COQUILLE RIVER ESTUARY MANAGEMENT PLAN

VOLUME III

PART 2

Inventory & Factual Base

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1. INTRODUCTION

1.1 Purpose and Scope of Plan

The Coquille River Estuary Management Plan provides a legal and technical basis for land use planning on the Coquille Estuary and its adjacent shorelands. For the purposes of this Plan, the estuary extends to the head of tidal influence as determined by the Division of State Lands. The adjacent shoreland area is defined in Part ill, section 1, and is illustrated on the accompanying sets of maps, as consistent with Statewide Planning Coals requirements.

The Plan must comply with Statewide Planning Estuarine Resources (Coal #16) and Coastal Shorelands (Coal #17). The Plan Provisions (Plan Map and Policy Statements] are designed to fulfill the many requirements of these goals; as necessary, reference is also made to other goals.

The Plan provides a basis for future State and Federal permitting actions for any proposed projects which affect estuarine waters, intertidal areas or other wetlands over, which these agencies have jurisdiction.

The Plan also promotes coordination between affected local governments (Coos County, Cities of Bandon, coquille and Myrtle Point, Ports of Bandon and Coquille, and other special districts) in the management and development of the Coquille River Estuary's natural and economic resources.

1.2 Statutory Background

See Section 2.3 for more detail.

Legislation requiring cities and counties to prepare comprehensive plans in accordance with the Statewide Planning coals is commonly referred to as Senate Bill 100, which became law in 1975, later amended in 1978 by Senate Bill 570. The specific statutes are found in ORS Chapter 197. Any actions within the scope of the coquille River Estuary Management Plan, which requires that permits must be consistent with the Plan provisions.

In addition, other State Statutes dealing with dredge and fill of tidelands, mitigation and other actions in estuaries must be complied with under the permitting authority of the Department of State Lands, and the U.S. Army corps of Engineers.

The Coquille River is classified as a "Shallow-draft Development Estuary;" that is, an estuary with maintained jetties and a main channel maintained by dredging at 22 feet depth or less.

1.3 Historical, Cultural and Economic Setting

The history of the Coquille River has been dominated by agriculture, lumbering and commercial and recreational fishing, it is a river system with estuarine characteristics; at one time substantial boats plied the river using the high tides even as far as Myrtle Point. The predominance of winter flooding restricted uses in the floodplain to agriculture and some industrial uses, with the result that settlements developed on benches above the river.

Until the advent of paved roads, the Cities of Myrtle Point and Coquille relied on the river for passenger and freight transportation. The Port of Bandon had ocean-going commerce surpassing Coos Bay until the disastrous Bandon fire of 1936 and shoaling at the entrance brought its eclipse. Up-river sedimentation and log debris increased due, in part, to the use of splash-dams for log transportation and other forest practices and in part to stream bank erosion or urbanization. As a result, navigation is no longer possible on many of the upper tidewater areas, and even recreational boats have difficulty negotiating severe shoals at low tide, current forest practices are more sensitive to such problems, but the legacy of earlier practices remain.

The character of the Coquille Valley is rural: none of the cities has over 5000 population. (See volume I, Part 1, Section 4 - Demographics for population data).

Prior to white settlement of the coquille River valley, Native Americans had settlements along the entire tidewater area, living on the abundant fish and game and using the river as their main communication corridor and source of sustenance. Thus, the area is rich in archaeological and historic sites, which the local tribes continue to protect. There is a strong local interest in historic preservation. The Bandon Historical Society's emphasis on marine history and archaeological preservation is one example.

In recent years, local groups and individuals have taken the initiative in tackling resource problems on the Coquille. One example is the effort of the Ports of Bandon and Coquille, Natural Conservation Service District and other individuals to clear obstructions from the stream and pursue a program of bank stabilization. Another is the cooperative effort between local Lions international and Steelheaders groups and the State Department of Fish and wildlife in a Salmon and Trout Enhancement Project (STEP) on Coquille River tributaries. The Port of Bandon, recognizing the critical importance of a major saltmarsh, has ensured its protection by transferring ownership to the U.S. Fish and Wildlife Service. Recreational boating needs have been provided for by the Port of Coquille with its development of a boat launch ramp at Myrtle Point.

Each of these actions points to a genuine local desire to enhance and protect the Coquille River resources while at the same time encouraging wise use.

2. PLAN COORDINATION

2.1 Relationship to County and City Plans

The Coquille River Estuary Management Plan is Volume III, which is an element of the Coos County Comprehensive Plan; at the same time, it is also an element of the Comprehensive plans for the Cities of Bandon, Coquille, and Myrtle Point. The estuarine management units and shoreland plan designations within their corporate boundaries and urban growth areas are an integral part of their Comprehensive Plan Maps. The Estuary Plan Policies also apply to estuarine and shoreland areas in their jurisdictions, if necessary, due to previous adoption of their plans, cities may need to revise their plans so as to te consistent with the Coquille River Estuary Plan. Detailed estuarine inventory information is not included in the cities' plans.

By statute, the County is responsible for ensuring that all plans within its borders are consistent and coordinated with the County's Comprehensive Plan. However, both the County and the cities are responsible for plan implementation and amendments, depending upon which jurisdiction the proposed activities occur in. in the case of shoreland areas within urban growth boundaries, implementation is a joint city-county responsibility, as set out in urban Growth Area Management Agreements.

2.2 Coordination with Special Purpose Districts

All special purpose district plans and activities must be in compliance with this Plan within the shoreland area. This includes specifically the Ports of Bandon and Coquille, and certain drainage districts. They may have more detailed plans which need not be incorporated into this document in their entirety, (for instance, the Port of Bandon dock expansion) but there must be coordination between the Plan and the projects, it should be noted that the Port of Bandon's district extends upriver almost to Arago (RM 30.5), while the Port of Coquille district takes in only the last few miles of tidewater from RM 30.5 to above Myrtle Point

2.3 Agency Coordination

Key resource agencies were important participants in this Plan's development. All other affected agencies were given opportunities to participate in the Planning process and to review and comment on the Plan. All effected agencies' implementing actions, including permit issuance, active management and financial assistance, shall be in conformance with the provisions of this Plan. See Appendix "A" for a listing of agencies, addresses and types of permits they issue. See also Figure 1.1 showing areas of permit authority for federal and state agencies in intertidal and subtidal areas.

2.3.1 Federal Authority

The federal government has authority over the navigable waters of the nation and the associated developments on land that affect navigable waters. Of primary federal interest are protection of water quality, preservation of migratory fish and wild life habitats and requirements for planning within the coastal zone. The most prominent federal authorities over the estuary are:

a. Section 10 Permit (Rivers and Harbors Act of 1899)

This permit, administered by the Army Corps of Engineers, is required for any construction or alteration in navigable waterways. The Corps has identified the extent of the navigable waterways in Oregon and in most cases navigable waters extend to the head-of-tide. The Section 10 Permit's purpose is to protect the navigability of the nation's waterways and the permit authority extends to the line of Ordinary High water (mean high water). To assure a thorough analysis of all relevant concerns, review is solicited from federal, state and local agencies. It is the policy of the Army corps of Engineers not to issue a permit over state or local government objections.

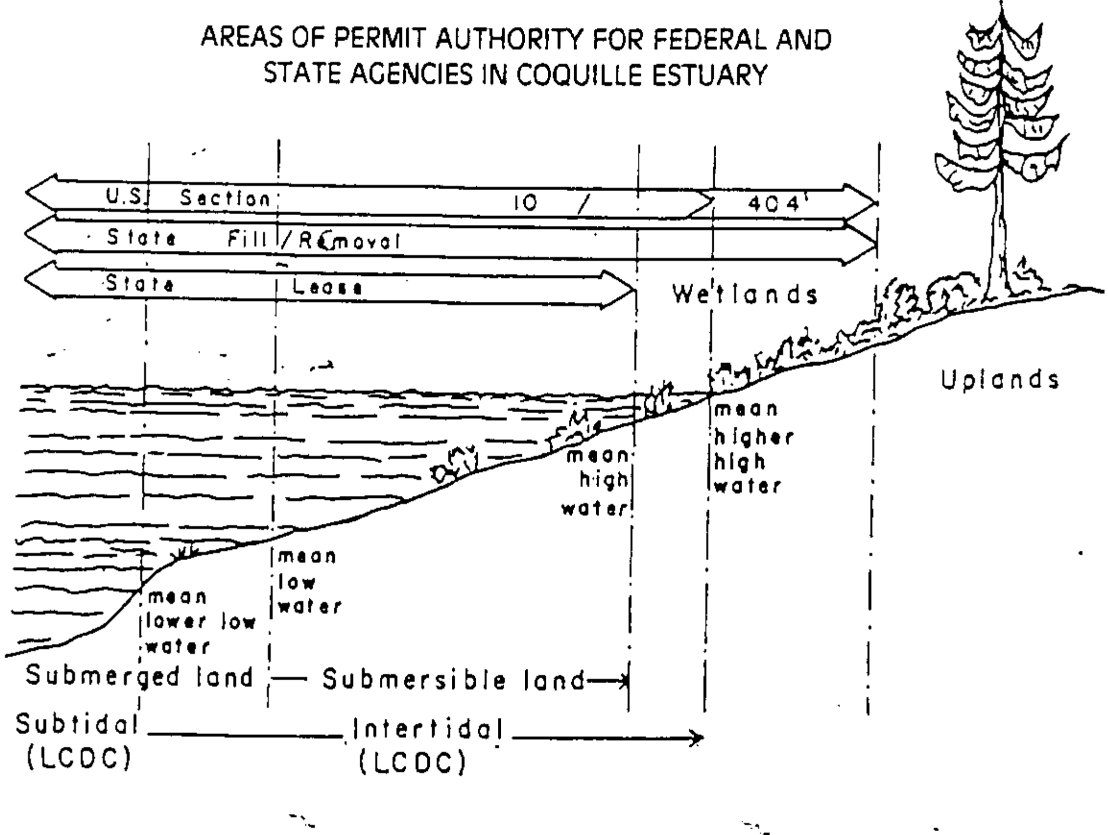
b. Section 404 Permit (Federal water Pollution Control Act, PL 92-500)

This permit covers only the disposal of dredged or fill material into the national waters, including wetlands associated with these waters. The major purpose of this act is to protect water quality. The permit program is administered jointly by the Environmental Protection Agency and the Army Corps of Engineers. The permit review process is similar to that for the Section 10 Permit. However, the EPA can override a decision by the Army Corps of Engineers to issue the permit if it has determined that the discharge would have an unacceptable impact on the aquatic environment.

c. Coastal zone Management Act (PL 92-583)

This act encourages development of land and water use planning programs by coastal states as a means to manage effectively the nation's coastal resources. The Act is administered by National Oceanic & Atmospheric Administration, Office of Coastal Zone Management. The Office of Coastal Zone Management is required to review the state programs to ensure that they meet specific standards. The approved Oregon Coastal Zone Management Program includes the Statewide Planning Coals, acknowledged local comprehensive plans, the Fill and Removal Law, the Forest Practices Act and other state agency policies. A key element of the Act is the establishment of a Federal/State partnership that requires activities at each level of government in the coastal zone be consistent with both federal laws and the approved State Coastal zone Management Program.

Figure 1.1 Areas of permit authority for Federal and State Agencies in Coquille Estuary



AFTER – MONTAGNE – BIERLY (1979)

2.3.2 State Authority

The state of Oregon is the owner of submerged and submersible lands of navigable streams, lakes and tidal lands within Oregon. However, some of these lands have either been sold or leased by the State Land Board. In addition to ownership rights, the State has jurisdiction over the management of natural resources and protection of water quality in all the waterways of the State. As noted previously, the State also has authority over land use planning throughout the State and the coastal zone. The most prominent state authorities besides ownership with respect to the estuary are:

a. Fill/Removal Law (ORS 468B.005 to 468B.070 amended 1991)

This permit is required for all fill or removal operations in state waters extending to the line of Ordinary High water (mean high water). The statute, as recently amended by HB 2985, states the public concern is the protection, conservation and best use of the water resources with particular attention to navigation, fishery and recreational use of waters. In determining whether to issue the permit, the Division of State Lands solicits comments from state and local government bodies.

When requesting a Fill/Removal Permit in an estuary, the LCDC must be addressed in addition to the requirements of ORS 468B. The statute specifies conditions whereby the Director of the Division of state Lands may require or waive mitigation of impacts caused by removal or filling of intertidal or tidal marsh areas of estuaries.

b. State Waste Discharge Permit (ORS 468B.005 to 468B.070 amended 1991)

The Department of Environmental Quality issues permits for discharge of wastes into waterways (as well as on land) under state authority and by delegation of the Federal Environmental Protection Agency's NPDES (National Pollution Discharge Elimination System) permit authority. In cases where section 10/404 and state Fill/Removal permits are not required or do not include all water quality requirements, the State waste Discharge permit would be required to ensure that water quality is protected.

c. Statewide Comprehensive Planning Programs and Coastal Coals (ORS 197.005 to 197.430

This statute requires all cities and counties to develop comprehensive plans consistent with Statewide Planning Coals. The statutes specify that the Goals must specifically address estuarine, tideland, marsh, wetland, beach and dune areas. Therefore, LCDC adopted four specific coastal Goals (Goals #16, #17, #18 and #19) in addition to the 14 general Goals. As mentioned previously, this Statewide Planning program has also been approved by the Federal Government as part of the state's Coastal zone Management Program.

The statute also requires that all state agency decisions affecting land use be consistent with the acknowledged Comprehensive Plan, or, if the Comprehensive Plan has not been acknowledged, be consistent with the Goals. Decisions affecting land use include all permits issued by State agencies. Each permit issued must be accompanied by a finding that it is consistent with the acknowledged Plan or the Goals. Unfortunately, federal decisions affecting land use are not bound to this same consistency finding.

d. State Permit issuance [ORS 197.180(1)]

This statute requires State agencies to apply the Statewide Planning Goals or acknowledged comprehensive plans when taking action with respect to programs affecting land use. The Department of Land Conservation and Development rule on State Permit consistency (OAR 660-031) which establishes procedures and standards for consideration of goals and acknowledged plans prior to the approval of state permits.

<u>State Permit Issuance</u>

ORS 197.180(1) requires State agencies to apply the Statewide Planning Coals or acknowledged comprehensive plans when taking actions with respect to programs affecting land use. The Department of Land Conservation and Development rule on state Permit consistency (OAR 660-31) which establishes procedures and standards for consideration of Goals and acknowledged plans prior to the approval of State permits.

The rule defines Class A and B permits, and sets forth procedures as follows:

- Consistency Review Procedures:

<u>Class A Permits</u>: permits affecting land use that require public notice and public hearing at the agency's discretion prior to permit approval. Included in the public notice must be a statement that the permit application is being reviewed for consistency with the goals or acknowledged plan. Public notice of the permit must be sent to the city or county and its citizen advisory committee. Testimony at the hearing concerning consistency of the proposal with the statewide Planning coals or an acknowledged Plan must be

considered. Agency determination of consistency is to be based on public comments and review by other agencies.

Class B Permits: permits affecting land use which do not require public notice or an opportunity for public hearing prior to permit issuance. The review process must assure that either: (i) the proposed use and activity are allowed by the zoning classification where an acknowledged Plan exists; or (ii) the applicant is informed that permit approval is not dependent upon a state agency's finding of compliance with the Statewide Planning Goals or the acknowledged Comprehensive Plan and the applicant must obtain a land use approval from the local government. The local government must include a determination of compliance with the Goals when they are applicable (i.e., when there is no acknowledged Plan). The local determination may be stated in conclusory form without extensive findings.

Review criteria [Class A and Class B Permits (OAR 660-31-025)]: if the local government does not have an acknowledged Plan, the State agency issuing the permit shall review the proposal's consistency with statewide Planning Goals. Where an acknowledged Plan exists, the agency shall only review a project's consistency with the Plan. The Statewide Planning Goals are not to serve as review criteria after Plan acknowledgement, unless the State agency issuing the permit finds:

i. the acknowledged Plan and implementing ordinances do not address or control the activity under consideration;

ii. the acknowledged Plan allows the activity or use but subject to future goal considerations by an agency; or

iii. substantial changes in conditions have occurred which render the Plan and implementing ordinances inapplicable to the proposed activity.

- Reliance on the Local Government's Determination (OAR 660-31-035): State agencies must rely upon the affected local government's consistency determination in the following cases:

1. when the agency finds that the local government has made a determination of consistency or inconsistency with its acknowledged Plan and ordinances;

2. where there is not an acknowledged Plan or the State agency makes a finding that the acknowledged Plan does not address or control the proposal or substantial changes in conditions have occurred rendering the Plan inapplicable, and the agency finds:

    a. the local review addresses the relevant Statewide Planning Goals, and

    b. the local review provided notice and the opportunity for public and agency review and comment.

If notice and public and agency review and comment were not provided, the agency shall rely on the local determination if not objections are raised during the agency's review.

LISTING OF CLASS A AND 8 STATE AGENCY PERMITS AFFECTING LAND USE

- Class A Permits:

Department of Energy (DOE)
– Energy Facility Site Certificates

Department of Fish and Wildlife (ODFW)
– Salmon Hatchery Permit

Division of State Lands (DSL)
– Fill and Removal Permits

Department of Transportation (ODOT)
– Ocean Shore improvement Permit

Department of Geology and Mineral Industries (DOGAMl)
– Permit to Drill - Geothermal well*
– Permit to Drill - Oil or Gas well*

* Agency's legislation does not provide for public hearing on permit review. Some other review process providing opportunity for public and agency comment is used.

- Class B Permits:

Department of Environment Quality (DEQ)
– Subsurface Sewage Disposal System permit
– Air Contaminant Discharge Permit
– Waste Discharge Permit (National Pollution Discharge Elimination)
– Indirect Source Construction Permit
– Water Pollution Control Facility Permit
– Solid Waste Disposal Site Permit

Department of, Geology and Mineral industries (DOGAMl)
– Surface Mining Operation Permit

Protective Health services Section, Health Division, Department of Human Resources
– Community Water Supply System Certification
– Organization Camp Sanitation Certificate
– Recreation Park sanitation Certificate
– Recreational Vehicle Park Plan Review

Water Resources Department (WRD)
– Appropriate Groundwater
– Appropriate Public Water
– Water Right Transfer

Public Utility Commissioner (PUC)
– Railroad Highway Crossing Project

Department of Transportation (ODOT)
– Road Approach Permit
– Airport Site Approval

Source for permit identification: OAR, Chapter 660, Division 31 – LCDC

2.3.3 Local Authority

Both the cities and county have a direct responsibility for planning within the estuary. This authority is carried out through locally adopted ordinances. Site specific authority is derived from the local authority to issue building permits.

Other bodies of local government, the Ports and the Soil and Water Conservation District also have authorities that regulate activities in the estuary. The Ports, under ORS 777.005 to 777.725, have authority to acquire land, levy fees and initiate developments to improve the workings of the Port and its facilities, in addition, the Ports and the Soil and water conservation District can initiate projects to prevent erosion.

Drainage districts are empowered by ORS Chapter 547 to construct and maintain dikes, ditches, and tidegates, levy fees and issue bonds. Their actions may require a state or federal permit if they fall within Division of State Lands or the Army Corps of Engineers' jurisdiction.

2.4 Consistency Between Local, State and Federal Plans and Actions

The Plan was acknowledged because of its consistency with State and Federal plans for the Coquille River Estuary. This Plan became the basis for evaluating local, state and federal permits or any state and federal action. Representatives of all agencies In the Coquille River Task Force formulated decisions, which were incorporated into this Plan.

3. PLAN DEVELOPMENT

3.1 Citizen Involvement Program

LCDC Goal #1 requires local governments "to develop a citizen involvement program that insures the opportunity for citizens to be involved in all phases of the planning process" in order to (a) provide effective communication between the citizens of Coos County and its elected and appointed officials; (b) provide opportunity for involvement in all phases of the planning process; and (c) assure that technical information is available in an understandable form and/or assistance' shall be provided to interpret and effectively use technical information.

Goal #1 further requires the Board of Commissioners to "adopt and publicize a program for citizen involvement that clearly defines the procedures by which the general public will be involved in the on-going land use planning process" (LCDC, 1975).

In 1977, a Citizen Involvement Program (ClP) was adopted by Coos County in order to guide the development of Coos County's Comprehensive Plan (Volumes I, II and III), and was acknowledged in 1986 by the Department of Land Conservation and Development. Since the acknowledgement of the Plan, the utilization and role of the Citizen Involvement Program changed and (which consisted of various committees developing and formulating strategies for land use planning in Coos County) was therefore, placed in the hands of the currently appointed Planning Commission.

The Coos County Planning Commission has a continuous and active role in land use decision making, and is kept up-to-date on statute and rule changes. Utilization of the Planning Commission in the role of land use decision-maker and "citizen involvement committee" expedites Coos County's Citizen involvement process within and outside of the unincorporated areas of the County.

In 1999, the Citizens of Oregon passed "Measure 56", which requires the County Planning Department to mail individual notice of plan and/or ordinance amendments, which might affect property owners outside city limits; the County continues to publish notice in a newspaper alerting Coos County property owners of the amendments.

3.2 Plan Development Process

Coos-Curry Council of Governments (CCOG) were initially designated as the lead agency for the estuary planning project by the Coos County Board of Commissioners. Upon completion of the CCCOC's work program in December 1980, responsibility for future revisions was passed over to the Coos County Planning Department.

Through an intergovernmental planning agreement, Coos County, City of Bandon, City of Coquille and City of Myrtle Point agreed jointly to establish a planning process to develop a management plan for the Coquille River Estuary. A Task Force was established as part of this planning agreement. The purpose of the Task Force was to provide direction for staff planners in plan development, to provide expert local knowledge, and to provide agency input and coordination. The Task Force included representatives of:

- Coos County Board of Commissioners
- Coos County Planning Commission
- City of Bandon
- City of Coquille
- City of Myrtle Point
- Port of Bandon
- Port of Coquille
- Coos County Soil and water Conservation District
- Coos County Cooperative Extension service
- Oregon Department of Fish and Wildlife
- Oregon Department of Transportation
- Oregon Department of Environmental Quality
- U. S. Army Corps of Engineers
- Chambers of Commerce
- Coos County Committee for Citizen involvement
- Audubon Society
- plus citizens representing agricultural, fisheries, forestry and recreation interests

A list of Task Force members are provided in Appendix "B". The Task Force conducted a series of regular workshop meetings beginning in January 1980, following an organizational "Community Workshop" meeting in October 1979, and a special agency coordination workshop (December 1979). A special committee was also formed to discuss the inter-relations of the coastal shorelands area and agricultural practices. The Task Force worked with staff planners to develop policy and review draft plan materials as they were produced, it followed these general steps in the process of preparing and revising the draft plan.

- Identify issues, concerns and needs.
- Develop context for plan formulation: i.e., discuss Statewide Planning Coals, estuarine classification, Army Corps of Engineers standards, etc.
- Review and discuss inventory and data base.
- Develop plan and management frame work: use designations and policy statement.
- Maintain on-going citizen involvement and agency coordination.
- Prepare draft document
- Conduct public review of draft
- Revise draft document in light of public testimony.

At this point, the Plan was passed on to the Coos County Board of Commissioners for final public hearings and adoption.

Appendix A – Laws, regulations, agencies affecting the Coquille Estuary

U.S. Government

U.S. Fish and Wildlife Service
Division of Ecological Services
727 N.E. 24th Avenue
Portland, Oregon 97232
234-3361, Ext. 4084

U.S. Army Corps of Engineers District, Portland
P.O. Box 2946
Portland, Oregon 97208
221-6996
Regulatory Functions Branch

A. License – propagation of wildlife
B. Permit – place explosives and harmful materials in waters
C. Permit – salmon hatchery
D. Ownership – oyster plat lease

National Marine Fisheries Services
P.O. Box 4332
Portland, Oregon 97208
234-3361, Ext. 4311

Environmental Protection Agency
1200 6th Avenue
Seattle, WA. 98101
(206) 442-1352
Ocean Disposal and Construction Permits Section

Oregon Department of Environmental Quality
P.O. Box 1760
Portland, OR 97207
(under DEQ/EPA agreement)

A. Approval – evaluation of suitability for proposed sewage disposal
B. Approval – plans for sewage and industrial disposal systems
C. Permit – indirect source
D. Permit – NPDES discharge and state water discharge permit
E. Permit – special, short-term air, water or solid waste

U.S. Coast Guard
Thirteenth Coast Guard District
Aids to Navigation Branch
915 Second Avenue
Seattle, WA 98174
(206) 442-5233

U.S. Soil Conservation Service
1220 S.W. Third Avenue
Portland, Ore 97204
221-2751
ATTN: State Conservationist

Appendix B – Task Force Membership

Name	Organization	Mailing Address
Clayton Weaver	City of Myrtle Point	1725 Stover Lane Myrtle Point, Oregon
Alex Linke	Port of Bandon	P.O. Box 206 Bandon, Oregon
Reese Bender	Ore. Dept. of Fish & Wildlife	300 5th Bay Park Coos Bay, Oregon
Harold Herndon	U.S. Army Corps of Engineers	P.O. BOX 2946 Portland, Oregon
Glen Carter	Department of Environmental Quality	P.O. Box 1760 Portland, Oregon
Ben McMakin	City of Bandon	P.O. Box 67 Bandon, Oregon
Doug Giles	Bandon Resident	Harrison Street Bandon, Oregon
Rex Gaslin	Coquille Chamber of Commerce	380 N. Folsom Coquille, Oregon
Eleanora Lorenz	City of Bandon	P.O. Box 1011 Bandon, Oregon
Ed 'Doc' Stevenson Chairman	Coos County Commissioner	Courthouse Coquille, Oregon
Jim Howe	Port of Coquille	P.O. Box 332 Coquille, Oregon
Jim Lauman	Oregon Department of Fish & Wildlife	P.O. Box 3503 Portland, Oregon
Vic Schweitz	U.S. Army Corps of Engineers	P.O. Box 604 North Bend, Oregon
Carl Wilson	Audubon Society	P.O. Box 617 Bandon, Oregon
John Phillips	Oregon State Parks Division	1155 S. 5th Coos Bay, Oregon
George Baker	Coquille Resident	433 W. 17th St. Coquille, Oregon

Lynn Cannon	Coos County Extension Service	Coos County Courthouse Coquille, Oregon
Phelps Elbon	Citizen for Fisheries	1340 7th Bandon, Oregon
Val Jones	State Parks & Recreation Division	P.O. Box 1265 Coos Bay, Oregon
Patti Strain	City of Coquille	99 E. 2nd Coquille, Oregon
Don Gray	Coos County Soil & Water Conservation District	382 N. Central Coquille, Oregon
Butch Parker	Oregon Department of Transportation	P.O. Box 1128 Roseburg, Oregon
Stan Hamilton	Division of State Lands	1445 State Street Salem, Oregon
Lou Felsheim	Committee for Citizen Involvement	P.O. Box 455 Bandon, Oregon
Jim Hanna	Port of Bandon	P.O. Box 206 Bandon, Oregon
Ken Messerle	Coquille Resident	Rt. 1 Box 225 Coquille, Oregon
Bob Taylor	Coquille Resident	153 N. Central Coquille, Oregon

1. INTRODUCTION – PLAN INVENTORY

1.1 Intent

This inventory is intended to provide the factual base by which the management decisions for the Coquille River Estuary are made. The inventory is intended to help citizens and planners understand the human/natural processes, which occur in the estuary. The inventory contains statements about problems due to hazards or the conflict between development and the need to conserve natural resources, and about opportunities provided by the economic and natural resources of the estuary. These statements, together with the requirements of Statewide Planning Goals, provide a basis for the development of plan policy direction. This document brings all the available environmental and cultural information relevant to the Coquille River Estuary and synthesizes it to form an adequate basis for decision-making. An effort has been made to summarize pertinent information and to provide a base to which additional information can be added as it becomes available. Where the existing information base is found to be inadequate for any reason for decision-making purposes, this is noted in the text.

1.2 Sources

Bibliographies at the end of each section list all formal sources of material for this inventory, which has been written primarily from published studies, personal interviews, and map and field research by CCCOC and county Planning staff. The Task Force served as an important source of information from the practical day-to-day experience of the river and its problems and opportunities gained by its members.

2. WATER RESOURCES

2.1 Introduction

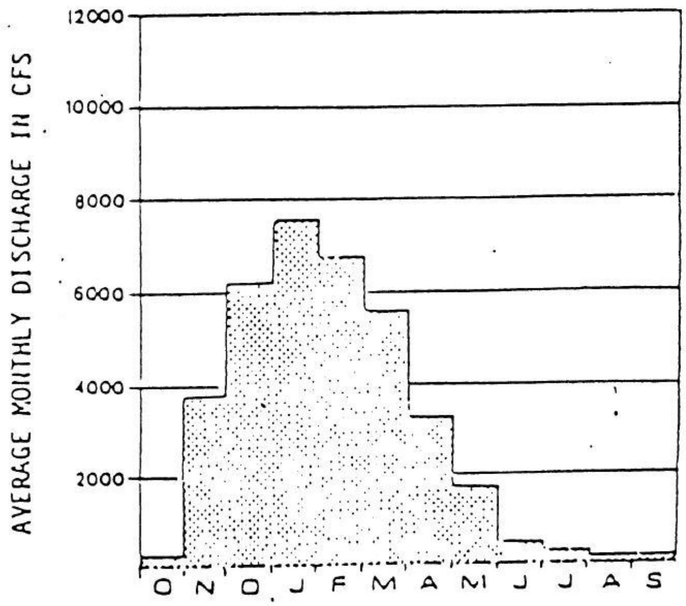
The Coquille River drainage basin, from its mouth at Bandon to the headwaters of the South Fork, measures 99 miles in length. The total area of drainage is 1,058 square miles, exceeded on the Oregon Coast only by the Columbia, Rogue and Umpqua drainage basins. Elevations range from sea level to over 4,300 feet. Stream gradients are steep along the upper reaches of the basin and flatten along the tidal reaches below Myrtle Point where the valley spreads out to form the floodplain.

The main stem of the Coquille River has a reach of 36.3 miles, winding northwesterly from Myrtle Point to Coquille, thence westerly to the Pacific Ocean at Bandon. The main stem drains 171 square miles and has a gentle gradient of about one foot per mile. As a result, tidal influence extends past Myrtle Point to approximately River Mile (RM) 39. Two tributaries converge downstream of Myrtle Point, the North and South Forks of the Coquille River.

2.2 Stream Flow and Water Availability

The monthly discharge of freshwater from the Coquille River has been compiled over a 28 year period. Year round average discharges are over 3,000 cubic feet per second with extremely high flow from December through March, while lowest flows occur during August and September. Monthly averages are depicted in Figure 2.1. (1)

Figure 2.1 Coquille River at mouth discharge in C.F.S.



SOURCE: Army corps of Engineers, E.I.S. Technical Appendices, p. D-5.

NOTE: This synthetic hydrograph is based upon available stream flow data and extrapolation of precipitation data taken at Powers, Oregon, 1933-1972.

An evaluation of water availability within the tidal area of the Coquille River must consider both the maximum consumptive rights, which could be exercised and the minimum perennial streamflows that apply to that unit or tributary.

The Oregon minimum streamflow law, passed in 1955, classifies fish and wildlife uses as beneficial uses of water and establishes a public water right to minimum streamflows to be designated by the State water Resources Board. Minimum streamflows are intended to assure that some flow remains in the waterways to sustain aquatic life or to minimize pollution. Problems arise typically during the summer months of August and September, resulting primarily from low rainfall and low groundwater storage. A minimum flow is similar to a water right as it protects a specified flow against future appropriations, except for human and livestock consumption. In the coastal zone, all established minimum flows reflect requirements for aquatic life. Other instream uses may have different requirements, but specific flows have not been identified.

The average September flow in the main stem of the Coquille River is 130 cubic feet per second, while the maximum consumptive rights are 108.61 cfs. The established minimum perennial streamflow is not known. A potential flow deficiency may occur for the main stem if the maximum consumptive rights plus the established minimum perennial streamflow exceeds the average September flow. It cannot be said that a flow deficiency would exist if all rights were exercised. However, it appears that existing rights and minimum flows now account for much of the streamflow normally experienced during the summer months. Irrigated land in the main Coquille Valley totals about 10,730 acres, out of a total of 52,109 acres of available land, much of which could be irrigation, [Ken Messerle, 9/81, personal communication] if adequate water is available. Therefore, future water needs may require water storage development, or they could be met at the expense of instream water uses, [see Coos County comprehensive Plan for potential water storage sites]. During periods of sustained flows below the established minimum perennial streamflows, a distributive procedure is applied whereby the most recent irrigation rights are suspended until minimum flows are achieved.

2.3 Water Uses

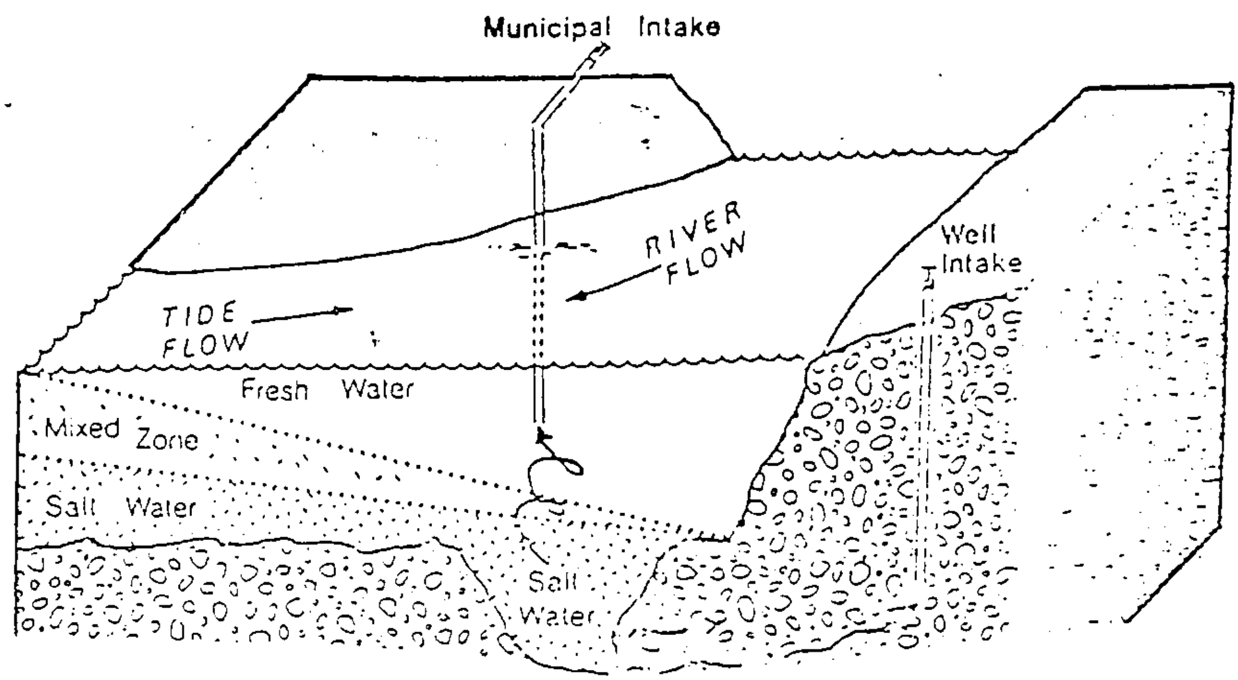
Water uses are categorized under two general types of use: consumptive and non-consumptive.

Consumptive water uses represent the portion of withdrawal that is consumed through evaporation, transpiration, or by municipal or domestic use. Irrigation is the largest consumptive use of the Coquille River Basin, following by municipal and domestic uses. Water diverted for non-consumptive purposes becomes available again at downstream locations. Non-consumptive uses include water use for mining, fish, power, recreation, etc.

Water from the Coquille River system is used for a variety of purposes. The City of Coquille obtains its municipal water supply from the mainstream Coquille River, which it treats by rapid sand filtration. Industrial water use includes lumber mill operations (including logs ponds) in the Coquille area, plus some cheese, fish and seafood processing plants downstream at Bandon. The river also is heavily used for irrigation purposes in the valley, including cranberry production in the Bandon area.

There are saltwater intrusion problems for industrial and domestic water and irrigation uses as far up the river as Coquille. The causes for this are as yet uncertain. One hypothesis suggests that incoming saltwater settles into large depressions along the stream bed and then either infiltrates into the freshwater aquifer near wells or mixes with freshwater during flood tides near, for example, water intake points for city water supplies (See Figure 2.2).

Figure 2.2 Saltwater intrusion: possible affect on water intakes



In addition to municipal water supply, industrial use, and irrigation, there are significant non-consumptive uses of freshwater in the main stem Coquille River. These include recreation (particularly fishing) and the provision of fish and wildlife habitats.

2.4 Water Quality

2.4.1 Introduction

Man's activities can substantially degrade water quality by waste discharges. Wastes may be classified into several categories:

A. Temperature; thermal discharges

B. Organic Wastes; potential sources include:

   a. Agricultural wastes and fertilization
   b. Forestry wastes and fertilization
   c. Municipal wastes
   d. Industrial wastes
   e. Domestic wastes (potentially, fertilizer)

C. Chemical or heavy metal wastes; potential sources include:

   a. Agricultural pesticides and herbicides
   b. Forestry pesticides
   c. Domestic chemicals
   d. Industrial wastes
   e. Oils, gases and other pollutants from urban and road runoff and boating

These wastes are placed into water bodies in two ways: (1) point discharges (such as municipal and industrial discharges); and (2) non-point discharges, where the wastes are carried to the water body by the hydrological cycle (examples of non-point discharges include agricultural and forest wastes and domestic septic tanks. -Point discharges are more easily controlled (although often at great cost), while non-point discharges are very difficult to control).

2.4.2 General Water Quality Characteristics

Water quality in the main stem Coquille River generally meets the state's water quality standards. (See Table 2.1.) Turbidity and fecal bacteria concentrations are sometimes high during the rainy season, however, particularly after the first major flood of the season, which flushes surface animal wastes into the river. Sluggish waters in log storage areas have in the past experienced seasonal problems with low dissolved oxygen and high water temperature (1). However, log storage is no longer a problem in coquille. There are no logs stored in the upper estuary and almost none in the lower section. There are no known problems of oxygen deficiency from fish migration and development in the Coquille River.

Table 2.1 Selected Oregon State Water Quality Standards for South Coast Basin Estuaries

	Minimum Allowable Standard
Dissolved oxygen	6 milligrams/liter
Fecal coliform bacteria	Median concentration – 14 organisms per 100 milliliters (shellfish areas) Log mean, 200 organisms per 100 milliliters (other areas)
Ph	6.5 – 8.5
Turbidity	No more than 10% increase in natural stream turbidities, except for emergency activities, dredging
Temperature	No significant increase above natural background; no adverse effects on fish or other aquatic life

SOURCE: Department of Environmental Quality, Oregon Administrative Rules, Ch. 340-41-325 (November 1, 1980)

As noted by the Oregon Department of Fish and Wildlife study "Natural Resources of Coquille Estuary" (2) "the lack of studies of flushing, tidal currents and circulation in the estuary limits understanding of the dispersion and duration of pollutants in the estuary. Since the summer volume of freshwater inflow is very small compared with the apparent tidal prism in the estuary, flushing from the upper estuary is likely to require many days". It cites a study by Zimmerman (3), which found that flushing from the upper Yaquina Estuary takes 13 days during an average August river flow conditions as the basis for this observation. The Yaquina Estuary has a long riverine section with similar geomorphic characteristics to that of the Coquille.

The location of pollution sources combined with flushing and circulation characteristics determine the extent of impact of pollutants on particular locations and habitats. Point sources of pollution in the Coquille are shown on the "Physical Alterations" map.

Erosion may also contribute to sediment loads. Erosion of banks and natural levees occurs in many places on the Coquille main stem during high flow. Erosion may be the result of natural current velocity or may be stimulated by shifts in currents from shoreline activities upstream or at the erosion site (2). Water quality is also adversely affected by turbidity and removal of shore vegetation. Another vital element in water quality, especially related to fish habitat, is water flow. The available supply of water determines the concentration or dilution of the matter in the water. Algal blooms have been reported along the main stem Coquille. A 1974 study (4) hypothesized that this was probably due to the nutrient loads from municipal sewage treatment facilities, irrigation return flows and livestock wastes. However, a letter from Glen Carter, Water Quality Analyst, Department of Environmental Quality (5) states that the algae are probably a result of natural conditions resulting from low flows and high water temperatures. Municipal sewage treatment plants operate efficiently during the summer algae growing periods, and there is essentially no direct irrigation return or run-off from animal wastes during summer. However, rare examples of careless over-irrigation can cause return-flow and erosion problems (George Baker, Task Force Meeting, September 13, 1981.

Measurement of water temperature and salinity in the Coquille River Estuary in 1978 demonstrated three major points:

A. Although the tidewater section is 41 miles long, the region of saltwater intrusion is fairly short, salinities of water near the bottom of the river approached zero near 8 miles and 13.8 miles from the mouth at low and high tide, respectively;

B. The water column was well-mixed with very little difference in temperature or salinity from surface to bottom;

C. There was a rapid increase in midsummer temperatures from the mouth upstream Midsummer water temperatures were around 11C near the ocean and rapidly increased to over 24C in the middle and upper estuary.

The lower estuary at high tide was essentially full-strength seawater, transparent green and relatively cool. In contrast, the upper estuary was murky and warm. Low summer discharge from the watershed and the long, narrow channel of the tidal watercourse appeared to produce little net flow to the ocean, thus producing a relatively stagnant, well-mixed, warm body of water (6).

The following is an excerpt from a March 24, 1980 letter by Glen Carter, which corroborates and expands upon the facts reported above:

> "The major municipalities and Bullards Beach state Park provide secondary treatment for sewage wastes, with disinfection of effluents before discharge. As with any technical devices, there are rare malfunctions that may reduce efficiency for short periods, but these are the exception and not the rule."
>
> "While coliform bacteria concentrations meet the standards most of the time, they do show occasional, sharp increases. These are believed to result largely from livestock, waterfowl, and other warm-blooded animals living on the broad, wet Coquille 'flats'. Diffuse animal waste sources are difficult to control, but, on the other hand, they are not a serious threat to estuary quality at present concentrations."
>
> "Summer water temperatures exceed those desirable for salmonid fishes, solar heating is the only significant cause of temperature increases; however, the impact on aquatic habitat and fishery production is likely compounded by extensive water withdrawal for irrigation."
>
> "Seasonal periods of elevated turbidity and sediment, related to freshets, plague the Coquille Basin waters. Some of it comes from natural slumpage and erosion of landforms, but it is also known that man's activities on land contribute further to the problem. Special efforts are being made by both public and private foresters to reduce the adverse impacts of forest practices on streams and water quality. Agriculturists have comparable programs for their areas of activity, water quality improvements resulting from the above land management programs may not be sensational on any particular day, but they are persistently moving in the right direction."

"We have no evidence that other water quality parameters may be out of order or may in any way detract from recognized beneficial water uses in the Coquille system."

2.4.3 Effluent from Existing Sewage Treatment Plants and Water Purification Plants

The Department of Environmental Quality presently has the authority to require waste discharge permits for municipal purification plant wastes. Wastes generated by water purification facilities in the basin have received only a minimum amount of attention due to the small volume. The common practice has been to return any such wastes to the most convenient surface waters. The Department of Environmental Quality is currently evaluating these waste sources to determine whether specific controls and permits are needed. It is likely that most sources will be adequately covered by a statewide general permit.

Bandon Sewage Treatment Plant (Major source for the following sections [4]): the Bandon plant is an activated sludge facility with a design population of 4,500 people and a design flow of .45 million gallons per day (mgd). The system presently serves 1,650 people. The receiving stream for the plan effluent is the estuary of the Coquille River. Plant operating records indicate an average BOD removal of 96 percent. The data is as follows:

Table 2.2 Plant operating records – Bandon Sewage Treatment Plant

Month	Average Monthly Flow – mgd	Influent BOD – mg/1	Effluent BOD – mg/1
August, 1972	.117	320	9
September	.133	280	10
October	.086	345	18
November	.143	224	5
December	.224	200	8
January, 1973	.267	229	17
February	.204	190	10
March	.309	213	7
April	.231	350	13
May	.157	340	17
June	.138	733	17
July	.124	380	10
Average	.178	317	11

SOURCE: Coos Curry Environmental Protection Program (1974)

- Bullards Beach state Park Sewage Treatment Plant: The treatment plant serving Bullards Beach State Park is an extended aeration-type facility with a design population of 230 people and a design flow of 13,000 gpd. The monthly average flow is generally in excess of the design capacity with maximum monthly averages of 24,000 gpd and maximum daily flows of 48,000 gpd. The plant discharges into the lower estuarine reach of the Coquille River.

Coquille Sewage Treatment Plant: The Coquille sewage treatment plant utilizes the activated sludge process and was designed to serve 6,600 people with a flow of 1.0 mgd. The estimated population presently served is 4,500 people. The receiving stream is the Coquille River operating records over the last year indicate 90 percent removal of BOD and 93 percent removal of suspended solids. The operating data is as follows:

Myrtle Point Sewage Treatment Plant: The City of Myrtle Point is served by a trickling filter treatment plant with a design population of 3,000 and a design flow of .36 mgd. It is estimated that 2,715 people are presently served by the system, which discharges into the South Fork of the Coquille River. Operating records indicate a BOD reduction through the plant of 81 percent. No data on the reduction of suspended solids is available. The operating records are summarized as follows:

Table 2.3 Plant operating records – Coquille Sewage Treatment Plant

MONTH	AVERAGE MONTHLY FLOW – mdg	INFLUENT BOD – mg/1	EFFLUENT BOD – mg/1	INFLUENT SS – mg/1	EFFLUENT SS – mg/1
August, 1972	0.52	181	18 -	-	-
September	0.45	234	16 -	-	-
October	0.43	236	14 -	-	-
November	0.74	81	11 -	-	-
December	0.86	42	14 -	-	-
January, 1973	0.55	34	8 -	-	-
February	0.94	30	7 -	-	-
March	1.06	58	11 -	-	-
April	0.97	38	10	69	9
May	0.91	108	11	54	5
June	0.65	181	5	77	4.5
July	0.51	139	4	90	2.2
Average	0.72	114	11	73	5
Lb./Day		684	66	438	30

SOURCE: Coos Curry Environmental Protection Program (1974)

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Table 2.4 Plant operating records – Myrtle Point Sewage Treatment Plant

Month	Average Monthly Flow – mdg	Influent BOD – mg/1	Effluent BOD – mg/1
August, 1972	0.196	-	-
September	0.198	-	-
October	0.253	-	-
November	0.352	-	-
December	0.399	-	-
January, 1973	0.366	113	38
February	0.505	90	10
March	0.606	87	15
April	0.357	97	20
May	0.282	158	21
June	0.294	146	18
July	0.272	170	37
Average	0.34	124	23
Lb./Day	-	352	65

SOURCE: Coos Curry Environmental Protection Program (1974)

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3. ESTUARINE PHYSICAL PROCESSES

3.1 Tidal Data

The only recorded tidal data on the Coquille Estuary are the mean tide levels at Bandon. There is limited information on tidal hydraulics, and computations of the tidal prism and flushing have been based on only the lower bay area of the estuary. Further study of tidal characteristics in the Coquille River Estuary is needed.

The estuary is fully exposed to waves at the throat. Tidal effects on the Coquille River extend as far as from 36 to 39 miles (near Myrtle Point) upstream. This is the longest of any river on the Oregon Coast other than the Columbia. The mean tidal range is 5.2 feet with a diurnal range of 7.0 feet and an extreme range of 10.0 feet. Tidal prism on mean range is 1.32×10^8 cubic feet with a diurnal range prism of 1.77×10^8 cubic feet. (1)

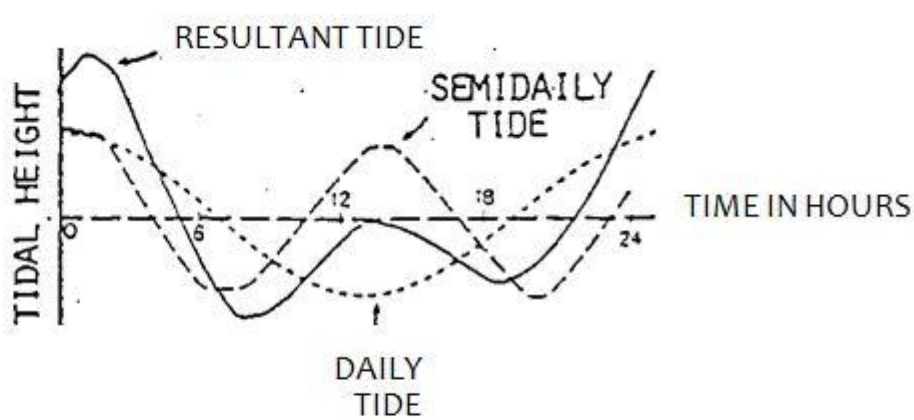
The tides are the source of much of the energy that drives the physical circulation of the Coquille River Estuary. This energy results in the mixing of fresh and saltwater, turbulence and the regular up and down stream movement of estuarine waters known as the flood and ebb of the tide. The rise and fall of the tide, the causes and effects of these tidal fluctuations and the associated tidal currents are discussed in this section.

Tidal actions are central to the functioning of an estuary. The tide inundates the tide flats and marshes, enhances circulation, aids navigation, helps control sedimentation and supports much of the complex biologic activity of the estuary and ocean shore.

In the Coquille River and on the open coast nearby, the tides are of a mixed type. (Two high tides and two low tides during a 24 hour period.) The rise and fall of the mixed tide as observed is shown in Figure 3.1. The elevation of Mean Lower Low water (MLLW) is, by definition, 0.0 feet.

During high river flow the tidal fluctuations in the upper estuary are greatly reduced. Nicholas has observed that high tide during the summer in the Arago boat ramp (RM 32) occurred at approximately the predicted low tide time for Bandon. He estimated the tidal range at Arago as 4-5 feet. (2)

Figure 3.1 Rise and fall of a mixed tide



A diurnal and semi-diurnal tide when combined produce a mixed tide. SOURCE: Cross, 1972, reproduced in (3).

Table 3.1 Coquille Tidal Levels in feet, relative to mean lower low water

Location	Mean Higher High Water MHHW	Mean High Water MHW	Mean Tide Level MTL	Meal Low Water MLW	Mean Lower Low Water MLLW	Extreme Low Water ELW
Bandon	7.0	6.3	3.7	1.1	0.0	-3.0

SOURCE: Natural Resources of Coquille Estuary, Oregon Department of Fish and Wildlife (1979)

Tidal range is highly important to an estuary. Its greater height in the brackish zones and at seaside makes those areas more productive. [4] The following are some effects of high tides in the estuary:

- They provide for greater exchange of nutrients and waste products.
- Turbidity is increased.
- Current velocity is heightened on the ebb tide and dampened (in rivers) on the flood.
- Water temperatures are moderated over the wetlands by being cooled in summer and warmed in winter.
- 'Warm-blooded' animals are able to feed in marshes and flats when the tide is out, except for ducks which usually find food more available at high tide. Birds and mammals which breed in the marsh must elevate their nest structures above the highest tide levels.
- Likewise, fiddler crabs must enter their burrows and snails must climb up the grasses to escape predation by fish as the tide comes in.
- High winds greatly amplify tides, piling water into the bay with sustained southwest winds in winter and blowing it out with prolonged northeast winds, in the latter situation, gulls have an opportunity to carry off shellfish on very low tides.
- Phytoplankton composition would be quite different in marsh pools and channels if tides did not provide an exchange of water. Since plankton productivity is higher in marsh pools than in the river, tides carry this living material into the estuary.
- Organic detritus is carried to the water from inundated areas.

Table 3.2 shows various tidal elevations together with definitions, as derived from the Army Corps of Engineers and other sources. The tidal range between Mean Lower Low water (MLLW) and Mean Higher High water at Bandon is 7.0 feet and the extreme tidal range is about 10.0 feet.

Table 3.2 Comparison of tidal elevations as derived from various sources

1. Tidal Terms	2. Description	3. Elevations for Bandon Estuary (feet)
Extreme High Tide	The sum of the highest predicted tide and the highest storm surge. The level used by engineers for design of harbor structures.	
Highest Measured Tide	Highest tide measured on the tide staff.	
a. (100 Year Flood Level)	A flood having a 1 % probability of occurring in any given year.	12.1
Highest Predicted Tide	Highest tide predicted from the tide tables.	
b. (Extreme Tidal Range)	Not defined.	10.0
c. Mean Higher High Water	Average of the higher of the two daily high tides observed over a given period of time. Used by National Ocean Service for navigational clearances.	7.0
d. Mean High Water	Average of all observed high tides. This is the boundary between tideland and "upland", the land at or above the level of mature high marsh	6.3
e. (Mean Tide Range)	Range between mean high water and mean low water	5.2
Mean Tide Level	Midway between Mean High and Mean Low Water	3.7
f. Local Mean Sea Level	Local average height of water surface for all stages of the tide.	3.59
Mean Sea Level [National Geodetic Vertical Datum-NKD]	The reference elevation used on the West Coast for elevations on U.S. Geological Survey topographical maps.	4.1
g. Mean Low Water	Average of all observed low tides. It is the boundary between tideland submerged land.	1.1

h. Mean Lower Low Water	Average of lower low tides.	0.0
Lowest Predicted Tide	Lowest tide from the tide tables.	
Lowest Measured Tide	Lowest actually measured.	
Extreme Low Tide	Lowest estimated tide that can occur.	-3.0

Source: U.S. Army Corps of Engineers

Current velocity varies with rain, tides, wind and cross-section of the river. There is at present no available data on current velocity. However, the following general observations can be made:

- Currents make water temperature more uniform.

- Strong currents make feeding more difficult for ducks and grebes, and other swimming mammals.

- Currents and turbulence are directly proportional to each other.

- Eroded sediments and organic detritus are carried distances proportional to the current velocity and the size of sediment particles.

- Aquatic animals, especially smaller ones, are particularly affected by strong currents.

- Submerged aquatic plants are seemingly less affected by currents.

3.2 Sediment Deposition and Flushing Characteristics

3.2.1 Deposition at Channel Entrance

[Major source for this section - Final E.I.S., Corps of Engineers (1975).) The present Coquille River Bay entrance is fully exposed to ocean waves approaching from northwesterly and westerly directions. The highest energy and most frequent ocean waves approach the entrance from the northwest and west, and a few high energy waves of short duration approach from the southwest. (1) Present orientation of the flared channel entrance directs northwesterly and westerly storm waves up the navigation channel, producing rough-water conditions at the Port dock and at the small boat mooring basis (River Mile 0.7). (1)

Wave action and littoral transport of sediment along Oregon's shoreline shift direction seasonally. During summer months wave action is primarily from the northwest. In the winter months wave action is primarily from the southwest.

A strong southerly set of ocean currents usually accompanies the northwesterly waves, which occur during the summer months when river run-off is low. The southerly set carries littoral drift around the end of the north jetty and deposits it in the channel. Because the amount of energy available for sediment transport is low, this creates serious shoaling and roughwater conditions at the entrance bar during later summer months. A northerly set is known to accompany southwesterly ocean waves, which occur during the winter months when the river run-off is high. Periodic river freshets during the winter months remove shoaling produced by the northerly set. There have, however, been periods up to several weeks in length when the entrance channel has been shoaled and the shallow controlling depths interfered with navigation even during the winter period.

The severe wave action from the southwest would indicate a predominant south-to-north transport of littoral material. However, there is a net loss of foreshore sediments associated with the waves from the southwest and a net gain of foreshore sediments associated with waves from the northwest. (1)

3.2.2 Flushing Characteristics and Deposition of River Sediments

Estuary flushing is not a constant, simple process. It depends on the complex interaction of many factors operating in the estuary.

An examination of the average river run-off for the period 1930-1961 indicated a mean flow of 2,200 cubic feet per second (cfs). The flow varies from a low of 90 cfs in August and September to a maximum of 5,500 cfs in February. These flows correspond to 170%, 7% and 424% the high water volume of the estuary. High river run-off promotes flushing and thus aids in the removal of sediment from the entrance.

Physical factors which control flushing of an estuary include (1) freshwater discharge, (2) tidal range (measured in feet between High and Low water marks) and average tidal level during each tidal cycle, (3) the vertical differences in salinity and currents and the resulting vertical mixing and (4) wind and wave action. When making flushing predictions these factors are simplified. Though not discussed here, several methods may be used to make predictions. Each has its advantages and disadvantages.

The Coquille River discharges approximately 100,000 tons of sediment per year. Although a large portion of this is deposited in the estuary, significant build-up occurs on the beach to the south of the South Jetty. During the low run-off summer months, stream discharge is not sufficient to flush sediment from the harbor entrance. (5) Dredge samples taken by the Corps of Engineers at the Coquille entrance in 1960 and 1970 indicate that the sediment deposited in the estuary is predominantly fine to medium sand size particles with an organic content of from 0.44% to 0.6%.

Annual dredging of the bar and ship channel is necessary to keep the harbor open to navigation. During a typical average year about 62,000 cubic yards are removed by hopper dredge and deposited in an Environmental Protection Agency designated interim ocean disposal site 0.9 mile due west of the river mouth in 40-60 fathoms of water. (1)

Deposition within the estuary produces a natural sequence of landform development, which proceeds from submerged land successively through tidal flats, tidal marsh, and meadow. Vegetation of the marshes efficiently entraps sediment so that ground elevations of marshes generally are a foot or more above the immediately surrounding tidelands. In quiet brackish waters, such as sloughs, clay flocculation by positive ions in the saltwater is now recognized as a major contributor of sediment.

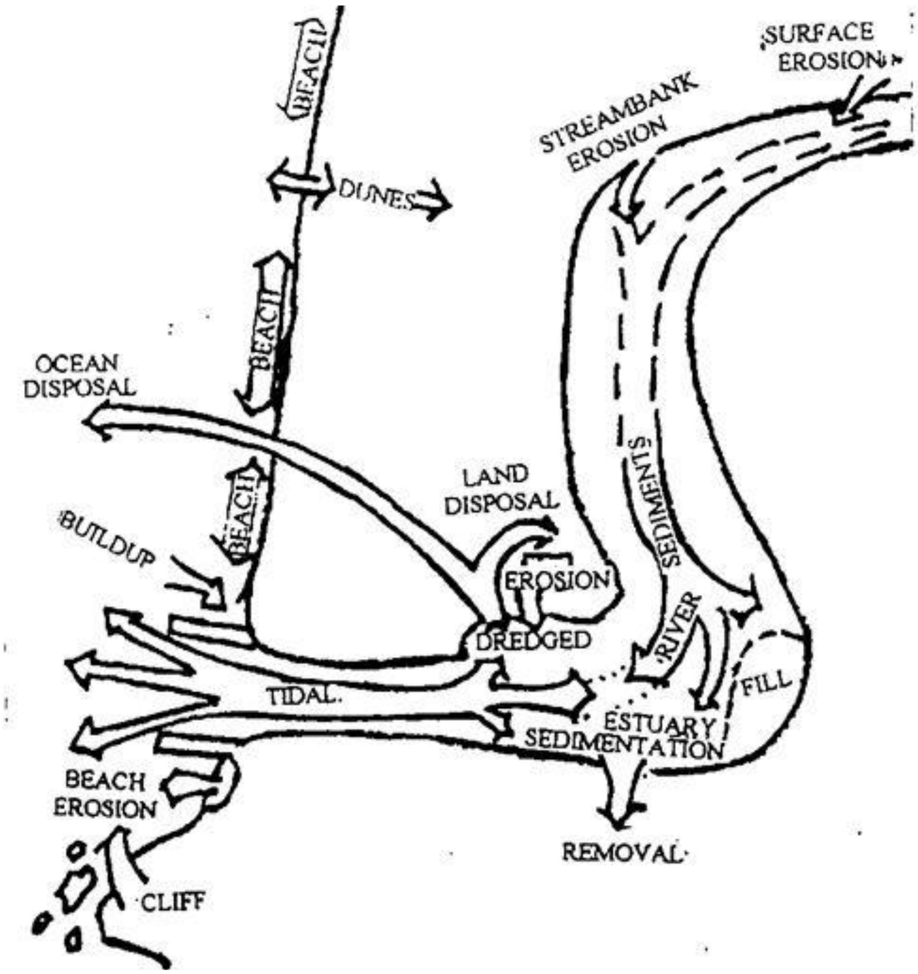
The filling of estuaries by sediments is a natural and irreversible process. Man can modify the rate of filling in several ways including:

A. increasing or decreasing the supply of sediment from the watershed;

B. increasing or decreasing the supply of sediment from the coastal zone; and

C. Modifying depositional patterns within the estuary.

Figure 3.2 Estuarine sediment transport



Beaulieu and Hughes (6) have summarized available evidence on the formation of estuarine marshes, which is quoted in full as follows:

> "The most significant change in the estuary of the Coquille River in historic times has been the rapid spread of marshlands along the east bank north of Bandon. Prior to 1895 most of the marsh did not exist. Since that time, the marsh has spread at rates up to 70 feet per year, although it has slowed considerably in recent years." (p.125)
>
> "The marsh occupies the inner bend of a meander, formerly an area of slack water. The brackish water site was ideal for deposition of flocculated clays and other fine-grained sediments. The slack water area probably formed when the Coquille River cut westward into the easily eroded spit, leaving its former channel. It is unknown when the river shifted to its present location. Available records show that the river has not changed course since 1887."
>
> "Formation of the marsh is here attributed to a sequence of natural events which included: a) a shift of the main channel of the river westward to produce slack water conditions along the old channel; b) regional shallowing along the east bank as a result of sedimentation; and c) rapid lateral spreading of marsh as a result of sediment entrapment."

"Logging and forest fires in the watershed undoubtedly contributed to the sediment supply but probably were not a major factor in the formation of the marsh. Before the marsh began to spread, shallow tidelands developed in the slack water as a natural result of hydraulic conditions and at a time prior to man's influence in the hinterland. Likewise the rapid spread of the marsh is explained primarily in terms of sediment entrapment by vegetation rather than a greatly increased sediment supply."

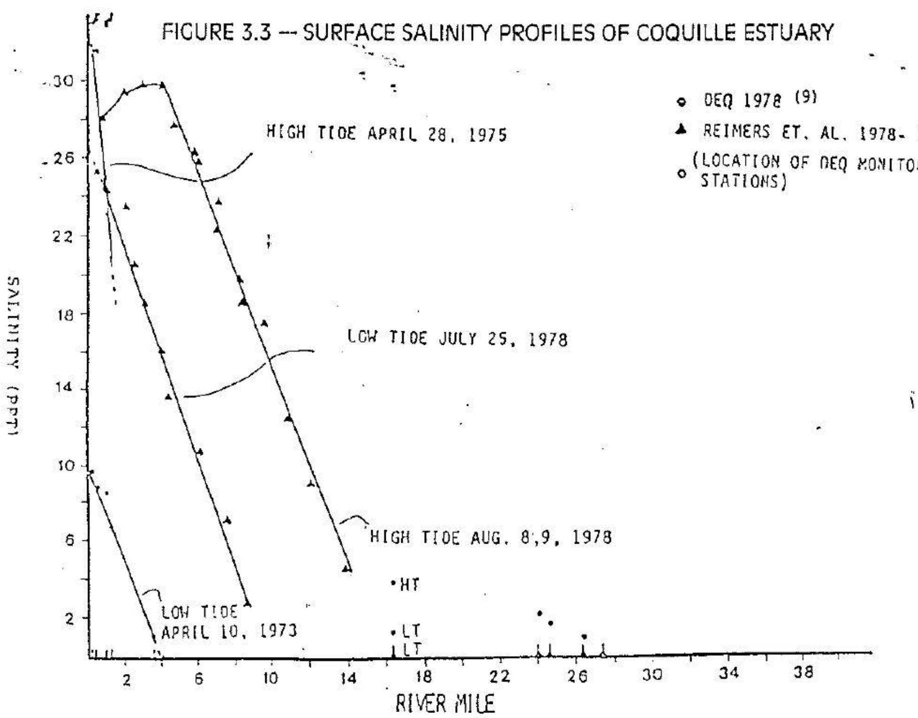
3.3 Salinity Levels and Mixing Characteristics

Few measurements of salinity are available for the Coquille. Spring and summer salinity regimes (Figure 3.3) have been drawn from data taken on four different days. Department of Environmental Quality monitoring stations in the Coquille are clustered near Bandon and the City of Coquille, and are of limited value for describing salinities and mixing characteristics throughout the estuary. Limited data indicate the estuary is fresh year round from RM 13.8 to the head-of- tide (RM 39). (7)

It is known that during periods of high runoff, the bay is essentially fresh. During late summer, July through October, when run-off is very low, it is assumed that the denser ocean water flows upstream along the bottom permitting certain salt tolerant species such as crab to migrate further into the bay at that time. (5)

In most Oregon estuaries the maximum extent of salinity intrusion is at or near the head-of-tide. However, this does not apply to the Coquille, and the difference between extent of salinity intrusion and head-of-tide for the Columbia is even greater, it is possible that the biological communities of the upper Coquille and Columbia Estuaries display similarities that do not occur elsewhere in Oregon. Summer water temperatures in the upper tide water of these two estuaries are also similar, regularly exceeding 68 F (7).

Figure 3.3 Surface salinity profiles



During summer, salinity at high tide in the lower 3 to 5 River Miles of the Coquille was uniform and above 30 ppt, while at low tide all salinity measurements were less than 30 ppt. Reimers, et. a. (8) measured surface and bottom salinity and temperature between RM 0 and RM 9. The difference between surface and bottom salinity was approximately 2 ppt, indicating the estuary was vertically well-mixed. Their data also shows that salinity in the channel dropped linearly from 30 ppt to 5 ppt over a stretch of approximately 9 miles that a varied in location with the tidal stage. This is a further indication of the thorough mixing of the fresh and ocean waters during the summer. At low tide no salinity values greater than 5 ppt were measured above RM 7. High tide salinities during summer were greater than 5 ppt up to about RM 13.8. Of the few available upstream salinity measurements, the mouth of Rink Creek (RM 26.4) is the farthest that values greater than 0 ppt have been found. (7)

During winter and spring the freshwater flow strongly limits the intrusion of marine water. The only available measurement of salinity during higher flows is on April 10, 1973. Stream flow data indicated that freshwater flow from the three main forks was 1,500 - 2,500 cfs that day, a level which is lower than average mid-winter flow and normal for April. Salinity at low tide was 9.6 ppt at the mouth, 1.0 ppt near the u. S. 101 bridge (RM 3.5), and 0.0 ppt elsewhere (9). Salinities at low tide during higher flow would be even lower than on April 10, 1973. Spring and winter mixing characteristics cannot be established from existing data, but the estuary is likely to be stratified at that time. (7)

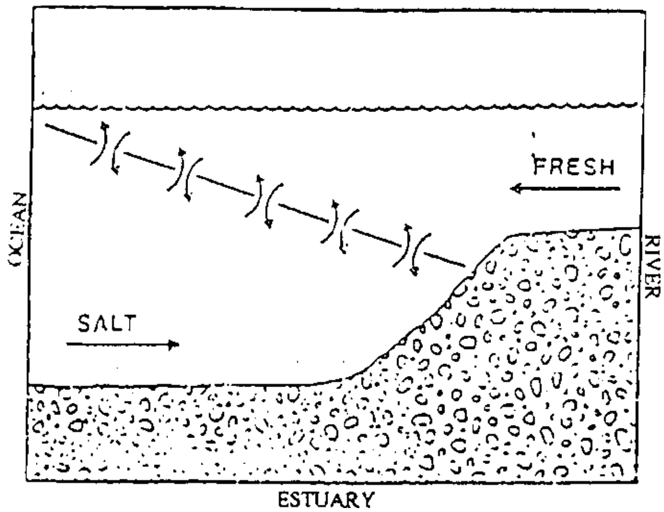
Saltwater is denser than freshwater, so that if two bodies of these waters meet, it is to be expected that the lighter freshwater will float on top of the denser saltwater. In fact this situation often arises in an estuary, and gives rise to a typical salinity distribution pattern. Where salt and freshwater meet, the less saline water floats on top of the more saline water and gradual mixing occurs.

Mixing Characteristics – Mixing refers to the dilution of saltwater in the estuary. Saltwater is brought in by the tides and freshwater flows in from the river. Because of a multitude of physical factors such as magnitude of freshwater inflows and the shape of an estuary, the proportions of fresh to saltwater can vary widely. Depending on other physical factors involved, the heavier saltwater may or may not "sink" to the bottom of the estuary. The numbers and types of freshwater, saltwater and estuarine organisms are a reflection of the salinity.

Mixing is an important parameter in that it can define a habitat both on the basis of salinity and the extent to which there is a salt and freshwater interface throughout the year. The following mixing types are most typical: (1) the two-layered system; (2) the partially-mixed system; and (3) the well-mixed system. The following descriptions and diagrams illustrate these different mixing characteristics.

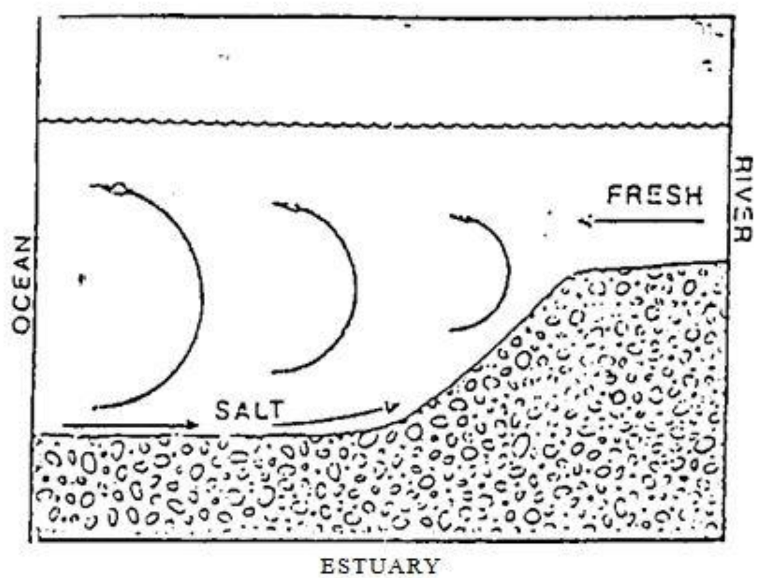
The two-layered system is characterized by a large difference in the salinity of the fresh surface water flowing out and the salty bottom layer flowing in. (See Figure 3.4) A salt "wedge" made up of inflowing seawater maintains a relatively constant position in the estuary along the bottom.

Figure 3.4 Two-layered estuarine system



Some of the saltwater mixes at the interface with the freshwater and is again carried out to the sea by the freshwater flow. The inflow of seawater on the bottom maintains the salt wedge and balances the salt lost to the freshwater. A relatively small tidal range exists and this limits the amount of mixing, which occurs. A high river run-off with a large volume of water flowing seaward on the surface maintains the sharp salinity interface.

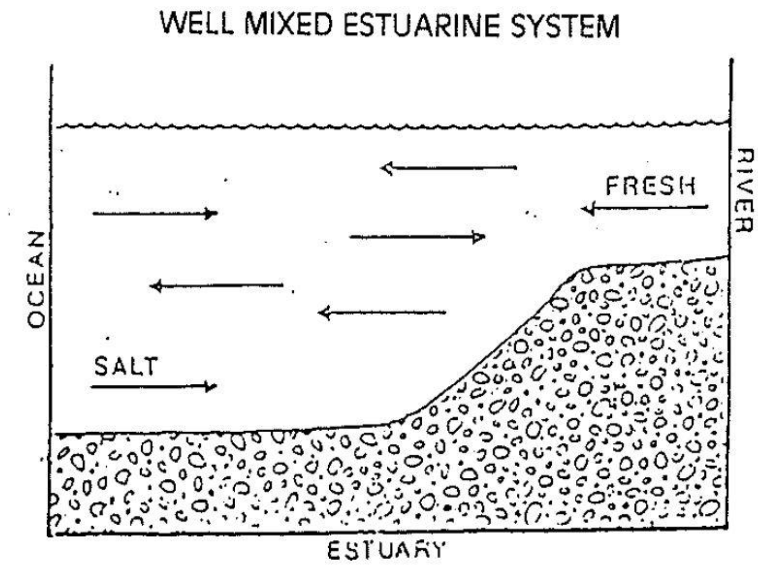
Figure 3.5 Partially mixed estuarine system



The partially mixed system also has a difference between the salinity of surface and bottom waters, but without the sharp interface of the two layered system (See Figure 3.5). Relatively moderate to strong tides contribute the energy required to bring about surface freshwater and the bottom saltwater. Moderate run-off also leads to greater mixing as a sharp interface is not maintained. The estuary has a moderate depth-to-width ratio, which enhances mixing. The difference between the surface salinity and the bottom salinity is 4% to 19%.

In the well-mixed system little difference in the salinity of surface and bottom water exists. (See Figure 3.6) A relatively large tidal range exists and provides turbulent energy for complete mixing. There is a very low run-off, which allows vertical mixing to be complete. And a low depth-to-width ratio exists so that the estuary is shallow and may have tidal flats. This low ratio tends to concentrate the turbulent mixing brought about by the tides. The difference between surface salinity and bottom salinity is 3% or less.

Figure 3.6 Well-mixed estuarine system



Over a year's time, the Coquille Estuary exhibits more than one, and in some cases, all of the above described mixing characteristics. In almost all of the riverine estuaries like the Coquille, various stages of two layered and partially mixed systems will occur. Some will also exist as well mixed systems during the times of extremely low freshwater inflows.

An estuary, which might go through all three mixing systems in the course of an annual cycle, could be described as follows. During the winter and spring, snow melt combined with high rainfalls in the estuary watershed cause high peak flows in the river, which flows into the estuary. The lighter freshwater spreads over the surface of the estuary and by the force of its mass, displaces the previously well-mixed surface. Once a stable condition is reached, the heavier saltwater layer will reach an equilibrium position and will move in and out with the tide. The relatively small amount of saltwater that is literally torn from the interface is diluted and flows out with the overlying freshwater.

As the freshwater inflow becomes lessened during certain times of the year, mixing becomes possible and the distinct line between salt and freshwater begins to disappear. This generally occurs during late spring/early summer and during late fall/early winter.

During the summer and early fall high tides and low freshwater run-off from the land combine to transform the estuary into a vertically homogenous system that shows very little difference in salinity from surface to bottom.

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4. PHYSIOGRAPHIC SETTING AND GEOLOGIC HAZARDS

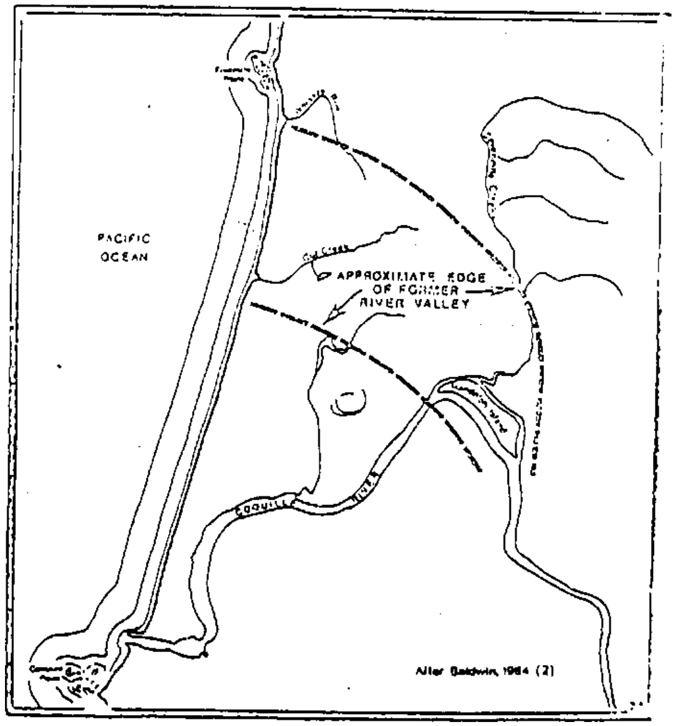
4.1 Geologic History

The coastal areas of Oregon and Washington have been characterized throughout much of geologic time by complex interactions between the neighboring oceanic and continental crustal plates. Much of this coastline remained part of the ocean floor until relatively recent times. During this long period, deposition of sea floor basalts alternated with thick accumulations of offshore and shallow-sea sediments. The source for these sediments was apparently the ancestral Klamath Mountains as well as thick, submerged piles of undersea volcanics.

Since the beginning of the Eocene epoch, roughly 60 million years ago, the pattern of deposition in the area became controlled by a long sequence of marine regressions and transgressions. The rocks deposited during this period contain evidence of beach, lagoonal, and deltaic environments, with minor periods of folding, faulting and erosion occurring between most of the units. This pattern continued into the Pliocene epoch, about 10 million years ago, when regional uplift caused the southern part of the Oregon coastal area to emerge from the sea. Since then, glacially-induced fluctuations in sea level have combined with continued regional uplift to create a well-preserved sequence of marine terraces which can be seen in the area elevations of 70 to 1,200 feet, with the higher terraces representing progressively older inundations. The latest sudden rise in sea level, associated with the close of the most recent (Wisconsin) glacial period, has flooded the mouths of the major coastal rivers to create the present-day estuaries, which continue to shift position and shape.

The Coquille Estuary, from the mouth of the river to the head-of-tidal influence, flows in a floodplain of alluvium deposited in what was once a deep valley, carved during a period of lowered sea level (the Wisconsin glacial period) through Tertiary strata, which is gently to moderately folded along northwest-trending axes. (This regional structural trend controls the drainage pattern of the area, and, to some degree, the shape of the present-day estuary.) When sea level rose with the retreat of the glaciers the ocean flooded the mouth of the river causing the sediment-laden river to drop its load of sand and silt in its former valley, instead of carrying it out to sea. The broad alluvial floodplain was built up over the last 10,000 years and the processes of sedimentation and deposition continue today (1, p.37-40). Poorly consolidated beds which are believed to represent an earlier estuary of the Coquille River exist between Cut Creek and Whiskey Run, to the north of the present mouth of the river. Apparently the river cut a valley at that location during some previous glacial period. The flooding associated with the interglacial period immediately following formed that estuary, with the latest advance of the glaciers (Wisconsin period) the Coquille carved a new valley at its present course, thus preserving the ancient estuarine deposits. (See Figure 4.1)

Figure 4.1 Former course of Coquille Estuary

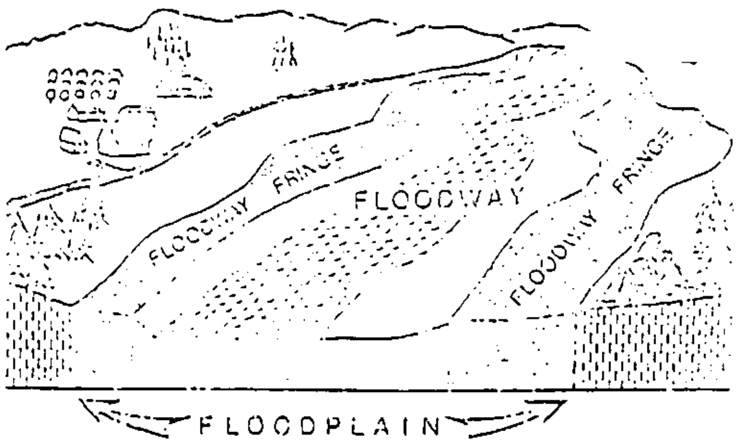


4.2 Stream Flooding

For floodplain management purposes, a flood prone area along a stream can be divided into two parts - the floodway and the floodway fringe – each located within the floodplain (See Figure 4.2).

The floodway is the minimum area for passage of floodwaters in order that flood heights upstream are not increased beyond an acceptable amount; it is the portion of the floodplain required to discharge the base flood. The floodway fringe bordering the floodway, may be subject to flooding but does not contribute appreciably to the passage of flood flows. Mapping this information can help to develop flood profiles indicating the flood elevations to be expected along the stream.

Figure 4.2   Floodway and floodway fringe



The topographic and climatic conditions existing in the Coquille River Basin often result in flood problems for the lowland areas during the winter and spring seasons. The floodwaters are primarily from rapid run-off of precipitation, or inundation of coastal lowlands as a result of tidal action, or direct precipitation or any combination of these causes.

Damages are most severe when high tides occur simultaneously with high stream flows (which often happens in the spring) restricting the ability of the stream to discharge into the ocean (3). Floods may occur as early as September or as late as May but are most likely to occur between November and March.

Flood problem areas in the Coquille valley have been identified by the Army Corps of Engineers. Among them are the following:

A. Tidal, along the lower Coquille River;

B. Lower portions of the City of Coquille;

C. Coquille River from Myrtle Point to Riverton;

D. Need for drainage of flood waters of the Coquille River from areas behind low natural and man-made levees;

E. Restricted channel at Riverton on Coquille; and

F. Saltwater flooding of agricultural lands on lower river.

Army Corps of Engineers studies give maximum recorded floods and flood magnitudes which may be expected to recur at gauging stations upstream from the estuary.

However, such detailed data is not available for the tidal portion of the Coquille. On the Coquille River, bank full discharge between Bear and Lampa Creek, RM 8 and 12, is 18,000 cfs (4, p.14). A discharge of this magnitude is possible once every three years on the North, South, East and Middle Forks of the Coquille River. Moreover, the combined total discharge of any two forks exceeds 18,000 cfs every year and river banks in the lower reaches of the drainage are overtopped about three times each year (4, p.14). At Coquille, bank full discharge is at gauge height 16.0' (9.6 feet msl). At gauge height 17.5' (11' msl) flooding of the lowlands begins along the south Fork near Catching Creek (RM 39). At gauge height 20.5'

(14' msl) the floodplains between Myrtle Point, RM 37, and Norway, RM 35, are flooded. Downstream from Coquille, siltation of the channel has raised the level of the riverbed, inhibiting post-flood drainage. Prior to agricultural development, much of the lower valley was characterized by Marsh growth and prolonged ponding (3, p.61).

The December 1964 flood was the greatest flood on record in Coos County in this century. Total damage in the Coquille basin was $3.1 million and included $1.44 million to agricultural land, $868,000 to industrial property, $178,000 to transportation, and $323,000 to channel improvements (3, p.67). At Myrtle Point, the South Fork of the Coquille River crested at 46.8 feet above mean sea level, nearly 10 feet above flood stage and approximately 5 feet above the level of the intermediate Regional Flood (see Table 4.1). At Coquille, the flood crested at 21.1 feet (msl) and water averaged 15 feet deep on the floodplain. This compares with a crest of 23 feet (msl) for the largest flood on record in that area in 1890 and a crest of 24 feet (msl) for the intermediate Regional Flood. (4, p.15)

It is estimated that the peak discharge on the main stem Coquille during the 1964 flood was 120,000 cfs.

Table 4.1 Water elevations of the 100-year flood in the Coquille River Basin

Location	River Mile	Appropriate low water elevation (feet, mean sea level)	100 Yr. Flood elevation (feet mean sea level)
Coquille River	0.1	Varies with tide	8
Bandon	16.4	Varies with tide	22
Riverton Ferry	24.6	Varies with tide	24 (2)
Coquille			
South Fork			
Mouth of N. Fork	36.3	1.5	36.5
Myrtle Point	37.4	2	41 (3)

Specific damage during the flood of 1964 included destruction of logging roads and bridges in the uplands, flooding of the sewage treatment plant at Myrtle Point, and forced evacuation of numerous residents at Myrtle Point. The community of Coquille was isolated from Coos Bay by 3 feet of water over the road at a point 4 miles west of Coquille. Two plywood plants were flooded to depths of 4 feet and numerous houses and pastures were damaged.

The January 1974 flood resulted in $173,000 damage along the lower reaches of the Coquille River. The flood crested at 17.2 feet (msl) (gauge height 24 feet) and inundated large lowland areas, it was the third largest flood since the 1955 flood, which crested at 37 feet near Myrtle Point.

4.3 Ocean Flooding

Ocean flooding can be caused by tidal action, storm surge, or tsunami and affects such landforms as beaches, marshes, tidal flats and low-lying interdune areas.

(1) Adapted from U.S. Army Corps of Engineers, Review Report: Coquille River and Tributaries, Oregon (1972).

(2) 23 msl for 1890 flood; 21.1 msl for 1964 flood.

(3) 46.75 msl for 1964 flood

SOURCE: Environmental Geology of western Coos and Douglas Counties. Oregon of Geology and Mineral industries (1975).

A Tsunami is a wave generated at sea by large earthquakes or violent submarine volcanic eruptions. It can have wave lengths of a hundred miles or more and amplitudes of seldom more than a foot while at sea and early detection is difficult. They reach velocities of 450 mph in some parts of the Pacific Ocean. The height of a tsunami at any particular location is determined by the magnitude of the generating disturbance, distance from the source and offshore bathymetry. The Coquille bank off the coast of southern Coos County is a shallow area whose possible effects on tsunami magnitude are not yet well-understood. Likewise the possible effects of submarine canyons are undefined. The narrow, shallow entrances, extensive marshes and winding lower reaches of estuaries tend to disperse tsunamis and their run-up (the elevation of land reached by the wave) tends to be dampened by the marshes. (3, pp. 73-75)

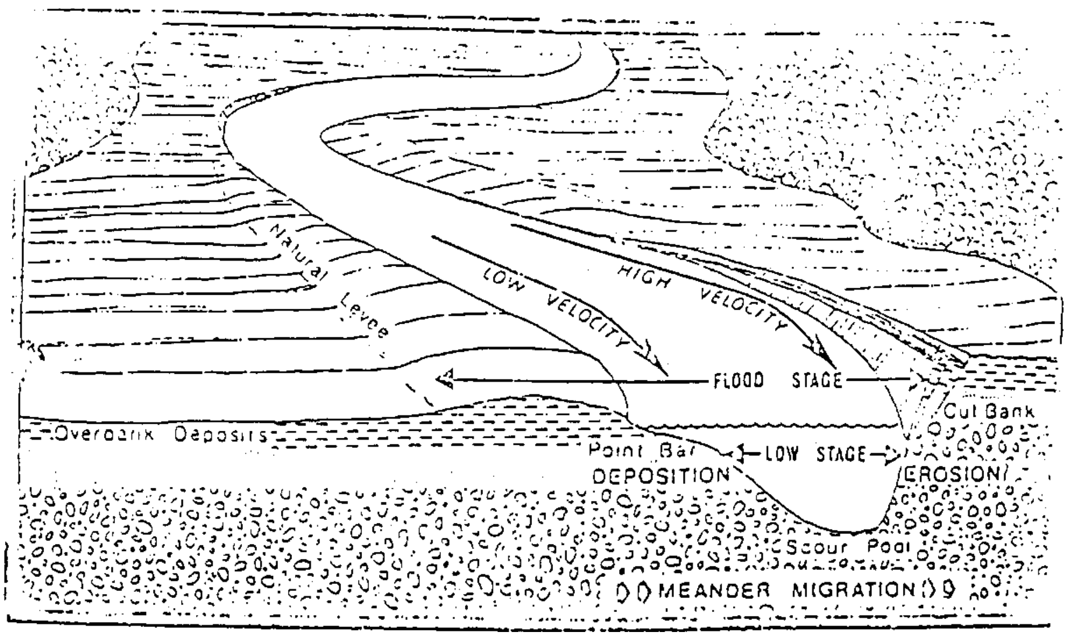
The impact on the estuary, however, "may be disproportionately high owing to the great extent and the very low elevations of much of the estuary borderlands" (3, p.77). Potential damage to the estuary includes flooding of tidal flats and marshes, damage to structures, vessels and moorings and danger to persons on beaches and tidal flats. A tsunami generated by the Good Friday earthquake in Alaska in 1964 caused $700,000 worth of damage and four drownings on the Oregon Coast. Downtown Bandon was temporarily flooded.

4.4 Streambank Erosion and Stabilizing Measures

Erosion occurs on stream banks and stream beds where stream velocity and hydraulic pressure exceed the capacity of the bank material to withstand it. Deposition occurs where the sediment-carrying capacity is reduced due to changes in the stream parameters (velocity, discharge, width- depth, load, channel roughness), such as on the inner parts of meanders, behind obstacles and on floodplains. Both can cause substantial changes over time in the course of a river and can result in considerable losses of land and other property.

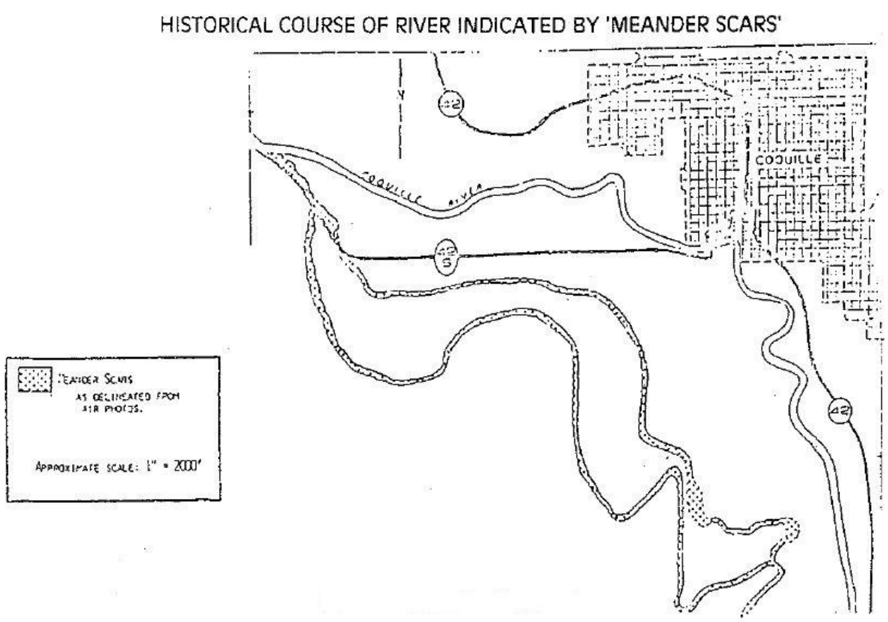
Stream bank erosion and stream deposition are exemplified by the processes taking place at river meanders (See Figure 4.3). Stream velocity is normally greater on the outside of a bend and hydraulic pressure is concentrated on that bank causing erosion and gradual undercutting. Eroded material is picked up by the current and carried downstream; suspended sediments have an abrasive action and add to the erosive power of the river current as does larger floating debris like logs and other material. Meanwhile, current is slacker on the inside of a bend and thus has less sediment bearing capacity. The coarser sediment is deposited in the slack water area to form a "point-bar". Gradually, as the point-bar grows and the cut bank recedes, the course of the river may shift, depending on the severity of erosion. This is termed "meander migration".

Figure 4.3 Stream erosion and deposition processes



The fact that meandering rivers occupy different channels with the passage of time is well-known to anyone familiar with the broad floodplain of the Coquille Valley. Meander scars, marking former channels of the river, are especially prominent in the valley southwest of Coquille (See Figure 4.4) but occur elsewhere in the valley as well, along with oxbow lakes, which are former channels still occupied by bodies of water now isolated from the flow of the river. These landforms are also known as "cut-off meanders".

Figure 4.4 Historical course of river indicated by "meander scars"



The Coquille River has experienced significant streambank erosion during recent years, particularly during the heaviest floods. The most recent severe flooding and erosion occurred during the winter of 1973-74, although erosion is experienced each winter. This has resulted in significant losses of farmland to some riparian landowners. The Coos Soil and Water Conservation District has shown deep concern in the last few years about this continuing cycle of erosion and the resultant loss of land and sedimentation. There has been a call to stabilize banks with riprap or non-structural measures like re-establishment of riparian vegetation. Riprap has been used successfully in a few areas (e.g. Bullards Beach State Park), but is generally a rather expensive method of stabilization and may only be economically justified where needed to protect a road or other expensive structure. In addition, though it is effective in preventing erosion at that site if properly installed, riprap may have the effect of increasing current velocity because of a reduced "coefficient of roughness". This can cause worse erosion at a downstream site. For both these reasons, vegetation management has been proposed as a cheaper and more natural method of controlling erosion. However, vegetative stabilization alone may be ineffective at sites of severe erosion, such as on the insides of bends. Here, the most effective approach may be to install riprap at the base of the eroded area, and use plantings and bank sloping above the riprap. This technique is being proposed for an extensive project between Myrtle Point and Broadbent (partially within the Estuary) to check severe erosion resulting in losses of farmland. Less severely eroded sites will use bank sloping and vegetative plantings. Designs to be used were developed by the U.S. Soil Conservation Service.

Riparian vegetation may be managed to improve its stabilizing qualities while reducing some of the hazards that it may cause. On the Coquille tidewater, large riparian species (typically alder or cottonwood) may be undercut at the roots. Eventually, they topple into the water, tearing out part of the bank and causing jams which compound the erosion. Other species, however, typically willow, grow low over the water. During flood stage they are partially submerged and protect the bank by breaking the force of the current. The root masses work to hold the bank together. The Coos Soil and Water Conservation District has been working in cooperation with riparian landowners and the local office of the Oregon Department of Fish and Wildlife on a project to remove large trees that are leaning or dangerously close to the water, while retaining snags that are important to osprey and bald eagle. Meanwhile, it has been proposed to propagate slips of native willow along stretches of riverbank that are unprotected by vegetation. Native willow is easily propagated and is expected to produce strong growth with a year or so, provided that erosion is not severe during the first winter.

The "Natural Hazards" map shows the location of the most significant streambank erosion problems. The most serious erosion occurs on tight meanders. The upper section of the riverine subsystem between Coquille and Myrtle Point experiences the worst erosion problems. Log debris from further up the system tends to jam up in this stretch and cause eddies which are deflected at the banks. Particular hazards exist where severe streambank erosion is occurring adjacent to a roadway. There are several locations along Highway 42S and the North Bank Road where this is occurring. For instance, immediately west of the 42S/Fat Elk Road junction, the road passes within 20 feet of the riverbank, lined with large alders, which are leaning over the river, unless these trees are cut and the bank stabilized, there is a high probability that erosion will threaten the road which is already subsiding at this point, when the trees fall into the stream. Riprap may eventually be necessary if severe erosion and subsidence cannot be averted at these locations.

4.5 Stream Depths, Siltation and Shoaling

The tidal Coquille River exhibits wide variation in stream depths as a result of natural hydraulic forces and the deposition of large quantities of silt and other sediment. See map "Water Depths" for data derived from two Army Corps of Engineers surveys. Depths from the mouth to RM 1.3 are based on the maintained depth of the authorized channel (13 feet). Depths from RM 1.3 to RM 3.0 are based on a 1963 survey. Depths from RM 3.0 to RM 38 are based on a 1965 survey. The depths shown indicate depth below mean lower low water [3.59 feet below mean sea level, 1974 adjustment].

In the 1963 survey, bank-to-bank readings were taken every 200 feet. In the 1965 survey, parallel sets of readings were taken along the channel at intervals of 50 feet (or about 106 pairs of readings per mile). River depth averages are shown at every River Mile (RM) for reference. Where applicable, the shallowest shoal and deepest hole are also shown, intermittent averages are shown when the river depth changes dramatically (i.e. plus or minus 4 feet) in the immediate area. Though the measurements are old, it is expected that the riverbed profile and areas of worst shoaling indicated on the map remain in nearly the same locations today. However, shoaling may be more or less severe depending on the amount of erosion in the previous winters. The worst areas of shoaling occur in the Coquille-Myrtle Point reach where bank erosion is also at its worst. Sedimentation is also worst in the upper tidal reaches because the heavy sediment load brought down from the forest uplands has a tendency to be deposited when the river gradient suddenly flattens out at the head-of-tide. In the reach above the North Fork confluence, water is sometimes as little as one foot deep (see Stream Depths map). Very heavy sedimentation has occurred in this reach. There are several other places between Johnson log pond and Myrtle Point where shoals reduce depths to less than six feet. Even recreational fishing boats have problems at low water in certain shoaled areas where depths are three feet or less. These problems are exacerbated by the presence of sunken logs and old pilings. The Task Force has identified minor scalping of shoals as a maintenance activity, which will be needed from time-to- time to permit boat passage.

It should be noted that the Army Corps of Engineers authorization includes the removal of drift logs and snags in the river up to City of Coquille, the upstream limit of the Federal project. The Coquille River is one of the few rivers on the coast where this is the case. However, the Corps has not acted upon this authorization since it conducted clearing and snagging operations in 1973-1974. The Corps could reactivate this program as a result of the latest study (See Section 5.3) to improve navigation.

It is evident that very extensive dredging would be needed to restore the river to its early navigability and make it suitable for barge traffic as far as Myrtle Point. At present, it is difficult to foresee any need to restore the river to commercial navigation as far as Myrtle Point.

Below City of Coquille, shoaling is by no means as severe or as frequent. The most significant areas of shallow water are in the bay between RM 1.3 and RM 2, opposite the Bandon marsh, where slower current and flocculation due to salinity has contributed to sedimentation and opposite Randolph Island between RM 6 and RM 7. Loaded shallow draft barges from Rogge Mill are currently able to negotiate the section in the bay during favorable tidal conditions (see Section 7.3.2). There are only four locations where depths are 8 feet or less between Bullards Bridge and City of Coquille. Technically, the same shallow draft barges could therefore navigate successfully up to the City of Coquille on the high tide if barge traffic returned to the middle section of the river.

However, the Task Force has raised the possibility that the natural channel depth may not prove adequate in the future between RM 1.3 and the Prosper area (RM 5.2). With the deepening of the entrance channel and boat basin construction, two changes might occur which could bring about a need to deepen the natural channel in this section:

i. Moore Mill and Rogge Mill would be able to switch to a deeper draft barge with improved bar depth. Stream depths between RM 1.3 and RM 3.5 might then become the limiting factor in navigation.

ii. As larger fishing vessels start using the boat basin and boat repair facilities and a recreational marina develop above Prosper, a need may occur to accommodate these larger vessels between RM 3.5 and 5.2.

At present, the minimum recorded depth in this section is six feet below MLLW (or 12.8 feet below MHHW), between RM 1.3 and RM 2. The Task Force states there may be a future need for a minimum depth of 15 feet below MHHW. Thus, the channel would require the removal of a maximum 2.2 feet depth where shoaling is at its worst to accommodate any expected increases in vessel size and draft up to above Prosper (RM 5.2).

The current Army Corps of Engineers study will address the question of the economic feasibility of dredging to remove shoals in the section of the channel between RM 1.3 and RM 3.5 (see Section 5.3.1)

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5. PHYSICAL ALTERATIONS

5.1 Introduction

Physical alterations of the Coquille River Estuary include primarily jetty construction, channel- dredging, diking and draining of large areas of former marsh land for agricultural use. Other activities such as construction of bridges, boat ramps, roads, wharves and docks have also had a significant impact on the physical configuration of the estuary. In addition, human activities in the upland regions of the Coquille River basin such as logging, road building and urban development have also affected the estuary through changes in sediment production. (1, pp 87-91)

Alteration of such features as the slope, configuration and composition of a streambed or channel, or changes in the amount of water or sediment in the stream can affect the degree and location of such natural processes as sedimentation, erosion and flooding (see sections on Water Quality and Geologic Hazards).

5.2 Jetty Construction

Between 1860 and 1880 the mouth of the Coquille River shifted south against the marine terrace at Bandon. The eroded face of the terrace marks the river's southernmost migration (See Figure 5.1). The first jetty project, authorized in 1881 and completed between 1903 and 1908, was among the earliest in Oregon (2, p.54). The construction of the jetties restores the mouth of the river to its approximate 1860 position.

The current Army Corps of Engineers project is designed to provide a navigable channel 13 feet deep (at Mean Lower Low water) and of suitable width. It was authorized by the River and Harbor Act of 1910 as modified by Acts of 1919, 1930, 1935 and 1945. The boundaries of the project extend from the seaward end of the jetties to RM 1.3, (see Physical Alterations Map) and the project encompasses the construction and maintenance of the north and south jetties (3,450 feet long and 2,700 feet long, respectively) and annual maintenance dredging of the navigation channel (see Section on Dredging). The current harbor entrance was completed in 1933. The North jetty was reconstructed in 1942 and extended 750 feet to the east in 1951. The North and South Jetties were repaired in 1956 and 1954 respectively (3, p.1-1 to 1-4).

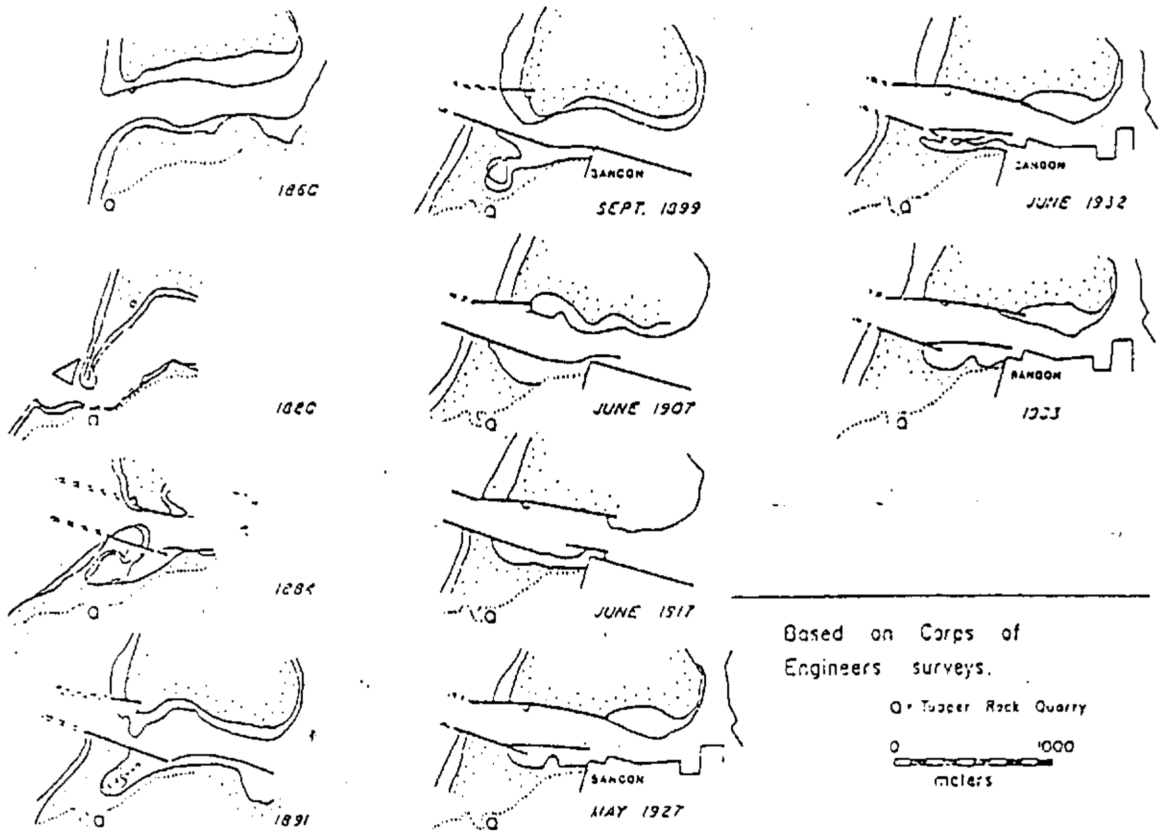
Table 5.1 Modifications of Coquille Bay Estuary by U.S. Army Corps of Engineers

Modification	Location	Depth	Dimensions Width-Length	Status
North Jetty	Entrance		3,450 ft.	1908 completed 1942 reconstructed 1951 extended 1956 repaired
South Jetty	Entrance		2,700 ft.	1908 completed 1954 repaired
Channel	Entrance	-13 feet MLLW	Suitable 1.3 miles	1933 completed

*Adapted from Percy and others, 1974. (3, p. 123)

Seaward advance of the adjacent shoreline is common following jetty construction; the beach growth is caused by interference with the longshore transport of sediments in the ocean. At the Coquille jetties, beach growth has been particularly pronounced (3, p. 4-1) and shoreline advance was greatest south of the jetties due to the larger embayment created by the placement of the South Jetty. This shoreline advance trapped a small lagoon behind the South Jetty (See Figure 5.1).

Figure 5.1 Effects of jetty construction on the Coquille River



THE HIGH TIDE SHORELINE IS GIVEN AS A DARK LINE AND THE LOW TIDE AS A THINNER LINE. SOURCE: Lizarraga-Arciniega, Jr., and Paul D. Komar, 1978 (2)

Current problems at the harbor entrance include a rough bar and recurrent shoaling conditions, restricting navigation by small boats, tugs and shallow draft vessels to the relatively calm periods of high tide (3, p. 1-1 to 1-4). In addition, the orientation of the breakwater tends to direct northwesterly and westerly storm waves up the navigation channel, contributing to rough water and surge conditions at the Port dock and the small boat basin (3, p. 4-4).

5.3 Dredging and Its Impacts

(Major source for following two sections, Final E.I.S., Chetco, Coquille and Rogue River Estuaries-Army Corps of Engineers, 1975).

5.3.1 Introduction

The current U.S. Army Corps of Engineers project at the mouth of the Coquille River includes a navigation channel to be maintained by dredging to a "suitable" width and to a controlling depth of 13 feet at Mean Lower Low water. The boundaries of the dredging program extends from the seaward end at the jetties to RM 1.3 (see Physical Alterations Map). The Corps annually removes dredge spoils in the neighborhood of 50,000 cubic yards and disposes of them at an EPA designated interim ocean disposal site (3, pp. 1-4 to 1-8).

Table 5.2 indicates the annual quantity of materials removed from the entrance channel and bar by the Army Corps of Engineers at Coquille River. The bottom area affected by dredging totals 98 acres. About 20% of this is dredged annually. The Port of Bandon has not performed any local maintenance dredging within the authorized project area since 1945.

The annual maintenance dredging is performed by a hopper dredge on a scheduled dictated by:

1) dredge availability [the same dredge is used at federal projects from California to Washington];

2) economic logistics; and

3) minimization of adverse effects on fish migration periods. The tentative schedule for the Coquille River project runs from April to July, although delays due to weather and bar conditions often push dredging operations into peak fishing seasons (3, pp.1-24, 4-29).

In 1962 local interests requested extension of the North Jetty and an increase in channel depth to 16 feet or 20 feet, MLLW. From RM 1.3 to RM 3.5, they requested a channel 14 feet deep MLLW. The existing channel in this area has a controlling depth of 8 feet MLLW. The Corps considered five plans for improving navigation in the harbor by extending the channel and protecting the entrance from cross-channel currents. In 1965, it was concluded that none of these plans would eliminate all delays to river traffic during period of low run-off, and therefore, further improvements were not economically justified at that time (3, p. 1-4 to 1-8).

However, at the urging of the Port of Bandon, Congress has authorized a study of navigation problems in the Coquille River entrance channel, and the feasibility of making improvements. The Port contends that the 13 foot channel is no longer adequate to accommodate the larger vessels calling at Oregon Ports. The Army Corps of Engineers has therefore started to investigate problems and needs, and to determine whether the channel should be deepened or other works undertaken. Economic costs and benefits, engineering feasibility and environmental impacts will be examined before making a final decision on whether to go ahead with a project. The Corps will be looking at the section from RM 1.3 - RM 3.5 as well as the currently maintained channel.

Table 5.2 Maintenance dredging by the Corps of Engineers at Coquille River (1957-1973)

Fiscal Year	Cubic Yards Removed	Average
1959	4,000	53,785
1960	96,385	
1961	45,226	
1962	79,395	
1963	75,027	
1964	56,242	
1965	62,250	
1966	66,810	
1967	54,500	
1968	45,537	
1969	25,900	
1970	34,900	
1971	50,500	
1972	14,450	
1973	90,370	

SOURCE: Final E.I.S., Chetco, Coquille and Rogue River Estuaries; Corps of Engineers, 1975 (p.1-8).

c:excel\v3p2t5.2

5.3.2 Physical and Biological Impacts of Maintenance Dredging

Maintenance dredging of the navigation channel and harbor entrance does not affect the bedrock geology of the estuary, but does affect the submarine topography in the area of dredging, and frequently removes naturally-formed sand barriers that develop at the mouth of the estuary.

Land disposal of spoils can affect the soils in the disposal area, water quality deterioration may also result from sediment run-off from shoreland spoils disposal areas associated with Corps permit activities unless these areas are properly located or diked to prevent such return. Dredging operations also affect water quality, by increasing the oxygen demand in the water due to the release of organic materials. Toxic metals, gases or other materials may be released from the bottom as well, although the likelihood of this is small, since most bottom sediments consist of clean sand and gravel. In the Coquille River, the accumulation of bark and other wood debris from earlier log rafting and storage in the estuary may result in the release of toxic sulfide compounds when the decomposed debris are disturbed by dredging. This effect is believed to cause a minimal increase in oxygen demand, and log rafting is not presently practiced on the Coquille River (3, pp. 4-5).

Dredging produces a variety of immediate and latent environmental impacts. The effects on organisms in the dredging project area may be identified on three levels.

Primary level effects include direct physical effects to organisms casually related to project activities (e.g., burial, siltation of filtering animals, killing benthic animals, food web disruptions, etc). Primary level effects are usually immediately observable (ecosystem effects may have a time lag) and traceable to the project activities.

Secondary level effects include impacts brought about by changes in the physical environment that subsequently change the biological structure of the dredged area. Secondary level impacts occur over a longer time span than primary level impacts and are often difficult to trace directly to the project. Changes in sedimentation patterns, tidal mixing, salinities and turbidity all tend to result in a changed biota.

Tertiary level impacts are the indirect result of a change in human use of the estuary. The estuary is affected by boat traffic, industrialization, recreational use and sewage loadings. Tertiary level impacts occur over an extended time span and are only indirectly traceable to the project.

Primary and secondary level effects are direct changes in the properties of the estuarine system. Tertiary level effects are long-term changes that result from an altered estuarine system (3, pp. 4-8).

Changes in the river bottom topography, alters currents, tides, salinity regimes and water quality. Changes in currents can create a shoaling problem. Changes in salinity can affect the vegetation in an area and reproductive cycles of organisms in the project area.

Dungeness and red rock crab generally inhabit the dredged areas in Coquille Bay only during their mating seasons of June through October. Those animals which move very slowly and which are in the dredging area during dredging operations are killed if they do not avoid the suction pipes of the dredge. Although there have not been sufficient studies done to determine the impact of dredging upon dungeness crab and red rock crab populations, their presence in Coquille Bay is closely related to changes in salinity.

Physical and biological factors in the estuarine system are intertwined. Man has demonstrated the ability to change almost any one of these factors and has found that he often sets up a "chain reaction" which ultimately changes other environmental factors quite dramatically. As a result, the anticipation of the reactions in the estuary is vital to ensure the health of the ecosystems in dredged areas.

The impact of annual maintenance dredging upon the terrestrial ecosystems is very slight, impacts upon the aquatic ecosystem are greater, although when compared to potential impacts of activities like new dredging they are relatively slight. Food chains can be temporarily interrupted when benthic organisms are removed from the river bottom.

The primary areas of food chain production are the intertidal mudflat and salt marsh areas, which are outside of the dredging areas. Most marsh lands and tidal areas are upstream of the dredging limits. Those that are downstream from dredging activity can be affected by increased turbidity levels from hopper dredge overflow. This action could temporarily reduce primary food production within this tideland area, but this, too, is a natural occurrence in the ecosystem during spring freshets when turbidity levels are high (3, pp. 4-8 to 4-11).

The extensive intertidal areas along the Coquille River Estuary include eelgrass beds. Annual dredging does not have a significant impact on these since they are on the intertidal estuary shore outside of the dredging area.

5.3.3 Other Potential Dredging Projects

The Plan identifies seven other specific sites where dredging is likely to occur to accommodate water-dependent projects. In addition, the Task Force has discussed the question of the need for future minor navigational improvements to remove shoals from the natural channel, particularly in the upper estuary where they pose a hazard for recreational boating, and between the current authorized channel and Rogge Mill (RM 3.5). See also section 4.5 "Stream depths, siltation and shoaling" for discussion of the exact locations where the most serious shoaling problems exist.

Site 1: Bandon Boat Basin expansion

The proposed Bandon Boat Basin expansion as discussed in the adopted original plan was completed in 1983 (communication with Alex Linke, Port of Bandon - March, 2000).

Site 2: Georgia-Pacific Dock

Georgia Pacific purchased the site in 1965 for the purpose as a regional chip loading facility or for some other water-dependent or related industrial use. Georgia Pacific is no longer the owner of this site. The dock continues to deteriorate because of lack of use and no maintenance. There are no current plans to repair the dock, nor dredge out the access channel for barging operations to resume at this site (communication with Alex Linke, Port of Bandon; March, 2000).

Site 3: Prosper Waterfront

The area of historic water-dependent commerce known as Prosper had previously planned to revive the area with a marina and as a tourist attraction. Those plans for the area known as Prosper have not taken place and are no longer being considered because of economic constraints for the area and Coos County. There are currently no plans to dredge the dockside area and the access channels from the main river channel; however, if the county's economy and tourism improves which would warrant the use of this channel and docking area, then dredging the dockside area and access channel would occur.

Site 4: Marine ways site

This site had a boat repair yard, which was proposed for major expansion. Since the date of adoption of this plan, the permits issued for the expansion have expired and are no longer valid. The earlier proposal for expansion (which involved filling a small diked area of saltmarsh and adjacent tidal flats) to construct seven (7) boat ways, and minor dredging out into the river channel to provide access, a piling-supported wharf and associated boat works and warehouse were part of the proposed development. The proposed development would have involved 4,200 cubic yards of dredging, plus annual maintenance dredging of 1,000 cubic yards, plus 5,000 cubic yards of intertidal/subtidal fill. If the site and the economy of the area, should warrant pursuing the earlier proposed development, the property owner would be required to obtain the necessary approvals and permits from the appropriate agencies (communication with Alex Linke, March, 2000).

<u>Site 5: Access channel to "Ferry Creek Flat" water-dependent development</u>

An access channel to docking facilities at the proposed Ferry Creek water-dependent development will be required. Since this is a subtidal area, a relatively small amount of dredging will be required.

<u>Site 6: Access to "Moore Mill Flat" water-dependent development</u>

At the time of this plan revision, the dock and the "Moore Mill" structure were not in operation and were continuing to deteriorate (communication with Alex Linke, March, 2000).

<u>Site 7: Proposed Kappos recreational marina</u>

A 15-18 acre area of diked marsh was slated to be dredged to accommodate a recreational marina. This site was adjacent to the boat works and marine ways site. The permits for the proposed activity have since expired and no work has been done. If, in the future, the earlier proposal would be accomplished, permits from the appropriate agencies would need to be obtained prior to commencing development. An intertidal and subtidal area in the main river channel would still need to be dredged to provide access to the proposed marina (communication with Alex Linke, March, 2000).

5.4 Dredged Material Disposal

5.4.1 Impacts of Current Corps Program

The current Corps program at the Coquille River involves only ocean disposal of dredged material, however, the Bandon Boat Basin Expansion plan called for disposal of dredge spoils on the south end of the Bandon spit, across the river from the boat basin site (see Section 5.4.2).

The disposal of dredged material can be beneficial or detrimental depending on how and where it is placed. The beneficial effects of dredged material disposal can include the creation of marshes or clam beds and reclamation of land suitable for development or the construction of levee systems for flood control. Ocean disposal of dredged material appears to be less detrimental than land or estuary disposal, particularly if care is taken in selecting the ocean disposal dump site. A potential impact of ocean disposal, if it is too close to the coast, is that the disposed material is available to enrich littoral sediment loads, which may return to be deposited in the estuary. Fortunately such return is an insignificant percent of the total material disposed. Other detrimental effects include oxygen depletion, turbidity and siltation, and alterations to existing hydrographic patterns.

The ocean disposal of material from a hopper dredge or bottom-dump barge minimizes the extent of the affected disposal area. At the disposal site, the bottom is covered initially with six inches to three feet of dredge material, which disperses laterally from the centerline and decreases in depth. The most likely change that occurs is that sediments in the ocean dumping area tend to be larger in size and greater in density than those naturally occurring at the site; however, the material is resorted and dispersed rapidly by wave and current action.

The ocean disposal site, approximately 0.9 miles due west of the jetty entrance, covers about 120 acres underneath 50 to 60 feet of water (pp. 1-24, 1-2a).

5.4.2 Potential Dredged Material Disposal Sites

Six potential sites for dredged material disposal have been identified, in addition to the offshore disposal site. They are marked on the map "Potential dredge and fill sites, mitigation or restoration sites." Four sites are in upland areas; two are in intertidal areas. Only site A is, however, an Army Corps of Engineers designated dredged material disposal site, together with the ocean site. The other identified sites are areas where spoils will probably be necessary to support water-dependent uses. This list is not intended to be exhaustive. Other sites for disposal may be identified in future, consistent with designations and permitted uses/activities. For instance, minor scalping of shoals in up-river locations will produce small volumes of spoils, which could be placed on adjacent shorelands, consistent with protection of wetlands and riparian vegetation.

Site A – North Spit designated dredged material disposal site

This is an upland area of conditionally stabilized sand dunes, which is proposed for the disposal of approximately 100,000 cubic yards of dredged material from the boat basin expansion project. The site would be surrounded by a retaining berm and water could be allowed to return to the estuary after an appropriate period to allow settling, spoils from both the extension of the federal channel and the construction of the boat basin itself would be disposed at this site. (See Section 7.3.1 for discussion of the boat basin project.] Source of this proposal is the Port of Bandon. Access to this site would be by barge to a temporary pier and access channel. Following disposal, the pier would be removed.

Site B – Prosper waterfront (Kappos property)

This site was an upland portion of a site for a proposed marine ways and recreational marina. The earlier proposal planned for dredging of a small partially diked salt marsh and a larger area of diked fresh water marsh would have been required in order to create the marina. The spoils would have been disposed of on a portion of the site to be developed for a marine ways and boat building works. There are no current plans for improvements to this site (communication with Alex Linke, March, 2000).

Site C – Prosper Waterfront – Port of Bandon and adjacent properties

There are currently no plans for improvements to this site (communication with Alex Linke, March, 2000).

Site D – Georgia-Pacific site

The site has been identified for a future bulk loading facility. A channel will have to be dredged to provide access to the dock, and dredged material disposal is appropriate on the adjacent upland. Appropriate measures would need to be taken to stabilize the spoils to prevent sloughing and to prevent uncontrolled run-off.

There are, in addition, two other sites planned for water-dependent development which will probably require fill: the site north of Moore Mill (E) and the Ferry Creek Site (F) (see Section 7.5 also). These sites are not needed for specific dredged material disposal, but could be used for this purpose.

5.5 Agricultural Diking and Drainage

(Source of following discussion, "Natural Resources of Coquille Estuary" (ODFW, 1979)

Extensive areas of former fresh and brackish marsh and swamp have been converted to farmland. (4, p. 36) The valley is narrowest in the lower river, and former marshes, these include Randolph Island which has been continuously diked to create agricultural land. A Corps project in the 1940's diked approximately 250 yards of a section at Bear Creek (see "Physical Alterations" map).

Most of the lower valley was probably high saltmarsh prior to diking. Diking is not extensive in the mid and upper sections of the river since natural levees exist along much of the shore, in the upper section over half of the valley is outside the floodplain and isolated from tidal influence, but part of the upper section was also probably freshmarsh or shrub wetland.

All of the original marshes probably had a soil elevation higher than Mean High Water (MHW). Since diking, many of these farmlands have subsided in places to elevations lower than the river surface at high tide.

Four major factors that contribute to subsidence of diked marshes:

1. The oxidation of organic matter, which remained undecomposed or partially decomposed in the marsh before drainage;

2. the loss of the buoyant force of water on the substrate after drainage;

3. physical compaction by equipment and livestock on the drained land;

4. shrinkage and settling of the substrate particles due to desiccation. (4, p. 36)

As a result of subsidence, dikes, tidegates and pumps must be adequately maintained in many areas to prevent permanent flooding. Although dikes have kept summer high tides from flooding the valley, winter freshwater flow often floods the entire valley. The small tributaries behind the dikes flood as well. Winter floodwaters remain on the subsided lands until the groundwater level drops in late spring or early summer. Drainage is inhibited by the natural levees as well as the subsidence; however, drainage ditch maintenance, cross ditching and land leveling have greatly improved the drainage of the low lands (Ken Messerle, 9/81, personal communication). The natural marsh system probably drained more quickly but flooded at a lower river discharge (4, pp. 36-37).

There are approximately 80 miles of major ditches and drainage channels in the Coquille valley shown on USGS topographic maps although there is a considerably greater amount of cross ditches, which are not shown. Most minor marsh channels have been filled or diked at the mouth. Some larger channels have also been filled and replaced by straight drainage ditches. A considerable length of meandering natural tidal channels have been lost since diking and drainage. Tides are now restricted to the mainstream coquille, small parts of the North Fork and South Fork, and a few small creeks. The marsh drainages, which are now cut off by dikes and tidegates would have formerly represented a significant portion of the tidal prism. Tidal range and currents in the river are almost certainly more extreme now than when they were moderated by flow through the marshes. The old marsh channels may have also influenced water quality and temperature in the estuary. (4, p.37)

The agricultural lands in the valley continue to supply a certain amount of nutrient input to the estuary from the decay of vegetation and animal wastes via the drainage ditch system. However, the amount of input is smaller because a large proportion of the biomass produced goes into hay and direct consumption by animals.

About 80 acres of the thousands of acres of former marsh have started to revert to high saltmarsh due to deterioration of the dike. That acreage is located upstream from prosper, in many places the diked land is dominated by water-tolerant plants such as rushes, sedges and skunk cabbage and cattails rather than pasture grasses or crops due to freshwater ponding in low-lying pastures. These meadows and surrounding pastures, though no longer estuarine, provide important habitats for migratory wildfowl during periods of flooding (4, p.37). (See 'Freshwater wetlands' Section 9.6.4)

Local agricultural interests have stressed the need to continue good maintenance of dikes (where they exist), tidegates, pumps and ditches to prevent the gradual reversion of grazing land to wetlands. In the past, federal funding has been made available to individuals and drainage districts through the Agricultural Stabilization and Conservation Service (ASCS), but recent federal policy changes have indicated that such funding will no longer be available where this affects wetlands, which include the extensive agricultural "wet meadows" of the Coquille Valley. Local agricultural interests have expressed concern that eventually repair and maintenance of these vital facilities will be severely curtailed, and are applying political pressure at all levels to bring about some modification of Federal policy as it affects established agricultural practices.

5.6 Other Physical Alterations

Subjects in this category include obstructions and alterations, which are individually small when compared to such projects as jetty construction and channel-dredging but which, when taken together, are widely recognized as important human impacts on the estuary.

As of February, 1974, 46 permits had been issued for activities in the Coquille River, including 3 for submarine cables, 29 for overhead wires, 1 for an outfall structure (the Bandon Municipal waste Treatment Plant), 6 for piling, bulkheads or wharves and 7 for miscellaneous projects (3, pp. 1-30, 1-31). Many water-dependent industries were once located on pilings over the flats and shores of the Bandon waterfront. Deteriorated pilings and wharves cover much of the Bandon waterfront area (4, pp.21, 22). Moore Mill and the Bandon waterfront are situated on substantial fills which have been in place for many years. Alterations of the area between RM 1.3 and RM 3.8 include several pilings and pile dike along each side of the channel at the lower end of this stretch; log storage along the channel and on the tidal flat north of the Moore Mill riprap along a half mile of the north shore; a boat ramp at Bullards' Beach state Park and fills at the U.S. Highway 101 bridge and the Rogge Mill site upstream from the bridge. The large marsh on the east bank of this section of the river was once grazed by cattle, but little evidence of this grazing remains (4, p. 30).

Other alterations on the long upper reaches of the estuary are concentrated at Prosper, Parkersburg, Riverton and above Coquille. Prosper, in particular, is the site of historical water- dependent activity and has potential for revival in future (see Physical Alterations Map). Unused pilings and small docks characterize many of these areas, and boat ramps are located below Randolph Island, and at Riverton, Coquille, Arago and Myrtle Point. The Randolph Slough is the most heavily altered area as it is bordered by the riprapped North Bank Road and is crossed by several bridges in varying states of deterioration. The uppermost of these has been converted to a road dike, which has cut off the flow of water through the slough, unused ferry facilities are located at Riverton. Georgia-Pacific Corporation uses the edge of the estuary surface at Coquille for transport of peeler blocks to the veneer plant. Oregon Highway 42S crosses the estuary at Coquille. The Arago road crosses the river at Myrtle Point. An unused railroad bridge did cross the river above Myrtle Point, until its removal in 1999. Until recently, there was a significant area of disused pilings between the Georgia-Pacific plant at Coquille and the Johnson log pond. Some of these pilings lay near the center of the river channel posing an obstacle to boating and probably also deflecting currents during high flow periods-Georgia-Pacific agreed to their removal, and this was recently completed as a cooperative project between the Port of Bandon and the Coquille Boat Club, restoring this section of the river to a more natural state.

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4. Natural Resources of Coquille Estuary: Estuary Inventory Report. Oregon Department of Fish and Wildlife (1979).

6. EXISTING LAND USE WITHIN COASTAL SHORELINE BOUNDARY

6.1 Bandon Waterfront and Lower Bay [mouth to RM 1.3]

The Bandon waterfront area has a few residences and smaller commercial uses, as well as containing several water-dependent/water-related uses. The Bandon Boat Basin, Port of Bandon Office, Bandon Fisheries plant and retail outlet, Robertson's concrete plant and the old Coast Guard station. The South Jetty area is largely residential with some commercial use and open space (including the County Park) The sewage treatment plant is at the east end of the waterfront at the mouth of Ferry Creek. The downtown commercial core of "oldtown" Bandon is immediately upland of the Coastal Shoreland Boundary.

6.2 North Spit and Upper Bay [RM 1.3 to RM 3.5]

The spit is entirely sand dunes and marshes in undeveloped state. The western half is in the Bullards Beach state Park. The spit is used for dispersed recreation, opposite the spit is the Bandon Marsh National Wildlife Refuge, which totals 712 acres of unaltered ground except for a few old log storage pilings. Bullards Beach campground lies immediately west of the Bullards Bridge. Adjacent to the bridge are the former Bullards dock and two small undeveloped parcels. Rogge Mill and dock lies east of the bridge and on the south side of the river.

6.3 Lower River – Prosper Waterfront to Bear Creek [RM 3.5 to RM 9]

Immediately east of Rogge Mill is a rural residential area with several small boat docks. The community of prosper is residential in nature with fishing boat docking facilities along the waterfront. Old docks lie between it and Prosper itself, on the north side of the Prosper road. A number of residences lie to the north of the prosper road close to the waterfront, immediately upriver of the marine way is a diked meadow area, which is reverting to saltmarsh. The floodplain is in exclusive agricultural use as far as the small community of Parkersburg, and again up to and including Bear creek, on the north side of the river the shoreland area is almost entirely in agricultural use; the only other uses are the Rocky Point Boat Ramp and some residential lots in the community of Randolph.

6.4 Midsection River – Bear Creek to Coquille [RM 9 to RM 25]

Land use in this section is predominantly agricultural, except when the shoreland boundary takes in some forested upland where there are geologic hazards. Within the coastal shoreland boundary, the community of Riverton contains a county boat ramp, a storage yard for logs salvaged from the river, a heavy equipment yard and some residences. There are no other substantial developments until Coquille. Roseburg Lumber Mill and log storage ponds, Sturdivant Park, disused warehouses, downtown Coquille, and commercial uses lie on the north side of the river. The only non-agricultural uses on the south bank are the county boat ramp and a group of small residential lots.

6.5 Upper River – Coquille to Myrtle Point [RM 25 to RM39]

Land use in this shoreland section is also predominantly agricultural. Other rural uses are Westbrook Mills #1 and #2, log ponds at Johnson and Norway, a boat ramp, commercial and residential uses in the community of Arago, and several small residential lots along Fishtrap Road south of Coquille. Uses within the shoreland boundary in Myrtle Point include two mills, bulk fuel storage, sewage treatment plant, a boat ramp and several commercial and residential uses. Aside from a few scattered rural residential lots, land use above Myrtle Point to the head-of-tide is agricultural.

7. ECONOMIC RESOURCES

7.1 Existing Economy of the Coquille River Estuary

7.1.1 Introduction

The following sections describe the major "basic" industrial groups to be found in the study area: lumber and wood products, commercial fishing and seafood processing, agriculture and recreation-tourism. Specific employment figures by industry groups are not available for the Coquille valley as an independent region. (For the following discussion, available data for the valley cities are presented, as are those for Coos County where they are thought to be representative of the study area.) Even with these data limitations, it is clear the valley economy is closely tied to the natural resource base of the region and highly specialized due to the dominance of the forest products industry.

7.1.2 Lumber and Wood Products

The economies of Coos County and the Coquille Valley are heavily dependent upon the lumber and wood products industry. It has been estimated that 68% of all employment in Coos County is derived directly and indirectly from this sector (1, p. in-26). In 1979 lumber and wood products represented 20.1% of all jobs in Coos County and 80.8% of all manufacturing employment (2).

Lumber and wood products is Bandon's largest economic sector and provided an estimated 270 jobs in 1976 (1, p. m-21). This accounted for approximately 4.5% of the Coos County employment in lumber and wood products. The major industrial employers in the vicinity of Coquille are also forest product related. The Coquille Area Employment Survey in 1978 shows 929 jobs under lumber and wood products "(3, p.52). These figures include employment associated with logging. Currently, there are seven mills in the Coquille Valley with employment ranging from about 700 to 1000 depending upon the market demand for wood products.

7.1.3 Fishing and Seafood Processing

The abundant seafood resources of the coast make any port city in the region a suitable location for commercial fishing and seafood processing. Fishing has been, and remains, a viable and culturally valued economic resource in the Coquille Estuary, particularly for the City of Bandon. However, the lack of a large boat basin and poor bar conditions have inhibited development of this sector. Only a few fishing vessels operate from the Port of Bandon year-round. These boats support a small processing plant, Bandon Fisheries, which employs an average of 60 people (personal communication, July 17,1980). The quantity of fish landed and processed at Bandon is expected to increase with expansion of the boat basin.

The major portion of the Bandon catch comes from offshore and includes salmon, shrimp, tuna, crab and bottom fish. In 1970, Bandon received 9% of the south coast salmon landings (4, p.94). Salmon frequent the cold, nutrient-rich upwelling currents in shallow water close to the coast and account for the largest portion of the statewide commercial fish sales. According to the Atlas of Oregon, the future outlook for the regional salmon fishery is not bright. "Heavy overfishing in the earlier part of the century, dam construction, water diversion to agricultural uses, and the alteration of spawning grounds by logging, road building and a variety of other causes are all involved" (5, p.62). Dungeness crab is taken near the shore all along the Oregon coast and has become an important commercial species since the 1930's.

About 20 species of bottom fish can be found in large numbers off the coast of Coos County. A shortage of facilities at Bandon has caused most of the larger bottom fishing boats to sell their catches at Charleston. Bandon Fisheries trucks shrimp from Charleston to Bandon, but other species of bottom fish have not been processed on any regular basis in Bandon (6, p.4).

The commercial catch landed at Bandon in 1977 is listed below. The list shows the catch measured in pounds, which does not portray the dollar value of the catch. The relative value generated by a given quantity of salmon is greater than that generated by the same quantity of the species listed.

Table 7.1 1977 catch at Bandon (approx.)

Salmon	500,000 lbs
Tuna	25,000 lbs
Crab	175,000 lbs
Shrimp	400,000 lbs
Bottom Fish	75,000 lbs (6, p. 4)

Shad is fished commercially in the estuary itself and fishing is restricted to the area below the Oregon 42S bridge (7, p. 17). Current status of shad population is unknown, but the only commercial shad fisherman in the Coquille Estuary averaged 7.5 shad per set-net day in 1978 compared to 8.0 shad per set-net day in 1977. Despite the mandatory use of lighter nets, the 1978 south coast shad season as a whole was very successful. Table 7.2 is a summary of the shad catch in the Coquille Estuary from 1975 to 1978:

Table 7.2 Shad catch in the Coquille Estuary

	Pounds Landed		Numbers Landed	
			Bucks	Roe
1975	14,403		1,309	2,619
1976	6,481		663	1,123
1977	2,204		104	473
1978	4,407		253	912
Coquille Shad Fishery Income, 1978				
	253 bucks @ $.45	=	$113.85	
	912 roe @ $1.10	=	$1,003.20	
			$1,117.05	

(Oregon Department of Fish and Wildlife, the '78 Coastal Commercial Shad Fishing, August 1978)

Fish taken by sport fishermen in the Coquille River include striped bass, steelhead and cutthroat trout in addition to the salmon, crab and shad discussed above [see Section on Recreational Fishing].

7.1.4 Agriculture

For a more detailed account of agriculture in Coos County, see the Coos County Comprehensive Plan, Agricultural Lands Element. Agriculture is an important basis sector of both Coos County and, more particularly, the Coquille Valley economies. The primary agricultural commodities in Coos County are, in order of importance, dairy, livestock, farm sales of timber and cranberries. Livestock raising in Coos County accounted for about three-quarters of the total County agricultural value in 1979 with 59% of the livestock value being made up of dairy products. The Coquille valley is the major region in Coos County for dairy production. It is also very important for beef and sheep raising.

The bottomlands on the Coquille Valley are the richest and most productive agricultural lands in the County due to the long growing season. While seasonal flooding limits the time available for grazing, it is also an important natural source of the nutrients brought in with sediments. Diking and drainage is important in maintaining the high productivity of this land.

There are about 52,100 acres of land in the main Coquille Valley area, or about half the acreage designated in the Comprehensive Plan for Exclusive Farm use. However, due to its high productivity, its importance to the County's economy is much greater than its proportional acreage, increased use of irrigation during late summer and improved drainage could further increase its productivity by lengthening the grazing season and establishing improved pasture varieties.

Only part of this acreage is within the Coastal Shorelands Boundary. However, policies in the estuary plan affect agricultural lands in the valley as a whole, as they relate to drainage particularly.

There is currently one cheese factory in Bandon (20 jobs) and one ice cream manufacturing plant in Myrtle Point (12 jobs) which supplies the Safeway chain. Data does not exist detailing the number of jobs directly and indirectly associated with farming and ranching in the Coquille Valley.

Currently, most of the milk products produced in the Coquille Valley go to one of the two plants mentioned above [see Section 3.3.2.1, Coos County Comprehensive Plan].

In addition to its importance for dairy processing, the Bandon area is the center for cranberry production in Coos County. Cranberries are raised in poorly drained soils such as the Blacklock series. Poor drainage permits the retention of water for long periods of time. Such soils might be considered poor or marginal for other types of agriculture, but are uniquely suited to cranberry production.

7.1.5 Tourism, Recreation and Retirement

The natural resources of the area provide many outdoor recreational opportunities, as well as an attractive location for retirement homes. These activities may be classified as basic, for tourists and retirees bring capital from other regions and stimulate growth in the non-basic sectors. Tourism and recreation are largely restricted to the summer months and concentrate along Highway 101 and the beach access points near Bandon. The interior valley also receives summer travelers and sportsmen during fish and game seasons.

7.1.6 Mining & Minerals

Although there are a number of rock, sand, and gravel quarries located in Coos County, most are located away from the estuary and virtually no rock or gravel is exported from the County.

Pursuant to ORS 215.298(2), property zoned "Exclusive Farm use" is identified as inventoried "1B" aggregate sites, in accordance with OAR 660-16-000(5)(b). There is not adequate information available to complete the Goal 5 process for the property. [OR 92-08-113PL 10/28/92]

7.2 Existing Uses

7.2.1 Water-Dependent and Water-Related Uses

Existing water-dependent and water-related uses can be separated into three (3) general categories: industrial uses (mill sites), commercial uses (including port facilities) and recreational uses (parks and boat ramps). Most of these are found in the Bandon waterfront or Prosper waterfront areas. Mills within the coastal shorelands boundary (one at Coquille, and one above Coquille) do not ship their products by barge. They are not considered water-dependent or water-related, which depends on the river for as an integral feature of its operations. The Bandon fisheries building adjacent to the Bandon Boat Basin is currently the only fish processing plant on the Coquille River. Existing water-dependent commercial uses include the Bandon Boat Basin and its associated water-related uses, a retail fish market and the Port of Bandon offices.

About 50 fishing boats are home-based at the Port of Bandon, and an additional 160 transient boats use the existing basin during the peak of the fishing season. There is considerable sport fishing activity during the summer months, commercial fishing activity during that period is estimated to include more than 2,000 boat trips which result in more than 300 tons of fish and seafood products landed at Bandon. The only other water-dependent commercial uses on the river are the moorage facilities at Prosper. Existing recreational uses include the South Jetty park and boat ramps at Bullards Beach State Park, Rocky Point, Riverton, Coquille, Arago and Myrtle Point.

7.2.2 Other Uses

7.3 Problem and Opportunity Analysis

The Coquille Valley economy shares the same characteristics as the remainder of Coos County's economy: a largely undiversified economy, which was heavily dependent on the forest products and fishing industry. Dependence on these industries allowed its inherent problems – seasonally, changes in the types of raw material available for processing, automation, extremely cyclical demand – to have many direct and indirect impacts on the overall economy of the Coquille Valley. Among the worst impacts are massive unemployment, in Coos County. Diversification of industry is necessary for local businesses to survive and would also expand employment opportunities in the region. Diversification is usually more beneficial if it includes not only attraction of new industry to the area but also improvement of conditions for existing industry. The following discussion elaborates on potential improvements in specific economic sectors.

7.3.1 Port Facilities

By far the most significant impediments to economic improvement of the Coquille River Estuary are the lack of adequate moorage and the depth of the entrance channel.

A. Entrance Channel

In response to a U.S. Senate resolution based on a request by Port of Bandon Commission, the Army Corps of Engineers is starting a navigation study of the Coquille River "to investigate navigation problems and needs related to the Coquille River and to determine if additional navigation works should be constructed" [COE letter dated 2/27/81].

According to the Port of Bandon Commission, the existing 13 foot deep channel is no longer adequate to accommodate larger vessels calling at Oregon coastal ports. The "Final EIS: Chetco, Coquille and Rogue River Estuaries" (December 1975) further identifies the situation as follows:

> "The channel depth at the mouth of the Coquille River prohibits the use of deeper draft barges which could make lumber shipping more economical. In the past, clearance requirements for fully loaded barges ruled out safe passage of the bar even at high tide whenever wave depths exceeded 6 feet. Based on studies of rough weather occurrence it was estimated that the bar was navigable, with delays while waiting for high tide, about 73% of the time and was not navigable at all the remainder of the time."

> "In attempting to overcome this problem, barges have sometimes been loaded only partially at the Coquille River. For example, a small tug brought an empty barge from Coos Bay to the Coquille River. After waiting for high tide to enter the harbor, the tug and barge were moved to the Rogge Lumber Mill, upstream of the Federal project area. Here the barge was partially loaded with about 1.3 million board feet of lumber to a draft of 6.5 feet. It was then shifted on the next high tide to the Moore Mill further downstream, on the existing navigation project. Here, the barge was loaded with an additional 1.5 million board feet of lumber to a draft of 11 feet. The barge was then moved to Coos Bay where it was top-loaded with about 1.3 million board feet to a draft of 14 feet. The fully loaded barge was then towed to California by an ocean-going tug and returned empty to either the Moore Mill at Bandon or Coos Bay. In addition to delays due to tidal conditions, lumber vessels also encountered delays due to rough water."
>
> "In order to eliminate the partial loading routine, Sause Brothers, the major shipping concern in the area, has shifted to shallow draft barges for use in Coquille River. This has allowed the barges to be fully loaded and shipped directly to the California markets. Delays on the Coquille River are not primarily a result of inadequate bar depths due to winter time conditions and weather." (8, pg. 2-73)

The Army Corps of Engineers' study is expected to focus mainly on improvements in the existing navigation channel, which terminates at the Moore Mill facility.

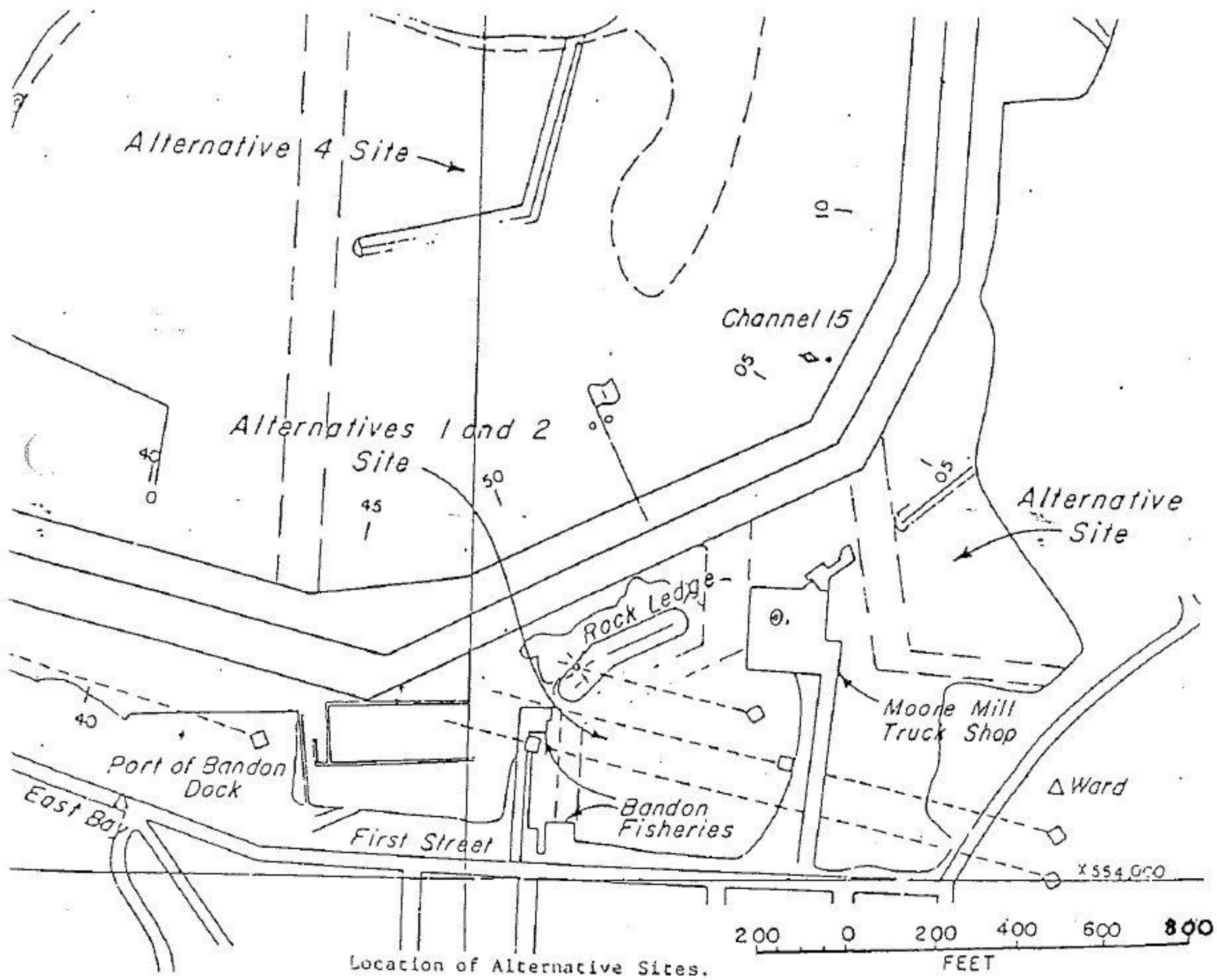
The Army Corps of Engineers is presently studying the cost/benefits of providing a 20 foot deep channel and other engineering modifications, which would make Bandon a secure harbor. The new designs would be intended to provide secure bar crossing 100 percent of the time during the summer and 90 percent of the time in the winter (4). The increased moorage facilities, the improved channel depth and secure harbor status should not only increase the number of commercial fishing boats using the Port of Bandon but should also substantially change the character of the fishing fleet (William Boodt, Army Corps of Engineers, personal communication, 8/81).

The lack of federal dollars to dredge the channel has kept the channel entrance from being utilized for commercial or industrial uses.

B. Boat Basin Project

The Port of Bandon has made a request to the Army Corps of Engineers that a protective breakwater be constructed with entrance and access channels, to provide shelter and access to year-round moorings for 90 commercial fishing vessels. The access channel inside the boat basin also includes a dock at which catches may be off-loaded from boats (see the attached map, Figure 7.1).

Figure 7.1 Alternative sites for Bandon Small Boat Basin



SOURCE: Army Corps of Engineers “Draft Detailed Project Report” (July, 1980)

The moorage facilities are being designed to accommodate vessels up to 85 feet in length. Presently the boats utilizing the Bandon Harbor are in the 30 foot to 35 foot range and are used primarily for salmon trolling. It is anticipated that the improved moorage facilities will attract larger salmon trailers as well as a number of bottom trawlers that harvest shrimp, crab and bottom fish. "It is anticipated that fish landing will increase substantially if moorage facilities in Bandon are expanded". (4)

According to the Army Corps of Engineers' "Draft Detailed Project Report" (July 1980):

> "Presently, there is only one mooring facility at Bandon and there is insufficient space for all commercial and sport boats during the peak of the fishing season. The commercial fishing boat facilities within the existing basin consist of one row of old, partly deteriorated, wooden floats which is without lighting, freshwater, or electrical power. Commercial boats are moored six abreast at times, which damages the boats and further deteriorates the floats and piling. Summer ocean swells have damaged the dock and pilings. Winter storm waves, although attenuated in progressing up the channel, make the moorage completely unsatisfactory." [4.pg.6]

"The proposed action is the construction of a rubble-mound breakwater, an entrance channel and an access channel. The 308 foot long rubble-mound breakwater would be constructed in alignment with the pierhead line, with a crest elevation of 14 feet above Mean Lower Low water (MLLW) and a crest width of 6 feet. The breakwater would be constructed using marine equipment. An entrance channel 100 feet wide and at least 10 feet deep is planned at the upstream end of the break-water and a 50 foot wide by 10 foot deep access channel leading to the west end of the basin is also proposed." [4, pg. 30]

"The related boat basin is proposed for construction by the Port of Bandon and is a separate action from the Corps' proposed project. The Port has applied to the Corps for a federal permit under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean water Act for construction of the boat basin. A separate environmental assessment addressing boat basin construction is being prepared in the course of the regulatory process." [4, pg. 29]

"Benefits of the proposed navigational improvements have been calculated to be $756,200. Annual costs for the 10 foot, deep, Federal project and basin were estimated to be $79,200. The benefit-to-cost ratio is 9.55 to 1. Annual costs for an alternative 14 foot deep federal project were estimated to be $109,600 and the annual benefits were $795,400. The benefit- to-cost ratio of the 14 foot deep project is 7.26 to 1. These ratios indicate that Corps participation in the 10 foot deep project is feasible." [4, pg.25]

The Corps of Engineers report concludes as follows:

"According to a letter from the U.S. Fish and Wildlife Service, no nationally recognized endangered or threatened fish or wildlife species are present within the influence of the project. The State Historic Preservation Office reports that no cultural resources of National Register potential have been identified which are likely to be affected by the project. Public Law 89-665 and Executive Order 11593 have been complied with."

"In compliance with Section 404(b) of the Clean water Act of 1977, an environmental assessment was prepared to determine the impacts of dredging a portion of the designated federal channel and placing the material on an upland site. Based on the evaluation, the federal portion of the boat basin project complies with Section 404(b) guidelines of Public Law 92-500."

"The proposed project complies with Executive Order 11988 which directs all agencies to assert federal leadership in order to reduce flood losses. Material dredged from the federal channel, as well as the moorage area, will be placed on land that is presently not within the flood hazard boundary. Structures in the project area, except for the breakwater, will be floating and will be designed to withstand occurrences of the estimated highest waters."

"Executive Order 11990 issued for the protection of wetlands is complied with. No wetlands will be affected by the Federal portion of the project." [4, pp.28-29]

7.3.2 Lumber and Wood Products

This sector will be one of the chief beneficiaries of entrance channel improvements. As noted in the previous section, the channel depth at the mouth of the Coquille River, especially when combined with a swell in excess of 6 feet, prohibits the use of deeper draft barges which could make lumber shipping more economical.

The nearest rail lines are in Coquille, 23 miles upstream from Bandon. Barges and ships using the mouth of the Coquille River run to ports from Coquille to Washington and even to Hawaii. The feasibility of future shipments of wood products to Australia is being explored (8, p.2-72). Improvements to the channel are therefore likely to generate a need for additional land area for shipment of lumber.

7.3.3 Fishing Industry and Aquaculture

The boat basin project and entrance channel improvements will very probably increase substantially the number of fish landings since the amount of time spent fishing will increase and the number of boats running to alternative ports (because of safety) will decrease.

This sector can also experience improvements through diversification of the species caught for commercial sale. There are about 20 species of bottom fish offshore which could be exploited if Bandon had more facilities (6, p.4). The Department of Fish and Wildlife has found the area between Cape Blanco and Heceta Head to be a "high catch" area for the following species (6, p.4):

Spiny dogfish	Sable fish	Skates
Lingcod	Ratfish	Dover sole
Pacific cod	English sole	Pacific whiting
Petrale sole	Pacific ocean perch	Rex sole
Yellowtail rockfish	Pacific sand-dab	Canary rockfish
Arrowtooth flounder	Other flatfish	
Darkblotched rockfish		

The marketing of bottom fish is very competitive. For this reason, the Coos, Curry, Douglas Economic improvement Association has stated that economic improvement efforts should strive to "provide local fishermen and processors every competitive advantage possible" (Task Force Minutes, July 28,1980, p.2).

Fish processing expansion could also cake the form of increased processing of fish products trucked or shipped in from other ports. Bandon's fish potential is greatest for shrimp, salmon and bottom fish (Task Force Minutes, #3, p. 3). (See below, Section 7.4.1 for a detailed assessment of future water-dependent land and waterfront needs connected to expansion of the fishing fleet).

The aquaculture potential in the Coquille Estuary has not been studied. Aquaculture activities in other estuaries along the south coast include underwater clam harvest, oyster cultivation and salmon sea-ranching. An underwater commercial clam fishery, where divers use a hand-held water jet, has existed in Coos Bay since about 1960. Commercial catches have ranged from 10,000 to 90,000 pounds of clams per year. This fishery is managed by the Oregon Department of Fish and Wildlife on a permit only basis with a season from July 1 to December 31. Oyster cultivation is another aquaculture activity, which has been developed in Coos Bay with some limitations due to water quality problems in portions of the bay. Salmon sea-ranching is a new commercial fishery to the south coast; in fact, the Port of Bandon has contemplated establishment of a salmon release and recapture facility on the Bandon spit. Five potential sites are identified (see Section 7.5) on the bay shore of the Bandon spit.

Based on a review by the Oregon Department of Fish and Wildlife, salmon hatchery and aquaculture permits could be granted on the Coquille River up to Beaver Slough (Task Force Minutes, February 25, 1980, p. 1). However, there is currently a statewide moratorium on the issuance of salmon aquaculture permits.

7.3.4 Waterborne Transportation

Improvements to the entrance channel, combined with fulfillment of the boat basin project, are likely to increase substantially the need for boat construction facilities and boat repair facilities.

7.3.5 Tourism, Recreation, and Retirement

Substantial improvements in the number of recreational boats-and sports fishing are likely upon improvement of the channel entrance and completion of the boat basin project, since the additional moorage space provided will tend to draw visitors both from inside and outside the County. An increase in the level of activity in this sector will help diversity the economy of the estuary. Provision of sufficient public boat launch ramps, park sites and private recreational facilities to take advantage of the existing tourist appeal to the area will be needed. Specific sites for future recreational developments are identified in Section 7.5, including a proposal for a large marina, and support facilities above Prosper.

7.4 Identified Needs

The previous section identified specific problems in the Coquille River Estuary that adversely affect the area's economy, and also discussed specific projects that could take advantage of economic opportunities to overcome these problems.

The task of this section is to identify as accurately as possible the needs for various uses in the estuary and adjacent shorelands so that the Plan can locate suitable sites for such needed uses.

It is necessary to arrive at a reasonable, quantified estimate of land acreage and water frontage needs, based on an assessment of future growth potential. However, these estimates are not intended as literal quota of land to be designated for these uses. A reasonable additional supply of land and waterfront is needed to allow "market flexibility" and to take account of site suitability, configuration and historic uses.

The Plan therefore must locate sites suitable for the following planned projects and the new uses expected to be generated by their development (see Section 7.5):

- Port facilities including entrance channel and boat basin;
- waterborne transportation including boat construction, boat repair, boat launching and barge loading;
- Fish processing and off-loading space; Aquaculture;
- Tourist development including commercial waterfront uses and recreation boat sites; and
- Lumber & wood products including storage of products at barge-loading sites.

It is noted that such needs are not 20-year needs; DLCD staff has stated that economic planning can realistically be done only for a 5-10 year period. Required periodic revisions and updates to the Plan can then assess the additional projects and uses needed to improve future economic conditions.

7.4.1 Future Needs for Fishing Fleet and Fish Processing

The following table (Table 7.3) illustrates the expected average annual catches by the type of vessels that will be accommodated in the new boat basin.

- Need for Facilities to Support Fishing Fleet

The existing fish processing plant (Bandon Fisheries) has a capacity to process approximately 1,250 tons per year. Presently the plant is processing only 625 tons per year. Of that amount only 105 tons (salmon) are landed at Bandon; an additional 520 tons of shrimp, crab and bottom fish are trucked to the processing plant each year from Charleston (2).

Based on the difference between the expected catches from the new fishing fleet and the capacity of the existing processing facility, additional processing facilities will be needed in the Bandon area.

The expected tonnage available for processing at the Port of Bandon should be adjusted based on fluctuating market conditions, poor weather, low cycles of available resources, export of products to outside processing facilities (75% of the product landed at Charleston is shipped out for processing) and political constraints placed on the fishing industry. In light of the above considerations, it is reasonable to assume that an additional two to three new seafood processing facilities will be needed in the Bandon area. Other facilities are also needed if Bandon is to attract a year-round fleet of large tonnage boats; "large trawlers and trollers are the life blood of a successful commercial harbor". (1) The facilities are listed in Table 7.4 which follows.

It is concluded that an additional 1,430 to 1,640 lineal feet of water frontage and 11 to 15.5 acres of back-up are likely to be needed for fish off-loading, processing and related activities within the planning period.

Table 7.3 Expected average annual catches at the Port of Bandon

Type of Boat to Be Accommodated in New Boat Basin		Per Boat Expected Catches in Raw Tons Per Year	Type of Catch		Number of Boats Be Accommodated in The New Boat Basin		Total Expected Catches in Raw Tons Per Year
80’ Trawler	=	500 – 1500 Tons	Bottom fish	x	4 boats	=	4,000 tons
65’ Trawler	=	500 – 1000 Tons	Bottom fish	x	6 boats	=	4,500 tons
		175 – 250 Tons	Shrimp	x	6 boats	=	1,275 tons
45’-50’ Troller	=	10 – 25 Tons	Salmon	x	16 boats	=	280 tons
		30 – 35 Tons	Tuna	x	16 boats	=	520 tons
		50 Tons	Crab	x	16 boats	=	800 tons
40’-45’ Troller	=	4 – 8 Tons	Salmon	x	16 boats	=	96 tons
		10 – 11 Tons	Tuna	x	16 boats	=	168 tons
		16 Tons	Crab	x	16 boats	=	256 tons
Below 30’ Troller	=	1 – 2 Tons	Salmon	x	48 boats	=	72 tons
TOTAL					90 commercial Boats at the Port of Bandon	=	11,967 raw tons per year potentially at the Port of Bandon (1)

Table 7.4 Facilities needed to support fishing fleet expansion

Water-Dependent Uses	Waterfront Requirements (feet)	Back-up Land Required (Acres)
2 Fish Processing Plants	400	3
Ice Plant/Ice Loading [1]	200	0.5
Dry Dock/Marine Repair [2,4]	300	2.5
Boat Building [4]	70	2
Fueling Station [1]	200	0.5
Subtotal	1,400	8.5
Water-Related Uses		
Cold Storage		1.5
New Coast Guard Building near Coast Guard Moorage [3]		2
Marine Hardware and Bail		1
Total	1,400	13

SOURCE: Acreage and waterfront estimates developed through personal communications with Joe Easley, Otter Trawl Commission of Oregon (July, 1981), and Wiley Welton, Charleston Drydock (July, 1981).

NOTES:
1. Assumes two boats icing, fueling, or off-loading at one time.
2. Assumes large enough operation to handle three boats at once.
3. According to Chief Russell, Charleston, Oregon (personal communication, July, 1981).
4. Use may be located upstream of the lower estuary (e.g. Prosper).

* The off-loading station planned for the Bandon Boat Basin is independent of the processing facility.

7.5 Potential Sites for Water-Dependent and Water-Related Uses

Possible sites for future water-dependent/related uses are found in the Bandon waterfront, Bandon Spit, Bullards bridge area and Prosper, Riverton and Coquille waterfronts.

A. Bandon waterfront

The South Jetty area is a primarily residential area, which the City of Bandon considers a suitable location for tourist-oriented water-related commercial development. There is a proposal to locate such development on pilings over the intertidal flat behind the South Jetty when the jetty is repaired as an extension of Bandon's downtown area [see Exception Statement, Part III, Section 5.3]. There is also a small water frontage area containing the old Coast Guard building, a gallery and several small dwellings, which has some potential for water-related commercial uses. The Port of Bandon plans to move its office to the Coast Guard building following the trade of the Bandon marsh and to make other space available for a maritime museum. None of these areas possess suitable characteristics to accommodate the future expected growth in fishing-related activities. The following is an assessment of sites, which might meet the need expressed in Section 7.4.1.

- Three major sites are considered [see Figure 7.2 below). These are:

  Site 1 - The Ferry Creek tidal flat (adjacent to Moore Mill truck shop)

  Site 2 - The tidal flat north of Moore Mill

  Site 3 - The parking area adjacent to the existing boat basin

- In addition, there are three minor sites:

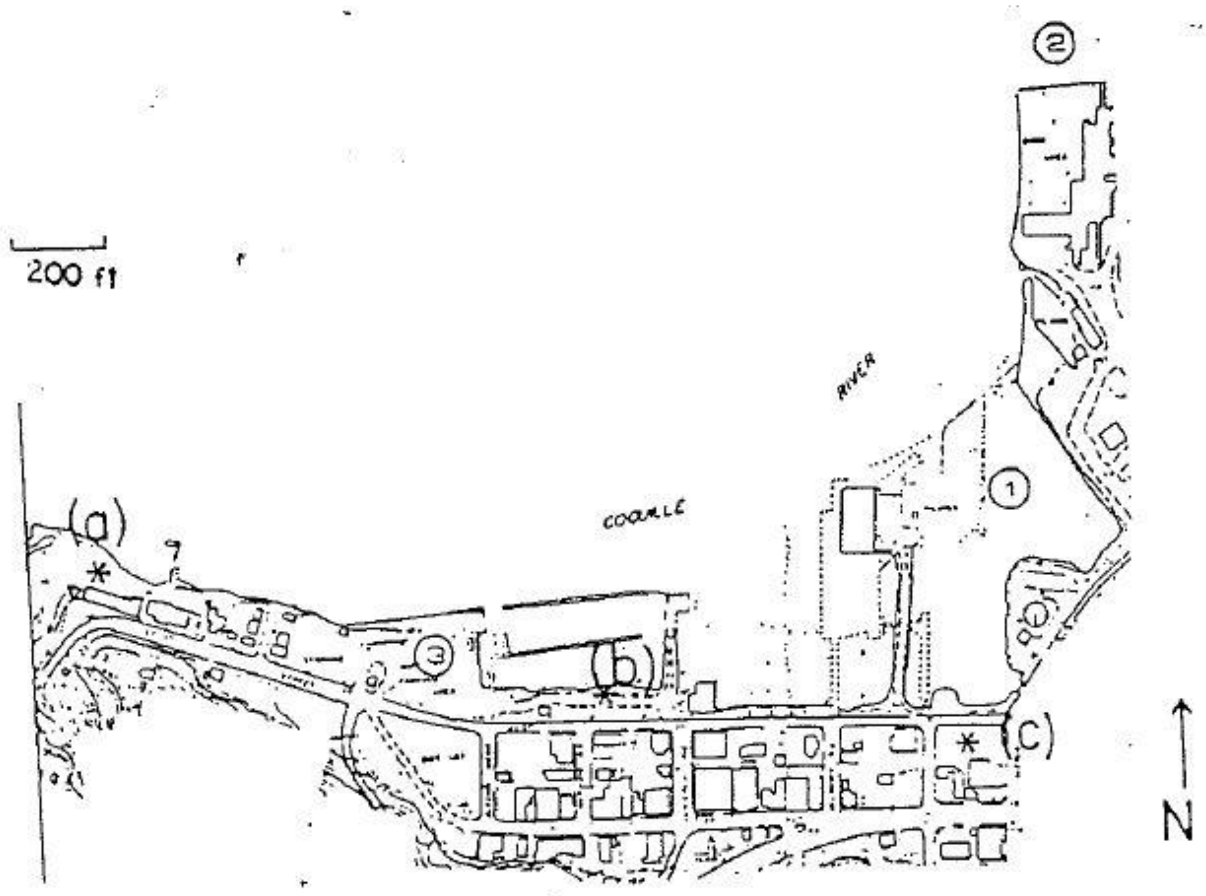
  Site (a) - Robertson's concrete plant

  Site (b) - Adjacent to existing boat basin

  Site (c) - Across First Street from the Ferry Creek tidal flat

The Bandon waterfront is constrained by the fact that important streets (First Street and Riverside Drive) run immediately parallel to the shoreline. These streets create problems for development of water-dependent uses requiring back-up land because of the need for direct access between the dock and shoreland facilities. It is therefore necessary to look at aquatic areas with development potential as well as shoreland sites.

Figure 7.2 Alternative sites for water-dependent uses on Bandon waterfront



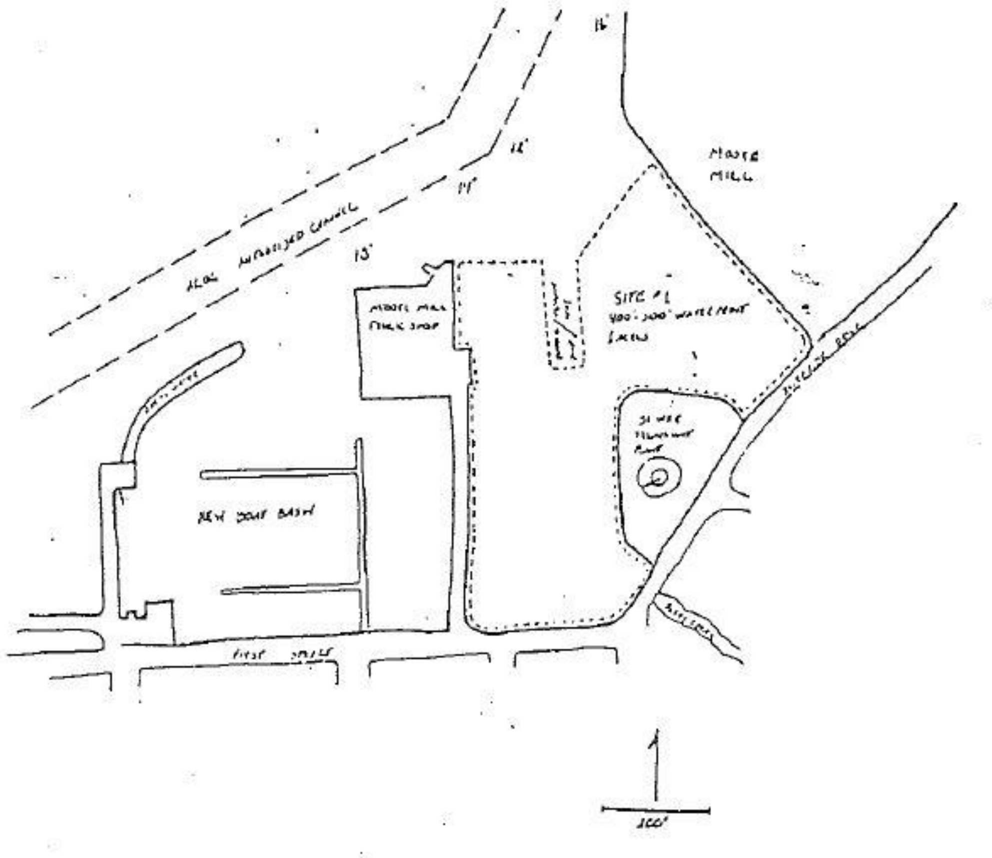
The alternative development sites in Figures 7.3 through 7.5 illustrate potential configurations of future water-dependent development based on minimum waterfront and back-up land needs. Specific future projects will differ in detail, but the sketches present the general outline of what is proposed for the purposes of this Plan.

- MAJOR SITES

    - SITE 1 – Ferry Creek Mudflat

Site #1 is considered suitable for a water-dependent site because of its size (6 acres) and its proximity to the navigation channel and the boat basin expansion. It has access to major roads and public infrastructure. It is an area that has been partially altered in the past by pilings and adjacent fills. With a fill of the dimensions shown, and a barge slip or marine way in addition to docking, the area would provide 6 acres of back-up and 400 to 500 feet of waterfrontage. This area would be particularly suitable for seafood processing and fishing-related services that are expected to be developed as a result of the boat basin expansion and channel improvement.

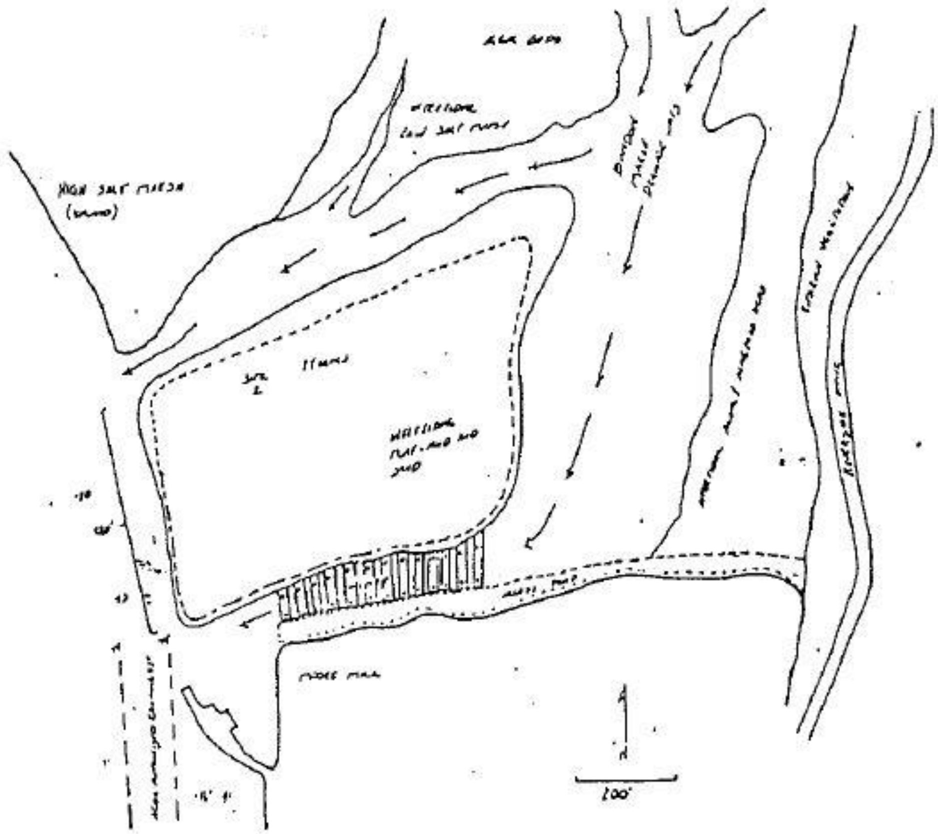
Figure 7.3 Site 1



- SITE 2 – Moore Mill Mudflat

Site #2 is considered suitable as a water-dependent site because of its size (potentially 7.4 acres), its proximity to the navigation channel and other water-dependent uses (Moore Mill and Barge Facilities). It has access to major roads and public infrastructure. Provision would be made to allow drainage of the marsh and mudflat area to the north through existing tidal channels as shown below. The site would require fill.

Figure 7.4 Site 2



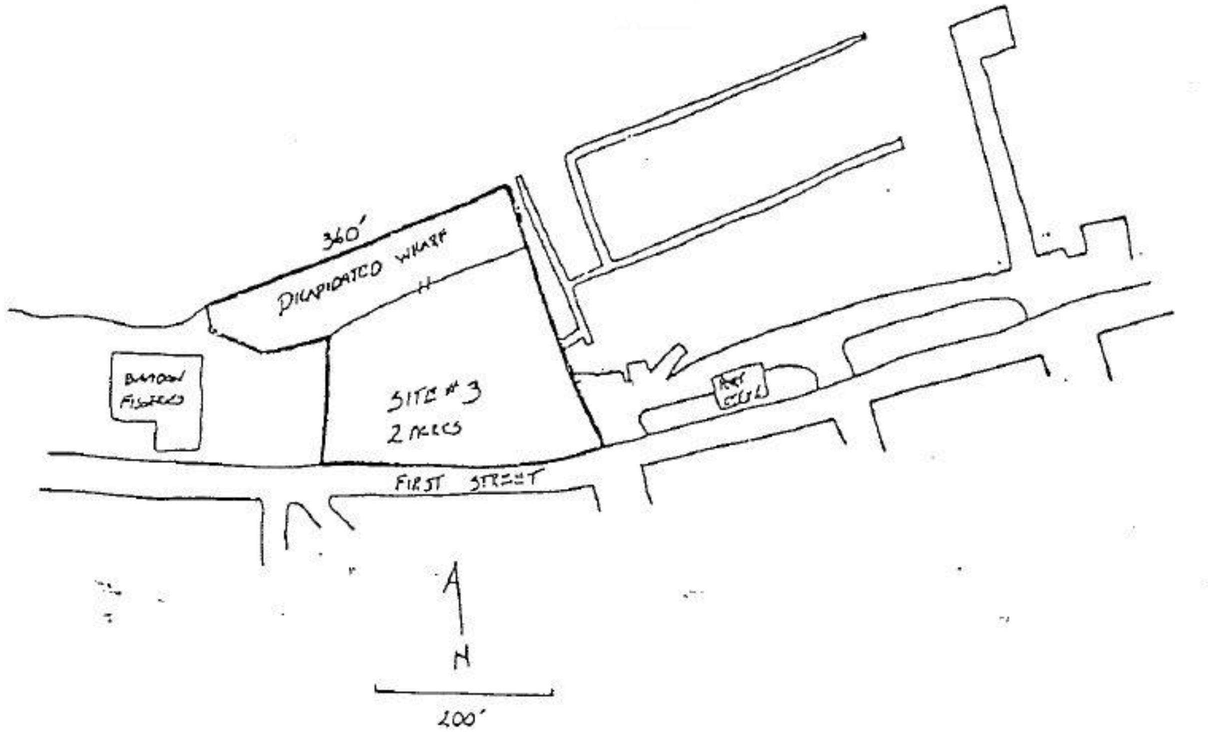
It would provide 7.4 acres of back-up surface and 420 feet of water frontage adjacent to the natural channel, immediately upstream from the authorized channel. The probable impacts of this proposal are discussed further in an Exception statement [see Part III, Section 5.4].

This site is, like Site #1, particularly suitable for seafood processing and fishing-related services (e.g. an ice plant).

- <u>SITE 3 – Parking Lot Adjacent to Existing Boat Basin</u>

Site #3 is considered suitable for water-dependent uses because of its size (2 acres) and its proximity to the navigation channel, the existing boat basin and Bandon Fisheries. It has access to major roads and public infrastructure. It is presently used as a parking lot for the recreation boat basin. It would provide for 2 acres of additional back-up land and 360 feet of water frontage adjacent to the maintained channel, without need for further fill. Strong currents and wave energy are a problem for moorage, and might require a breakwater. This site, though smaller than the others, would also be suitable for fish processing and fishing-related services.

Figure 7.5 Site 3



- MINOR SITES

    - SITE (a) – Robertson's Concrete Plant

This site lies closer to the bar than the others and experiences strong tidal currents and wave action, which severely limits its usefulness for moorage. It is also currently in use for concrete products manufacturing, a use which is expected to effectively rule this site out for fishing- related uses for the foreseeable future.

- SITE (b) – Adjacent to Existing Boat Basin

This is a narrow site, which lies between First Street and the Boat Basin, it is currently occupied by the Port office and parking. It may become available for water-dependent uses. It is appropriately located immediately above the Boat Basin and additional moorage could be provided next to it but only for relatively small boats. Also, its usefulness is limited by the elongated shape and small size (800 feet by 80 feet at a maximum). The Boat Basin also needs to retain adequate parking space which would be greatly reduced by the development of Site (b).

- SITE (c) – Across First Street from the Ferry Creek Tidal Flat

This site is a small vacant lot (approximately 20,000 square feet) together with adjacent underutilized lots. It has the advantage of proximity to the Ferry Creek area (Site #1) and the Boat Basin expansion but First Street, an important connector street, runs between the two sites. However, much of the northern half of the adjacent block is also vacant and the existing uses are low-intensity. Development of Site #1 and the Boat Basin would tend to create pressure to redevelop this site also. Vacation and closure of the adjacent section of First Street and Elmira Street would greatly enhance the value and usefulness of this site for small water-dependent or water-related uses. A total of approximately two to four acres are potentially available at this site including street areas, depending on how much use conversion takes place.

- CONCLUSIONS

The three major sites could provide a total of 15.4 acres and 1,180 to 1,280 feet of water frontage. An additional two to four acres might be made available at Site (c). Site (b) can provide about 350 feet of waterfrontage to the existing Boat Basin, although the back-up space is limited. Neither of these sites is large enough to provide for basic land needs but might prove useful for miscellaneous smaller water-dependent or water-related uses. Though these sites provide adequate back-up space due to the configuration of the sites, there is still a shortfall of 150 feet of water frontage if the limited frontage to the existing Boat Basin is ruled out. Prosper waterfront is a historic area for boat building and repair and could provide adequate waterfrontage for these uses. Land and waterfrontage availability have been assessed below in (D).

B. Bandon Spit

Five (5) sites have been identified on the Bandon Spit as being suitable for aquaculture. These on-shore sites appear to be the most (although not the only) physically suitable sites for salmon release and recapture facilities. Due to the lack of road access to these sites, only low-intensity small-scale release and recapture facilities are contemplated.

C. Bullards Bridge Area

The Georgia-Pacific property (Bullards Dock) is considered a potential site for barge loading for wood chips or other wood products or similar bulk materials. It is not intended to site a chipper here. The presence of the State Park next to this site is seen as a potential conflict. However, restricting the use to loading only would reduce conflicts with noise and a line of trees acts as a visual screen to the site. The nearest overnight campsite is also some distance away. The site has easy access to Highway 101. A site immediately west of the Bullards Bridge is considered well- suited to some type of water-dependent tourist-oriented recreational development due to its location on Highway 101 and the proximity of other recreational uses in the State Park. This site could provide valuable river frontage for recreational boat moorage and back-up land for related facilities. Due to its proximity to the Georgia-Pacific site and Highway 101, it also has industrial potential and such a need may be identified within the plan period.

D. Prosper Waterfront

Prosper is an area where boat building and repair and similar activities have historically occurred along with moorage. It provides the few sites that are well suited to boat repair. There is vacant land for upland activities (approximately 6 acres), limited space for on-land dredge spoil disposal and ample channel depth. There is water frontage of about 900 feet available, though minor improvements are needed. Road access is fair. Such a location for boat building and repair would be preferred over Bandon waterfront, where space is more valuable for fishing-boat moorage and fish processing due to its closeness to the bar. Based on estimates in section 7.4.1, land and water frontage is adequate in this area to make up the shortfall in the Bandon area. The site immediately west of Bullards Bridge (on the north shore) might also be suitable but its location suggests that recreation would be a higher use. Sites further up river might also be suitable, but lack the locational advantage of Prosper, which is about 3 miles from Bandon by road and 4-1/2 miles by river.

A major recreational marine project with 200 to 250 boat slips together with a boat building/repair shop, marine ways and recreational support facilities is proposed for a site above Prosper. The site comprises 34 acres of which 22 acres lie below the County road within the Coastal Shorelands Boundary. The lower area consists of a former diked pasture, where part has reverted to high saltmarsh due to breaks in the dike. The remainder is freshwater marsh or forested wetland. The proposal is to dredge a 15 to 18 acre area for a marina and to locate the shop and marine ways in the same general area as an existing facility. Restaurant and hotel facilities are proposed for an upland area outside the shoreland boundary.

The purpose of the project would be to attract recreational boat owners from a wide area to a destination-type resort with slips for long-term moorage and hook-ups to a waste water treatment system (see Exception Statement for greater detail on this proposal, Part III, Section 5.5).

E. Riverton Waterfront

The Riverton waterfront has the advantage of good road access and a deep channel and provides opportunities for a variety of small scale light industrial, commercial or recreational uses dependent upon water access. One site has received approval for a boat repair operation though current use is for heavy equipment storage. The adjacent site is currently vacant. Though distant from the Bandon Boat Basin, these sites may in the future be used for boat repairs or other activities in connection with stream clearance. Another potential use is for barge loading (and "export" to Coos Bay or other destinations) of coal mined from the Riverton coal field, should mining of the coal eventually prove financially feasible.

F. Coquille Waterfront

The Coquille waterfront has a narrow strip of land between the railroad track and the river, which might be suitable for some type of water-dependent/water-related commercial or recreational use. The segment of riverbank east of the bridge has been proposed for a commercial boat land and related facilities. It is currently vacant. The segment west of the bridge extending to Sturdivant Park is currently mostly occupied by deteriorating warehouse buildings. All of these sites are either within the city or its urban growth boundary. It is theoretically feasible to use the site west of the bridge for a shallow-draft barge loading facility. However, the prospect of such a proposal appears unlikely. The most likely possibility for this site would be recreational boat moorage and related commercial facilities as already proposed east of the bridge. However, should there be found to be no future need for other water-dependent development, general commercial uses could be acceptable according to the Goal #17 priorities for shoreland uses (priority #5). For these reasons, and due to the small area available, these sites are not considered "suitable for water-dependent uses" under Goal #17. In addition to the sites listed above, two potential sites for boat ramps have been identified at Lampa Creek (Port of Bandon site) and at Sturdivant Park (Coquille) (see also Section 8.1.4).

APPENDIX 'A' - 'WATER-DEPENDENT' AND 'WATER-RELATED' USES

Goal #16 (Estuarine Resources) of the Statewide Planning Coals identifies general use priorities (from highest to lowest) are:

A. uses which maintain the integrity of the estuarine ecosystem;

B. water-dependent uses requiring estuarine location, as consistent with the overall Oregon Estuarine Classification;

C. water-related uses which do not degrade or reduce the natural estuarine resources and values; and

D. non-dependent, non-related uses which do not alter, reduce or degrade the estuarine resources and values.

Goal #17 (Coastal Shorelands) identifies priorities in a similar way, but with two additional categories.

General priorities for the overall use of coastal shorelands (from highest to lowest) shall be to:

1. promote uses which maintain the integrity of estuaries and coastal waters;
2. provide for water-dependent uses;
3. provide for water-related uses;
4. provide for nondependent, nonrelated uses which retain flexibility of future use and do not prematurely or inalterably commit shorelands to more intensive uses;
5. provide for development, including nondependent, nonrelated uses, in urban-areas compatible with existing or committed uses; and
6. permit nondependent, nonrelated uses which cause a permanent or long-term change in the features of coastal shorelands only upon a demonstration of public need.

"Water-dependent" is defined as:

> "A use or activity which can be carried out only on, in, or adjacent to water areas because the use requires access to the water body for water-borne transportation, recreation, energy production, or source of water."

A. The following definitions also apply:

   1. access: means physical contact with or use of the water;
   2. energy production: means uses which need quantities of water to produce energy directly (e.g., hydroelectric facilities, ocean thermal energy conversion);
   3. recreational: e.g., recreational marinas, boat ramps and support;
   4. require: means the use either by its intrinsic nature (e.g., fishing, navigation, boat

moorage) or at the current level of technology cannot exist without water access;

5. source of water: means facilities for the appropriation of quantities of water for cooling processing or other integral functions;

6. water-borne transportation; means uses of water access:

   i. which are themselves transportation (e.g., navigation);

   ii. which require the receipt of shipment of goods by water; or

   iii. which are necessary to support water-borne transportation (e.g., moorage fueling, servicing of watercraft, ships, boats, etc. terminal and transfer facilities).

B. typical examples of water-dependent uses include the following:

1. aquaculture;

2. certain scientific and educational activities which, by their nature, require access to coastal waters: estuarine research activities and equipment mooring and support;

3. commercial: e.g., commercial fishing marinas and support; fish processing and sales; boat sales, rentals, and supplies;

4. industrial: e.g., manufacturing to include boat building and repair; water-borne transportation, terminals, and support; energy production which needs quantities of water to produce energy directly, water intake structures for facilities needing quantifies of water for cooling, processing, or other integral functions;

5. recreation: means water access for fishing, swimming, boating, etc. Recreational uses are water-dependent only if use of the water is an integral part of the activity.

"Water-related" is defined as:

"Uses, which are not directly dependent upon access to a water body but, which provides goods or services that are directly associated with a water-dependent land or waterway use and, which if not located adjacent to water would result in a public loss of quality in the goods or services offered. Except as necessary for water-dependent or water-related uses or facilities, residences, parking lots, spoil and dump sites, roads and highways, restaurants, business, factories, and trailer parks are not generally considered dependent on or related to water location needs."

BIBLIOGRAPHY: ECONOMIC RESOURCES

1. City of Bandon Comprehensive Plan, Coos-Curry council of Governments (1977)

2. Comprehensive Economic Development Strategy, 1980-81 Action Program, Coos-Curry-Douglas Economic improvement Association (1980)

3. City of Coquille 1995 Comprehensive Plan Inventories Coos-Curry Council of Governments (1978)

4. Bandon Boat Basin Draft Detailed Project Report U.S. Army Corps of Engineers Portland District (1980)

5. Loy, Atlas of Oregon

6. City of Bandon, inventory of coastal Resources, Coos-Curry Council of Governments (1977)

7. Natural Resources of Coquille Estuary, Estuary Inventory Report O.D.F.W., (1979)

8. Final E.I.S., Chetco, Coquille and Rogue River Estuary U.S. Army corps of Engineers, (1972)

8. CULTURAL RESOURCES

8.1 Recreational Opportunities

8.1.1 Fishing

Sports fishing has long been popular on the Coquille River Estuary, with most of the interest centering on the anadromous species of salmon and trout which feed and spawn in the Coquille (see Biological Resources – Distribution of Fish Species). Between mid-September and the first good high water in November, both chinook and coho abound, mainly in the lower 20 miles of the Coquille River. Most of the angling is by boat, with some along the shore in the upper reaches. Other commonly-caught species (as determined in the study by the Fish Commission of Oregon in 1971) include surf smelt, red-tail perch, and relatively few shiner perch by shore angling; Dungeness crab by boat fishing; and softshell clams by clamming. Some shad and striped bass are also taken (1, p. 74).

Shad and striped bass are fished in the spring and summer, cutthroat trout and salmon are fished during late summer and fall, and steelhead fishing takes place during the winter in the upper reaches of the estuary. Perch and smelt fishing is popular in the summer in the lower parts of the estuary (2, p. 17).

The following table (Table 8.1) summarizes data for sport fishing in the coquille for several years prior to 1974.

Table 8.1 Estimated annual harvest data for sport fishing at Coquille Bay

Species	Area Fished	Annual Harvest (total #)	Effort (angler-days)	Gross Expenditures
Salmon	Estuary	1,300	3,250	$96,200
	Coquille River System	150	600	$11,100
	Ocean	500	600	$37,000
Sea-run Cutthroat	Coquille River System	400	250	$4,625
Steelhead	Coquille River System	3,500	14,000	$259,000
Shad	Coquille Bay	250	115	$2,127
Striped Bass		50	95	$1,758

Source: Percy et al., Description and Information Sources of Oregon's Estuaries, O.S.U. (1974).

In 1973, the Oregon Fish Commission published a study of recreational fisheries on the Coquille River Estuary conducted between March 1 and October 1, 1971. (3) The boundaries of the study extended only from the seaward end of the jetties to the U.S. 101 Bridge, approximately 4 miles upstream. Even so, its findings are illustrative of recreational fishery use of the lower estuary. They are as follows:

- <u>Boat Fishing</u>: An estimated 1,800 boat angler trips were expended on the estuary. The boat anglers spent 5,000 hours fishing. Peak activity was in August.

Five species of fish and one species of crab were identified in the boat anglers' catch. Dungeness crab was the principal species taken and accounted for 91% of the total number of animals taken. The major catches occurred from June through August. Fishing success (catch per hour) was highest during June.

- Shore Fishery: Interview data revealed that 11,700 shore angler trips were expended on the Coquille River Estuary. The city docks and the north jetty were the principal fishing areas; 69% of the anglers fished there. Shore anglers spent 25,100 hours fishing; July was the peak month of activity.

  Twenty species of fish and two species of crabs were identified in the shore anglers' catch. Surf smelt and red-tail surfperch were the principal species taken, accounting for 85% of the total number of animals caught. Catch and fishing success were highest in July when surf smelt entered the estuary.

- Tideflat Fishery: Figure 8.1 shows the distribution of bay clams in the Coquille River Estuary. Caper clams are found in the intertidal and subtidal zones of the lower bay. Softshell clams are found scattered through the lower bay up to the Highway 101 bridge. The principal area of digging is outlined on the map.

  Approximately 170 tideflat user trips were expended to harvest clams and mussels from the estuary. Tideflat users spent 200 hours collecting these animals. Peak activity was in March. The major digging effort (49%) was in the treatment plant area where 82 user trips, representing 95 user hours, were expended.

  Two species of clams and one species of mussel were harvested by tideflat users. Softshell clams accounted for over 99% of the animals dug. The treatment plant area was the principal area of catch, providing 1,400 clams or 54% of the harvest,

- Scuba Fishery: The small number of scuba divers interviewed on the Coquille River Estuary precluded making an estimate of catch and effort for this fishery.

- Angler Origin: Over half (53%) of the anglers interviewed were residents of Coos County, 35% were Oregon residents from outside Coos County, and 12% were out-of-state residents.

Table 8.2 Angler origin

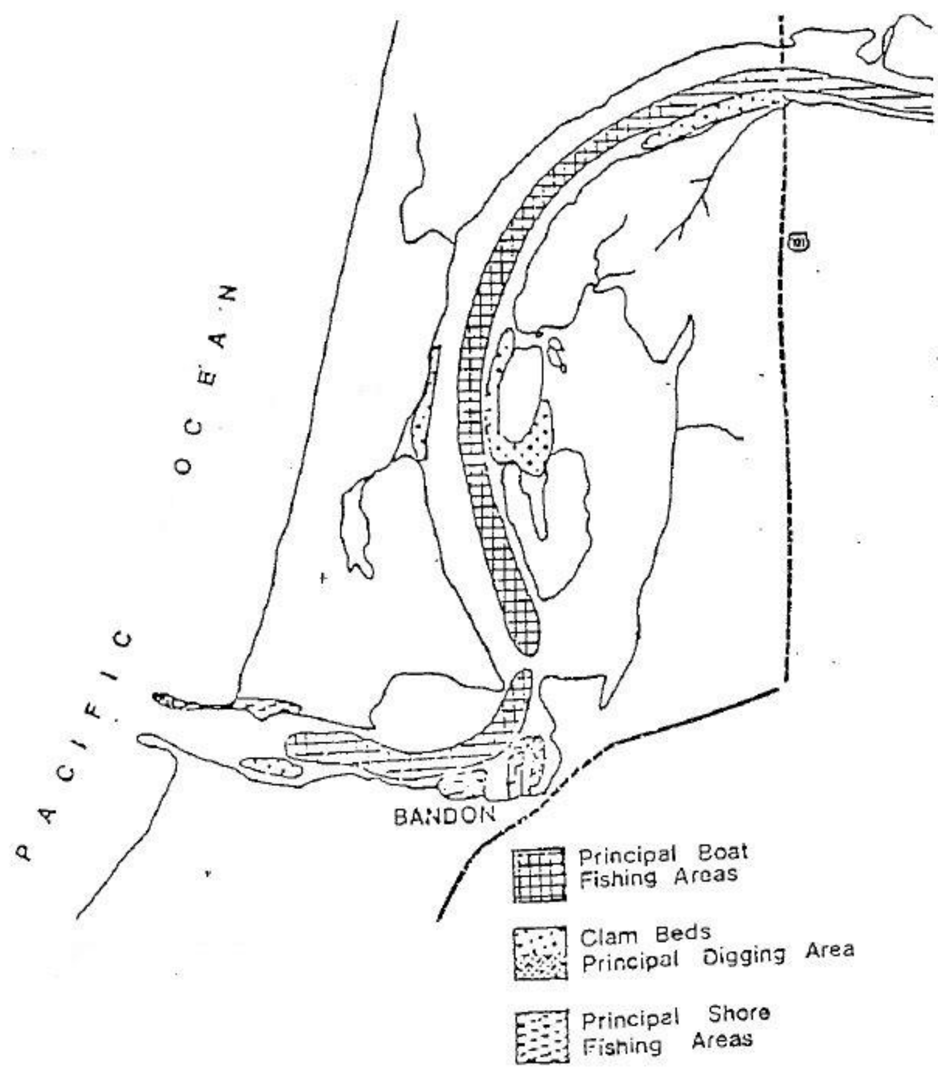
	County	State	Non-State
Boat	1,051	618	86
Shore	5,995	4,187	1,549
Tideflat	144	21	4
Total	7,190	4,826	1,639
Percentage	52.7	35.3	12.0

Source: Gaumer, et al. (3)

- Combined Recreational Fisheries: A total of 13,700 resource user trips (1,800 boats, 11,700 shore and 200 tideflat) were expended on the Coquille River Estuary during the study. The 13,700 user trips represented 30,300 hours of effort (5,000 boat, 25,100 shore and 200 tideflat). Peak activity for the boat, shore and tideflat fisheries was in August, July and March. Areas receiving the principal use for boat, shore and tideflat fisheries were below the city docks (35%) and treatment plant (49%), respectively (see Figure 8.1).

Anglers of the three fisheries harvested 67,600 animals [62,000 fish, 3,000 crabs, and 2,600 clams (See Table 8.3).] Dungeness crab comprised 91% of the boat anglers' total catch. Fish were the principal animals harvested by shore anglers and represented 99% of their total catch. Surf smelt was the main species caught, softshell clams comprised over 99% of the tideflat users' total take. Comparing the catch for all three fisheries revealed that shore anglers harvested 62,500 or 92% of the total animals taken. Boat anglers and tideflat users each caught 2,600 marine animals. Peak catch for the boat, shore and tideflat fisheries occurred in June, July, and August respectively, combining all fisheries, July was the principal month of catch.

Figure 8.1 Principal recreational fishing areas in Coquille Bay



Source: Gaumer, et. al. (1973) (3)

Table 8.3 Recreational harvest and use

Recreation Fishery	Days	Fish	Crabs	Catch Clams	Shrimp	Misc.	Total
Boat	1755	234	2,363	0	0	0	2,597
Shore	11,731	61,766	683	0	0	0	62,459
Tideflat	169	0	0	2,622	0	7	2,629
Combined	13,655	62,010	3,046	2,622	0	7	67,685

Source: Gaumer, et. al. (1973) (3)

Table 8.4 Parks and recreation sites

Park	Location			Facilities				Activities		
	T.	R.	S.	Camp Sites	Trailer Sites	Picnic Sites	Boat Ramp	Swimming	Fishing	Hiking
Bullards Beach State Park	28	14	7	-	128	85	x	x	x	x
Judah Parker County Park	28	14	15	-	-	2				
South Jetty (County)	28	15	26	-	-	-	x		x	

See next pages for revised information, continuation of this table.

8.1.2 Hunting

Hunting for waterfowl along the first sixteen miles of the Coquille River peaks in December and was estimated at 900 hunter-days in 1970. There is exceptionally good pigeon hunting above Prosper (approximately River Mile 6.5).

8.1.3 Parks and Recreation Sites

The following pages list facilities and activities available at various recreation areas. All of the areas identified are open to the public use. They are administered and maintained by the State of Oregon, Coos County, and the Port of Bandon.

- Moorage Facilities

1) NAME: Port of Bandon Moorage
OWNERSHIP: Port
ACCESS: In Bandon, on south side of River at RM 0.7
CAPACITY: Water surface area of 6 acres; 60 permanent and 90 transient moorage spaces (6 boats abreast)
LAUNCHING: Paved, one lane ramp
SERVICES: Fuel, bait, water and electricity, garbage disposal
RATES: $1.00/ft/mo.

	USE PATTERNS:	Open year-found; active season April-October; 100% occupancy in active season; no waiting list
	PLANNED EXPANSION:	Plans submitted for 110-space commercial boat basin, plus additional 30 spaces for recreational boats

- <u>Boat Ramps</u>

1)	NAME:	Bullards Beach Boat Ramp
	OWNERSHIP:	State
	ACCESS:	North side of River, entrance off Highway 101 at RM 2.9
	TYPE:	Paved, two lanes
	SUPPORT FACILITIES:	60 parking spaces, restrooms, garbage disposal, loading dock
2)	NAME:	Rocky Point Ramp
	OWNERSHIP:	County
	ACCESS:	North side of River, 2.2 miles east of Highway 101 on North Bank Road
	TYPE:	Paved, one lane
	SUPPORT FACILITIES:	40 graveled parking spaces, toilets, garbage disposal
3)	NAME:	Riverton Boat Ramp
	OWNERSHIP:	County/State
	ACCESS:	In Riverton, halfway between Bandon and Coquille
	TYPE:	Paved, one lane
	SUPPORT FACILITIES:	25 graveled parking spaces, toilets, disposal
4)	NAME:	Coquille Boat Ramp
	OWNERSHIP:	County/State
	ACCESS:	In City of Coquille, just east off Highway 42 South Bridge at RM 24.5
	TYPE:	Paved, one lane
	SUPPORT FACILITIES:	80 paved parking spaces, toilets, garbage disposal
5)	NAME:	Arago Ramp
	OWNERSHIP:	County/State
	ACCESS:	In Arago, halfway between Myrtle Point and Coquille on west side of the River at RM 32
	TYPE:	Paved, one lane
	SUPPORT FACILITIES:	50 graveled parking spaces, toilets, garbage disposal
6)	NAME:	Point Ramp
	OWNERSHIP:	County
	ACCESS:	in Myrtle Point, off Spruce Street, near downtown commercial area
	TYPE:	Paved, one lane
	SUPPORT FACILITIES:	Paved parking spaces

Source: "Commercial and Recreational Boating Facilities in Oregon Estuaries" (1979) (4)

The Bandon South Jetty County Park is approximately one acre and consists of an unpaved parking lot and flush type restrooms. It provides access for beachcombers and fishermen to the jetty, the river mouth and the ocean beach. At the east end of the parking area is a seafood restaurant, located on properties belonging to the Port of Bandon. Beachcombers (and migratory birds) find interest in the numerous pools of a marsh strewn with jetty rocks immediately east of the park behind the jetty. Marine algae, invertebrates, and small fish are found there, in addition to a bed of softshell clams, which contains an occasional gaper clam. Fishing along the perimeter of the rock jetty is popular.

The Bandon saltmarsh is popular for bird watching, due to the wide variety of species found there.

The stellar attraction at the North Jetty is the old Bandon lighthouse, one of the most scenic on the Oregon Coast and one of only two National Historical Sites in Coos County.

The North Jetty site, a part of the City of Bandon, is of great historical, aesthetic, recreational and economic value to the area. The jetty, the uncrowded beach, and the forlorn charm of the lighthouse has attracted tourists, artists, and photographers.

Bullards Beach State Park is the main developed recreational facility on the lower Coquille. Most of the users are attracted to the overnight trailer park and the ocean shore, although there is a boat ramp on the estuary shore, which provides good access to the excellent fishing in the bay.

8.1.4 Future Recreational Needs

The many tourist facilities available on and around the Coquille River Estuary are visited by large numbers of people each year. There is a need, however, to develop further attractions, which encourage tourists to make Bandon and the South coast a destination instead of just an overnight stop. If the various sites and activities are both more attractive and more available, tourists will be encouraged to spend a greater length of time exploring local areas of interest.

Providing additional moorage facilities for both commercial and sport boats at the Bandon Boat Basin will assist in this (see Section 7.3.1 for needs analysis); however, additional facilities such as boat ramps are needed along the rest of the Coquille River. The creation of facilities, which can accommodate sailboats and yachts will also need to be considered in the future due to the increasing number of sailboat owners. A marina development with support facilities has been proposed on a site up-river from Prosper, which promises to draw in boat owners from a wide area and to make this a destination resort (see Section 7.5 for more details).

Improved access to the estuary, particularly for bank fishing and bird watching is identified as a need by the Task Force. The Oregon Department of Fish and Wildlife has identified potential sites for bank access (5) and has a standing policy of acquiring access from cooperative landowners, either through outright purchase, access easement purchase or agreements. A private landowner above Riverton has proposed a private fishing club development including 55 fishing shelters, parking, water and sanitation and bank access. This is a response to a need for private, as well as public, fishing access. Existing and potential bank access sites are identified on the map "Recreational Sites". Primary bird watching areas like the North Spit and the Bandon Marsh are already substantially in public ownership, so there appears to be no obvious need to provide additional access for this purpose.

Other types of tourist attractions such as sternwheeler tours and downtown waterfront renovation could make the Coquille Estuary even more of a recreational attraction.

The following sites have been found suitable for additional recreational boat ramps:

- PROPOSED BOAT RAMPS

1. <u>River Mile 12, SE Bank of River</u>
T.28S. R.13W, Sec. 30
Ownership: Port of Bandon
Land Type: Road subject to flood
Cover Type: Pasture and brush
Road Access: Highway 42S
Uses: Salmon, steelhead, striped bass and other fishing
Needs: Access to 5 miles of river now remote from ramps
Good Recreational Potential

Source: George Baker, Coquille Boat Club

2. <u>Rover Mile 24.3, N. Bank of River</u>
T.28S. R.13W, Sec. 30
Ownership: City of Coquille (Sturdivant Park)
Land Type: Level area subject to flood at extreme stages
Cover Type: Willow, Alder and Blackberry
Road Access: Travel on Railroad right-of-way from Highway 42S (Front Street)
Uses: Heavy salmon, steelhead, trout and catfish fishing
The park facility and the boat ramp have been completed and is in use daily.
Good Recreational Potential: The State Marine Board's facilities plan provides for a boat ramp to be provided near the City of Coquille (4)

Source: George Baker, Coquille Boat Club

A need also exists for two other ramps in the river sections half way between Riverton and Coquille and between Coquille and Arago. There appear to be no sites in public ownership so future availability of sites depends on the willingness of private owners to provide them. The private fishing club development mentioned above (8.1.4) is in the right general location to provide ramp access. Public road access to the river is available here via Clausen Road.

8.2 Historical and Archaeological Sites

Goal #5 (Natural Resources, Scenic and Historic Areas and Open Space) requires that historic and archaeological sites be protected.

The history of the Coquille River and the Coquille Valley spans close to a century and a half and recalls such events as Indian battles, feverish mining activity, riverborne shipping, logging and lumbering, and the early exploits of retired treasure hunters. Certain historical sites are officially recognized in the inventories of various state and local agencies. There are other unrecorded sites, but these are generally the remains of old mills and canneries, and are not considered sufficiently important to be identified and protected, due to the fact that the structures have been substantially destroyed. The Bandon Lighthouse is the only structure of national significance (see Table 8.5 for a list of sites).

Table 8.5 Historical sites

Map Number	Site	Date	References
1	Bandon Lighthouse*	1896	1, 2, 3, 6, 7
2	Peterson Lighthouse*	1887	1, 7
3	Parker Landmark*	1870's	1, 7

*Recorded historical sites

The Bandon Lighthouse is in good physical condition, though no longer operating. It is a popular landmark with photographers and painters. The Peterson House is still occupied, and is in sound structural condition. It is a prominent feature in the historical settlement of Prosper where almost all other traces of the original community have disappeared. This enhances the importance of this remaining structure. The Parker Landmark is simply a roadside commemorative marker at the Judah Parker County Park.

Archaeological sites along the Coquille River Estuary contain important traces of prehistoric Indian habitation of the area, and include the remains of middens, weirs and fish traps, and villages. Table 8.6 lists sites and their features.

Table 8.6 Inventory of archaeological sites

Descriptions of Lower Coquille Archaeological Sites Part I: North Bank Sites

Site	Site Type	Cultural Strata	Period of Site Use
T. 28, R. 14, S. 25	Village or camp	Upland midden	Unknown
T .28, R. 14, S. 25	Village (destroyed by upland houses and erosion after 1950s) midden cemetery		After 300 BP*
T. 28, R. 14, S. 24	Fishing station?	Tidal wetland	
T. 28, R. 14, S. 18	Large village cemetery	Riverbank and upland midden	300 to 100 BP and possibly earlier
T. 28, R. 14, S. 18	Fishing station	Riverbank wetland	650 BP to < 300 BP
T. 28, R. 14, S. 17	Seasonal village Fishing station	Riverbank midden above earlier tidal wetland	750 BP to 300 BP
T. 28, R. 14, S. 17	Camp	Upland lithics	~ 3200 BP
T. 28, R. 14, S. 17	Village cemetery	Upland midden and lithics	Unknown
T. 28, R. 14, S. 17	Seasonal village Fishing station	Riverbank midden, tidal wetland	Weirs ~900 to 800 BP
T. 28, R. 14, S. 17	Seasonal village Fishing station	Riverbank	Weirs ~ 1030 to 800 BP Village after 750 BP
T. 28, R. 14, S. 16	Seasonal village Fishing station	Riverbank midden, tidal wetland	Weirs ~750 BP Village after 750 BP
T. 28, R. 14, S. 09	Seasonal village Cemetery (?) Fishing station	Riverbank midden, tidal wetland	Weirs ~ 700 BP Village after 700 BP
T. 28, R. 14, S. 15	Residential (?) Fishing station	Riverbank middle, tidal wetland	Unknown
T. 28, R. 14, S. 15	Village	Midden	Unknown
T. 28, R. 14, S. 15	Fishing station	Tidal wetland	~ 900 BP
T. 28, R. 14, S. 30	Village	Multiple midden layers	~ 3500 to 600 BP

T. 28, R. 14, S. 30	Residential	Midden	Unknown
T. 28, R. 14, S. 30	Village cemetery (?)	Upland midden	Unknown
T. 28, R. 14, S. 30	Fishing station	Tidal wetland	Unknown
T. 28, R. 14, S. 18	Fishing station Tool-making	Lithics on sand levee; weirs in tidal wetlands	Weirs ~ 650 BP
T. 28, R. 14, S. 16	Village Fishing station	Riverbank midden, tidal wetland	Weirs ~ 1200 to 600 BP; midden after 600 BP
T. 28, R. 14, S. 09 f	Fishing station (?)	Tidal wetland	Unknown
T. 28, R. 14, S. 10	Tool-making, possibly residential	Eroding from above riverbank	
T. 28, R. 14, S. 15	Tool-making, possibly residential	Eroding from above riverbank	
T. 28, R. 14, S. 22	Fishing station	Tidal wetland	
T. 28, R. 14, S. 22	Fishing station	Tidal wetland	~ 3400 BP
T. 28, R. 14, S. 19	Weirs		
T. 28, R. 14, S. 23	Weirs		

* BP = Before Present

Noted areas below have not been categorized and compiled with specific information for sites. The study is currently continuing and once the information has been provided, an update to the plan will be appropriate. Areas with archaeological sites in general areas are as follows:

Township	Range	Section
29	14	35, 36
28	13	7, 8, 18, 17, 1, 12, 36
28	12	7, 18
29	12	8, 9, 27, 5, 4

Native people who lived on the Coquille River Estuary used its resources and cast off waste remnants, which deposited information about their daily lives. Many of the sites provided evidence of the types of foods utilized, plank house architecture, cemeteries and a wide variety of tools. Villages and middens have been found, with the oldest site of a midden dating back 3400 years. As of this update, this is the oldest site discovered on the Coquille. Erosion has, and is occurring at several riverbank sites. Causes for the erosion in several areas appears to be due to the effects of tectonic activity. Once the upland soils become exposed to repeated wetting and drying from tidal currents, they began to crack and shear away from the bank. Particularly vulnerable to this type of erosion are the shell middens. The erosion of loose middens and shell lenses undercuts thick sections of the bank, causing collapse. Wave action from wind and baot wakes undoubtedly speeds up the erosion process. Preservation of these eroding sites will likely require alteration of the slope of the riverbank. In some places, the landowner has placed rock riprap along the shore to stabilize eroding areas. Unfortunately, the soils beneath the riprap eventually wash away and the rock settles on the more consolidated wetland sediments at the base of the cut bank.

Exposure of the sites, provided mapping of the site characteristics, sampling for radiocarbon dating, and collecting of distinctive artifacts for analysis, conservation and interpretation.

ORS 97.740-760 and 358.905-955 accord protection of Indian graves and objects. The law provides that no person shall remove, mutilate, deface, injure or destroy any cairn, burial, human remains, funerary object, sacred object or object of cultural patrimony of any native Indian. Persons disturbing native Indian cairns or burials through an oversight shall at their own expense reinter the human remains or funerary object under the supervision of the appropriate Indian Tribe. The law also provides for excavation by a professional archaeologist of a native Indian cairn or burial, shall be initiated only after prior written notification to the State Historic Preservation Office and the state police, and with the prior written consent of the appropriate Indian tribe in the area of the intended action.

Coos County has provided a check-list and method for the property owner to notify the local tribes and to receive the Tribes response. The table lists the general location of the archaeological sites within the Coquille River Estuary. The listed sites provide the County, property owner, and general public with appropriate information to provide notification to the Tribes for their comments.

8.3 Areas of Scientific Importance

All of the natural areas within the estuary study area which have been recognized as possessing scientific value are, in fact, places of unique habitat. As such, their main scientific value for biological or ecological study.

The descriptions and locations, which follow, are from the natural areas inventory list for Coos County compiled as part of the Oregon Natural Heritage Program by the Nature conservancy. Letters refer to the scientific areas map. Additional details are given below for the Coquille River saltmarsh.

Table 8.7 Areas of scientific importance

Site Name and Description	Location	RM	Status
A. <u>Coquille River Estuary Tideflat</u> Saltmarsh, important feeding/resting area for birds and waterfowl	S. 18, 19 T. 28S R. 14W	1.5	Surveyed
B. <u>Prosper Pigeon Concentrations</u> Crucial habitat for bandtailed pigeons; on Coquille River	S. 10 T. 28S R. 14W	7	Not Surveyed; Verified
C. <u>Randolph Heron Feeding Area</u> Greg blue heron feeding area in Randolph Slough two miles from Rookery	S. 35 T. 27S R. 14W	NE of 6 to 7	Not Surveyed; Verified

<u>Coquille River Estuary Tideflat Marsh</u>

<u>Size</u>: 300 acres approximately
<u>Location</u>: S. S1/218, Portion 19
<u>Ownership</u>: State Land Board, Port of Bandon and Moore Mill

- <u>Protection Status</u>: Now protected upon transfer of ownership from Port to U.S. Fish and Wildlife Service, southern part in Moore Mill ownership will remain unprotected.

- <u>Description</u>: This extensive low-salinity area of saltmarsh and tideflat is in the estuary of the Coquille River just north of the City of Bandon and across the channel from Bullards Beach State Park. The saltmarsh is described as low sandy marsh type, but it is on a predominantly silty substrate, and many areas of the marsh are intermediate in vegetation character between low sandy type and immature high marsh type. The marsh is strewn with beach logs and debris, but is relatively undisturbed. Interfingered through the marsh are several large and numerous small tidal drainage channels and sedge forms large dense stands along these channels. Composition in the marsh is essentially a patchwork of small areas dominated by a single or few species, depending on marsh elevation, substrate, etc., so that over the whole marsh there is much diversity.

- <u>Natural Elements</u>:

  Lowland emergent wetland west of Cascade Mountains

  Lowland stream segment-tidal reach

  Waterfowl wetland

  Shorebird/marshbird habitat

- <u>Ecological Significance</u>: This site was identified by marine biologists as a medium priority Research Natural Area need. It is the only sizeable saltmarsh between Coos Bay and Smith River, California and is undoubtedly one of the best and most extensive occurrences of the low sandy marsh vegetation type on the Oregon Coast, and is of great significance for the overall contribution to fishery productivity. Within the marsh there are small areas of single species dominance in salt pans, standing freshwater holes, slightly elevated mounds, ditches and drainage channels. Because of the impressive array of habitats the marsh is very valuable for autecological studies of salt tolerance, habitat specificity, etc. The site is of the same general vegetation type as Cox Island (LN-65, 66) in the Siuslaw Estuary. This marsh is apparently slightly older and more elevated and has fewer areas at low marsh elevation with obvious daily tidal influence. Overall diversity and quality is slightly higher at Cox Island as it is isolated from direct human influence.

- Management/Use Considerations: The marsh receives some human use, primarily from hunters, clam diggers and hikers, due to its proximity to the City of Bandon and Highway 101. The overall effect of this use on the marsh has been relatively light and has not resulted in any obvious compositional changes. A few old tire tracks are found in the marsh, and a few weeds occur there. Access restriction is suggested for the area during the breeding and nesting seasons, but no restriction should be necessary otherwise, unless use increases. The marsh vegetation is relatively fragile, but recovers rapidly from minor disturbances. If use increases, a raised trail may be a necessity. The marsh (at the southern end) is presently threatened by its potential for development by dredging and filling. As a consequence, the U. S. Fish and Wildlife service has negotiated a purchase of the greater part of the marsh from the Port of Bandon.

8.4 Aesthetic Values

The lower riverine portion of the Estuary, particularly between Bear Creek and Riverton where the river winds through a steep sided valley, has some definite scenic values. However, it is a feature typical of coastal rivers, and is less impressive than the canyons of other rivers. There is no site, therefore, that would qualify for outright protection as an "exceptional aesthetic resource" under the provisions of the coastal shorelands goal.

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9. BIOLOGICAL RESOURCES

9.1 Biological Organization of Estuarine Ecosystems

The biological organization within the Coquille River Estuary has resulted from an evolutionary selective process. The environmental conditions that most adversely affect the ecosystem of the estuary are those which depart in the greatest way from the existing estuary environmental organization. Two general types of such departures can be identified: (1) introduction of materials and conditions which are significantly different from those of the evolution of the estuary; and (2) changes in relative dominance, frequency, distribution, and magnitude of environmental conditions.

The ecological system of the estuary can be altered by a multitude of different conditions; it is a dynamic system. The species in the estuary must adapt and compete for available resources within the greater environment. The estuary ecological system possesses a self-organizational capacity, which is continually directed toward increased persistence under existing conditions. This self-organizing process can be viewed from two similar, though distinctly different, perspectives: evolution and succession. Evolution involves a long-term adjustment of species to long-term changing environmental conditions, succession involves the short-term adjustment of systems to environmental conditions.

Estuarine ecosystems display organizational responses to changing environmental conditions as a particular change or set of changes becomes more strongly influenced by the dominating change and relatively less influenced by the remaining environmental conditions. When one environmental condition dominates those species and systems of species, which are best suited to that condition, will tend to dominate the system.

The environments of the Coquille River Estuary are characterized by two significant properties. First, wide fluctuations in salinity temperature, water depth, water velocity, and turbulence are typical. Such fluctuations can produce physiological stress. However, these same fluctuations provide "services" to the system such as nutrient dispersal, waste removal and distribution of aquatic life. Moreover, within the estuary, such fluctuations are dominated by the tides and by distinct seasonal changes and are thus reasonably predictable. Second, the estuary is a relatively open system that is freely connected to the open ocean and to freshwater streams. This openness is accentuated by the tides, which results in extensive mixing of oceanic and estuarine waters. The estuary should not be considered a highly stable ecosystem in the sense of consistency of structure, but rather should be considered as a resilient system capable of a variety of adjustments to environmental conditions.

The identification and description of different habitats for estuarine biological resources is possible, even though habitats are usually not sharply delineated or mutually exclusive. Organisms are distributed along gradients of environmental conditions, rather than in precisely definable regions. Thus, habitats will tend to be limited by zones of change in the values or characteristics of the aquatic environment's physical and chemical properties.

Several examples of general habitat types common in Oregon estuaries may be given. These include:

A. High salinity (usually greater than 25 parts per thousand-ppt) channels, washed by tidal currents, with stable bottoms of boulders or compacted clay or clay-sand mixture seaweeds commonly attached. This habitat is frequented mostly by marine fishes such as black rockfish, ling cod, greenling, flounder, Pacific herring, northern anchovy, and salmon, invertebrates such as shore and crabs are common sea birds and seals are also common visitors to this habitat. Major natural resource value is recreational fishing and crabbing.

B. High salinity mud and sand flats adjacent to the mouths of the estuary alternately inundated and exposed by tides, sometimes blanketed with filamentous algae and typified by the presence of numerous clams and other invertebrates. Estuarine fishes such as flounder and viviparous perches frequent such areas when they are inundated. Such habitat is important to shorebirds and waterfowl for feeding and loafing areas, and harbor seals use the beaches for "haul-outs." Major natural resource value is recreational and commercial clamming.

C. Medium salinity (usually 15-25 ppt) channels, regularly washed by tidal currents stable bottom of compacted clay-sand, and typified by fluctuations of salinity and temperature. Dungeness crabs and viviparous perches use these channels for access to shallower feeding grounds in spring, summer, and fall. Jack smelt and anchovies also congregate in these areas during summer. Anadromous salmonids pass through this habitat on their migrations to and from the ocean Major natural resource values are crabbing and fishing for salmon.

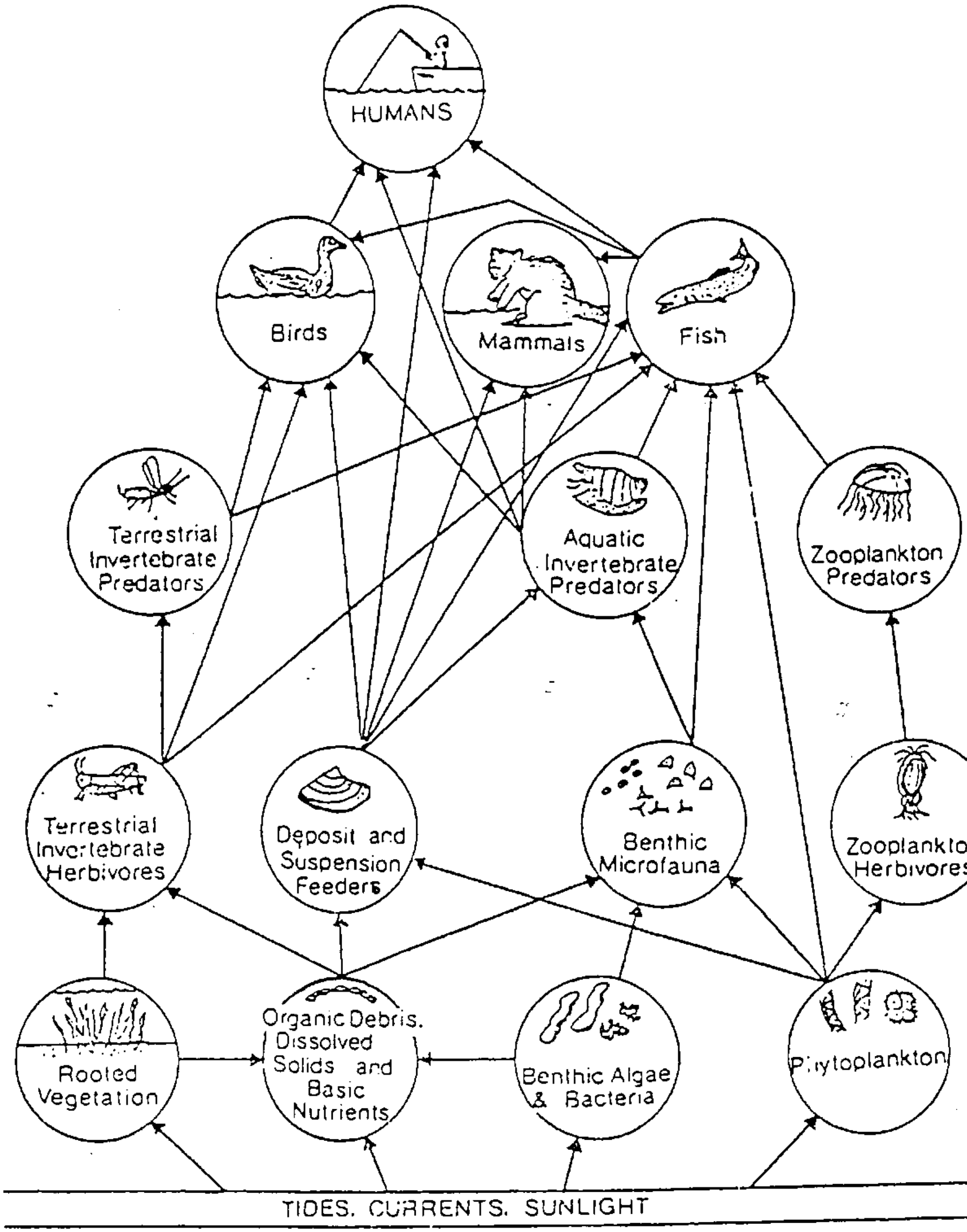
D. Low salinity (usually less than 15 ppt) channels, regularly washed by tidal currents, stable bottom of compacted clay-sand often covered with a shallow layer of silt and detritus, typified by extreme fluctuations of salinity and temperature. Softshell clams, flounders, sea run cutthroat trout, and sculpins frequent this habitat. Major natural resource value is recreational fishing for flounder and cutthroat trout.

E. Medium salinity (usually 15-25 ppt) mud and sand flats and proximate sloughs, alternately inundated and exposed by tides, commonly blanketed with filamentous algae in mid-summer, often supporting emergent plants such as eel grass, and typified by the presence of numerous cockles and gaper clams. Such habitat is important to waterfowl for feeding and loafing areas. Furbearers, particularly - raccoons, frequent these areas, searching for food. Flounders, viviparous perch, and crabs feed extensively on these grounds when they are inundated. Major natural resource values are clamming, crabbing, and recreational fishing.

F. Low salinity (usually less than 15 ppt) mud and sand flats and proximate sloughs, alternately inundated and exposed by tides, often blanketed by filamentous algae in midsummer, commonly supporting emergent plants, and typified by extensive populations of softshell clams. Waterfowl and furbearers frequent these areas in search of food. Deer and bandtailed pigeons obtain salt and some sustenance from this habitat. These areas often serve as nursery grounds for the young of viviparous perch, flatfish, herring, shad, striped bass, and crustaceans such as crabs and Crago shrimp. Shad and striped bass often utilize this habitat for spawning grounds. Major natural resource value is clamming, waterfowl hunting, and spawning and nursery areas for those species listed above.

G. Freshwater areas under tidal influence at the heads of estuaries, typified by well defined river banks and sluggish water flows. This habitat supports extensive populations of anadromous cutthroat trout and crayfish. Other migratory salmonids linger in these areas on their journeys to and from the ocean. Diving ducks nest and feed in this habitat, and puddle ducks rest and preen on these waters. Major natural resource value is habitat for anadromous salmonids and recreational fishing.

Figure 9.1 Estuarine food web



Adapted from Estuarine Resources of the Oregon Coast, Wilsey & Ham, 1974

H. High or medium salinity, rocks or shells at various levels of the intertidal zone, such as breakwaters, dikes, and revetments in bays.

I. Pilings and logs at various levels of the intertidal zone.

J. High salinity, spray and splash zones in or above intertidal zone, usually rocky and near the open coast, such as jetties.

Finally, the openness and temporal organization of tidal estuaries enables them to be a principal connecting system between marine and freshwater systems. Where exchange of biota between freshwater and marine systems has been found beneficial to the survival of these systems, the evolutionary process has resulted in organizational selection to favor such an exchange. It would be difficult to identify any ecosystem type of comparable size, which contributes as significantly as tidal estuaries do to the larger functioning of the biosphere.

The value of a habitat depends on many considerations. The relative amount of a habitat type, its geographical distribution, vulnerability to deterioration, resiliency, and its ability to renew itself are vital considerations. Equally important are the resources it supports. Fish and wildlife population densities, species variety, social importance of the species, their vulnerability, resiliency or adaptability to other habitats, and critical factors affecting the populations also are essential assessments to the adequate measure of habitat values.

In addition to those species of commercial value, tidal estuaries make available a wide range of species, which have become part of the integrated structure of the oceanic systems. A mutual organizational partnership exists between the coastal zones, including estuaries, and the larger system of the ocean. It is easy to think mistakenly that because of the overwhelming size of the oceans this partnership is unimportant to the oceanic systems. One half of the fish production of the world's oceans occurs within the coastal zones (1). Estuaries, which are significant parts of the coastal zones, are among the most biologically productive areas known on the earth, and a wide variety of species depend upon estuarine systems.

9.2 Nutrient Cycling in Estuaries

The abundant fish and animal life of estuaries depends on phytoplankton, marsh grasses and submerged plants for most of its food. All of these plants require a continual supply of nutrients plants need, such as potassium, calcium and magnesium. Seawater lacks only concentrations of nitrogen and phosphorus, a fact, which acts to control the growth of estuarine plants.

The Coquille Estuary usually contains high concentrations of nutrients. For the most part this is a result of high concentrations of nutrients in the inflowing freshwater, but it may also be due to erosion of older marine sediments. The contact of sediments with the shallow estuarine waters is another extremely important feature. When organic matter decays at the top of the sediments nitrogen and phosphorus are made available to the organisms in these shallow waters. Both the circulation of water through the upper layers of the sediment and the resuspension of sediments into the water column serve to move regenerated nutrients from the sediments to the water (2, 3).

The high concentrations of nutrients entering the estuary and the mechanisms and processes that retain nutrients within the Estuary provide a rich nutrient environment for the growth of plants. These are mostly rooted plants and algae attached to the sediments or to large plant stems; phytoplankton are usually washed out of estuaries before large blooms can develop.

The estuary, including shallow water areas, tideflats, eelgrass, and marshes, is one production unit. In the same manner, inland wetlands are an integral part of the food chain of the lake, floodplain, stream, and groundwater environment of the region. Tidal wetlands are among the most productive natural systems known to exist.

Wetland plants in general, and marsh plants in particular, are important in the aquatic food chain because solar energy, carbon dioxide, and water are converted into carbon compounds in plant chlorophyll, and because nutrients (such as phosphorus and nitrogen) are assimilated and converted into compounds, usable by a wide-range of organisms.

The intertidal marsh is a particularly important location within the production system because:

A. Large quantities of detritus (organic debris resulting from plant death) wash into the estuary with daily and seasonal high tides;

B. The individual segments of plant debris form a surface on which small life forms cling, providing a more concentrated source of food energy for feeding organisms (i.e., particles of detritus after colonization by bacteria may have a protein content twice as great or more as that of the original particle) (4); and

C. Algae production may be higher in marshes than in the open waters of the estuary because of lower turbidity (4).

Odum and de la Cruz in Lauff (1967) state that "...organic detritus is the chief link between primary and secondary productivity, because only a small portion of the marsh grass is grazed while it is alive. The main energy flow between ...levels is by way of the detritus food chain." (cited in (4).

Primary phytoplankton production takes place in the shallow waters of the estuary. A particularly important type of energy production takes place on the tideflats through the interactions of a variety of plant and animal forms. This production occurs on the wet surface as well as within the sediments, as stated recently by a zoologist, "...a muddy shore is unique among environments in having these two productive layers, one on the surface and another a few centimeters below the ground" (5).

The major primary producers are diatoms and single-celled algae. The presence of these plants is at least partially determined by the type of sediments present and the amount of organic material in the soil (5), once again demonstrating the inter-relationship of physical and biological factors in the estuarine environment. Other primary producers include eelgrass (Zostera) and other algaes such as Cladomorpha.

The marsh is of special importance because considerable amounts of decayed material are released to the estuary environment, and an optimum location for production to other plants is provided, in this regard, Eltringham observes:

> "thus, between them, the algae and the higher marsh plants are able to maintain an uninterrupted sequence of photosynthetic activity which must make the saltmarsh one of the most productive of all intertidal areas." (5)

9.3 Distribution of Fish Species

Table 9.1, showing estimated numbers of adult spawning anadromous salmonids in eleven South Coast stream systems, demonstrates clearly that the Coquille River is the most important fisheries stream on the South Coast. These figures are from 1972, and have changed substantially in some cases due to natural changes in population and stocking or habitat improvement efforts. (See below for some revised up-to-date figures). Table 9.2 shows the type and distribution of all fish species observed in the Coquille Estuary.

Table 9.1 Estimated number of adult anadromous salmonids spawning in South Coast Basin stream systems. [1, 2, 3]

Stream System	Chinook Spring	Chinook Fall	Coho	Steelhead	Sea-run Cutthroat
Tenmile Lakes	0	0	17,900	10,500	8,000
Coos River	0	5,000	8,300	5,000	3,500
Coquille River	50	4,900	23,000	16,100	12,000
New River	0	1,600	400	2,300	1,500
Sixes River	0	3,000	300	2,500	3,000
Elk River	0	3,200	800	3,500	2,800
Euchre Creek	0	60	0	159	200
Hunter Creek	0	900	50	1,000	600
Pistol River	0	500	50	1,200	4,000
Chetco River	0	3,000	500	4,000	2,500
Winchuck River	0	400	50	1,500	1,500
Others	0	20	350	350	400

[1] Estimates by OSGC and FCO biologist.
[2] Numbers indicate spawning escapement, total run would be computed by adding appropriate sport and commercial harvest date.
[3] Estimates include hatchery contributions.

Source: Thompson, K. E., et al., Fish and Wildlife Resources of the South Coast Basin, Oregon, and their Water Requirements. Oregon Game Commission, 1972.

Table 9.2 Origin and distribution of fish species of Coquille Estuary
(Gaumer et. al. 1973; Reimers et. al., 1978; Smith 1956; Thompson et. al., 1972)

		Type of Fish			Occurrence (RM)			
Common Name	Scientific Name	Anadromous	Saltwater	Freshwater	0-1.3	1.3-3.8	3.8-14	14 & up
Pacific lamprey	Lampetra tridentatus	X			?	X	?	?
American shad	Alosa sapidissima	X			X	X	X	X
Pacific herring	Clupea harengus pallasi		X	X	X			
Northern anchovy	Engraulis mordax mordax		X	?	X	X		
Chum salmon	Oncorhynchus keta	X						
Coho salmon	Oncorhynchus Kisutch	X			X	X	X	X
Chinook salmon	Oncorhynchus tshawytscha	X			X	X	X	X
Cutthroat trout	Salmo clarki clarki	X			?	?	X	X
Steelhead (rainbow) trout	Salmo gairdneri	X			?	X	X	X
Surf smelt	Hypomesus pretiosus		X		X	X	X	
Eulachon	Thaleichthys pacificus		X		X	?		
Pacific tomcod	Macrogadus proximus		X		X	X		
Tomsmelt	Atherinops affmis		X		X	X		
Threespine stickleback	Gasterosteus aculeatus		X	X	?	X	X	X
Bay pipefish	Syngnathus griseolineatus		X		?	X	X	
Striped bass	Morone saxatilis	X	X	X	?	?	X	X
Redtail surf perch	Amphistichus rhodoterus		X		X	X		
Shiner perch	Cymatogastr aggregata		X		X	X	X	
Striped sea perch	Embiotoca lateralis		X		X	X		
Walleye surf perch	Hyperprosopon argenteum		X		X	X		
Silver surf perch	Hyperprosopon ellipticum		X		X	X		
White sea perch	Phanerodon furcatus		X		X	?		
Pile perch	Rhacochilus vacca		X		X	X	X	
Saddleback gunnel	Pholis ornata		X		X	X	X	
Pacific sandlance	Ammodytes hexapterusx		x		?	x		
Black rockfish	Sebastes melanops		X		X	?		
Kelp greenling	Hexagrammos decagrammus		X		X	?		
Rock greenling	Hexagrammos Lagocephalus		X		X	?		
Whitespotted greenling	Hexagrammos stelleri		X			X	?	

Lingcod	Ophiodon elongatus	X		X	X		
Coastrange sculpin	Cottus aleuticus		X		X	?	?
Prickly sculpin	Cottus asper		X		X	X	X
Buffalo sculpin	Enophrys bison	X		X	X		
Pacific staghorn sculpin	Leptocottus armatus	X		X	X	X	X
Cabezon	Scorpaenichthys marmoratus	X				X	X
Speckled sanddab	Citharichthys stigmaeus	X			X	X	X
English sole	Parophyrs vetulus	X			X	X	
Sand sole	Psettichtyhys melanoctictus	X		X	X	X	X
Starry flounder	Platichthys stellatus		X			X	X
Largescale sucker	Catostomus macrocheilus		X				X
Brown bullhead	Ictalurus nebulosus		X				X
Bluegill	Lepomis macrochiris		X				X
Largemouth bass	Nucrioterys sakniudes		X				X
Blackside dace	Rhinichthys osculus		X				X
Mosquito fish	Gambusia affinis		X				X

Source: Natural Resources of Coquille Estuary-ODFW (1979); from Gaumer, et al., 1971 Coquille River Estuary Resource Study (1973); Reimers, et. al., Fall Chinook ecology project (1978); Smith, H. S., Fisheries Statistics of Oregon 1950-1953 (1956); and Thompson, et. al., Fish and Wildlife Resources of the South Coast Basin, Oregon, and their Water Requirements (1972).

Spawning salmonids can be found in the estuary and the upland tributaries in the fall and winter, striped bass and shad spawn in the estuary in May and June, and brown bullhead can be found there as well (6, p. 73).

The small remnant run of spring Chinook salmon spawning in South Fork of the Coquille and its tributaries is the last known run of this species in the South Coast basin (7). They hold over in pools in the upper South fork during the summer to spawn during the winter, which makes them vulnerable to environmental changes (e.g. water temperature), and to poaching (Al McGie, personal communication, 10/81).

The Oregon State Game Commission formerly operated the fish hatchery on Ferry Creek near Bandon and in 1970 released approximately 800,000 trout in upland streams. The hatchery is still operated by a private firm, which contracts with the State Department of Fish and Wildlife to raise steelhead for release into the Coquille system.

Current estimated populations on the Coquille system are as follows: Spring Chinook - 50; Fall Chinook - 7 000; Coho -15,000-18,000; Steelhead - 20,000; Searun cutthroat - 28,000 (Al McGie, Reese Bender personal communication, 10/81). Coho populations are currently well below the productive capacity of the system, which is approximately 30,900 fish, and are also down from the 1972 figure of 23,000. Fall Chinook stocks are increasing naturally. Steelhead is well up from 1972 due, in part, to intensive stocking efforts.

The State Department of Fish and wildlife has embarked upon an extensive Salmon and Trout Enhancement Program (STEP), using their own eggs and volunteer labor from local citizens. Hatch boxes have been placed in a number of small tributaries of the Coquille system, and spawning habitat improvements are being made. This effort is part of state policy to improve output and spawning conditions for native stocks of anadromous fish.

In 1978 Reimers, et.al., (8) conducted a study of juvenile fall Chinook salmon in the Coquille estuary They found that the juvenile Chinook moved downstream to the estuary from upland tributaries in May, and moved fairly rapidly to the lower estuary by early July. Once there, however, it appears that the juvenile salmon did not move immediately into the ocean and some were still present in the estuary in November. The study's conclusion was that while the long tidewater reach of the estuary offers important rearing areas for juvenile Chinook during May and June as they pass through, their rapid downstream migration to the lower estuary indicated that perhaps "less than 25% of the Coquille Estuary is suitable for rearing juvenile Chinook salmon through the summer" (8).

Many of man's activities in the Coquille Valley and in the entire watershed can have direct and adverse effects on the condition of the basin's streams as fish habitat areas. Extensive logging activity, extreme floods and intensive fishing effort were all statistically correlated with decreases in the fish returns in the Coquille River in the period from 1923 to the 1950's (1, p. 16).

9.4 Bird Habitat

An important element of the Coquille inventory is the location, description and extent of "the important feeding areas, spawning areas; nurseries; migration routes; and other biologically important areas of marine birds. This information can facilitate the identification of areas for preservation and areas possessing development potential so that economic, recreational, aesthetic and natural values can be protected.

Waterfowl are biologically tied to the aquatic ecosystem. It provides food and water, escape from predators, sanctuary, space for normal living activities, and resting and nesting areas. Elimination of this habitat reduces the amount of these resources available to the waterfowl populations dependent upon them, and a reduction in carrying capacity results. Neighboring habitat can never absorb the displaced birds and the total population is reduced by starvation, disease, and lowered breeding output. Any permanent loss of habitat results in a permanent loss of waterfowl.

The principal waterfowl habitat functions provided by Oregon coastal wetlands are:

A. to furnish wintering waterfowl with sufficient foods, rest, and space to minimize natural mortality through the fall and winter months;

B. to return adequate numbers of healthy birds to the breeding grounds to ensure maintenance of flyway population levels; and,

C. to provide spring and fall migration habitats for birds wintering in California and Mexico (9).

Species occupation of an area is often very seasonal. Many birds nest in Oregon during the spring and summer, but migrate south in the winter. Some migrate from further north to Oregon for the winter, and still others pass through the State while on longer journeys. The waterfowl flyway along the Oregon coast is a part of the Pacific Flyway, extending from Alaska to Mexico. Coastal wintering grounds include the Coquille River Basin. Oregon's Coastal Zone saltmarshes are particularly important to migratory waterfowl, shorebirds and other waterbirds of the Pacific Flyway. Many species depend on this habitat for the wintering season. Submerged lands are resting areas for waterfowl.

Inventory information concerning birds and their habitat requirements is not extensive. Most data consists of species lists or categories of relative abundance. Accurate bird population estimates are hard to develop. The U.S. Fish and Wildlife Service monitors waterfowl game birds, ducks and geese, but few other assessments exist. As a result, population trends are difficult to monitor. Table 9.3 provides an estimation of the number of ducks and geese using coastal wetlands. The inventory is conducted by the U. S. Fish and Wildlife Service.

Table 9.3 January waterfowl inventory Oregon Coast, 1969-72

County	1969	1970	1971	1972	1973	Average
Clatsop	4,192	6,204	7,345	8,691	8,754	7,017.2
Tillamook	6,701	5,667	10,118	9,521	13,047	9,010.8
Lincoln	2,631	3,571	13,519	6,946	7,409	6,815.2
Coos	20,997	16,330	15,280	34,662	N/A	21,817.25
Curry	590	2,876	N/A	5,623	N/A	3,029.66
TOTAL	35,111	34,648	46,162	65,443	29,210	42,114.8

Source: Concept Plan for Waterfowl Wintering Habitat Preservation: U. S. F. W. S. (1979)

The Coquille River valley is an important part of the southern Oregon Coast waterfowl habitat complex. This is born out by Table 9.3 where it is shown that Coos County has higher counts of waterfowl than all other coastal counties. A great deal of waterfowl interchange occurs daily between Coos and Coquille estuaries.

Winter flooding of the region provides a significant increase to the waterfowl habitat. The flooded farmlands of the Coquille valley are important resting and feeding grounds for migratory waterfowl, with peak use between December and March.

During winter storms, birds move from the coast into the Coquille valley to seek shelter. A survey on March 13, 1979, in the Coquille River recorded the following duck totals (9, p. 93):

pintails	11,200
widgeon	8,625
bufflehead	320
mallard	75

Waterfowl values for species of concern in both the coquille Estuary and the Coquille River Valley are shown in Table 9.4. All included wildfowl have been described as important wintering species in the Oregon coastal habitat from a biological and/or economic standpoint.

Values are based upon vulnerability to loss of habitat for each of the waterfowl groups within Table 9.4. Brant habitat (although none is noted on the Coquille) is most vulnerable because of eelgrass requirements. Swan, geese, and dabbler habitat is also easily lost to destructive practices; diver and sea duck habitat is more secure (9, p. C-9).

Table 9.4 Waterfowl values of the Coquille Estuary and the Coquille River Valley

Species of Concern

	Coquille Estuary		Coquille River Valley	
Swans	Low		Low	
Geese	None		Low	
Pacific Brant		None		None
Snow Goose		None		None
Canada Goose		None		Low
Dabbles	Moderate		High	
Pintail		Low		High
Widgeon		Moderate		High
Mallard		Low		High
Green-winged Teal		Low		High
Divers	Low		Low	
Canvasback		Low		Low
Scaups		Low		Low
Ruddy Duck		Low		Low
Sea Ducks	Low		Low	
Scoters		Low		None
Mergansers		Low		Low
Goldeneyes		-		Low
Bufflehead		-		Low

Source: Concept Plan for Waterfowl Wintering Habitat Preservation: U. S. F. W. S. (1979)

Birds of the ocean, estuary and freshwater bodies are found in the Bandon area. Species composition is highly diverse. The most important shorebirds include great blue herons, gulls, belted kingfishers and double-breasted cormorants (99). Large great blue heron feeding grounds are located along the northern edge of Randolph Island, RM 6. A number of very uncommon birds have been spotted in the last year in the area, including the bar-tailed godwit, the Hudsonian godwit, the white-tail kite, and the ruff (personal communication Alan McGie, ODFW). The tidal flats and saltmarshes of the lower Coquille Estuary are particularly important feeding grounds for shorebirds [see map: Estuarine Wetland Habitats].

A partial list of birds that may be found within the Coquille Estuary habitat is shown below in Table 9.5. upland bird species are too numerous to describe within this inventory. Further information upon upland bird species may be obtained from the Oregon Department of Fish and Wildlife or the Bureau of Land Management in Coos Bay.

Table 9.5 Wildlife species found within the Coquille Estuary

Common & Scientific Name	Preferred Habitat	Residency	Habitat Status Quantity/Quality	Population Trend	Abundance
MAMMALS					
River Otter	Streams & riparian habitat	Resident	S/F	S	Fairly Common
Beaver	Streams & riparian habitat	Resident	S/F	S	Fairly Common
Muskrat	Riparian habitat marshes	Resident	D/F	S	Uncommon
Raccoon	Riparian habitat	Resident	S/F	S	Fairly Common
Mink	Riparian habitat	Resident	S/F	S	Fairly Common
Spotted skunk	Brushy areas, Riparian habitat	Resident	S/F	S	Uncommon
Short-tailed weasel	Brush, forests, riparian habitat	Resident	S/G	S	Fairly Common
Long-tailed weasel	Forest, brush, riparian habitat	Resident	S/G	S	Fairly Common
Shrew mole	Riparian habitat, all habitats	Resident	S/F	S	Fairly Common
Black-tailed deer	Riparian habitat	Resident	S/G	S	Common
Opossum	Riparian habitat	Resident	S/G	I	Common
BIRDS					
Bald eagle	Coastal rivers, & lakes Stage 5 and 2	Migrates during fall, returns January	S/F	I	Uncommon
Short-eared Owl	Open areas Marshes, Stage 1	Winter	S/P	S	Uncommon
Marsh hawk	Riparian habitat & marshes	Resident	S/P	S	Uncommon
Osprey	Coastal lakes & rivers, snags Stage 4&5	Summer	D/F	S	Uncommon
Mallard	Lakes, rivers,	Resident Migrants	S/F	S	Fairly common

	bays				
Wood ducks	Lakes, streams	Residents	S/F	S	Fairly common
Common Merganser	Streams, lakes	Resident	S/F	S	Uncommon
Greater scaup	Bays, rivers, lakes	Winter resident	S/P	S	Very common
Green-wing Teal	Marshes, bays	Winter resident	D/P	S	Very common
American Widgeon	Marshes, lakes, bays	Resident & Migrants	D/P	S	Very common
Gadwall	Marshes, lakes	Resident & Migrants	D/P	S	Very common
Pintail	Lakes, ponds	Resident & Migrants	S/P	S	Very common
Ruddy ducks	Lakes, bays	Resident & Migrants	S/P	S	Very common
American coot	Ponds, marshes	Resident	D/F	S	Very common
Canvasback	Marshes, bays	Migrants	D/P	S	Rare
Pelagic cormorant	Ocean, bays	Resident	S/G	S	Very common
Green heron	Marshes, lakes & streams	Resident	D/F	S	Uncommon
Great Blue Heron	Submerged	Resident			Common
Black brant	Estuaries, coastal areas	Winter visitor	S/G	S	Very common
European widgeon	Bays, lakes, fields	Winter visitor	S/F	S	Rare
Shoveler	Marshes, lakes	Resident	D/F	S	Uncommon
Redhead	Bays, ponds, lakes	Resident	D/F	S	Common
Ring-necked duck	Lakes, ponds	Resident	S/F	S	Common
Harlequin duck	Submerged				Uncommon
Oldsquaw	Submerged				Uncommon
White-winged scoter	Ocean, bays & lakes	Resident	S/G	S	Very common
Surf scoter	Ocean, bays	Resident	S/G	S	Very common
Common scoter	Ocean, submerged				Uncommon
Red-breasted merganser	Bays, rivers	Winter	S/G	S	Common
Pectoral Sandpiper	Submerged	Fall migrant			Few
Baird’s sandpiper	Submerged	Winter resident			Common
Semi-palmated sandpiper	Beaches, tidal flats	Winter	D/G	S	Uncommon
Rock sandpiper	Rocky coasts	Winter visitor	S	S	Uncommon
Least sandpiper	Marshes, tidal areas	Winter	D/G	D	Very common
Dunlin	Beaches, tidal flats	Winter visitor	D/G	D	Very common
Short-billed dowitcher	Mudflats, marshes	Migrants	D/G	D	Common
Western sandpiper	Mudflats, beaches	migrants	D/G	D	Very common
Sanderling	Sandy beaches	Winter	S	S	Very common

Glaucous-winged gull	Bays, garbage dumps	Resident	S/G	S	Very common
Western gull	Ocean, bays & lakes	Resident	S/G	S	Very common
Herring gull	Ocean, bays & lakes	Winter visitor	S/G	S	Uncommon
California gull	Bays, lakes, & rivers	Resident	S/G	S	Very common
Ring-billed gull	Ocean, bays, lakes	Resident	S/G	S	Common
Mew gull	Ocean, bays, rivers	Winter visitor	S/G	S	Very common
Bonaparte's gull	Ocean, bays, lakes	Migrants	S/G	S	Very common
Glaucous gull	Ocean, submerged	Winter			Uncommon
Heerman's gull	Ocean, submerged				Common
Black-legged kittiwake	Ocean, bays	Winter visitor	S/G	S	Common
Common murre	Ocean, bays	Resident	S/G	S	Very common
Pigeon guillemot	Ocean, bays	Resident	S/G	S	Common
Marbled murrelet	Ocean, bays, streams	Resident	S/G	S	Uncommon
Common loon	Ocean, bays, lakes	Resident	S/G	S	Common
Arctic loon	Ocean, bays	Winter visitor	S/G	S	Very common
Red-throated loon	Ocean, bays	Winter visitor	S/G	S	Very common
Red-necked grebe	Lakes, rivers, bays	Resident	S/G	S	Uncommon
Horned grebe	Lakes, rivers, bays	Resident	S/F	S	Common
Eared grebe	Lakes, marshes, rivers	Resident	D/F	S	Uncommon
Western grebe	Bays, lakes	Resident	S/G	S	Common
Pied-billed grebe	Rivers, bays, lakes	Resident	S/G	S	Uncommon
Brown pelican	Ocean, submerged	Summer			Common
Double-crested cormorant	Ocean, bays, lakes	Resident	S/G	S	Very common
Brandt's cormorant	Ocean, bays	Resident	S/G	S	Very common
Bufflehead	Lakes, bays	Migrants	S/P	S	Common
Snow goose	Submerged				Uncommon
Canada goose	Submerged	Winter			Common
Whistling swan	Submerged				Uncommon
Whitefront	Submerged				Uncommon
Wandering tattler	Coast, rocky, intertidal	Migrants			Uncommon
Killdeer	Sandy beach, submerged				Common
Whimbrel	Sand beach,				Uncommon

	submerged				
Virginia rail	Marshes	Residents	D/P	D	Uncommon
Black-bellied plover	Mudflats, open marshes	Winter visitor	D/F		
Common snipe	Marshes, wet meadows	Resident	D/F	D	Common
Spotted sandpiper	Marshes, wet meadows	Resident	S/F	S	Uncommon
Willet	Marshes, beaches	Summer	D/F	D	Rare
Greater yellowlegs	Marshes, mudflats	Winter visitor	D/G	D	Uncommon
Lesser yellowlegs	Marshes, mudflats	Migrants	D/G	D	Uncommon
Red knot	Tidal flats	Migrants	D/G	D	Rare
Belted kingfisher	Streams, bays, rivers	Resident	D/G	S	Common
Great egret	Submerged		S/G		Uncommon
Long-billed marsh wren	Fresh water marshes	Resident	D/P	S	uncommon

It should be noted that the "Abundance" column should not be strictly applied to the Coquille Estuary Study area. It was developed for the BLM Coos Bay district and refers to abundance of the particular species in the district as a whole. All of the species listed, however, are likely to be found within the estuary study area.

Habitat Quality, and Population Trends are designated as follows:
(I) Increasing, (S) Stable, (D) Decreasing, (G) Good, (F) Fair, (P) Poor

SOURCE: Bureau of Land Management, Unit Resource Assessment, Appendix D #17, pp. 103-5, Alan McGie, Oregon Department of Fish and Wildlife, personal communication

9.5 Endangered and Threatened Wildlife

Endangered species are those that are currently in danger of extinction, and threatened species, those that are likely to become endangered in the foreseeable future. Although the extinction of living species has occurred throughout history, in modern times the rate of extinction has greatly accelerated, and there is general agreement that human activities, primarily those associated with land development, are responsible for this increase. In the United States, no fewer than 40 species of birds and mammals have disappeared since 1820. As of 1975, the Fish and Wildlife Service had classified as endangered or threatened 143 species of wildlife in the United States, the Virgin islands, Puerto Rico and the trust territories.

Most of these species are geographic isolates, being endemic to oceanic islands. Others are restricted to aquatic habitats or "islands" of remnant vegetative associations, once much greater in expanse but now reduced through habitat changes. Some have evolved in restricted habitats and were never very abundant.

The other species are wide-ranging. Habitat alteration has had a profound impact on these species also, often by restricting their ranges and isolating populations. Past land management practices have tended to decrease ecological diversity, removing key habitat features essential to the survival of some species.

Table 9 6 lists rare, endangered, threatened and protected species observed, or thought to be present, within the Coquille River Estuary, (10, p. F-2 and personal communication, Alan McGie, ODFW).

Table 9.6 Rare, endangered, threatened, or protected species of the Coquille River Basin [1]

	Oregon Status [2]	Range	Habitat
Birds			
Caspian tern	R	Local breeding, wanders world-wide	Ocean, estuaries, beach
California brown pelican	P	N. California to S. America	Ocean, estuaries
Northern bald eagle	T	Alaska, Canada to S. US	Estuaries, beach, lakes and snags
Western snowy plover	T	Coast, S. Washington to Baja, California	Tideflats, sandpits are the nesting sites
Marine Mammals			
Harbor seal	P	N. Alaska to California, Hudson Bay to New York	Coast, river mouth
Mammals			
White-footed vole	R	W. Oregon and NE California	Estuary and stream edge spruce
Plants			
Silvery phacelia	R	Bullard's Beach; additional range not known in Coquille Estuary	Beach, dunes

Source: E.I.S. Technical Appendices, U.S. Army Corps of Engineers, (1975)
[1] Not an official fish and wildlife list; update necessary
[2] Status Key: R = rare; E = endangered; T = threatened; P = protected

As understanding of species requirements increases, efforts to ensure that those requirements are met also will increase. For some endangered and threatened species (notably those most restricted and isolated) this will consist of preserving all available habitat and protecting it from further encroachment. In addition, it may be possible to extend some species' restricted or depleted ranges by transplanting them to presently unoccupied or newly-developed habitats. The conservation of other species requires that their needs be considered along with the management of associated resources. Perhaps most important is recognition of potential dangers and adoption of corrective action before more wildlife populations are threatened (11, p. 89).

9.6 Estuarine Wetlands

9.6.1 General Introduction

Approximately 20,000 years ago, the last great advance of glacial ice spread across the continent and resulted in major lowering of the sea level, from 300 to 450 feet below the present level. As the glaciers melted, the sea level increased once again, until maximum submergence was reached about 6,000 years ago. After the glaciers had retreated northward and the waters of the sea and the rivers rose to fill the scoured lakebeds and river channels, vast marsh and swamp areas began to form wherever the land and water met. As the present post-glacial climate warms, these wetland areas gradually dry and become covered with upland vegetation. But on the coasts, the tempering influence of the sea slows this process, and storm tides continue to flood the lowlands, increasing the persistence of wetland vegetation through time. (12)

The formation of wetlands begins with the deposition of material along the margins of the estuary, forming shallows. The shallow water areas are basic wetland types in themselves, with independent functions and values, as well as being essential components of the other wetland types. When deposits build up above the low tide level, the tideflat wetland type is established. When the tideflat becomes sufficiently stabilized for-rooted vegetation to become established, the tidal marsh wetland type is formed. The marsh itself is a dynamic community within which an orderly replacement of plants takes place through time, and eventually the process can produce an upland meadow or Sitka spruce woodland.

A. This inventory of wetlands includes two general categories based on the environment in which they occur. They are:

   1. Estuarine Wetlands: those marshes, tideflats and shallow waters occurring in close proximity to the sea and primarily (although not exclusively) tidal and saltwater in character; and

   2. inland Wetlands: those freshwater marshes, swamps and bogs of the floodplain, which occur inland from tidal influence.

B. The major functions and values of wetlands as described include:

   1. food energy production and nutrient cycling;

   2. production of fish and wildlife;

   3. prevention of erosion;

   4. absorption of pollutants;

   5. silt trap;

   6. moderation of water temperature; and

   7. absorption of flooding and wave impacts.

The estuary, including shallow water areas, tideflats, eelgrass, and marshes, is one production unit. These coastal wetlands are among the most productive natural systems known to exist. (12)

Wetland plants are important in the aquatic food chain because solar energy, carbon dioxide and water are converted into carbon compounds in plants (chlorophyll) and because nutrients (such as phosphorus and nitrogen) are assimilated and converted into compounds usable by a wide range of organisms.

Primary phytoplankton production takes place in the shallow waters of the estuary. These muddy environments are unique in having productive layers both on the surface of the bottom and a few centimeters beneath. The major primary producers are diatoms and single-celled algaes. They depend on the vast amount of nutrients brought in from the watershed by the coastal rivers for their survival. Through these primary producers, considerable amounts of decayed material are released to the estuary environment, making the mudflats one of the most productive of all intertidal areas (5).

Current and salinity, the primary factors affecting the estuary wetland system, vary considerably from one area to another, considerable seasonal differences occur in the stream flow entering the Coquille estuaries from the Coast Range. Large volumes of freshwater flood the estuary in winter reducing salinity, while in summer these flows drop significantly. Tides and winds push wedges of saltwater through the estuary and up the river, producing considerable daily fluctuations. Other physical factors of importance include the density of water masses, air temperature, and exposure to sunlight.

9.6.2 Intertidal Marshes – General Characteristics

The intertidal marsh community extends from bare silt and mud through several successional stages in the low marsh (the area inundated by the daily tides), to the high marsh (the area inundated during peak tides and storm tides) and to the line of landward vegetation (in Oregon's estuaries, generally the alder and Sitka spruce line).

The low intertidal marsh is the area wetted twice daily by the high tides and contains a plant and animal community, which is estuarine and at least moderately tolerant to salt and brackish water. Environmental factors such as the duration of tidal exposure and submergence, tidal water salinity, water quality, and soil nutrients largely determine the location of tidal marshes and plant species distribution. The intertidal marsh is composed of vascular aquatic and semi-aquatic vegetation rooted in poorly-drained and poorly aerated soil. The high marsh community, while still tolerant to some concentrations of salt in the soil solution, generally exhibits more freshwater and upland characteristics.

Examples of indigenous intertidal vegetation include:

(D) Seaside arrow grass (Triglochin maritima)

(A) Pacific silverwood (Potentilla pacifica)

(A) Western dock (Rumex occidentalis)

(D) Bullrush (Scirpus validus)

(D) Three-square rush (Scirpus americanus)

(D) Brass Buttons (Cotula coronopifolia)

(A) Paintbrush orthocarpus (Orthocarpus castillejoides)

(A) Dodder (Cuscuta salina)

(D) Salt grass (Distichlis spicata)

(D) Alkali grass (Puccinellia maritima)

(A) Jaumea (Jaumea carnosa)

(A) Milkwort (Glaux maritima)

(A) Marsh clover (Trifolium wormskjoldii)

(A) Lileaopsis (Lileaopsis occidentalis)

(A) Land spurry (Sperularia canadensis var. occidentalis)

(A) Saltbush (Atriplex patula var. hastata)

(D) Salt rush (Juncus leseurii)

(D) Spike rush (Eleocharis parvula)

(D) Spike rush (Eleocharis parishii)

(D) Spike rush (Eleocharis macrustachya)

(D) Sedge (Carex lyngbyei)

(D) Tufted hair grass (Deschampsia caespitosa)

(A) Sego pondweed (Potomogeton pectinatus)

(D) Eelgrass (Zostera maritima)

(A) Seaside plantain (Plantago maritima)

(A) Gum plant (Grindelia integrefolia)

(A) Creeping bent grass (Agrostis alba)

(D) Glasswort (Salicomia spp.)

D = Dominant Species A = Associated Species

The lower intertidal marsh provides food and shelter for the animal communities of the estuary waters. The great numbers of algae and eelgrass in the area provide a basic source of good energy. Diatoms (small to microscopic one-celled plants enclosed with shells of silica) occur in great numbers and are able to survive during low tide on, and just under, the surface of mud in the marsh. However, extensive siltation in marsh and mudflat areas prevent photosynthesis in these plants and reduces the food energy available to the marine environment.

Tidal flats are those areas of land between the mean high tide and the mean low tide line-the area covered and uncovered daily by the ebb and flow of the tide. These areas, commonly called mud flats, have sparse vegetation, including eelgrass, rockweed, and other algae. Tidelands consist of sediments, primarily gravel, sand, silt, and clay washed into the estuary by the river and the sea. They also contain large amounts of organic material, primarily deteriorated particles of marsh plants and other plant refuse from upland areas. Because of this organic load and the action of bacteria in the mud, oxygen is depleted in the tideflats at rates, which vary with the mixture of sediments. Tightly packed particles of clay allow for little penetration of gasses, and therefore mud flats may become deficient of oxygen. Adequate circulation in the estuaries provides for a more desirable combination of sediments.

Mud flats, especially those with a low sand percentage, are often unstable when agitated. Marsh vegetation consolidates this material and stabilizes it somewhat, but construction on tideflat and marsh fills is often susceptible to the consequences of instability in times of earth movement such as slides or tremors.

Significant organisms in the tideflat zone include eelgrass and other species of algae which live in the water or on the thin film of water held by the capillary attraction of the tideflat particles. The tideflats support an animal community primarily of burrowing organisms, the most familiar being various species of clams. Physical factors such as currents, salinity, water quality and temperature have a significant influence on tideflat organisms. These are creatures of the estuary as a whole, not just of the immediate tideflat environment. As a result, tideflats generally support relatively few species of which there are a great number of individual organisms. However, when eelgrass becomes established on the tideflats, a much more favorable environment is created for a variety of organisms.

The seagrass/eelgrass wetland type is composed of those beds of eelgrass (Zostera maritima) which occur in Oregon estuaries.

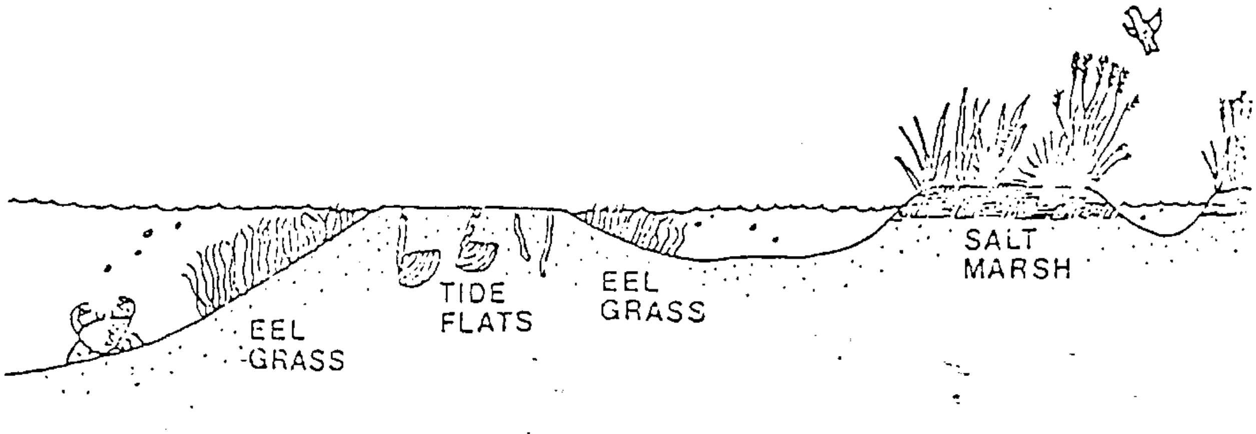
Eelgrass occurs in the well-flushed high salinity areas of the estuary where the bottom is not affected by intense sedimentation or other natural or man-caused disturbances. The density of the beds change seasonally as well as from one year to another. Eelgrass is tolerant to long-term submergence and is the dominant plant on the lower tidelands. Inorganic and organic material collects in eelgrass and adds to the buildup of tideflats. Thus, eelgrass in many cases represents the first stage in the transition of a tideflat to a mature marsh community.

Eelgrass provides an environment for a great variety of organisms on the mud below, within the plant mass, and in the surrounding waters. The most familiar animals of the eelgrass community are the Dungeness crab and several species of clams. Migratory birds and fishes also make use of these wetland communities.

Besides the basic function of producing food energy used in the estuary and marine ecosystem, the most important biological characteristic of the intertidal marsh is its significance as a transition zone between different habitats. The estuary is the zone where land and sea meet, and the tidal marsh is the actual location where that meeting takes place.

The survival of the plants and animals of the estuarine waters depends on adjustment of changing levels of salinity, and on ability to withstand tides and currents. For this reason, most estuary organisms are benthic, that is, buried in the bottom mud or attached in some way. Bottom species include a variety of worms and other invertebrates (including crabs and shrimp), and a variety of fish. Bottom species in estuaries are considered to be more abundant and valuable than those found either in the ocean or in freshwater. There is a great variety of small to microscopic plants (phytoplankton) and animals (zooplankton) floating in the water and drifting with the tides and currents. The distribution of this plankton in the estuary is determined by physical factors, especially salinity, phytoplankton is often concentrated at the surface and in the fresher parts of the estuary. The estuary contains many species of fish and serves as a feeding ground for numerous waterfowl and wading birds. Oregon's estuaries are used extensively for wintering and resting by the migratory birds of the coastal portion of the Pacific Flyway (12).

Figure 9.2 Cross-section of a typical intertidal marsh



9.6.3 Subtidal Lands in the Coquille Estuary

[Major Source: Natural Resources of Coquille Estuary, ODFW, (1979)]

Subtidal lands are those lands that occur below the mean low tide and are either never exposed or only exposed along the upper margins when the tides' ebb exceeds the mean. This environment furnishes abundant nutrients and suitable living space for a wide variety of fish and wildlife. The ratio of salt, brackish, and freshwater varies with the tides and distance from the mouth. The water area above the submerged lands is the main channel to the sea and provides major fish passage, harvest and navigational values.

This is the area to which fish and some invertebrates retreat when the tide ebbs and is the resting area for waterfowl. Many species of fish and shellfish spend all or part of their life cycle in estuaries. For a large group of marine life, they serve as nurseries, as spawning and feeding grounds, and as areas of transition for fish migrating between freshwater and the ocean. The submerged lands also are very important to several species of non-game birds and waterfowl.

Recreational fishermen spend many man-days in this area in pursuit of estuarine fish, shellfish and anadromous fish going to or from their spawning grounds.

The marine subsystem [from mouth to RM 1.3] is roughly 60% subtidal. See Table 9.7 for estimated acreage of different habitat types in the Coquille bay and marine subsystems.

Table 9.7 Habitat distribution in the Coquille Marine and Bay subsystems, as estimated from ODFW Habitat map

Habitat Type	Marine Subsystem		Bay Subsystem	
Subtidal	85		235	
Intertidal	60		495	
Shores		2		20
Flats		48		80
Aquatic Beds		10		45
Tidal Marsh		-		320
TOTAL	145		730	

Source: Natural Resources of Coquille Estuary, ODFW (1979)

Most of the subtidal habitat lies in the channel, but some lies in the boat basin. The bed of the channel is fine riverborne sands overlaying sedimentary bedrock which is sometimes exposed by dredging or currents. There is no information on subtidal vegetation. Available knowledge of fish and crabs indicates that species in the marine and bay subsystems are nearly identical, though the rock-outcrops and jetties may provide important habitat for rockfish, rock greenling, cabezon and other species attracted to rocky areas. Surf smelt are also abundant. Dungeness and rock crab are caught in the channel in summer. There is no information on other fauna. The bay subsystem is only one-third subtidal, including the channel and small marsh channels. The substrate is thought to be mainly sand or sand/mud in the marsh channels. The presence of gaper clams in the bay intertidal flats is a strong indication that subtidal clam beds are located in the channel.

Almost all the riverine subsystem is subtidal. The substrate has not been sampled but is known to contain wood debris and sunken logs. Reimers (8) found 18 fish species in the lower riverine subsystem, including anadromous, saltwater and freshwater species [see Section 9.3, and Table 9.2.]. Shiner perch and juvenile Chinook were most abundant. Shrimp and Dungeness crab were also found. The mid and upper sections were found to contain at least 16 fish species (mostly anadromous or freshwater). Juvenile Chinook were most abundant in spring and summer, and juvenile shad in late summer. Reimers also found shrimp in the midsection and Asian freshwater clams in the upper section.

9.6.4 Freshwater Wetlands

Wet meadows are areas of waterlogged soils, generally without standing water in the summer but flooded with shallow water in the winter. They are characterized by various sedges bulrushes and skunk cabbage, in the coastal zone these areas are often located on broad alluvial plains such as the Tillamook valley and the coquille Flats. These areas are usually former salt or fresh marshes, which have succeeded into mature, more upland forms, or more likely, were diked and drained to provide pastureland for dairy cattle. The coastal Oregon dairy industry developed to a large degree as a result of the drainage of tidal marsh areas.

Wet meadows are important as feeding areas for certain species of ducks and geese. Birds finding shelter and protection in coastal marshes often feed in wet meadows [see Section 9.4, Bird Habitat].

The Oregon Department of Fish and Wildlife estimates there are 5,810 acres of wet meadows in the coastal zone.

Table 9.8 Distribution of the wet meadow wetland type

County	Acreage	% of Total
Lincoln	370	6.4
Douglas*	1,140	19.6
Coos	3,840	66.1
Curry	460	7.9
	5,810	100.0

* Coastal portion. Source: Atkins and Jefferson "Coastal Wetlands of Oregon OCCDC (1973).

Swamps are wetland areas characterized by woody vegetation, rather than by the reeds and rushes of the marsh areas. They are generally fringe or transition areas on the upland margins of marsh areas. Because of the vegetation characteristics of these areas, they are often regarded as riparian habitat types.

Swamps are important for the seasonal storage and release of surface and ground waters; they provide valuable habitat for wildlife, both for production and for wintering.

A wetland survey was undertaken in August/September 1980 by planning staff, local farmers, and ODFW and EPA officials, to determine the value of freshwater wetlands in the Coquille Valley and what conflicts, if any, exist between wildlife values and agricultural management. The study group looked at a sample of 26 sites across the entire valley; however only 9 are within the Coastal Shorelands Boundary. The results of the evaluation are given in Appendix 'A', and consist of two parts; a biological evaluation and an agricultural suitability evaluation. Scores are based on a subjective 1-10 scale with each evaluator assigning a score based on best judgment, and then averaging all scores. The scores are only intended to indicate relative values among the different sites.

The general conclusions were two-fold:

(i) Many of these wetlands are extensively used by waterfowl during the winter and spring months, while flooded.

(ii) At the same time, many of them are also valuable agricultural land once the water table has lowered sufficiently to allow for grazing.

A later evaluation by ODFW personnel (Pete Perrin, personal communication 5-81), outlined the areas of freshwater wetlands that are judged to be "significant wildlife habitat" under the terms of Goal #17. Their conclusions are summarized below for wetlands that lie within the Coastal Shorelands Boundary [see Inventory Map, "Freshwater Wetlands", for location of sites].

- Site #1 – The lagoon behind the South Jetty in Bandon; this is an aesthetically pleasing natural feature which is well-suited to protective measures, and is recognized as such by the City of Bandon Comprehensive Plan. Its value comes from the presence of year round fresh-water and riparian vegetation. However, it is not considered a "significant wildlife habitat."

- Site #2 – This freshmarsh on the North Spit adjoins a saltmarsh and is best suited to dispersed recreation and wildlife uses. It is extensively used by waterfowl, and is considered a "significant wildlife habitat".

- Site #4 – This is a former diked meadow where part of the dike has broken down. Part of the site is subject to tidal influence and has typical high saltmarsh vegetation. The part of the site furthest from the river contains plant communities typical of freshwater marsh. However, the freshmarsh portion is considered a "significant wildlife habitat" under Goal #17.

- Site #7 – This site is typical of most freshwater wetlands in the Coquille Valley. It is a 'wet meadow' type, a former freshmarsh or swamp before agricultural development, in which air photos reveal traces of the original marsh channels among the drainage ditches. Only a part of the area is within the Coastal Shorelands Boundary. It is a low-lying flat, which accumulates floodwater, run-off from small streams and direct precipitation, which gradually drains off or evaporates in the summer, as a result of long-standing seasonal water (normally until April/May each year) and high water tables throughout the year, aquatic plants like bullrush, sawgrass, reed and cattails (in the drainage ways) persist in the wetter areas and give the area a typical 'wet meadow' appearance. Cattle graze in the area and appear not to have an adverse effect on the diversity of the vegetation. It is the judgment of ODFW personnel that current agricultural practices (including maintaining existing levels of drainage) are compatible with the wildlife values of this "wet meadow" habitat type. This is because they continue to flood each year in spite of drainage, because they lie lower than the surface of the river in many places and provide valuable feeding and resting places during the winter and spring for migratory wildfowl. During the rest of the year, they provide habitat for great blue heron and egret. Crazing only occurs after floods have subsided and migratory wildfowl have left the area. The other sites, though smaller, generally fit this characterization, although some have remnants of riparian tree species like alder, ash, myrtle and willow.

These 'wet meadow' areas, while extensively used by wildfowl in the winter months, are not considered "significant wildlife habitat" under Goal #17. They are part of a habitat type already quite abundant in the Coquille Valley, and contribute little to habitat diversity [Pete Perrin personal communication 5/81]. However, riparian vegetation in these areas is important to wildlife and fish populations, and is identified and protected as required by Goal #17.

It is interesting to note that the delineation of wet meadow areas is an inexact science at best. There are often no clear boundaries between wet meadow vegetation types and regular grazing. During the flood season the entire valley bottoms flood, covering ‘wetlands’ and ‘non- wetlands’. It is only as the floods and water table subside and the depressions remain saturated that the typical 'wet-meadow' environments can be distinguished. Actually, migratory wildfowl use the entire flooded area, and do not show any preference for 'wet- meadow' areas for feeding unless the water table has already greatly subsided. Agricultural practices can enhance wildfowl habitat by providing forage and open water areas.

Improved drainage beyond current practices will not prevent flooding. However, there is some difference of opinion on whether it would impact wildlife values. The Task Force believes that improved drainage would only add a month or so to the grazing season by lowering the water table more rapidly during April and May, during the period of less waterfowl use. However, ODFW biologists feel that any decrease in the time of flooding or high water table must necessarily mean less use for waterfowl. They judge that increased levels of drainage would therefore have some impact on wildlife values.

9.6.5 Intertidal Marshes in the Coquille River Estuary

The major source for this section is "Natural Resources of Coquille Estuary", ODFW (1979). Generally, the predominant influence on the Coquille River intertidal marshes is the very high flow of freshwater, which dilutes and limits saltwater intrusion. This is particularly important in the spring, when river runoff is high, and new marsh plants are germinating or spreading roots after winter dormancy. Because the river waters are less dense than intruding saltwater from the ocean, the river freshwater tends to float on the surface and spread over newly-sprouting marsh plants as the tides rise. Local winter and spring rains cause high estuary tributary water flows, high water tables, and relatively low soil and water salinities.

Intertidal marshes once dominated the landscape of the Coquille River Valley. Most of the intertidal marshes along the edge of the river have been diked, drained and used for agriculture. Of the intertidal marshes that remain, the most significant is located along the east bank north of Bandon. [See Section 3.2.2 for historical account of the formation of this marsh, and Section 8.3 for additional details on its scientific importance.]

The marine subsystem is about 40% intertidal (see Table 9.7). Of the 60 acres of intertidal habitat most, (48 ac.) is flat, although there are two algae beds. The bay subsystem is about two-thirds intertidal (about 495 acres), of which most is tidal marsh, though there are also extensive tidal flats, some containing aquatic beds. The riverine subsystem has a limited amount of intertidal marsh; acreage has not been estimated. Apart from a few limited areas of saltmarsh above Prosper (see Inventory Map 'Estuarine Wetland Habitats') most intertidal areas occur as fringing marshes or mud flats.

The following details intertidal habitats in each system, as a supplement to the 'Estuarine Wetland Habitats' map.

a. Marine Subsystem. [Mouth to RM 1.3]

The marine subsystem includes three small intertidal flats with different substrates and each with algae beds: the South Jetty flat, the North Jetty flat, and the Bandon waterfront flat. The South Jetty flat with its tidepools is popular with beachcombers and migrating birds. It has a cobble/gravel substrate; over half the area has a bed of macroalgae attached to the cobbles. There is a bed of softshell clams in this flat with an occasional gaper clam being dug. It also has small fish and invertebrates. The North Jetty flat has a varied substrate; predominantly sand to mixed sand and mud. There is a small algae bed on boulder substrate. Clams are not present but numerous species of juvenile fish were found by Reimers (8) by seining; surf smelt, Chinook salmon, flat fish and shad. The Bandon waterfront flat is divided by the Moore Mill truck shop causeway. To the east is a tidal flat of mixed sand/mud with a seasonally dense mat of microalgae. This is the location of the principal softshell clam digging area, which is adjacent to the sewer treatment plant outfall. To the west, the substrate is mainly mixed sand and mud. Algae is attached to logs and rocks. An extensive study of the Bandon waterfront intertidal area has been conducted by Oregon Institute of Marine Biology (13); it lists flora and fauna in six different environments. Its findings are shown in Table 9.8. The boulder shores along the jetties are also significant habitats; they are thickly colonized by mussels and other common plants and animals of rocky intertidal areas and are important feeding/resting areas for several shorebird species.

b. Bay Subsystems [RM 1.3 to RM 3.8]

Intertidal areas of the bay subsystem are located at the Bandon Marsh National Wildlife Refuge and flat and along the spit and north shore.

It is hard to overestimate the biological importance of the 290 acre Bandon marsh and flat to the entire Coquille River system. This importance has been recognized by the Port of Bandon, until recently the owner of some 90% of the area, and they have arranged a transfer of ownership to the U.S. Fish & Wildlife Service in exchange for use of the old Bandon Coast Guard building to protect this resource.

This marsh alone accounts for about two-thirds of the total acreage of inter-tidal habitat on the Coquille. The marsh has about equal areas of high and low marsh habitats. The low marsh is one of the largest of its type in Oregon (4). The gradation of plant communities from flats to low marsh and high marsh is not as distinct here as at other sites, according to Frenkel et al (14) who analyzed this marsh. They also found some characteristic fresh water inflows into the marsh.

About a third of the tideflat area is seasonally vegetated with an algal mat, half of which also contains a moderate growth of a seagrass. The substrate is mixed sand and mud, grading more to mud toward the south. At the southern tip adjacent to Moore mill is a former log storage area where substrate is densely impacted with wood debris [see Potential Mitigation Sites, Section 9:10.].

While neither fish nor invertebrates have been systematically surveyed, the Bandon marsh is likely to be one of the most important intertidal areas for primary production, fish and wildlife habitat, moderating currents and regulating water temperature. It is certainly also a valuable area for migratory wildfowl (notably widgeons and pintails), providing feeding and resting areas. The northwestern section of this flat, adjacent to the channel is the principle location of soft-shell clams. However, the conditions are not conducive to growth and survival because of elevation and exposure. The middle of the tide flat is densely covered with shrimp holes, while the part containing wood debris has few, but has many tube holes of smaller benthic invertebrates.

There are about 20 acres of intertidal shore in the bay subsystem. The shore between the Bandon marsh and the channel has a mixed sand/mud substrate with two eelgrass beds. The southern shore near Bullards Bridge is muddier and may be impacted by wood debris. It contains a softshell clam bed and some gaper clams (15).

The north shore of the channel has three narrow habitat zones, algae-covered sand/mud in the lower intertidal area, unvegetated sand/mud substrate and algae attached to cobble from riprap along the shore. To the south the shore of the spit has a sand or sand/silt substrate with occasional algal mats. Reimers et al (8) found that the northern shore of the channel, the Bandon marsh shore and the spit shore are all used heavily by shiner perch and juvenile Chinook during the summer.

The spit contains a number of channels, small flats and saltmarshes, grading to a large freshmarsh in one location. Salt-tolerant species like salt grass, pickleweed and pacific silverweed are found here. Drift logs and sand encroachment have covered pats of these marshes [see Section 9.10, Potential Mitigation Sites]. Small pockets of softshell clams are found in the associated flats. The spit exhibits a variety of important intertidal and sand dune habitats.

Two other marshes on the north shore, either side of Bullards Bridge, were at one time joined. The downstream marsh is almost covered by drift logs, and a restoration project has been identified here [see Section 9.10], Elevation, location and scattered marsh plants indicate that it is potential saltmarsh. The upstream marsh contains a small flat with algae eelgrass. Both high and low saltmarsh are present and the uppermost segment is covered with logs.

c. Riverine subsystem [RM 3.8 to RM 39]

The riverine subsystem has been drastically changed from its original condition by agricultural drainage and diking (see Section 5.5). The lower riverine reaches, up to a little above Bear Creek, were probably at one time high saltmarsh and contributed substantially to primary production. There is now very little contribution to estuarine production from the riverine section.

Most remaining intertidal habitats are found in the lower riverine subsystem where shores are broad. The substrates are usually mud. There is fringing growth of eelgrass as far upstream as Randolph Island (RM 6). In many places, too, there are fringing growths of saltmarsh between the shore and the dike; these growths are found as far upstream as RM 9. There are some remnants of high saltmarsh immediately above Prosper. Some have been diked but are still largely subject to tidal influence; this is the case with a 35 acre meadow where the tidegate has gone, leaving it to gradually revert to saltmarsh vegetation [see Potential Mitigation/Restoration sites, Section 9.101.

Though general benthic surveys are not available, Reimers et al (8) observed dense beds of corophium invertebrates near Randolph and at the mouth of Bear creek, which are important in the diet of juvenile salmonids. A bed of softshell clams was found near Sevenmill creek, further upstream than they were previously known to exist. The lower riverine shores appear to be important fish rearing areas. The intertidal shores of the mid-riverine section are generally narrow, tree-lined with mud, gravel or wood debris substrate. Their importance for fish rearing is not known. Generally, very little is known about the biological characteristics of the riverine sub-system, which makes it difficult to assess the possible impacts of dredging or other activity upriver.

Table 9.9 Survey of flora and fauna of site of proposed Bandon Boat Basin

	Substrate	Flora	Fauna
I			
Rocky Area	Rocky Embankment		
Pilings	Highest Rocks	Bare	Bare
	Middle Rocks	Gigartina crustata	Barnacle Zone – Balanus glandula
	Low Rocks	Algae Zone (Fucus, Ulva, Gigartina)	Nereis grubei Cancer magister
	Sand - Gravel	Ulva angusta	Mytilus edulis Pholis ornata
	Mud – Pilings (Mud extremely Black, anerobic looking)	Ulva linza Ulva lactuca Enteromorpha	Idotea wosnesenslei Littorina sculata (on pilings) Gnorimospheraeroma oregonensis Collisella digitalis (on pilings)
II			
Waste Water Run-Off	Fine, Sandy Mud (Hard, packed)	Algal growth confined	Red unidentified nemertean
		Ulva focus gigartina	Cryptomya californica Macoma (shells) Cancer magister
	Mud (Black-Anerobis looking) close to Bandon fisheries	Limited algae growth	No fauna
III			
Rocky Area, Bandon Fisheries	Rocky Area	Ulva Fucus Gigartina	Mytilus edulis Cancer magister Balanus glandula Red unidentified nemertean Pholis ornata (abundant) Gnorimosphaerma oregonensis
	Mud-Sand	Some Ulva	Red unidentified nemertean Mediomastus californiensis Nereis grubei
IV			
Mud-Clay Flat	Mud Flat	Ulva	Mytilus edulis Callianassa sp. Balanus glandula Mya arenaria Nereis grubei
	Mud Clay		Pholis ornata Idotea wosnesenslei Macoma sp.
	Mud Gravel		Corophium sp.

			Spionid (unidentified worm)
V (Gravel; Sand)	Rocky	Fucus	Mytilus edulis
		Ulva	Nereis grubei (abundant)
			Pholis ornata (abundant)
	Mud-Sand, Gravel		Gnorimosphaerma oregonensis
			Hemigrapsus oregonensis
VI Sand and Rocky Embankment	Sand	Ulva (dence)	Nereis grubei
	Low Rocks	Ulva, Fucus	Littorina sculata
			Cancer magister
	Middle Rocks		Gnorimosphaerma oregonensis
			Hemigrapsus oregonensis
	Upper Rocks	Bare	

Source: University of Oregon Institute of Marine Biology; Flora and Fauna of Bandon Marine Flats, Student Survey, unpublished data. (1978)

9.6.6 Values of Estuarine Wetlands

Tidal saltmarshes, whether located in estuaries or simply adjacent to marine waters, are valuable to coastal ecosystems, and to society, in a number of respects. Among the values provided are shore stabilization, storm buffering, pollutant filtering, waste treatment, sediment trapping and nutrient storage and cycling. The values also include fish and wildlife habitat, hunting places, aesthetic attraction or visual landscape relief, and most importantly, primary production of food for marine and estuarine biological systems. In this last regard, they serve as a principal component in fixing, storing and exporting the energy and nutrients without which life in coastal waters could not exist (16).

Where tidal or saltmarshes are prominent features, they have been shown to make the major contribution of primary food materials utilized by estuarine animals (17). The nearshore marine environment and estuaries are among the most productive habitats on earth (18). Fully two-thirds of the nation's commercial fish species depend upon estuaries as spawning, nursery, or feeding areas during at least some stage of their lives (19). Other components involved in primary production are the plankton of open marine waters, kelps and seaweeds, submerged eelgrass beds, and mud algaes.

Saltmarsh grasses are grazed directly by deer and elk; raccoons, mink and skunks feed among them; ducks feed on the plants and small animal organisms of the marsh bottom; black brant feed on picklewood (Salicornia spp.) in addition to eelgrass and sea lettuce found seaward of most marshes; sandpipers, herons and other shorebirds feed and seek shelter in marshes and nearby tidal flats; small birds such as marsh wrens and red-winged blackbirds, as well as ducks, nest in marsh reeds and rushes. Decaying marsh plants are an important food source for oysters, clams, crabs and shrimp. This detritus is also eaten by small invertebrates (copepods, amphipods, mysids, etc.) that dwell on the marsh bottom and cling to marsh plants, which are principal food sources of fish such as flounder, sole, and juvenile salmon. The shallow waters of marshes and mudflats also give sanctuary to small fish and larger predator species.

On an acre-for-acre basis, estuaries are on the order of 20 times more productive than the open ocean and 10 times more productive than shallow marine water or areas of nutrient upwelling, owing mainly to the organic matter production by marsh plants (20). The real significance of saltmarsh productivity lies in the fact that nearly 50 percent of the food material produced is washed out or exported by tidal action into nearshore estuarine and ocean waters in a form that is utilizable by forage fishes, filter feeds such as clams, by large and small crustaceans, and by planktonic organisms. These smaller organisms, in turn, are food for larger marine fishes, seabirds, and mammals. The fish, shellfish and some birds and mammals are taken by man for sport, for food and other uses.

While productivity is probably the most important measure of the ecological value of a habitat (2), it is not the only one. Another very important function of marshes to society is the role played in the treatment and breakdown of nitrate and sulfate pollutants in the water.

Water-borne pollutants enter streams, which lead to the ocean where these compounds tend to be trapped in the estuaries. Marshes and swamps and their adjoining mudflats uniquely perform as the world's kidneys, removing wastes that would otherwise accumulate in the environment, except for the processes performed in the special oxidizing-reducing environment of marshes and mudflats. The work of Odum (22), and others has revealed that marshes can yield a great cost and energy saving to society by eliminating the need for expensive tertiary sewage treatment in coastal areas, provided that regulated amounts of sewage waste are introduced to these areas following secondary treatment.

In addition, marsh vegetation accelerates the settling of silt and other debris from river and estuary waters. This function has particular significance in estuary areas where shellfish and other marine organisms may be disturbed or destroyed by heavy siltation. Additionally, undisturbed marshes may prevent silt from entering navigation channels.

Wetland vegetation, particularly dense stands of marsh, act as a buffer for storm tides and waves, easing the potential for erosion. Marsh vegetation is a natural stabilizer of stream and channel banks, and the marsh acts to stabilize shifting river and tidal channels, lessening the potential for destructive erosion during high water flows.

9.7 Plankton

9.7.1 General Introduction

"Plankton" comprises those organisms dwelling in open water and having such feeble powers of locomotion that they are at the mercy of water currents. This group includes bacterioplankton (bacteria), phytoplankton (plants) and zooplankton (animals).

One of the most useful groupings for plankton is size classification. The largest plankton (macroplankton) range from 0.2 millimeters (mm) to more than a meter and include animals such as copepods, fish larvae and jellyfish. The next smaller group (microplankton) ranges from 0.02-0.2 mm and includes most phytoplankton and protozoans. Plankton in the smallest size grouping (nanoplankton), less than 0.02 mm include bacteria and the smallest phytoplankton.

To understand plankton and their relationship to physical factors and to each other, it is necessary to understand their growth and reproductive processes.

Bacterioplankton may regenerate within a few hours by asexually reproducing copies of their genes and then dividing in two. Phytoplankton, which may reproduce sexually or asexually, generally require a day or more to double in size, even under favorable environmental conditions. Zooplankton growth rates vary enormously from less than a week for protozoa to more than a year for some larger macroplankton.

Nutrients in the estuary are derived from three sources: (1) freshwater entering the estuary; (2) marine waters; and (3) regeneration within the estuary by zooplankton excretion and decomposition processes. Nutrient oxygen values are generally high in the estuary, owing to high values (5-8 ml/liter) during summer, when offshore upwelling occurs. Silicate values are always high in river water and probably are never limiting, even though river phytoplankton (diatoms) utilize large quantities of silicate to manufacture their delicate encasements. Silicate values in the salt wedge are much lower, phosphate levels are about equal in entering fresh and marine waters in winter, depleted in late summer freshwaters (probably due to upriver phytoplankton growth and uptake) and enriched in entering marine waters during upwelling season. Nitrate levels in entering freshwater vary from near zero in summer to high levels during winter, while nitrate levels in entering marine waters behave in the opposite manner. The depression in summer nitrate values to very low levels is probably due to upriver phytoplankton growth and uptake, and would seem to indicate that nitrate is limiting for summer phytoplankton production in the estuary. However, other forms of nitrogen such as ammonia, may be available and utilized by the freshwater phytoplankton which extend into the estuary.

9.7.2 Phytoplankton

Phytoplankton, one of the primary producers in the estuarine ecosystem, utilize nitrogen, phosphate, silicate, carbon dioxide and other minor constituents in the photosynthetic process to produce organic matter. Phytoplankton require sunlight for photosynthesis and therefore are confined to surface waters where light penetrates.

Factors affecting phytoplankton productivity in the estuary may include: (1) the availability of light; (2) the depth of the photic layer which is a function of river water turbidity; (3) concentration and resupply rate of nutrients; (4) water temperature; (5) river flow and amount of vertical mixing; (6) the rate of grazing by herbivores (primarily zooplankton); and (7) the presence or absence of micro- constituents (e.g. vitamins) or growth-inhibiting substances in water.

In some estuaries the growth of phytoplankton is restricted to a narrow zone near the water surface because the incident light is rapidly attenuated by silt carried in suspension, where the water is fairly clear and the flushing time of the estuary fairly long, a rich phytoplankton may develop.

Turbulence may supply nutrients to phytoplankton but may also make the water turbid and thus reduce the light supply.

Phytoplankton change inorganic nutrients into organic compounds capable of being digested by certain crustaceans and fishes. Organic detritus is also partially produced by phytoplankton and many aquatic animals feed directly on this detritus, especially in summer.

9.7.3 Zooplankton

In contract to the phytoplankton, which consist of only a few principal groups, the zooplankton include animal phyla.

The zooplankton of estuaries may be considered under two categories. The permanent plankton includes those animals that are planktonic for the whole of their lives, while the temporary plankton includes forms, which become planktonic at certain seasons, or for parts of their life cycles, in spring and early summer, the temporary plankton may be quite abundant as they seek dispersal and food. Some benthic animals, such as amphipods and harpacticoid copepods, live both in the sediments and water column with equal ease. Accordingly, the division between plankton, fee- swimming animals and bottom dwellers is not precise, but varies depending on individual life cycles, feeding and other behavioral habits.

Seasonal variation in the horizontal distribution of zooplankton reflects the varying tolerance of dilution of seawater with variation in temperature. In temperate regions many marine plankters are able to tolerate lower salinities in summer than in winter, so that they penetrate further into estuaries during the summer.

The vertical migration cycle may also be influenced by vertical salinity stratification in estuaries. The marine forms penetrating in the lower more saline layers may be inhibited from ascending into the upper layers of lower salinity. Some zooplankters undergo a diurnal cycle of vertical migration. Many ascend when the light intensity decreases and descend when the light intensity is high. This leads to the possibility of very complex distributions. The complexity of the distribution patterns is further compounded by the complex current patterns found in the estuary.

9.7.4 Diatoms, Fungi, and Algae

The distribution of different species of diatoms in estuaries is governed by a variety of factors. Salinity is important to many species. There are sufficient brackish water species to ensure that all parts of an estuary will have a variety of diatoms. Some of the estuarine species can tolerate and grow in a wide range of salinities.

Salinity is not the only important factor. Some species seem to be more tolerant than others to organic materials released in the black, poorly oxygenate layer.

On the upper parts of a mud flat there is a danger that the surface may dry out, and some species of diatoms have developed the ability to secrete a mucilaginous envelope which protects them from this hazard.

At the opposite end of a mud flat, near low water mark, the major problem faced by a diatom in an estuary with turbid water is lack of light. The mud may be exposed for only a couple of hours on each tide, and when the tide returns, it cuts out the light. The species found near low water mark seem to have the ability to move rapidly, particularly at low temperatures. This enables them to reach the mud surface rapidly as soon as it is uncovered by the tide.

The fungal flora of an estuary is richer in vegetated areas than in areas of bare mud. Many of the fungi in estuarine soils are widespread in other soils. In addition to the widespread species there are also some species characteristic of saltmarshes. The typical saltmarsh fungi are found more frequently low on the shore. This difference may be explained by the transient species being washed into the water from the land and finding good conditions for growth among the non-specific detritus low on the shore, while the upper shore is colonized by the fungi more adapted to live on specific saltmarsh plants.

There are also many algae associated with the higher plants in saltmarshes. Green and blue-green algae are particularly widespread through saltmarshes. Areas of bar mud are often colonized first by blue-green algae, such as Phomidium and Nostoc, the filaments of which may increase the stability of the mud surface. The mud on the sides of creeks often has a covering of Oscillatoria and Vaucheria. Several species of the green algae Enteromorpha also act as primary colonizers of bar mud and sand. Once they have become established, these algae can trap material on both the flood and ebb tides and so raise the general level of the mud surface. Some of the larger brown algae may also play a part in colonizing bare mud.

Several of the fucoid algae that are abundant on rocky shores also extend into estuaries wherever the substratum is suitable. In addition to colonizing any rocky areas, some of the species also have dwarfed sterile forms, which reproduce vegetatively in saltmarshes.

9.7.5 Plankton in the Coquille Estuary

Plankton in the Coquille have not been systematically studied. The Coquille Estuary is predominantly subtidal, but there is very little information available about subtidal benthic animals or plants, information is also sparse on benthic invertebrates in intertidal areas; however, a few observations have been recorded by Gaumer, et al. (15) and students at the University of Oregon Institute of Marine Biology (13) [See Section 9.6.5(a)].

9.8 Benthic Invertebrates

9.8.1 General Introduction

All organisms, plant or animal, which live within, on, or closely associated with the bottom sediments belong to a group known as benthos. Benthic animals that live within the sediments are called infauna while those that live on or just above the sediment surface are epifauna. Much of the infauna is microscopic, living among the particles of sediment. Infauna may be sedentary or mobile, burrowing through the sediments. Epifauna are usually larger mobile animals, but some are also sessile, attaching themselves to available firm substrates, such as rocks or wood pilings.

Some studies divide benthos into two groups by size, the smallest group called microbenthos and the larger macrobenthics. This report will cover invertebrate macrobenthics, including organisms, which are larger than 1 mm. in size and visible with the naked eye. Most epifaune (crab, shrimp etc.) and some infauna (clams, polychaetes, etc.) are included in this group. The larger macrofauna can be further divided into three feeding types: selective particle feeders, deposit feeders and filter feeders.

9.8.2 Habitat

Selective particle feeders may be scavengers, predators, or herbivores, feeding either on whole organisms they capture or fragments of plants or animals. Fishes, crabs, some worms and other mobile species fall into this category. The food is primarily organic material and is broken down by mechanical and chemical processes, wastes are combined with mucus and often form distinctive fecal pellets, which may make up a significant percentage of the bottom sediments.

Deposit feeders include two general types. Some are worms that move through the sediment, ingesting and utilizing what organic material is contained therein, and discarding the remains as feces. Other deposit feeders bury themselves in the sediment; using siphons or other extension, they suck up detritus that has recently fallen to the bottom. These animals are unselective in what tjeu feed upon, but they often have efficient sorting mechanisms. Nevertheless, the feces of these deposit feeders may contain a high percentage of inorganic material.

Filter feeders draw in water and particulate matter. Most clams, for example, use tiny hair-like cilia to create currents of water over a mucous network, which traps particles. Others, such as tube- dwelling worms, may force water through their burrows by body movements. Some have efficient sorting mechanisms, much the same as deposit feeders. Feces of filter feeders is primarily organic.

9.8.3 Factors Affecting Distribution and Abundance

The distribution and abundance of estuarine benthos are affected by many physical and biological factors, which vary in both spatial and temporal dimensions. These include: (1) substrate type; (2) salinity and other chemical and physical conditions of the water; (3) river flow; (4) tidal forces and degree of tidal exposure; (5) exposure to wave and current action; and (6) effects of grazing, predation and harvesting.

Unfortunately, no information is available specifically relating these parameters to actual species distributions in the Coquille Estuary.

9.9 Riparian Vegetation

(See Inventory Map – "Riparian Vegetation")

Species of vegetation which are dependent on water but are upland rather than aquatic or semi- aquatic in nature are termed riparian. These plants form the boundary between the wetland vegetation and upland environments, and are of primary importance as an "edge", providing cover for animals living in and moving through both the upland and wet vegetation environments bordered by the riparian species. Riparian vegetation provides important shade to streams moderating water temperature, provides nutrients to fish and invertebrate populations from its leaves, filters pollutants, stabilizes banks and helps prevent erosion.

Riparian vegetation occurs along streams, rivers and slough banks. Vegetation is usually in a dense narrow band. Species of plants of this type are those dependent on the water such as willow, cottonwood, alder, spruce, myrtle and ash.

Riparian vegetation is a concentration point for a variety of game and non-game species, because it provides food and cover. This vegetation renders the open agricultural areas suitable as wildlife feeding areas by providing the necessary cover.

The riparian vegetation band is almost continuous for large sections of the river above the lower riverine subsystem (RM 9, Bear Creek area). Gaps have occurred where bank erosion has been especially severe, or where landowners have removed vegetation to provide easier access to the river for cattle watering, fishing access or other reasons. In some places, riparian woodlands are found in a broader area where conversion to pasture has not occurred. These broader riparian woodlands are probably very similar to the original forest cover. The banks of the lower riverine section, by contrast, are almost devoid of riparian vegetation, other than fringing saltmarshes.

This may be due to the extensive artificial diking which has been carried out in the lower section to prevent flooding by brackish water from harming non-salt-tolerant pasture grasses. In the middle and upper riverine sections, where saline intrusions infrequently occur, artificial diking has not been extensively carried out and natural levees have provided partial flood protection. Consequently, riparian vegetation has seen relatively little disturbance.

The bank protection function of riparian vegetation is particularly important. Root masses bind the otherwise erodible silt loam soils together. Indiscriminate removal of vegetation, particularly on bends in the stream, can lead to a higher risk of bank erosion (see Section 4.4, "Streambank erosion and stabilization measures" for further discussion). Riparian erosion is a huge problem on the upper portion of tidewater.

Landowners may need to remove sections of riparian vegetation from time to time for stock watering access, irrigation intakes or other purposes. Provided the bank clearing is well located and otherwise follows sound management practices, it should pose no problems for bank stability.

Recreational uses like boat ramps and fishing access, sometimes require minor removal of riparian vegetation. A current proposal by a private club for 55 fishing shacks near Riverton has been approved as a conditional use, with the conditions including limitation of vegetation removal to that shown on a site plan. Club rules also restrict cutting of vegetation. With these safeguards in place, impacts on riparian vegetation and its values are expected to be minor.

9.10 Potential Mitigation/Restoration Sites

9.10.1 Introduction – Goal Requirements

The Estuarine Resources Goal (#16) requires that "when dredge or fill activities are permitted in intertidal or tidal marsh areas, their effects shall be mitigated by creation, restoration or enhancement of another area to ensure that the integrity of the estuarine ecosystem is maintained".

Goal #16 language on mitigation includes the concept of restoration. Thus, the Goal requirements for mitigation may be achieved by creating a marsh area where no tidal influence exists, by restoring degraded marsh area, or by enhancing an existing estuarine area. Mitigation is required by the Goal for dredge or fill activities in intertidal or tidal marsh areas. However, restoration can occur either to fulfill mitigation requirements or as a voluntary action. Goal #16 continues: "Restoration is appropriate in areas where activities have adversely affected some aspect of the estuarine system and where it would contribute to a greater achievement of the objective of this goal. Appropriate sites include areas of heavy erosion or sedimentation, degraded fish and wildlife habitat, anadromous fish spawning areas, abandoned diked estuarine marsh areas, and areas where water quality restricts the use of estuarine water for fish and shellfish harvest and production, or for human recreation".

The guidelines on mitigation indicate that in choosing suitable mitigation sites for a particular project, the plan should select those with similar ecological characteristics, so that over time, upon restoration to the estuarine system, it might develop similar flora and fauna. It goes on to note that sites in "general proximity" to the proposed dredge or fill action would probably be best suited: otherwise, sites may be selected according to the following characteristics, starting with the most important:

a. salinity regime,
b. tidal expose and elevation,
c. substrate type,
d. current velocity and patterns,
e. orientation to solar radiation, and
f. slope

The Guidelines conclude that if areas of similar potential cannot be found, then areas of "greatest scarcity compared to their historical abundance and distribution" should be selected.

Appropriate areas include:

(a) Dredged material islands, which could be lowered to the intertidal level.

(b) Diked marsh areas which have been abandoned or are in disrepair; and

(c) Estuarine areas removed from effective circulation by causeways or other fills.

The Coastal Shorelands Goal (#17) simply requires local government, with state and federal assistance, to identify coastal shoreland areas, which may be used to fulfill the mitigation requirements. These areas shall be protected from any new uses and activities, which would prevent their ultimate restoration or addition to the estuarine ecosystem.

9.10.2 Implementation

The Division of State Lands (DSL) has been given statewide responsibility for administering all estuarine mitigation\restoration programs. DSL determines which projects will require mitigation\restoration and what mitigation\restoration actions will adequately compensate for dredge or fill impacts. The specific procedures and information requirements to be administered by DSL have been adopted as ORS 196.800-196.830 and Administrative Rules (OAR, Chapter 660, Division 31). The following general outline summarizes DSL's requirements and processes:

1. A DSL application for a removal-fill permit must be complete with the following information provided:

   A. Specific nature and amount of material to be removed or the amount of fill, the waters and the specific location from which it is to be removed or where the fill will be placed, the method of removal or filling and the times during which removal or filling is to be conducted.

   B. DSL may require additional information as is necessary to enable the director to determine whether the granting of a permit is consistent with the protection, conservation and best use of the water resources.

2. DSL will request comment on their permits within 45 days after receiving the request for comment. If comment fails to meet the 45 day requirement, or no comment is sent, DSL will assume there is no objection to the application.

3. The Resource inventory and impact Assessment should not be lengthy or complex, but it should enable reviewers to gain a clear understanding of the impacts to be expected, it should include information on:

   A. The type and extent of alterations expected;

   B. The type of resource(s) affected;

   C. The expected extent of impacts of the proposed alteration on water quality and other physical characteristics of the estuary, living resources, recreation and aesthetic use, navigation and other existing and potential uses of the estuary; and

   D. The methods which could be employed to avoid or minimize adverse impacts.

The appropriateness of any proposed mitigation site and action is determined by DSL. County involvement in the process is to review the DSL application and determine if the activity will require an application submittal to the County.

9.10.3 Potential Mitigation or Restoration Sites

(See Inventory Map)

Ten potential mitigation or restoration sites have been identified in the Coquille Estuary. They are all in either the bay subsystem (below Bullards Bridge) or in the lower riverine subsystem, within the area of regular saline intrusion during seasonal low flow periods. They are in a number of different ownerships, both private and public, and most have been identified by ODFW as noted below. Descriptions of each are as follows (see also Table 9.10):

Table 9.10 Mitigation/Restoration Sites: Summary

Site #	Location T.	R.	S.	Tax Lot	Size (ac) approx.	Potential Community	Landowner	Source
1	28	14	19CD	300, 400, 500	3 ac.	High saltmarsh	Moore Mill	ODFW (1979) Co. Plng. Staff
2	28 28	14 15	18 13	300 200	14 ac.	High saltmarsh	Moore Mill/ St. Parks Div.	ODFW (1979)
3	28	14	18	900	12 ac.	High saltmarsh	Port of Bandon	ODFW (1979)
4	28	14	18AD	100, 200, 300	4 ac.	High saltmarsh	Bates, Mcdonnell, Kay	ODFW (1979)
5	28	14	17	200	5 ac.	High saltmarsh	Bandon	ODFW (1979)
7	28	14	10	NA	1 ac.	Tidal Channel	State Tidelands	ODFW local office
8	28	14	15	1600	1 ½ ac.	High saltmarsh	Kronenberg	ODFW local office
9	28	14	9A	100	6 ac.	High saltmarsh	T. Hultin	Co. Plng. Staff
10	28	14	9A	500	12 ac.	High saltmarsh	Fahy, Fetters	Co. Plng. Staff
11	28	14	16	700	4 ac.	High saltmarsh	Lindquester	Prosper Development

- Site 1. This is a small upland area on the edge of the Bandon saltmarsh. It is in Moore Mill ownership. This small upland island could be "scalped" down to intertidal level to add more surface area to the saltmarsh. It is expected that it would be rapidly colonized by saltmarsh vegetation from the surrounding area. This site could serve as mitigation for activities in the Bandon waterfront and Moore Mill area. There are no sites identified downstream. The site is derived from ODFW mapping (see Map - "Estuarine wetland Habitats") but is identified as a possible mitigation site by County Planning staff. Note that this site has also been identified as a potential fill site for water-dependent use.

- Site 2. This is an area of tidal marsh on a small inlet, which is densely covered in part by drift logs. Removal of the logs so as to allow revegetation by high and low saltmarsh species would be a possible restoration project. This site was identified by ODFW (1, p. 34). It may be necessary to fence the marsh area to prevent impacts by off-road vehicles. The narrowness of the inlet may limit the amount of tidal exchange, which in turn would limit the extra nutrient production, which might result from restoration action. However, as with other restoration sites, which are covered with driftwood, the value of the logs provides an extra incentive, which might make this project more attractive. Ownership is split between Moore Mill and the State Parks Division.

- Site 3. This potential mitigation site consists of three old dredge spoil islands, which might be "scalped" down to intertidal level in the same manner as Site 1. Again, rapid colonization by high saltmarsh vegetation from the surrounding area could be expected. The site was until recently owned by the Port of Bandon, before its transfer to the U.S. Fish and Wildlife Service. This site is convenient for mitigation for actions on the Bandon waterfront. However, its "biological potential", salinity, regime and other characteristics are dissimilar from those of the waterfront area. This site was identified by ODFW (1, p.34).

- Site 4. This potential restoration site consists of a driftwood-covered intertidal area. It was identified by ODFW (1, p. 34) as tidal marsh which contains occasional marsh plants, indicating its suitability for restoration by removal of the logs. The site is owned by three private parties, and the adjacent upland has been identified as a potential water-dependent site (see Section 7.4.2). This Site might provide suitable mitigation for nearby development either on the neighboring Georgia-Pacific property or on part of the same site.

- Site 5. This site has been identified as a possible restoration site by ODFW (1, p. 35). It is an intertidal marsh area, which is covered by driftwood at its northern extremity. This site would probably develop high saltmarsh vegetation, based on the nature of the adjacent plant community. It would form a useful addition to the existing marsh area, which has a well developed circulation system. The marsh east of the bridge is owned by Bandon investors, and is part of a very large holding (1,600 ac.) to the north of Bullards Beach State Park (the former Fahy Ranch) on which a major recreational complex may be proposed.

- Site 7. This site was identified by local ODFW staff (Reese Bender, 1980, personal communication) as a suitable restoration site. A fill was placed in Randolph Slough, cutting off tidal circulation and creating a potentially stagnant area. Removal of the fill has been agreed upon between the Port of Bandon and local ODFW staff as adequate mitigation for proposed dredging in the Bandon boat basin project.

- Site 8. This site was identified by local ODFW staff (Reese Bender, 1980, personal communication) as a suitable mitigation site. It is a small wet meadow area with no apparent recent history of agricultural use, which could be opened up to tidal influence by removing an existing bank. This site is the furthest upstream, but is well within the limits of fringing high saltmarsh communities, it is therefore expected that it could eventually develop high saltmarsh characteristics. The owner is Agnes Kronenberg. This site might be suitable to mitigate any future actions in the upper part of the lower riverine subsystem (e.g. at Parkersburg) should any proposals occur.

- Site 9. This site has been proposed as part of the mitigation package for the Prosper Development Company marina proposal. It consists of about 6 acres total, part of which is upland, while other parts are high saltmarsh or a transitional marsh type between saltmarsh and upland. There are opportunities to restore the higher areas to saltmarsh and to enhance the existing saltmarsh by constructing tidal channels to introduce tidal action. There is also an archaeological site (CS-17), but this has been greatly damaged by erosion. A recent survey found that cultural remains are found below a 0.7 meter thick layer of silt, and the archaeologist's opinion is the surface of the site could be lowered by up to 0.5 meters for mitigation purposes, without damaging the archaeological resources (personal communication, Reg Pullen, BLM, Sept. 1982). Bank stabilization may be necessary to prevent further erosion as part of mitigation actions.

- Site 10. This site is an area of former pasture land which has been disused for some years. The tidegate is in disrepair, and there has been some reversion to saltmarsh in an old channel. The riverward portion of the site is upland, but the back part of the site has characteristics of a transitional marsh (dominated by Pacific silverweed and Baltic rush). The site has good mitigation potential if the dike is removed and the higher part of the site is graded down to an appropriate elevation. The site is owned by Mabel Fahy and Hazel Fetters.

- Site 11. This site has also been proposed as part of the Prosper Development Company mitigation package. It is currently upland and, it has been proposed to construct a tidal channel into this 4-acre site and grade down the surface to an intertidal elevation to create high saltmarsh. The site has the potential to develop vegetation typical of high saltmarsh after these changes have occurred. The site is owned by Mr. and Mrs. Lindquester.

This list is not intended to exclude other possible mitigation/restoration actions. Other proposals could be entertained by Division of State Lands at the time of a specific dredge or fill project and their adequacy assessed.

In addition to these sites, it is theoretically feasible to regard any of the diked meadows below about a mile or so above Bear Creek as potential restoration sites. This is the section within which brackish water flooding has been excluded by dikes in order to prevent the killing of non-salt-tolerant grasses. If these areas were re-opened to estuarine influence, it is probable that in time they would revert to plant communities typical of high saltmarsh. However, it is impractical to consider these as likely sites, as farm use is likely to continue in the foreseeable future, together with maintenance of dikes and tidegates. It would also prove difficult and expensive to limit the extent of tidal flooding to the intended area, once dikes were breached, which might unintentionally affect neighboring property.

There is a possibility of conflict between the mitigation and restoration requirements of Goal #16, and the protection of agricultural lands mandated in Goal #3, where there are diked agricultural lands, which could also be used for mitigation or restoration. However, Goal #16 makes it clear that "abandoned diked estuarine marsh areas" (emphasis added) are appropriate for restoration; this implies that where dikes and tidegates are intact restoration is not appropriate. LCDC has made an interpretation that the use of agricultural land behind intact dikes and tidegates for restoration purely as a voluntary action, and not as a type of mitigation, would require an Exception to Goal #3. (Estuary/Agricultural Land Exception policy, 8/5/77]

It is not possible to justify such an Exception at this time, because mitigation/restoration sites are inventories and protected for foreseeable future needs. If this list proves inadequate at some future time, other sites will need to be identified; an Exception could not be justified to allow the use of diked agricultural lands unless no other suitable alternative sites could be found.

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Restoration is appropriate in areas where activities have adversely affected some aspect of the estuarine system, and where it would contribute to a greater achievement of the objective. Appropriate sites include areas of heavy erosion or sedimentation, degraded fish and wildlife habitat, anadromous fish spawning areas, abandoned diked estuarine marsh areas, and areas where water quality restricts the use of estuarine waters for fish and shellfish harvest and production or for human recreation.

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COQUILLE ESTUARY WETLAND SURVEY

AGRICULTURAL EVALUATION RATING SCHEDULE

1.	Soil Type:	Class I	Score 10	
		Class II	Score 8	
		Class III	Score 6	
		Class IV	Score 4	
		Class V Above	Score 1	
2.	Existing drainage district:		Yes	10
			No	1

3.	Estimated relative cost of drainage:		
	Existing ditches and dikes functioning in good condition, tidegates, no woody vegetation be cleared:	10	Ideal situation
	Existing ditches and dikes, but extensive clearing out required; woody vegetation over 50% of area	5	median situation
	No ditches or tidegates, whole area covered by woody vegetation	1	worst situation
4.	Feasibility of drainage:		
	No depression; feasibility of natural drainage of river without pumping	10	
	Roughly level with river; no marked depression; pumping unnecessary; with tidegates	5	
	Lower than river; marked depression below ground level of land; requires pumping	1	
5.	Potential productivity:		
	Feasibility of row crops	10	
	Rye grass, clover feasible	8	
	Reed, canary grass only	5	
	No productive potential	1	

6. Persistence and frequency of flooding:

SCS ratings

Infrequent, short	10
Moderate frequency and persistence	5
Frequent, long	1

7. Degree of colonization:

100% coverage usable species (reed, canary, etc.)	10
50% coverage usable species, 50% wetland (rushes, sedges)	5
Entirely wetland species	1

8. Proximity to existing agriculture:

100% surrounded by existing agriculture contiguous	10
50% surrounded and contiguous	5
No adjacent agriculture	1

9. Irrigation potential:

Available salt-free water, existing water-rights	10
Poor water conditions, potential water rights	5
Very poor water, high salt, no water-rights available	1

10. Ownership single or multiple:

Single	10
Three	5
Five or more	1

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