The Nehalem Estuary

Critical Wetlands

<u>Introduction</u>[1]

Great assortments of aquatic wildlife use the estuaries. The estuary serves as home, hideout, nursery, and supermarket for great assortment of shrimps, clams, and oysters. Some, such as the Dungeness crab and Pacific oyster are valuable commercial species.

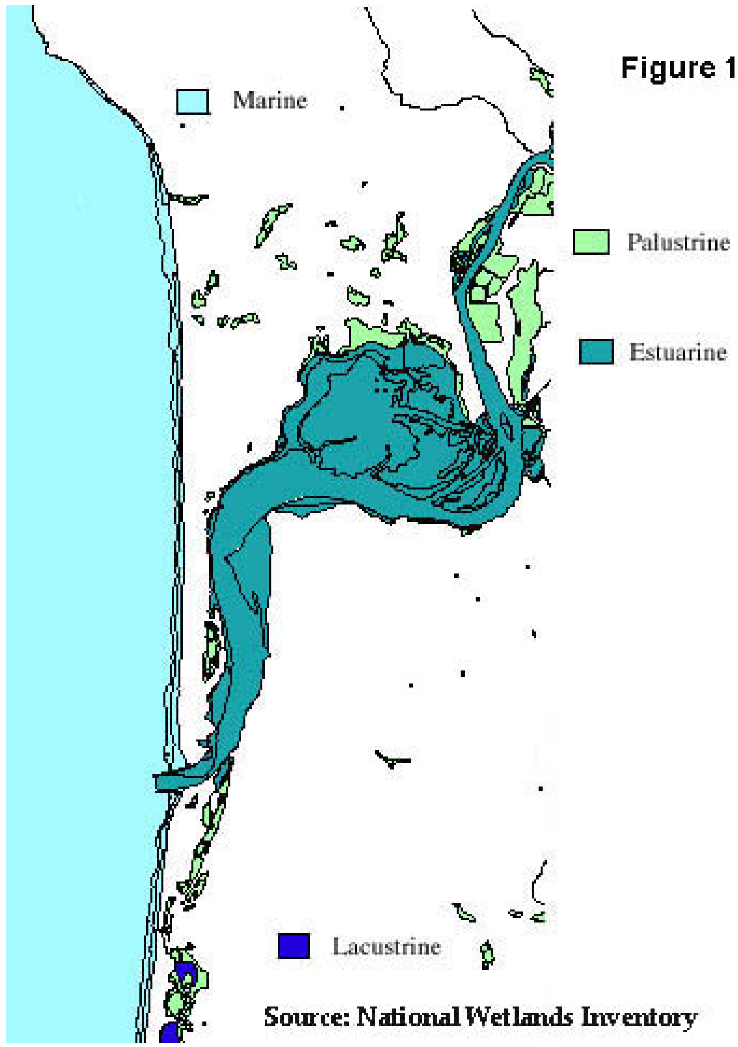
The unique life histories of anadromous salmon and trout require that individuals migrate through the estuary at least twice during their lives. The first migration occurs when these fish are juveniles as they leave their natal streams on their way to the ocean. The second migration occurs when the adult fish leave the ocean and return to the streams to spawn.

Oregon's estuaries appear to be particularly important for juvenile salmon for three reasons. First, tidal creeks, marshes, eelgrass beds, and channels furnish the young salmon with productive feeding areas where they forage and grow before heading out to sea. Second, the shallow estuarine habitats also offer refuge from predators, especially those marine mammals, birds, and fish that hunt for juvenile salmon in the deep channels and near shore areas. Finally, the brackish estuarine waters provide an acclimation area for salmonid smolts while they adapt to the marine environment.

Other anadromous species find food and refuge during their migrations to and from the rivers of their origin. These include white sturgeon, American shad, striped bass, and Pacific lamprey.

Several species of surfperch visit the estuaries to bear live young in the spring and to feed in the summer. Shiner perch are year-round residents and prey for many fish, birds, and marine mammals. Other forage fishes that spawn and feed in the estuaries include Pacific herring, northern anchovy, and several species of smelt. Juveniles of many important marine species forage and grow in Oregon's estuaries, among them the English sole, sand sole, starry flounder, lingcod, cabezon, and more than a half-dozen species of rockfish.

[1] Adapted from <u>Salmon and Trout in Estuaries</u> http://www.harborside.com/~ssnerr/EMI%20papers/salmon.htm



Wetland Systems[2]

The estuary is one of five types of Wetland Systems.

> **Marine -** the open ocean overlying the continental shelf and its associated high-energy coastline.
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> **Estuarine** - deepwater tidal habitats and adjacent tidal wetlands that are usually semi

[2] Adapted from **Classification of Wetlands and Deepwater Habitats of the United States**, Cowardin, Lewis M; Carter,Virginia; Golet, Francis C.; and LaRoe, Edward T.; U.S. Department of the Interior, Fish and Wildlife Service, Office of Biological Services, Washington, D.C. 20240; 1979. http://www.nwi.fws.gov/classifman/classman9.html

enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land.

3. **Riverine** - all wetlands and deepwater habitats contained within a channel, with two exceptions: a) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and b)habitats with water containing ocean derived salts in excess of 0.5%.

4. **Lacustrine** - permanently flooded lakes and reservoirs, intermittent lakes, and tidal lakes with low ocean-derived salinities.

5. **Palustrine** -The group the vegetated wetlands traditionally called by such names as marsh, swamp, bog, fen, and prairie, which are found throughout the United States. It also includes the small, shallow, permanent or intermittent water bodies often called ponds.

Estuarine Subsystems[3]

It is possible to broadly define four types of subsystems in estuaries, which are distinguished by geologic, riverine, and tidal forces.

Marine - The marine subsystem is a high-energy zone located near the estuary mouth. Strong currents influence the bottom, and the substrate is primarily coarse marine sand, cobble, or rock. Kelp and other algal species often cover the rock substrates and form microhabitats for many species. Fish utilizing the marine subsystem are marine species.

Bay - The bay subsystem is a relatively protected environment, often characterized by a broad embayment between the estuary mouth and narrow upriver reaches of tidewater. Normally the bay subsystem has a large percentage of intertidal land. Bay sediments are primarily a mixture of coarse marine sands and fine river-borne silts and clays. Most bays have a wide diversity of habitats with extensive intertidal flats, eelgrass beds, algal beds, and marshes.

Riverine - The riverine subsystem includes the upper tidewater portions of the larger tributaries that enter the estuary. A large percentage of the subsystem is narrow, sub tidal river channel. Sediments range from fine silts and clays to cobble and gravel. Small fringing marshes frequently occur on narrow, intertidal portions of the riverbank; riparian vegetation typically lines riverbanks where there are no marshes.

Slough - The slough subsystem is a sheltered environment, which is usually a narrow, isolated arm of the estuary with a very limited freshwater flow from uplands. Sloughs usually have fine organic sediments and high percentages of intertidal land consisting of

[3] Adapted from **The Oregon Estuary Plan Book**, Cortright R, Weber J, Bailey R; Oregon Department of Land conservation and Development, 1987. http://www.inforain.org/epb.htm

flats, eelgrass beds, and marshes.

Habitat Classes[4]

Tide is a major limiting factor for many species in aquatic environments. Special adaptations are required by intertidal species to resist desiccation and tolerate large variations in temperature and salinity associated with tidal exposure.

Sub tidal habitats are below extreme low water, and thus have continuously submerged substrates. Intertidal habitats are exposed and flooded by tides as often as twice daily or as seldom as a few times a year

Within **intertidal areas**, a marked zonation of species is often apparent due to variation in the frequency and duration of exposure between lower and upper intertidal elevations.

The habitat classification system identifies a range of sediment sizes that represent unique sub tidal environments. . Certain species flourish in particular types of sediment. For example, organisms that filter food from the water column generally inhabit coarse, clean sands. In quiet waters where fine, organically rich muds occur, deposit-feeding polychaetes or other invertebrates ingest the sediment directly

An important consideration in evaluating proposed development in estuaries is its impact on current patterns and sedimentation processes, and the resulting effects on habitats.

1.1 Unconsolidated bottom - Sand-mud bottoms are typically higher in organic content than sand bottoms, and are firmer and more aerated than mud. Mud bottoms are primarily silt and clay; organisms living in mud must be able to tolerate low oxygen concentrations. Wood and organic debris bottoms will be found where current velocities are low or where there is a continuous supply of organic material. Finally, finer sediments may be intermixed with cobble/gravel substrates.

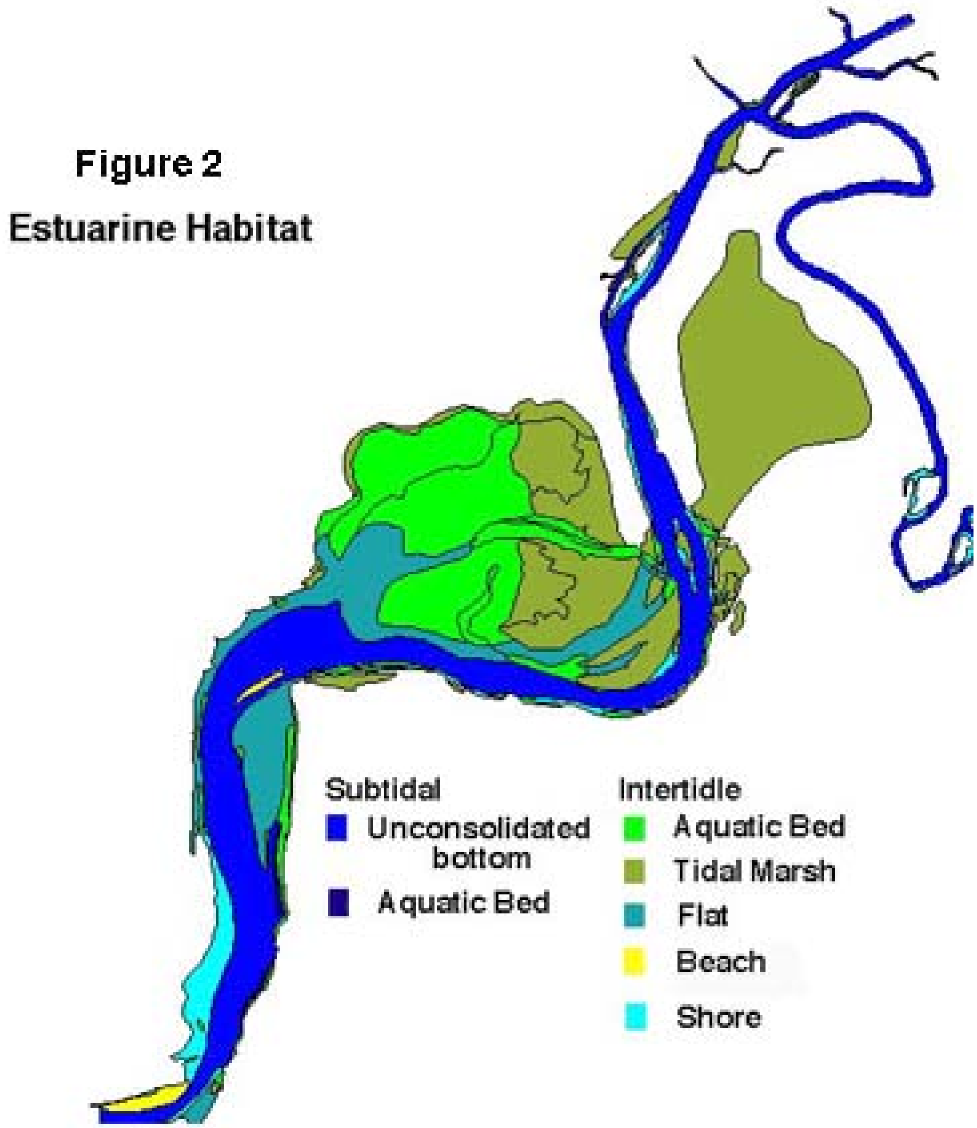
1.2 Rock bottom - Most sub tidal rock habitats are located near the mouth where strong tidal currents and turbulence require that organisms be firmly attached to the substrate or seek the protection of sheltered cracks and crevices.

1.3 Sub tidal Aquatic bed, and

2.3 Intertidal Aquatic bed -The aquatic bed category includes both sub tidal and intertidal algal and **eelgrass beds** that frequently occur in bay and slough subsystems. These communities probably represent a significant portion of the primary production in Oregon estuaries. Eelgrass is the most common species of sea grass in Oregon estuaries. It grows in both sand and mud substrates. It is a rapid growing plant that provides habitat for a diverse community of estuarine plants and animals. Its leaves support large numbers of algal and invertebrate epiphytes, which are consumed by fish and larger invertebrates

[4] ibid

and are the primary food of black brant during their migration along the Oregon coast.



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2.1 **Shores** are narrow, steeply sloped intertidal habitats that occur where river and tidal currents are relatively strong. Algal and invertebrate species are firmly attached to rocky shores, but waves and currents may limit plant and animal production on unstable, unconsolidated shores.

2.2 **Flat** are generally sheltered from strong currents and wave action and their gradual slopes tend to dissipate wave and tidal energies. As a result, flats form a relatively stable environment for colonizing species. In addition, large shallow flats store heat and may have an important role in the temperature budget of the entire estuary. Tidal flat sediments vary from fine muds to cobbles. Shallow water depths often result in extensive algae blooms in the spring and summer, when many flats could be classified as intertidal aquatic beds.

Recreational clamming is popular in these areas during low tides, particularly in the spring and summer. Bottom-feeding fishes graze over flats during high tide. Great blue heron, great egret and a variety of shorebirds feed in the shallows as the tides recede.

2.4 **Beach/bar** habitats are dynamic environments subject to strong water currents in the form of tides, waves and river flow. They always have less than 30 percent vegetative cover. Bars occur within estuaries as elongated ridges of coarse sand, cobble, or gravel, and are bordered by water on at least two sides.

2.5 **Tidal marshes** are characterized by rooted herbaceous or woody hydrophytes that grow between lower high tide and the line of nonaquatic vegetation. These can be divided into four major subclasses: high and low salt marsh in marine and brackish areas, and fresh and shrub marshes beyond saltwater influence. Composition of these marsh communities varies with tidal elevation, sediment types, and salinity regime.

Critical Estuine Habitat[5]

Eelgrass beds

Eelgrass is a relatively tenacious and highly productive flowering plant, common in the sheltered waters of bays and sloughs. Eelgrass beds are a complex habitat that performs processes essential to the health of an estuary and its many inhabitants. Beds of eelgrass are vulnerable to natural and human-caused disturbances, particularly those activities that cause excessive sediment deposition, erosion, and increased water turbidity.

Plant production in Oregon estuaries is highly seasonal. The timing of fish migrations, spawning,

[1] Adapted from Salmon and Trout in Estuaries http://www.harborside.com/~ssnerr/EMI%20papers/salmon.htm

and invertebrate reproduction in estuaries corresponds closely with dramatic increases in plant production during the spring and summer

Along the Oregon coast, eelgrass beds typically occur in the subtidal and intertidal areas of the lower estuary, where bottom sediments are a mixture of sand and mud. While they can withstand normal tidal and estuarine currents, seasonal storms that increase wave action and currents can damage leaf blades and uproot plants. Although eelgrass is shade tolerant, it requires a certain amount of water clarity and sunlight penetration to thrive and survive. Consequently, channel dredging and other human activities that lead to excessive turbidity are potentially harmful to the eelgrass beds, as is the construction of docks and marinas above or adjacent to eelgrass.

Salt marsh

Salt marsh communities are among the most fertile assemblages on earth, capable of producing six times as much organic matter as commercial farmland. Although salt marshes function in many of the same ways as eelgrass beds by providing food and refuge to countless organisms, they are also ecologically different.

Salt marsh communities serve as transition zones between aquatic and terrestrial ecosystems. Low tides leave marshes high and dry twice a day, so terrestrial creature are more prevalent than the aquatic species that must move in and out with the tides. Other marsh inhabitants, such as various worms and clams, deal with the waxing and waning of tides by residing and making a living in the marshes' bottom sediments. Plants in the low marsh are highly salt tolerant

The tremendous productivity of the marsh is related to the decomposition of vegetation. Tidal action carries this material out of the marsh and into the estuary, where it becomes food for the many organisms that consume dead organic matter, which in turn are eaten by other organisms in the estuarine food chain.

Juveniles Salmon appear to use estuarine marshes directly as refuges from predation. The shallow, vegetated creeks and channels in marshes, often clogged with woody debris, offer refuge from larger predators which are unable to navigate the shallow and restricted waters.

Woody Debris

Most driftwood arrives in estuaries by way of riverine currents. Large woody debris is deposited on the edges of the upper estuary by extremely high tides, storm surges, and seismic waves.

Downed trees sometimes settle in the tidal portions of rivers and creeks where they become refuges from predators for a variety of fish, including starry flounder, juvenile sturgeon, and both juvenile and adult salmonid.

Driftwood is usually abundant in upper salt marshes. Scattered throughout the marsh, large wood remains in place until floods, storms, or exceptionally high tides refloat it. Refloated driftwood leaves shallow depressions in the marsh, creating potholes that hold water at low tide and harbor juvenile fish and other organisms.

Salmonid use of Estuary[6]

Chinook Salmon

Chinook occur along the West Coast in five races defined according to what season adults migrate from salt to fresh water. Some populations re-enter the coastal rivers and creeks in winter or spring, while others return in summer or fall.

Juvenile chinook are carnivorous and opportunistic feeders. In the estuary, they frequent an assortment of habitats, from mud flats to eelgrass beds, and consume a large variety of invertebrate and fish larvae, crustaceans, insects, and other fish.

Coho Salmon

Juvenile Coho spend a year or more in fresh water before migrating to the ocean. Depending on location, smolts might spend no more than a couple of days or a month or more in estuaries before heading to sea. Like Chinook salmon, juvenile Coho are opportunistic carnivores, feeding on large zooplankton and small crustaceans, insects, invertebrate and fish larvae, and juvenile fishes, including other salmonid.

Chum Salmon

Soon after they absorb their yolk sacs, chum salmon fry head for the estuary, where they might spend up to several months preparing for life at sea. Juvenile Chum move throughout the estuary with tidal flows, frequenting tidal creeks, sloughs, and marshes. As opportunistic and carnivorous feeders, young chum salmon forage in shallow estuary waters on small crustaceans and terrestrial insects. Older chum move to deeper waters where they prey on crustacean and fish

[1] Adapted from Salmon and Trout in Estuaries http://www.harborside.com/~ssnerr/EMI%20papers/salmon.htm

larvae, copepods, amphipods, and other crustaceans.

Steelhead Trout

Steelhead smolts and adults spend little time in the estuaries, rarely more than it takes to pass through on their way to the ocean or rivers.

Cutthroat Trout

Cutthroat juveniles migrate from Oregon's coastal streams into the estuaries from February through May, where they feed on insects, crustaceans, and fish. As they grow, young cutthroat show a marked preference for fish. Adult sea-run cutthroat often inhabit small tidal streams, sloughs, backwaters, and tidal freshwater regions of estuaries prior to the fall rains that initiate their spawning migrations. Some cutthroat reside permanently in estuaries.

Adult Salmonid

It's not uncommon for adult salmonids occupying nearshore coastal waters to move into the lower estuaries for brief periods to feed on abundant forage species, then return to the ocean. So estuaries serve as important feeding areas for both adult and juvenile salmonids. Additionally, just as ocean-bound juvenile salmonids might use the estuary to gradually acclimate to salt water, some returning adults, bound for their natal streams, similarly use the estuary to re-accustom themselves to fresh water.

Current Conditions

Threats to Wetland and Esturine Habitats[7]

The northern Oregon coast historically provided a wide variety of wetland habitats in its estuaries, lakes, rivers, and freshwater marshes. Shoreline development, harbor dredging, diking, and drainage of tidal marshes, canalization of rivers, clearing of riparian forests, filling, ditching and drainage of freshwater marshes, road building, and logging in upper watersheds have significantly reduced the quantity and quality of the area's coastal wetlands.

Tremendous areas of Oregon marsh have been diked to create upland for pasture and other uses. Such diking has greatly reduced estuarine integrity and productivity. Extensive diking has resulted in altered marsh community composition, canalized estuarine water courses, reduced productive intertidal surface area, and restricted transport of organic materials and nutrients to and from the estuary. Construction of causeways and roadbeds has had identical results. Filling

[7] Oregon Wetlands Plan, 1994 http://wetlands.dfw.state.or.us/plan.htm

for shoreland development has sacrificed huge expanses of marsh in many Oregon estuaries.

Development pressures along parts of the northern Oregon coast have increased dramatically in recent years. Residential and commercial development associated with the area's growing tourism and recreation economy has been concentrated in the coastal strip, much of it around the estuaries and lowland lakes that comprise much of the most important wetland habitat in Lane and Lincoln Counties.

Loss of riparian habitat is a particular concern. Rising land prices and growing development pressure could threaten the economic viability of some agricultural operations that support significant waterfowl use on the diked former tidelands, and conversion to hybrid cottonwood plantations is a possibility in some areas. Oyster mariculture is expanding and could result in degradation or destruction of eelgrass beds.

Nehalem Bay

The Nehalem Estuary has 1,800 acres of bay and river waters, 1078 acres of marshes and tide flats and an extensive beach/dune complex. The area has been one of the least developed of the States coastal estuaries. As other centers become more crowded, it is likely that the Nehalem Bay Area will increasingly experience more intense development more intense development with its attendant pressures on Bay and River resources.[8]

Despite extensive diking and conversion of wetlands to pastures, the Nehalem River estuary retains substantial tidal marshes on Lazarus Island and south and west of Dean Point. Adjacent tidal mudflats are used extensively by waterfowl. These habitats are complimented by upstream pasturelands that function as freshwater wetlands and attract waterfowl when shallow flooding occurs due to heavy rainfall. Waterfowl numbers in recent years have ranged from 600 to 3,600 birds.[9]

The estuary is also important for a variety of other migratory birds, including shorebirds. The diked Gallager Slough area still functions as a wetland and is known to birders throughout the Northwest for the diversity of birds seen there. The American Fisheries Society has identified the Nehalem estuary as a high priority corridor for protection and restoration under its proposed strategy for maintenance of aquatic diversity.[10]

Protection of Wetlands and Estuary

Tidal wetlands are afforded a substantial degree of protection under current State and local laws and land use regulations, but protection of riparian habitat, freshwater marshes and agricultural lands with wetland values is less assured.

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8 Adpated from Nehalem Wetlands Review, A comprehensive assessment of the Nehalem Bay and River (Oregon) U.S. Army Engineer District, Portland, 1977

9 Oregon Wetlands Plan, 1994 http://wetlands.dfw.state.or.us/plan.htm

10 Oregon Wetlands Plan, 1994 http://wetlands.dfw.state.or.us/plan.htm

Varying degrees of protection for wetlands outside of the estuaries are provided by a variety of federal, state, and local laws and regulations, including:

Section 404 of the federal Clean Water Act, which regulates filling of wetlands.

The state of Oregon's statewide land use planning program and city and county land use plans, which address wetlands under a number of policies, including Goals 5 (Open Spaces, Scenic and Historic Areas, and Natural Resources), 16 (Estuarine Resources), and 17 (Coastal Shore lands).

The state of Oregon's Removal-Fill Law, which regulates removal and filling of material in waters of the state, including wetlands.

The state of Oregon's Forest Practices Act, which limits timber harvests in "significant wetlands."

Estuine Management Units[11]

The Oregon Department of Land Conservation and Development has established guidelines for the protection of Oregon's estuaries. Areas of the estuary are classified as 1) natural 2) conservation or 3) development each with it's own permissible uses.

<u>Natural Managemen Units</u>

Management Objective: To assure the protection of significant fish and wildlife habitats, continued biological productivity in the estuary, and scientific research and educational needs. These areas are to be managed to preserve the natural resources in recognition of dynamic natural, geological and evolutionary processes.

Areas Included: Major tracts of salt marsh, tide flats, and sea grass and algae beds.
Permissible Uses:

Undeveloped low-intensity, water-dependent recreation;

Research and educational observation;

Navigation aids, such as beacons and buoys;

Protection of habitat, nutrient, fish, wildlife and aesthetic resources;

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[11] Adapted from **The Oregon Estuary Plan Book**, Cortright R, Weber J, Bailey R; Oregon Department of Land conservation and Development, 1987. http://www.inforain.org/epb.htm

Passive restoration measures;

Dredging necessary for on-site maintenance of existing functional tidegates and associated drainage channels, and bridge crossing support structures;

Riprap for protection of uses existing as of October 7, 1977; unique natural resources; historical and archeological values; and public facilities; and

Bridge crossings.

<u>Conservation Management Units</u>

Management Objective: To provide for long-term uses of renewable resources, which do not require major, alterations to the estuary, except for the purpose of restoration. These areas are to be managed to conserve natural resources and benefits.

Areas Included: Tracts of significant habitat smaller or of less biological importance than those included in natural management units, and recreational or commercial oyster and clam beds not included in natural management units. Areas that are partially altered and adjacent to existing development of moderate intensity which do not possess the resource characteristics of natural or development units are also included in this classification.

Permissible Uses:

High-intensity water-dependent recreation, including boat ramps, marinas and new dredging for boat ramps and marinas;

Minor navigational improvements;

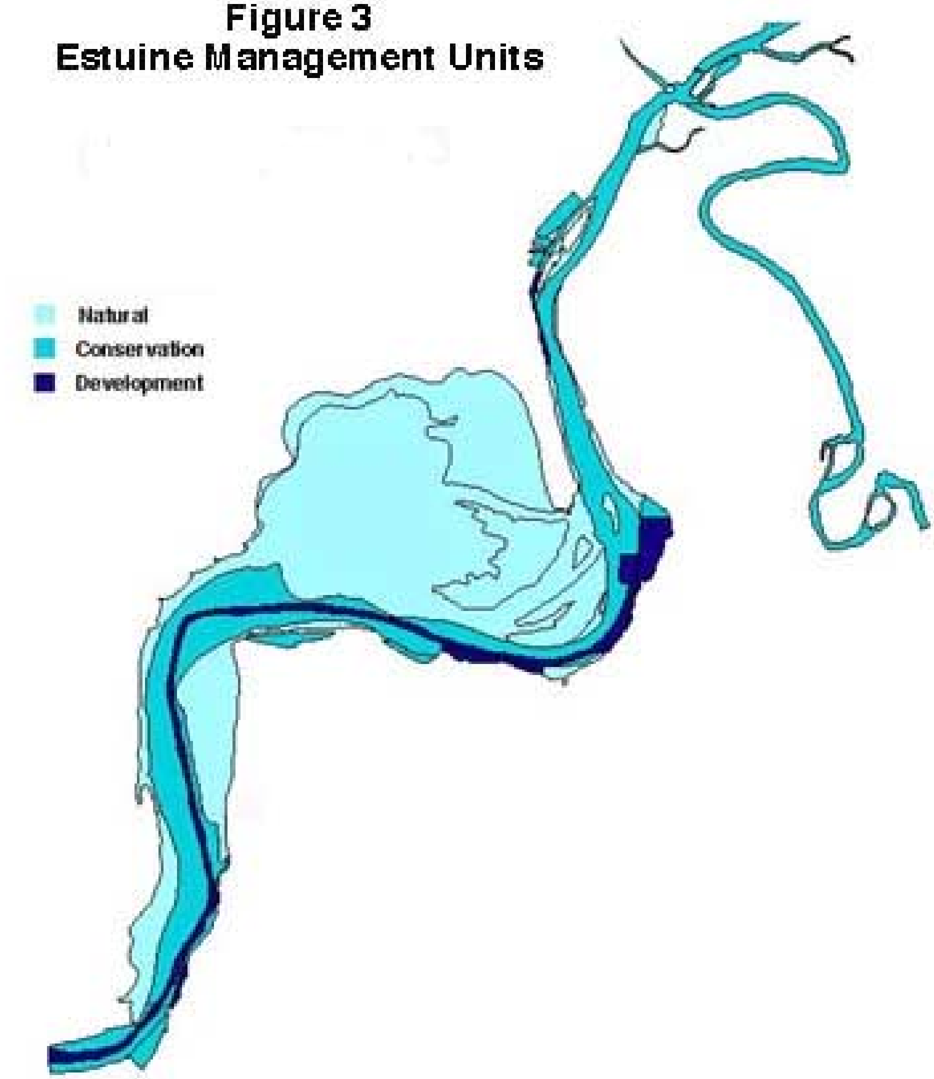
Mining and mineral extraction, including dredging necessary for mineral extraction;

Other water-dependent uses requiring occupation of water surface area by means other than dredge or fill;

Aquaculture requiring dredge or fill or other alteration of the estuary;

Active restoration for purposes other than protection of habitat, nutrient, fish, wildlife and aesthetic resources; and Temporary alterations.

Figure 3
Estuine Management Units



Development Management Units

Management Objective: To provide for navigation and public, commercial, and industrial water-dependent uses consistent with the level of alteration allowed by the overall estuary classification.
Areas Included: Deep-water areas adjacent or in proximity to the shoreline, navigation channels, sub tidal areas for in-water disposal of dredged material, and areas of minimal biological

significance needed for uses requiring alteration of the estuary.

Permissible Uses:

- Dredge or fill, as allowed elsewhere in the goal;
- Navigation and water-dependent commercial enterprises and activities;
- Water transport channels where dredging may be necessary;
- Flow-lane disposal of dredged material, monitored to assure that estuarine sedimentation is consistent with the resource capabilities and purposes of affected natural and conservation management units;
- Water storage areas where needed for products used in or resulting from industry, commerce, and recreation;
- Marinas;
- Aquaculture;
- Extraction of aggregate resources; and
- Restoration.

Usually, the only areas that automatically qualify as development management units are existing developed areas and authorized navigation channels. In order to designate new areas for development, plans must provide additional justification through a "goal exception."

To justify a goal exception, facts and reasons must be set forth which meet the following four tests:

- Reasons justify why the state policy embodied in the applicable Goals should not apply;
- Areas, which do not require a new exception, cannot reasonably accommodate the use;
- The long-term environmental, economic, social and energy consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site; and
- The proposed uses are compatible with other adjacent uses or will be so rendered through measures designed to reduce adverse impacts.

As part of Oregon's statewide land use planning program cities and counties are required to designate mitigation sites to accommodate future development along estuary margins. Mitigation sites, which are categorized as high, medium, and low priority, are intended for use with the Removal-Fill Law when unavoidable development impacts occur to estuarine wetlands. High and medium priority sites are protected exclusively for mitigation, while low priority sites are not protected and are available for other uses including non-regulatory restoration.

Local mitigation site inventories have a number of disadvantages. First, most of them were completed in the early 1980's and are outdated. Second, since mitigation sites were chosen on a site-specific basis with criteria weighted toward the interests of future development, information about the ecological and functional significance of the mitigation sites is lacking.