse interactions between competing multiple users into complementary situations among beneficial multiple users. We are only just beginning to see what can be accomplished in the realm of beneficial multiple use, and I can find no reason for faintheartedness in facing the future optimistically. Therefore, we should expect to devise new methods of meeting the demands placed on our coastal and estuarine zone resource as social and economic pressures rise without destroying it in the process. But the surest way of achieving success is to establish visionary objectives and get on with the task.

Mr. Thorndike Saville, Jr.
Technical Director
Coastal Engineering Research Center
Washington, D.C.

RESEARCH NEEDS IN THE COASTAL ZONE

It is a pleasure to be here to discuss with you some of the research needs in the coastal zone. Throughout man's history, the coastal zone has been one of the most critical areas to mankind. Man developed from and by the sea, and has lived in one way or another by and with the sea ever since. Yet man's knowledge of the coastal area is appallingly small. I will try to indicate some of the needs for research to gain more knowledge to both use and protect the coastal area for the optimum benefit of man. Others of you will have other suggestions and ideas, and I believe that the point of this panel is to bring these out and discuss them.

Now, my organization, the Coastal Engineering Research Center of the Army Corps of Engineers, is one of the major federal research organizations dealing with the coastal zone. But our work deals with coastal engineering, and the impact of engineering projects on the environment. There are many other areas of research needs than these. Consequently, in the material which I will present, I am in no way presenting the description of our, or even Corps of Engineers, work in the coastal zone, or work is planned or programmed for the Corps of Engineers. It will encompass some items which are not within the mission of the Corps of Engineers, or are peripheral to that mission. It should be taken as an expression of my own ideas, and does not in any way represent those of either my own office or the Corps.

First, there is a need to know and understand the physical processes involved in the coastal zone. This knowledge is needed to predict what may (or may not) happen in both long and short term. For example, we need to know the wave climate in an area in order to predict the best operating time for such things as offshore mining and construction, recreational sailing, and storm wave damage to our shore, whether in a developed or undeveloped state. We need short range predictions of the waves in order to determine whether to hoist storm warnings, or not; whether to batten down houses or industries situated at the shoreline; whether to postpone or call off operations at sea -- fishing, mining, construction, research itself, recreation -- you name it -- any and all of the various activities of man in the nearshore zone.

We need to know how these waves are generated; how they travel forward to reach the shore; how they change as they pass over shoals or around promontories, as they enter inlets and harbors, and as they break and run up on the shore face or cliff. For example, how does the projection of Cape Cod affect waves coming into Massachusetts Bays and Cape Cod from the North Atlantic? Obviously it gives an area sheltered from waves from some directions, but not necessarily from those from the Gulf of Maine. If you were designing a power plant, a fish cannery, or some other operation close to the shore, this effect would be of vital importance in the picking of a location and in the design for protection from the waves.

What is the effect of the Gulf Stream - or any other major current - on the waves passing through it? Can it steepen them and cause them to break, leaving an area of relative calm behind? Can it reflect them back to sea, again leaving an area of calm? Or can it add energy to the waves

because of the current velocity itself, thus causing higher waves on the shore side? We don't know.

We need to know more about the forces which waves exert on boats, on structures, and on the shores themselves. And while we think mostly of waves as exerting a horizontal force, it is obvious that a wave rising under a pier or an offshore platform can exert a tremendous vertical force if it reaches the surface of the pier or platform. In the Arctic, and even in northern New England, ice can form around structural members such as piles, from the freezing of spray. This ice forms a projection out from the pile, and as a wave comes up under it that wave can again cause a significant uplift force. Such a problem is augmented in some New England areas by the large range of tide.

Can these waves engender vibrational forces, and particularly are such forces affected by the spacing of structural members such as piles?

Even if we know the forces which might be exerted, we are not yet home free. These forces are repetitive, and we need information on fatigue resistance and the effect of hundreds or thousands or hundreds of thousands of these forces applied over a period of time.

Currents, whether caused by the tide, by the wind, by the general oceanic circulation, or by the waves themselves are equally important. They too exert forces, and particularly they exert forces on small particles which may move easily. These particles may be the sediment which makes up our ocean bottom and the shores; or they may be anomalous substances introduced into the water for one reason or another. These latter we generally call pollutants.

We need to know much more about the way sediment is moved along our

beaches. Is it to be moved along the shore, and if so, in what direction and at what rate? How does this rate vary from day to day and season to season? Can we stop the movement? If so, what happens to the beach, and how fast? If we build a groin to hold material from moving along a beach, or jetty to prevent movement of material into a navigational channel, we know that the beach on one side will accrete; however, on the other side of the groin or harbor entrance the beach will normally recede or erode. How much damage may be caused by this erosion, and what can we do about it? Do we protect that area with more groins, presenting what may be to some an aesthetically unpleasing, cut up shore, "littered" with rock or sheet pile structures? Do we continuously feed that beach with other sediment obtained from some other source? Or do we try in some way to bypass the surplus material caught at the updrift side of the groin or jetty? In the past we and others have frequently taken material to nourish and feed beaches from bay and estuarine sources. But, this material is now fast running out, and we also are finding more and more that in so doing we may destroy a valuable estuarine resource. In fact, in some areas we may want to reverse the process and put material into the estuary in order to create, or recreate, shallower estuary and marsh areas. Accordingly, now we are looking to the use of sand from offshore to nourish our beaches. But here we also have questions to answer. For example, how close to shore can we remove material from the offshore zone and not do damage to the shore purely by digging a hole, thus steepening the nearshore slope, and making it easier for beach material to be moved offshore by the waves and be re-deposited in that hole? More efficient equipment and techniques are also needed.

These problems deal with the transport of sediment along the shore. An equal need for research is on the movement of materials in an on and offshore direction. We know that we have seasonal changes in our beaches, with our beaches normally being fat and wide during the summertime - fortunately when the demand for recreational use is at its greatest - and frequently have eroded beaches in the wintertime when we have more storms. But, what is this seasonal back-and-forth change? How is it affected by differing degrees of wave exposure to the ocean at different locations? What might be the extremes which would occur, as opposed to the average over a number of years? These are questions which are of major importance in determining how close a building, whether it be beach cottage or a major industry, or a park road, should be placed to the shoreline; or how wide to restore or build a beach.

We need to know more about the stress of the wind on the water, and the way in which it pushes that water toward the shore thus creating a storm surge. New England above Cape Cod is not exposed to the extreme hurricane surges of our South Atlantic and Gulf Coasts. Nevertheless, this area can experience significant storm surge from northeasters. And some of you may remember the flooding of Providence, Rhode Island, in some past hurricanes. Providence itself is now protected by the Fox Point barrier, but the problem still exists for other areas along the coast. Determinations of these possible extreme water levels is necessary for good planning and zoning, as well as for design of protective structures. Prediction during a particular storm occurrence is necessary to give adequate warning to individuals and industry in an area. It is a problem which is being worked on cooperatively by the Weather Service (primarily from the predictive

standpoint) and the Corps of Engineers (primarily from the standpoint of long term extremes for design). And, of course, the Atomic Energy Commission has an interest in even more extreme extremes in terms of protection for nuclear power plants and desalinization plants located at the shore to permit use of ocean water as a coolant.

So far I have emphasized the need to know from a standpoint of design for protection against danger. However, along with these determinations goes a determination of the degree of risk associated with each condition; and even more importantly, the degree of risk which one is willing to take. Sometimes this can be put in terms of money, as, for example, the design of an offshore oil drilling platform where, if we ignore the ecological considerations for the moment, one could equate the risk in terms of the cost of the damage versus the increased cost to prevent that damage. But sometimes risk factors are not easily quantified in terms of economics. It would seem obvious that one would require a much greater safety factor for a nuclear power plant (regardless of cost) than for a simple recreational beach cottage. This degree of protection is a matter of immediate concern to the power industry and also to the regulatory and permit agencies of the government.

How do we determine the acceptable degree of risk? And particularly in terms of intangibles. How do we quantify risk in terms of aesthetics or conservation? For it must be quantified if we are to deal in a rational - not emotional - manner. How do we relate these intangibles to priorities for jobs, or better living for the poor? Eventually these become political decisions - not engineering, scientific, or economic ones. But the politician needs a basis of fact to make his decision.

Let me now turn from physical problems to some of the biologic needs.

We need to know the effects of any action which we take in the coastal zone on the overall environment both physical and biological. We need to know the changes which our actions will cause directly on the biology of an area, and those changes which will be caused indirectly because changing the physical environment in turn affects the biological environment. It is perhaps here that our greatest lack of quantifiable knowledge lies. There is not now an adequate basis for preconstruction or preoperational prediction of all of the significant ecological changes that might result from the impacts of man's actions in the coastal area. Competent coastal ecologists can provide useful informed estimates of the probable effects at any selected site, if some information exists already. And let me emphasize that these are only estimates, and they can be provided only if some original information exists on what is there to start with. But we do not as yet have much that is quantifiable and exact in this area. These first estimates are of exceptional value - there's no question - but we need to be able to make more precise and reliable predictions before it will be possible to make fully rational decision between possible alternatives. Research is badly needed to put this area onto a more quantifiable and rational basis. For example, we need improved knowledge on the structure and dynamics of biological populations in communities at coastal sites; and furthermore of the effect of possible and probable perturbations on these. Studies need to be made of the change in, and fate of the principal anomalous substances in the nearshore zone, and the ecological effects of these. This would include not only items which we as man now introduce into the marine area through effluents of one type or another, but also all types of cargoes, and particularly those which might be used in the super ships

of the future, since these may accidentally be introduced in future transport operations.

It's interesting to note that reducing "pollutants" can be detrimental to man's current activities, as well as beneficial. I have been told that the partial cleaning of a major harbor allowed the reintroduction of the marine borer, causing considerable damage to the port facilities, and, in effect, increasing the cost to the consumer of products handled through that port. Similarly, I have been told that the sardine industry in that area suffered disastrously when the sewage effluent was significantly reduced. However, I leave it to you as to whether that was truly a detriment. (This last does though point up the fact that sewage effluent is highly nutrient, and properly used could be developed into a beneficial fertilizer for planned mariculture - another area for research and development.)

There are obviously so many types of biota, and as the interconnection between these biota is so complicated and interwoven it would be impossible to fully understand everything about them. Thus a marine ecosystem is almost impossible for truly definitive definition. However, it should be possible to determine indicators, and to give realistic and rational estimates of effects that might occur.

It is hoped that improvement might be achieved by the use of both physical and mathematical modelling of the physical, chemical, and biological systems in an area which might be affected by man's activities. Although they involve considerable simplifications, both physical and mathematical models can quickly provide estimates of trends and reactions to change. Their accuracy is, however, fully dependent on the accuracy of the simpli-

fication involved. Sometimes these are grossly oversimplified, and the models produce only such results as "water usually runs downhill." But given reasonable assumptions, and carried out by people with knowledge in the physical and mathematical modelling fields, they can produce results of real import.

So far I have stayed more or less in the nearshore zone. However, I know that one of the major concerns in the New England area, as well as much of the rest of the United States, is the possibility of using deep draft harbors offshore. The so-called super ports. Actually, with the continuing press of population, it is almost certain that man will eventually regress into the sea with artificial islands or other offshore facilities. It is my own belief that these will most probably be developed as multiple purpose facilities, to encompass seaports, airports, recreational activities, living, desalinization, and other industrial purposes. Along with Dr. Nierenberg of Scripps, "I can foresee the development of huge floating platforms, manmade islands serving as airports, weather stations, resort hotels, industrial centers, military bases." New construction techniques will be required, and a vast new knowledge of design and effects of such structures will be needed. New techniques will obviously be employed. One such may be the perched beach concept where a toe wall offshore from the island may be built up from the ocean's bottom to contain a beach area, thus saving the large additional quantities of fill material needed to construct a protective dike. In terms of ports, the dimensions of the port itself, and channels and turning basins associated with it, would need considerable study. Where a World War II type tanker could come to a crash stop in a distance of about 1/2 mile, the 400,000-ton vessels of the near future re-

quire on the order of 5 miles. The potential for disaster in a confined area is clear when it is estimated that by the year 2000 there will be more than 2,000 of these super ships plying the international sealanes. Use of these offshore structures will require research on a lot of other criteria too. Access can be by plane and boat; by overhead cableway; by floating, semisubmerged, or submerged pipeline; by large tunnels containing rail, automotive, and conveyor belt transport systems; or by bridge or causeway. Foundation problems, scour, and resistance to wave forces would need much further study.

Islands might also be constructed both for and from offshore waste disposal. Our waste problem is one of our major ones. It is accentuated by growing population and growing use of disposable products. A large diked area in deep water could possibly create a waste disposal area at minimum cost, affording a disposal area for large cities for a number of years. This could be in conjunction with, or separate from, other offshore construction.

With the increased recognition of the importance of our estuarine systems in the overall food chain, and for man's benefit, it would appear possible if not probable that offshore barriers may be constructed to create artificial estuaries. These again would probably have multiple use, the barrier itself being used for parks and recreation or possible industrial use, and the area between the barrier and the land being used to create a new estuary.

I have mentioned physical and biological or ecological problems, but have not gone into the socio-economic field. But there are obviously implications involved, and much research is needed in this area too. Labor-management relationships will have to take into account major changes in

methods of operation. Relocation of individuals and areal concerns would be integrated into development of offshore areas. Overall planning and zoning regulations to manage the new types of areas and new types of operations certainly need research and definition. How do we handle financing -- and there are large problems ahead there. Research in legal areas will be needed too.

I have completely ducked developmental questions of new or at least relatively new industries and resource development such as mariculture, wave or tidal power as an alternative to fueled power, waste reuse or recycling -- or planned use for fertilization of the sea, handling methods for new transport types (the LASH is already an actuality in New England with transfer barges using Providence).

I have tried to point out a few of the types of research needs, without particularly pointing to work which is currently underway or planned, or which might be planned. I know that there are many other areas of need, and I hope that some of these will be brought out in the ensuing discussion. Thank you.

Mr. William J. Hart, Vice President
Coastal Zone Resources Corporation
Wilmington, North Carolina

TECHNIQUES FOR MANAGEMENT OF COASTAL ZONE RESOURCES

In my view, management of coastal zone resources now and in the year 2000 poses a dramatic challenge to the resiliency of our democratic institutions. For the most part, the three-tier structure of U.S. federalism (leaving aside whether local governments are simply sub-divisions of state

government and whether regional organizations are separate tiers) has responded to objectives that have been closely allied with the growth and development of mercantile interests. The impetus for imposing more rigorous management regimes on the use of coastal resources is rooted in the cauldron of environmental concern -- a cauldron called conservation that simmered on a side burner for decades, but that now boils so furiously on the front burner that its explosive threat could cause the cauldron to be "back lashed" to the rear burner.

The once convenient symbiosis of growth, development, and progress with the public health and welfare -- so neatly summarized two decades ago by the phrase, "What's good for General Motors is good for the country" -- is now questioned. For example, Dade County, Florida, officials adopted a no-more-tourist-advertising policy. They agreed that the South Florida environment is already over-crowded and that there are no solutions to mounting power, water, and transportation problems that will not complete drastic alteration of the natural environment for the worse. What is doubly interesting is the way in which the questioning takes place: there are instances of group conscience exercised by groups of citizens within municipalities, but the overwhelming volume of questions come from groups some distance removed from the actual site of a proposed project. This is recognition of the economic and geographic externalities (another way of saying all actions taken by one individual affects many others) implicit in the management of environmental resources -- particularly in the coastal zone. The fact that people and values can be injured by the actions of others -- the action of the U.S. Forest Service in the development of the Mineral King Valley does affect a substantial number of people in the nation

as a whole -- is fundamental to the matter of "standing" to sue for injunctive relief in the courts. To my mind, the recent proliferation of environmental actions in the courts signifies serious questions about how well our administrative system registers and deals with changing citizen perceptions of value: what is happening is that those allocative mechanisms that favor "business as usual" values over quality of life values will suffer increasingly severe shocks (and shock to the system is exactly what the court directive to FPC in the matter of consolidate Edison's application for a pump storage facility in Storm King Mountain was) until acceptable responsiveness is achieved.

Very little has or is being done to significantly reshape government process from what is a pliable political situation created by new awareness of the environment and related economic implications. For the most part the knowledge is not new, but, with very few exceptions, political bullets are not being bitten. Planners content themselves with the expenditure of time and money to construct elaborate matrices and soft-ware systems to store and retrieve inventory information: the descriptions of the work resemble the search for a modern equivalent of the alchemists philosopher's stone where current bio-physical and socio-economic factors can be inserted in a formula that "presto!" yields an optimum mix of uses of coastal resources without causing anyone to make a decision. Positive actions, like those that Delaware enacted this year, ^{1/} will set out State priorities for use of Certain coastal resources. It was a political act, taken by a political executive and a political legislative body with full knowledge

^{1/} House Bill No. 300, First Session, 126th General Assembly, 1971, creating Chapter 70, Title 7, Delaware Code.

that somebody would be hurt and somebody would be benefitted. Even in the Delaware case, there are ambiguities left to administrative discretion, for example, offshore bulk product transfer facilities are prohibited, but industrial development is to be controlled by a permit system. Someone will have to decide whether or not an application will be approved.

The balance of this paper is given over to limited discussion of some factors that are at work in allocating environmental resources and their implications for coastal management institutions in 2000.

II

The first factor at work is change. It is worth restating that the biological-physical, social-economic, and institutional environments of the coastal zone are constantly changing.

Erosion and accretion changes shorelines; micro-climates are continually changing. As with these two segments, all parts of the natural setting of the coastal zone exhibit shifts. More apparent are changes wrought by man. Population growth has been singled out as the factor responsible for deterioration of environmental conditions. In the United States the real culprit is technology. The rates at which most resources -- such as water -- are use, and the rates at which environmental problems -- such as solid waste materials -- grow have far exceeded the growth rate at which our population has grown.

Similarly, the value system that determines the uses to which the changing resource configuration will be put changes. The market place has been remarkably successful in gauging changes and allocating and reallocating resources according to relative supplies, demands, and prices. But there is increasing acceptance of the fact the market has inadequately registered the demand, supply, and price relationships of relatively clean water

and air, open space, natural sand dunes, and other environmental goods and services.

Technological change intrudes on this scene. It is now possible to recycle existing material or to build new marshes to meet future demands. There is no technical blockage as long as there is a collective willingness to pay the marginal costs of applying a technology appropriate to reduction of the illeffects of mineral extraction or to enjoy the marsh even if what was marsh is now dry land.

Values perceived will change according to the proximity of individuals to a resource and according to time. There is a fairly regular, concentric pattern of value, which tends to shift according to personal assessments of what is important. Some idea of the complexity of the structure can be gained by considering some of the possible opinions held for a marsh: The owner thinks of it as a non-productive burden unless he is:

- A developer who things of it as a flat area where building lots can be built cheaply and sold dearly; or
- A retiree who enjoys the marsh as a barrier to development;

. Local residents may think of the marsh as:

- An evil smelling mosquito breeding ground that ought to be filled and built on to help lower the local tax rate; or
- A place to harvest shellfish and who doesn't want to see it changed;

. Affluent residents of a distant suburb may see the marsh as:

- An ideal place to find waterfowl;
- A place which should remain intact to absorb high water and the energy of storms; or
- A good location for housing lots so as to facilitate enjoyment

of boating water and of adjacent marsh which, of course, ought not to be filled and built on.

There are at least as many more possibilities. The shifts in how each group may assess the marsh can be caused by:

- . Change in the supply -- that is, the last stretch of marsh will be viewed differently than a small parcel on the edge of several thousand acres;
- . Whether the marsh is in an urban or rural setting;
- . Whether local residents are in low income as opposed to high income brackets;
- . Changes in the family status -- many desirable properties are sold to developers by heirs soon after the demise of the family patriarch.

While movement is slow, institutions also change. In the past decade there have been rather notable changes in the way state and local governments operate. A little more than a decade ago I was struck by the contrast between the composition of budgets for Vermont towns and town budgets in New Hampshire. The Vermont town budgets showed a large transfer component from the State government. State transfer payments made up only a small part of New Hampshire town budgets. Reliance on transfer payments is now the rule at both state and local levels. The change is due largely to the proliferation of categorical federal grants-in-aid programs that are usually channeled through each statehouse. (It might be parenthetically observed that much of the money was authorized to encourage the states to do what they should have been doing anyway; a point that has relevance in the current coastal zone funding controversy.)

Two important conditions are attached to this change in public service

funding. They are:

- . To the degree that the federal and state governments are willing to pay for certain services through transfers to local government, they can, in the interest of all the people, have standards for the type and level of service that is delivered to the people.
- . Recognition by some governors, federal officials, and citizens that the federal categorical system of grants fostered confusion and much working at cross purposes by agencies of state and local governments.

Very general trends interacted with these conditions to produce one of the more rapid changes in institutions seen in our system. The general trends are:

- . A growing concentration of people in urban regions
- . The centrifugal dispersion of urbanites from the core city to the suburbs.

This means that the majority of resource and social issues in the nation today are urban; INCLUDING MANAGEMENT OF THE COASTAL ZONE.

The institutional response is the rise of sub-state regional organizations. Metropolitan scale problems prompted the leaders of central cities to seek ways to integrate the problems of the cities with the resources of the burgeoning suburbs. The most visible institution is the regional planning council, an interesting blend of conventional advisory -- hence, irrelevant -- city planning commission with political decision makers. The hand of the advisory regional planning bodies was strengthened materially by the Demonstration Cities and Metropolitan Development Act of 1964. Section 204 of the Act directs the metropolitan agency to

prepare comprehensive development plans for the region and compare all applications made by jurisdictions for federal categorical grants-in-aid with the plan. Each subsequent application for a federal grant submitted by jurisdictions in the region were to be examined for compliance with the regional plan. Projects found to violate the plan are not likely to be funded.

At the same time, the sometimes ludicrous conflicts between categorical programs led certain governors and the Office of Management and Budget to act. Armed with the Intergovernmental Coordination Act of 1968, the experience of a number of governors who issued executive orders prohibiting the creation of federally financed special planning regions such as Economic Development Districts, and experience with Circular A-80 that implemented the Section 204 review process, OMB issued Circular A-95 establishing a "clearinghouse" procedure for the bulk of federally supported categorical programs.

Nearly every state has analyzed its bio-physical, socio-economic, and institutional settings. On the basis of the findings, the governors have designated regional and state clearinghouses. The result is very uneven. The range of state actions include:

- . Emergence of the nation's first truly regional government in Minneapolis-St. Paul
- . Conscious effort in Texas to have single policy boards serve as a council of government; supervise a Resource Conservation and Development District, an Economic Development District, the Cooperative Area Manpower Program System, Comprehensive Health Planning, and similar programs; programming the deliver of

- State agency services; and combining 204 and A-95 reviews
- . Completion of regionalization studies, but in consistent designation of agencies to serve as regional clearinghouses
 - . Designation of old 204 agencies to perform A-95 functions with the spaces between SMSA boundaries left to state level clearinghouse.

Attempts to draw together the often diverse programs of federal agencies have produced institutional changes too. Economic development regions, typified by the New England Regional Commission, and river basins commissions, typified by the New England Rivers Basins Commission, are relatively new institutions. They were created to provide mechanisms to mesh federal programs and priorities with state programs and priorities, but they may not have the same statutory focus and can compete with one another for state favor.

Far-reaching changes have been made in response to the awakening environmental conscience of the nation. The creation of the Council on Environmental Quality and the Environmental Protection Agency cannot be overlooked. The move to include public review of impact statements required by Section 102 of the National Environmental Policy Act of 1969 as part of the regional clearinghouse procedures and the revival of interest in coastal zone management by EPA are of most direct interest to coastal zone managers.

In spite of the overwhelming evidence that the total milieu is dynamic in each dimension, the preponderance of management planning is based on static concepts. Plans are made to specify the areas "needed" for industrial, commercial, residential, and open space uses at some future date. The planning documents still look as though the surface of the earth is two

dimensional; there is little in the way of analysis of what changes in the bio-physical, socio-economic, and institutional environments will mean, or that there are likely to be differences of opinion about what is good for a particular place at a particular time.

It is now evident that the simplistic "make a plan" solution for coastal resources was easier said than done. Two planners charged with designing optimum resource use in a given area will seldom produce identical plans; if one planner is a biologist and another a transportation engineer, the plans will never be the same and the likelihood is that two identically trained resource planners responding to different social value systems, where one must be responsive to a town board and the other to a legislature, will produce quite different allocations of resources.

Unless there is a sharp break with the static method of resource planning and a realization that public agencies ought to be utilizing a variety of mechanisms to influence the allocation of coastal resources now, any new categorical grant program designed primarily to plan for the use of coastal resources will probably follow the path of the Land and Water Conservation Fund: production of plans of all kinds to enable functional administrators to continue to do what they have always done in ways they have always done them.

State and federal transfer payments have emphasized the partnership aspect of the delivery of public goods and services and the relationship of these goods and services to those provided by the private sector. In nearly all functional areas the operating system is shared by all levels of government; that is, there are few areas that are exclusively for jurisdiction of one level of government. As in education where public schools supported with funds from local, state, and federal sources interact with

private institutions at elementary, secondary, university, and adult levels as part of the total education opportunities available to citizens, the total systems of housing, recreation, and transportation are made up of historic accommodations among the multi-tiered public sector and the private sector.

All goods and services are delivered at specific times and places. What is needed is the location of a point in the delivery system that will permit the assessment of specific projects in terms of the direct influence of the project on the bio-physical environment at the point of impact, and at the same time permit evaluation of the physical and economic repercussions of the project on both the bio-physical systems and socio-economic systems.

Evaluations are now more difficult to make than at any time in the past. New knowledge and technology account for this. We now know that warm water discharges can be good for some things; that makes outright opposition to power plant sites more difficult; we now know that there are ways to meet consumer demand for shellfish in artificial environments; this makes it difficult to incur the cost necessary to maintain sufficiently high water quality conditions to continue dependence on natural harvests.

We are 20 years late in recognizing the natural limits to man's settlement of the earth. Just as citizens in general recognize that septic tanks create stinking messes in areas with poor percolation and planning officials congratulate themselves on their ability to let the health department break up the monotonous row subdivision and lake front development, lo and behold! We know how to use an Apollo closed system located in the basement, and someone will have to attack row subdivision and lakefront development on aesthetic and social grounds.

This means that society now has to specify in precise terms the nature

of a social optimum; currently our system is inadequate to the task. The basic means available for determining what people want is still the market place. During the past two decades, goods and service not measured in the market place, such as outdoor recreation, have been included in public policy decisions through the medium of proxies for market price. Many of the measures have been and are unrelated to reality, as in the case of the outdoor recreation values found in Supplement 1 to Senate Document 97, while some, based on true supply-demand-price relationships, do yield useful statements of consumer willingness to pay for public services.

It should be noted here that price has been a generally overlooked factor in management planning for coastal and other resources. There is more than one example of changed water use when the opportunity cost of the water was inserted in plans rather than considering it as a free good. And differential pricing to reflect public scarcity can be accomplished through the tax structure.

But many of the choices facing society today are not registered in the market place; in fact, there is no way to say which is good and which is bad. The choice is simply a matter of preference. Our President, Dave Adams, is fond of pointing out that Clapper Rails require low marsh for survival and the Least Tern thrives on exposed sandy sites such as dredge spoil. He points out that if society wants the Least Tern, dredge spoil sites should be encouraged. Of course, this is over simplified. The question is who and how will the decision for one or the other be made. Up to now we have relied solely on the market values created by dredging for the entire decision. There is a need to find ways to show interrelationships and choices available and determine preference. The process is

complicated by the fact that the preferences found will vary by physical proximity to the specific site to be affected by the choice. Individual owners may be in favor of land use control until it interferes with what they want to do with their land. Local units of government, struggling with the burdens of providing reasonable levels of service to neighborhoods, are not going to be favorably inclined to wilderness rather than increased jobs in wood industry. It is the division in the perception of value that provides the basis for an organization to plan and manage coastal resources, indeed for managing environmental resources in general.

III

The management system in 2000 will probably capitalize on regional innovations. The emphasis ought to shift from a single state agency preparing a coastal zone management plan to a more effective structure that may not lend itself to a master plan map rendering. The system will center on the fact that agreement on the goals, objectives, and targets for the use of coastal resources must be agreed to on the ground; that is, specific changes for particular acres will be agreed to by all involved levels, including the private sector whose acquiescence may have to be purchased.

The system itself will be a dynamic two-way flow. General objectives and policies will be articulated by the federal and state governments. They will be increasingly specific; that is, federal language that requires a state to exert control over a critical development will go further and specify such things as non-use of hurricane flood plains. Federal agencies, meeting in regional configurations -- I really expect one set of regional organizations at the national level that combine the several existing

multi-state regional partnership arrangements, possibly operating under the aegis of a new OMB that includes some council on environmental quality functions -- will be charged with applying these policies to their operations and expecting state compliance before activating any project or program.

State law can enforce and, as necessary, expand the scope of federal policy. The option is the state's. The government (executive and legislative branches) could opt to ignore the federal policies leaving federal agencies with the task of meeting the national interest, as stated by the policies, by direct action.

State actions -- and I like to think of the old Wisconsin flood plain statute, the Maine Environmental Improvement Commission Statute, and the new Delaware law as exemplifying the type action I have in mind -- set the frame work for preparing regional development plans by sub-state regional agencies. The bulk of the benefits emanating from holding flood plains free from development are not usually registered in a municipality or group of municipalities in a region, but at the state and federal levels. Thus, the responsibility for achieving this responsibility -- not pontificating about how good it would be -- ought to be at the state and federal levels. Thus, those areas where external benefits control will be delineated on regional maps and the implications for use duly noted.

At the same time, municipal plans will be prepared. I would like to see a revised municipal framework for planning. Provision would be made for more active citizen participation in the formulation of goals and objectives; the administration of zoning would be handled quasi-judicially, and advance planning would be performed as part of the city manager's or mayor's office with ties to the sub-state regional agency. This would

more than improve responsiveness and equity in allocations to neighborhood areas. Even with the present way of doing things, municipal plans would form the basis for identifying regional issues and responses to state and federal policy at the sub-state level.

At the regional scale, the sub-state regional agencies will have begun to take form as embryonic, one man-one vote, regional governments. Not many of them will look like the Minneapolis-St. Paul Metropolitan Council does today. There will probably be revisions in funding: all will draw a major share of their budgets from the state, a part will come from direct regional taxes, and some will come from municipal contributions. Some agencies will be operating regional facilities which may, in the case of the Port of New York Authority, corrode objectivity if they are not held accountable to the regional electorate.

In the process, conflicting municipal positions and the reasons for them are sorted out and many issues traded off among the constituent jurisdictions in a region. The amount of information needed to conciliate municipal rivalries is considerable. It will be based on attempts to understand the mechanics of the most dynamic areas in the nation: the fermenting urban region with all that implies -- decaying downtowns, outmoded industrial plants, flights to the suburbs, bankrupt schools, and intensive demand on all coastal resources.

As the regions will allocate on the basis of local goals, objectives, and priorities, the states will have the task of allocating among the regions. It is possible that four coastal regions have accorded high priority to regional airports. Should the state have four in its airport plan? If not, which regions should be chosen: an existing center or two areas

hoping to use the airport as a needed stimulus for growth? What rationales are to be advanced to the political decision-makers?

The interchange between the regions and state capital will test state objectives and policies and provide the grounds for executive and legislative change. The interchange ought to be the ground work for preparation of state program budgets.

The final annual state program is a balancing off of the regions against one another for priorities and the resolution of regional-local value conflicts with state policy (and remember either or both sides may give or one or the other may be bought off -- for example, initial state policy may protect all marshes in spite of convincing regional evidence that conversion of high marsh will not be damaging biologically; the state is then given the opportunity to express its willingness to pay for maintenance of high marsh for aesthetic reasons.)

Similarly, the state program will compete for federal support within a multi-state region and among multi-state regions.

Many gains would grow from such a system. Noting a few is in order. The system is open. This is so because planners serve as staff to political decision-makers at each level so that reasonably integrated programs are implemented by line agencies and there are opportunities for continuing citizen involvement in setting goals and objectives, formulating action plans, and reviewing project proposals at each level. There are opportunities to test cause and effect relationships and meet problems with policy changes rather than simply throwing money at them, and to test the willingness of beneficiaries to pay commensurate costs.

The key, it seems to me, is imaginative state use of the new regional mechanisms. The oft made observation that the states are the keystone in

our system is true to me now and likely to be in 2000. The states are partners with the federal agencies in the multi-state regions; they can make the sub-state mechanisms as sterile or as virile as they want. I think that state inaction will push the federal government more and more into incestuous relationships with sub-state regions. The local-regional-state budgeting relationships are the critical policy concerns. They need not wait for coastal zone or national land use policy legislation to be forged. They are essential to useful regional responses to environmental impact evaluations now.

From this one can infer that I think the sub-state region is the place where the action is. I do! With the possible exceptions of Rhode Island and Delaware, the state is too large a geographic unit for comprehensive planning. The state can comprehensively plan for the delivery of service, but the specifications, location, and monitoring of the effect of each functional component can best be performed at the regional level. It is at this level that most of the forces converge; where realistic predictive models can be built and used to form policy, where physical and financial inter-regional transfers can be made part of the management scheme. With the data available for regional planning, it would be instructive if benefit-cost calculations were made part of the Section 102 environmental impact evaluations. (Therein lies the topic of another paper.)

I do not think there is need to wait for federal coastal zone legislation if a state wants to proceed now. It seems extraordinary to me that the coasts are only important to the nation or that only federal agencies are able to think in comprehensive terms about our coasts. Probably one of the salient needs at the federal level now is policy guidance to the federal agencies about what the national interest is and what they ought to do about it. And the direction ought to be explicit in a study of Long

Island Sound performed under the aegis of a multi-state regional organization.

To the degree that Congressional funding constitutes a statement of priority and an expression of willingness to pay for action on the coasts in the national interest, all well and good. But the funding ought to be guided by a more comprehensive mechanism than can be provided by a single state line department.

The search for an appropriate state coastal zone authority is also like the alchemists philosopher's stone. Recognition of the governor as the chief planner and manager of a state's coastal resources -- as inferred by language requiring him to designate an authority -- is appropriate. We can only hope that the governors will see this directive in the light of an extension of their responsibility to set policies and priorities for the management of the total environment of their states and the importance of sub-state regions in the process.

Professor J. W. Devanney III
Massachusetts Institute of Technology
Cambridge, Massachusetts

SHALL WE ALLOCATE THE COASTAL ZONE UNECONOMICALLY?

The basic purpose of my presentation is to speak to what I believe are some serious misconceptions about the economics has to say with respect to coastal zone allocation. These thoughts are abstracted from a study we did for the Marine Sciences Council about a year ago.¹ I am afraid it

¹

Devanney, J. W. et al. Economic Factors in the Development of a Coastal Zone. Report to the National Council on Marine Resources and Engineering Development. September 1970.

will be a rather talky presentation. Ordinarily when I get up at these things, I say "here is the problem we worked on; here are the assumptions -- the model -- we used; and here are the results." Short and simple. I think it is symptomatic of the level of public debate with respect to the allocation of the coastal zone that I can't do the same thing today. I cannot, for example, say

"We analyzed whether or not society should allocate a portion of the Maine coastline to an oil refinery under the assumption that society wishes to operate in a Pareto-optimal manner. We accepted the present distribution of income. We assumed a range of willingnesses-to-pay for air, water, and scenic quality. We adjusted for unemployment by assuming the following opportunity cost of labor. Here are our results as a function of the social opportunity cost of air, water and scenic pollution. They indicate that the following effects, alledged to be net benefits of the projects are actually transfer payments into the locale of the refinery and washes to society. That the figures purporting to be representative of the value of the local lobster industry overstated its net contribution to real wealth by a factor of five."

I would be able to go on in this vein and to have everyone who is genuinely interested in the coastal zone know what I was talking about. People could then discuss the assumptions, comment on the numbers, narrow down areas of disagreement and, in short, we could make some progress. In plain fact, I cannot. Not only is there little understanding of the economics of resource allocation on the part of the people most concerned with the coastal zone but there is also an active antipathy against becoming familiar with

these principles--an antipathy based on the mistaken impression that these principles sanction the present allocation. One result of this anti-intellectualism is that the protagonists of non-market values are unable to rebut arguments for development which are economically fallacious, arguments which fail to distinguish between transfer payments and net changes in societal wealth, arguments in which double counting is rampant. It would seem to me that if one's opponent had a consistent history of using economics incorrectly, the first thing one should do is learn enough economics to punch holes in his argument on his own grounds. Case in point is the Cross Florida Barge Canal. Excretal economics went unchallenged for a very long period. Remember solid economics will indicate most government development projects are losers even if non-market environmental costs are valued at zero. The SST for example.

Secondly, at present people who are dissatisfied with the way the coastal zone is being allocated have no coherent means of deciding which projects to oppose and which to accept. One result is an almost complete concentration on obtaining political leverage with no idea as to how one is going to use this leverage once one obtains it. Cases in point: Magnuson Bill and its colleagues.

Finally, with the power comes the heavy responsibility to be consistent with society's desires. The people who stopped the Maine refinery are saying that avoiding the environmental disbenefits of the project is worth at least half a billion dollars to society. If in fact society is willing to pay only \$250 million to avoid these non-market effects, these people will have stolen 250 million dollars from society. Not all industrial projects in the coastal zone should be opposed. We are responsible for

the consequences of our activities. And it is only through solid economic analysis that we can obtain insight into a very important subset of consequences.

Well, I hope I have said enough to indicate that the economics of resource allocation does not necessarily sanction present decision, nor the results of the private market, nor for that matter some of the policies being advocated by various conservationist groups. Now I think it is time to get a little less negative and to see what policies are indicated by viewing the coastal zone as simply another resource requiring allocation.

SOME BASIC CONSIDERATIONS REGARDING SOCIAL CHOICE AND PUBLIC INVESTMENT

The most basic fact of life for society is that it can not have as much of everything as it desires. At any point in time the amount of all types of resources--land, minerals, water, air, machines etc.--is fixed. This basic limitation implies that a society cannot have all it wants of everything. It must forego some goods in order to obtain others.

The term good, in this context is to be interpreted in its original sense to mean anything desirable whether it be a material good (a physical commodity) a psychological good, an esthetic good, or whatever. Thus, air quality or scenic architecture is a good in this context.

However, there is one important difference between the typical material good and the typical non-material good which we must keep in mind from the onset. Most material goods have the characteristic that the use or consumption of a unit of the good by one person effectively prevents someone else from consuming the same unit of that good. On the other hand, many non-material goods such as clear air or beautiful scenery

can be consumed communally. One person's enjoyment of the good does not prevent, or often even diminish, the ability of the good to be enjoyed by another. Goods which fall into the first category are private goods. Those which fall into the second, collective goods, and we will have cause to refer back to this distinction in the future. This basic constraint on society's options is usually represented by the so-called production possibilities surface.

The production possibilities surface divides the space of all possible combinations of goods into wasteful, wastefree, and infeasible. In the first case, the combination of goods is such that the society could have more of at least one good without giving up any of another good, or equivalently the society could have more of every good. We shall call such a combination of goods wasteful. In the second case, the combination of goods is not attainable by any arrangement of the resources of the society and this combination is said to be infeasible.

The problem is how to decide among the alternative wastefree allocations open to a society. In order to speak to this question one has to assume, at least provisionally, an objective or goal for the society. Otherwise, we will be arguing in circles. For an allocation that looks good to one objective function will look lousy to another. If we are going to do anything more than shout at each other we will have to for the sake of argument speak in terms of an objective function. Means for deciding between various points on the production possibilities surface.

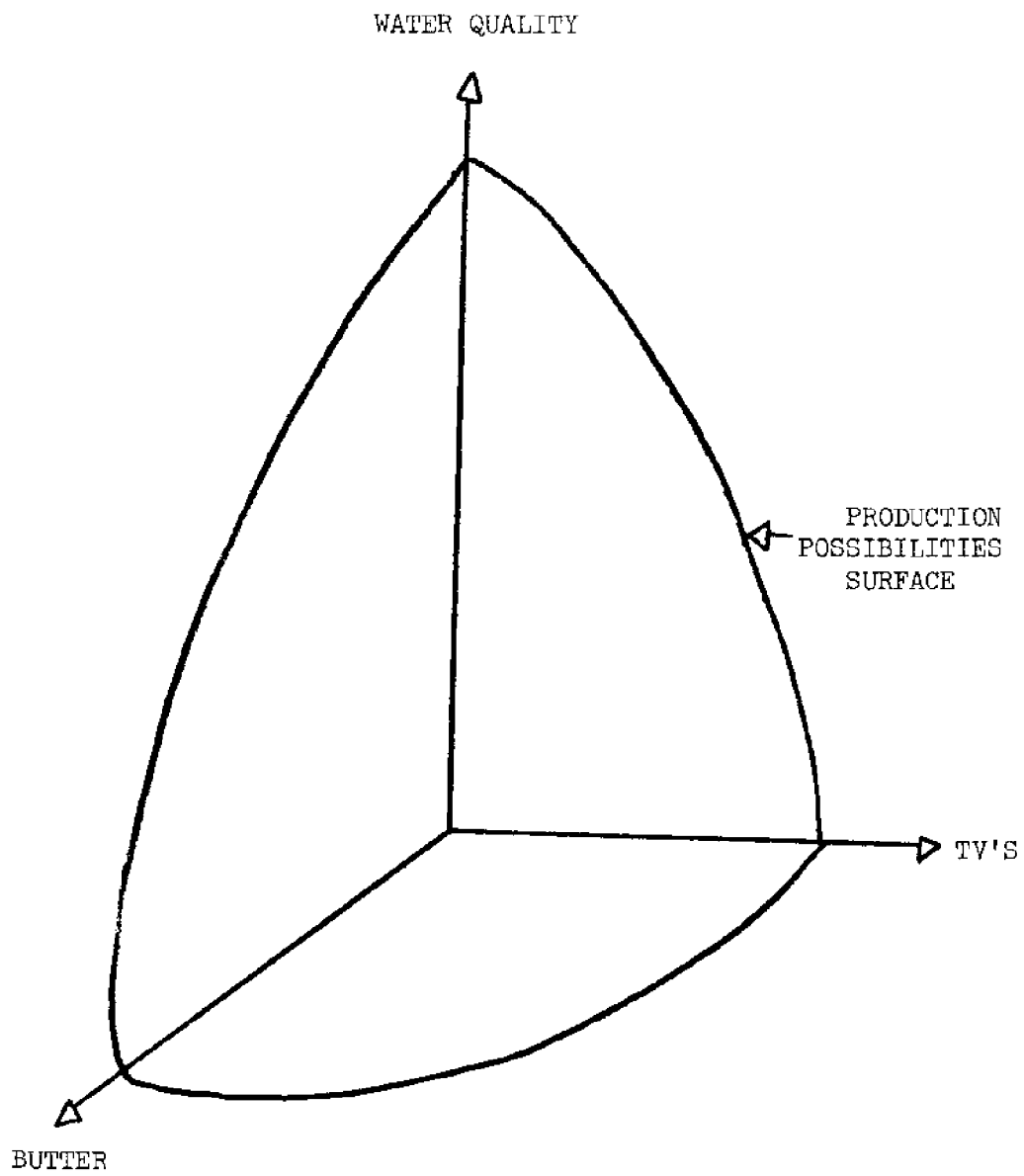
Essentially, four different methods for making this difficult choice have been suggested in the past. We might characterize them as follows:

- 1) The dictator

- 2) Intrinsic suitability,
- 3) Representative political consensus,
- 4) Willingness-to-pay

1) The first of our methods, which we have called the dictator, in which an individual or a small cohesive group unabashedly equates its own values with those of the society is historically one of the most popular methods and counts among its attempts at allocation some of the developments of which man is most proud. It has had its failures and does have its disadvantages. The most basic one is that it begs, albeit in a rather effective manner, the basic problem of reconciling individual value systems. If a society accepts one of a number of ethical precepts about the value of the individual, this at-times-attractive possibility is no longer open to it. Therefore, since we are attempting to shed light on the coastal zone allocation problem in a country which has made an at least theoretical commitment to the individual, we will consider it no longer. Perhaps the most important present-day proponents of this system in the USA are certain of the more architectural schools of thought in urban planning, and certain of the more elite environmental groups.

2) An allocation scheme for land which has achieved some prominence in the last few years is based on the idea that, on the basis of natural geological and ecological characteristics, one can identify certain areas as intrinsically suitable for certain purposes and other areas as intrinsically unsuitable for other purposes. Having made this identification, one implements zoning procedures consistent with it. This viewpoint, which underlies the arguments of many conservationist groups, has been most fully developed by McKarg, reference (1).



A HYPOTHETICAL PRODUCTION POSSIBILITIES SURFACE
FOR A THREE GOODS ECONOMY

FIGURE I

1. THE DICTATOR
2. INTRINSIC SUITABILITY
3. REPRESENTATIVE POLITICAL CONSENSUS
4. WILLINGNESS-TO-PAY

FIGURE II

This philosophy raises questions of how one determines intrinsic suitability and, more basically, if one bases development decisions strictly on natural characteristics, one may find, for example, that all of Oregon is intrinsically suitable for recreation but none of Nebraska. However, it is not clear that zoning provisions implementing this finding would lead us to the allocation which would be most consistent with society's values, however defined. Even more importantly, this approach begs the hard questions which are precisely the issues on which the society needs the most help. For example, one may determine that Machias Bay in Maine is intrinsically suitable for preservation and wilderness recreation (it is an unusually beautiful bay which is probably unique on the East Coast with respect to lack of previous development) and also that Machias Bay is intrinsically well suited to oil transshipment (it is unique on the East Coast in being able to handle tankers of greater than 80 foot draft within 1/4 mile of shore in sheltered water with direct access to the sea). It is inhuman. No representation of people's values.

In actual practice, this scheme, at least as developed by McHarg, is applied very flexibly, leaving a wide range of alternatives open. In short, pushing this idea very hard leads to some rather strange allocations; insofar as the idea is not pushed hard, it begs the basic question.

3) Some form of representative political consensus based directly or indirectly on the ballot, is practiced presently in a large part of the world. Such a process would be strengthened and formalized under present legislative proposals with respect to the coastal zone.

The ballot in all its forms has its share of problems both practical (keeping representatives' values consistent with constituents', providing

a spectrum of alternatives) and theoretical (tyranny of the majority indivisibility of the vote).

Secondary Benefits. I will not go into these problems in detail but rather take as obvious the fact that the ballot in practice cannot represent peoples desires precisely enough to be regarded as a final arbitreur in all or even most coastal zone allocation decisions. The political process needs help.

4) This brings us to the fourth valuation scheme which we will call 'willingness-to-pay'. Under this set up, each individual is regarded as the sole judge of his own welfare. Furthermore, each individual is assigned control (private property rights) to a certain amount of resources (land, capital and labor) and he is free to exchange these resources for any of the goods produced by the society according to any mutually agreeable bargain with the controllers of these goods. Generally, this exchange is facilitated by a surrogate good called money in which case the individual's control over his set of resources translates itself into income.

Given this set up one can rank a person's preferences according to his willingness to pay. Thus, if a person is willing to pay \$1.00 of his income for a hamburger and 50 cents for an increase in water quality, then by this scheme we presume he values the hamburger more than the water, and that if he obtains the hamburger he is better off than if he obtains the water quality. Thus, we are assuming that all the values a man has for a good whether it be a material good, an esthetic good, or a psychological good can be quantified by finding out how much of other goods he would be willing to forego to obtain the good in question. Note that this valuation scheme applies to collective goods as well as private goods.

Resource allocation economics is based on the acceptance of this valuation scheme. This is equivalent to accepting as a goal for society, the maximization of a weighted sum of all goods produced

$$\sum_i \alpha_i x_i$$

where the index i includes collective, non-market goods such as air quality as well as market goods such as heating oil. The coefficients are the marginal willingness-to-pay for each of the goods. This sum can be thought of as a measure of society's real wealth where the concept of wealth has been extended to include non-market goods. The acceptance of this valuation scheme immediately raises a number of important questions such as:

- 1) Where do you get the α 's?
- 2) On what distribution of income do you base the willingness-to-pay?

However, in the time available to me, I want to focus on just two issues; and their implications for coastal zone organization and regulation, for my goal today is to consider what I sense are some major misconceptions about what such economics has to say to the coastal zone.

The two issues are:

- a) the first has to do with effluent charges
- b) and the second involves the problem of secondary benefits

THE PRIVATE MARKET AND WILLINGNESS TO PAY

It can be shown that if we had perfectly functioning, completely competitive markets for all the goods which a society values then the operation

of these markets would result in an allocation of resources which is consistent with the 4th valuation scheme and the present distribution of income. Thus, if we had such a system and accepted the willingness-to-pay valuation scheme there would be no more need to worry about the allocation of the coastal zone than there would be to worry about the provision of toothbrushes.

In actuality, throughout the society and in particular in the coastal there are many goods for which properly functioning markets do not exist. In fact, there are a number of goods of large and increasing social importance for which no market exists at all. It is instructive to investigate the cause for these failures in the market system. Essentially, it involves the problem of collective goods.

COLLECTIVE GOODS

Collective goods differ from private goods in that individuals do not obtain exclusive possession of the goods they purchase; they are not able to exclude others from the use of these goods. The prototypical example is national defense. If one cannot exclude or be excluded from a particular good, then it is rational for each citizen operating individually to refuse to buy a good he desires, forcing others to purchase the good which he then enjoys without cost to himself. Of course, others reason similarly and the good, for which the group as a whole may be willing to pay a great deal, will not be provided. Thus, collective action either through regulation or public investment will be required if the allocation consistent with willingness-to-pay is to be obtained in this situation.

The collective goods of importance in the coastal zone are:

- 1) air quality
- 2) water quality
- 3) scenic quality

Exactly those goods with which the conservationists are most concerned.

The basic problem then is that since it is impossible or at least extremely difficult to provide such goods to one without providing for all, it is impossible for a functioning market for these goods to develop. No market means no price and hence the cost to a private decisionmaker of reducing society's supply of these goods is zero, and he acts accordingly. If properly functioning markets in these goods had been able to develop; the price of a unit of each of these goods would be the amount that people would be willing to pay to avoid the loss of that unit. If such prices did obtain, the market system would result in that allocation, that amount of air and water pollution which is consistent with society's willingness-to-pay for all costs of the good. As it is, the market will result in levels of pollution in excess of the desired level--something greatly in excess.

From this point of view its quite obvious what one should do in principle to correct this situation. Artificially, make the price for these goods equal to the price that would obtain if the market system were able to enunciate people's willingness-to-pay for these goods. In a word, one should use effluent charges.

Now there are a lot of strange statements going around concerning effluent charges. For example, "It is a license to pollute." Of course, it is. So is any form of regulation which allows any effluent at all. And one can be sure that an allocation which resulted in 0 levels of all

pollutants would not be consistent with society's desires. The operational comparison is an effluent charge system that leads to a certain level of pollution versus direct regulation which leads to the same level. Direct regulation is clumsy and inflexible and loses the advantages that can be obtained in inducing the decentralized decisionmaking such that makes the competitive market such an efficient device under the right conditions.

For example, a rule that factories limit their discharges of a particular pollutant to a certain percentage of total discharge is less desirable than a system of effluent fees that achieves the same overall level of pollution because with the latter each firm would be able to make the adjustment in the manner that best suited its own situation. Those firms who found it very expensive to reduce the level of pollution would adjust their output less than those firms who found it cheap to reduce this level. Society would achieve the same level of pollution at less costs to itself. Or again, one hears "Industry would merely pass the costs on to the consumer and it is not fair that the consumer should pay for industry's pollution". Of course, this would happen to the same extent under direct regulation. More basically, it should happen. To the extent that industry is unable by changing technology to reduce pollution, then the desired level of pollution is most economically obtained by reduced output and the only way to get the consumer to economize on such reduced output is to up the price of the final product. I suggest it is eminently fair that the steel user pay the price of the pollution that his demand for steel inflicts on society.

In short, taking willingness to pay as a valuation scheme for society points very strongly toward a system of effluent charges rather than direct regulation.

Next I would like to turn to another major source of misunderstanding about economics and the coastal zone. This involves the concept of secondary benefits.

Historically, attempts to correct for market imperfections in resource allocation have centered around cost benefit analysis. The idea here is that if one knew or could guess the prices for all goods and resources which would result if we had a market system which perfectly represented willingness-to-pay, then one could simulate the operation of such a system by calculating the return on projects which would result at these prices and actually undertake those projects which were most profitable at these prices-- these would be the projects which result in the largest increases in societal real wealth in the wide sense.

Unfortunately, for this basically valid idea there is many a slip 'tween cup and lip. It would not be going too far to say that cost-benefit fell into the hands of its enemies and the most important slip involves the concept of secondary benefits.

In measuring effects, it is extremely important to distinguish between the direct and indirect effects. The direct effects are those which accrue to the consumers or users of the project, the users of the power supplied by a coastal generating plant, the bathers on a beach, the swallows of polluted air, the inhabitants of a coastal housing project, the viewers of marsh wildlife. The indirect effects are those that accrue to the suppliers of the resources which make the investment possible. These include the payments made to the construction workers and maintenance personnel, sellers of material and land, and in turn the payments that these groups make to bar owners, retailers, and so on.

Consider the construction of a nuclear power plant on the shoreline. The plant will output electricity, heated water and some chemical wastes, a visual impact on the surrounding area, etc. These are direct effects and the value that the individuals in the affected region place on these effects measures the various benefits and disbenefits of this development.

The construction and operation of the plant will also require a number of inputs including land, labor and material. The value of these resources diverted to the plant is the cost of the development. Of course, these resources must be paid for their employment for they must be bid away from other uses. The nuclear plant construction worker will receive a sum of money for working on the plant and this is certainly a benefit to him. Further, he will spend a substantial portion of his pay in the locale of the plant, and this is certainly a benefit to the local merchants, doctors, and tavernkeepers. These people in turn will spend some of this money in the locale and so on. The same argument could be used for expenditure on any other input. Values which arise this manner are called secondary benefits. The question then is should we count all or part of the costs of the plant as a benefit on the grounds that people in the locale would willing to pay something to see these expenditures take place?

The answer is no. The fact that one has to pay a construction worker \$6.00 per hour to work on the plant means he was worth \$6.00 per hour elsewhere. Thus, his employment on the plant means a loss to some other project. Similarly, the financial effects which accrue to the locale of the plant from the construction workers' expenditures would accrue no matter where the plant was located. Of course, different shopowners would see this money if the location were changed. More generally, wherever the money

(resources) were spent, be it on a plant or something else, approximately the same secondary benefits would accrue. Thus, from the point of view of society as a whole, these indirect effects are a wash. One can change their geographical incidence but they do not represent any net changes in wealth to the society. Rather, they represent a transfer payment from the entire society to a more localized area. The costs of a project cannot be counted as a benefit. Of course, such double counting occurs all the time with antagonistic analysts adding up all the transfer payments favorable to their preconceived answer while conveniently forgetting about those transfers which don't.

However, secondary effects can be overwhelmingly important to political bodies representing small portions of the society. If differences in the geographical incidence of the secondary effects associated with a particular investment, whether public or private, shift these effects outside of the area the political body represents, this area suffers a very real loss. As a result, a local community can rationaly view a project in a very different manner from the region as a whole. What is a wash to the entire society can be something for which a locality within that society may be willing to pay a high price. Whether an indirect effect is a wash or not to a political body will depend on the range of the responsibility of the political body involved. For example, differences in the location of a refinery within Maine will give rise to differentials in the geographical incidence of secondary effects which will be extremely important to the communities considered for the location of the refinery but which will be a wash from the point of view of the State of Maine. On the other hand, the decision of whether or not to build a refinery in Maine will give rise to parochial benefits which will have a net effect on the Maine economy but

which are washed from the point of view of the country as a whole.*

Indirect effects or secondary benefits, on the other hand, are a completely arbitrary concept defined by and changing with the boundaries of the political bodies involved.

Secondary effects are the reason why political subbodies compete with each other for large private or governmental installations. A result of such competition is that a developer can use these effects to implement projects which are inconsistent with society's values.

In using secondary effects in this manner, the developer is employing transfer payments from the entire society to the locale of the development as a lever. He is not creating any net values. He is simply transferring income from one diffuse group to a much more localized one.

If there is widespread unemployment, then the above statements will have to be altered slightly. Unemployment is a situation in which the private market over estimates the opportunity cost of labor. Technically, unemployment is the situation where, at the market wage rate, the supply of labor is greater than the demand. In a perfectly functioning competitive economy, this would be a temporary situation. The wage rate would quickly drop to the rate at which supply would equal demand, which lower rate we will call the shadow price of labor.

In other words, unemployment should be handled not by postulating a secondary set of benefits and including them in the analysis, but by adjusting the costs of labor on the project to reflect the social cost to the economy of the employment of said labor on the project being analyzed.

* It is ironic that when people talk about the "economic" benefits of a project, they are almost always referring to these parochial effects which with the help of economic analysis that they are not net benefits at all but merely transfer payments.

Finally, I would like to address what I think the implication of these two phenomena, i.e.

- 1) The market's incorrect valuation of collective goods
- 2) The existence of effects which are net increases in wealth to certain political subbodies but not to society as a whole,

are with respect to coastal zone organization.

The basic problem is to generate a scheme which will give expression to society's values for non-market goods but not give political expression to secondary benefits. This is not easy. The fact is that the institutional measures that society has evolved to correct market misallocations in the coastal zone have not only not corrected these failures but in concert have exacerbated them or at least replaced them with a different set of misallocations from the point of view of willingness to pay. An example is the coupling of zoning and the property tax.

With these sobering thoughts in mind, I am going to outline a suggestion for a coastal zone management system

The plan is not particularly original. To a large degree it is an amalgam of ideas that have been around for some time. However, the particular combination is probably unique and at least it will yield a starting point for discussion which is somewhat more developed than the completely general guidelines contained in present (1970) coastal zone management bills.

The system we have in mind is outlined in Table I. The basic rationale behind this particular organization is an attempt to allow expression of society's willingness to pay for collective goods while at the same time not allowing or at least not encouraging competition among political subbodies on the basis of secondary benefits.

TABLE I

A SYSTEM FOR MANAGING THE COASTAL ZONE

Federal

Responsibilities

Standards for zoning, effluent charges, regulation
Approval of state environmental plan
Standards for state C/B studies
Interest rates
Non-market benefits
Environmental effects and costs
Leave out parochial benefits
Fund Education
Research

Enforcement Mechanism

Federal funding of state land use/coastal zone
authority

Support

Income taxation

State

Responsibilities

Develop and get environmental plan approved
Levy effluent charges and regulate effluents for
which continuous monitoring is inefficient in
accordance with plan
Approve large scale projects
Acquire land and develop recreation and conservation
projects
Lease off-shore properties and license water column
Conduct and call for C/B studies in support of above

Enforcement Mechanism

Courts, Preemptive fines

Support

Land acquisition and development: state general funds
Operating expenses and studies: state - federal

Local

Responsibilities

Provide local public services, local zoning, siting of state
approved projects

Support

User charges

ATTENDEES:

SECOND NEW ENGLAND COASTAL ZONE MANAGEMENT CONFERENCE

Mark Abelson, Regional Coordinator
U.S. Dept. of the Interior
J. F. Kennedy Building
Northeast Region
Boston, Massachusetts

Arthur Alexiou
National Atmospheric & Oceanographic Agency
Office of Sea Grant Program
Rockville, Maryland

Spenser Apollonio
Department of Sea and Shore Fisheries
State House
Augusta, Maine

Robert M. August
New England Natural Resources Center
506 Statler Office Building
Boston, Massachusetts

Jon. E. Austad
Engineer-Management Service Division
Anderson-Nichols & Company, Inc.
150 Causeway Street
Boston, Massachusetts

Walker Banning
Clark University
950 Main Street
Graduate School of Geology
Worcester, Massachusetts

William E. Barnes
Environmental Devices Corp.
Marion, Massachusetts

William A. Bivona, Information Center
Manager
NEMRIP, University of Rhode Island
Narragansett Bay Campus
Kingston, Rhode Island

Robert C. Blumberg, Director
Division of Mineral Resources
Leverett Saltonstall Building
100 Cambridge Street
Boston, Massachusetts

Dr. Ned Brush
Peat, Marwick, Mitchell
One Boston Place
Boston, Massachusetts

Jere Chase, President
New England College
Henniker, New Hampshire

Arthur Chesmore
Massachusetts Division of Fisheries
100 Cambridge Street
Boston, Massachusetts

Jean A. Cochrane
The New England Council for Economic
Development
1032 Statler Office Building
Boston, Massachusetts

Tom Costello
Editor/Publisher
National Environmental News
Christian Street
Oxford, Connecticut

Jerome Degen
Anderson-Nichols & Company, Inc.
150 Causeway Street
Boston, Massachusetts

Jack Donnan
Department of Resource Economics
University of Rhode Island
Kingston, Rhode Island

Penelope B. Drooker
 Jackson & Moreland
 600 Park Square Building
 Boston, Massachusetts

A. Thomas Easley, Executive Vice President
 The New England Council for Economic
 Development
 1032 Statler Office Building
 Boston, Massachusetts

Robert H. Ellis, President
 The Center for the Environment & Man
 275 Widsor Street
 Hartford, Connecticut

Barbara Fegan, Organization
 Vice President
 League of Women Voters
 Box 545
 South Wellfleet, Massachusetts

George Fox, Nuclear Information Manager
 Northeast Utilities
 Berlin, New Hampshire

Alvaro W. Freda
 Rhode Island Coastal Council
 RR 4 Box 802
 Narragansett, Rhode Island

Richard A. Gardiner
 Richard A. Gardiner & Associates, Inc.
 Land Planning & Design
 1750 Cambridge Street
 Cambridge, Massachusetts

Phillip L. Goggins
 Dept. of Sea and Shore Fisheries
 State House
 Augusta, Maine

Professor Bernard L. Gordon
 SNEMSA--Southern New England Marine
 Sciences Association
 Northeastern University
 Boston, Massachusetts

Walter J. Gray, Director
 NEMRIP, University of Rhode Island
 Narragansett Bay Campus
 Kingston, Rhode Island

Kenneth Green, Chief Planning Officer
 Office of Planning and Programs
 Coordination
 Leverett Saltonstall Building
 100 Cambridge Street
 Boston, Massachusetts

Harmon H. Guptill
 Civil Engineer, Planning Branch
 N. E. Division Corps of Engineers
 424 Trapelo Road
 Waltham, Massachusetts

Stuart O. Hale
 Southern New England Marine
 Sciences Association
 Graduate School of Oceanography
 University of Rhode Island
 Kingston, Rhode Island

Warren R. Healey, Director
 Marine Resource Development
 The New England Council for Economic
 Development
 1032 Statler Office Building
 Boston, Massachusetts

Harriet P. Henry
 174 Prospect Street
 Portland, Maine

Professor William Henry, Chairman
 Resource Department
 University of New Hampshire
 Morrill Hall
 Durham, New Hampshire

Paul T. Hicks
 Rhode Island Petroleum Association
 One Fifty Francis Street
 Providence, Rhode Island

Richard F. Hill
 Federal Power Commission
 Washington, D.C.

Dean A. Horn
 Sea Grant Program
 Mass. Institute of Technology
 Cambridge, Massachusetts

J. R. Jackson, Jr., Manager
 Exploration Department
 Humble Oil & Refining Company
 P.O. Box 2180
 Houston, Texas

Anthony R. Jarrett
Portsmouth Economic Commission
City of Portsmouth
126 Daniel Street
Portsmouth, New Hampshire

LCDR C. R. Lindquist
Coast Guard
c/o New England River Basins Commission
55 Court Street
Boston, Massachusetts

Bruce W. Mattox, Resource Economist
NEMRIP - New England Marine Resources
Information Program
University of Rhode Island
Narragansett Bay Campus
Kingston, Rhode Island

Fred Mangelsdorf
Woods Hole Oceanographic Institution
Woods Hole, Massachusetts

William V. McGuinness, Jr.
The Center for the Environment & Man
275 Windsor Street
Hartford, Connecticut

James A. McLaughlin, Public Relations
The New England Council for Economic
Development
1032 Statler Office Building
Boston, Massachusetts

Dr. William W. Miner
Save the Bay, Inc.
Rhode Island Coastal Resources
Management Council Member
E. Shore Road
Jamestown, Rhode Island

Edward A. Myers
University of Maine
IRA C Darling Center
Portland, Maine

Mrs. Donald B. Nason
Mack Hill Road
Amherst, New Hampshire

Robert W. Neal
Arthur D. Little, Inc.
Acorn Park
Cambridge, Massachusetts

Hugh F. O'Rourke
Boston Fisheries Association
Administration Building
Fish Pier
Boston, Massachusetts

Wadsworth Owen, President
Vast Inc.
Mystic, Connecticut

R. A. Poitras
State of Maine, Executive Dept.
State Planning Office
189 State Street
Augusta, Maine

Richard J. Quinton, Phd.
Chairman--Conservation Commission
Bridgeport, Connecticut

Tony Redington
State of Maine
Executive Department
State Planning Office
189 State Street
Augusta, Maine

Professor David A. Rice
Boston University School of Law
765 Commonwealth Avenue
Boston, Massachusetts

Benjamin S. Richmond
National Oceanographic Data Center
U.S. Dept. of Commerce
NOAA/NODC Liaison Office
Box 91
Woods Hole, Massachusetts

Robert E. Robes
Cape Cod Planning & Economic
Development Commission
First District Court House
Barnstable, Massachusetts

Niels Rorholm
University of Rhode Island
Dept. of Resource Economics
Sea Grant Office
Kingston, Rhode Island

Neil W. Ross, Marine Resource Analyst
NEMRIP, University of Rhode Island
Narragansett Bay Campus
Kingston, Rhode Island

Rogers Rutter
State Planning
Governor's Office
State of New Hampshire
Concord, New Hampshire

George Sahady
New England Regional Commission
55 Court Street
Boston, Massachusetts

George J. Schwartz
Anderson-Nichols & Co., Inc.
150 Causeway Street
Boston, Massachusetts

William W. Seaward
Seaward Construction Company, Inc.
Rt. 236
Kittery, Maine

Paul H. Shore
Federal Power Commission
Regional Office
26 Federal Plaza
New York, New York

Lucy Sloan
38 Green Street
Cambridge, Massachusetts

Paul Ferris Smith
EG&G Environmental Equipment Division
151 Bear Hill Road
Waltham, Massachusetts

Professor David A. Storey
327 Draper Hall
Agricultural & Food Economics Dept.
University of Massachusetts
Amherst, Massachusetts

John R. Taft, Consulting Engineer
27 Moulton Road
Duxbury, Massachusetts

Richard Tetlock
Coastal Research Corporation
30 Lancaster Street
Boston, Massachusetts

David L. Turner
Science & Technology Rep.
Mass. Dept. of Commerce &
Development
Leverett Saltonstall Building
100 Cambridge Street
Boston, Massachusetts

David F. Twombly
City of Portland, Maine
Planning Department
213 City Hall
Portland, Maine

Carl E. Veazie
Bowdoin College
Public Affairs Research Center
Brunswick, Maine

Gerry H. Whiting
Edward C. Jordan Co., Inc.
379 Congress Street
Portland, Maine

Mrs. Barlow Cutler Wotton
Long Island Sound Assoc.
Box 496
Westport, Connecticut

Ronald L. Wrigley
Division of Budget
State of Rhode Island & Providence
Plantations
Department of Administration
State House
Providence, Rhode Island

Dr. John W. Zahradnik
Professor of Biological Process
Engineering
Dept. of Agricultural Engineering
University of Massachusetts
Amherst, Massachusetts

