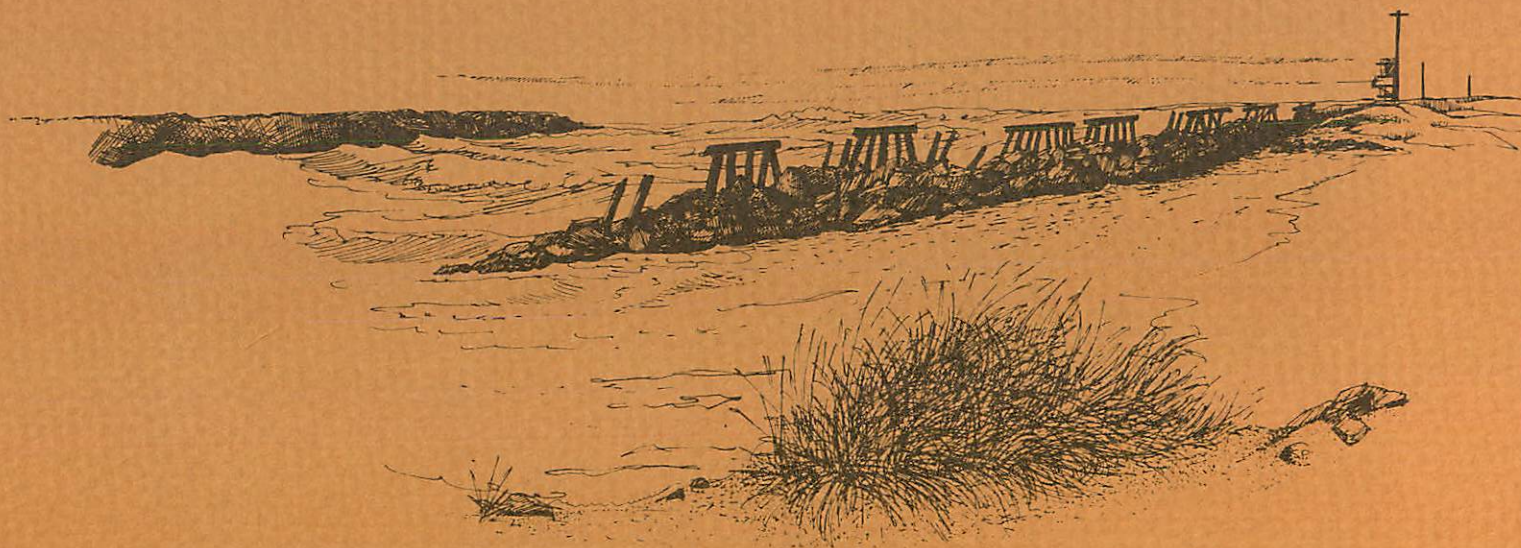


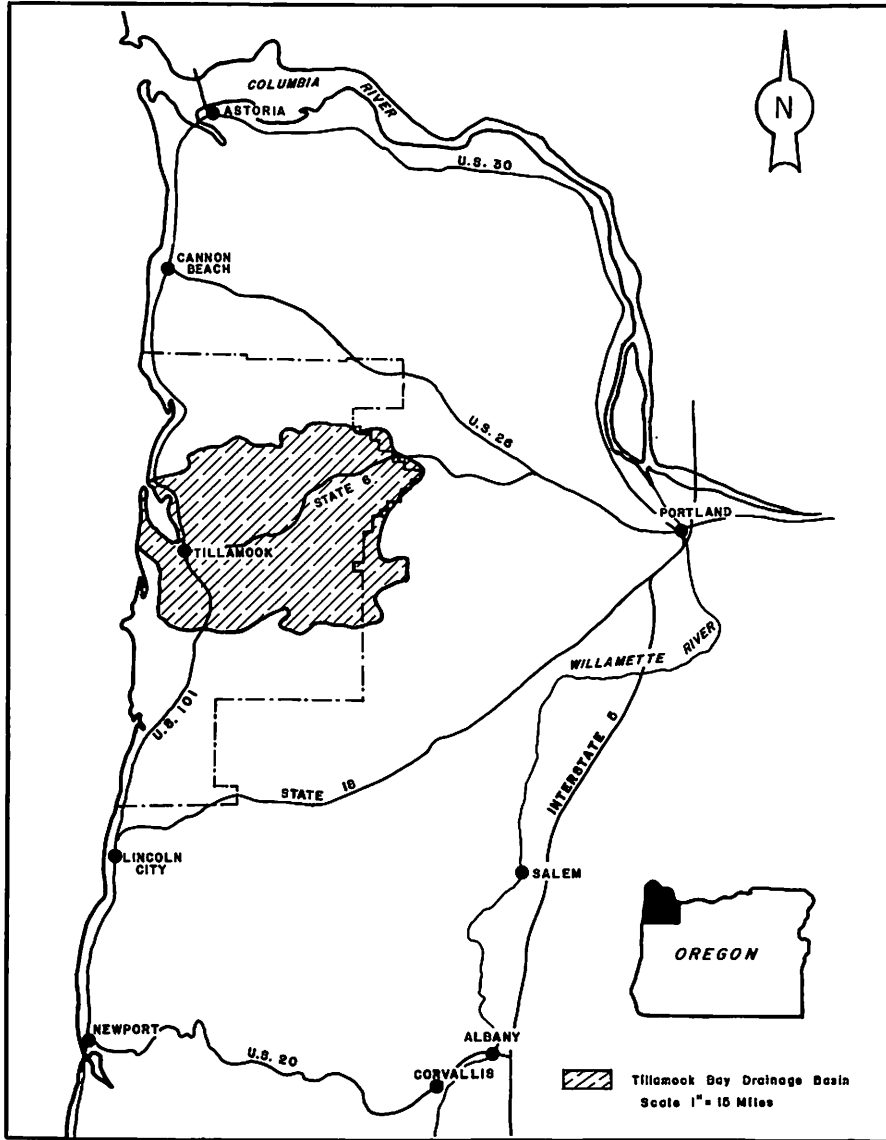
Tillamook Bay

Task Force Report

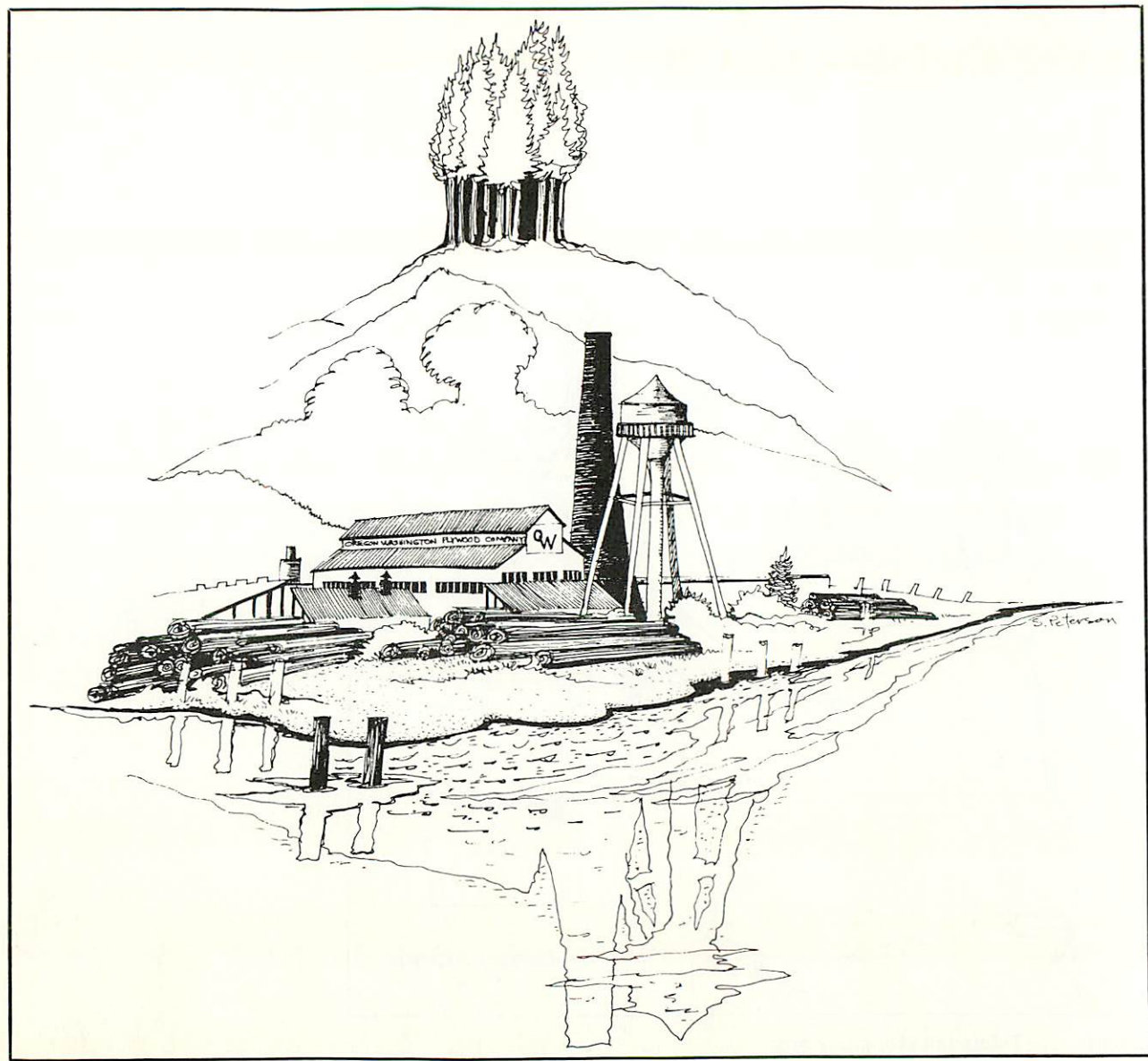
Oregon State University
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Special Report 462
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Location of Tillamook Bay study area



Introduction

The Tillamook Bay Task Force was organized in 1973 to study the Tillamook Bay area and to recommend guidelines for its future development.

From its beginning the Task Force set out to represent and respond to the needs and desires of local citizens. To this end, representatives from port authorities, city councils, the board of commissioners, and industry served on the Task Force.

Of equal importance were contributions by members of the technical advisory group, who advised the Task Force on a variety of topics. This group consisted of representatives from local, state, and federal agencies that exercise jurisdictions in the study area.

In their work, Task Force members examined natural, governmental, land use, and economic resource characteristics. Diverse natural and man-made elements were included in their study. They divided the Tillamook Bay shoreline and associated water areas into 15 units.

Specific elements receiving study ranged from geology, soils, and wetlands; through aquatic life and wildlife; to zoning, land use, and sewage services.

Early work involved central coordination among agencies and local authorities with jurisdiction on the bay. Members quickly identified

problems, collected planning documents and technical reports, and prepared overlays for maps.

Agency representatives helped gather existing data on the natural environment. Staff members assembled and presented information on governmental and land use characteristics.

After they had collated the available data and had formulated initial goals, members prepared a community attitudes survey to ensure that the goals defined during the study reflected needs and desires of the local citizens.

They then used the survey responses to revise the initial goals and to shape their final recommendations.

Six subcommittees were appointed to investigate particular aspects of the Tillamook Bay environment. These dealt with: 1) natural resources, 2) marine recreation, 3) transportation, 4) sedimentation and flood control, 5) planning and zoning, and 6) public education and study implementation.

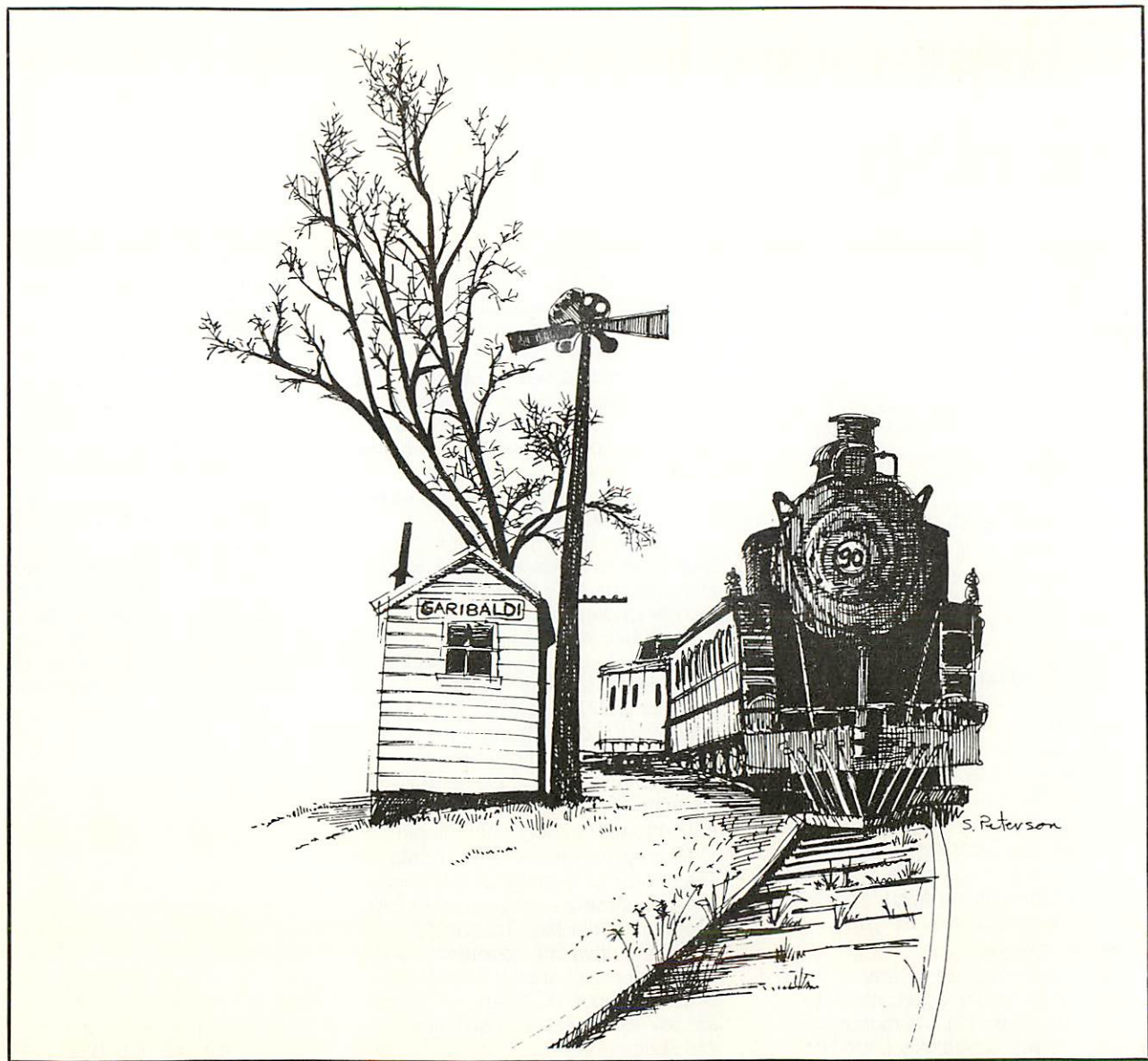
As they were working out goals, Task Force and technical advisory group members were also analyzing each unit of the bay. This analysis examined physical, governmental, and resource characteristics of the units, and their ability to accommodate certain uses and activities.

Next, the Task Force recorded results, noting locations where specific uses and activities were suitable or suitable with limitations. Uses were eventually ranked, assigning the highest priority to the most desirable alternative within a particular unit.

They performed this process three times, refining and modifying the order of suitable uses as they collected more information.

This report summarizes the results of their work, including their recommendations. It includes background information on the area of the study, the Tillamook Bay estuary, and adjacent uplands.

This report is published by the OSU Extension Service as part of its educational role in community development and its marine advisory program, and as a model for other development and planning efforts.



Tillamook Bay: its natural setting

“That part of the mouth and lower course of a river in which the fresh water of the river mixes with the salt water from the sea” is the glossary depiction of an estuary. Dictionary definitions fail to convey any sense of the natural beauty of an estuary—or recognition of benefits derived from its use.

A definition by the American Association for the Advancement of Science helps round out the meaning but does little more to portray the significant qualities of an estuary such as Tillamook Bay: “A semi-enclosed body of water which has free connection with the sea and within which ocean water is measurably diluted with fresh water from land drainage.”

However defined, estuaries are special places whose natural mixing of salt and fresh waters causes beneficial things to occur. The Tillamook Bay estuary is a good example of an estuary.

Located 50 miles south of the Columbia River and 65 miles north of Yaquina Bay, the Tillamook Bay estuary is six miles long, three miles wide, and has a surface area of 12 square miles at high tide. Steep, forested uplands flank it on the northeast and southwest.

To the southeast, the Tillamook, Wilson, Trask, and Kilchis Rivers create a broad flood plain. In the northeast a fifth river, the Miami, enters the estuary at Miami Cove, east of the town of Garibaldi, over a narrow flood plain.

All five rivers rise in the Coast Range, which borders the estuary to the east. Together they drain 533 square miles of the west slope of the range.

The terrain in this area is steep, with only a small percentage in slopes of less than 20 percent. Flat land occurs on the flood plains, on fills in the Garibaldi area, and on several remnants of marine and river terraces. As a result, little land is suitable and available for urban or rural development.

Flat lands on the flood plain are flooded annually in many locations. These plains are now used primarily for agriculture.

The strong marine influence of the Pacific Ocean dominates climate in the Tillamook area. Wet winters and dry summers characterize the region, and temperature ranges are narrow. Frequent storms between November and March drop heavy rainfalls over short periods. Average annual precipitation for the drainage basin

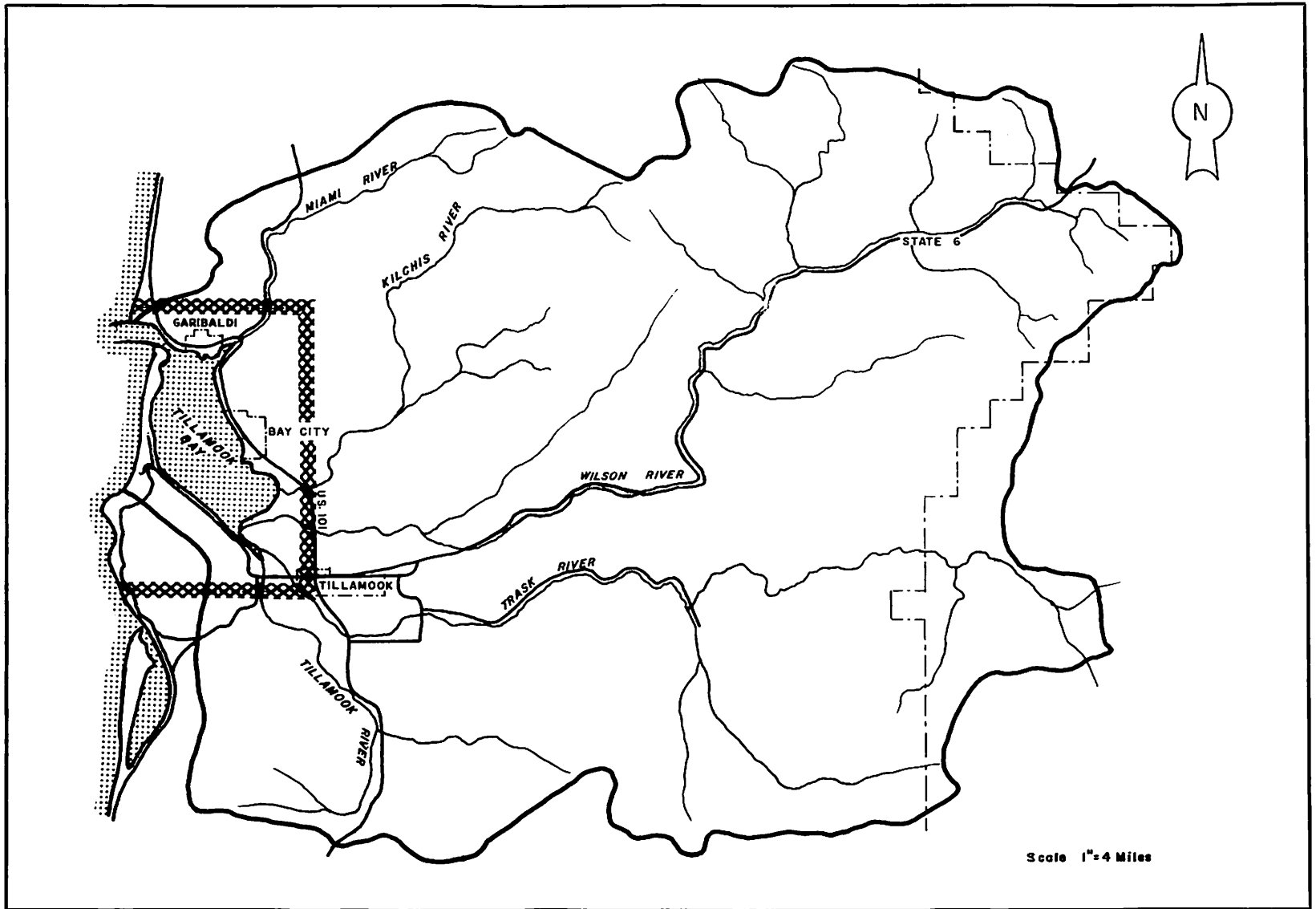
is 115 inches, with a 90-inch average at Tillamook and up to 150 inches at higher elevations.

The average January temperature is 42°F and the average July temperature is 58°F at Tillamook. Temperatures seldom drop below freezing near the shoreline of the estuary. This results in a growing season of 190 days without a killing frost. Fog is common throughout the year, particularly during night and morning hours.

Whatever the weather, the water temperature within the estuary usually remains in a range from 50° to 59° F all year, benefiting aquatic life. Salinity—the proportion of salts in the waters of the estuary—also affects the growth of aquatic life.

The Tillamook Bay estuary provides a range of habitat which supports a diversity of aquatic life and wildlife. No single type of habitat in nature is independent of the others. This interaction influences estuarine diversity and contributes to high natural productivity. In short, a healthy estuary is of great value in the food chain.

The Tillamook Bay estuary has been classified by the Oregon Coastal Conservation and Development Commission as a



Tillamook Bay drainage basin and study area

partially mixed, or two-layered, estuary with high marine biological value and high to moderately high terrestrial biological value. An active, interdependent ecological web links the water, tidelands, marshlands, rivers, and sloughs of the estuary.

Total productivity in an estuarine area is proportional to the ratio of length of shoreline to area of water surface. The longer the shoreline per unit of water area, the greater the potential for biological productivity. Thus, irregular, natural shorelines tend to be more productive than filled, straightened shorelines. When ratios of shoreline-to-surface area are favorable—as they are in the Tillamook Bay estuary—aquatic vegetation is abundant, making the estuarine system a food-rich habitat that serves as a nursery ground and habitat for a great many species of life.

Tides affect growth of estuarine vegetation, by decreasing or increasing the exposure of algae, phytoplankton, and other aquatic plants to sunlight as the volume of water changes over the marshes and tidelands. Thus, not only the length of the boundary between land and water but the surface area of and depth of the water in the estuary are important factors in estuarine productivity.

There are 4,163 acres of tideland and about 800 acres of marshland in Tillamook Bay.

Tidelands in Tillamook Bay estuary support several large communities of eelgrass, which are critical to the maintenance of a productive estuarine system. Many forms of crustaceans that are food for fish,

shellfish, and birds depend on eelgrass. Eelgrass also provides protective cover for young fishes and is an important diet of many types of waterfowl.

Phytoplankton and zooplankton, which swim or drift freely in the waters of the estuary, are an important food source for wildlife. These small estuarine plants and animals provide a large part of the food required by small fishes, which in turn are eaten by larger fishes that are of direct importance to the local commercial and sport fisheries.

Gravel, sand, and mud flats support large populations of benthic life such as clams and burrowing worms. The estuary and its tributaries are spawning grounds and rearing areas for a variety of fishes, including herring, smelt, shad, salmon, and trout. Herring, for example, spawn on rocks and pilings; surf smelt, in sand. Shad, salmon, and searun trout reproduce in the rivers. The waters of the bay provide rearing areas for these and other species during one or more stages of their life cycles.

At least seasonally all of the following abound within the Tillamook Bay estuary: salmon, steelhead, and searun cutthroat trout; bottomfish and rockfish; Pacific herring, northern anchovy, and surf smelt; Dungeness crab; ghost and mud shrimp; oysters; and cockle, littleneck, butter, gaper, and Eastern softshell clams.

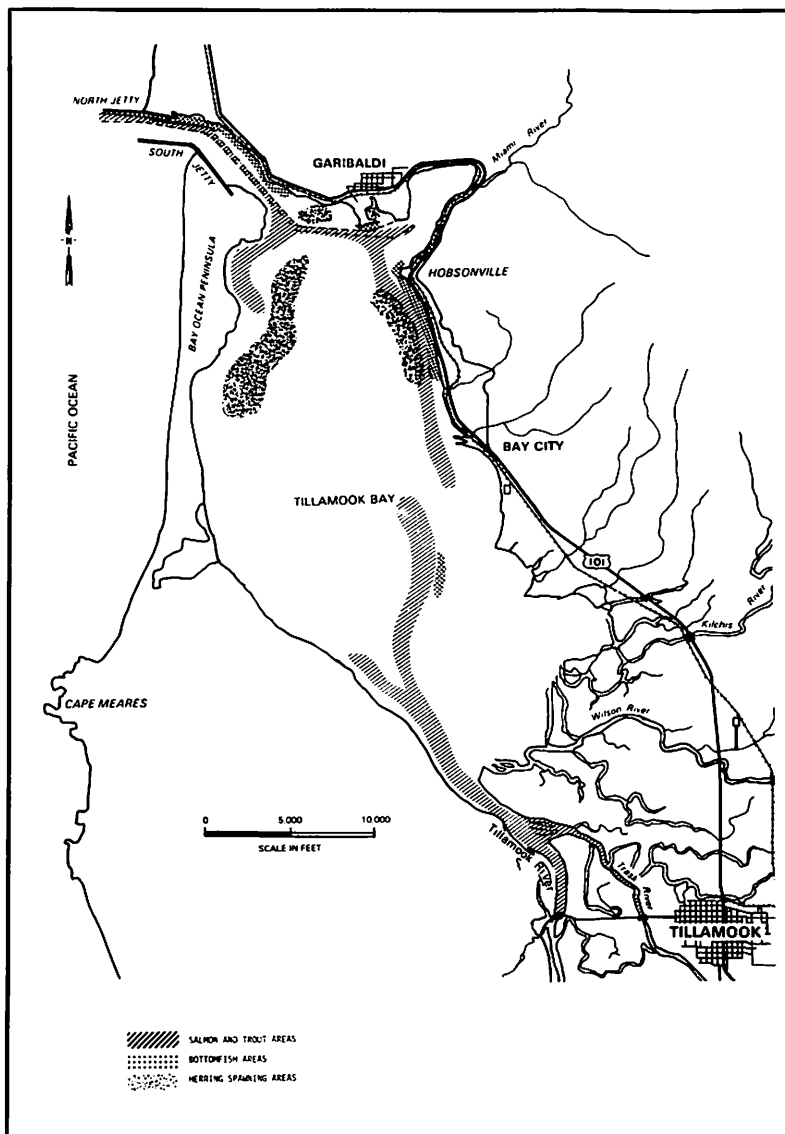
Marine mammals including the hair seal, fur seal, and sea lion live in the estuary seasonally.

The area's marshlands are an important source of vegetative nutrient. Vegetation and organic

debris from the marshlands is carried into the lower estuary by tide and flooding, where it decays. In the process, it nourishes organisms throughout the estuarine food chain. The marshes benefit the estuary in other ways. They absorb large amounts of flood water and chemical and organic contaminants. They afford excellent habitat for wildlife. More than 30 species of waterfowl and over 20 species of shore birds make the marshlands their home in one or more seasons. So do countless snails, worms, insects, and other invertebrates and plants upon which the birds depend for their diet. Freshwater mammals, including mink, otter, beaver, and muskrat, are common in the marshlands.

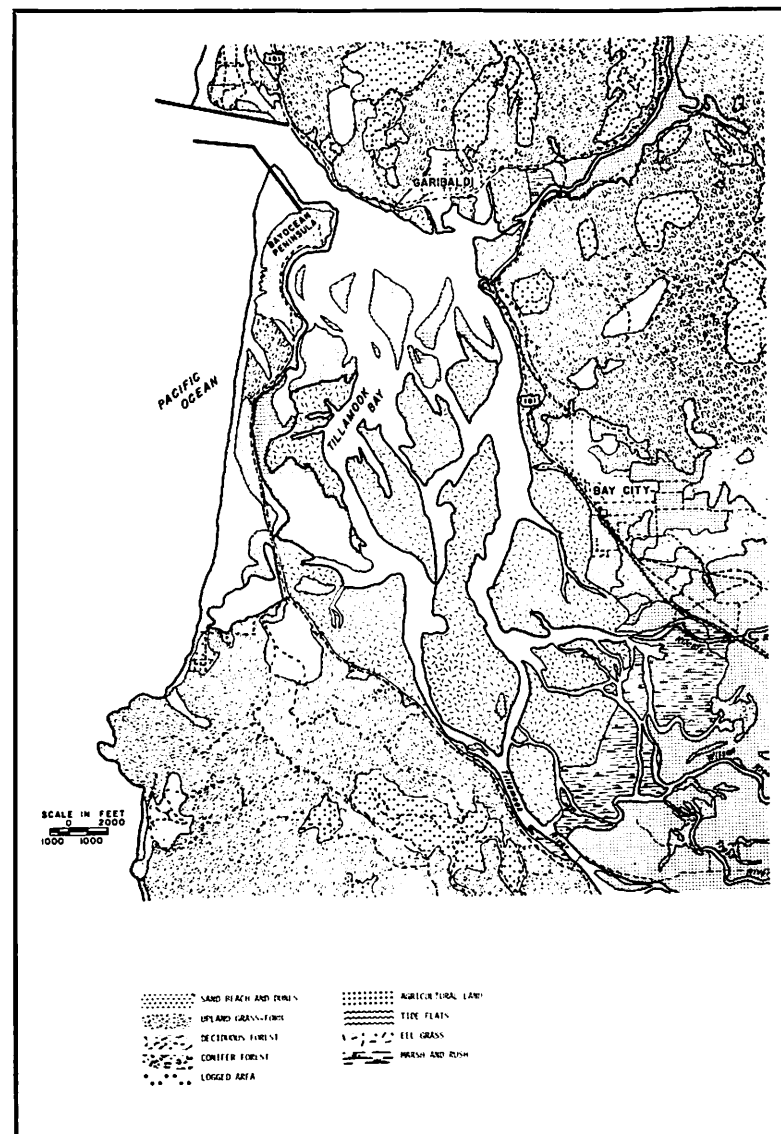
The diked and undiked lands on the flood plains along the tributary rivers support many of these same mammals plus deer and elk, which sometimes come into now-fenced pasture lands to graze.

The uplands surrounding the estuary are home to certain of the same wildlife and inland aquatic life forms as inhabit the flood plains. Freshwater game fish inhabit the upland lakes and streams, and bear are still to be found in the stands of timber that thrive on the slopes of the surrounding Coast Range.

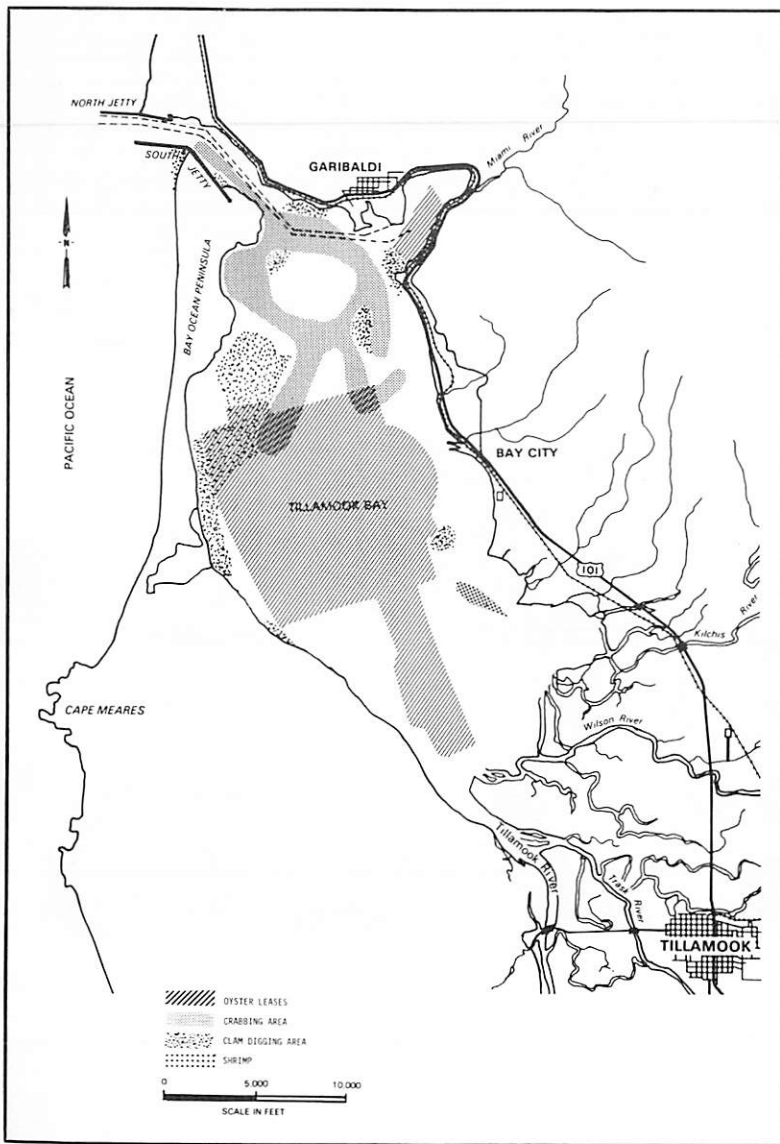


Sport fishing and herring spawning areas

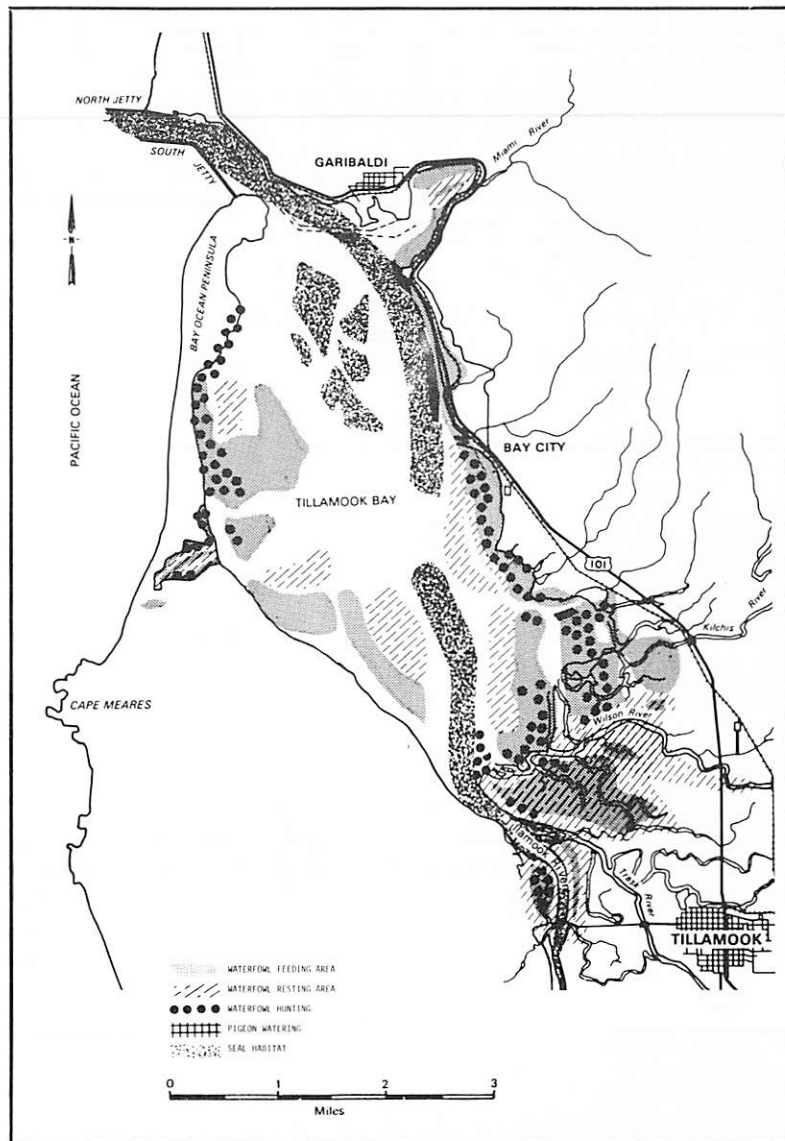
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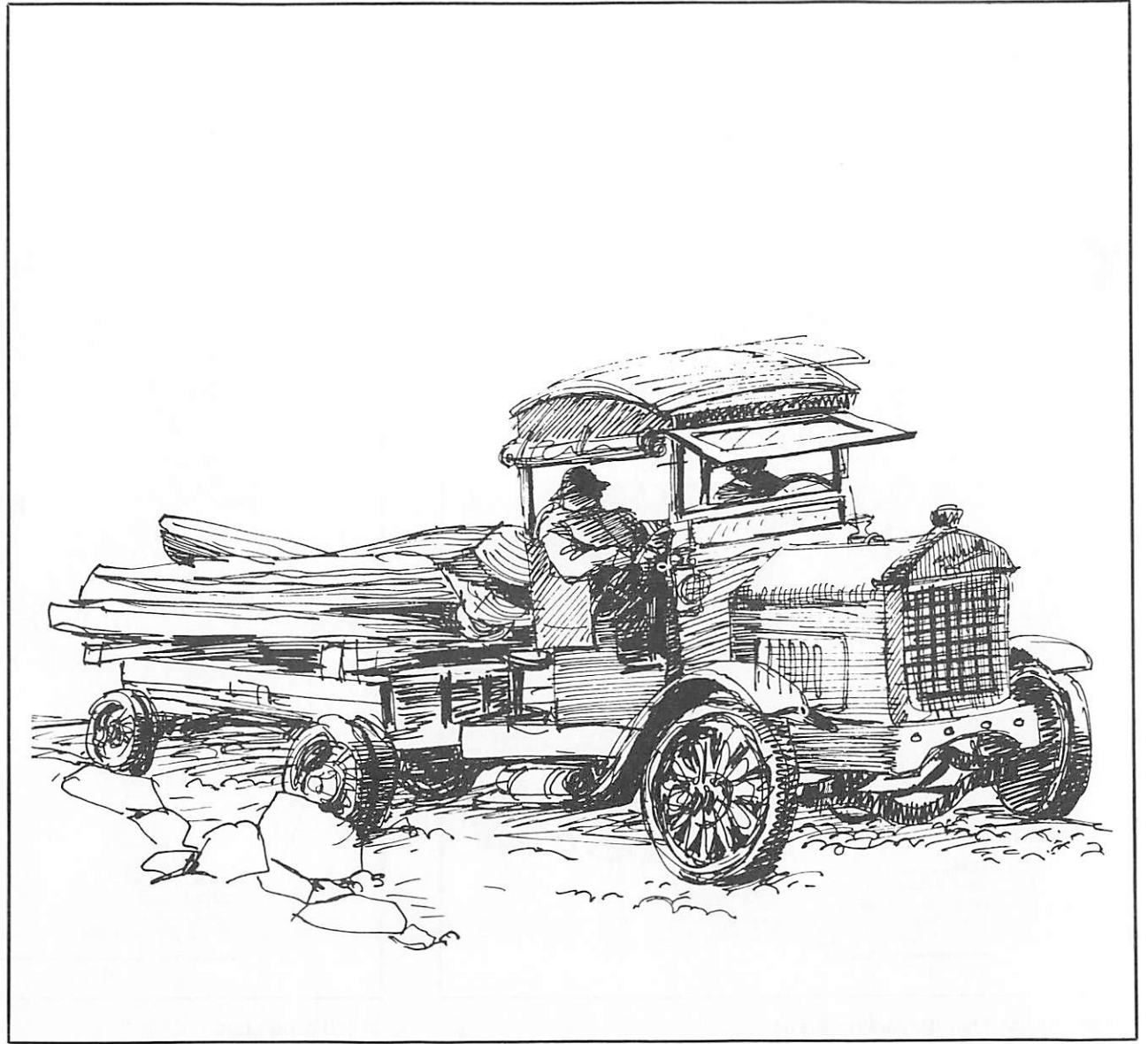
General habitat types in the Tillamook area



Principal shellfish harvesting areas



Wildlife habitats



Factors affecting life in Tillamook County

Abundant natural productivity in and around the Tillamook Bay estuary has always attracted human settlement. Settlement weaves the human animal into the web of biological interdependence of the estuarine ecosystem. The human resident, however, looks to satisfy economic as well as biological requirements. Effects of the human presence have escalated from negligible, when only a scattering of Northwest Indians frequented the region, to inescapable—at the present population level and economic pace.

Harvesting and managing renewable resources such as the timber of the upland slopes; fencing, diking, and converting flood plains to pastures for dairy herds; and extending stone jetties into the Pacific to protect shipping in the entrance to Tillamook Bay can elevate quality of life—to a limit. However, if pushed beyond that limit, the resulting alterations of natural conditions can move the human population into the province of diminishing returns, and hasten the collapse of the natural productivity on which economic welfare depends.

Thus, the Tillamook Bay Task Force began its study at least partly

out of concern for maintaining balance between quality of life and natural productivity within the study area.

Lumbering, farming, recreation, shipping, and fishing are the lifeblood of the communities around Tillamook Bay. Human population in Tillamook County has grown from a few hundred settlers a century ago to 18,000 by 1970. The economic development accompanying this expansion has accelerated certain rates of change, such as erosion and sedimentation. Some timber resources have been devastated by fires; areas of the bay that were once navigable have filled with sediments eroded from burn areas; several species of fish are scarcer than before these influences altered the estuary; some waterfowl and wildlife habitats, modified by economic activities, now sustain reduced bird and animal populations. These shifts, in turn, adversely affect some area residents and visitors who are not involved directly in the economic pursuits that accelerated the changes.

Sedimentation

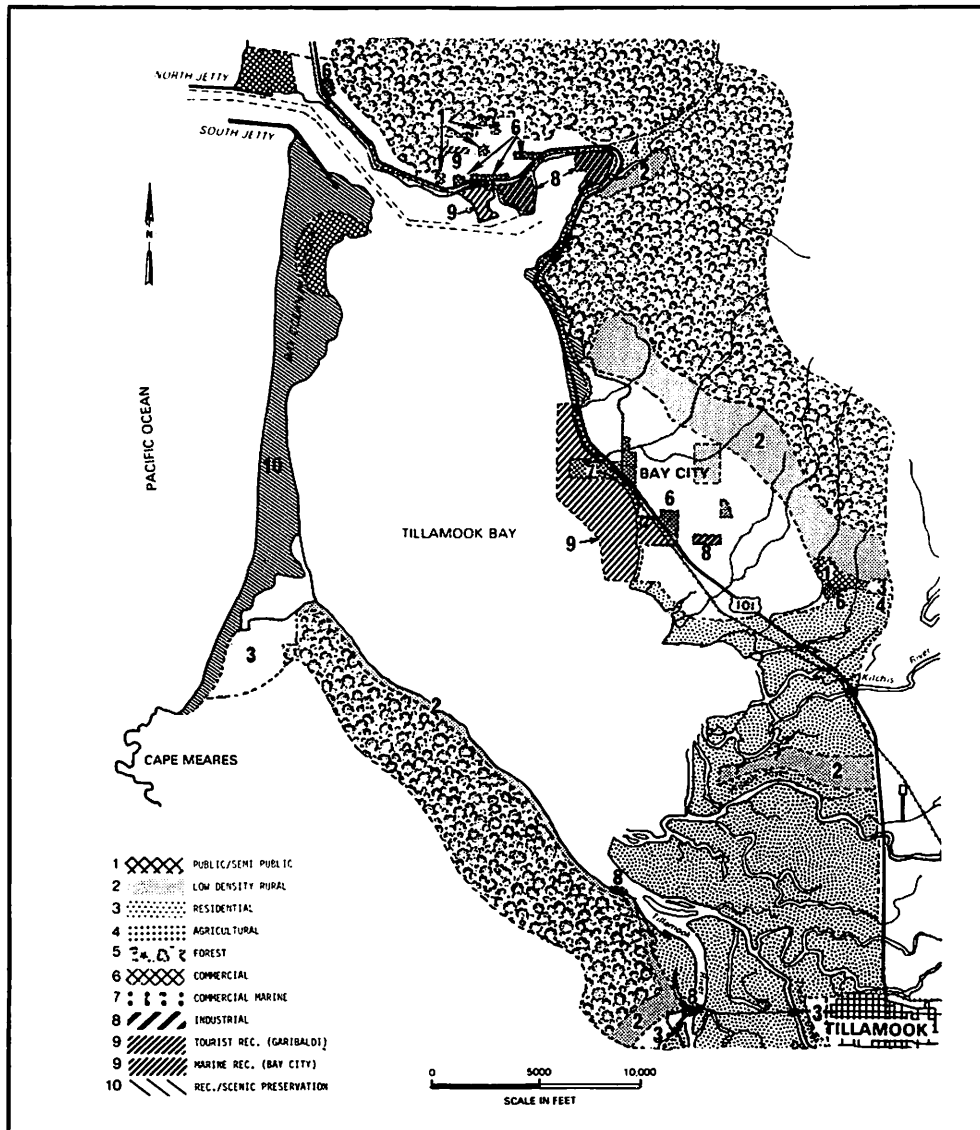
Four-masted schooners and steamers once loaded cargoes of lumber, cheese, and wood boxes at

docks on Hoquarten Slough. Now, the channels that they plied are impassable to shipping because of sedimentation. Shallow-draft small boats have trouble navigating the south bay.

Sediments carried down the rivers and into the bay have built up at rapid rates, filling former channels south of Garibaldi. All of the navigation channels south of the existing Garibaldi channel now have been abandoned.

Recent heavy erosion has been traced in part to the devastating fires that burned over extensive areas between 1933 and 1951. Trees and shrubs that had sheltered the soil from the direct impact of precipitation were denuded or consumed, exposing the soil to heavy erosion. This exposed and destroyed root systems that normally anchor soils on the steep slopes, further contributing to the erosion.

After a severe fire and until plants and grasses regenerate, precipitation strikes the exposed soil directly. Water saturates the soil, runs off the surface, and quickly erodes small channels. As these become larger, more soil particles and debris are carried downslope. Large channels and gullies form and move still larger



Composite of comprehensive plans

loads of sediments into streams and rivers.

Rapidly flowing streams carry the sediments along. The faster water moves, the greater the sediment load it can transport. But where flowing streams enter a body of standing water, as in the case of an estuary, the water velocity drops and the sediments settle to the bottom. In this way river channels become filled with sediments, often aggravating flooding when runoff is heavy. Thus, over a very brief period in relation to the geologic evolution of the bay, this process has caused significant reduction in the volume of Tillamook Bay.

Adding to the problem have been road construction, logging of green timber, and salvaging of burned and partially burned timber. Rains; denuded, shallow rocky soils; and steep slopes combine to produce abnormally high erosion rates.

The U.S. Army Corps of Engineers has been cooperating with Tillamook County and the Ports of Tillamook Bay and Bay City in local attempts to initiate a study of the feasibility of restoring navigable channels into the south bay. The project promises benefits beyond restoration of navigation. It can lower flood levels and avert potential property losses. If channels are created to allow salt water to intrude into the south bay, economically important estuarine production can be enhanced.

Land fill

This sedimentary filling of the estuary has caused rapid expansion of marshlands in the deltas of the

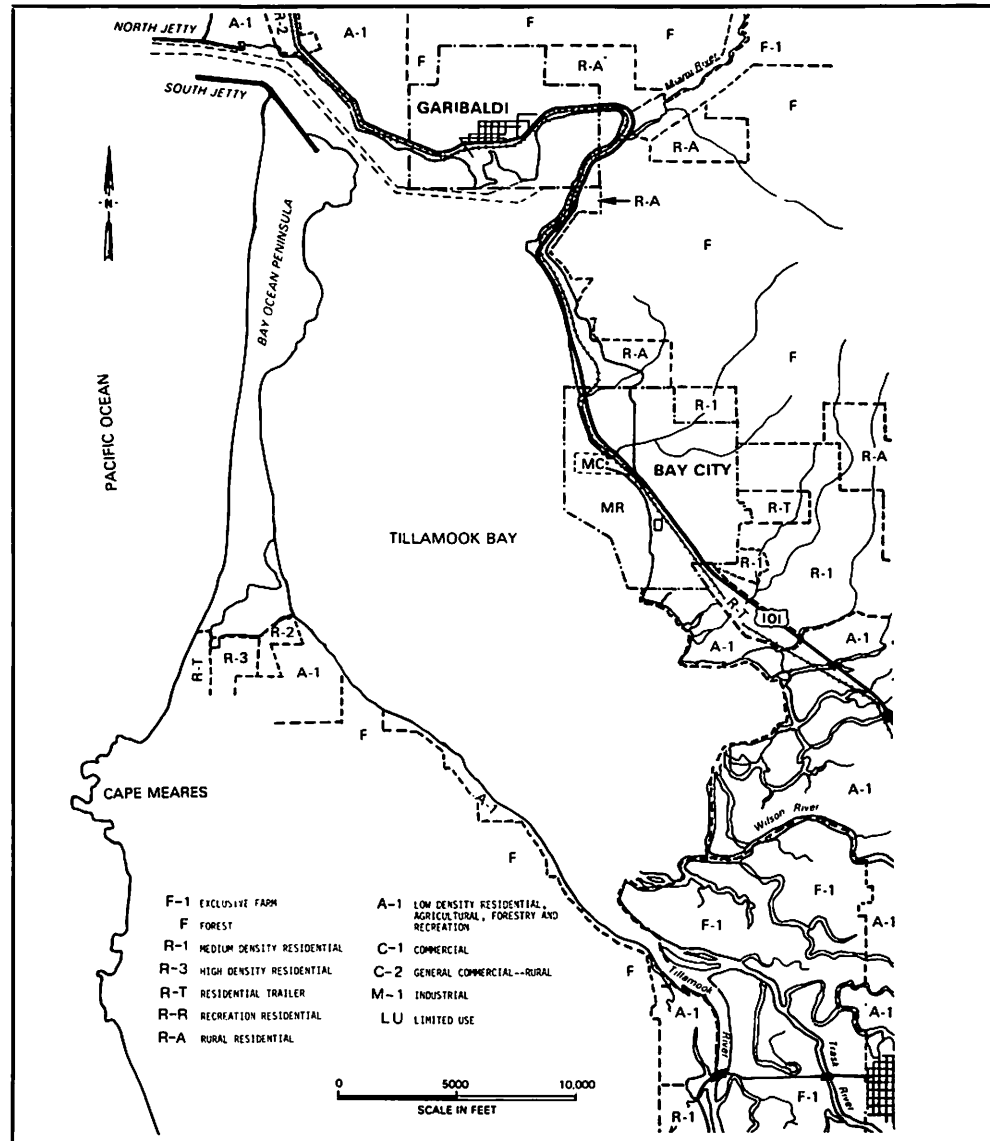
Kilchis, Trask, and Wilson Rivers. Over the past century the diking of tidal marsh area for dairy land has to some extent claimed acreage that once was part of the estuary.

Often the filling of estuarine wetlands and tidelands results in loss of natural productivity. However, some filling or placement of piling is occasionally unavoidable when making economically essential improvements for water-dependent human activities. Review of proposed fills by appropriate resource agencies that are equipped to assess the results of proposed alterations can minimize or eliminate destructive impacts.

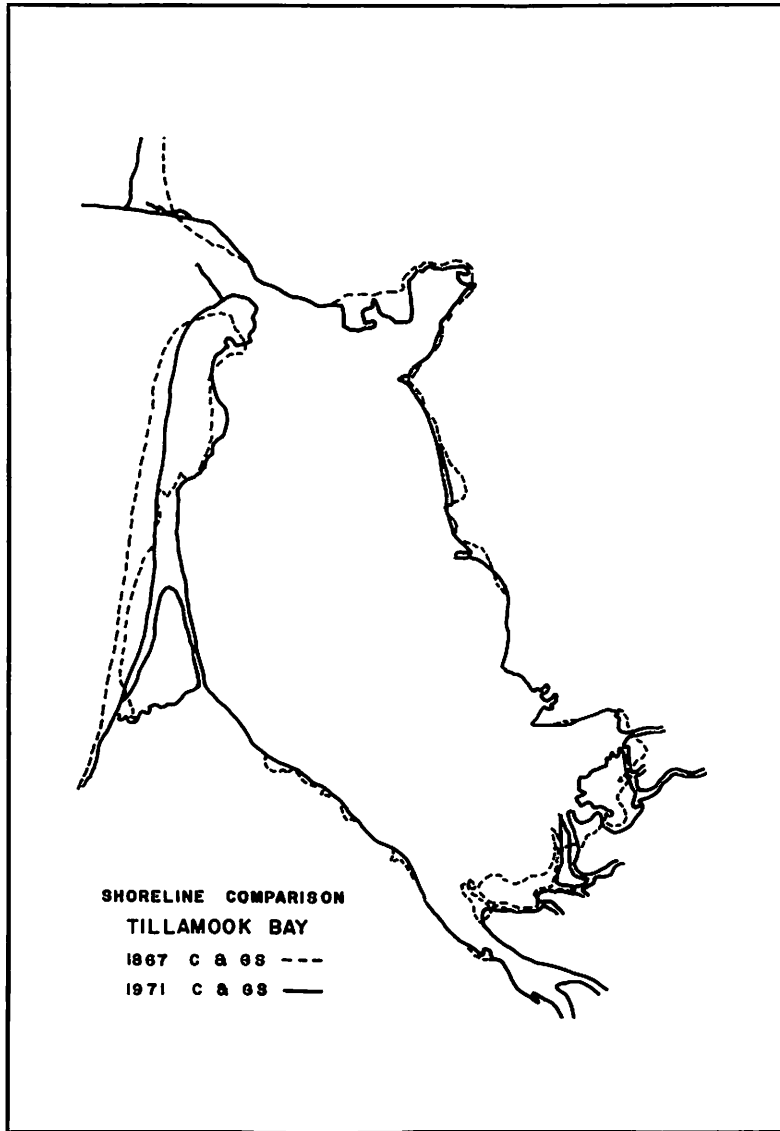
Ocean-front erosion has been a major concern in the Tillamook area for many years. Erosion and storm waves breached the Bayocean Peninsula in 1952 and contributed to the final loss of the resort community. Because sandspits are dynamic and change constantly under the onslaught of waves, currents, and winds, anything that upsets natural sand transport processes such as construction of jetties, removal of sands from beaches, and disruption of dune vegetation, may cause rapid changes in the configuration of a sandspit.

The Corps of Engineers believes that conditions have stabilized on the Bayocean Peninsula since it placed a rock fill there in 1954 to close the breach. The more recent construction of the south jetty is expected to contribute to stabilizing the peninsula too.

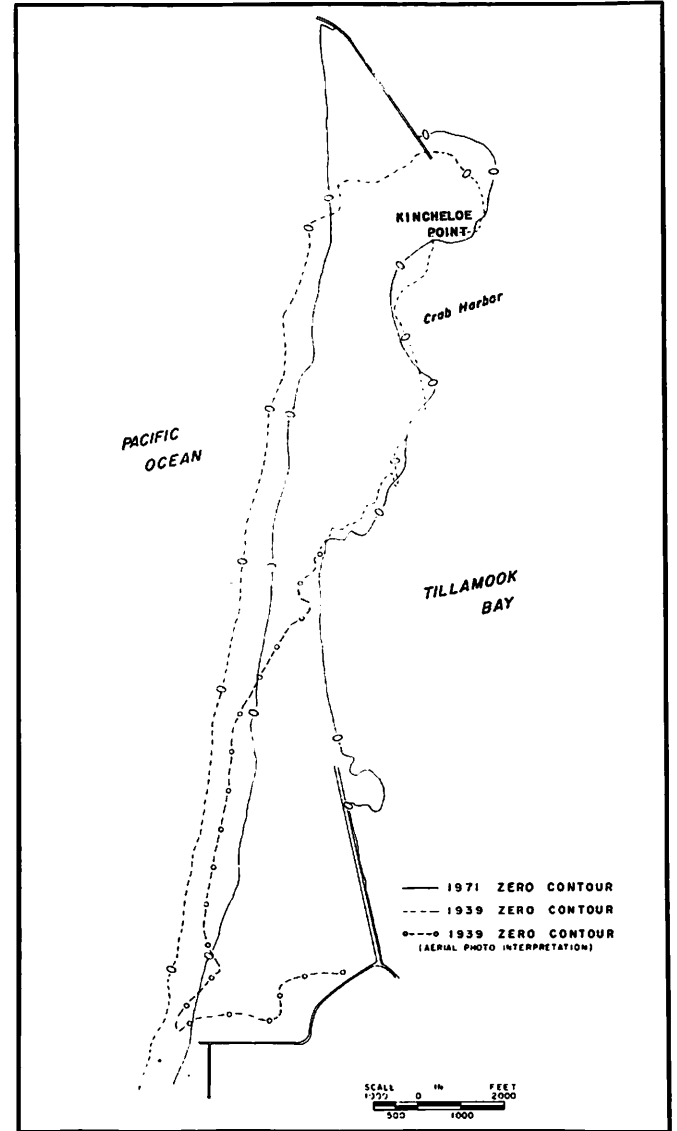
Wind erosion is a problem on the sandspit. Rabbit Hollow, a large wind



Composite of zoning maps



Shoreline changes from 1867 to 1971



Comparative changes in Bayocean Peninsula

gap, extends from the foredune across the sandspit to a point close to the bay shoreline. Sand that has collected behind the south jetty is also blowing over its top. Unless both areas are stabilized, this sand will continue to be deposited in the estuary at an abnormal rate. Strict regulation of activities on the sandspit is needed to prevent disruption of dune vegetation.

Local government jurisdictions

Tillamook County, the cities of Tillamook, Bay City, and Garibaldi, and the ports of Tillamook Bay and Bay City are the main governing bodies.

The county maintains a planning staff who are responsible for orderly development outside incorporated areas. The cities do not have full-time planning personnel but are very conscious of the need for planning. They have recently made progress toward assuring orderly development within incorporated boundaries.

Tillamook County has adopted a comprehensive plan and a zoning and subdivision ordinance. These serve as the basic controls for development. The county has also prepared a comprehensive water and sewage study, a transportation plan, and a parks and recreation study.

The city of Tillamook, which has a planning commission, recently completed a comprehensive plan and zoning ordinance. Bay City's planning commission approved a comprehensive plan and zoning ordinance and is now preparing a subdivision ordinance.

Garibaldi, which completed a comprehensive plan in 1964, recently formed a citizens advisory committee to begin preparing a new one with the help of the Clatsop-Tillamook Intergovernmental Council.

Tillamook County along with the Port of Tillamook Bay, which has jurisdiction over the southwest portion of the bay, have contracted with a consultant in cooperation with the Port of Bay City to prepare a development report for the bay. The Port of Bay City has jurisdiction over the northeast portion of the bay, and shares jurisdiction over the channel entrance with the Port of Tillamook Bay.

The offices of the Port of Tillamook are at the Tillamook industrial park, formerly a naval air station, southeast of the city. The port is evaluating the potential for channel improvements to provide shipping facilities in the south bay. The Port of Bay City has facilities at Garibaldi including a barge dock and a boat basin. Several commercial and industrial firms lease property from the port.

In addition to these traditional levels of local government, the area is dotted with many water and sewage districts. Water supplies for the region are drawn mainly from wells and creeks. The availability or lack of water and sewage treatment services influences residential and industrial development.

Garibaldi, Tillamook, and Bay City have sewage treatment plants that provide collection and treatment to more than 3,500 services. The Port of Tillamook Bay and the Tillamook County Creamery Association

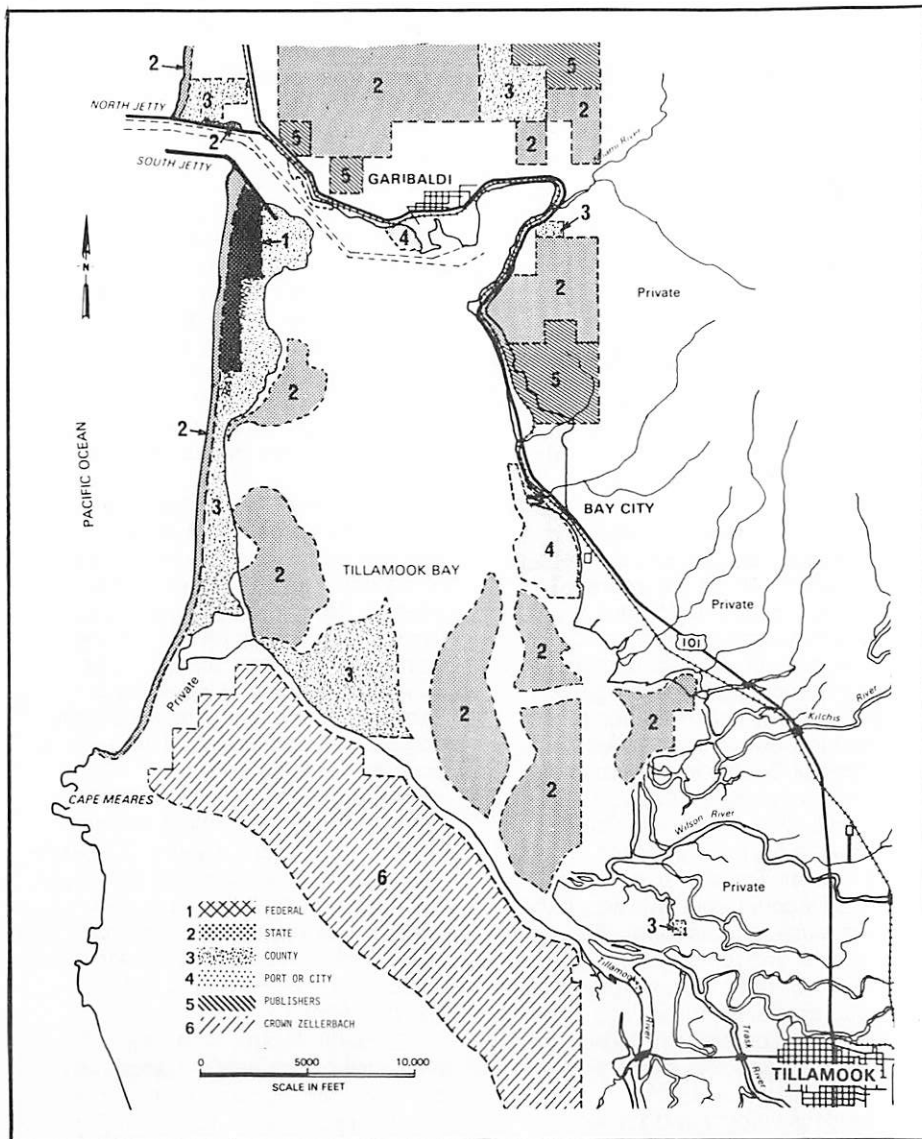
maintain private industrial sewage systems.

Bay City has one of the newest sewage treatment facilities in the county, with a potential to serve more than 2,000 units. Garibaldi recently updated its treatment plant, although it still lacks the capacity to handle wastewater from seafood processing plants on the waterfront.

Treated sewage is monitored by the Department of Environmental Quality at the Garibaldi boat basin, at Bay City, and on the Trask River. Sewage facilities in the area generally suffer problems because of infiltration during the winter months when precipitation is heavy.

Although many state and federal agencies are active in the area, the principal federal presence consists of the U.S. Army Corps of Engineers, the Bureau of Land Management, and the U.S. Forest Service. The National Land Use Policy Act, if passed by Congress, will emphasize procedures for establishing and maintaining a continuing inventory and guidelines for major land use decisions that have regional or statewide impact. The federal Coastal Zone Management Act encourages and assists states to develop and administer management programs to use land and water resources in the coastal zone wisely.

A number of state agencies also have a major impact on the area: the State Land Conservation and Development Commission, the now defunct Oregon Coastal Conservation and Development Commission, the Department of Geology and Mineral Industries, the Department of



Land ownership patterns

Environmental Quality, the Division of State Lands, the Nuclear and Thermal Energy Council, the Soil and Water Conservation Commission, the Water Resources Department, the Department of Health, and the Highway Department, among them.

Land ownership

Patterns of land ownership influence economic growth. Small, privately owned parcels tend to be developed before larger parcels. Larger parcels in the study area, mostly held by the state or the federal government, probably will not be available for development in the foreseeable future. Some of the large private holdings may have potential for large-scale development into residential subdivisions, industrial complexes, or recreation sites.

Much of the uplands outside incorporated areas is held by the Oregon Department of Forestry. Federally owned parcels at Barview (for the U.S. Coast Guard) and on the north end of the Bayocean Peninsula account for a small portion of the study area.

The largest areas of public lands owned by the county are at Barview and on the Bayocean sandpit. Cities in the area hold only small parcels, which are mostly reserved for open space, public utility, or watershed needs.

Private lands lie within incorporated cities and on the flood plain. Crown Zellerbach and Publishers Paper Company own large upland areas.

The tidelands are owned by the state, county, port, and by private

citizens, a situation contributing to confusion. More than 50 percent of the immediate shoreline of Tillamook Bay is in state highway or Southern Pacific Railroad rights of way, greatly restricting use and activity in many locations.

Ownership patterns indicate a lack of land suitable for development in the shoreland area. Ownership in the rugged uplands, on the tidelands, and at the Bayocean Peninsula is all in large parcels. Incorporated cities, communities, and flood plain areas are divided generally into smaller, privately held parcels.

The land east and south of Bay City and Tillamook is in private ownership, but flooding and agricultural use curtail development. Garibaldi, Barview, and Cape Meares have few private parcels of land.

Existing land-use patterns include industrial, commercial, residential, navigational, pasture, timber production, or public purposes. Industrial development on Tillamook Bay exists principally along the Garibaldi shoreline, where ocean-going barge facilities, wood products processing plants, and fish processing facilities are located. Oyster processors are located at Garibaldi, Bay City, and on the southwest shore. Other major industrial complexes within the study area include the Port of Tillamook Bay industrial park and the Tillamook cheese factory.

Channels for shallow-draft shipping extend from the bay entrance to a turning basin near Miami Cove.

Lands along the Miami River delta and flood plain and an extensive area

on the south bay flood plain are used primarily as pasture for dairy herds.

Commercial development is concentrated in the cities and along U.S. Highway 101. Residential development is also centered in the cities. All five population areas have urban densities exceeding two or more dwelling units per acre.

Upland areas are important timber producers that are managed by the Oregon Department of Forestry and by private industry.

Public and semi-public lands are concentrated at Barview and on the Bayocean Peninsula. The main concentration of urban land use is in Garibaldi, Bay City, and Tillamook. Low-density rural concentrations are found on the south flood plain and Hobsonville Point on the county road.

FISH and CRAB
Visitors Welcome



Proper framework for development: public participation

As the preceding overview suggests, planning for regional development is involved, complicated, and time consuming. In attempting to draft recommendations for development in the area of the Tillamook Bay estuary, the Task Force sought the counsel of the residents of the communities that will be most affected by development.

In April 1974 the *Tillamook Headlight Herald* published a Task Force survey designed to profile community opinion on conservation and development issues pertaining to Tillamook Bay.

Survey questions dealt with residents' attitudes about:

- 1) use of the Bayocean Peninsula
- 2) restoration of the bay
- 3) additional recreation facilities
- 4) recreational use of the bay

Approximately 1,000 people responded, and their responses gave valuable insight into public opinion on future management and development of Tillamook Bay. According to respondents area residents are generally concerned about:

- 1) conserving resources and preserving the rural nature of Tillamook County
- 2) supporting local government and planning and management programs to solve problems
- 3) controlling growth to ensure that natural amenities are preserved
- 4) lack of job diversity and job opportunity
- 5) rundown areas

Residents place high value on:

- 1) lack of urban pressures
- 2) recreational amenities
- 3) natural beauty and environment
- 4) quality of life

They think that Tillamook Bay resources should be managed to provide:

- 1) new industrial locations around the bay
- 2) water transportation and shipping facilities
- 3) additional access to the shoreline
- 4) additional boat ramps
- 5) general recreation including fishing, boating, clamming, and sightseeing.

They want to discourage:

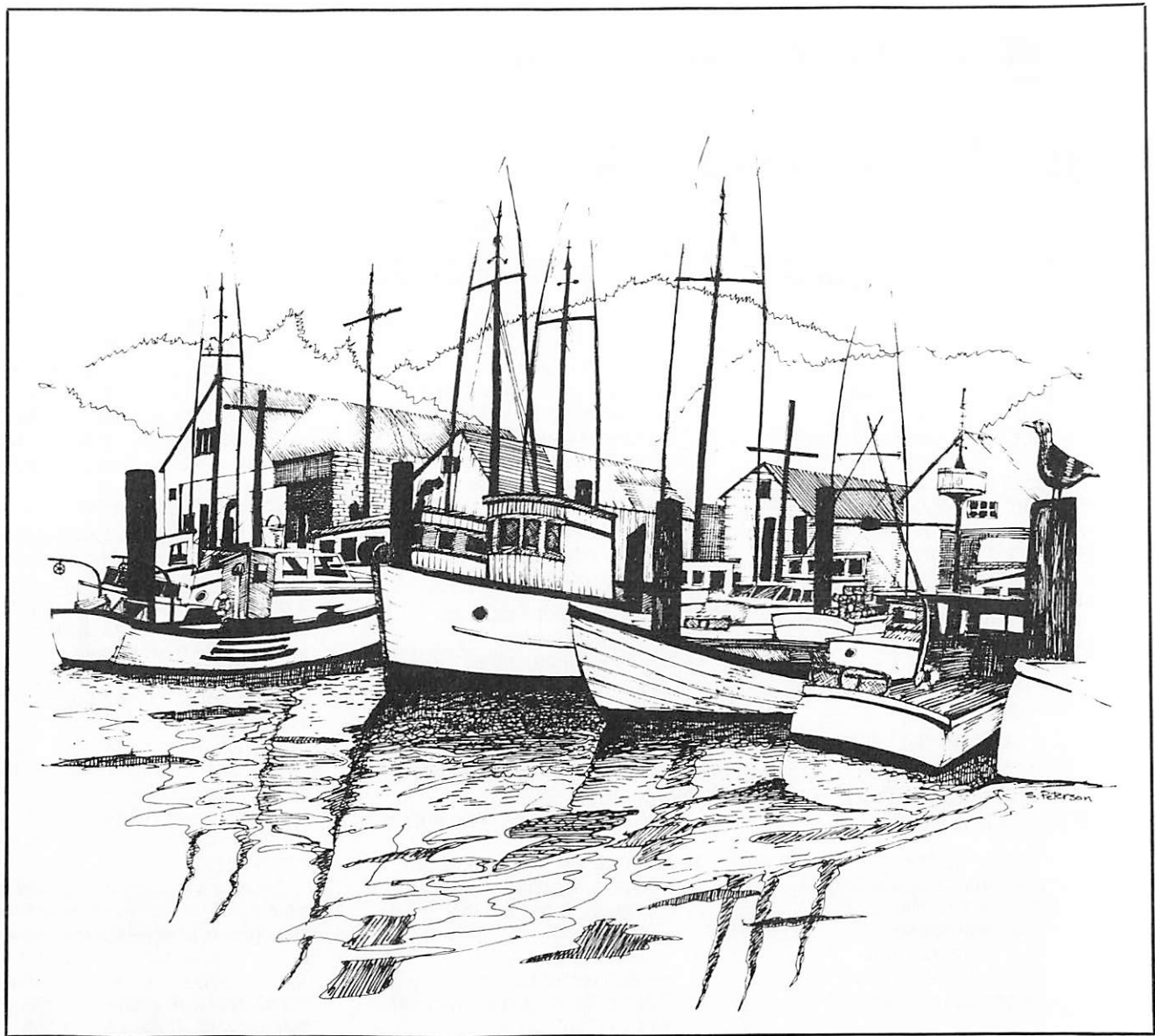
- 1) continued development of the county tourist industry
- 2) additional motels and restaurants near the bay
- 3) additional marinas (although they strongly favor more boat ramps)
- 4) rapid urban growth

Most respondents favor using the Bayocean Peninsula as a natural preserve with no development or as a day-use park with only limited facilities; few favor its development for commerce or homesites.

Responses to the survey also support consolidating the Ports of Tillamook Bay and of Bay City, if an equitable tax base can be established—although 21 percent are undecided on this issue.

Finally, respondents prefer using local taxes to help pay for restoration of the bay.

Thus armed with knowledge of the opinions of concerned citizens and background information on resource and planning concerns for the Tillamook Bay estuary, Task Force members were ready to begin formulating recommendations.



Task Force recommendations

For orderly development in the Tillamook Bay estuary area, The Task Force makes the following recommendations:

Planning

1. The development guidelines contained in the Task Force Report should be adopted and incorporated into comprehensive plans. New management programs for the area should be prepared by local, state, and federal agencies.

2. There should be a coordinated, on-going planning program for integrating the present and future studies of Tillamook Bay; it should strike a balance between development and conservation and should be monitored by the Task Force.

3. A site-specific development program should be prepared immediately to coordinate activities of all local, state, and federal agencies and authorities on the Task Force that have interest and that exercise jurisdiction in the area.

4. The Task Force should be granted authority to conduct initial review of any development proposals, with all local government agencies represented.

5. An investigation should be made to determine the feasibility of consolidating the Ports of Bay City and of Tillamook Bay, with a fair and equitable tax base.

6. The Port of Bay City and the governments of Bay City, Garibaldi, and Tillamook County should immediately prepare a traffic flow, access, and parking plan for the Garibaldi shoreline.

7. The U.S. Army Corps of Engineers should be encouraged to follow through after completing an approved, multiple-purpose study of Tillamook Bay, to effect maximum restoration of the bay, including flood alleviation, restoration of navigation, improvement for recreational uses, and enhancement of aquatic environment.

8. Policies of the Oregon Coastal Conservation and Development Commission and of the Land Conservation and Development Commission should be reviewed; those judged applicable and consistent with Task Force recommendations should be adopted.

9. Studies should begin immediately on the Nehalem, Sandlake, and Nestucca estuaries.

10. Appropriate and innovative regulatory techniques should be developed for Tillamook Bay.

Uses and activities

11. Shoreline uses that are *water-dependent* should have first priority for development in the areas identified by the study as suitable; *water-oriented* shoreline uses should receive second priority.

12. Public access to the shoreline of the bay should be unrestricted everywhere possible, with access points well marked, permissible uses clearly identified, and parking facilities provided.

13. Planning programs should strive to separate conflicting or incompatible land and water uses and activities.

14. Effective pollution control measures should be established and enforced in the Tillamook Bay drainage basin; sewage treatment services should be provided as many residents as is economically feasible; subsurface sewage disposal should be carefully managed; and the air shed of the Tillamook Bay drainage basin should be studied and air quality standards should be maintained.

15. Creation and maintenance of navigation channels that can accommodate barge traffic into the Tillamook River should be encouraged.

16. The effect of increased sand and ghost shrimp populations on other estuarine resources should be investigated and methods to control or reduce ghost and sand shrimp populations should be studied.

17. Aquatic habitats within inland water systems should be enhanced and maintained; the filling of inland marshes that provide wildlife habitats should be discouraged except when resulting losses can be justified.

18. Surface and ground water quality in the Tillamook bay drainage basin should be kept at the maximum level attainable under practical principles and standards.

19. Oyster farming should be encouraged as a compatible, productive and viable industry.

Multiple-purpose restoration and protection

20. Tillamook Bay should be restored by removing recent sedimentation, the south bay should be made navigable, aquatic and wildlife habitat should be restored, and *diverse* economic opportunity should be encouraged.

21. The south jetty at the channel entrance should be extended to the authorized length.

22. Recreational uses of the bay and development of associated support facilities should be encouraged.

23. Recreation sites for fishing, hunting, boating, scuba diving, and shellfish harvesting should be identified with appropriate markers at all suitable locations.

24. Open space in and around Tillamook Bay should be conserved as much as possible.

25. Historic and otherwise unique sites and structures should be identified with appropriate markers.

26. The visual and aesthetic qualities of the bay should be enhanced and conserved.

27. The fish industries should be expanded by developing appropriate programs, particularly in aquaculture and mariculture, by emplacing artificial reefs to enhance fish populations, and by constructing a marine science facility to house studies on methods for improving estuarine production.

28. The status of proposed improvement and bypass route for U.S. Highway 101 should be monitored by the Task Force.

Resource conservation

29. Maintaining a healthy and functioning physical and biological system in Tillamook Bay is vital to the region's economy and is, therefore, a basic goal of the Task Force; this goal includes placing high value on the estuary's food production and cycling of nutrients for fish and wildlife, absorption of pollutants, rearing and sheltering of fish and wildlife, suitability for commerce and shipping, and recreational diversity.

30. Fish and wildlife should be well managed and the populations of finfish, shellfish, waterfowl, and other wildlife species should be increased to the estuary's carrying capacities.

31. Management guidelines and regulations for the harvest of fish and shellfish should be enforced rigidly.

32. A coordinated program should be established to monitor and control land use in the Tillamook Bay drainage basin; its scope should not be limited to logging, road construction, land development, and reclamation.

33. Debris and sediments should be removed from inland waterways to increase stream flow capacities and to limit downstream transport of debris.

34. River banks and the bay shore should be stabilized wherever erosion is taking place; after critical sites are identified, riprap or other means of stabilization should be used.

35. Timber harvesting along major river banks and the bay shore should be managed to minimize shoreline disruption.

36. Establishment of multiple-purpose channels for navigation, flood abatement, and greater saltwater intrusion should be studied further; the impacts of dredging on estuarine habitats should be assessed; disposal of dredge spoil should be consistent with Task Force guidelines; and restoration or removal of existing pile dikes in the south end of the bay should be investigated.

37. Disposal of dredge spoils within the drainage basin should be at sites recommended by the Task Force; the formation of spoil islands or artificial tide flats should be prohibited unless associated with suitable and approved shore-related development or with enhanced marine productivity.

38. Any development on the flood plain or along the bay shore which would restrict free passage of water or would interfere with flood overflow should be prohibited.



Epilog: the ideal for Tillamook Bay

This report looks at the Tillamook Bay estuary, past and present. Resource management problems are multiple but far from insoluble.

But what of the estuary's future?

The restoration of Tillamook Bay is a goal desired by a majority who live around it. Any project of this magnitude implies a great investment in time and capital for:

- 1) extensive dredging of the estuary
- 2) reestablishing aquatic life in disturbed areas
- 3) detailed scientific studies employing sophisticated monitoring to predict effects of dredging and the probability for enhancing aquatic life—*before taking action.*

Such restoration cannot result from a single governmental or institutional program, however. The costs loom prohibitive and the ecological effects are as yet unknown.

A realizable first step in restoration is proper management and regulation of existing resources.

An important preliminary step has already been taken: the residents around the Tillamook Bay estuary have recognized that significant problems exist; concerned individuals—and groups such as the Task Force—are motivated to find solutions.

The condition of the estuary can never be as it was before the area was settled. The future reality will always be less than the ideal. But human impact on natural productivity can be managed, in the Tillamook Bay estuary and elsewhere, if concerned residents will act.

Glossary

anadromous—(of fish) migrating from the sea up a river to spawn.

aquaculture—the artificial raising, or farming, of freshwater species.

aquatic life—that which lives or grows in water.

benthic—on or in the bottom of a body of water, usually in reference to marine minerals, plants, or animals.

carrying capacity—ability of a natural system to support a finite, specific number of a species on a perpetual basis.

crustacean—aquatic animal that has a hard, jointed outer shell, such as lobster, shrimp, or crab.

dredge spoil—disposable material excavated by dredging.

ecology—branch of biology dealing with the relation between organisms and their environment.

estuary, estuarine—that part of the mouth and lower course of a river in which the fresh water of the river mixes with the salt water from the sea.

flood plain—a nearly flat plain along the course of a river that is naturally subject to flooding.

habitat—the native environment of an animal or plant.

invertebrate—an animal without a backbone.

jetty—a pier or structure of stones or piles projecting into an open body of

water to protect a channel or harbor by deflecting waves and currents.

mariculture—the artificial raising, or farming, of marine species; similar to aquaculture except generally used in reference to activity in salt water.

marshland—an area characterized by marshes, swamps, or bogs.

pelagic—of, relating to, or living or occurring in the open sea.

riprap—the placement of boulders or other heavy material along a shore or bank to lessen the impact of waves or currents against it.

slough—an inlet from a river or estuary, generally in bottom land.

terrestrial—that which lives or grows on land; not aquatic.

tideland—land alternately exposed and flooded by the ebb and flow of the tide.

upland—land or an area of land lying above the level where water flows or flooding occurs.

wetland—a tract of land having wet and spongy soil.

wildlife—animals that live free in nature, as opposed to those fenced in and domesticated, including species hunted for food or sport.

Our village life would stagnate if it were not for the unexplored forests and meadows which surround it. We need the tonic of wilderness—to wade sometimes in marshes where the bittern and the meadow-hen lurk, and hear the booming of the snipe; to smell the whispering sedge where only some wilder and more solitary fowl builds her nest, and the mink crawls with its belly close to the ground. At the same time that we are earnest to explore and learn all things, we require that all things be mysterious and unexplorable, that land and sea be infinitely wild, unsurveyed and unfathomed by us because unfathomable. We can never have enough of Nature. . . .

—HENRY DAVID THOREAU
WALDEN

This report summarizes the work of the Tillamook Bay Task Force Study Team and cooperating State and Federal agencies.



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SERVICE**

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