THE PENOBSCOT BAY RESOURCE PLAN

AUGUST 1972

MAINE COASTAL PLAN

State Planning Office
Augusta

Due to the failure of the new and inexpensive technique for color reproductions attempted in this report, details on the color resource maps are not as clear or as readable as we'd hoped. The originals of these maps are, however, available for reference at our office at any time.

MAINE COASTAL PLAN

State Planning Office
Augusta

KENNETH M. CURTIS
Governor

PHILIP M. SAVAGE
State Planning Director

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Introduction

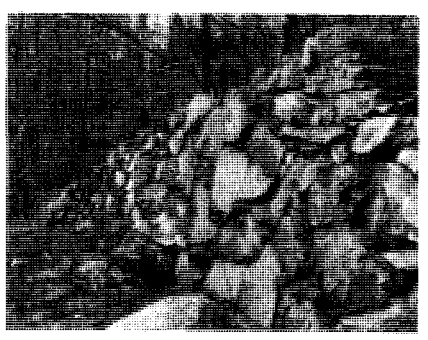
This publication on the Penobscot Bay Pilot Area Project is the third of the three publications written as part of the Maine coastal planning task. The first, *Maine Coastal Development Plan, Phase I Report, June 1970,* dealt with the need, goals, objectives and activities involved in the coastal planning effort. The second, *Maine Coastal Resources Renewal, July 1971,* examined in detail three present and future land uses of the coast; aquaculture, energy and recreation; and included a suggested industrial recycling proposal along with recommended methods for implementing coastal development policies.

The coastal planning task, including these three publications, is an attempt to deal in a more systematic way with the many and varied problems of coastal protection and development. In the past, public policy in Maine contained no such process. Problems and issues have been dealt with singularly and in isolation with no clear idea of all the relationships involved or the total impact of results. We have too many times taken a disorganized, haphazard, opportunistic, no-policy approach to our problems.

Fast and continuous change has created a natural and social stress, the extent of which we in Maine are only beginning to feel. New products, new uses, new activities and new needs are being devised and sold or imposed upon the people and the environment of this country. The substances themselves are so new that our bodies and the ecosystem which supports us are unable to adapt. The fact that these variables are changing so quickly means that the entire natural system has had little time to adapt. The problem as a whole has been called "environmental pollution." The constituent parts of this are air pollution, water pollution, land pollution and societal chaos. Nature as we know it must only cope with moderate stresses brought about by combinations of the first three parts. In addition to the first three, man is heavily influenced by the fourth — the stress produced by the mad frenzy associated with the cycle of production, marketing, fabricated need, and then consumption. As this pace grows, the symptoms of the problem are beginning to surface; increased crime, violence, drug abuse, alienation, mental illness, total loss of purpose and direction.

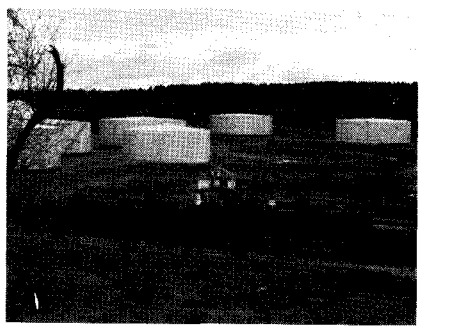
Ironically, one of the by-products of this uncoordinated frenzy is "waste." This is the by-product of man's activities which is not immediately suitable for human consumption. Our society has become so highly product-oriented, that we have lost sight of the usefulness of "waste." Just the fact that we use the word "waste" indicates a problem. Waste materials are usually disposed of in heavy concentrations directly upon small areas of land, or volumes of water or air. Most of the animals, plants or people directly affected are overwhelmed and unable to adapt to the change.

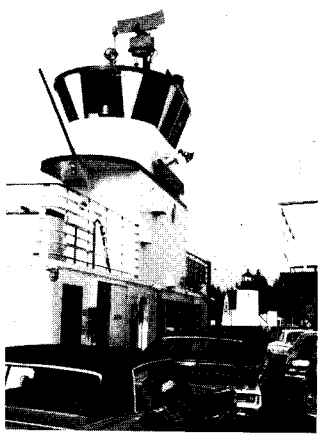
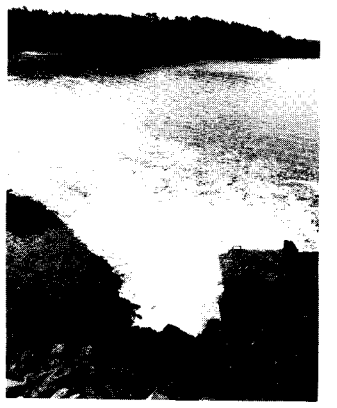
These crises, go beyond our laws and reflect a fundamental testing of national character; however, our immediate concern with these issues and conflicts underscores the urgent need for adequate water and land use planning and the need to develop modern land use legislation from which will evolve development policies and guidelines that equitably provide for the needs of people and of nature. Our first objective must be to minimize the areas of conflict and enhance the areas of harmony.




The State of Maine is in a position which is at once crucial and enviable. Enviable in the sense that Maine still possesses many natural resources not available to the rest of this country, yet crucial because the state faces enumerable and continuous pressures for developing and altering these resources. Because Maine is a highly, undeveloped state it is in a unique position to establish a modern policy for land use management and define a more balanced direction for the rest of the country.

This publication stresses the need for land use planning, controls and legislation, and presents a process through which they can be developed and maintained. It is the hope of the State Planning Office that this document will serve as a catalyst to shape the vital decisions and directions critical to the land use management needs of the State of Maine and its local government units.

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Perspective

Development Trends

Much of Maine's industrial economy has over the last century moved from the coast to inland areas. As coastal Maine shipping and waterborne commerce declined late in the 19th century the state gradually turned its back to its points of ocean access and began to develop instead its inland areas by rail and highway. Recent recreational pressure for coastal lands has however been great as limited shore frontage and access has been gobbled up by speculators and summer residents. Some of the figures presented in Table 1 provide clear evidence of this. They also indicate that similar recreational pressures are also beginning to accelerate in inland areas. The important distinctions appear to be the much higher land values and population densities which exist along the coast.

It is certain that pressure will continue to be very heavy along the coast, although the form of that pressure may be changing. Permanent population and employment trends (Table 2) indicate that most of the coastal counties have continued to grow substantially during the 1960's, while similar growth in the inland areas has leveled off. The statistics for retail establishments and for eating and drinking places make two points in particular: Retail trade throughout the state has apparently become more concentrated in a smaller number of large establishments, while the rapid growth of smaller transient-oriented services has switched from the coast to inland areas. A result of the coastal land-boom has been that most free access to the shore has been cut off by coastal land owners, while those areas of the coast that are within easy driving distance for short-term vacationers are becoming too crowded. A spillover of summer tourists and the winter recreation potential have shifted the pressure for transient-oriented services to the inland areas. Thus with the introduction of a four-day work week, longer summer vacations and the popularity of camping, many more of the transient visitors to Maine's coast have come as part of extended camping trips. They bring their trailers and tents with them, and thus they require no restaurants or lodging facilities.

During the past several decades, most of the coastal land pressure especially south of Penobscot Bay has been caused by developers and summer residents buying and dividing land for summer use. This situation still exists along the eastern coast where land remains available. The inland lake and mountain areas are also experiencing a substantial increase in the number of recreational homes (Table 2). In the coastal towns of the southern coast, however, there has been a decline in the number of seasonal homes built and maintained (Table 3). High land prices and simple lack of desirable space have apparently slowed the flow of summer residents into the area. Permanent population has increased in Maine's three southern coastal counties, however, indicating either that many summer people have either decided to claim permanent residence or that many summer homes have been sold and converted to a year-round use by their new owners.

TABLE 1

	STATE	PERCENTAGE IN COASTAL TOWNS[1]	PERCENTAGE IN INLAND TOWNS
Land Area (1970)	30,933 sq. mi.	10.2%	89.8%
Population	993,663 persons	35.7%	64.3%
Real Property Valuation	$3261.7 million	41.7%	58.3%
Year-round homes	312,937	37.7%	62.3%
Seasonal homes	84,232	37.7%	62.3%
		PERCENTAGE IN COASTAL COUNTIES	PERCENTAGE IN INLAND COUNTIES
Land Area	30,933	25.2%	74.8%
Population	993,663	46.8%	53.2%
Retail Sales Volume	$1471.3 million	46.7%	53.3%
Covered Employment	224,029	46.5%	51.3%[2]

1. "Coastal Towns" are towns located on tidal water in York, Cumberland, Sagadahoc, Lincoln, Knox, Waldo, Hancock, and Washington Counties.
2. 2.4% of those employed in the State were not employed within any particular county.

Note: Sources of information are listed at the end of the report.

Much land is still available east of Sagadahoc County, and summer home development continues in much of the middle and eastern coast. The substantial increases in population and number of year-round residences are particularly significant in Lincoln and Hancock counties. Seasonal population continues to increase, but in addition summer homes are rapidly being converted to permanent use as retired people and people with independent incomes are buying property and moving permanently to Lincoln and Hancock Counties. To a lesser extent this trend appears in Knox County also.

In Washington County, a general lack of job opportunities has caused a substantial outmigration of permanent residents, but this has been accompanied by an influx of summer people.

These general coastal population and development trends are not as evident in the Waldo County area of Penobscot Bay, however. The coastal portion of Waldo County experienced a population growth of 8.4 percent between 1950 and 1960 while the following decade saw virtually no population growth in that area (Table 3). The relatively heavy industrialization of Belfast and Searsport and the polluted condition of upper Penobscot Bay may have helped to discourage both seasonal and permanent population of much of the Waldo County area. As the condition of the river and the Bay continue to improve, however, a substantial increase in seasonal as well as permanent population can be expected.

In addition to these pressures for recreational and residential development, there has been in recent years a new appreciation for the industrial potential of offshore oil or gas fields, estuaries suitable for commercial aquaculture, deep harbors, and abundant supplies of cold water for cooling power plants and refineries. At present we can only speculate about the mixed benefits which such industry might bring.

TABLE 2

	MAINE	COASTAL COUNTIES	INLAND COUNTIES
Population — 1970	993,663	354,337	639,326
Percent change 1960-70	+2.4%	+3.4%	+1.7%
Percent change 1950-60	+6.1%	+4.8%	+6.8%
Covered Employment 1970 — Number of persons	224,029	104,086	114,572
Percent change 1960-70	+16.8%	+23.3%	+9.8%
Percent change 1950-60	+18.1%	+15.4%	+16.9%
Number of Retail Establishments — 1967	10,331	5,032	5,299
Percent change 1958-1967	-8.1%	-10.9%	-5.1%
Percent change 1948-1958	-5.1%	-1.4%	-8.6%
Number of Eating and Drinking places — 1967	1,438	744	694
Percent change 1958-1967	-10.3%	-15.3%	-4.4%
Percent change 1948-1958	+1.2%	+11.6%	-9.0%
Number of lodging, repair, entertainment and amusement services and small business — 1967	3,407	1,889	1,518
Percent change 1958-1967	+5.9%	+3.2%	+9.4%
Day use of National and State Parks Percent change 1960-70.	+119%	+126%	+64%
Real Property Valuation — millions of dollars — 1970	3,261.7	1,360.0	1,901.7
Percent change 1960-70	+52.5%	+61.1%	+46.9%
Year-round homes 1970	312,937	117,878	195,059
Percent change 1960-70	+7.8%	+7.5%	+8.1%
Seasonal homes 1970	84,232	31,783	52,449
Percent change 1960-70	+13.2%	-2.7%	+25.6%

Economic Drawbacks

Most economists would agree that Maine's economy is in poor shape, although a slight upturn may occur in 1972 and 1973. The problems are basically (1) the distance involved in moving Maine products to national markets; (2) a harsh climate which increases production costs, operation costs (fuel) and construction costs; (3) a shortage of venture capital and skilled entrepreneurs in the state; (4) a highly seasonal economy. These problems have traditionally been major road blocks to improving Maine's economic growth.

Although some of the state's economic problems may in the short run be thought to stem from recent environmental legislation, they are for the most part rooted in the state's traditional economic problems as well as those currently besetting the nation. Beneficial change will only come through many small coordinated actions to improve aspects of Maine's traditional industries, keeping the future options open, and *not* through single industry "pot-of-gold" schemes which might appear to promise immediate solutions but serve only to raise expectations.

TABLE 3

	Population—1970	Percent Change 1960-70	Percent Change in number of Year-Round Homes 1960-70	Percent Change in number of Seasonal Homes 1960-70
State Total	992,048	+2.4%	+7.8%	+13.2%
Coastal Towns	354,337	+3.4%	+7.5%	-2.7%
York	74,344	+1.3%	+13.9%	-20.3%
Cumberland	142,870	+1.0%	+5.0%	-5.9%
Sagadahoc	22,594	+2.1%	+7.0%	-3.3%
Lincoln	17,949	+11.5%	+19.5%	+3.0%
Knox	25,973	+1.7%	+7.0%	+2.0%
Waldo	14,111	0.0%	+8.8%	-3.4%
Hancock	33,073	+7.3%	+10.7%	+14.0%
Washington	23,423	-9.0%	-6.9%	+27.4%
Inland Towns	637,711	+1.7%	+8.1%	+25.6%
Pilot Area	19,511	+6.1%	+7.6%	-6.9%

Small, coordinated actions imply unprecedented coordination of efforts and effective plans to bring these actions to fruition. Many of the traditional natural resources which have supplied the backbone of the state's economy are now threatened because of intensive use and increasing demand. Thus a balanced ecologic-economic based state plan which sets forth clear alternatives for Maine's key natural resources such as her deepwater ports, large rivers, coastal and wilderness lands would begin the process of outlining and organizing the many small coordinated actions needed to more finely tune Maine's existing economic base Recommendations of the Governor's Task Force on Energy, Heavy Industry, and the Maine Coast should emerge soon with a segment of this policy — suggestions for a heavy industrial land use policy for Coastal Maine.

Maine's present economic situation is clearly indicated by the following statistical profile: Population increased nationally by 11.5 percent but only 2.4 percent in Maine in the 60's, due largely to a 10 percent outmigration. Much of the *increase* is probably attributable to older retirees moving into the state. A very recent survey by a nationwide moving firm showed, however, that migration may have

changed in the last three years. Inmigration has surpassed outmigration as more families move into the state, leaving "unlivable" suburbs and cities in other areas of the northeast. The flood of people wanting to leave the northeast's urban areas for these reasons has, nevertheless, been somewhat held back by the severe lack of any kind of employment opportunities in Maine.

From 1960-1968 the state's labor force was approximately 400,000 with an increase of only 18,000. During the same period unemployment dropped from 8 percent in 1960 to 4 percent in 1968. However, in the recent economic slowdown Maine's unemployment has reached the highest level in a decade and Maine's manufacturing wage still remains 24 percent below the national average with per capita income $400 below the national average, and $600 below New England.

Again, as the foregoing suggests, a plan and general goal for Maine's future must be a middle ranged one: Neither one which attempts to quickly raise per capita income to the national average (as that would almost surely increase the potential destruction of Maine's natural resources), nor one which nullifies the very important objective of some substitution of high wage for low wage industries, but one which gradually raises the living standard of all inhabitants without damaging the valuable environmental resources of the state. This will require careful preparation and long range planning.

This then is our dilemma; and it has been reiterated many times in the past several years: We possess one of the most beautiful and relatively unspoiled sections of real estate in the nation. It is becoming obvious, however, that a lot of people want to use this land for their own enjoyment or profit. *How can we, the people who now live here, take advantage of the economic benefits which may result from this use of the land without ruining the beauty which we now enjoy?* Even with extensive planning, it is doubtful that the total of this highly idealistic goal can be reached; however, we should be able to guide the use of land to produce a net gain for most of the people in this state. In order to plan for whatever growth may occur along the coast, and thus assure the greatest economic benefits for the state as a whole, we must ask and attempt to answer some basic questions: (1) What does the area have? — Its land, resources and people. (2) What is being done with these assets? — Land and water use, industry, agriculture, government services. (3) What can be done to improve and enhance what the area has? — Opportunities and limitations imposed by these resources. (4) What steps can be taken to ensure that these resources will be used in a fashion that will preserve the quality of life along the coast?

The Maine Coastal Plan will begin to provide some of the answers to these questions by looking carefully at a small area of the coast. In the past, many of the arguments on both sides of the development and environmental issues have been backed by very little solid data. We feel that it is necessary to produce actual information about resources and land use in a usable form so that land use, development and zoning decisions can be made by the people affected and with knowledge of the implications.

Summary

What we have outlined in the following pages are the essential elements required for effective resource planning of Maine's coastal as well as inland areas. The techniques and approaches are demonstrated in the 13-town area of upper Penobscot Bay primarily because; (1) much of the wide range of land types, land uses and economic activities of coastal Maine are found in the Penobscot Bay area. (2) considerable data is available to explain the resources and activities of the region. (3) extensive recreational, commercial and industrial activities exist together within the region. (4) as the Penobscot River and Bay are cleaned up, there are indications that many new permanent and seasonal residents will begin moving into the area.

In brief some of the major guidelines we have followed are:

1. Land and water uses permitted in any area must be based on what the area's resources are capable of withstanding in terms of its vulnerability to the proposed intensity of use. The vulnerability of various resources in the Penobscot Bay area are depicted in the maps that follow.
2. Types of activities or uses allowed in specific areas must meet certain requirements that increase in number and detail according to the degree of change or intensity of use that has been proposed. For example:
   a. *Important or unique environmental areas are a heritage of the past we owe as a debt to the future.* They must be carefully protected. Proposed activities or uses of these areas must be prohibited or regulated so as not to destroy this priceless heritage. State and regional level control of these areas is recommended. These areas are identified in the material that follows.
   b. *Heavy, large scale industrial developments are activities that typically affect more than one community.* Their siting and operational regulation must also be undertaken at the regional and state level. Costs and benefits can thus be effectively analyzed and more equitably distributed throughout the area affected. We feel that information presented here will provide a basis for the decisions the Department of Environmental Protection will make in administering the Site Location Law.
   c. *Other forms of development or their extent can be controlled by local and regional authorities with certain overall statewide guidelines.* Reasonable statewide guidelines for control of these land uses are provided herein as well as an outline of what types of government control are required at different levels of government. Many of the provisions suggested herein are similar to the requirements being written for communities to follow in their adherence to the Shoreline Protection Act.

This report follows the order suggested by the questions which we raised earlier:

1. What does the area have?
   Maps showing the area's natural resources.
   The history and the people of the area.
2. What is being done with these assets?
   Maps and explanations of land use and economic activities.
3. What can the people of the area do with these resources?
   Map showing the opportunities and limitations imposed by resources and current activities.
   Sketches of three possible alternatives for the future of the area showing possible changes in population, life styles, income levels and impact upon land and resources.
4. What steps can be taken to ensure a desirable future?
   The family's role — the implications of resource-use decisions made at the family level.
   The government's role — A suggested land use policy for the state and an explanation of which government agencies and levels (local, regional, state) would ultimately be responsible for implementing the policy.

A great deal of what we've outlined in this report reflects many of the comments and suggestions we obtained from local people at our preliminary meetings in Belfast, Searsport and Rockland. Part of the purpose of the report is to stimulate additional responses from coastal citizens. Therefore, we have asked questions concerning various aspects of our work. Based on the responses and evaluation of the Penobscot Bay Pilot Project effort, a similar program will be designed for other areas of the coast. Thus it is vital for our continuing work that we receive many responses to the few questions that we are asking here at the end of this report.

Most importantly, we hope that the information presented on the maps and tables and in the appendix can be used by local planning boards for determining zoning areas beyond what is required as a minimum from the state point of view, as well as for evaluating future development proposals. It is also hoped that researchers from colleges, universities and state agencies can use the information presented here as a suggestion for future research priorities.

In general then resource patterns are identified, means of protecting vulnerable resources are recommended, three different possible future development patterns are outlined based on resource advantages and limitations, and finally the means for accomplishing whichever alternative is deemed most desirable by the people in the area is also offered.

Priorities For Further Coastal Planning

We have outlined which regions will be mapped next according to major coastal watershed boundaries. Natural resource and land and water use information will be organized and presented for each of these regions followed by legislative recommendations to implement the key conclusions derived from the planning inventory.

As indicated on the map, the first areas to be mapped are those where there is considerable pressure to develop unused land.

Other criteria used in determining priorities for which coastal regions we intend to undertake next are:

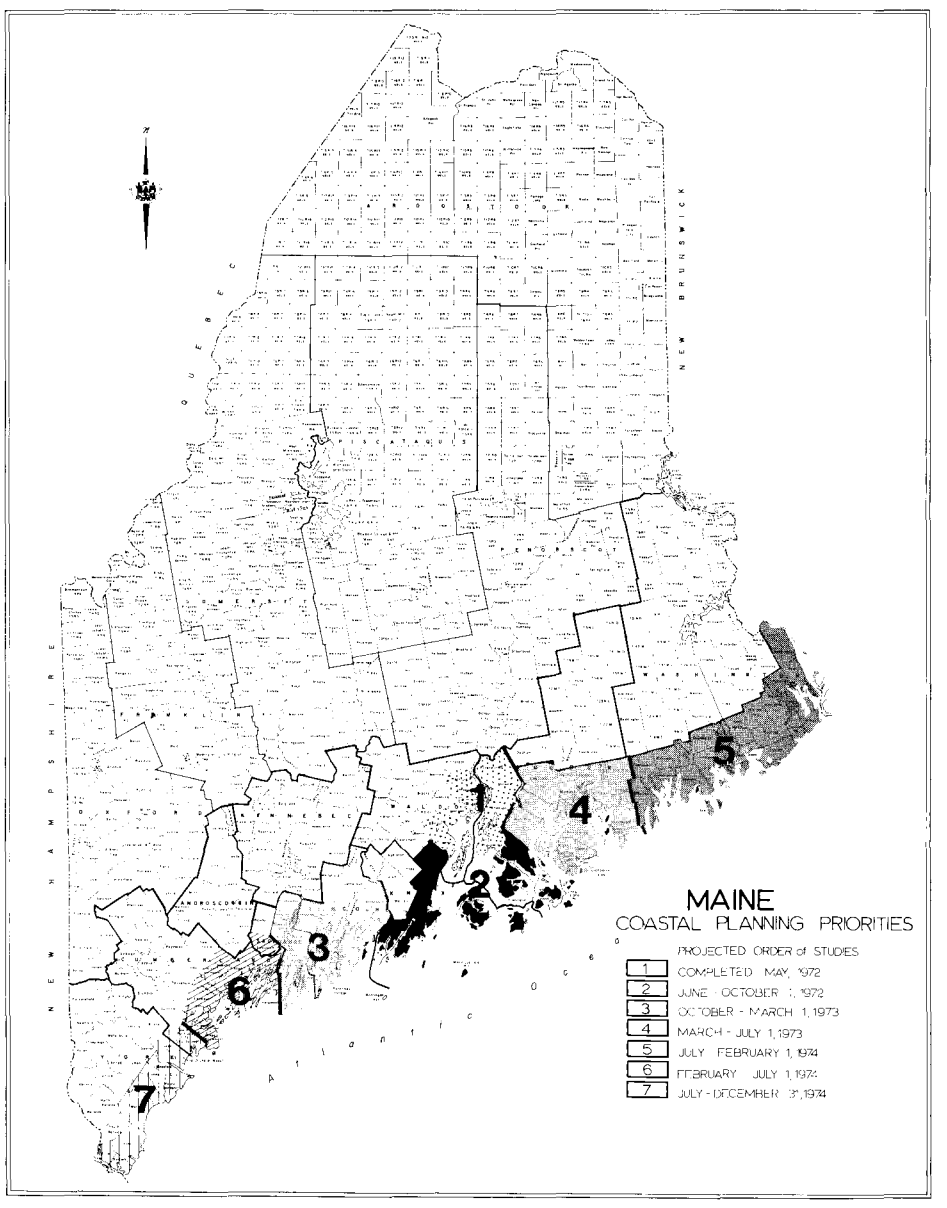
Areas where both strong development pressures (deepwater Harbors, growth communities) and unique, fragile, highly significant environments exist

Areas where little or no planning activity has existed or is currently underway

Areas which are relatively close to major employment centers or populated areas and are easily accessible

Areas which lack basic soils surveys to assist in reviewing the acceptability of proposed developments

Thus specific areas to be dealt with next are shown on Map 1.



Area Resources

NATURAL RESOURCES

The maps included here locate and describe natural resources and conditions. They are intended to provide much of the information required to determine the sources, extent and probable implications of problems that may arise from the use of these resources. The maps themselves do not outline a plan for future growth and development of the region, but they provide a basis for intelligent analysis of problems related to land and water use.

The maps are arranged to show first those features that determine the physical character of the region – Bedrock and Surficial Geology, Slopes, Hydrology, Water Classification and Estuary Conditions. (A brief description of the climate of the area is also included.) The other maps reveal information about the living resources of the area – Forest Types, Forest Growth, Wildlife, and Fish.

The results of man's use of the environment are reflected in some of the resource maps – Hydrology, Water Classification, Estuary Conditions, Forest Types and Forest Growth. The location and impact of people's activities are presented on the two Land Use maps included in the next section.

Bedrock Geology and Surficial Deposits

The earth materials of the Penobscot Bay area may be divided into three major categories: (1) bedrock, or ledge, which underlies the entire area, (2) surficial deposits, which include all of the unconsolidated or loose materials overlying the bedrock, and (3) soils, which form a thin surface layer, supporting vegetative growth. Many additional subdivisions of these three categories have been recognized in the study area, only a few which are described below. Soils have not been mapped because soils inventories have been conducted in only a few of the towns in this area.

Two types of bedrock found in the area are metamorphic rocks, (including pelite, quartzite and limestone) which were originally soft sediments laid down in marine environment and subsequently altered both physically and chemically by heat and pressure within the earth, and plutonic rocks, (including granite, granodiorite, diorite, and gabbro) which formed from melted material that moved upward into preexisting "country" rocks where it cooled and crystallized. Later erosion of the overlying country rock has left these plutonic rocks exposed at the surface today.

Among the surficial materials recognized in the area are till, sand and gravel, marine clay, and swamp deposits. These surficial materials are largely the result of the last continental ice sheet that advanced, melted, and readvanced across the State of Maine. The advancing ice incorporated into its mass great quantities of debris as it plowed up soils and loose rocks, and plucked, gouged, and ground up boulders from the bedrock. During transport, and when the ice eventually melted, these materials were redeposited resulting in a number of distinctly different sediments.

Till – Till is a poorly-sorted sediment deposited directly by the ice in much the same way a plasterer spreads plaster across a wall. Till may consist of 99 percent clay or 99 percent boulders or any combination of these in intermediate sizes. There are two types of till in the project area; Type 1, which exhibits a poorly-sorted, dense, and impervious clay, and Type 2, which has a silty to sandy clay.

Sand & Gravel – Sand and gravel deposits consist of sediments of all sizes that were transported by the ice and later released and washed away during the melting of the ice by meltwater streams. Movement by water resulted in the sorting of these materials.

Marine Clay – As the climate grew warmer the ice mass retreated and gradually disappeared from the state. During the time of final glacial melting the sea flooded the lands reaching far into central Maine. Today we find throughout the area a layer of blue-gray silty marine clay up to a maximum elevation of 290 feet above mean sea level generally conceded to be the height which the sea reached during this period of flooding.

Swamp & Wet Land Deposits – Swamp and wetland deposits occur in local, poorly-drained, water-saturated ground. They are made up of partly decomposed organic matter with some intermixing silt, clay, and sand.

Geologic inventories are important in understanding and evaluating the potential of the land for drainage, water-bearing and foundation characteristics, solid and liquid waste disposal suitability, as well as agricultural productivity of land and the extent of exploitable minerals and rocks.

Groundwater – Most earth materials are not solid, but contain openings or voids. At some depth below the land surface, these voids become filled with water and the materials are saturated. The upper surface of the saturated material is called the water table. The position of the water table changes seasonally. This is caused by varying amounts of precipitation and the nature of the vegetative cover which influences the amount of water moving downward. The rate of water flow through the earth materials depends on the interconnections of the voids and is called permeability. Sand and gravel particles being larger in size also have larger pore spaces and therefore more permeable than till. Those materials that are permeable enough to yield usable quantities of water are referred to as equifers.

The aquifers that yield the most water in Maine are the coarse to medium-grained and well-sorted sand or gravel deposits. These unconsolidated glacial deposits have both high porosity (capacity to store water) and high permeability (capacity to transmit water). At the opposite extreme is the marine clay, which is nearly impermeable and in this area often separates overlying and underlying permeable units into two distinct aquifers. Materials of intermediate permeability include Type 1 and Type 2 till, with the latter being moderately sorted and therefore the better aquifer.

The rock types shown on the bedrock geologic map generally are not high yield groundwater sources. The metamorphic or melting processes to which these rocks were subjected have destroyed any original permeability. Groundwater can, however, move through and is often stored in numerous fractures or cracks in the bedrock. Fractures are often connected together, thus water wells drilled in bedrock most likely intercept one of these fractures which will supply enough water for domestic use. High yield wells in bedrock intercept many water bearing fractures and are often a result of shear or fault zones.

To continue to furnish sufficient groundwater to wells, fracture systems or shear zones must be recharged. Water may enter the system at the surface where fractures are exposed to surface runoff, or where they come into contact with fresh water bodies such as rivers and lakes. The bedrock aquifers are, however, most commonly recharged by the percolation of water through overlying unconsolidated surficial sediments. The quantity and quality of water in bedrock aquifers can be affected by conditions of water and soil closer to the surface.

Waste Disposal – In order to protect groundwater supplies from pollution, holding lagoons, treatment facilities, and sanitary land fill sites should be confined to areas where the bedrock is dense (few fractures) or where the surficial material is not so permeable. Disposal sites should be located in slowly permeable materials, such as the Type 1 till or marine clay, because these materials greatly slow down the downward migration of water contaminated by the waste materials. This allows time for various natural biologic and chemical processes to operate and largely eliminate any contaminates in the water.

Because of their high permeability, sand and gravel deposits are generally unsuited for waste disposal operations. Similarly, limestone areas, because of limestone's tendency to dissolve along fractures making the rock highly permeable, should also be avoided as treatment or land fill sites. Even if these permeable deposits are locally thin or for other reasons are not important aquifers, contaminants introduced into them could migrate to other aquifers and pollute active and potential ground water supplies. Only under a few circumstances are large gravel or limestone deposits suitable for waste disposal regardless of the tempting convenience of existing pits and quarries.

Economic Evaluation – There are several rock types in the project area that have potential economic value. The most obvious are the large granite bodies that are potential sources for building and dimension stone. The viability of granite as an economic deposit is a function of its texture, color, and fracture patterns. Base metal sulfides, such as copper, lead, zinc, nickel, and cobalt, are most likely to be associated with the volcanic rocks that occur in the project area on the east side of Penobscot Bay. Where these volcanics are in contact with other rock types or are associated with shear or fault zones, they can be prospective mining areas.

The suitability of the limestone in the northern Penobscot Bay area for cement manufacturing or agricultural lime is uncertain at this time due to insufficient detailed data; however, limestone and its products can be considered as a potential economic deposit in the area.

Of considerable economic importance for construction, especially of roads, are the various unconsolidated surficial deposits in the area. The Maine State Highway Department soils reports have assigned the American Association Group Index Rating to most of the sediment types occurring in the project area, with the highest ratings applying to the sand and gravel deposits shown on the surficial geology map. The materials inventory contained in the State Highway's soils report conform to those sand and gravel areas designated on the surficial map. These soils reports (found in the appendix) contain a detailed and quantitative analysis of the surficial materials in those areas.

Foundation Qualities – Rock mechanic studies of igneous and metamorphic rocks show that as a group these bedrock types have considerable inherent strength and demonstrate favorable bearing and load characteristics. Consideration should be given, however, to weaknesses that may occur in limestone areas. This is due to limestone's tendency to dissolve easily which can form solution cavities that are not always detectable by casual inspection of the ground surface. Also the structural weaknesses in highly developed shear or fault zones should be considered where heavy and complex foundation work is contemplated. It is emphasized here that the existing faults and shear zones in the project area are inactive and do not present the displacement hazards that occur in those areas of the world, such as Southern California, where vertical and horizontal crustal movements are presently active.

Unconsolidated surficial deposits are said by engineers to be "normally loaded," a term that refers to their condition rather than their bearing capacity. It means that the deposits have not been preconsolidated or compressed by loads greater than those exerted by the weight of the sediments themselves. Placing a load of any kind – a building, a dam, or a highway fill – on such material creates an additional pressure. As a result, additional compression, accompanied by sinking of the surface of the deposit and of the structure upon it, must be expected. Sinking is caused by expulsion of water from the sediment and by rearrangement of the particles as the supporting water is removed. The amount of sinking is a function of the added load, thickness of underlying unconsolidated deposits, water and clay content of the deposits, and time.

Type 1 till and the marine clay, both with poor internal drainage, have a poor bearing capacity. The high percentage of clay in these materials causes large amounts of water to be retained. The water tends to lubricate the flat particles of the clay, and when a heavy load is placed on these materials, they will slip and shift, especially in

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STATE PLANNING OFFICE

PREPARED BY JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
NOVEMBER, 1971

Scale
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FEET

BEDROCK GEOLOGY MAP
of the
PENOBSCOT BAY AREA

Compiled by P.H.Osberg
1971

STRATIGRAPHY

PLUTONIC ROCKS
- DEVONIAN — 25
- DEVONIAN (?) — 24
- 23

STRATIFIED ROCKS
Bucksport Block
- 22 APPLETON SCHIST
- SILURIAN (?) — 21 BUCKSPORT FM.

UNCONFORMITY
- 20
- 19 — PASSAGASSAWAKEAG FM.
- ORDOVICAN (?) — 18

Megunticook Block
- ORDOVICAN (?) — 17 PENOBSCOT FM.
- 16 MEGUNTICOOK FM.
- 15 BATTIE QUARTZITE

Dodge Mtn. Block
- ORDOVICAN (?) — 14 BENNER HILL FM.

Penobscot Bay Block
- DEVONIAN — 13 CASTINE FM.
- DEVONIAN — 12 THOROUGHFARE ANDESITE
- DEVONIAN - SILURIAN — 11 AMES KNOB FM.

UNCONFORMITY
- ORDOVICAN (?) — 10 ELLSWORTH SCHIST
- 9 NORTH HAVEN GREENSTONE
- 8 OGIER POINT FM.
- 7 CLAM COVE FM.
- 6 BEAUCHAMP POINT FM.
- 5 ROCKPORT LIMESTONE
- 4 WESKEAG QUARTZITE
- 3 HOSMER POND SCHIST
- 2 ROCKLAND LIMESTONE
- 1 SLAB CITY FM.

LITHOLOGY
- NONRUSTY, LIGHT-COLORED PELITE
- NONRUSTY, DARK GRAY PELITE
- RUSTY, SULPHIDIC PELITE
- GRAY QUARTZITE
- QUARTZ-PEBBLE CONGLOMERATE
- LIMESTONE
- LIMESTONE CONGLOMERATE
- MAFIC VOLCANIC
- UNDIFFERENTIATED VOLCANIC ROCKS
- AGGLOMERATE
- GRANITE AND GRANODIORITE
- DIORITE AND GABBRO

CONTACTS
- FORMATION BOUNDARY
- THRUST FAULT
- HIGH-ANGLE FAULT

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2. STEWART, D.S. 1971, UNPUBLISHED MAP AND NOTES
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Source: Maine Geological Survey- February, 1972

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PRELIMINARY SURFICIAL GEOLOGY MAP of the PENOBSCOT BAY AREA

EXPLANATION

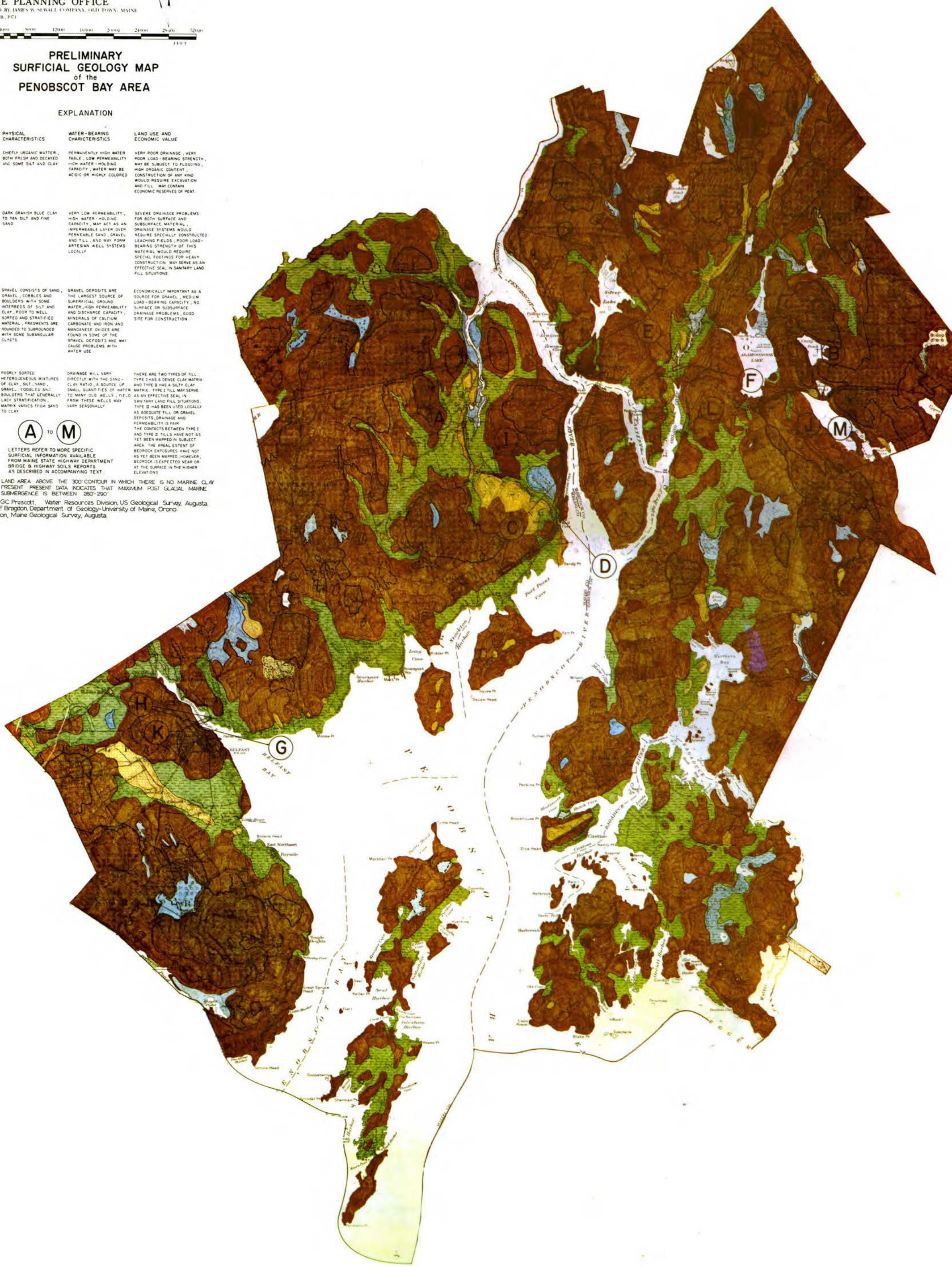
GEOLOGIC UNITS	PHYSICAL CHARACTERISTICS	WATER-BEARING CHARICTERISTICS	LAND USE AND ECONOMIC VALUE
SWAMP DEPOSITS	CHIEFLY ORGANIC MATTER, BOTH FRESH AND DECAYED AND SOME SILT AND CLAY	PERMANENTLY HIGH WATER TABLE, LOW PERMEABILITY HIGH WATER-HOLDING CAPACITY; WATER MAY BE ACIDIC OR HIGHLY COLORED	VERY POOR DRAINAGE, VERY POOR LOAD-BEARING STRENGTH, MAY BE SUBJECT TO FLOODING, HIGH ORGANIC CONTENT, CONSTRUCTION OF ANY KIND WOULD REQUIRE EXCAVATION AND FILL. MAY CONTAIN ECONOMIC RESERVES OF PEAT.
MARINE CLAY DEPOSITS	DARK GRAYISH BLUE CLAY TO TAN SILT AND FINE SAND	VERY LOW PERMEABILITY, HIGH WATER-HOLDING CAPACITY, MAY ACT AS AN IMPERMEABLE LAYER OVER PERMEABLE SAND, GRAVEL AND TILL, AND MAY FORM ARTESIAN WELL SYSTEMS LOCALLY	SEVERE DRAINAGE PROBLEMS FOR BOTH SURFACE AND SUBSURFACE MATERIAL, DRAINAGE SYSTEMS WOULD REQUIRE SPECIALLY CONSTRUCTED LEACHING FIELDS; POOR LOAD-BEARING STRENGTH OF THIS MATERIAL WOULD REQUIRE SPECIAL FOOTINGS FOR HEAVY CONSTRUCTION. MAY SERVE AS AN EFFECTIVE SEAL IN SANITARY LAND FILL SITUATIONS.
GRAVEL DEPOSITS	GRAVEL CONSISTS OF SAND, GRAVEL, COBBLES AND BOULDERS WITH SOME INTERBEDS OF SILT AND CLAY, POOR TO WELL SORTED AND STRATIFIED MATERIAL, FRAGMENTS ARE ROUNDED TO SUBROUNDED WITH SOME SUBANGULAR CLASTS.	GRAVEL DEPOSITS ARE THE LARGEST SOURCE OF SUPERFICIAL GROUND WATER, HIGH PERMEABILITY AND DISCHARGE CAPACITY, MINERALS OF CALCIUM CARBONATE AND IRON AND MANGANESE OXIDES ARE FOUND IN SOME OF THE GRAVEL DEPOSITS AND MAY CAUSE PROBLEMS WITH WATER USE.	ECONOMICALLY IMPORTANT AS A SOURCE FOR GRAVEL, MEDIUM LOAD-BEARING CAPACITY, NO SURFACE OR SUBSURFACE DRAINAGE PROBLEMS, GOOD SITE FOR CONSTRUCTION.
TILL DEPOSITS BEDROCK (INCLUDED WITH TILL)	POORLY SORTED HETEROGENEOUS MIXTURES OF CLAY, SILT, SAND, GRAVEL, COBBLES AND BOULDERS THAT GENERALLY LACK STRATIFICATION. MATRIX VARIES FROM SAND TO CLAY.	DRAINAGE WILL VARY DIRECTLY WITH THE SAND-CLAY RATIO, A SOURCE OF SMALL QUANTITIES OF WATER TO MANY DUG WELLS, YIELD FROM THESE WELLS MAY VARY SEASONALLY.	THERE ARE TWO TYPES OF TILL. TYPE I HAS A DENSE CLAY MATRIX AND TYPE II HAS A SILTY CLAY MATRIX. TYPE I TILL MAY SERVE AS AN EFFECTIVE SEAL IN SANITARY LAND FILL SITUATIONS. TYPE II HAS BEEN USED LOCALLY AS ADEQUATE FILL OR GRAVEL DEPOSITS, DRAINAGE AND PERMEABILITY IS FAIR. THE CONTACTS BETWEEN TYPE I AND TYPE II TILLS HAVE NOT AS YET BEEN MAPPED IN SUBJECT AREA. THE AREAL EXTENT OF BEDROCK EXPOSURES HAVE NOT AS YET BEEN MAPPED. HOWEVER, BEDROCK IS EXPECTED NEAR OR AT THE SURFACE IN THE HIGHER ELEVATIONS

A TO M

LETTERS REFER TO MORE SPECIFIC SURFICIAL INFORMATION AVAILABLE FROM MAINE STATE HIGHWAY DEPARTMENT BRIDGE & HIGHWAY SOILS REPORTS AS DESCRIBED IN ACCOMPANYING TEXT

LAND AREA ABOVE THE 300' CONTOUR IN WHICH THERE IS NO MARINE CLAY PRESENT. PRESENT DATA INDICATES THAT MAXIMUM POST GLACIAL MARINE SUBMERGENCE IS BETWEEN 260'-290'

Sources: GC Prescott, Water Resources Division, US Geological Survey, Augusta.
HW Borns, F Bragdon, Department of Geology-University of Maine, Orono.
WA Anderson, Maine Geological Survey, Augusta.



steeply sloping areas. The drainage and expulsion of water from the relatively well-sorted sands and gravels occurs readily, however, making the bearing capacity of these materials much greater.

Slopes

This map is probably the simplest yet the most useful of the resource maps. Basically it gives an indication of the ridge-valley sequence throughout the area and thus allows the viewer to "get the lay of the land."

Slopes also play an important role in determining the suitability of a site for almost any kind of activities. Flat areas, suitable for intensive development or high speed roadways, can be easily identified. On the other hand, regions possessing the scenic qualities associated with high or varied relief also stand out, allowing development to be planned so as to avoid disruption of the scenic quality of the area.

Used in combination with other physical and living resource maps, sites can be examined to determine drainage characteristics, susceptibility to erosion, and suitability for farming, waste disposal, and highway, railroad and road construction.

Steep slopes limit easy accessibility to certain areas. This condition eliminates many sites from consideration for lumbering or industrial and high-density residential construction, leaving such areas untouched and available for recreation — the activity to which high-relief areas are best suited.

Various planners have used slopes to establish land use guidelines. Naturally the slope limitations for certain land uses will change in different topographic areas of the world. The Soil Conservation Service recommends that areas with slopes greater than 12 percent be left as forest land, to prevent erosion. Such areas should not be cultivated or developed. In general, however, transportation corridors require slopes under 15 percent, development of urban areas should be limited to slopes under 5 percent, and ski areas require average slopes of 15 percent or more. (The slope of a hill is determined by expressing the vertical change as a percent of horizontal change, for example, a vertical change of 1 foot with a horizontal change of 10 feet is a slope of 10 percent.) Of course, the economic advantages of building on steep slopes often seem to outweigh the problems of safety, cost or inconvenience as the City of San Francisco and the terraced gardens of Japan vividly illustrate.

In the Penobscot area, steep slopes (greater than 15 percent) occur primarily in the following areas: along the shore and in the southern part of Northport, along the Passagassawakeag River in Belfast, in the vicinity of Mt. Waldo in Frankfort and Prospect, along the Penobscot River near Mt. Tuck in Prospect, from Jacob Buck Mt. to Alamoosook Lake in Bucksport and Orland, and on Cape Rosier in Brooksville.

Hydrology

The orientation of slopes and the movement of water reinforce one-another. That is, water follows the downhill direction dictated by the slope, but water also cuts and carves soft rocks and soils, changing the slope by its action.

The force of gravity causes many of the results of man's and nature's activities to move downhill with the water. For this reason, it is important for land owners and water users to know what substances and activities exist upstream from them. To aid in servicing this need, the Hydrology map has been prepared from the topographic contours and slope patterns on the Slopes map to designate rivers, streams, major drainage areas and dams.

There are six major drainage areas which drain the Penobscot area; Little River, Passagassawakeag River, Goose River, Marsh Stream, the Orland (or Narramissic) River, and the Bagaduce River. None of these drainage areas are included entirely within the area. That is, all of these streams receive water from towns outside the Penobscot area. Most of the area not included in these major drainage basins is drained by small streams which empty directly into the Penobscot River or Penobscot Bay. However, the Upper Patten Pond area in Orland drains into the Union River Bay at Surry, and the Rocky Pond, Gott Brook and Winkumpaugh Brooks areas of Orland flow into the Union River system. A small area around Moulton Pond in Bucksport also flows into the Union River system.

Knowledge of and respect for the drainage system of an area is vitally important for planning purposes. In addition to supplying water, the rivers, streams, lakes and groundwater systems are the principal transportation network servicing the environmental systems of plants and animals. Particles and dissolved minerals from rocks, soils and plants as well as "waste" material from animals and people are all transported by water from high elevations to low elevations and from producers to consumers throughout the interdependent chain of nature. The balance of plants, animals and men which support and provide for one-another is dependent upon the continued supply of proper materials by this water transportation network.

Man's use of the water system has included human consumption of water and surface water, transport of sewage and industrial waste materials, power production, transportation of goods, and recreational swimming, boating and fishing. The discharge of sewage and industrial waste has, in many cases, disrupted the environmental balance by placing large concentrations of specific substances in the water, threatening the health of many humans as well as overwhelming many species of plants and animals. Construction of dams for water supply or power generation has further disrupted the system. The dams cause the river water to slow down, with the result being that much of the suspended material is dropped behind the dams. Those plant and animals downstream which require these suspended nutrients are diminished. Another well-publicized problem with dams is the obstruction to the migration of salmon, alewives, smelt and other anadromous fish.

In Belfast at the mouth of the Little River are two major impoundments which provide for the town's water supply (dam numbers 1 and 2).

The main branch of the Passagassawakeag River is about 14 miles in length and its source is in the township of Brooks, in Waldo County. A steep natural gorge near City Point, Belfast prevents most anadromous fish from entering the river basin. Any migrant fish which do negotiate the gorge are blocked by an old sawmill dam at Holmes Mill (dam number 4). Most of the streams in the Passagassawakeag system carry a very low volume of warm water during the summer. There streams seem to be unsuited for Atlantic salmon and other cold-water species. However, the habitat does seem suitable for warm-water fish.

Eight dams (numbers 5-12) near the tide waters of the Goose River limit anadromous fish. The majority are owned by Sherman and Company, shoe and leatherboard manufacturers.

The mouth of Marsh Stream has on either side 325 acres of brackish meadow. This area is now under the protection of the Department of Inland Fisheries and Game and provides waterfowl such as black ducks, golden eyes, teal, geese and brant with nesting, feeding and migration areas. Neither dam on this stream (numbers 15 and 16) has a fishway.

The Orland River watershed drains about 113 square miles of forest and agricultural land and provides habitats for both cold-water and warm-water fish. A low dam in Orland Village (number 19) limits the tidal flow but has a fishway which permits passage of alewives. Stubbs Brook and Whites Brook are spawning and nursery areas of anadromous brown trout. Alamoosook Lake and Toddy Pond both have new fishways in their dams (numbers 20 and 22). Craig Pond dam (number 21) is owned by the United States Fish and Wildlife Service. It is here that an intensive spawning program of the Atlantic salmon is in progress. Most of the smaller streams and brooks of the Orland have abundant trout.

Toddy Pond and Alamoosook Lake are ranked "smooth and pleasant" by the *A.M.C. New England Canoeing Guide* for 1971, and the Orland River is ranked "mostly smooth and pleasant."

The Bagaduce River is a highly scenic estuary with tides ranging from 9½ to 11 feet. The Canoeing Guide also ranks this river as "smooth and pleasant."

Water Quality

The Water Classification Map shows Water Quality Protection and Improvement classes designated by 101st Maine State Legislature. These classifications designate rivers, streams, lakes, ponds, and tidal or marine waters according to the water quality which must be maintained. Any potential polluter must demonstrate that his use of water in a given water area will not degrade the water below the standards set by the classification.

Detailed descriptions of the water classes and legal enforcement procedures are included in the volume entitled *Environmental Improvement Commission Revised Statutes of 1964.* This can be obtained from the Commission office in Augusta.

In general, Class A (fresh) water "shall be maintained in a condition suitable for recreational purposes, including bathing, and for public water supplies after disinfection." Class SA water (tidal water) "shall be suitable for all clean water usages, including water contact recreation and fishing; and must be suitable for harvesting and propagation of shellfish and for a fish and wildlife habitat."

Class B-1 water "shall be acceptable for recreational purposes, including water contact recreation, for use as potable water supply after adequate treatment and for a fish and wildlife habitat."

Class SB-1 waters must meet these standards, and in addition they "shall be suitable for the harvesting and propagation of shellfish." Class B-2 and SB-2 waters require basically the same restriction as do B-1 and SB-1 waters; however, specific water quality restrictions — dissolved oxygen levels, coliform bacteria levels, hydrogen ion concentration, etc. — are stringent for B-1 and SB-1 waters.

Class C waters "shall be of such quality as to be satisfactory for recreational boating and fishing, for a fish and wildlife habitat and for other uses except potable water supplies and water contact recreation, unless such waters are adequately treated." Class SC waters, in addition to these requirements, "may be used for the propagation of indigenous shellfish to be harvested for depuration purposes. . . . and for industrial cooling and process use."

Several conflicting classifications are readily apparent from the map. For instance, the waters surrounding Sears Island, and some of the tidal water in Stockton Harbor are Class A; however, the streams flowing into these areas are Class C. Also, the Bagaduce, upstream from West Brooksville is classified A, but all streams flowing into the Bagaduce are Class B or C, and the tidal water downstream is Class B. It is rather questionable whether a body of water can attain a Class A condition when all sources flowing into that body are classified B or C.

Another question arises concerning the boundaries of water classification areas. This is especially true in tidal waterways where water classifications refer to the quality of water along the shore of mainland areas and islands. These classifications apparently extend outward from the shorelines to municipal boundaries. However, if a body of water separating two classified shorelines lies wholly within a single township does each classification extend to the center of that body of water? Confusion again results when several classified areas converge on the center of such a body of water. Where and how do these classified areas intersect? How can such definite boundaries be maintained, when the circulation patterns of bays and estuaries obviously do not conform to municipal boundaries?

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Penobscot Bay Pilot Project
STATE PLANNING OFFICE

PREPARED BY JAMES W. SEWALL COMPANY, OLD TOWN, MAINE

NOVEMBER, 1971

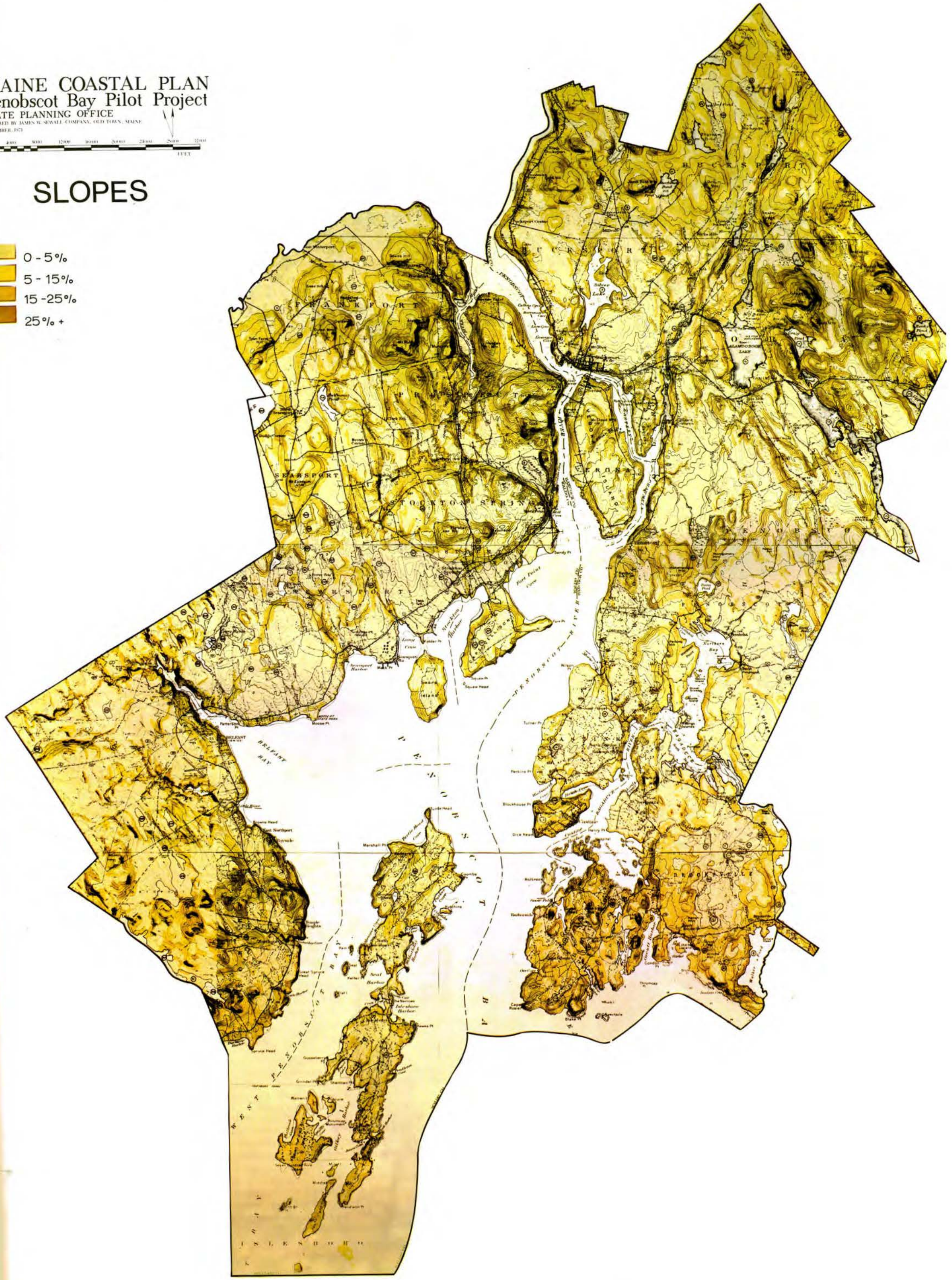
Scale

0 4000 8000 12000 16000 20000 24000 28000 32000

FEET

SLOPES

- 0 - 5%
- 5 - 15%
- 15 -25%
- 25% +



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HYDROLOGY

MAJOR WATERSHEDS

I LITTLE RIVER
II PASSAGASSAWAKEAG RIVER
III GOOSE RIVER
IV MARSH RIVER
V ORLAND RIVER
VI BAGADUCE RIVER

DAMS

1-25

PENOBSCOT DEPTH CONTOURS

30'
60'
120'
180'

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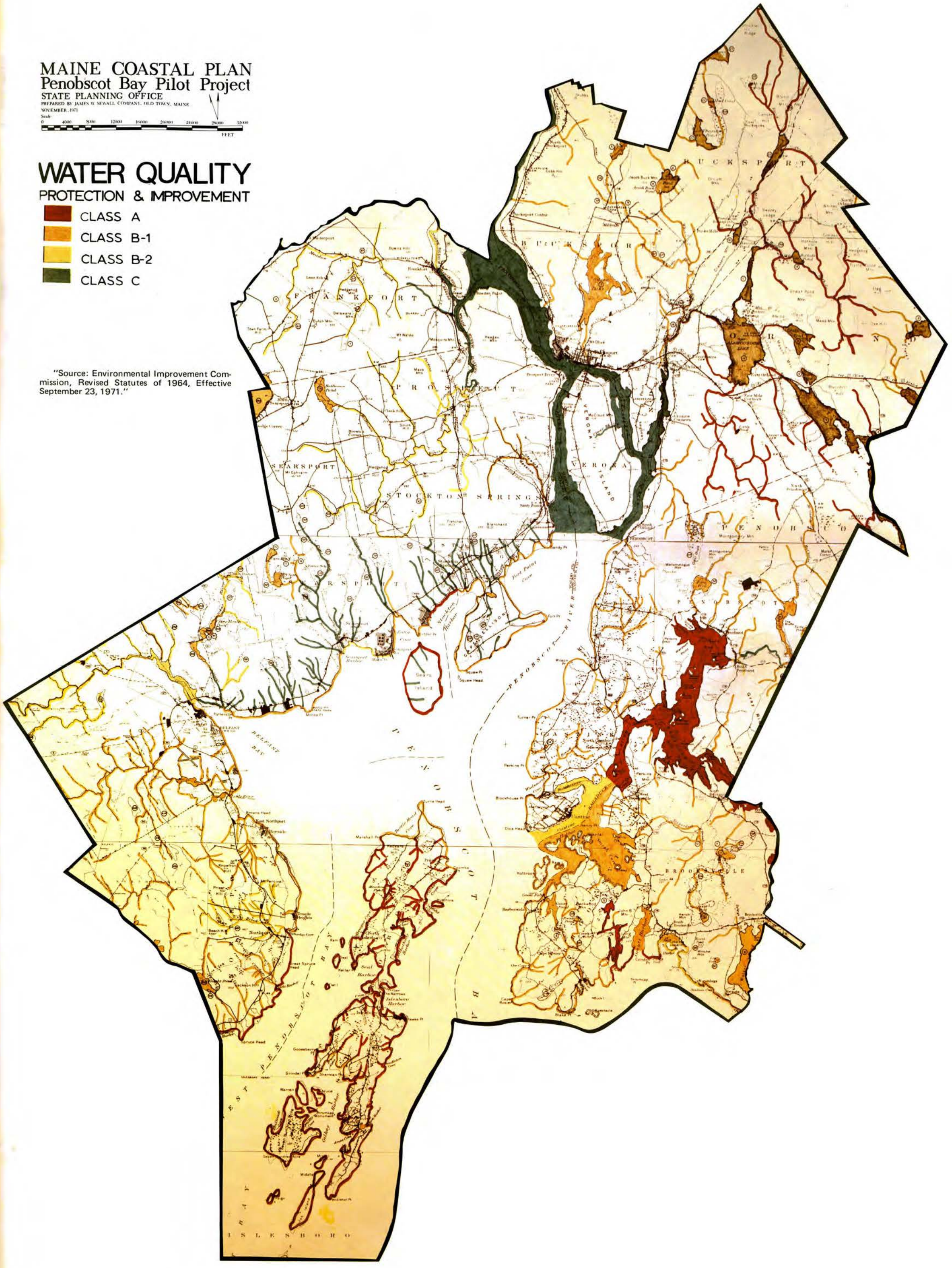
WATER QUALITY
PROTECTION & IMPROVEMENT

- CLASS A
- CLASS B-1
- CLASS B-2
- CLASS C

"Source: Environmental Improvement Commission, Revised Statutes of 1964, Effective September 23, 1971."



WATER QUALITY CONT.

As the classifications of tidal waters are mapped along the entire coast, many similar confusing situations can be expected. These questions will be resolved by mapping the existing classifications and comparing them with surrounding resource uses and needs. The resource information presented in the Maine Coastal Plan can provide the basis for this reassessment of the classifications of all estuaries and streams in the coastal zone. Using this resource and land use data, water classifications can be made to conform to the actual conditions of rivers, streams and bays as they serve plants, animals and people. For instance, high priority wildlife areas, streams with high diversity of fish; estuary regions inhabited by clams, scallops, lobsters or other valuable species, and waterways which serve protection areas (the Synthesis map) should all be protected with a Class A designation.

Climate

The climate of the Maine coast is noted for its variable and unpredictable nature. Certain general patterns do stand behind this confusing mass of weather, however, and in planning for any development of the Penobscot Bay region, it is worthwhile to be familiar with these trends and to be aware of the extreme conditions which do exist from time to time.

Although winds in Maine may blow from any direction at any time of the year, the dominant winds are the "Prevailing Westerlies" — the basic eastward flowing air mass of the northern temperature zone. This situation provides Maine with a continental climate, i.e., large diurnal and annual temperature ranges and an even distribution of rainfall throughout the year.

In Maine, the westerly wind pattern is enhanced by the interaction of two pressure systems: a low pressure system (counterclockwise wind rotation) centered to the northeast of Maine and a high pressure system (clockwise rotation) centered near Bermuda. The positions of these pressure systems shift during the year, both systems moving northward during the summer and southward in the winter. As a result, the Bermuda high dominates Maine's weather from June to August, bringing pleasant weather with low rainfall and causing winds to blow primarily from the southwest. During the winter months — December to March — the low pressure system causes winds to shift to a northwesterly direction. In Penobscot Bay this pattern is especially evident toward the mouth of the Bay. Inland, toward Bangor, interference caused by land masses obscures the seasonal wind pattern.

Unsettled conditions occur frequently during the winter months when cold, continental air masses move freely to the coast and collide with warmer, moist marine air. Frontal disturbances and extra-tropical cyclones bring precipitation and high winds to the Maine coast during all seasons, but they occur most often and with highest intensity during the unsettled winter months.

Winter storms generate winds from every direction; however, the most notorious of Maine's winter storms is the "Northeaster," a low pressure cyclone which moves along the New England coast toward the northeast.

Summer conditions are considerably calmer and sunnier than winter weather. Storms happen less often and are of much less intensity. For example, Coast Guard warnings — small craft, gale and whole gale — were displayed from Rockland to Eastport twenty-six times during January of 1971 and sixteen times during February. Such warnings were posted on three occasions in June and eight times during July of the same year.

Probably the most noteworthy of summer weather conditions is the incidence of heavy coastal fog, particularly during the early daylight hours. This fog is produced by moist southerly and southwesterly winds which blow from the warm Gulf Stream across the cold Labrador Current which flows southward along the Maine coast. Cold temperatures cause the moisture to condense to fog. The fog blows into the pocket formed by Penobscot Bay. In the Penobscot region fog is a particular problem at the mouth of the Bay — the Rockland-Deer Isle area. It dissipates quite readily upon reaching the head of the Bay.

In the late summer and early fall, tropical storms and hurricanes sometimes stir up the air and water of the Penobscot coastal region, and they often bring prolonged heavy rain. Such storms seldom cause heavy damage as they usually move out to sea far south of Maine. On the average, such storms pass within 60 miles of the Maine coast only once every 4.9 years.

Official weather data for Penobscot Bay are registered only at Rockland and Belfast. However, available information from Bangor and Bar Harbor can provide a basis for generalizing weather patterns in the Bay.

Bar Harbor and Rockland, both located on open water, have two of the highest levels of precipitation on the Maine coast, averaging 49.82 and 46.81 inches per year. Temperature and precipitation data indicate that as one moves toward the head of Penobscot Bay, marine influences become less pronounced. Precipitation is lower in Belfast and Bangor while the annual temperature range is greater there than at the mouth of the Bay. The seasonal temperature range — the difference between July and January temperature averages — is 45.0°F. Average precipitation over the Bay area is 45.8 inches per year. Snowfall for the area averages 70 inches per year. The average annual temperature for the four regional weather stations is 44.9°F. (This includes readings taken at Bangor Airport which is at an elevation 202 feet.)

Precipitation in Maine's coastal region averages about 760 million gallons of water per square mile. This is an average of 9.2 million gallons per capita per year.

In the Penobscot Bay region, the mean total hours of sunshine per year is approximately 2600. During the month of July, the sun shines an average of 300 hours or 63 percent of the daylight time. November and December have the lowest percentages of sunshine — 130 hours each or 45 and 48 respectively.

The mean annual relative humidity is about 75 percent, ranging from an average of 70 percent in April and May to 80 percent in September. Annual lake evaporation averages approximately 22 inches, with 78 percent of that occurring between May and October.

Coastal Maine's continental climate tempered by the ocean provides summer conditions which are very pleasant and winters which are entirely livable. Summer fog and winter storms provide hazards to shipping, and the random interactions of pressure and frontal systems add a degree of unpredictable character to the area's weather. Penobscot Bay shares this weather completely with only a few minor local variations — temperature, wind direction, precipitation, frequency of heavy fog, etc.

Tables are included in the Appendix (a separate volume) showing data for temperature, precipitation, wind speed and velocity, percentage of possible sunshine and fog horn operation in the Penobscot area.

Estuaries

The Estuaries map attempts to depict in a general fashion the natural processes which constitute and support the natural environment of various portions of the estuary, and those ways in which man has altered that natural framework. The first step in this process is to locate and map regions or sections of the estuary according to physical conditions.

A region is distinguishable by the conditions which so dominate the region as to be the primary force in determining what lives there. To the extent that existing information allowed, this has been done on the "Estuaries" map. The parameters used for this classification procedure reflect the wide range of physical conditions which exist in the Penobscot estuary. Unfortunately, many of the parameters which are essential in determining the biological character of an area of the estuary remain unstudied.

The following are the factors which have been considered for classification purposes:

Static parameters	physical configuration
	associated drainage areas
	bottom sediment and shore materials
	mean depth of water
Variable parameters	tidal range
	tidal and river currents
	river and stream discharge rates
	kinds and sources of pollution
	flushing rates
	dissolved oxygen levels
	water salinity
	water temperature
	water turbidity

(Tables, maps, and further descriptions showing the observed trends of these parameters are included in the appendix. Also included are suggestions for future research in Penobscot Bay and other Maine estuaries.)

The variable parameters are of particular importance because they give an indication of the type and degree of physical or chemical changes which occur. To a considerable extent, these changes determine what lives in a particular area. When conditions change quickly or unpredictably, individuals and groups of plants or animals must use their energy to adapt to the change. This taxes their ability to grow and to reproduce. Those individuals or species which are unable to adapt or to escape die off. Such changes which require adaptation or escape are known as stress conditions. There are three basic interacting forces which are the prime reasons for these variations in physical conditions — the tide, the weather, and man's use of the estuary.

Regions delineated on the map have been defined according to fourteen categories of conditions. These have been broken down into two groups — natural areas and areas of man-induced stress. The term "stress" has been used in describing the second category, because the man-affected areas have been narrowed down considerably. Obviously the entire estuary has been affected to some extent by man's activities. The areas which we have singled out are those where the concentration or intensity of man's activities and pollution are so great, that the abundance and/or diversity of species has been severely limited. In general then, the areas primarily affected by man's pollution have suffered such extreme changes in chemical or physical conditions that species' capacity to tolerate or adjust to change has been completely overwhelmed.

Stress conditions resulting from man's activities are superimposed upon the naturally occurring situation. In many cases, however, a natural estuarine region can also be distinguished by naturally occurring stresses. Extensive colonies of particular animals and plants have adapted to such conditions over long periods of time and enjoy protection from predators. These "zones of reduced competition" are actually marginal areas for many species, where they require considerable energy for constant adaptation to the frequently changing conditions. Such colonies are therefore very fragile, and intolerant of any further unexpected stress which might be caused by man's activities.

Maine's salt marshes are a good example of a kind of region with a high degree of natural stress. Here the rugged conditions support specially adaptable species in great abundance by eliminating their less adaptable predators. Heavy tides sweep nutrients in and out, but they also continually expose the area to sudden changes in temperature. Tides and sudden rainfall and runoff also bring quick changes in salinity. Because of the very fragile but highly productive nature of the salt marshes,

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ESTUARIES

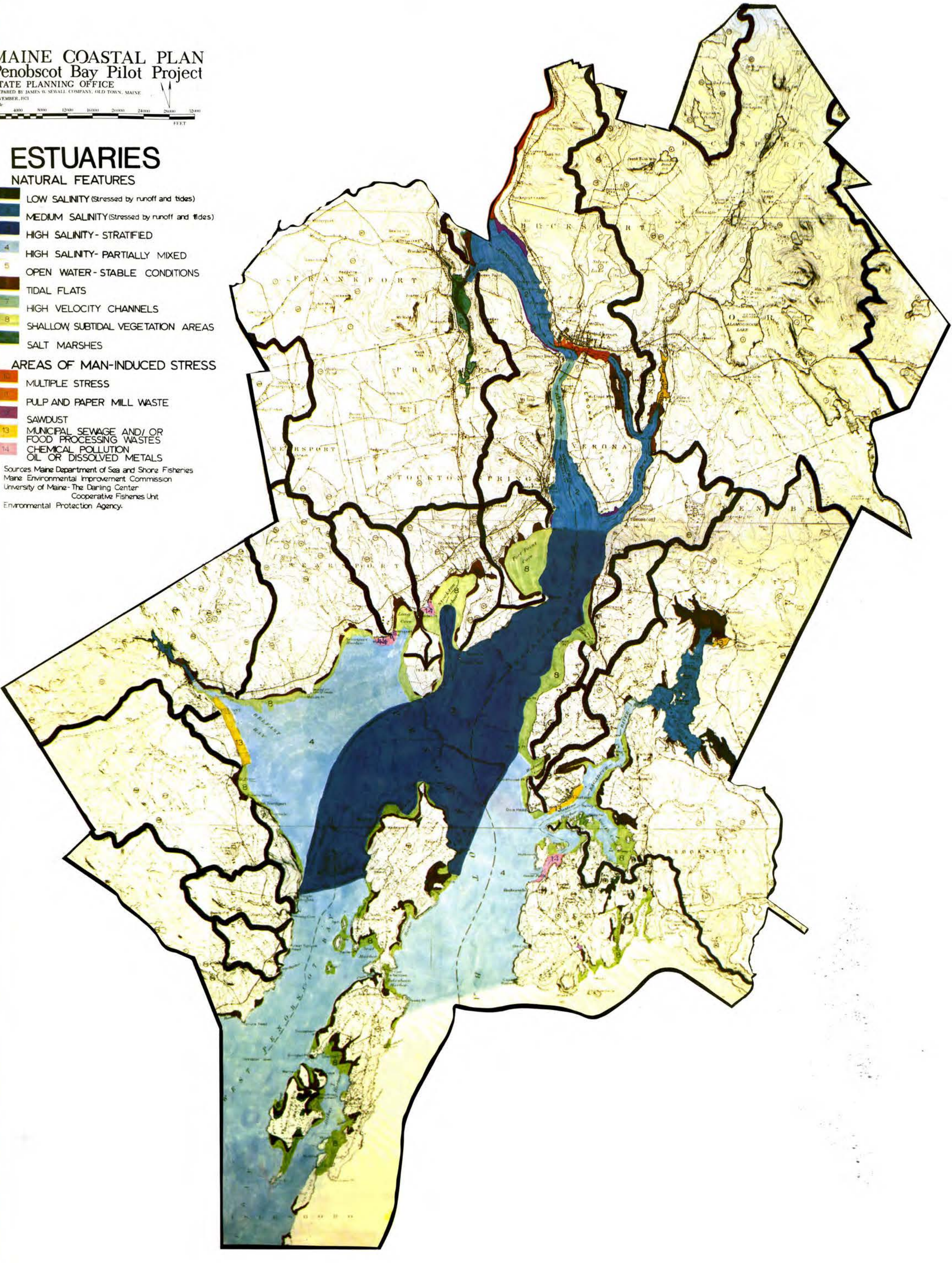
NATURAL FEATURES

1. LOW SALINITY (Stressed by runoff and tides)
2. MEDIUM SALINITY (Stressed by runoff and tides)
3. HIGH SALINITY - STRATIFIED
4. HIGH SALINITY - PARTIALLY MIXED
5. OPEN WATER - STABLE CONDITIONS
6. TIDAL FLATS
7. HIGH VELOCITY CHANNELS
8. SHALLOW, SUBTIDAL VEGETATION AREAS
9. SALT MARSHES

AREAS OF MAN-INDUCED STRESS

10. MULTIPLE STRESS
11. PULP AND PAPER MILL WASTE
12. SAWDUST
13. MUNICIPAL SEWAGE AND/ OR FOOD PROCESSING WASTES
14. CHEMICAL POLLUTION OIL OR DISSOLVED METALS

Sources Maine Department of Sea and Shore Fisheries
Maine Environmental Improvement Commission
University of Maine - The Darling Center
Cooperative Fisheries Unit
Environmental Protection Agency.



ESTUARIES CONT.

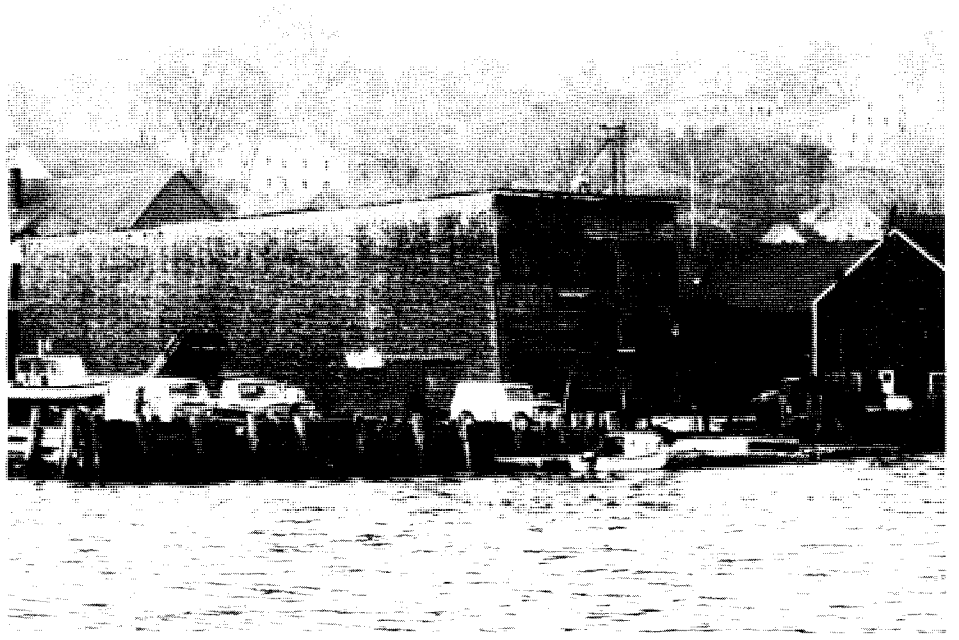
development within the adjacent watershed of a salt marsh should be carefully controlled if not entirely prohibited.

Intertidal flats, composed of sand, gravel, or mud support varying populations of clams, mussels and worms depending largely upon the composition of the sediment and the conditions of the water which washes over them with each tidal cycle. The intertidal environment allows a degree of protection, but requires adaptation to the constant cycle of inundation and exposure to various stresses; drying, changing temperatures, seasonal runoff, and sediment deposition.

The subtidal vegetation area is a preliminary classification used to describe the area immediately below mean low water where extensive rooted vegetation might be expected to exist. The regions included are stable, gently sloping areas less than twenty two feet below mean low water – within range of sunlight. The turbidity, i.e., transparency, of the water and composition of substrate materials would further limit which areas actually support heavy vegetation. Further research should be done to locate these vegetation areas and to map them according to species.

High velocity channels are generally distinguished by currents of three to twenty miles per hour. Sediments are usually swept out of the system, requiring any permanent residents in this region to cling to hard surfaces. For those species which are able to hold on, the tide and river currents provide abundant nutrients, since large volumes of water must pass in and out of the channel. At the same time however, virtually every polluting substance discharged into the upstream portion of the estuary passes through the channel.

The temperature and chemical conditions of water overlying and surrounding the intertidal, subtidal and channel systems further limit animal and plant species' abundance in those areas. Other areas of the estuary are classified according to salinity trends. (Salinity is the concentration of dissolved salts in water.) Salinity itself and changes in salinity determine the suitability for various species. Salinity can also be used to trace water flow to determine the dispersal of pollution. In low salinity or oligohaline areas salinity normally ranges between 0 and 10 parts per thousand. (Sea water in the Gulf of Maine is about 32 parts per thousand.) These areas experience diurnal and seasonal fluctuations in temperature similar to those of inland rivers and streams, and tidal changes of salinity can be large.



Medium salinity areas range from 5 to 25 parts per thousand, with a high degree of vertical stratification, i.e., a wide range of salinity from top to bottom. The more dense, high salinity water occupies the bottom, and the amount of mixing by current, wind and tide determines the degree of stratification. In deep areas such as at Bucksport, the difference between surface and bottom salinity may be as much as 18 parts per thousand. Salinity will change over a tidal cycle by a few or several parts per thousand depending upon the weather. The salinity difference between the periods of extreme low and extreme high fresh water runoff is great at all depths, often greater than 15 parts per thousand.

The high salinity, stratified region receives considerably more ocean influence than do the medium and low salinity areas. Salinity of the bottom water remains virtually constant at 30 or 31 parts per thousand throughout the year and through the tidal cycle. Surface waters of this region, however, range from 10 to 30 parts per thousand according to the volume of fresh water runoff. Thus the degree of stratification changes considerably between the heavy spring runoff and the late summer drought.

The high salinity, partially mixed area also shows a seasonal change in the degree of stratification. During periods of extreme high freshwater discharge it possesses virtually the same characteristics as the high salinity stratified water. Under normal runoff conditions, however, the influence of the river is less direct in the partially mixed region, thus there is less stratification and somewhat higher surface salinity. Bottom salinity again is nearly constant, and under normal runoff conditions surface salinity ranges between 25 and 30 parts per thousand.

Near the mouth of the Bay, a situation of nearly constant salinity exists. This is particularly true in the eastern side of the Bay where the influence of the tide seems to be greatest. In this area, surface salinity remains above 28 parts per thousand except during extreme high runoff.

An area designated as suffering a "multiple stress" condition is influenced by various sources and several kinds of pollution – municipal sewage, industrial chemicals, and suspended particles and heated discharge, etc. Some of the symptoms are low dissolved oxygen, low transparency and high content of harmful bacteria.

Pulp and paper mill waste presently discharged by the St. Regis plant at Busksport includes suspended particles of wood fiber and clay as well as some dissolved chemicals and heated water.

The sawdust found along the banks of the upper estuary differs from the fine fibrous material discharged by St. Regis. The dust has resulted from lumbering operations along the river. In some areas it is several feet thick, smothering whatever plant or animal species originally inhabited the flats and bottom sediments.

Municipal sewage and food processing waste raise the concentration of harmful bacteria and suspended solids, limiting the sunlight available for submerged plants, causing a general hazard to health, and lowering the aesthetic value of the area. Bacteria from these sources contributes to the general pollution of clam flat areas, making clams in much of the bay unfit for consumption.

Chemical pollution along the shore of Searsport consists of various fractions of oil and petrochemicals. The bottom and intertidal areas have virtually become a biological desert. Chemical pollution of Weir Cove and of the north shore of Cape Rosier consists of dissolved metals, primarily copper, zinc, and lead, washed by the tide and runoff from the Callahan mine. Although these metals may limit the species' abundance in the areas directly affected, their influence is noted over a much wider area. The metals do not decompose, thus they may work their way up the food chain, reaching lethal proportions in higher animals. They are diluted and transported throughout the estuary by the tide, and they are retained for long periods by fine bottom sediments.

In May of 1972, the Callahan Mining Corporation announced intentions to develop an experimental aquaculture enterprise in the Goose Pond -- Ram Island area. The success of the venture and the quality of the fish should provide some insight into the productivity of these polluted waters. Also, it should be kept in mind that aquaculture, like any other concentrated activity, can cause pollution.

Outlined on the Map are areas of drainage of the major secondary streams entering the estuary and watershed areas which directly influence partially enclosed portions of the estuary. The size of these drainage and watershed areas provides a basis for determining the volume of fresh water runoff which would directly influence the temperature and salinity regime in a river mouth or enclosed harbor. In addition, the watershed regions can aid land use planning activities by defining those portions of the estuary which would be directly influenced by development of land.

The "Estuaries" map should act as a guide for future use of the estuary, for use of the land surrounding the estuary, and for further research to better understand how the system functions. The information base for the "Estuaries" map can, for example, outline areas which might be suitable for aquacultural pursuits such as oyster rafts in high velocity channels and lobster reefs in the deep, high salinity regions.

Recreational and industrial uses of the estuary can be located out of the range of direct impact upon fragile, unstable areas. Also, the effects of accidental oil spills from shipping operations can be more easily predicted, and cleanup operations can be more effectively directed.

Forest Types and Forest Growth

The Forest Types map shows areas of ten acres or more which have been identified from aerial photography and can be labeled according to the kinds of trees which dominate. There are four categories; hardwoods, softwoods, mixed forests with a predominance of hardwood trees, and mixed forests with a predominance of softwood trees. As the name implies, the Forest Growth map shows the age of forest growth – young, medium, or mature. Used together, these two maps indicate the types and ages of all forested areas within the Penobscot area.

In general, conditions in the western half of the region tend to be more favorable for the growth of hardwoods than those in the eastern portion. The softwood growth rate in Hancock County has been estimated to be three times the growth rate of hardwoods. In Waldo County, the softwoods grow 2.5 times faster.

The Society of American Foresters has classified the area according to two designations: The forests of the Brooksville area are described as "spruce – fir – northern hardwoods." In this area, the rate of regeneration of spruce and fir is quite rapid, thus much of the young growth in cut-over areas is very dense. The remainder of the region is classed as "transition hardwoods – white pine – hemlock."

Forest information can give an indication of the minerals which are present in the water and soil. Forest types are also an indicator of past land uses – young trees on overgrown farm and lumbering lands or mature stands on inaccessible or unused land.

Woodland areas provide a habitat for wildlife, determined by the density, maturity, and types of trees. For example, deer seek areas where a mature softwood stand is available for winter protection, near young hardwoods suitable for grazing.

MAINE COASTAL PLAN
Penobscot Bay Pilot Project
STATE PLANNING OFFICE

FOREST TYPES

Areas 10 acres or more with:

- HARDWOOD SPECIES
- SOFTWOOD SPECIES
- MIXED HARDWOOD-SOFTWOOD
- MIXED SOFTWOOD-HARDWOOD

Common species found:

HARDWOOD	SOFTWOOD
SUGAR MAPLE	RED SPRUCE
YELLOW BIRCH	WHITE SPRUCE
AMERICAN BEECH	BLACK SPRUCE
WHITE ASH	WHITE PINE
GREEN ASH	RED PINE
NORTHERN RED OAK	BALSAM FIR
WHITE OAK	NORTHERN WHITE-CEDAR
HICKORY	EASTERN HEMLOCK
	PITCH PINE
RED MAPLE	JACK PINE
SILVER MAPLE	TAMARACK
PAPER BIRCH	
BIGTOOTH ASPEN	
QUAKING ASPEN	
BLACK ASH	
AMERICAN BASSWOOD	
ELM	
BLACK CHERRY	
BALSAM POPLAR	

MAINE COASTAL PLAN
Penobscot Bay Pilot Project

STATE PLANNING OFFICE

PREPARED BY JAMES W. SEWALL COMPANY, OLD TOWN, MAINE

NOVEMBER, 1971

Scale

0 4000 8000 12000 16000 20000 24000 28000 32000

FEET

FOREST GROWTH

Height and Size Classes

- YOUNG GROWTH
- MEDIUM GROWTH
- MATURE GROWTH

MAINE COASTAL PLAN
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NOVEMBER, 1971

Scale
0 4000 8000 12000 16000 20000 24000 28000 32000
FEET

WETLANDS

An inventory of MAINE'S existing & potential areas

- EXISTING — AREAS COVERED BY WATER DURING THE ENTIRE YEAR
- POTENTIAL — AREAS IMPERFECTLY-DRAINED (too wet to farm, too dry to raise ducks)
- MUDFLATS — PRINCIPAL FOOD PRODUCING AREAS-WINTERING DUCKS

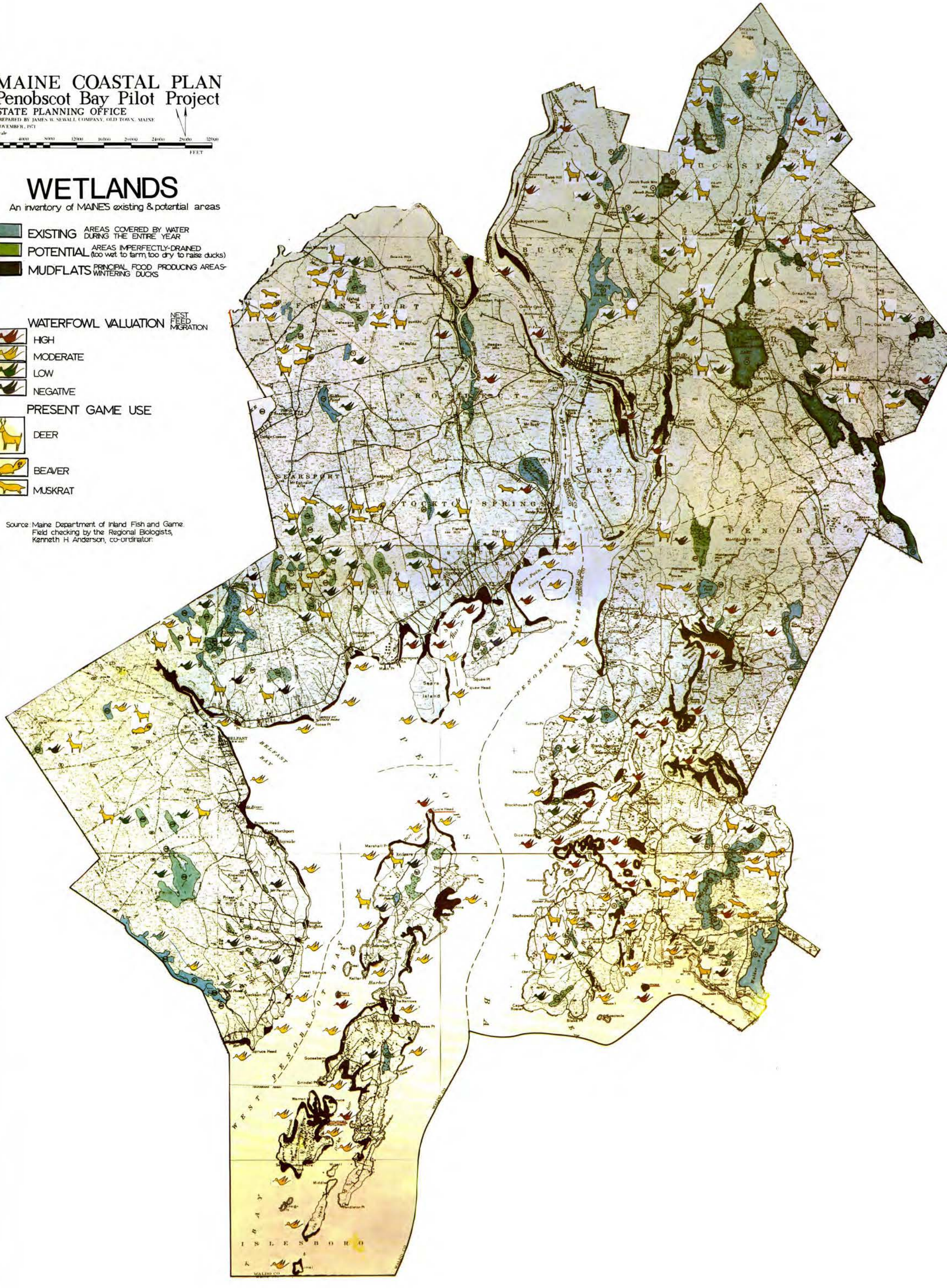
WATERFOWL VALUATION — NEST FEED MIGRATION

- HIGH
- MODERATE
- LOW
- NEGATIVE

PRESENT GAME USE

- DEER
- BEAVER
- MUSKRAT

Source: Maine Department of Inland Fish and Game.
Field checking by the Regional Biologists,
Kenneth H. Anderson, co-ordinator.



When this situation is found near a stream or wetland, the entire region comprises a wildlife habitat which should be preserved.

Most commercial lumbering activities in this area are very small and local in scale. In some cases, individual land owners cut and ship pulpwood to the St. Regis plant at Bucksport. Durham State Forest, located northwest of Knowlton Hill in Northport, is presently being managed for timber production, with income from the operation being used to provide scholarships to the University of Maine.

Commercial forest cutting requirements differ according to the product; however, these maps used with the Slopes map should give a general idea of the extent of accessible stands of hard, soft and mixed timber.

The forest maps should also be used to guide future lumbering activities in order to prevent destructive cutting. Used with the Hydrology and Slopes maps, the Forest maps show the importance of heavily forested areas for breaking and holding the flow of water within drainage areas. Extensive forest growth is necessary to even out the flow of runoff to prevent flooding as well as forest fires. The roots of the trees and litter of decomposing wood and leaves make the forest soil porous, allowing rain water to penetrate. When forest growth is destroyed, the water-retaining capacity of the ground is reduced. The heavy concentration of runoff causes soil erosion and flooding during wet periods, and the lack of retained moisture makes such an area susceptible to fires during dry periods.

The problems of soil erosion and flooding are especially acute in areas of steep slopes. Lumbering in such regions can destroy the soil cover, preventing regrowth of trees and causing harmful siltation of rivers, lakes and estuaries.

Forest cover can also be a consideration in planning for recreation sites and camping areas.

Wetlands

In the past, marshes, bogs and tidal wetlands have been viewed as smelling, muddy eyesores, unsuited for any construction or agricultural use. Their location, often adjacent to important harbors or rivers, has frustrated land developers. Wetlands have in many cases been drained, filled or otherwise altered to support development. Recently, however, scientists have begun to prove that in many cases the greatest social, ecological and economic benefits to be derived from wetlands can be realized by leaving them untouched.

Marshes and wetlands produce tremendous volumes of plant matter, with productivity equaling or exceeding that of modern agricultural land. The high concentration of grasses and algae in a marsh environment directly or indirectly supports many land animals, bird, fish and shellfish which inhabit the wetland, the adjacent land, or the rivers and estuaries downstream. If the productive capacity of wetland is destroyed by dredging, filling, pollution or siltation, plants and animals, fish and shellfish will be affected over a wide area. Such a situation might occur in the marsh area along the west bank of the Penobscot River just north of the Marsh Stream. A small pocket of marshland lies just south of the Frankfort-Winterport line, providing an excellent wintering habitat for water-fowl. The birds feed on the flats which stretch from the marsh to Marsh Bay. Fairly extensive timber cutting on the steeply sloped area north of Marsh Bay threatens to cause erosion and subsequent siltation, destroying the marsh and smothering the productive mud flats.

The actual productive capacity of most marshes — in terms of their plant production or support of wildlife — is at present impossible to determine. Such a determination could be made by measuring the amount of energy which is consumed by the marsh in the production and support of plants and wildlife; the same method for determining the value of an estuary. At present, the necessary data does not exist to make such an exhaustive study, and it is quite sufficient to be aware that marshes and wetlands simply are very important for production and support of land animals, birds, and fish. This simple knowledge supports the statement that all wetlands should be preserved to protect the wildlife which gives us food and recreation.

On the wetlands map, wetlands have been ranked, using the information obtained by the Maine Department of Inland Fisheries and Game in their *Inventory of Maine Wetlands*. The Inventory indicates the abundance of waterfowl and land animals in each significant wetland area, providing a reasonable indication of the relative productivity of the wetlands within the Penobscot area.

Permanent wetlands are marked blue and potential wetlands — imperfectly drained areas — are marked green. Productive mud flats which are potential overwintering areas for waterfowl are colored dark brown. Areas labeled with a red bird are nesting or feeding areas for large numbers of waterfowl. These areas or sections which harbor large concentrations of beaver, deer, muskrat or mink along with moderate numbers of waterfowl are high priority wetlands.

Among the high priority wildlife areas are: the region around the Meadow Brook in Brooksville, the entire Bagaduce River estuary, the area of Hothole Stream in Orland, the Blood Mountain and Long Pond area in Bucksport, the lower branches of the Marsh Stream, and the Goose River area in the northeast corner of Belfast.

High priority wetlands are not suitable for any development. They should be protected from the harmful effects of pollution caused by sewage, industrial waste, and runoff from agricultural land. Furthermore, development within the drainage areas associated with each of these high priority wetlands should be controlled to avoid erosion of soil. High concentrations of soil and silt in streams lower the transparency of the water, and the sudden deposition of these materials in marshes smothers many plants and animals which are vital to the productivity of the wetland system.

Several of the islands in the Bay should be pointed out as important bird rookeries and nesting areas. Turtle Head on Islesboro is a great blue heron rookery. Thrumcap Monument in Isleboro is a tern rookery, and Thrumcap Island off Brooksville is a tern nesting area.

The Maine Department of Inland Fisheries and Game specifies and monitors through Game Warden service the limit and length of open season hunting in the 13 communities of this study area. In 1971 the registered deer kill was 520.

On March 10, 1972, the United States Government passed a Federal law giving full protection against killing — by any means — the following migratory birds: Eagles, Hawks, Ospreys, Kingfishers, Herons, Egrets, Bitterns, Ravens, Crows, Jays, Cormorant, Loons, Seagulls, Terns. Nuthatches, Owls, Storm Petrels.

Fish

This map is a compilation of information prepared by the Department of Sea and Shore Fisheries and data gathered by the Department of Inland Fisheries and Game for their *Index of Lake Surveys*. It is not intended to be a definitive inventory of all fish species found in each of the ponds, streams, rivers or bays. It simply mentions those species which have been sighted quite frequently in particular areas. This is especially true in the cases of lobsters and anadromous (migrating) fish. Depending on weather and other conditions, lobsters might be found almost anywhere in the Bay south of Verona Island. The shallow, rocky areas around Islesboro, however, seem to provide the best lobster habitats. Anadromous species have been noted in several inland rivers and ponds, but because they migrate from salt to fresh water, they are also present at various times of the year throughout the stream mouths, bays, and estuaries.

Those ponds and lakes which are included in the *Index of Lake Surveys* are classified as either warm or cold. Warm-water lakes are generally 50 feet or less in depth and there is little variation in temperature from top to bottom. Smallmouth and largemouth bass, chain pickerel and white perch are well suited to these lakes. These fish spawn near the shoreline during the spring and summer, thus if cottage owners along the stream draw heavily from the water and change the water level during the spawning season, the young fish will not survive. If solar heating is coupled with a high concentration of nutrients from raw sewage or additional quantities of phosphorous, the growth of algae is accelerated. Soon the system is depleted of its oxygen context and the pond or lake is considered eutrophic. It is important to consider this situation in evaluating lake shorelands for development using septic tank sewage disposal.

MAINE COASTAL PLAN
Penobscot Bay Pilot Project

STATE PLANNING OFFICE

PREPARED BY JAMES W. SEWALL COMPANY, OLD TOWN, MAINE

NOVEMBER, 1971

Scale

0 4000 8000 12000 16000 20000 24000 28000 32000

FEET

FISH

MIGRATING
- ALEWIFE
- EEL, AMERICAN
- SALMON, ATLANTIC
- SMELT, AMERICAN

COLD WATER
- TROUT: BROWN (SQUARETAIL), LAKE (TOGUE),
- SALMON, LANDLOCKED

WARM WATER
- BASS: SMALL MOUTH, LARGE MOUTH
- HORNPOUT
- KILLIFISH, BANDED
- MINNOWS
- PERCH, WHITE, YELLOW
- PICKEREL, CHAIN
- SUNFISH
- SUCKER, WHITE

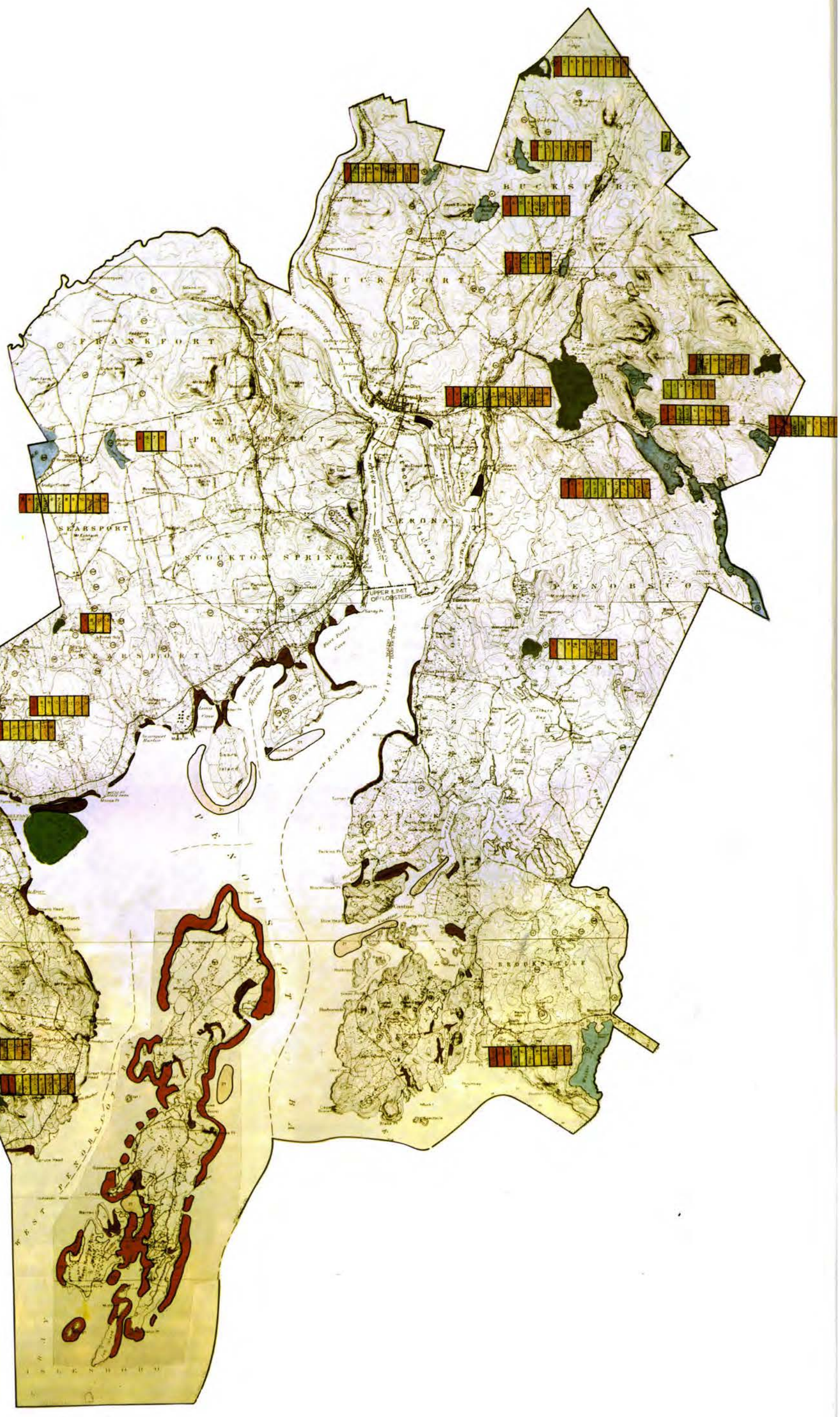
SALT WATER
- BASS, STRIPED
- MACKEREL
- SHAD
- STICKELBACKS

SHELLFISH
- CLAMS
- LOBSTERS - THROUGHOUT WATERS 46°-46.5°F PREFER ROCKY SHORES
- SCALLOPS

WARM WATER PONDS

COLD WATER PONDS

Sources INLAND FISH AND GAME
SEA AND SHORE FISHERIES

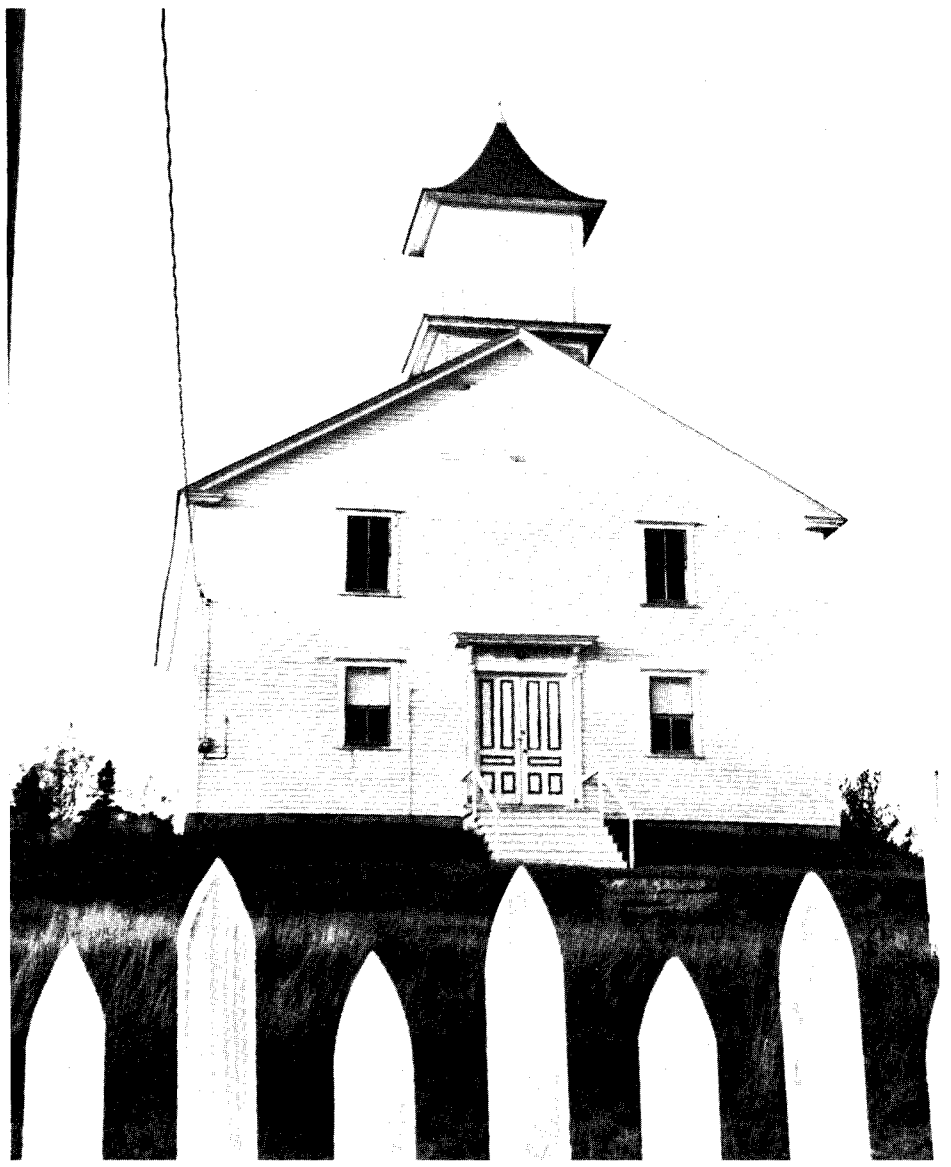


Cold ponds are relatively deep and spring fed, thus they are not very susceptible to eutrophication. In addition, cold-water conditions support unique and rich colonies of plants and animals – brown trout and landlocked salmon, for instance. These would be threatened by any discharges of heated water. These lakes are especially valuable to fishermen because the deepest water supports cold-water fish species during the summer months, while warm-water species are frequently found in the upper layer of water. In the spring and again in the fall these lakes "overturn," as constant temperature at all depths allows cold-water species to come to the surface.

Clam flats in Penobscot Bay have been numbered according to the Sea and Shore Fisheries productivity ratings – 1-poor, 2-fair, or 3-good. Intertidal flats up river from Sandy Point have not been rated because the relatively low salinity and high concentration of sawdust and other pollutants in the upper estuary apparently prohibit production of clams of a marketable size in that area.

Cultural Resources

The greatest resources the Penobscot Bay area has are its people. While many of the area's resources, problems, and potentials are not necessarily unique, the ways in which the people of the area decide to use their resources, attempt to solve their problems and develop their potential certainly will be unique, for Maine has in large part been bypassed by much of the technological chaos which has followed development in other areas of the country. The primary purpose of our work in Penobscot Bay is to begin bringing into focus the decisions to be made by the people of the Penobscot Bay area as to what the future of the region will be as it now enters post technological society.



Early History

The rural upper Penobscot Bay region has long been characterized by problems which beset many fishing and agricultural regions of Maine and America. Faced with the continued shift away from fishing and farming as a vital regional employment base, the human and economic resources of the Bay region have suffered as a result of the rural to urban migration trends of young people and new industries. The early history of the region, however, differed greatly from these recent trends.

Penobscot Bay's resources have fed, powered, and sheltered Americans since before the French Indian wars. During the period of early settlement by English and French colonists, the Penobscot Bay area became a zone of conflict. At one point, the French claimed all land west to the Kennebec, and the English claims ran east to the St. Croix. The Penobscot region was a buffer zone between the French and the English areas. The region achieved the reputation of a "no man's land" during the long series of wars between the English and the French and Indians. The wars lasted for about 150 years. Peace in 1763 opened the area to secure settlement and determined the political control of Maine; however, land ownership and control in the Bay area remained very disorganized for at least 50 years. As settlers moved in, uncertain ownership of land invited a squatter class which further discouraged the development of an organized political and economic system.

In most of the early communities of Penobscot Bay, the economy was locally oriented and based upon farming, fishing and lumber. A general shortage of wood in England gave a high value to Maine's forests. Cutting was encouraged to clear land for farming, and wood became the medium of exchange since it was the only substance which promised to hold value in Maine's disorganized economy. Local harbor towns – Belfast, Searsport, Bucksport and Castine – became shipping centers for the lumber and farm and fishing resources of the area.

By 1820, the lumber reserves along Penobscot Bay were largely exhausted, and the search moved inland along the river. From 1820 to 1850, the economic focus of Penobscot Bay shifted upstream to Bangor, the terminus of the Penobscot River lumber drive. During the 1850's Bangor was one of the world's busiest lumber ports. The shipping associated with the lumber trade brought raw materials into the bay and stimulated shipbuilding, quarrying, and manufacturing in the harbor towns. The combination of the beauty and the commercial importance of Penobscot Bay helped Searsport to become a town of sea captains. At one time, 10 percent of the U.S. Merchant Marine captains made their homes there.

After the Civil War, several factors contributed to the gradual decline of Penobscot Bay's economy: American shipping was severely disrupted by the war. Penobscot lumber reserves were dwindling, and iron hulls gradually made Maine's wooden ships obsolete. Paper mills and railroads moved Maine's economy inland, and Penobscot Bay lost its value as a transportation corridor. The river which once brought commerce from the sea, now is an obstacle to the east-west movement of land transportation.

The rail lines which run to Searsport and Bucksport, and the Maritime Academy at Castine have enabled the bay to retain some of its maritime importance; however, the economy based on farming, fishing and marine commerce has been largely replaced by small, marginal industries and services for tourists and summer residents. Farmers and fishermen have been caught in the squeeze of inflation, as prices paid to primary producers have increased at a very slow rate, while the cost of manufactured goods and equipment has risen sharply. Fishing activities have been further limited by pollution of shellfish areas, and pressure for summer home sites has pushed land prices and taxes out of the reach of most farmers.

The declining economy produced a substantial surplus work force. Much of this labor force was absorbed by the rather marginal food processing, leather goods and chemical industries in Belfast, Searsport, Stockton Springs, Bucksport and Brooksville. The paper plant at Bucksport has supplied employment to hundreds of local residents since it began operations in 1930. Most of the remainder of the labor force either adapted their activities to service permanent as well as seasonal residents and transient tourists, or they left the area in search of opportunities elsewhere.

The tourist industry has been no less marginal than most of the manufacturing industries in the area. Its distance from major population centers has kept the upper Penobscot Bay region somewhat out of the reach of the heavy concentration of vacationers which have flocked to the shore areas of New Hampshire and York, Cumberland and Sagadahoc counties. In addition, in recent years, many of the tourists visiting the Maine coast have come with trailers and tents. The camping trend has hurt the restaurant and motel owners. While contributing little to local economies, campers add to the problems of summer traffic and wear and tear on roads.

A cycle seems to have evolved, including several interacting factors; distance from population centers, relatively high volume of camper tourists, labor surplus, marginal industries and water pollution.

Recent Trends

The following eleven tables give a profile of the population in the thirteen towns of the upper Penobscot Bay area. This section begins with permanent population figures for individual towns as they are entered on the second Land Use map (page 27). From there, the population is broken down according to age, income levels, income sources, occupations, education, and place of birth. Additional tables describe housing trends and the normal transportation modes used by workers.

BASIC COMMUNITY STATISTICS – A COMPARISON CHART

		BELFAST	BROOKSVILLE	BUCKSPORT	CASTINE	FRANKFORT	ISLESBORO
Population	Year Round	5957	673	3756	1080	620	421
	Seasonal	7656	1334	4934	1633	691	1825
	Rate of Summer Increase	29%	98%	31%	51%	11%	336%
Transportation	Town Roads	63 miles local streets	26 miles town ways 24 miles State Aid 50 Total	110 miles local streets & roads	2 miles town ways 10 miles State Aid 5 miles State Highway 17 Total	20 miles Town ways 11 miles State Aid 4 miles State Highway 35 Total	
	Other	U.S. Rt. #1 runs through the town		U.S. #1 1 #95 (20 miles away)			
Light, Heat, and Power		Central Maine Power	Central Maine Power	Central Maine Power	Central Maine Power	Central Maine Power	Central Maine Power
Water		Belfast Water District Storage - 1.5 to 2.0 million gals Rates - $4.80 @ 1,200 cu. ft.	(No Public)	Bucksport Water Co.–a subsidy of St. Regis Inc. Use St. Regis – 18,000,000 gpd. Town 225,000 Storage – 317,000 gal Rates $7.80 @ 1,200 cu. ft.	Castine Water District	(no public)	(no public)
Sewage		Public Secondary Treatment Facilities in Construction Stage	(No Public)	7.6 miles sewer lines Treatment facilities in planning stage No ordinance regarding industrial wastes	Sewage facilities in planning stage	(no public)	(no public)
Education		Enrollment / Pupil Teacher Ratio Belfast Area HS 459 13/1 Pierce School 203 25/1 E. Belfast Elementary 221 25/1 Gov. Anderson 351 22/1 George Robertson 267 16/1 Crosby Hill Jr. High 358	Enrollment / Pupil Teacher Ratio Member of SAD #73 97 26/1	Enrollment / Pupil Teacher Ratio Bucksport High 590 18/1 Luman Warren 160 30/1 G. Herb Jewett 426 23/1 Bucksport Jr. High 297 20/1 School Union 91 and SAD 18	Enrollment / Pupil Teacher Ratio Grade S. 80 1/13 High School 25 – * Castine tuitions high school students to Bucksport	Enrollment / Pupil Teacher Ratio Frankfort Elementary 121 22/2 * Other grades are bussed to Searsport SAD #56	Enrollment Islesboro Elementary & High School 80
Government		City Manager and Five Councilmen	Town with 3 Selectmen	Town with Town Manager and 7 Selectmen	Town with 3 Selectmen	Town with 3 Selectmen	Town with 3 Selectmen
Economy		Major Firms / Employees Belfast Canning Co. 51-75 Belfast Manufacturing 51-75 Penobscot Poultry Co. 450-500 Journal Publishing 26-50 Maplewood Packing 301-350 Mathews Brothers Co. 26-50 Penobscot Frozen Foodlockers 51-57 Truitt Brothers Inc. 201-500 Waldo Shoe Corp. 151-200	Rural municipality with recreation potential 20 miles (approx.) coastal frontage-Bagaduce River (32 miles frontage) Major Firms / Employees Callahan Mines (closing 1972) 100 Seal Cove Boat Yard 1-4	Major Firms / Employees St. Regis Paper Co. 800-900 Wrights Dairy 1-4 Northeast Coal and Dock Co.	East side Penn-Bay great recreation potential Major Firms / Employees Maine Maritime 100-110 Alonzo Eaton Boat building 1-4	Marina	Excellent summer recreation potential Major Firms / Employees Dark Harbor Boatyard 5-10 Islesboro Industries Inc. Knitting and Sewing
Property Tax		Mill rate .045 Assessment ratio 85% Relative tax load Medium large	.024 55% small	.053 30% (medium small)	.031 80% (medium small) (New revaluation in process)	.124 30% (medium large)	.128 .25% (small)
Community Services		Hospital – Waldo County Gen. (60 beds) 7 physicians 3 dentists 2 optometrists 2 veterinarians Churches – 10 Protestant Belfast free library 2 Catholic 1 library	Castine Community Hospital (18 miles distant) Churches – 2 Prntestant	Hospital – Bangor (18 miles distant) 3 physicians 2 dentists 3 optometrists 1 osteopath 5 Protestant Churches – 1 Catholic Buck Memorial Library	Castine Community Hospital (16 beds) 2 physicians	Bangor or Belfast Hospitals (14 and 18 miles distant) One Protestant Church	Belfast Hospital (14 miles) Camden Hospital
Percent of Land Used For:	Forests	58%	70%	70%	69%	74%	68%
	Agriculture & Mining	27%	18%	14%	19%	17%	11%
	Water Areas	5%	8%	11%	2%	5%	3%
	Urban Transportation and Recreation Areas	10%	4%	5%	11%	4%	17%

Table 5 divides the population of the area and of each town into four groups; pre-school, school age, work force and elderly. Table 5 also shows what percent each group is of the total population. Percentage figures are also presented for the State of Maine and the nation. The comparison indicates that the Penobscot area population is close to Maine and the nation in its general outline. However, the proportion of elderly people and pre-school children is somewhat higher than the national total, with a corresponding lower percentage of school-age children and adults of working age.

AGE BREAKDOWN BY TOWN 1970
TABLE 5

	Pre-School 0-6	School Age 7-17	Work Force 17-64	Elderly 65+
Belfast	691 – 12%	1238 – 21%	3232 – 54%	796 – 13%
Brooksville	89 – 9%	457 – 46%	319 – 32%	127 – 13%
Bucksport	457 – 12%	876 – 24%	2036 – 55%	313 – 9%
Castine	65 – 6%	89 – 8%	787 – 73%	139 – 13%
Frankfort	79 – 13%	174 – 28%	302 – 49%	65 – 11%
Islesboro	31 – 7%	80 – 19%	226 – 54%	84 – 20%
Northport	78 – 11%	185 – 25%	393 – 53%	88 – 12%
Orland	158 – 12%	359 – 28%	680 – 52%	110 – 8%
Penobscot	103 – 13%	167 – 21%	374 – 48%	142 – 18%
Prospect	48 – 13%	85 – 24%	182 – 51%	43 – 12%
Searsport	213 – 11%	490 – 25%	1028 – 53%	220 – 11%
Stockton Springs	147 – 12%	285 – 24%	598 – 50%	161 – 14%
Verona	53 – 12%	98 – 22%	220 – 50%	66 – 15%
Penobscot Area	11%	24%	53%	12%
State of Maine (1970)*	9%	26%	54%	12%
Nation (1968)*	9%	26%	55%	10%

*National and State age distribution breakdown is; 0-4 years, 5-17, 18-64, and over 65.

Note: Percentages have been rounded to the nearest 1%, thus some percents may not add up to 100.

Table 6 shows the population totals and the percent change in the population from 1960-70 by town. Castine shows the largest increase while Prospect suffered a 13.1 percent population decrease.

Table 6 also compares year round housing, and seasonal housing with population changes from 1960-1970 for the Penobscot area. Analysis of the table shows that the towns can be grouped into roughly four basic descriptions; The industrial towns (Bucksport, Searsport and Belfast) with low population growth and little housing construction; the growing coastal recreation towns (Brooksville, Castine, Northport, Orland, Penobscot and Stockton Springs) with a population growth of over 10 percent and a substantial increase in housing; the unique island town (Islesboro)

COMPARISON OF RELATIVE RATES OF CHANGE FOR POPULATION AND HOUSING 1960-70
TABLE 6

	Total-1960	Total-1970	Percent Change	Housing Change Year Round %	Housing Change Recreational %
Belfast	6140	5957	+3	0	-13
Brooksville	603	673	+12	+12	+8
Bucksport	3466	3756	+8	+8	+42
Castine	824	1080	+31	+19	+29
Frankfort	692	620	-10	-17	-75
Islesboro	440	421	-4	0	-6
Northport	648	744	+15	+26	+22
Orland	1195	1307	+9	+14	+17
Penobscot	706	786	+11	+13	+2
Prospect	412	358	-13	-17	-42
Searsport	1838	1951	+6	+13	-10
Stockton Springs	980	1142	+17	+19	-11
Verona	435	437	+1	+9	-53
Penobscot area			+5	+7	-7
State of Maine*			+3	NA	NA
Nation*			+13	NA	NA

*Source – Maine Pocket Data Book

TABLE 4

NORTHPORT	ORLAND	PENOBSCOT	PROSPECT	SEARSPORT	STOCKTON SPRINGS	VERONA
744	1307	786	358	1951	1142	437
2565	2561	1030	466	3062	1517	709
250%	96%	31%	30%	57%	33%	62%
36 miles town roads	26 miles of local streets and roads	10 miles town ways 19 miles State Aid 7 miles State Highway 36 Total	9 miles town ways 11 State Aid 8 miles State Highway 27 Total	55 miles local streets and roads	30 miles local ways	1.4 miles town way 9 miles State Aid 1.2 miles State Highway 11.5 Total
on U.S. #1				on U.S. #1 25 miles Interstate 95	on U.S. #1 25 miles I 95	
Central Maine Power	Central Maine Power	Central Maine Power	Central Maine Power	Central Maine Power	Central Maine Power	Central Maine Power
(no public)	(no public)	(no public)	(no public)	Searsport Water District Normal daily use 400,000 Storage 500,000	Served by Searsport Water District	(no public)
(no public)	(no public)	(no public)	(no public)	(no public)	(no public)	(no public)
* Member SAD #36 Northport School (temporarily closed)	Enrollment / Pupil Teacher Ratio Orland Consolidated 265 / 25/5 Orland sends high school students to Bucksport as a member of School Union #91 (140)	Enrollment / Pupil Teacher Ratio Elementary 127 / 1/7 * Tuition High school students to George Stevens Academy (54) and Bucksport (5)	* Member SAD #18	Enrollment / Pupil Teacher Ratio Searsport Dist. High 336 / 20/1 Searsport Elementary 229 / 13/1 Brick Special 18 / 8/1 Searsport Central 82 / 27/1 Searsport Jr. High 171 / 25/1 * Member of SAD #56	Enrollment / Pupil Teacher Ratio Central School 204 / 28/3 Member SAD #56	* Member SAD #18
Town with 3 Selectmen	Town with 3 Selectmen	Town with 3 Selectmen	Town with 3 Selectmen	Town with 3 Selectmen	Town with 3 Selectmen	Town with 3 Selectmen
- Rt. #1 good for small business - great summer recreation potential - coastal frontage	Major Firm / Employees Thurston Co. Inc. boats, fish tanks / 5-10	5 miles coastal frontage Major Firm / Employees Acadia Peet Moss / 10	Major Firm / Employees Mitchell Concrete / 11-25	located on U.S. #1 daily freight service on Bangor-Aroostook R.R., and a deep water port Major Firms / Employees C. H. Sprague & Son (Bunker C or #6 oils) / 16 Delta Chemical Inc. (Sulfuric acid, alum ammonium sulphate) / 20-50 Jarka Corp. of N. E. (shiphandlers) / 60 part-time	coastal location old Corenco facilities available	- Rural resident town in the Penobscot River adjacent to Bucksport
.068 50% (medium large)	.037 65% (medium small)	.017 100% (medium small)	.155 35% (medium large)	.31 100% (large)	.45 67% (medium small)	.39 75% (medium small)
Belfast Hospital (12 miles distant)	Castine Community Hospital (14 miles) Bangor Hospital (20 miles) 1 local physician	Castine Community Hospital (17 miles distant) 1 Protestant Church	Bangor Hospital (20 miles) Belfast Hospital (15 miles)	Belfast Hospital (10 miles) 2 Protestant Churches	Belfast Hospital (10 miles) 3 Protestant Churches	Bangor Hospital (17 miles)
77%	75%	75%	70%	72%	75%	75%
12%	11%	17%	16%	14%	13%	12%
6%	9%	5%	8%	4%	3%	3%
5%	4%	3%	6%	11%	9%	9%

SOURCES: Eastern Maine Development District, University of Maine Extension Service, and Personal Inquiry by Coastal Planning Unit, State Planning Office

with a well-developed recreational economy and a declining population, and finally the declining inland or river towns (Prospect, Frankfort and Verona) with little or no growth in population and volume of housing units.

The statistics for housing in Stockton Springs, Searsport and Verona suggest the possibility that many recreational homes are being converted to year-round use.

Table 7, shows how many people rent and how many own their own homes according to income levels. Approximately 71 percent of the families who are above the poverty level own their own homes, while among families which are below the poverty level, 76 percent own their own homes. Verona, Frankfort, and Prospect have the largest percent of people owning their homes, while Northport and the more industrialized towns — Belfast, Bucksport and Searsport — have the largest number of rentals. It is also important to note the significantly higher proportion of persons in the Penobscot area vs the nation who own their own homes.

FAMILY AND INDIVIDUALS IN HOUSING UNITS BY TENURE AND POVERTY STATUS
TABLE 7

	Above Poverty Status		Below Poverty Status	
	Owner	Renter	Owner	Renter
Belfast	57%	29%	7%	7%
Brooksville	74	9	10	7
Bucksport	63	25	6	6
Castine	68	-	18	14
Frankfort	60	4	36	-
Islesboro	86	6	4	4
Northport	50	24	26	-
Orland	77	6	13	4
Penobscot	57	4	26	13
Prospect	78	8	14	-
Searsport	60	20	17	3
Stockton Springs	63	10	22	5
Verona	88	-	12	-
Penobscot Area	63	20	12	5

National Housing Trend — Owner Occupied — 62% Renter — 38%
Penobscot Area — Owner Occupied — 75% Renter — 25%

Table 8 shows the family income distribution for the Penobscot area. The towns of Frankfort, Islesboro, Northport and Penobscot have the highest concentration of middle income population, while Brooksville and Stockton Springs show the highest percentage of low income people. Castine and Orland have particularly high concentrations of high income families. It should be noted that 11 percent of all families in the Penobscot area have incomes below $3,000, while 60 percent earn between $3,000 and $9,999.

FAMILIES BY FAMILY INCOME
TABLE 8

	Low	Middle		High
	$0-2,999	$3,000-5,999	$6,000-9,999	$10,000+
Belfast	11%	36%	27%	26%
Brooksville	25	29	19	27
Bucksport	11	20	34	35
Castine	-	14	38	49
Frankfort	8	42	38	12
Islesboro	-	30	46	24
Northport	4	20	56	20
Orland	9	19	30	42
Penobscot	9	11	65	15
Prospect	8	-	69	23
Searsport	12	17	35	35
Stockton Springs	18	28	27	26
Verona	10	14	42	34
Penobscot Area	11	23	37	28
Maine	10	21	34	35
National	9	17	28	46

Note: 1969 U.S. Family Median Income $9,433
1970 Maine Family Median Income $8,205

TYPE OF INCOME – PERSONS 14 YEARS OLD AND OLDER
TABLE 9

	Wage and Salary	Self Emp.	Soc. Sec. Retired	Pub. Assist	All Other
Belfast	53%	5%	16%	5%	22%
Brooksville	44	6	24	1	25
Bucksport	57	6	20	4	13
Castine	69	5	11	2	13
Frankfort	72	2	21	4	1
Islesboro	52	3	18	5	22
Northport	67	10	10	2	10
Orland	62	5	7	15	11
Penobscot	51	11	22	3	13
Prospect	62	11	14	3	10
Searsport	62	3	19	2	14
Stockton Springs	47	9	24	1	19
Verona	65	7	16	5	7
Penobscot Area	56	6	17	3	17

PERCENTAGE OF PERSONS LIVING IN FAMILIES BELOW POVERTY LEVEL
TABLE 11

Belfast	10%
Brooksville	33
Bucksport	9
Castine	-
Frankfort	34
Islesboro	-
Northport	7
Orland	9
Penobscot	29
Prospect	6
Searsport	13
Stockton Springs	18
Verona	5
Penobscot Area	12
Maine	14
National	11

COUNT OF PERSONS 16 YEARS OLD AND OLDER BY OCCUPATION
TABLE 10

	Professional or Technical	Manager Administrator	Sales Workers	Clerical Workers	Craftsmen Foreman	Operators Non. Trans.	Transport Operators	Non-Farm Labor	Farm Mgr.	Farm Labor	Service Non-Private	Household Service	Occ. not reported
Belfast	10%	8%	6%	11%	9%	20%	7%	8%	-	2%	11%	3%	5%
Brooksville	10	11	4	10	18	5	8	14	-	2	4	8	6
Bucksport	18	10	5	10	21	17	3	3	1	-	9	1	3
Castine	20	8	9	10	3	3	5	17	-	3	13	-	10
Frankfort	3	4	9	6	17	20	-	17	-	5	9	-	13
Islesboro	-	11	-	6	43	7	-	35	-	-	-	-	-
Northport	12	3	-	10	13	23	4	5	-	-	20	3	6
Orland	10	3	5	9	17	31	3	5	1	-	8	2	5
Penobscot	8	15	2	9	27	12	5	9	-	-	6	2	4
Prospect	-	8	3	3	24	18	5	15	-	15	7	-	3
Searsport	9	5	2	7	16	25	10	3	-	3	12	2	6
Stockton Springs	9	3	2	8	14	12	7	16	2	1	13	2	11
Verona	8	3	14	8	19	34	-	9	-	-	9	-	5
Penobscot Area	11	8	5	8	15	18	6	8	-	2	10	2	6
Maine	12	8	6	13	14	18	4	6	1	1	10	2	5
National	15	11	7	18	14	14	3	4	2	2	9	1	-

PERSONS 65+ YEARS BY POVERTY STATUS
TABLE 12

	Number	Above	Below
Belfast	762	73%	27%
Brooksville	186	69	31
Bucksport	492	74	26
Castine	60	68	32
Frankfort	47	38	62
Islesboro	65	73	27
Northport	44	68	32
Orland	94	70	30
Penobscot	130	66	44
Prospect	32	84	16
Searsport	232	74	26
Stockton Springs	204	76	24
Verona	35	57	43
Penobscot Area	2383	72	28
Maine	NA	77	23

TRANSPORTATION MODE TO PLACE OF EMPLOYMENT
TABLE 14

	(driver) Private Auto	(passenger) Private Auto	Commercial	Walk	Other	Work at Home
Belfast	70%	11%	6%	7%	4%	2%
Brooksville	58	12	-	2	19	9
Bucksport	61	20	1	10	1	7
Castine	44	15	-	25	4	13
Frankfort	32	52	-	16	-	-
Islesboro	61	19	-	8	12	-
Northport	68	27	5	-	-	-
Orland	76	20	-	-	1	3
Penobscot	67	4	3	7	5	14
Prospect	76	-	-	14	11	-
Searsport	83	13	-	4	-	-
Stockton Springs	80	11	-	2	-	8
Verona	69	26	-	5	-	-
Penobscot Area	68	15	2	7	3	4
Maine	64	15	2	12	3	4

EDUCATION
YEARS OF SCHOOL COMPLETED(PERSONS 25 YEARS AND OVER)
TABLE 13

	None	Some Elem.	Completed Elem.	Some H.S.	Completed H.S.	Some Coll.	College Graduate
Belfast	1%	7%	15%	24%	35%	10%	9%
Brooksville	-	2	13	29	41	10	4
Bucksport	1	5	12	17	41	13	10
Castine	-	-	18	18	7	36	20
Frankfort	-	6	28	34	28	5	1
Islesboro	-	4	3	33	50	5	4
Northport	-	10	19	26	33	5	7
Orland	-	3	16	21	46	10	4
Penobscot	1	8	13	33	41	2	1
Prospect	3	10	14	27	39	7	2
Searsport	1	4	23	21	33	8	10
Stockton Springs	1	6	15	28	34	8	7
Verona	-	-	16	21	49	15	-
Penobscot Area	1	6	15	24	37	10	8
Maine	1	10	15	20	35	11	8
National	NA	NA	13	NA	34	NA	11

STATE OF BIRTH – NATIVE POPULATION
TABLE 15

	Born in Maine	Born in Another State	Born Abroad	Not Reported
Belfast	80%	12%	0%	8%
Brooksville	80	13	1	6
Bucksport	85	11	1	3
Castine	60	31	3	6
Frankfort	90	4	-	6
Islesboro	92	7	-	1
Northport	81	17	-	2
Orland	85	11	1	3
Penobscot	79	15	-	6
Prospect	87	10	-	3
Searsport	83	13	-	4
Stockton Springs	78	15	-	7
Verona	98	1	-	1
Penobscot Area	82	12	1	5
Maine	80	16	1	3

Note: "Native Population" includes all persons who were either; (1) born in the U.S. or its possessions, or (2) have at least one native parent.

MAINE COASTAL PLAN
Penobscot Bay Pilot Project

STATE PLANNING OFFICE

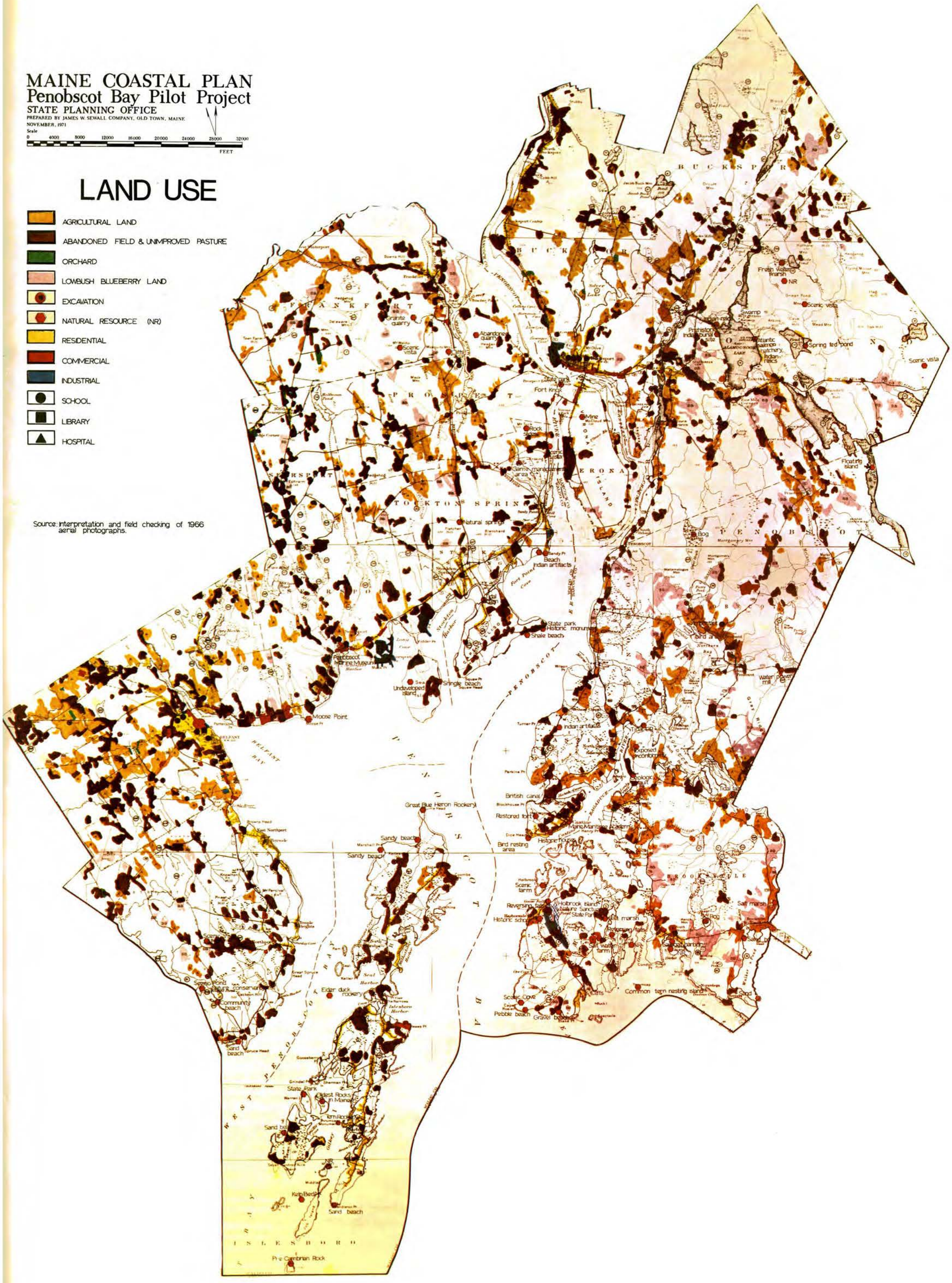
PREPARED BY JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
NOVEMBER, 1971

Scale
0 4000 8000 12000 16000 20000 24000 28000 32000
FEET

LAND USE

- AGRICULTURAL LAND
- ABANDONED FIELD & UNIMPROVED PASTURE
- ORCHARD
- LOWBUSH BLUEBERRY LAND
- EXCAVATION
- NATURAL RESOURCE (NR)
- RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- SCHOOL
- LIBRARY
- HOSPITAL

Source: Interpretation and field checking of 1966 aerial photographs.



MAINE COASTAL PLAN
Penobscot Bay Pilot Project
STATE PLANNING OFFICE

PREPARED BY JAMES W. SEWALL COMPANY, OLD TOWN, MAINE

NOVEMBER, 1971

Scale

0 4000 8000 12000 16000 20000 24000 28000 32000

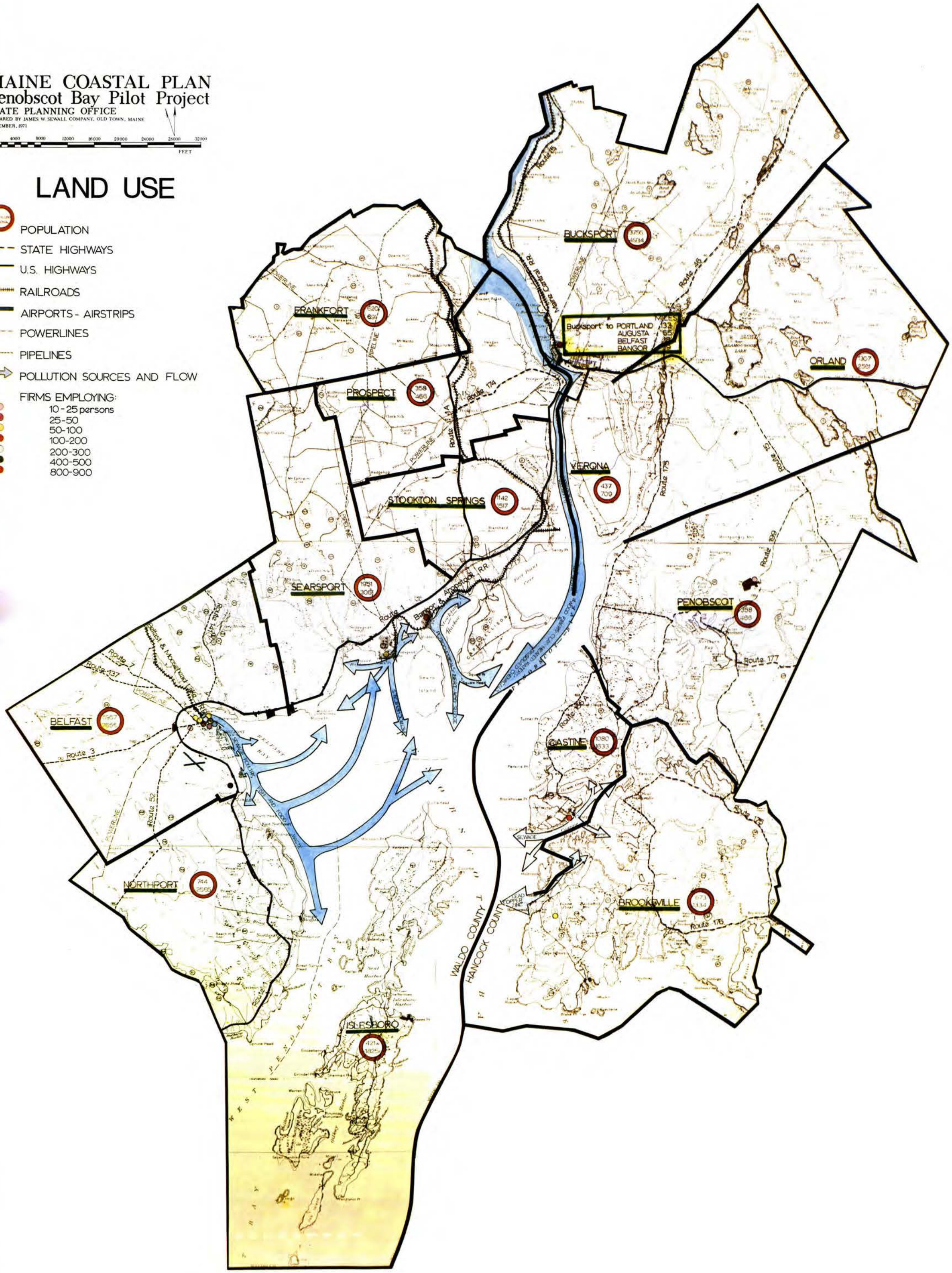
FEET

LAND USE

- POPULATION
- STATE HIGHWAYS
- U.S. HIGHWAYS
- RAILROADS
- AIRPORTS - AIRSTRIPS
- POWERLINES
- PIPELINES
- POLLUTION SOURCES AND FLOW

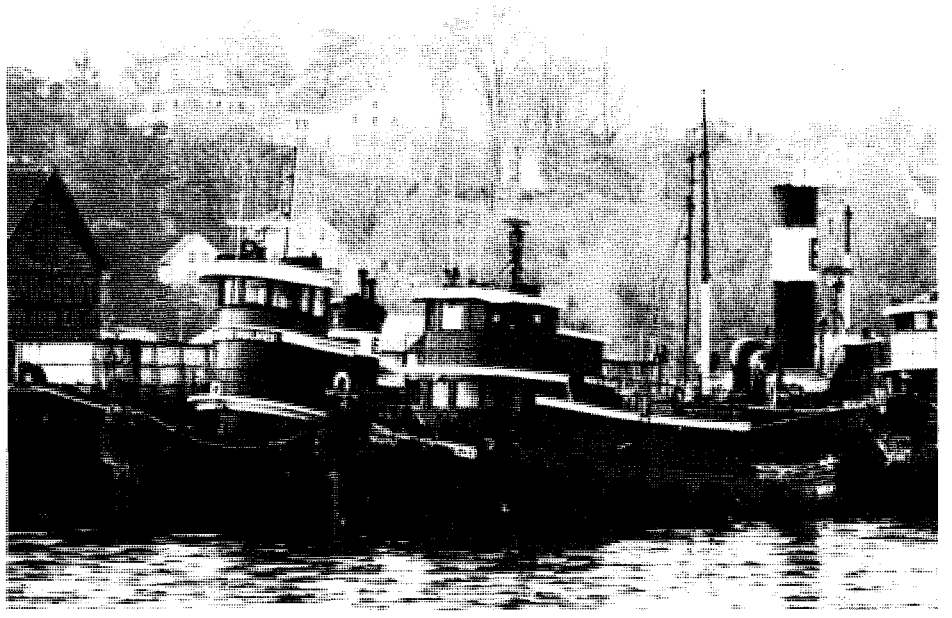
FIRMS EMPLOYING:

- 10 - 25 persons
- 25-50
- 50-100
- 100-200
- 200-300
- 400-500
- 800-900



Existing Resource Uses

The most significant living resource in the Penobscot area is man, and in many cases his activities exert the strongest influence upon the ecological balance of the region. Moreover, activities which people pursue in this area have been determined primarily by the economic and aesthetic value of the physical and living resources in the area.



Many modern activities either do not depend upon the resources of their particular location or they depend upon just one resource — location, minerals, available labor, for example — with little or no need to respect the other resources of the area. Furthermore, with the perfection of high speed, long range transportation, several industries or activities in a particular region may have no contact at all with one another. Thus a particular industry has no opportunity to understand nor any reason to respect the needs and requirements of other activities in that area.

For these reasons, there is a need to identify and to map those land use activities which might harm the resources of the area, which may conflict with one another, or which may provide opportunities for new activities within the region.

Together, the two Land Use maps present an inventory of population and existing land use activities. The relationships to topography, rivers and bays, and other physical features help to explain the present pattern of people and activities. Comparing these patterns with the information presented on the Resource maps locates presently improper land uses — activities which are carred on despite the limitations posed by natural conditions.

In addition to normal land use classifications — residential, commercial, and industrial — the Land Use 1 map locates blueberry land, farm land, and areas which are agriculturally productive or which could be reverted to agricultural land quite readily. As much as possible, these lands and their productive capacity should be protected.

In several cases, farm buildings are present without adjacent or surrounding agricultural land. We have assumed that this setup is a poultry farm. Knowledge of the location of poultry farms and manure dumping sites is vitally important, because chicken manure may cause nitrate and bacteria pollution of ground and surface water systems.

Commercial service areas and local or municipal services (schools, hospitals, and libraries) are located on the map. Easy access to these services is necessary for many people and industries, and knowledge of their whereabouts will augment regional development by preventing overlapping, redundant, or conflicting service activities.

The second Land Use map shows the relationships of town boundaries, transportation routes, population (seasonal and permanent), employment, and the flow of industrial and municipal pollution in the estuary. A red circle corresponds to each town, giving permanent as well as seasonal population figures. Smaller circles represent centers of employment, with a color key to indicate the number of people employed in each of the establishments. The largest employers in the area are: St. Regis Paper Company in Bucksport, the Belfast poultry plants — Penobscot and Maplewood, Truitt Brothers Shoe Company in Belfast, and the Maine Maritime Academy in Castine.

Resource Allocations

Synthesis

The Synthesis map represents the combined total of all the previous resource maps. It expresses limitations to certain intensities of land use according to environmental restrictions. In interpreting the limitations imposed by these resources, we began with the following assumptions:

The Penobscot area is beautiful and vulnerable, and its development is inevitable. However, development can be accommodated. Experience from other areas has indicated that uncontrolled growth is inevitably destructive. Observance of the natural order can avert this destruction and ensure enhancement by preserving the efficency of natural processes.

Development must conform to this natural order and to regional goals according to regional needs and capabilities. Under such circumstances the area can absorb all prospective growth without despoilation. It has been proven on many occasions that planned development is more profitable than unplanned growth. Public and private powers will, however, need to be joined in partnership in a process to realize such a goal.

The protection areas delineated in green on the map indicate those areas that are vulnerable to man (such as spawning and breeding grounds, steep slopes), areas that offer protection or are dangerous to man (such as estuarine marshes or flood plains), or areas that are particularly unique and precious to man (such as areas of geological, ecological or historic interest). It is recommended that no development be permitted other than those uses which maintain, support, or enhance the natural character of these protection areas. The Synthesis map depicts and numbers each protection area according to what type it is. It is likely that similar protection measures will be required as part of the community's obligations for meeting the provisions of the state's Shoreline Protection Act. These designated protection areas are a minimum restriction of community lands which if otherwise treated would certainly disrupt fragile ecological systems and greatly threaten the area's water quality, productive habitats and biotic systems.

Other areas on the Synthesis map, colored in red and blue, indicate areas which have few if any recognized environmental restrictions to development for man's activities. They have been designated as suitable for intensive use. This designation does not, however, mean that each of these areas will or should be developed. It does mean that if development does take place, there will be few if any environmental limitations. The extent of these limitations would depend upon the site requirements of a particular activity, development or industry.

The information compiled and interpreted to make these determinations constitute the base data required to subject any planned proposal to the test of least cost — maximum benefit to the community. It must also be remembered that these are preliminary, general determinations of land use suitabilities useful as a guide to community actions. Specific land use proposals for these areas will require further, more detailed investigations of the characteristics and probable impact of the specific use that might be proposed. In addition, as more and better resource information is compiled and mapped, these designations should be reviewed.

MAINE COASTAL PLAN
Penobscot Bay Pilot Project
STATE PLANNING OFFICE

PREPARED BY JAMES W. SEWALL COMPANY, OLD TOWN, MAINE

NOVEMBER, 1971

Scale

0 1000 2000 3000 4000 5000 6000

FEET

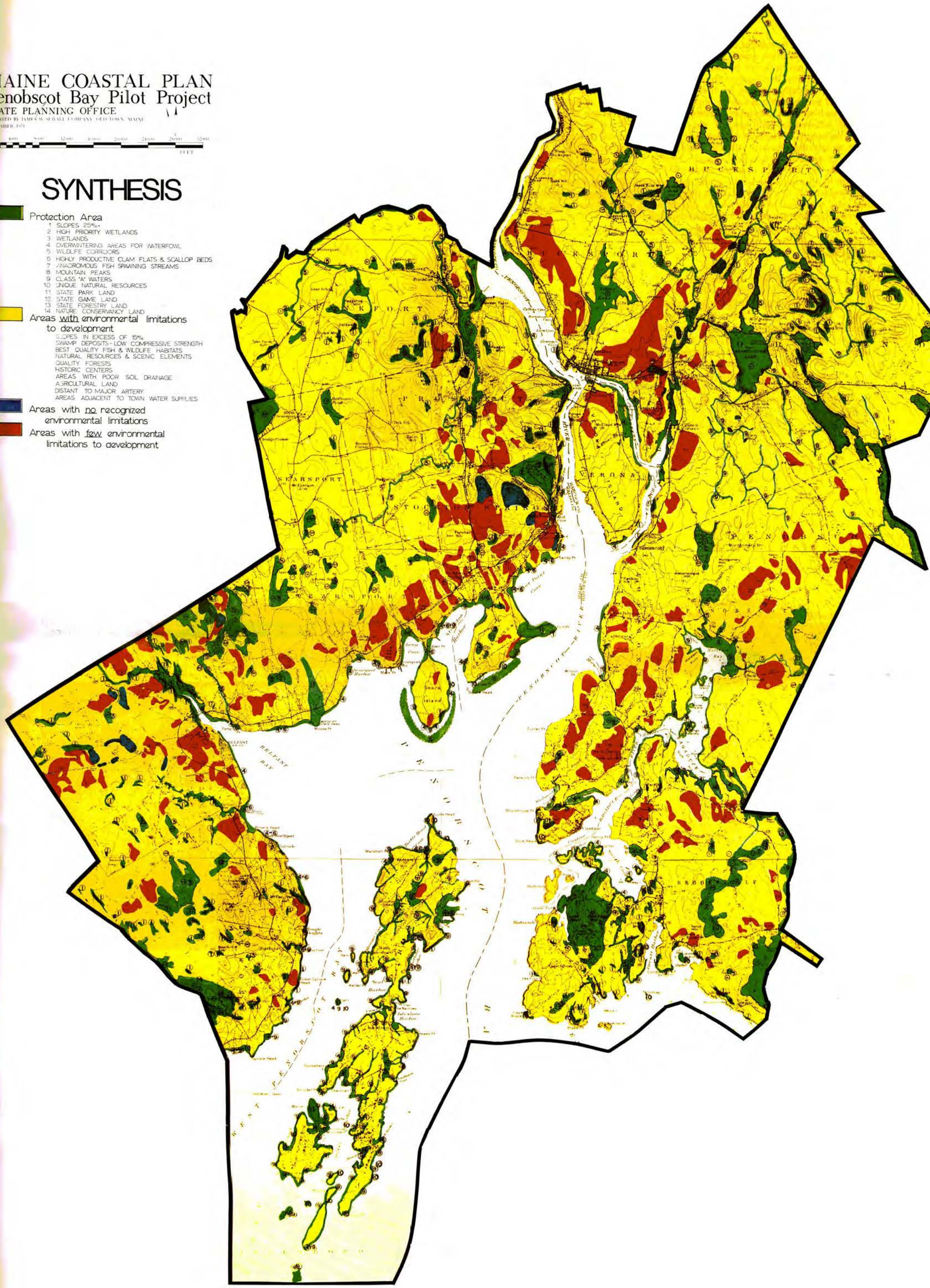
SYNTHESIS

Protection Area
1. SLOPES 25%+
2. HIGH PRIORITY WETLANDS
3. WETLANDS
4. OVERWINTERING AREAS FOR WATERFOWL
5. WILDLIFE CORRIDORS
6. HIGHLY PRODUCTIVE CLAM FLATS & SCALLOP BEDS
7. ANADROMOUS FISH SPAWNING STREAMS
8. MOUNTAIN PEAKS
9. CLASS "A" WATERS
10. UNIQUE NATURAL RESOURCES
11. STATE PARK LAND
12. STATE GAME LAND
13. STATE FORESTRY LAND
14. NATURE CONSERVANCY LAND

Areas with environmental limitations to development
- SLOPES IN EXCESS OF 15%
- SWAMP DEPOSITS - LOW COMPRESSIVE STRENGTH
- BEST QUALITY FISH & WILDLIFE HABITATS
- NATURAL RESOURCES & SCENIC ELEMENTS
- QUALITY FORESTS
- HISTORIC CENTERS
- AREAS WITH POOR SOIL DRAINAGE
- AGRICULTURAL LAND
- DISTANT TO MAJOR ARTERY
- AREAS ADJACENT TO TOWN WATER SUPPLIES

Areas with no recognized environmental limitations

Areas with few environmental limitations to development



The other maps of the Penobscot area and this Synthesis map provide an indication of the values and the resources which the area contains. Local residents will thus be able to insist that the development process both public and private respond to these values. Developers will now know where they intend to tread and, more positively, can be led to areas intrinsically suitable for their energies. Also, by using this data base, more specific land use regulations can be imposed by communities at their discretion, to for example facilitate the provision of community utilities. At the same time, this compilation of information will greatly assist the Department of Environmental Protection in reviewing development proposals submitted under the Site Location Law. It must be stressed, however, that this Synthesis map is not a plan. A plan is a determination to achieve certain social goals, related to the power of society to accomplish these. So far this exercise seeks only to reveal nature as a working storehouse with implications for land use and management. This information provides indispensable ingredients to a plan but is not the plan itself. Other elements needed for such a plan and examples of some of the directions in which social goals for the Penobscot area could take are provided for consideration in a later section.

Much research remains to be undertaken to support, refine and substantiate the conclusions that have been drawn here. A detailed listing of these research needs is provided in the Appendix.

ALTERNATIVE FUTURE RESOURCE USES

The major reason for production of the Resource maps and descriptions is to provide tools for making land use decisions. We recognize that industrialization and development are necessary to convert resources into products required by modern man. Any sudden or drastic changes resulting from such development of the natural environment should, however, be undertaken only with full understanding of the consequences.

Heavy industrial development is seen by many as offering the possibility of escaping the day to day treadmill of a marginal income. By others somewhat less concerned with economic survival, such development poses a severe threat to the unique environment of Penobscot Bay and the Coast of Maine.

As planners, we have dealt with persons who hold both opinions, and we feel that these concerns need not conflict. Indeed, these concerns can complement one another. Environmental protection ultimately implies the most efficient use of natural resources. In addition to assuring our biological well-being by renewing the air, cleaning the water and providing light for the growing of our food, the concern of environmentalists is that the processes of nature continue to function properly.

Those concerned with employment opportunities are most interested in assuring that these processes of nature be used for man's improved economic well-being. Yet it is clear that understanding and preserving the efficiency of natural processes is also the key to increasing the efficiency of the industries and activities which sustain men. By carefully evaluating the capabilities of different resources and their existing uses we can arrive at intrinsic suitabilities of these resources for future uses. Different land areas are capable of withstanding different intensities of land use. By understanding the underlying organization and capability of natural resource systems we can avoid unnecessary stress-producing uses and the resulting inefficiency. We can thus fit man's activities more properly to his surroundings and to his place within the environmental framework.

The ultimate goal of such natural process planning is to ensure that the people of Penobscot Bay can continue to have various future options open to them. By using what we have wisely, a multitude of activities can be conducted and will operate well in the Penobscot Bay area. However, if we foolishly squander resources, the future choices will be limited. If we live, work, and build without respect for the rocks, soils, water, air, plants, animals, and scenery which support and entertain us, these valuable resources may be lost. We will then become dependent upon other areas of the state, nation or the world for products and activities which had existed nearby. Using the resource data provided here, local, regional and state agencies can make decisions about the acceptance and placement of development with some degree of assurance that the natural environment will not be jeopardized.

The greatest value of recognizing man's place in nature may, however, be more sociological than biological. Given the complicated and rapid pace of industrialized, urban life, the beauty and solitude of unspoiled rural areas provide relief from stress and pressures of urban life. Man is part of nature, an integral element in the vast chain of life on earth. The recognition of man's place in this chain and the positive stimulus derived from nature provide vital sustenances to the humaness of man. The large number of city and suburban dwellers who flock to the mountains, the lakes and the shore during weekends and vacations is demonstrable evidence of this need.

Areas such as wetlands, flood plains, wildlife habitats are examples of areas that must remain as natural enclaves – protected and preserved from man's industry. These irreplaceable areas contribute most to the health and continued existence of the

natural environment. Development of or near such areas should be undertaken only after the most stringent review and only as a last resort. This is why on the previous synthesis map these areas are recommended to be placed in a protection district, while other areas less fragile are identified as being suitable for development.

In the Penobscot Bay area we feel that planning done with these multiple objectives in mind can accommodate any proposed heavy industrial development and minimize its environmental impact. The final choice as to the extent of development or even whether such development takes place rests with the people of the state and the Penobscot Bay Region. The choice that is made, however, should reflect all the consequences that are likely to result. Heavy industrial development for example will mean not only improved income opportunities it will also imply drastic changes in the traditional way people of the area have had of doing things. The staid pace and independent life styles of the Maine Coastal resident will be drastically altered by increasing wealth, population, organization and specialization accompanying industrial development. Some of the changes that might occur are provided on the following charts which suggest three alternative development possibilities for the future of Penobscot Bay and the probable consequences of each.

The first alternative future we have deemed as possible for the Penobscot Bay area consists of a projection of past and present trends – a continuation of doing things in the same fashion as we have in the past. The second alternative suggests a greater degree of community and public awareness of existing activities in the area, an enhancement and improvement of existing industrial operations, increased efficiency through better coordination and planning, and the implications for the people involved. The third possibility outlined presents what we believe might occur with heavy industrial development such as major port development. It must be stressed here that we do not try to forecast the future because it begins in the present – in the decisions we make or fail to make now – in the way we design our environment and establish the lines of constraint.

The maps provided in this report depict the resources that the area has. The futures presented here indicate in a general way some of the options the area has in using these resources. The futures are in reality no more than our speculations of probable consequences; – consequences based on results that have occured in other areas which have undergone similar developments. By no means do we pretend to be forecasters of the future. However, while living and working in the Penobscot area, certain local statewide, and national trends have appeared to us, trends which could indicate how the future of the area might progress. We feel that these thoughts should be included in this report. We hope that our ideas will stimulate local discussion and comments. We suggest that the general outline of each of the alternative futures be reviewed carefully, individual conclusions reached and community preferences sounded and conveyed to local areas representatives. The questions included as part of this report are intended for this purpose.

Future I

Continuation of present population growth, income levels, and general way of life

Assumption

A simple projection of past trends based on a continuation of random land development, uncoordinated government response and ineffective community organization.

Where we Live — The Land, Air, Water

Water

—General condition of the Penobscot River and Bay improves somewhat.

—The major effects of water clean up are still primarily aesthetic (smell, bubbles, visual impact) but health becomes an increasing concern in the larger towns and in swimming areas.

—Domestic sewage, industrial waste, and agricultural runoff are still targets of media campaigns; control laws passed but the Penobscot area still suffers from lax enforcement.

—Creeping pollution of harbors, rivers and bays continues primarily due to increased boating, light oil spills, untreated industrial wastes and untreated sewage from increased population of the bay and river. Not enough is done to lower the general rate of discharge.

—Runoff from clear cutting of wooded areas for construction causes more flooding.

—The draw on the groundwater table increases with new building and water demands; some major towns are experiencing brief water shortages, discoloration, salt water intrusions near the coast.

—Shallow fresh water ponds continue to suffer from excessive eutrophication.

—Appearance of some nitrate poisoning in small streams from chicken waste runoff.

Energy

—Electric power demand grows in the study area due to building and more home reliance on electric power; costs are increasing as existing industry, new appliances, and other states draw on Maine resources through interstate power agreements.

—Additional nuclear plants have been constructed and plans for more are pending with increasing demand for locations in Coastal Maine. The possible hazards cause public concern.

—Extension of power agreements with Canada bring more power through Maine to the Northeast.

—The pressure to build another oil port continues; some oil and gas is being imported from new offshore Nova Scotia fields, but most shipped out of the state, prices continued to increase steadily.

—No one is using chicken manure for methane gas production. The process remains in the experimental stage.

Agricultural Land and Soil

—A few large scale farms remain profitable. Most other lands are sold for real estate profits, or held for soil bank revenues.

—There are more people using the organic farming method.

—Many pasture lands revert to woodland.

—More demand for land caused by out-of-staters fleeing cities and suburbs.

—Influx of outsiders continues, but resistance to land selling has grown and the real estate market gets very tight.

Recreation Land

—More travel in general, recreational lands are overcrowded with many tourists in all seasons.

—Pressure on state parks, and public and private campsites continues to be a crisis level. Reservations needed for campsite space.

—State Parks Department forced to compete in "tight" real estate market as land prices continue to climb.

—Formerly inaccessible "wilderness" lands reached by thousands. Waste removal — has become one of the new problems.

—More "open" land posted.

—Out of state investors buy up large areas for subdivision and recreational housing.

—Land owners supported by State (in policy only) for good land management.

—State produces plans for proper land management but no implementation.

Air

—Major municipalities notice summer smog.

—National Air Quality Index talked about as bad air from other states moves through.

—Hospitals experience rise in respiratory diseases.

What we Use — Materials and Structures

Housing

—"Suburban sprawl" continues to spread around larger towns.

—Maine continues to have the worst rural housing shortages in the nation.

—More trailers purchased, at the same time more wealthy people move into the state, resentment of mobile homes leads to more local laws prohibiting them.

—A few in-state prefabrication housing firms start up, some fold, only a handful continue. Only a few successful prefabricated housing firms remain.

—Old housing stock deteriorates. Most of the best old homes are bought by outsiders for second homes.

—Most people with incomes below $9000 cannot afford new houses.

—Overcrowding increases in apartments.

—Loss of some historic buildings through lack of maintenance, demolition, etc.

Transportation

—Autos and trucks continue as major travel modes.

—Increased summer traffic congestion on Route One.

—Autos get more anti-pollution equipment, but there are more cars, thus no net improvement in air quality.

—Major town roads continue to be straightened and paved with continued preemption of land and destruction of landscape.

—More roadside businesses built, congested commercial development along highways.

—Railroads continue to suffer from poor management, high rates, and lack of statewide and regional coordination.

—Little use is made of water transportation other than for cargo-carrying purposes.

—New motorized activities increase — snowmobiles, motorcycles — causing substantial harm to fragile areas.

—More second homes built and bought with little or no subdivision regulation — influx of upper class with independent incomes.

Species and Vegetation

—Encroachment threatens important fresh and salt water habitats.

—Hunting and fishing rights and limits continue as major issues.

—Some animal species endangered: Osprey, Eagles, Blue Heron, Puffins and Salmon.

—Public sentiment grows against large area clear cutting as more of it is seen. Statewide selective cutting accepted.

Sewage & Solid Waste

—Sewage is still handled by each individual household; more septic systems are built near the sea and lake and river shores.

—Controls needed in large municipalities, lakes, and sea shores; some implemented, but insufficient and unequal enforcement.

—Secondary sewage treatment facilities built by major municipalities removing 97 percent of pollutants.

—Sludge from secondary treatment facilities becomes a disposal problem.

—No coordinated regional system to manage and utilize industrial and agricultural wastes.

—Because of the high demand for lake and shore property, buildings and septic systems continue to be built on poorly suited soils and close to lakes, rivers and bays.

—Continued resistance and uneven enforcement of the Uniform Plumbing Code.

—No regional collection, recycling and/or disposal of solid waste.

What We do — People & Activities

Economy

—Unemployment rate for the state continues to exceed the national level.

—No sufficient training programs, many persons have out-dated skills.

—Recreation and tourism continue to grow in importance for the economy.

—The poultry industry continues to suffer from increasing competition from other areas for the nation's markets.

—The shoe industry remains marginal, with increased competition from foreign markets.

—Summer people bring a few "think tank" industries to wealthy coastal towns.

—Aquaculture projects are experimental. Usable portions of estuaries are gradually preempted for other uses.

—Out-migration of unemployed accompanied by in-migration of dissatisfied middle class.

Education

—More "qualified" teachers available, quality declines.

—Funds curtailed, local tax revolts, change in funding from property tax to income tax still disputed in the courts, general reduction in services and leveling off of budgets.

—Drop-out rate has climbed slowly.

—Appearance of more alternative schools.

—Vocational training still not sufficient.

—Universities train people for positions which are completely filled or which are not available within the state.

Crime

—Continued emphasis upon the symptoms of crime, lacking recognition of its underlying causes.

—Increase in robberies and arson.

—Correctional system primitive, small reforms made.

—National Crime Data Bank established and used by local officials.

Health & Medical Care

—During 1960-70, the cost of living rose 20 percent — cost of health-care rose 12 percent; health services remain inadequate. Most people cannot meet the cost of health care.

—Casual relationship between environment and health recognized.

—National Health Insurance talked about, but very little happens — better health care for the elderly still does not exist.

—Hospitals regionalized.

—Malnutrition in Maine still exceeds national average with surplus food and stamps still main government program available.

—Drug and alcohol abuse continues.

Future II

Moderate population growth rate, some improvement of present employment opportunities, emphasis placed upon orderly development of resource-based industries

Assumption

Projection of a future, based on careful government rationalization of development and environmental protection, improvements in the efficiency of the recreation, poultry, fishing and farming industries.

The economy more closely linked to an appreciation and respect for the land and water resources. Results are greater efficiency in working with natural materials and greater concern with preserving the natural system.

Where we Live — The Land, Air, Water

Energy

—Power demand and rates increase slowly, interstate compacts created, local people are more responsible in their use of power.

—One nuclear reactor built, but state controls the production of power for out-of-state consumption. Strict federal safety standards and better back-up systems are instituted.

—Canadian power agreements bring substantially more hydroelectric power to the state.

—New gas supplies brought in through strictly regulated port structure in the Searsport area.

—Energy supplements such as tidal flow, solar heating and wind generated power are harnessed, outside investors become involved.

Water

—Condition of Penobscot River water has improved considerably.

—Pollution or harbors, rivers and bays is stopped through controls of domestic sewage, boat toilets, and industrial waste and agricultural runoff.

—Much time is still required to remove accumulated pollutants from rivers, lakes and estuaries. Media campaigns focus on specific local problems.

—Sanitary dry toilets become less expensive and are used by many people.

—More awareness of the needs for water recycling. Individuals, industries and towns use water more efficiently.

—Water taken from groundwater sources is returned after treatment.

—Oyster, salmon, and lobster aquaculture enterprises become legally and economically feasible and are more intensively developed.

—Uses are found for under-utilized marine species such as mussels, skate and dogfish.

Agricultural Land and Soil

—Penobscot Bay is more clearly seen as a unique resource of the state with its longer growing season, good soils and slightly warmer climate.

—Penobscot Bay towns enact stronger shoreline and lake protection laws and general land use controls. Building permits are denied when plans do not conform to these regulations. Tax rewards provided for town planning.

—Suburban sprawl somewhat inhibited through the use of forest, agricultural and residential zoning. Development is generally limited to areas which are not well-suited for agriculture.

—Fewer of the old large scale farms, more smaller organic growers, with accompanying diversity of crop production and reduced scale of farm operation for those engaged.

—Sewage treatment sludge and dry toilet residue are processed and used by chicken and aquaculture industries working together to produce high quality feeds from these "waste" materials. Other needed feed supplements are produced locally.

—Local organic marketing certification, and processing industries started.

—Local people begin to raise more of their own food.

—Chicken manure used in methane gas plants as an energy source for silage production — this provides a partial solution to nitrate pollution of water runoff to groundwater sources.

—New animal food sources are used — yeast from canning wastes, protein from paper waste products, and algae from petroleum products.

Recreation Land

—Controlled access within capacity limits of parks, natural areas, etc. — high taxation of campers meets the added cost of providing campers facilities. High charge in public campgrounds for out-of-state campers.

—Second homes are built under stricter site controls and zoning — some talk of a second home tax — cluster zoning is enacted to preserve open space.

—Slight trend away from cars as recreation travel modes — ferries, trains, etc., bring groups of people in from out of state to specified, concentrated areas.

Species and Vegetation

—Fishing seasons and restricted licensing imposed for shrimp and lobster fishing.

—Some species have made a dramatic comeback: Alewife, Bear, Wolf, Salmon.

—The habitats of endangered species are protected, such as those of: Eider Ducks, Blue Herons, Eagles, Ospreys, Beavers.

—Better education through the media teaches the ecological interdependency of all life forms.

Air

—Penobscot area towns begin to notice summer smog as bad air from other states moves through — Air Quality Index raises public concern — people become more aware of the quality of Maine air.

—Greater pressure for interstate compacts to clean up regional airsheds.

What we Use — Structures and Materials

Housing

—Financially state supported Community Development Corporation established for housing development and greater land protection.

—The housing shortage somewhat ameliorated through State Government support of successful prefabrication companies, better trailers, and some apartments.

—Housing Bank provides money for repairing and renovation houses and apartment buildings. The system operates efficiently by providing preventative repairs at an early stage.

—Maine Housing Authority builds some units for elderly and low income and disabled people.

—Old houses restored as new residents renovate farms, large village homes, etc.

—Greater usage of locally produced building materials such as spruce framing, cedar shingles.

—A few "new towns" and "planned communities" are built in Maine, all housing, including mobile homes, is permitted only in areas designated as suitable for such development.

—Minimum standards for room occupancy enforced.

—Building codes standardized and enforced by each municipality, less substandard housing built, fewer fires.

Transportation

—Coordinated planning of industrial locations allows commercial transportation to become more efficient and profitable.

—New roads and other transportation services are considered as part of the cost to the region of industrial and residential development.

—Autos remain major mode although a beginning is made to enlarge mini-bus service within and between major towns.

Nationally advertised tourist routes bring more people all four seasons — the impact of larger numbers of tourists mediated, however, by better distribution of facilities and attractions.

—Increased rail freight service as "unit" trains begin to appear.

—Belfast uses its railroad as a tourist carrier and attraction.

—Bangor International Airport facilities utilized for shipment of distinctive Maine products — fish, poultry and veal.

Sewage and Solid Waste

—Penobscot area towns enact controls over sewage systems on the shores of bays, rivers and lakes — septic systems must conform to standards based upon consideration of soils, slopes and water table.

—All major towns have at least secondary treatment plants. Farms use sludge as a fertilizer resource.

—Small towns handle sewage under guidance of a strict Plumbing Code.

—People become much more interested in the dry toilet — extensive composting of waste.

—Sanitary landfill becomes more popular and more successful. Proper locational criteria are used. Most materials are recycled placing less demand for such facilities.

Noise

—Recreation vehicles are required to meet noise restrictions, such as those now being proposed in Massachusetts.

What We Do — People & Activities

Economy

—Property tax reforms — greater proportion of local tax money from state and federal revenue sharing.

—Control of entry into primary industries such as fishing and forestry make them more viable for state residents.

—Most clam flats are reopened for digging.

—Summer residents bring specialized, light industries and "think tank" organizations to wealthy coastal towns.

—Many young people decide to live off the land in a local self-help economy.

—Hand crafted items made and sold by local people in community craftshops.

—Aquaculture projects create more jobs, provide good working conditions and decent incomes and an opportunity to use and develop skills.

—Large-scale marketing system set up to maximize incomes of aquaculturists and organic farmers.

—Establishment of a regional and state land bank.

—Office and sales forces grow near large towns.

Education

—Dropout rate slows as education becomes more relevant to local industries.

—More stress on quality in teaching instead of just qualifications as experience becomes more important than educational attainment.

—Greater stress on small local group relations and less large scale bureaucracy.

—More education for all people — Junior colleges; technical, specialized, adult education.

—University funding levels off and their programs become more relevant to Maine needs and occupations.

Crime

—More stress on the underlying causes of crime and the relationship between crime and the environment.

—National trend of increasing city based crime. Communities make a more conscious effort to watch their own areas more closely.

—National Crime Data Center used by small towns.

Health and Medical Care

—The causal relationship between environment and health taught by media and in high schools.

—Food quality and nutritional requirements linked to health.

—National Health Insurance instituted. Health insurance provides preventative medicine and early treatment, allowing medical care to become less expensive overall.

—Better programs for health care for the elderly started on a national level which affect the Penobscot area.

—Welfare demand and dollars brought more in line — real need is reduced and standard guidelines established.

—People through media and experience begin to realize that drugs are no substitute for life.

Future III

High population and economic growth rates, unemployment remains relatively high for the non-technically skilled, and environment slowly deteriorates

Assumption

Rapid and substantial population growth rate and increase in income and economic levels, expansion of existing industries with additional port and heavy industrial development.

Where we Live — The Land, Air, Water

Energy

—Power demand increases considerably. Homes and businesses rely more heavily on electric power.

—Several nuclear plants built in Maine, more planned; problems with safety systems; public continues to be largely unaware of future implications, although protests over environmental impact continue.

—Several fossil fuel plants built along the Maine coast.

—New oil and gas fields opened up on the Atlantic Shelf, and major oil ports constructed on the Maine coast, the local area experiences income benefits, but major capital profits go out of state.

—Tide, wind and solar sources tapped on experimental basis only.

—Thermal pollution slowed considerably by state and federal controls but many new sources appear.

Water

—Greater population — greater volume of sewage.

—Controls of domestic sewage, industrial waste, and agricultural runoff legislated, but ineffective, operation of treatment facilities and intermittent enforcement.

—Most industries install some treatment facilities; however, an increasing concentration of people and industry results in continued heavy pollution of the river and the bay.

—Health problems increase, Penobscot area towns register public complaints.

—Some salinization of groundwater sources along the shore as a result of excessive industrial utilization of water resources.

—The water table drops as people and industries demand more water. Some families experience problems with their wells and towns begin to institute legal actions over water resources and riparian rights.

—Lake and seashore development controls are enacted, but planning and enforcement are unable to keep up with the rapid population growth.

—Seasonal flooding becomes a problem in low areas as some wetland storage areas are sacrificed for development.

Agricultural Land and Soil

—The number of large farms declines rapidly.

—The chicken industry experiences good growth, but becomes increasingly artificial in production methods, relying more on out-of-state sources for feed grains.

—Old larger forests increasingly cut up for housing as new families following jobs move into the state — enforcement of subdivision controls relaxed somewhat in attempt to satisfy the heavy demand for new housing.

—Some zoning set up, but basically insufficient to control land users resulting from the demand for new and rapid growth — much construction continues on unsuitable land.

Recreation Land

—In the Upper Penobscot Bay area there is an increase in the number of seasonal homes owned by out-of-state people.

—Private interests create more campgrounds and "leisure" based communities.

—Demand for open space activities increases geometrically.

—The volume of tourists and campers reaches a saturation level, with little additional benefit for local people.

—Increased industrialization begins to discourage recreational uses of the land.

—State Parks cannot meet the increased demand and many people are turned away.

Species and Vegetation

—Much destruction of wildlife habitats and wetlands by uncontrolled influx of people as new building continues.

—Intensive forest management stressed but the demand increases for all uses of forest lands and wood related products.

—Some destruction of wetlands due to land-filling as new building continues.

—Hunting and fishing controls are based on peak seasonal demand and not on environmental balances.

—Further destruction of shellfish areas due to dredging and filling of harbors and oil spills from increased tanker and general shipping traffic.

Air

—Air Quality Index established and given wide media exposure.

—Air quality declines due to local automobile and industrial emissions and bad air from other states.

—More cars produce more polluted air along Route One, in larger towns and on Interstates.

—Hospitals experience a sharp rise in respiratory diseases.

What we Use — Materials and Structures

Housing

—More people move into the area seeking jobs, although many more people are housed, the housing shortage continues.

—Trailers are more widely accepted as inexpensive, readily available housing, and many more are built.

—Towns try to discourage mobile homes resulting in many poorly planned, unattractive and congested trailer parks.

—Many more subdivisions to accommodate new workers and summer residents appear.

—Suburban sprawl is encountered around the major towns. Some larger towns spread, begin to merge and lose their identity.

—More shopping centers are available for local people.

—Temporary influx of construction workers causes severe strain on housing and water supplies, sewage treatment facilities and schools.

—Housing construction creates additional jobs in the area.

—Housing code exist and guide new construction but is often ignored in many towns because of the severe housing shortage.

—Much overcrowding of existing multi-family structures in larger towns of the Penobscot area causes fires and social problems.

—Many second homes built for summer use by local residents.

—Prefabricated units become increasingly popular although costs are still high for the average family.

Transportation

—Searsport facilities expanded for deep water vessels.

—A container ship, rail, truck and air system established at Searsport and Bangor International Airport.

—Route One is widened to accommodate vastly increased traffic.

—Route One by-pass is constructed around Searsport.

—Much larger four-season traffic flow.

—Many new roads and Interstates built with corresponding preemption of land, pollution, destruction of neighborhoods, landscapes and high costs. However, access to all points is greatly improved.

—Strip developments grow up along Routes One and 1A between Camden, Belfast, Searsport and Bucksport.

—Better truck access with many more trucks entering the area on new roads. "Unit" trains linked to the national and Canadian networks.

—Bangor International Airport begins to ship Maine products to overseas markets.

Sewage and Solid Waste

—All major towns have secondary units, but sludge remains an unsolved problem.

—Many more home septic tanks built; greater demand on the water table and suitable soils.

—Towns are forced to use environmentally unacceptable methods to dispose of mountains of solid waste.

Noise

—A general increase in all noise levels.

What we Do — People & Activities

Economy

—New industries drawn to the Penobscot Bay area — many new jobs created.

— Some new office parks built in large towns which attract office and sales workers.

—Expanded ports facilities provide jobs for local people.

—Much outside capital flows into state.

—Many new jobs created, but workers move into state following them. Unemployment situation improves somewhat, but the local employment level fluctuates with that of the national economy.

—Many locally owned retail establishments fold and are replaced by large chain establishments.

—A number of aquaculture projects started; remain experimental only.

—Property tax system revamped to provide more equitable distribution of revenue from industrial development.

Education

—Increasing population causes overcrowding in schools.

—More money spent by Penobscot area towns on education.

—More teachers available, quality remains the same.

—Greater emphasis upon technical as well as vocational education.

Crime

—More new people move in, with a corresponding rise in crimes of all types.

—Police very over-worked, more money spent.

—National Crime Data Bank used.

Health & Medical Care

—Costs continue to rise.

—Unplanned growth, sudden increase in population density and the sudden change to a more organized urban style of life cause severe social problems.

—More doctors and paraprofessionals move into area.

—Regional hospitals built still overcrowded.

—National Health Insurance instituted.

—Food stamps and surplus food do not meet the needs — hunger remains an unsolved problem.

—Unplanned growth causes the costs of the welfare programs to rise.

—Drug abuse increases as society changes too rapidly.

THE FAMILY AS A POLICY-MAKER

The series of maps in this report represents the resources which support the lives of residents of 13 towns in upper Penobscot Bay. Each person in the area draws upon this storehouse of energy and materials (as well as the larger supply of the nation and the world) for his or her needs.

Planning for the preservation and the efficient use of resources and services within such a region has primarily been the function of local planning boards, regional planning agencies and state governments. Such planning is intended to coordinate decisions made at the community level regarding the placement of development activities and services. The result should be to promote the efficiency and convenience of industries and services while protecting usable resources.

In addition, planning and purchasing decisions made at the family level have a significant impact upon the future quality of resources which support people within the Penobscot region and throughout the rest of the state and the nation.

Much current information shows that the pattern of consumption of materials and energy in our homes has effects which reach far outside the boundaries of our own property limits and local shopping areas. There are *environmental costs* which go beyond the purchase and operating costs involved in buying and using most common household items. Many of the implications are related to the materials and processes required to manufacture most products. Depletion of resources, and contaminated air and water are well publicized results of many manufacturing processes. The constant search for new resources, the rapid consumption and the disposal of these resources, and increasingly poor health resulting from harmful substances in our air, water, and food are problems which have come to the public's attention only in the last five years and sooner or later must be corrected. For most of us in Maine, the problems caused by heavy manufacturing industries seem far removed from us and we have difficulty seeing any tangible environmental damage or *excessive environment costs* connected with our buying choices.

Using as an example a few basic assumptions about the consumption of materials and energy, we can come up with an energy budget for two representative families of four with roughly equivalent standards of living which gives a better idea of how our energy choices are linked to the quality of the environment in Penobscot Bay as well as elsewhere in the country.

The following paragraphs describe the two families; their patterns of consumption and their influence upon the resource budget of the Penobscot Bay area.

The first family, the Thompsons, live in a wood frame house (which is twenty years old) with three bedrooms on a one acre lot on the edge of a small town. The Thompson's house faces south. The front of their house is shaded by medium growth hardwoods, and some spruce and fir trees grow in the back yard. The entire house is shaded during the summer, and the south side is open to the sun during the winter.

The second family, the Davises, live in a new mobile home (as do one third of all families moving into new, single-family homes) on a one acre lot by a hard surfaced town road five miles from town. Their trailer lies parallel to the road which runs north-south, thus it faces east and west. Their lot was bulldozed so except for the few small trees which they planted it is not shaded from the sun. Consequently, their house requires air conditioning.

These alternative life styles have far-reaching consequences. Lumber and metal are both formed by energy. One important difference is that the molecular structure of wood is formed through photosynthesis (using CO_2 and creating O_2) while aluminum is smelted from bauxite using electricity or other fossil fuels. Construction of the Davis family's aluminum home may require *150 times* as much net fuel energy as the lumber home of the first family. The Davises' air conditioning uses 3,000-4,000 KWH's per year. The first family's air conditioning also depends on energy, but it is unlimited sunlight and wind. Another consideration is that the Thompsons' house can be repaired easily, has low energy demands, and will probably have a total life of 60 years, with four different users. The Davises' trailer, like a car, will last from only 7-12 years and then will have to be hauled to a factory or to a dump. Possibly it can be recycled (if this is economical then, which it is not now).

The Davises heat their home with electricity (10,000-15,000 kilowatt hours per year) which is generated at power plant primarily by the burning of fuel oil. The Thompsons heat their home directly by burning oil. The energy efficiency of converting oil to heat in the home is about 70 percent. That is, 70 percent of the heat content of the fuel is converted to useful heat. The process of burning oil to generate electricity and using electricity to produce heat in the home has efficiency of only 35 percent. Also, the Thompsons' house faces south, thus natural solar heating helps to warm their home during sunny winter days. The spruce and fir trees also help by blocking the cold winds from the north and west.

Because the Thompsons' house is twenty years old, the trees, bushes and grass are well established, providing shade and shelter for birds, screening the house from wind and noise, and holding runoff. In their back yard, the Thompsons have planted a large vegetable garden which is farmed using natural materials and methods, thus building the regenerative power of the soil.

The Davises have planted a few small trees and bushes around their home. Their grass is still very sparse, and the lawn gets very muddy and tends to erode easily during heavy spring rains.

The Thompsons are within walking distance of work, schools, and stores, and have one car. The Davises' home is five miles from all three; they use two cars daily and their children ride a school bus. The Thompsons average about 10,000 miles a year on their car, and the Davises use each of theirs for 25,000 miles a year. With a car lasting about 100,000 miles, the Davises consume .5 of a car per year and 2,000 gallons of gasoline, the Thompsons use .1 of a car per year and 1,333 gallons of gasoline. Including the cost of electricity used in automobile manufacturing, repairing and gasoline refining, the Davises use 3000 KWH/year embodied in their automobile transportation, 1000 KWH more than the Thompsons.

Each of these families has a modern kitchen; however, the Thompsons have only the basic stove, refrigerator, clothes washer and drier, and freezer. The Davises go in more for appliances and have an electric carving knife, deep fat fryer, food waste disposal, dishwasher, blender, etc. (Table I shows a breakdown of the energy requirements for different electrical appliances).

All these simple consumer choices obviously have a large impact on the environment, particularly when multiplied by 200 million Americans. The Thompsons' total energy needs are considerably lower than the Davises' because of choices made at the market level.

TABLE 16
ESTIMATED POWER CONSUMPTION OF ELECTRIC APPLIANCES

Appliance	Average Wattage	Estimated Use	Estimated KWH Consumed Annually
Broiler	1,436	80 min/week	100
Coffee Maker	894	20 min/day	106
Deep Fat Fryer	1,448	66 min/week	83
Dishwasher	1,201	50 min/day	363
Food Blender	386	6 min/day	15
Food Waste Disposer	445	11 min/day	30
Range	12,207	16 min/day	1,175
Toaster	1,146	5.6 min/day	39
Food Freezer (Frostless 15 cu ft)	440	46% of the time	1,761
Refrigerator (Frostless 12 cu ft)	321	43% of the time	1,217
Refrigerator-Freezer (Frostless 14 cu ft)	615	34% of the time	1,829
Clothes Dryer	4,856	34 min/day	993
Iron (hand)	1,008	23 min/day	144
Washing Machine (automatic)	512	33 min/day	103
Washing Machine (non-automatic)	286	44 min/day	76
Air Conditioner (room)	1,566	10% of the time	1,389
Dehumidifier	257	40% of the time	377
Fan (attic)	370	2.2 hours/day	291
Hair Dryer	381	42 min/week	14
Heat Pump	11,848	3.7 hours/day	16,003
Heater (radiant)	1,322	22 min/day	176
Humidifier	117	16% of the time	163
Sun Lamp	279	66 min/week	16
Water Heater (quick recovery)	4,474	2.9 hours/day	4,811
Radio	71	3.3 hours/day	86
Television (black and white)	237	4.2 hours/day	362
Television (color)	332	4.1 hours/day	502
Sewing Machine	75	2.8 hours/week	11
Vacuum Cleaner	630	84 min/week	46

Source: Edison Electric Institute, national averages

Both the Thompsons and the Davises have freezers; however, the Thompsons cultivate a small plot of land "organically" and freeze their food. The Thompsons also try to buy beverages only in returnable bottles. Both choices help to limit the volume of solid waste which must be disposed of. The Davises buy predominantly pre-packaged frozen food. The Davises' food is thus cultivated with the use of artificial fertilizers which affect the nitrogen-fixing capacity of the land where the food is grown. These fertilizers introduce poisons into the drinking water of many distant communities. The Davises also rely heavily on extensive packaging and throw-away containers. In this case the environmental costs can be readily seen. The Davises' town provides a sanitary landfill for disposal of solid waste. The cost to the town of acquiring the land and operating the facility has been quite high. Because of the congestion and confusion involved with individuals bringing their own trash to the dump, the town has decided to purchase trucks and provide pick-up service. The cost of buying and maintaining trucks and paying salaries to workers will boost the Davises' taxes considerably.

The Thompsons and the Davises have *similar* living standards, but the Davises use *1.5 to 4 times* as much electrical and total energy per year. We speculate with some confidence that the environmental stress of manufacturing, packaging and disposing of the commodities which are part of the Davises' life style is also greater than for the Thompsons.

In addition to these comparisons the placement of the houses suggests other unquantifiable energy limitations. The Thompsons rely on a town water system and their sewage is treated by a town secondary waste treatment plant. The Davises get their water from their own drilled well or spring and their sewage passes through their own septic tank and leach field. Taken individually this poses no problem, but many houses or trailers each with its own well and septic system located on a poorly drained soil threaten personal health, and groundwater quality, placing an added stress on an already overtaxed ecosystem.

In addition, the fact that the Thompsons use only one car against the Davises' two make the relative stress on the environment heavier in the Davises' case. More driving means more pollution, more noise, more roads and less available land for photosynthetic energy production. The picture, is familiar. One family living on a road is not noticed, but many families living five or so miles from town poses the spector of "suburban sprawl" with few trees, many cars, more expensive community services, and destruction of the natural environment.

The implications of these simple alternative energy budgets are apparent. Energy consumption indicates the strain which we place upon the environment in two ways: First, we need energy to heat and light our homes and to run machines which produce the goods that our standard of living seems to require. Most of our energy comes from fossil fuels – decomposed plants which were produced by the sun. We are using these fuels much faster than the sun and the plants can possibly replace them. Secondly, the industries which transform energy into usable forms – oil, electricity, coal and chemicals – are among the worst of industrial polluters. Heated water and high concentrations of harmful substances in water and air kill many of the plants and animals which convert energy to forms that can be used by man. Many of these substances have direct impact upon humans.

Both families are typical of those that live in the Penobscot area. Neither are irresponsible in their preferences given existing prices and available products. However, the overall potential impact of these differing patterns of consumption is great. One family uses approximately three times the earth's regenerative energy to live happily and bring up their children. One family is managing its land in a way which will enrich their lot and those of their neighbors, while the other is at best a temporary stopgap against time. The choices which are behind these life styles are not momentous ones filled with rhetoric and drama, but simple everyday common sense choices capable of being made in the market place. Taken statewide or nationally, the picture is impressive in its implication.

Can the country be run more efficiently?

The following tables show the present national electric energy budget:

TABLE 17

	1970	Annual Rate of Change 1960-70
Population	204,8 Million	+1.3%
Per Capita Personal Income	$3911	+3.0%
Average Price of Electricity:		
Residential	2.10c/KWH	-4.2%
Commercial	2.01c/KWH	-4.6%
Industrial	0.95c/KWH	-2.8%
Residential Sales	447.8 billion KWH	+8.6%
Commercial Sales	312.8 billion KWH	+10.5%
Industrial Sales	572.5 billion KWH	+5.2%

The table indicates that population is increasing, the price of power is decreasing, while sales are increasing. Clearly the average individual, unless conscious as to the true costs of electric power, will naturally purchase more electric power. Similarly, the average individual, unless educated to the environmental impact of his choice of different types of food, house sites, number of vehicles, uses of water and commodities he buys, will continue to increase suburban sprawl with its resultant problems. Thus the problems facing the Penobscot area like those facing Maine and the nation come basically down to the question: Should we locate and consume so as to deplete our supplies of energy, materials, and land, or should we begin to "count the cost" environmentally as well as economically?

Most of the comparisons made between the two families are simple ones. To some extent energy choices are up to each individual. Each individual can look at his or her own resource demands and determine which are necessary and which are in excess – no outside experts are needed, only common sense and a certain degree of environmental responsibility.

In some cases, however, people must buy what is available at a price which they can afford. This is particularly the case with mobile homes. It is clear that these will continue to be the best alternative for low-cost housing in Maine until we can account for the full costs involved in making, living, and disposing of mobile homes and also find a durable, low cost substitute. The purpose of this section has not been to chastise Maine families for choices they presently make, but only to indicate possibly different alternative choices that might be made if total costs were included in the valuation of existing choices. In other words the burden is not so much on the family as it is on those whose function it is to provide the range of consumer choices available, and in a much cheaper, more efficient, less environmentally destructive way.

TOWARD A STATE LAND USE POLICY

In formulating an acceptable policy for the State of Maine on land use management and programs, we should begin by asking ourselves what state actions to improve land use would be acceptable in light of the current attitudes and behavior of Maine people. Do enough Maine people really want improved land use management when such programs will involve expert instead of individual judgment, and when such programs will mean the substitution of collective goals in place of single individual judgments?

Most residents of Maine exhibit a low tolerance for bureaucracy and centralized regulations, whether in large-scale government programs or other highly organized activities such as those conducted by the State University system. In light of the fact that over four hundred units of local government in Maine still lack effective land use planning and management controls at the local level, it is clear that they also resist collective action at the local level. Citizens of Maine must understand that proper land use planning is essentially applied human ecology. Our present planning work as represented by this plan is an attempt to move toward a better relationship between man and the processes and substances of nature which support and sustain him, to relate the intensity of land use to fit the natural capacity of the land to sustain such use.

Much of America's pre-industrial landscape still exists in many parts of Maine. These pre-industrial landscape types are small towns, farms and forests where these three distinct environments have evolved harmoniously through the years. All three of these, however, were harmed in places by the addition of industry which introduced new, more complicated relationships within the traditional simple agrarian economy.

These new industrial land uses created a greater diversity in man's role – not only farming man and forestry man but also factory man, metropolitan man, suburban man, automobile man, etc. With these different functions the old harmony between the simple land uses – between town and country – were destroyed, creating incompatible effects on the environment.

Planning has in the past attempted to create better conditions by isolating such incompatible activities through a policy of zoning. Isolation of separate land uses may not, however, be the best solution. What we need is not zoning which separates land uses, but zoning which creates a harmonious environment where suitable groups of land uses coexist in a suitable setting. Thus, instead of the old style segregation of land uses, a new style of integrated zoning should be encouraged. This would be zoning as a constructive process – the integration of separate land uses to form interacting combinations in planned environments.

Our earlier report, *Maine Coastal Resources Renewal,* suggested such a concept for industrial recycling integrated with a new or existing community for coastal Maine. In addition, present zoning proposals should not attempt to freeze particular areas to anticipated uses – to decide too much too soon. Minimum development and guidance suggestions should be made based on land capabilities, with no particular area designations being made until an actual use has been proposed. When such uses are proposed, performance standards should be enacted to ensure that a pleasant *and* convenient environment can be designed.

Thus our present task is more like fitting goods, as they arrive, into suitable containers. The function of the zoning proposals we make herein is in fact to provide appropriate settings for all our activities according to the carrying capacity of the area's natural resources. Appropriate land use *combinations* are not, however, as easy to determine. Some uses are inherently incompatible like freeways and housing, others such as recreation, housing, light industry and wildlife are not so easily determined.

As a minimum state responsibility toward preventing incompatibility of land use, we therefore have attempted to identify the types of development which because of their special nature become matters of statewide concern. On our synthesis map we have designated only a recommended protection district, with other areas identified as being suitable for intensive use but not necessarily restricted or set aside for such use.

Many of the recommendations we are making in this report are in accordance with recently enacted state land use legislation. The people of Maine through action of the last two sessions of the Maine Legislature have authorized three major pieces of state level land use regulation: The Site Selection Act, Mandatory Zoning and Subdivision Control for Shoreline Areas, and the extension of planning, zoning and subdivision controls to all the wildlands of Maine through the Maine Land Use Regulation Commission. Although it is difficult to speculate on attitudes to further environmental legislation, it is safe to assume that our present bureaucratic structures will need to somehow become less bureaucratic, less centralized, closer and more responsive to the people of Maine. Under such circumstances Maine citizens may be less reluctant to accept certain kinds of overview planning over the control of land for the collective good of the people of the state.

An acceptable state policy and program for land use control should be decentralized. It will need to be as simple and direct as possible so that it will be easier for Maine people to adjust both their attitudes and behavior to these new conditions.

Although the need for increased state concern for the consequences of development is urgent, it is also vital that this immediate concern deal effectively with major problems without unnecessarily increasing the time or the cost of the land development process. A time-consuming and inefficient procedure requiring the approval of many state or federal agencies for land use decisions of minor importance could have serious social, economic and political consequences.

It is important to recognize at the outset that a great number of land use decisions that should be made by local governments have no major effect on state or national

interests. Moreover, most of these decisions can be made only by those people who are familiar with the local social, environmental and economic conditions. The decision on the use of a small parcel of land located at the corner of Doak Road and Vine Street in Belfast, for example, should be made in Belfast, not in Augusta or in Washington.

The first task is to balance the need for expanded state participation in the control of land use with the objective of limiting this participation to those land use decisions which clearly involve only state or regional interests, while at the same time retaining local control over the smaller community issues of strictly local concern. The problem of defining state interests and local interests is not an easy one, but it has been done in the Site Selection Act, the Mandatory Shoreline Zoning and Subdivision Act and the extension of the jurisdiction and powers of the Maine Land Use Regulation Commission. These legislative acts authorize the state to control certain large-scale developments, to manage critical areas such as shorelines and to protect an uncontrolled area.

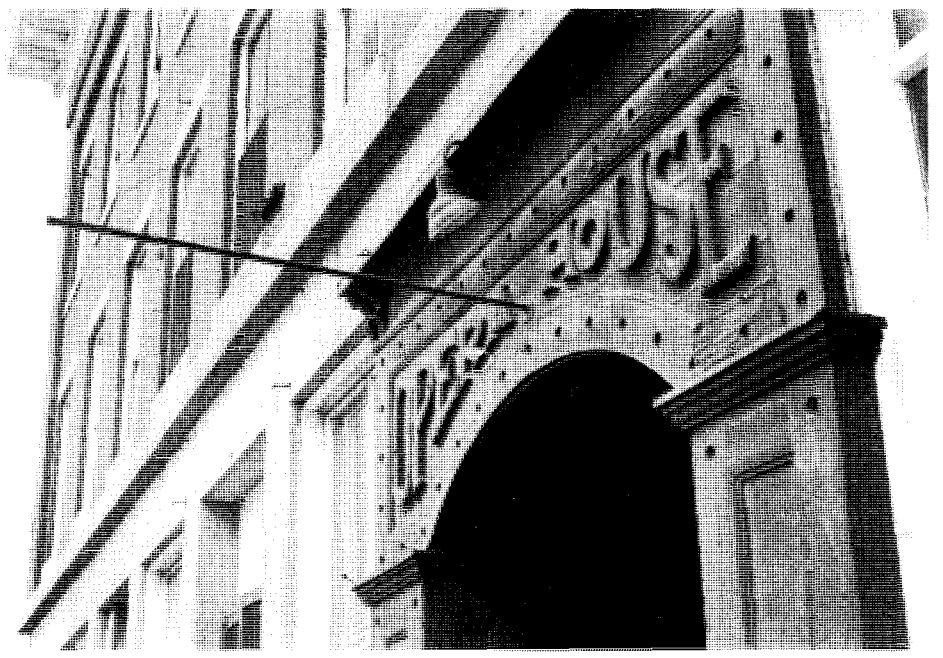
The first major element of a state land use policy, on the basis of recent experience, is that *State government should take the responsibility to identify areas of critical concern and to regulate those areas in the public interest.* To identify such areas, the state may establish four guidelines for the selection of such areas:

First, the state may designate portions of the state which because of their natural resources, unique characteristics or other considerations become areas of statewide concern. The shoreline areas covered under the Mandatory Zoning and Subdivision Act of 1971 are examples of areas of such state concern.

Second, some types of development may have only local impact if undertaken on a small scale, but may be of state or regional significance when undertaken on a large scale. This applies to commercial, residential and industrial development of large size as regulated under the Site Selection Act.

Third, some types of development by their very nature and impact almost invariably become matters of state or regional concern. This would include major airports, public utility transmission lines, power plants and major highways.

Fourth, areas that cannot be supervised or controlled by local governments or other regulatory authorities must become the responsibility of the state. The planning, zoning and subdivision controls over the unorganized and deorganized areas of the state by the Maine Land Use Regulation Commission is an example of this type of situation. This may also include areas where local governments refuse to act over a certain period of time in the organized areas.



The second major element in the State Land Use Policy is *the need to formulate and implement policy and program for the urban areas and local communities of Maine.* An essential element of this policy is that areawide, regional planning serves as a framework for local government activities. The manageable aspects of our environment and economy now come in regional packages. Furthermore, in a state as large and diverse as Maine, regional planning agencies are better able to respond to sectional peculiarities necessary for the development, acceptance and implementation of water and land use plans.

This regional approach was made official by order of Governor Curtis on January 26, 1972, when he issued an Executive Order establishing a system of official planning and development districts for the entire state. The eight major drainage basins in Maine served as the framework for the designation of the districts. Effective land and water use planning was the major criteria used in delineating the boundaries of these districts; they are large in size but small in number so that they can deal with and coordinate the many issues and relationships involved in proper land management.

The success of the river basin approach, while not utilized extensively in this nation, is apparent in many European situations such as the Ruhr Valley. It permits an ecologically sensitive total land use view of a drainage system, and thus allows for a comprehensive approach to environmental degradation from all sources rather than the usual approach of a site-by-site abatement program.

The estuaries of our state, where the complicated interactions between fresh and salt water occur, are prime examples where the regional implications — defined as watershed areas — are especially noticeable. If the estuaries of Maine are to be reestablished and maintained as something more than open sewers, effective planning and programs must provide for the management on a watershed or river basin basis.

Environmental, economic, social and political problems are so interrelated in the design and implementation of land use controls that we must integrate the functional with the geographic and administrative aspects of government on a consistent area basis. The proliferation of land development review and approval bodies at the local government level will increase both construction and government costs. The long run objective of a well-planned, livable environment requires that planning and project review be carried out on a regional basis.

We must, in the future, avoid the growth and multiplication of a great number of conflicting and overlapping special agencies, boards or commissions to handle in isolation one problem after another and in the end seriously diminish our capacity to deal with complete ecosystems in a coordinated, comprehensive and continuing manner.

This policy should also clearly define the local decisions that will be left to local communities based on information developed in consultation and cooperation with communities in Maine. The state may explore the option of developing a temporary system of land controls for these communities not ready or willing to exercise such controls until such time as local controls are enacted or brought up to state standards.

Technical assistance and financial support to the regions and local units must be expanded to have a workable program. Much of this additional support may become available from the state level land use bills introduced to both Houses of the 92nd Congress in 1971 and expected to pass this year. All bills would place responsibility for implementation on the states with provision for delegation of some responsibilities to regional agencies and local governments. There are also explicit or implied requirements in all bills for methods for inventorying, designating and exercising state control over critical areas.

It should be the policy of the state government to take direct, remedial action when local government and private landowners are powerless or reluctant to act in the interests of land management. So that there be consistent policy and direction, the state should provide guidance, authority when needed, and financial assistance to help overcome local deficiencies and disparities.

The third major element is the need to establish clear and coordinated policy, performance standards and criteria at the state level for the guidance of state, federal and local governments and private developers for effective implementation and coordinated land use planning and control.

The State of Maine may want to consider its own version of the landmark National Environmental Policy Act of 1969 to provide a general declaration of land use control and environmental policy and establish general criteria now scattered and fragmented among many state agencies, and add the definition of critical areas described in the first element of land use policy.

The development of more sophisticated impact statements at the state level can serve to assemble all relevant technical information, discover potentially irreversible effects, help evaluate planning alternatives and define public concerns. It is an extremely valuable evaluation tool and, if used in conjunction with overall land and water use planning, individual projects could be implemented with more complete knowledge of their long-term effects.

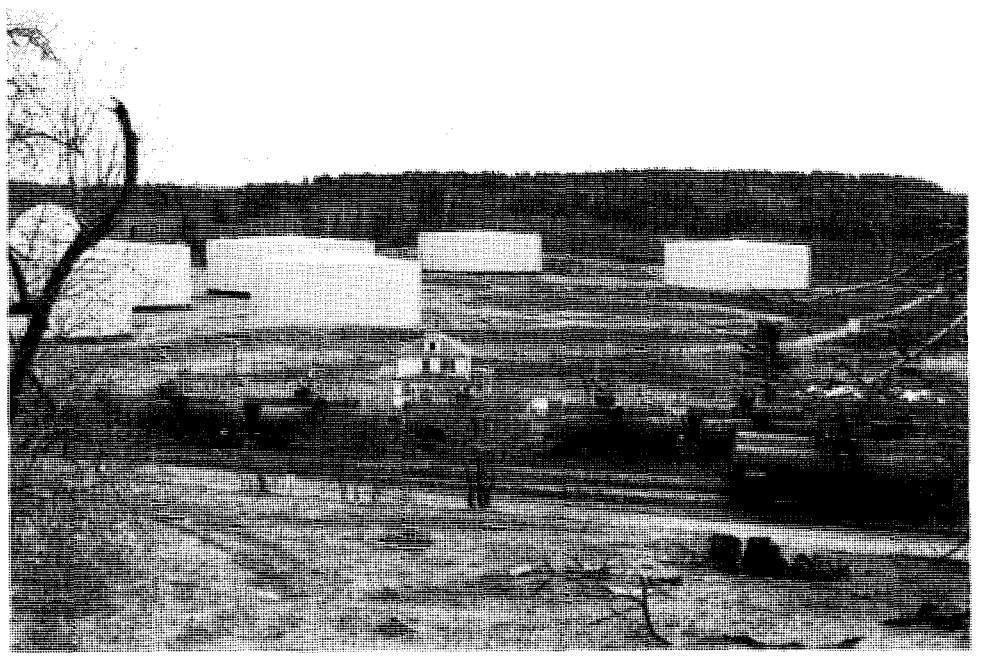
The only analysis that existed before the advent of Environmental Impact statements was the practice of assessing dollar values as the sole basis of weighing or justifying all elements in a complex situation, the cost-benefit analysis. The limitations of this approach are now widely recognized in that they attempt to force all elements of a resource situation into a dollar framework. Such calculations have been generally used to justify a choice made rather than to determine which choice is best.

It is desirable for the state to coordinate and integrate many of the major existing laws, add new policy and criteria to provide in one law and policy the guidelines for state and local agencies. Such law and policy would require all state and local agencies to conform to the policy and standards to effectively head all agencies in the same direction and to unify federal, state and local policy on land use. Each regional agency could also determine more specifically refined standards, based upon minimum requirements and guidelines prepared at the state level for application within that particular region.

The fourth major element is a method of review and coordination of land acquisition plans and proposals of all state agencies. The recent work of the new Interdepartmental Committee on Public Lands and other recent developments points out the need for more effective coordination of land acquisition programs within state government. This could be accomplished by expanding the present project notification and review system carried out under the A-95 procedure. It would briefly provide a central clearinghouse for: (A) all land holdings of state agencies, and (B) all land acquisition proposals of state agencies. Like the A-95 process, approval or recommendations of the clearinghouse and other relevant state agencies, plus conformance to state land policy, standards or criteria would be a prerequisite for land acquisition or disposal by the state.

In addition to federal projects, state projects should also be added to the A-95 review process to aid in the coordination of the state public improvements program and also set up a method to assess their overall impact on state land use, their environmental impact and economic consequences.

The fifth element in a state land use policy is to encourage the use of taxation at both the state and local level to reinforce and support land management goals and objectives. In general, this means that the state and local tax system should support the highest and best use of land as defined in state policy, laws, standards and criteria. In 1965, for example, the Hawaii legislature applied a tax deferral technique by allowing tax exemptions on land in their urban zones dedicated for open space, public recreation and landscaping. The negative effect of the property tax on land use and development in all communities is well known.



It is expected that this element will be a major concern of the seven-member special committee now studying Maine's tax structure. It is a major concern of the present study now being conducted by the Governor's Office on alternative methods of state financing and state revenue.

The sixth element in a state land use policy is that of providing up-to-date institutions and organizations to effectively plan and control water and land use in the state. The State Planning Office has in the last three years been developing a state planning and management system which attempts to provide for the *participation* of those affected, for *continuous* planning so that plans may be revised and updated and for *coordination* so that all components are properly related at four levels of planning — federal, state, regional and local.

This system includes the following four major components:

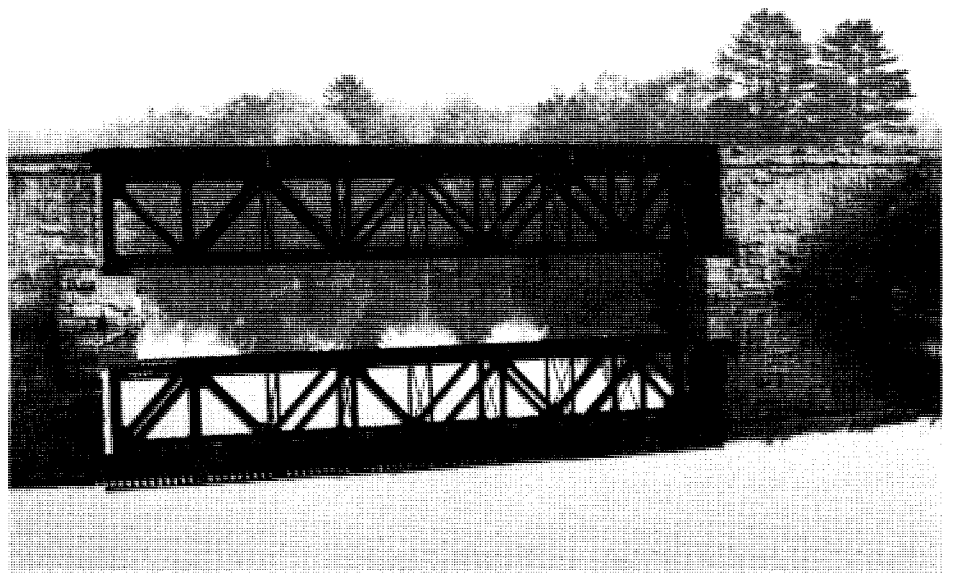
1. State Government Reorganization
2. Official Planning and Development Districts
3. A State Comprehensive Policies Plan
4. A State Information System

None of the four components are completely developed. Early in March 1972 a Special Session of the 106th Maine Legislature approved 10 out of 13 proposals for new departments. Although the establishment of ten new major departments is a significant and unprecedented accomplishment, it did not deal effectively with the major environmental and natural resource functions of the state.

The continued fragmentation of functions and scattering of responsibilities in these areas makes it difficult – if not impossible – for the Chief Elected Official of this state and the legislature to develop a comprehensive strategy and launch a coordinated attack on the complex problems in these vital functions of state responsibility.

Many agencies in these areas will continue to represent narrow, parochial interests. One agency may easily duplicate the work of another or all may work at cross purposes. The Governor will continue to devote a substantial part of his valuable time to resolving conflicts and dealing with details that these department heads could handle themselves if the Executive Branch were better organized.

In constructing a model for such institutions and organizations, we must avoid giving overall land and water use planning to agencies with a narrow mission or built-in bias. We should also learn from the experiences of federal agencies with this problem. The following statement by Charles R. Goldman, Director of Environmental Studies, University of California, summarizes the views of most qualified observers on this issue:



"Since the two major federal agencies responsible for planning water developments are also responsible for construction (the Corps of Engineers and the Bureau of Reclamation), it is unreasonable to expect them as a general practice to consider alternatives which would mean non-development. Further, it is unlikely that their plans necessarily reflect a wide range of interests. At the same time, despite current enthusiasm, the environmental interests are still not really well enough organized nor well enough financed to undertake their own studies of large water projects.

"It is uncertain whether new governmental agencies such as the Environmental Protection Agency and the Water Resources Council can effectively represent the range of environmental interests. There can be no doubt that governmental agencies at all levels are earnestly attempting to accommodate environmental interests in their planning. Fox[1] believes that this 'in house' process of developing a concensus might leave the more committed environmental groups embittered and the decision–making process at a stalemate. He concludes that the federal government should have a separate environmental Resource Planning Agency which would actually take the lead in developing regional environmental resource plans . . . In such an organization it would be wise to include such resource agencies as the U.S. Fish and Wildlife Service who have a clear environmental involvement but not such developmental and construction agencies as the Bureau of Reclamation and the Corps of Engineers. Finally, it would be unwise for such an agency to possess any regulatory responsibility."

Comprehensive, overall planning for state water and land use should not, therefore, be located in a promotional, construction or regulatory agency.

Both water and land use planning and policy are essential as a guide for long–term regulatory activities. This was pointed out in a recent comprehensive report on innovative land use laws and programs of several states for the Council on Environmental Quality. In this report, "The Quiet Revolution in Land Use Control" by Bosselman and Collies, the following paragraph completed their analysis of Maine's Site Location Laws:

"In the long run the Site Location Law may be seen as more of a stopgap remedy than a permanent solution. The absence of any overall state planning process that provides a rational basis for regulation, and the reliance on clearly inadequate criteria for decision–making, must eventually weaken the program's effectiveness. The major question for the future is whether the state can expand the Site Location Law into a more comprehensive land regulatory system that leaves the local issues to local governments but deals with major development proposals in the framework of a broader conception of state planning than the current law contains."

In a broader sense, the need for a state land use policy also grows out of an increasing awareness of the many interrelated issues, activities and problems that confront this state. No doubt other concerns in addition to the elements listed here should be included as we proceed to provide a framework within which urban and rural development and the quality of our environment can be assessed. To provide proper perspective a state land use policy is not just a natural resource policy, it must also be concerned with the problems of economic growth, the provision of public services and regulation at all levels of government, the allocation of public resources and the very structure of our federal system of government.

Historically, the control of land has been a local function in our federal system of government, but in recent years local units have been unable to deal with large-scale projects or handle involved proposals which require expertise more likely to be available at the state levels.

All the legislative proposals being considered by Congress recognize this trend. It now seems that there will be some form of federal land use bill and the responsibility for implementation will be on the states. State governments will be called upon to assume new responsibilities in land use management. Because of these developments, Maine must be prepared to use this opportunity and accept responsibilities for the management of its water and land resources.

[1]Professor Irving K. Fox, University of British Columbia

Postscript

A STRATEGY FOR RESTRAINT

A tenet that we have tried to follow in all our work is the need for reasoned restraint. Restraint in unnecessarily increasing the state's regulatory powers over local areas, restraint in suggestihg any alteration of environmental resources, restraint in irrevocably committing particular areas to particular uses. The danger of making wrong decisions for utilization of our coastal areas is a constant spectre. We cannot accurately program its future use. We can, however, state that certain features of that coast are dear and indispensable, and we can devise ways of protecting these features so that they are not irreversibly altered. This has been our approach. We have begun the process of identifying some of these vital features that make the Coast of Maine as significant as it clearly is. The Resource Maps for Penobscot Bay described earlier are a first step in this process.

To preclude further federal and state involvement over local lands will require local people in Maine's communities to develop an awareness of what needs doing in their communities and take the initiative to do it. Otherwise we can confidently state that someone in Augusta or Washington, often unaware of local situations, will determine what the needs are for Maine's communities.

Much of what needs doing is reflected in the work that this report has presented:

1. A protection of the fragile environmental areas.
2. Development of only those areas that are suitable for intensive land use activities.
3. A continuing process for the statement and refinement of community intentions and plans.
4. Greater pressure on and demands for local political leaders to advocate, support, bring together and assist in revising these community intentions and plans.
5. Regional organization of communities to undertake and coordinate services that can be more easily and cheaply provided on a regional basis.

It is our opinion that the area's rare natural resources can be more effectively utilized than they have been in the past. We hate to resort to old cliches, but an important challenge faces us. That is to create in this area and in this state a viable economy that will serve many people and which will preserve the rural beauty of the area, the look of peace, order and openness which is fast fading from the scene in too many parts of America.

The need to maintain open space is great. Productive farmland can in many cases accomplish this aim – it can add beauty to the landscape at the same time it adds food to our tables and a stimulus to the economy.

We believe an expanded role can be played by family farmers particularly within the Penobscot Bay area including organic and fish farmers and consumers, in developing an adequate land policy for Maine. This would not necessarily mean just farming since an increase in the number of small farms would stimulate small business and community development outside the cities. There is a great need to provide the means for the many people wanting to come to Maine who are at best becoming "insecurely employed" in the city and want to return to a more meaningful direct relationship with the land.

In addition we feel certain that it is possible to build high technology industry in Maine and still retain reasonable individual and local autonomy, responsiveness and direction. Public development corporations would assist greatly if adequate checks and balances can be imposed over the considerable power and authority they would have to have.

Greater efforts by indigenous industries (poultry, paper) to recycle and utilize their wastes for a wider range of products could also expand economic opportunities in the area. Methane production from chicken wastes, and yeast and protein from paper waste products are only two examples of potentially feasible operations. While admittedly much of this is an over-simplification, it is, we believe, the net substance of a more people-oriented direction that could evolve if such suggestions were given credence and worked toward.

One of the area's most obvious opportunities, tourism, is at the same time its most serious threat. The gradual preemption of sizable areas of land for housing and other recreation-related activities needs to be carefully regulated. Certain segments of the tourist industry can be extremely profitable. Others, such as the camper traffic, provide relatively little income to the region or the state. Three major problems are posed by Penobscot Bay's growing tourist industry: the continuing construction of recreational housing in areas unsuited for such developments; the rapid disappearance of shoreline areas accessible to Maine's citizens; and the suffocating effect of increasing numbers of tourists in relatively few areas.

Although the recently enacted Shoreline Protection Act may help in solving the first two problems, (particularly if it were extended to control a larger area) it cannot control the flow of recreation seekers to Maine. We have as yet no effective way of controlling the impact of large numbers of persons. The state cannot officially restrict numbers because of federal requirements against such policies, and neither can we control the distribution of tourists because today's auto-oriented Americans generally control their own means of access to recreation spots. Attractive, alternative means of transportation need to be introduced to reduce the degrading impact of an increasing number of auto-oriented tourists. Passenger train service, hovercraft ferry service, and expanded air service to key recreation areas in Maine with adequate facilities to handle large numbers of people need to be instituted to service our many out-of-state visitors. At the same time certain key recreation spots, particularly camping areas, need to be restricted to providing Maine people with ample, uncrowded recreation space.

Our function here has been to suggest possibilities based on the area's given resources. We strongly believe in the power of the land and related water resources to indicate to man what activities he can conduct there. Maps and other information compiled in this report reflect this potential for Penobscot Bay.

Both the work on the Penobscot Bay and the section on Land Use Policy are only beginnings of major and, we hope, continuing tasks. It should also be the beginning of continuing dialogue – and action – so that specific and general goals, as well as trends, can be identified. Our primary concern as planners must be to develop a sensitivity to this *process* among all the people of Maine who must be involved in planning activities. This sensitivity carries with it a responsibility on our part to present society as an ecological system.

Above all, we want to help the citizens of Maine to see current problems and issues in terms of long-range goals, relationships and consequences. This publication is also an effort to indicate now the future consequences of present decisions, to anticipate future problems, and begin the design of future alternatives so that the people of

Maine may make a choice rather than wait until a crisis descends demanding an immediate response.

It is certain our critics will be quick to condemn us as anti-technology or anti-progress. Yet we strongly believe in the need for technology – carefully controlled and directed toward democratically conceived goals. We strongly believe in the need for progress – progress that reflects a growth and improvement in quality, not simply growth that increases numbers and useless products. Finally, we also fervently believe in the power and ability of society and communities to direct and determine their own ends. We do not present any grand design or sweeping social theory. We expect that each step toward change in Penobscot Bay will be a pragmatic Yankee solution designed to meet a real problem. We are familiar with the Penobscot Bay area. A few of us live near or within the identified area. All of us have traveled the area extensively. We have offered suggestions and possibilities which admittedly are biased by our own experiences and observations. It is now up to the people of the area to determine those that are acceptable to them.

Ronald A. Poitras – Alda Stich – Gary Higginbottom – Robert D. Elder

Credits

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Please answer the questions at right, tear out and send.

Questionaire is pre-addressed.

1. We are interested in how people feel after reading over Future I. What would your reaction be if in the next five years, Maine growth was pretty much a continuation of the past as regards population, income levels, and general way of life?

Strongly favorable ☐ Somewhat favorable ☐
Somewhat unfavorable ☐ Strongly unfavorable ☐

Don't know ☐

2. What is there about Future I that you (like) (dislike)?

The Land, Air, and Water

Materials and Structures

People

Fold

3. Now what about Future II; what would your reaction be if in the next five years Maine showed moderate population growth and some improvement of present employment opportunities, but State Government had a little more to do with things like schools and regulation of the environment.

Strongly favorable ☐ Somewhat favorable ☐
Somewhat unfavorable ☐ Strongly unfavorable ☐

Don't know ☐

4. What is there about Future II that you (like) (dislike)?

The Land, Air, and Water

Materials and Structures

People

Fold

5. And finally, what about Future III, how would you feel if in the next five years Maine's economy and population expanded substantially, however, the quality of the environment slowly deteriorated and unemployment remained relatively high for the non-technically skilled?

Strongly favorable ☐ Somewhat favorable ☐
Somewhat unfavorable ☐ Strongly unfavorable ☐

Don't know ☐

6. What is there about Future III that you strongly (like) (dislike)?

The Land, Air, and Water

Materials and Structures

People

STAMP

Maine Coastal Plan
State Planning Office
189 State St.
Augusta, Maine 04330

FROM:

Maine Coastal Plan
State Planning Office
189 State St.
Augusta, Me. 04330

TO: