Oregon Central Coast Estuary Collaborative Strategic Action Plan

2015-2035

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Table of Contents

1 INTRODUCTION 2
2 PARTNERSHIP ROLES 4
3 SCOPE 7
4 VISION 7
5 ECOLOGICAL PRIORITIES AND GOALS 9
6 PROFILE OF THE FOCUS AREA 10
7 CONSERVATION NEEDS AND OPPORTUNITIES 13
8 THEORY OF CHANGE: GOALS, STRATEGIES, OBJECTIVES AND ACTIONS 16
9 PROGRESS MONITORING FRAMEWORK 26
10 ADAPTIVE MANAGEMENT 29
11 SUSTAINABILITY 29
12 LITERATURE CITATIONS 30
13 PARTNERSHIP CERTIFICATION – Core Group 33
GLOSSARY 34
APPENDICES 36
Appendix I. Primary Interests 36
Appendix II. Table A. Characteristics of the 11 largest estuaries in the OCCEC Focus Area. 37
Appendix II. Table B. Characteristics of smaller estuaries on the Central Oregon Coast. 38
Appendix II. Table D. Implemented Estuarine Restoration Projects as of 2017 40
Appendix III. Major Estuary Profiles 43
Appendix IV. Addendum to Action Plan 65

1 INTRODUCTION

The Oregon Central Coast Estuary Collaborative is a network of estuary conservation and restoration practitioners collaborating to improve the health and resilience of estuaries on Oregon's central coast. We exist to provide technical and other support for organizations conducting estuary conservation and restoration on the Central Oregon Coast. The group was initially founded by eight non-profits and watershed councils (the Core Group) but welcomes others who are willing to constructively engage in/support estuary conservation/restoration, either on specific projects and/or more broadly.

The purpose of this strategic action plan is to identify goals and activities we can all work towards and to coordinate our actions to increase the effectiveness, efficiency, and scale of conservation efforts for central coast estuaries. The plan focuses on work we can do as a Collaborative to achieve shared outcomes and to help all participants be more effective; it will complement work each partner is implementing within their own organizations. While deciding on the process we wanted to use to develop our plan, we made the decision to not just aggregate portions of plans that had been developed for specific estuaries but to consciously think about what we could do at a broader scale and as a group to help advance healthy estuaries. We are incorporating ideas from other plans as appropriate, but we didn't want to limit our scope by starting from that perspective.

We used The Nature Conservancy's Conservation Business Planning approach to develop a Strategic Action Plan (SAP) for the group. This approach is derived from the Open Standards for the Practice of Conservation [About Conservation Standards (CS)], but Business Planning puts the emphasis on solid strategy development and de-emphasizes viability and threat assessment. It is designed to address issues that are broader than more traditional place-based work; therefore, it is more applicable to the scale of planning we need for our collaboration.

At the start of our planning process, we brainstormed a list of the primary interests of conservation groups as well as our perception of other key stakeholders' interests (Appendix I). We consulted a set of simple conceptual models illustrating how ecological processes function in estuaries in general (Aldous et al. 2008) to guide our next step of identifying the major ecological, political, or socioeconomic factors that impact primary interests or present opportunities (i.e., conservation situation analysis).

We incorporated these interests into our situation analysis diagrams in a variety of ways. Many of the conservation interests help define our target of "Ecologically Functional Estuaries". While the primary focus of this group is conservation, we also wanted to make sure to capture important social interests, without straying too far into the social well-being realm. We decided "Healthy Estuaries Support Human Communities" captured that perspective. As we built out the diagram, we added "Clean Water", "Carbon Sequestration" and "Recreational & Commercial Opportunities" as additional social interests we wanted to consider. However, some of the social interests in the list can conflict with the conservation interests.

To represent this dichotomy, we started by constructing a situation analysis diagram from a conservation perspective then one from a social perspective. There was a lot of overlap between the diagrams, but this approach helped us identify some factors that did not emerge from the conservation focused diagram. For example, loss of agricultural land can occur from subsidence resulting from the effects of diking (e.g., compaction from livestock, oxidation of peat due to loss of continuous saturation) as well as development and restoration for conservation purposes. Also, many tide gates are failing, and state and federal fish passage rules oftentimes require expensive infrastructure and a potentially lengthy permitting process. This may present an opportunity to work with willing landowners to benefit both conservation and social interests. The two diagrams were then merged into one combined situation diagram that illustrates factors that impact conservation and social interests in central coast estuaries (See Figure 3 in Section 7 below). This process also helped us identify potential intervention points and strategies to help address those factors.

This current plan identifies prioritized strategies and associated objectives with measurable ecological outcomes that we will work to achieve over the next 20 years.

We then constructed diagrams called results chains for most of the priority strategies (See Section 8). Results chains help organizations evaluate strategies by making linkages from strategies to outcomes through a series of "if…then" causal statements. These chains focus on the measurable achievement of results, not activities, and allow determination of strategy effectiveness, even early on, by identifying intermediate results we need to see in order to reduce the threats that affect outcomes. Implicit assumptions are made explicit so they can be tested. Our situation analyses (conceptual models) show the situation today; results chains show desired future conditions and measure whether we're moving towards them. We did a preliminary risk assessment as part of constructing the results chains. We then defined specific activities we will implement to achieve these outcomes and identified lead entities and a timeline for each. These activities are updated periodically. We then identified measures of success.

OCCEC meetings will occur at least biannually and at least once every five years we will have on the agenda to review and update the action plan as needed. Topics will include:

- Review of ongoing activities;
- Review of completed projects (lessons learned);
- New project development;
- Review composition of the group (re. recruiting new participants); and
- Review of Action Plan.

Approximately every five years, monitoring data will be evaluated and used to assess progress towards goals and objectives in the Strategic Action Plan and to update the plan. This will be a formal opportunity to reassess if our strategies are advancing our goals as we anticipated in our theory of change and results chains or if adjustments need to be made. This could occur earlier than five years if conditions change or if there is new scientific information that should be incorporated. As monitoring data show the achievement of goals and objectives, new goals and objectives will be developed to continue to build on these successes.

Action plan review will ensure plan relevancy. Any changes will be documented in a plan addendum, along with rationale for the change. Included will be clarifications and recommendations for plan improvement as we adaptively respond to changes in the ecological, political, and socio-economic environment influencing estuarine restoration and protection. Our results chains will assist us with tracking progress and determining whether strategy changes are necessary. Regular review of the plan will ensure that it remains a "living document" and the addendum will serve as a record of the OCCEC's development as a dynamic and functioning team.

2 PARTNERSHIP ROLES

Implementation Partner	Experience	Anticipated Contributions
Confederated Tribes of Siletz Indians	As a coastal tribe, CTSI has a long tradition of sustainably managing natural resources and supporting estuarine habitats along the Oregon Coast. The current biological staff bring over two decades of experience in prioritization of restoration projects, on-site restoration, and land acquisition of estuarine lands for conservation. Additionally, CTSI has monitored several salt marsh channel systems along the Oregon coast for channel morphology and fish production, producing results that help to influence management practices and better utilization of restoration funding.	CTSI anticipates contributing in two ways. First, CTSI will continue to contribute directly to ongoing methods of completing strategic plans that identify and prioritize conservation, enhancement, and restoration of areas in the central Oregon coast estuaries. Secondly, CTSI plans to provide professional support via hydrodynamic modeling, mapping, and continual monitoring of central coast estuaries' habitat, fish, and shellfish.
Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians	CTCLUSI is a coastal tribe within the focus area that has an innate connection with the land and waters of the Siuslaw Watershed and Coastal Lakes since time immemorial. This connection has shaped their culture and roles as stewards. CTCLUSI has combined their Traditional Ecological Knowledge (TEK) with today's best science, allowing them to integrate traditional resource management into stewardship activities, restoration, and water quality monitoring in the Siuslaw Basin.	CTCLUSI anticipates providing staff to assist with project planning implementation/restoration activities, water quality and fish monitoring activities, outreach and education, and technical assistance for projects that are located within the Siuslaw Watershed and Coastal Lakes. CTCLUSI is also committed to providing plants for restoration that are of cultural significance as funding and resources allow.
Estuary Technical Group (ETG) of the Institute for Applied Ecology	ETG brings broad perspective and experience from decades of on-the-ground tidal wetland restoration and monitoring in Oregon and the Pacific Northwest and has provided strategic decision support for estuary restoration and conservation in all major estuaries of Oregon and across the Pacific Northwest and the West Coast. ETG's work includes analysis of climate change threats to tidal wetlands, and scientific outreach to bring the results of estuarine ecology research into practice for improved estuary management.	ETG provides technical information on estuaries that OCCEC can use for its activities. Examples include mapping of future tidal wetlands under sea level rise scenarios for the whole coast of Oregon; detailed assessment of tidal site alterations and conditions from whole-estuary studies in the Necanicum, Nehalem, Tillamook, Yaquina, Alsea, Siuslaw, Umpqua, Sixes and Elk; and a reference conditions dataset from least-disturbed tidal marsh, scrub-shrub tidal wetlands, and forested tidal wetlands in Oregon that provides a "blueprint" for restoration design.
MidCoast Watersheds Council	The MidCoast Watersheds Council is dedicated to improving the health of streams and watersheds of Oregon's Central Coast, so they produce clean water, rebuild healthy salmon populations, and support a healthy ecosystem and economy. The Council works in an area of nearly one million acres, including all streams draining from the crest of the Coast Range to the Pacific, from the Salmon River on the north to Cape Creek at Heceta Head on its south.	The MCWC will be a core partner in the OCCEC, with anticipated contributions from staff as well as from three members of the board. MCWC expects to continue our focus on whole watershed restoration, from the headwaters to the Pacific, and see collaboration in the five major estuaries (Salmon, Siletz, Yaquina, Alsea, Beaver Creek), as well as smaller direct ocean tributaries with tidal influence in

	Between its incorporation in 1994 and 2016, the MCWC has done assessment, prioritization, restoration, monitoring and outreach projects totaling over $10 million. MCWC has also generated over $19.2 million in local activity through employment and goods and services involved in the restoration work.	Lincoln and Lane Counties. In the past, MCWC has completed watershed assessments based on 6th fields throughout our coverage area and will contribute this data as needed. MCWC also has completed a prioritization of areas for restoration and conservation under an anticipated sea level rise scenario (4.7' expected by 2100). This prioritization includes our area as well as all Oregon estuaries south of the Columbia River through an Estuary Assessment, landward migration zone study funded by OWEB and USFWS. Maps and data for each estuary within the OCCEC is available for use.
Nestucca-Neskowin-Sand Lake Watersheds Council	The NNSL Watersheds Council has worked on estuary restoration since its first Nestucca Bay clean up in 2000. There are four estuaries in our working area: Neskowin, Little Nestucca, Nestucca, and Sand Lake estuaries.	NNSL has established a "Sand Lake Working Group". The working group consists of state and federal landowners and other natural resource stakeholders working within the basin. The goal is to work with a contractor and the working group to share current data and management plans and identify data gaps. Then the contractor will work with partners to acquire any needed data to produce a limiting factors analysis for coho within the estuary and stream system. The final goal of the process will be to use the LFA to identify potential restoration projects and partnerships to execute those projects. NNSL also works actively in the Nestucca and Neskowin estuaries doing clean-up initiatives and restoration projects.
Siuslaw Watershed Council	The SWC has prioritized conservation and restoration of estuary habitat on the Siuslaw River since the early 2000s and has accomplished estuary restoration projects as an organization and as a member of estuary restoration-focused partnerships. Estuary restoration was identified as an organizational priority in the SWC's 2004 Strategic Plan, in 2005 the SWC worked with Green Point Consulting to complete a prioritization study for conservation and restoration of estuary land, and strategic conservation and restoration of estuary land continues to be a focus for SWC efforts. The SWC also has extensive experience with developing partnerships and working within them to accomplish watershed restoration.	The SWC will continue its commitments as a core partner in the OCCEC and will utilize its extensive restoration and partnership experience and its Siuslaw estuary-specific knowledge in support of the OCCEC.
The Nature Conservancy	TNC identified estuarine conservation in Oregon as one of its top priorities in its 2012 Strategic Plan. In addition to broader-scope	TNC is currently providing facilitation services to the Collaborative. In addition to on-going facilitation of the

	strategies, TNC is working to restore estuarine habitats at two preserves in the Tillamook Bay area. TNC has been organizing small groups of conservation practitioners into partnerships known as Learning Networks since at least 1999 to accelerate conservation work. TNC also has a lot of experience with conservation planning.	group, TNC expects to continue our restoration work at our Kilchis Estuary Preserve, assist with estuary acquisitions, participate in the Tillamook County Wetland Restoration Task Force, participate in developing a coordinated estuary restoration monitoring framework, share our tide gate prioritization tool with partners, and participate on the Tide Gate Coalition.
The Wetlands Conservancy	TWC has developed conservation plans and strategies for the Yaquina and Alsea lower watersheds and estuaries. TWC owns and manages 500 acres in the Yaquina and 225 acres in the Alsea and has worked closely with State Parks on acquisition and management of the Brian Booth State Park in Beaver Creek. TWC is working with Confederated Tribe of Siletz Indians to do a Conservation Area Identification and Priority Plan for the Lower Siletz Watershed.	TWC will continue our annual King Tide flights and photography and provide those photographs to the collective. TWC is continuing to improve our restoration and conservation prioritization tool and hope others can use it. TWC created a conservation priority map from the Salmon River to Coos Bay. The areas are blobs not down to the parcel level. We have worked with many OCCEC partners on the map, we want to continue working with OCCEC to update the map and track conservation of those areas over time by the collaborative.
Tillamook Estuaries Partnership	TEP is a National Estuary Project started in 1999. It has a Comprehensive Conservation and Management Plan that outlines 63 actions to address water quality, habitat restoration, flooding, and stewardship to improve the health of the Tillamook Bay. Since 2002, TEP has expanded its study area to include all of the estuaries in Tillamook County and implements a robust water quality monitoring program in all of the bays and their watersheds and has been active in restoration, either as a lead or partner, throughout the study area.	The TEP will continue to be a core member of the OCCEC providing technical assistance, policy guidance, and implementing on-the-ground projects that positively impact estuarine health throughout the 5 estuaries in Tillamook County.
U.S. Fish & Wildlife Service Restoration Programs	The US Fish and Wildlife Service's Coastal Program has supported many estuarine-related endeavors on the central Oregon coast, including several OWEB funded projects such as the Landward Migration of Tidal Wetlands in Oregon Estuaries. USFWS has also completed estuarine restoration projects at Siletz Bay NWR, Nestucca Bay, and at the Miami and Salmon Rivers and has assisted Oregon State Parks and other landowners with their efforts to enhance salt marsh habitats.	The USFWS will continue to guide the OCCEC's development and implementation of its strategic plan. Technical assistance with individual projects will be provided as needed, including site assessments, fish and wildlife surveys and data synthesis, permitting, and environmental compliance. Project funding is available through several Service programs, as well as the ability to bring in scientific expertise in fish passage, geomorphology, engineering, and other disciplines.

3 SCOPE

Focus Area

The focus area for this partnership is estuaries on the Central Oregon Coast from the Siuslaw Estuary to Nehalem Bay (Figure 1). Our justification for agreeing on this area includes both ecological and social/logistical factors. The estuaries within this geography are predominately classified as drowned river mouth estuaries, while further south, there are more lagoon types. There is also a separate group of partners working on estuaries on the south coast. Under our FIP Capacity-building grant, we agreed to expand our northern boundary to include the Nehalem Bay estuary. This incorporates all the Tillamook Estuaries Partnership service area and is probably the extent to which we can expect participants to travel to meetings. Further north, there are few major estuaries outside of the Lower Columbia, which stands alone.

Organizational Goals

- Gain an understanding of conditions and threats to estuaries on the central Oregon coast.
- Develop priorities for conservation and restoration activities within our geographic scope.
- Improve knowledge, effectiveness, efficiency, and capacity for participating organizations to do estuary conservation and restoration.
- Engage in conservation and restoration efforts at a larger scale than members could do individually.
- Improve capacity to monitor the effectiveness of restoration and conservation actions.
- Analyze the effectiveness of the Collaborative and continually seek to improve.
- Share accomplishments, results, and knowledge gained as a result of our activities.

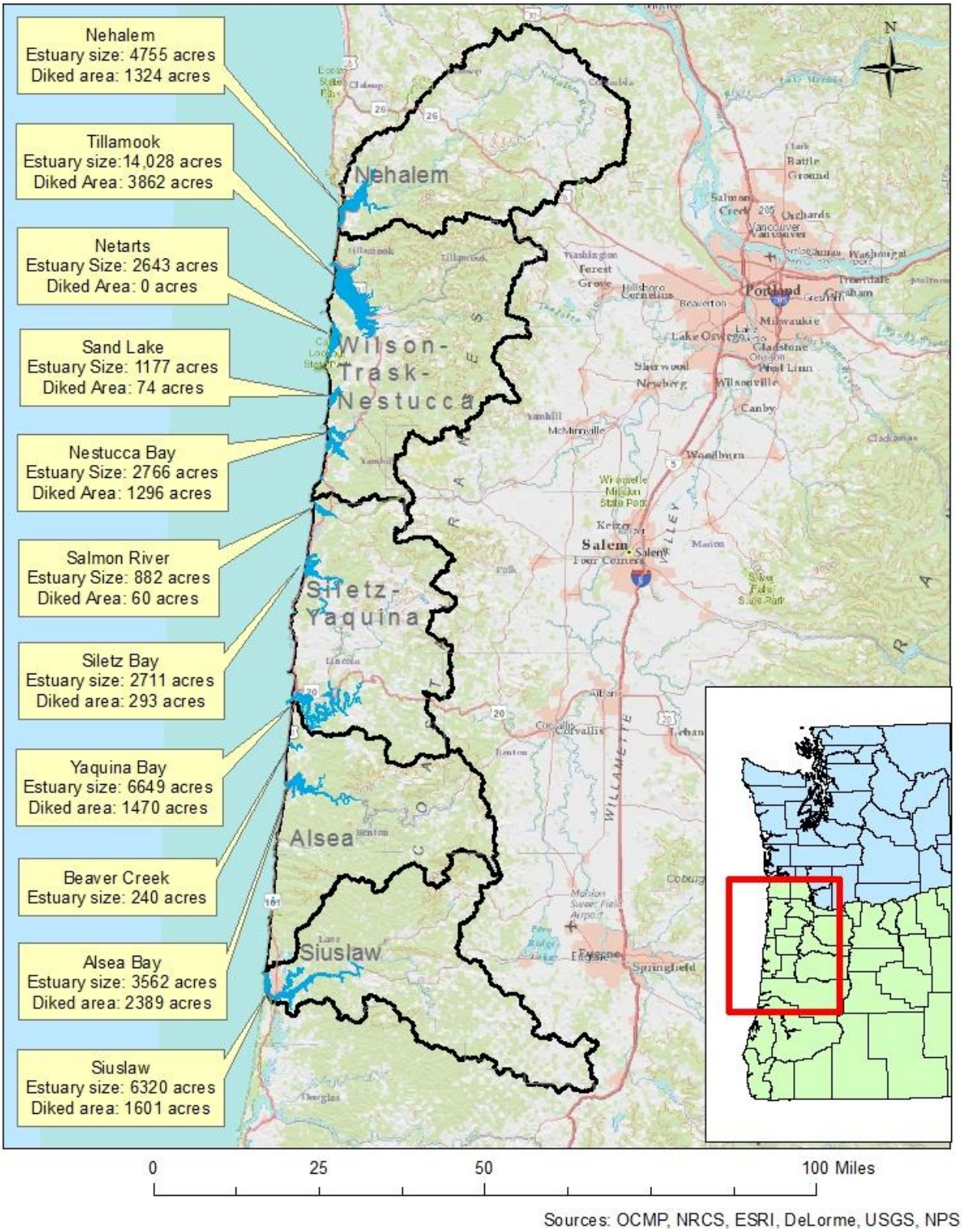
Temporal Scope

This plan was first developed in 2015/2016 and updated in 2020/2021. As we thought about our long-term goals, we decided it might take 20 years to achieve them so we set that as the timeframe for this plan with the understanding that we would periodically review and update it as conditions changed.

4 VISION

Our vision and long-term ecological goal is a network of healthy and resilient estuaries on Oregon's central coast that sustain a full complement of thriving native fish and wildlife populations, and support economically and socially vibrant communities.

Figure 1. Oregon Central Coast Estuary Collaborative focus area



5 ECOLOGICAL PRIORITIES AND GOALS

The land-sea interface found in estuaries is one of the most ecologically rich and complex habitats on earth. It supports an extraordinary array of fish, shellfish, birds & mammals including coho & other salmon, migratory birds, and juvenile marine fish and forage fish. Estuaries provide nursery habitat for many of Oregon's most valuable coastal commercial and recreational fisheries including crab, salmon, and steelhead, as well as supporting a host of other species such as lingcod, green sturgeon, brown rockfish, starry flounder, English sole, and herring (Hughes et al. 2014). Estuaries also provide important social services such as flood control, sediment detention, carbon sequestration and water quality improvement.

The Open Standards planning approach we are using recommends the selection of ecological communities or systems as "coarse-filter" conservation targets (Parrish et al. 2003). These ecological systems/habitats are chosen to represent and encompass the full suite of biodiversity in the project area for place-based conservation. Individual species can also be selected to supplement the system targets if conservation of the system itself would not be sufficient to conserve especially significant species with special needs beyond a healthy functioning system. Since our group's focus is on the estuarine systems on the central coast, we felt that our conservation target should be "Ecologically Functional Estuaries". While we recognize that impacts to the upper watersheds draining into the estuaries do affect estuarine health, we felt the historic loss of tidal wetlands in the estuaries due to diking and other alterations was the biggest threat to that system so that is where we are focusing our efforts. These complex systems warrant the multi-disciplinary approach of our collaborative to support, learn from, and build on each other's work.

In addition to this conservation target, we wanted to highlight that conservation of estuaries can also result in outcomes that enhance human well-being and benefit the local economy such as: reduced flooding, increased recreational opportunities, healthier fish & wildlife resources, clean water, and benefits to the local economy from implementing restoration projects. So, we identified the following Human Well-being targets as well: healthy estuaries that support human communities, clean water, recreational & commercial opportunities, and carbon sequestration.

The need to increase the scale of estuary conservation is supported by a diversity of plans. Oregon's Coast Coho Plan calls for restoration of 5000 acres of tidal wetlands statewide. Estuaries are identified as a Strategy Habitat in the Oregon Conservation Strategy. Strategy habitats are those with a high degree of historic loss and that are important to recover and conserve to support a broad suite of species. The National Marine Fisheries recovery plan for Oregon Coast Coho (NMFS 2016) calls out the need for estuary restoration. Protecting and restoring healthy ocean and coastal habitats (including estuaries) is one of the seven priority areas identified in the West Coast Governor's Agreement. The OWEB Watershed Health Indicators for Oregon Coast Coho ESU identifies benchmarks needed for viable estuaries. The amount of hydro-modification is a key one; "Extent of wetlands altered by restricted flow: Limiting: > 40% of historic wetland area modified, Moderate: 20-40% of historic wetland area modified, Adequate: <20% of historic wetland area modified" (Bauer et al. 2008; pg. 53). Goal #1 below is based on these benchmarks and would bring all estuaries in our focus area up to at least the "Moderate" level. Estuaries are mentioned as a priority in many other conservation plans on the Oregon Coast by a variety of other entities as well.

> GOAL 1: By 2040, the percent of functional tidal wetlands across the OCCEC Focus Area will be increased from current 43% to desired > 60% by increasing hydrologic connections to tidal flows, restoring channels, and replanting native tidal wetland vegetation as needed.
> GOAL 2: By 2040, key estuary lands will be protected through fee title acquisitions or long-term easements to conserve current, and potential future, tidal wetland areas that are likely to withstand sea level rise into the future.
> GOAL 3: By 2030 there will be increased landowner acceptance and understanding of the ecological benefits estuaries provide and the projects that restore them.

GOAL 4: Through science, collaboration, and engagement with community members and decision makers, there will be improved opportunities to advance estuary conservation, restoration, and resiliency on the Central Oregon Coast.
GOAL 5: By 2035, at least 5 priority transportation or other infrastructure impact project sites have increased hydrologic connection to tidal flows.
GOAL 6: By 2035, each Central Coast estuary has an invasive species Early Detection Rapid Response program in place to catch new invasions early.

6 PROFILE OF THE FOCUS AREA

The estuaries in our focus area extend from Nehalem Bay at the north end to the Siuslaw Estuary on the south. The major estuaries include: Nehalem, Tillamook Bay, Netarts, Sand Lake, Nestucca, Salmon River, Siletz Bay, Yaquina Bay, Beaver Creek, Alsea Bay, and Siuslaw, as well as smaller ones associated with smaller rivers, e.g. Neskowin Creek, Devils Lake, Yachats River, Tenmile Creek, and Sutton Creek. Multiple tables in Appendix II provide summary information about these estuaries. The estuaries of our central coastal zone vary greatly in size from Tillamook, with an area of around 14,000 acres, draining an area of almost 360,000 acres (560 square miles) to very small estuaries, with estuary drainage areas of 11,000-17,000 acres (17-27 square miles). Short profiles of the major estuaries in our focus area can be found in Appendix III.

There are thirty-six estuaries inventoried in our study area in the 2014 "Inventory and Classification of West Coast Estuaries" (Heady et. al. 2014). According to the CMECS classification system (the Coastal and Marine Ecological Classification System, the national standard for classifying estuaries) most of the estuaries in our focus area (27), including all the large estuaries, are classified as riverine estuaries. Six of the estuaries are considered "Lagoonal Estuary" (Lake Lytle, Smith Lake, Chamberlain, Sears, Sand Lakes and Fogarty Creek) and one (Netarts) is considered an "Embayment/Bays" (see Appendix II, Table C for definitions of estuary types). Appendix II, Table A contains data on total historical area of tidal marshes and swamps, and the proportion of those tidal wetlands that have been lost; the data are from Brophy (2019) whose analysis was primarily based on the Oregon Coastal Management Program's mapping of diked areas (Lanier et al. 2014, available on DLCD's Coastal Atlas).

The Department of Land Conservation and Development has classified 21 of the large estuaries on the coast into three categories (based largely on the conditions and uses of the estuaries when the classification was being done, in the early 1970's). These categories are Natural, Conservation, and Development (Shallow Draft, dredged to less than 22' depth and Deep Draft, dredged to deeper than 22'). In our focus area, we have two estuaries classified as Natural (Sand Lake and Salmon River), four classified as Conservation (Netarts, Nestucca, Siletz and Alsea), three classified as Shallow Draft (Nehalem, Tillamook, Siuslaw) and one classified as Deep Draft (Yaquina). Even within Development estuaries, there are management units designated for natural and conservation uses.

The Oregon Central Coast Estuary Collaborative includes active representatives from Federal agencies such as the US Fish and Wildlife Service and USDA Forest Service. These entities own and manage 15% of the estuarine lands in our focus area overall but as much as 82% in some estuaries such as the Salmon River (Table 1 & Figure 2). We have representation from state agencies such as Or. Dept. of Fish and Wildlife; also, local non-profit and watershed council partners are working directly with Or. Parks and Recreation Dept. staff in estuaries where they own property. We also have active participation from the Confederated Tribes of the Siletz Indians and the Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians. Several land trusts own estuarine property in the focus area including: Lower Nehalem Community Trust, North Coast Land Conservancy, The Nature Conservancy, The Wetlands Conservancy, and McKenzie River Trust. Nearly all of these land trusts are actively engaged in the Collaborative.

Many of the estuaries are owned primarily by individual, private non-industrial landowners. Engagement of such a large number of diverse landowners across a wide geography is challenging, so our approach is to work through various local groups such as the watershed councils and the Tillamook Estuaries Partnership in their local estuaries. We also hope to work with other entities with connections to these landowners such as the local Soil & Water Conservation Districts and Natural Resources Conservation Service more in the future (many of them are included in our e-mail distribution list but only some have been more active in the partnership to date). In addition, one of our Outcomes identified in the action plan is to foster increased social acceptance and understanding of the ecological benefits estuaries provide through various methods of engagement with this key audience.

Table 1. General land ownership in the focus area by estuary.

	All Major Estuaries	Nehalem	Tillamook	Netarts	Sand Lake	Nestucca Bay	Salmon River	Siletz Bay	Yaquina Bay	Beaver Creek	Alsea Bay	Siuslaw
Federal	15.0%	0.0%	0.1%	0.0%	0.4%	22.8%	82.0%	24.6%	0.0%	0.0%	21.7%	11.5%
State	4.9%	4.0%	0.0%	70.5%	10.7%	5.6%	0.7%	0.0%	1.3%	36.2%	2.2%	3.8%
City and county	1.1%	0.0%	0.9%	0.0%	3.4%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	4.5%
Tribal	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%
Private industrial	2.0%	4.4%	0.4%	2.0%	0.0%	1.2%	0.0%	3.0%	19.3%	3.3%	2.9%	0.1%
Private non-industrial	77.0%	91.6%	98.7%	27.5%	85.5%	70.3%	17.4%	72.3%	79.2%	60.5%	73.1%	79.9%

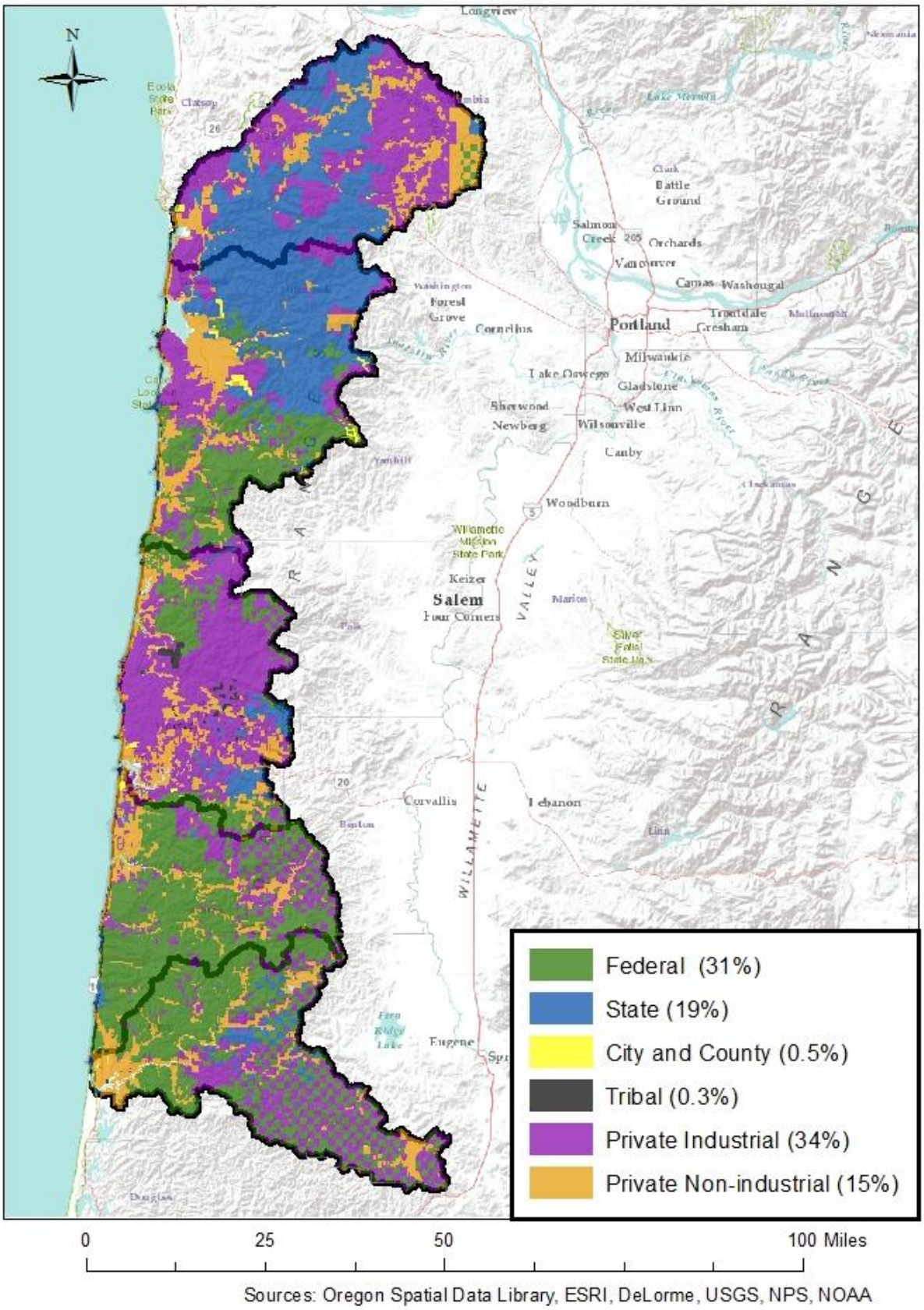
Commercial fishing is an important economic factor in the communities within the focus area. The commercial fleet in the focus area operates primarily out of Garibaldi (Tillamook Bay), Pacific City (direct ocean launch), Depoe Bay, Newport (Yaquina Bay), and Florence (Siuslaw estuary). These fleets concentrate primarily on the offshore groundfish (e.g., whiting, flatfish, sablefish, rockfish), Dungeness crab, shrimp, salmon, and tuna fisheries. There are some small commercial bait fisheries (e.g., sand and mud shrimp, clams), within several of the focus area's estuaries (Tillamook, Siletz, Yaquina, Alsea, and Siuslaw). Yaquina Bay once supported a commercial herring fishery but hasn't in recent years. Recreational fishing (e.g., salmon, herring, perch, rockfish, flounder, sturgeon, crab, clams, shrimp [sand and mud]) occurs throughout our central Oregon Coast estuaries and recreational charter boat fisheries are most active in Garibaldi (in Tillamook Bay), Depoe Bay, Yaquina Bay, and Florence (on the Siuslaw).

Two estuaries in our focus area contain commercial oyster operations for the non-native Pacific oyster (Netarts and Yaquina), and native oyster restoration is also ongoing in those estuaries. These bays were documented to have historic populations of native oysters (which were overfished in the 1800s for markets in San Francisco and New York). Native oyster restoration has been promoted by The Nature Conservancy, the Confederated Tribes of Siletz Indians, and Oregon State University.

There has been much federal, state, tribal, county, and non-governmental interest and investment in our area's major estuaries. Two of our area's estuaries contain USFWS refuges (the Nestucca and Siletz), the Tillamook Estuaries Partnership evolved from a Tillamook Bay National Estuary Program funded by the Environmental Protection Agency (EPA). The Oregon Watershed Enhancement Board, the USFWS's Coastal Program and National Coastal Wetlands Program, the US Forest Service (USFS), the Pacific Coast Joint Venture, Ducks Unlimited, and Western Rivers Conservancy and other funders have helped watershed councils, land trusts, and The Confederated Tribes of Siletz Indians to acquire or restore tidal wetlands for conservation and restoration throughout our area. Additionally, the USFS, the EPA, The Confederated Tribes of Siletz Indians, Oregon Department of Fish and Wildlife, Oregon Department of State Lands, and Oregon State University have also all played roles in studying estuaries and their restoration.

There has been considerable progress made in initiating estuarine restoration projects within our focus area. Table D in Appendix II summarizes tidal wetland restoration efforts by estuary (as of 2017). The projects listed in this table are those that endeavor to restore more natural hydrological and biological processes and functions (e.g., removing or breaching dikes, initiating channels in historic locations, filling drainage ditches etc.).

Figure 2. General Land Ownership in the Watersheds of the Focus Area



7 CONSERVATION NEEDS AND OPPORTUNITIES

Although geographically estuaries cover only a small area, the essential ecological functions they deliver make them critically important. Estuaries provide key habitat for a broad range of fish and wildlife, including many economically important marine species and species of concern, such as black brant and sturgeon. They provide habitat for salmon transitioning to salt water as well as a food-rich environment that supports rapid growth of juvenile salmon prior to ocean entry. In their study of coho salmon use of restored and natural estuarine wetlands in the Salmon River, Jones et al. (2014) found that estuarine-associated life-history strategies accounted for 20–35% of the adults returning to spawn. Estuaries also support other important social and ecosystem services such as flood control, water quality, carbon sequestration, and coastal food web support.

People use estuaries in a variety of ways including agriculture, recreation, and transportation. However, 150 years of increasing human use have taken a toll on our estuaries, resulting in substantial loss of estuary habitats. Tidal wetland losses average around 60% for tidal marsh and 95% for forested and shrub tidal swamps (Brophy 2019), leaving only a small fraction of the high-quality tidal wetlands that once provided the valued services listed above. However, our group realizes that the human uses that have reduced the area of tidal wetlands also have high cultural and economic value. Therefore, we seek to integrate our approach with human uses, by working to enhance ecological functions on working lands, improving road infrastructure, and restoring ecosystem services estuaries provide such as flood control for example.

Altered Key Ecological Attributes (from Aldous et al. 2008) form the basis for understanding what the direct threats are to estuaries. Such critical ecological attributes, if missing or altered, would lead to loss of estuarine function over time. These key altered biophysical factors are: reduced habitats, tidal & floodplain disconnection and altered circulation, altered sediment regime, degraded sediment quality, degraded water quality, and climate change impacts (e.g., change in timing & distribution of rainfall, increased storm surges & intensity, acidification and sea level rise).

The primary human activities leading to these altered conditions (i.e., direct threats) include incompatible agricultural activities (such as dredging, ditching, tiling, tide gates, and dikes); introduction of invasive species; competing land uses; roads, railroads & inadequate culverts; septic systems; stormwater runoff; industrial development in estuaries; and incompatible forestry practices. Additional threats to the social targets include loss of productive agricultural land, natural hazards, loss of access to estuary lands for recreation, and overfishing.

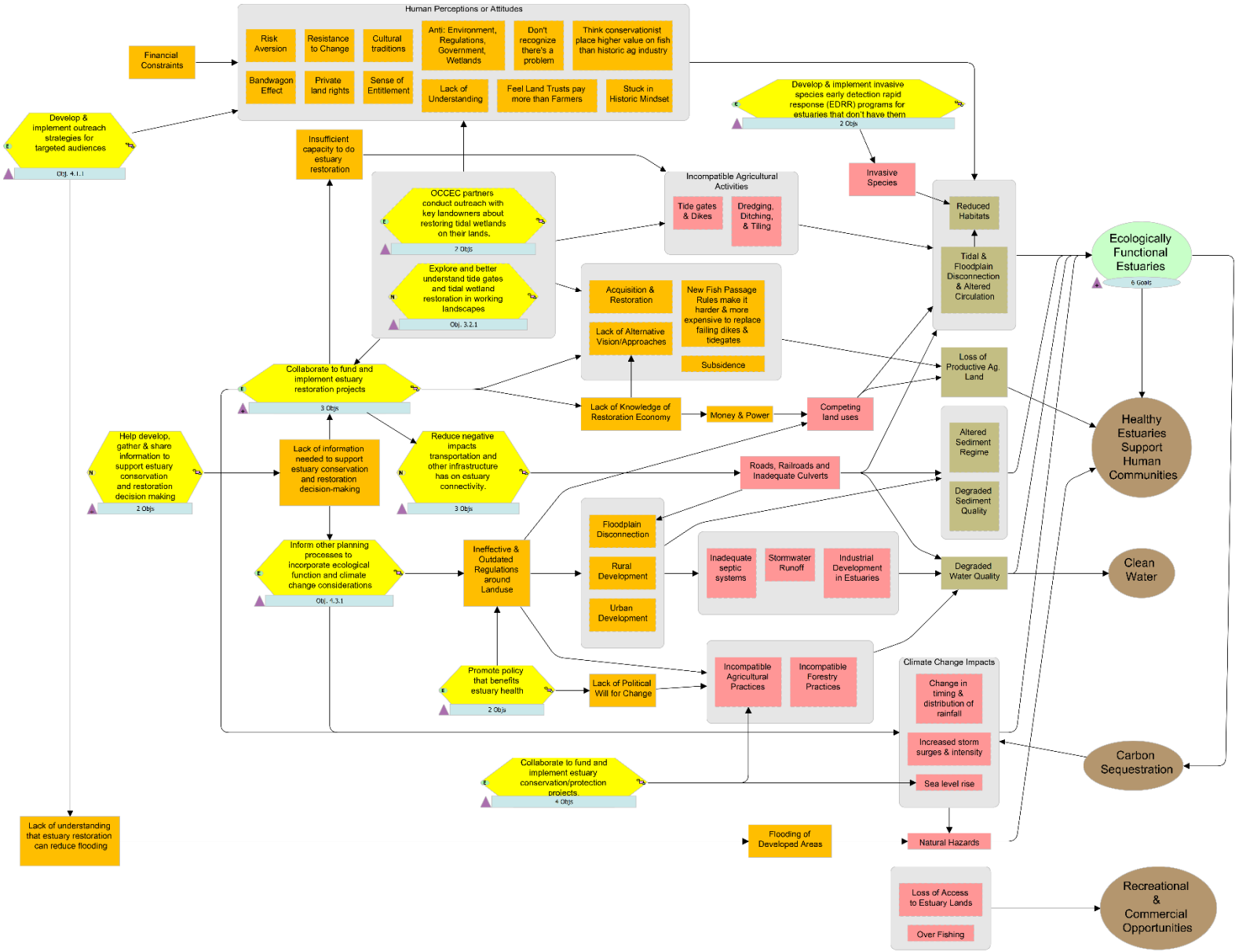
The team identified many factors believed to contribute to these threats (Figure 3). In particular, differing human perceptions or attitudes, financial constraints, ineffective &/or outdated regulations around land use in estuaries, lack of understanding about the restoration economy and flood-control benefits of estuary restoration, and lack of political will for change were cited as important factors. Given the current status of our estuaries, and impacts from potential climate change, we are challenged to find new approaches and to scale up our estuary work.

The following symbols are used in the diagrams throughout this plan:

Legend Table
Conservation Target
Human Wellbeing Target
Direct Threat
Contributing Factor
Intermediate Result
Threat Reduction Result
Strategy
Draft Strategy

Legend Table
Goal
Objective
Indicator
Biophysical Factor
Group Box
Task
Activity
Measurement

Figure 3. Central Coast Estuaries Situation Diagram



8 THEORY OF CHANGE: GOALS, STRATEGIES, OBJECTIVES AND ACTIONS

Strategy logic represents the cornerstone of a project's theory of change, explaining in narrative and diagrammatic form how selected strategies are expected to achieve essential intermediate results and ultimately, Outcomes. This involves being very explicit about how we'll take advantage of big opportunities, influence the decisions and behavior of important actors, and create the conditions that will incentivize or enable conservation over the long term. Results Chains (e.g., logic models) are an effective tool for describing a theory of change. A situation analysis diagram (See Figure 3) serves as the basis for creating a results chain diagram. The situation analysis diagram describes the situation today, whereas the results chain shows the desired future condition. Each of our priority strategies are represented in at least one results chain, however closely linked strategies are sometimes combined on the same results chain diagram.

1. **OUTCOME/GOAL: By 2040, the percent of functional tidal wetlands across the OCCEC Focus Area will be increased from current 43% to desired > 60% by increasing hydrologic connections to tidal flows, restoring channels, and replanting native tidal wetland vegetation as needed.** (see Appendix II for background data)
    - 1.1. **Strategy: Collaborate to fund and implement estuary restoration projects.**
        - **1.1.1. Objective:** Implement restoration projects on about 900 acres in the Yaquina and Alsea estuaries by 2028. (MCWC, CTSI, MRT, TWC, USFWS, DU, PSMFC, ODFW, Lincoln SWCD, Fred M. VanEck Forest Foundation, BLM, USFS)
            - **1.1.1.1.** Action: Submit a competitive Focused Investment Partnership (FIP) application to OWEB
            - **1.1.1.2.** Action: Implement the FIP Initiative focused on the Yaquina and Alsea estuaries from 2022 to 2028
        - **1.1.2. Objective:** At least five prioritized estuary wetland habitat restoration projects, covering ~400 acres, implemented in OCCEC estuaries outside the FIP area by 2028. (TEP, TNC, NNSL, CTSI, USFWS, SWC, MRT, OPRD, DU)
            - **1.1.2.1.** Action: Update list of potential priority projects
                - 1.1.2.1.1. Pull together relevant projects from participating group's priorities outside of the Yaquina and Alsea estuaries for OCCEC prioritization
            - **1.1.2.2.** Action: Help lay the groundwork for implementation of priority projects (ODFW, USFWS)
            - **1.1.2.3.** Action: Identify and hire expertise for shared needs across projects (e.g., design, hydro-geo-morphologist etc.) (TEP, TNC, USFWS)
            - **1.1.2.4.** Action: Develop MOUs as needed for joint OCCEC proposals that provide transparency (TEP)
            - **1.1.2.5.** Action: Use consistent measures and messages for greater impact (All as appropriate)
            - **1.1.2.6.** Action: Seek out economies of scale in implementation steps (e.g., joint grant proposals, share resources, consultants, technologies, LIDAR processing, drone flights, helicopter & other equipment mobilization, native plant nurseries) (All as appropriate)
            - **1.1.2.7.** Action: Coordinate & share information (TNC, TEP, ODFW, ETG, PSMFC)
                - 1.1.2.7.1. Coordinate and share common guidance on restoration best practices (TEP, ODFW, ETG)
                - 1.1.2.7.2. Host periodic information exchange forums for OCCEC partners (TNC)
        - **1.1.3. Objective:** Implement additional priority tidal wetland habitat restoration projects to bring the cumulative total of acres restored between 2021 and 2040 to at least 2010 acres.
            - **1.1.3.1.** Action: Obtain Institute for Natural Resources (OSU) tide gates and diked areas data layers and evaluate for other potential project ideas (TEP, TNC, ODFW, NNSL, ETG)
            - **1.1.3.2.** Action: Identify, prioritize and implement next round of estuary conservation and restoration projects (TWC, TEP, NNSL, MCWC)

2. **OUTCOME/GOAL: By 2040, key estuary lands will be protected through fee title acquisitions or long-term easements to conserve current, and potential future, tidal wetland areas that are likely to withstand sea level rise into the future.**
    - 2.1. **Strategy: Collaborate to fund and implement estuary conservation/protection projects.**
        - **2.1.1. Objective:** Protect 100-440 acres of remaining tidal swamp habitats and priority Landward Migration Zone (LMZ) lands in the Yaquina and Alsea estuaries by 2028. (CTSI, MRT, TWC, USFWS)
        - **2.1.2. Objective:** By 2028, bring 400-700 acres in the Yaquina and Alsea estuaries into conservation ownership to allow for future restoration. (CTSI, MRT, TWC, USFWS)

2.1.2.1. Action: Submit a competitive Focused Investment Partnership application to OWEB

2.1.2.2. Action: Implement the FIP Initiative focused on the Yaquina and Alsea estuaries from 2022 to 2028

2.1.3. Objective: Protect at least 100 acres of remaining tidal swamp habitats in the OCCEC estuaries outside the FIP area by 2035.

2.1.4. Objective: By 2028, bring at least 250 acres in OCCEC estuaries outside the FIP area into conservation ownership to allow for future restoration.

2.1.5. Objective: 5% (~750 acres based on 4.7' SLR Scenario) of tidal wetland Landward Migration Zone (LMZ) lands protected in estuaries in the OCCEC focus area by 2035 (guided by priorities established in Brophy & Ewald 2017)

2.1.5.1. Action: Implement relevant protection strategies for priority projects

3. OUTCOME/GOAL: By 2030 there will be increased landowner acceptance and understanding of the ecological benefits estuaries provide and the projects that restore them.

3.1. Strategy: OCCEC partners conduct outreach with key landowners about restoring tidal wetlands on their lands.

3.1.1. Objective: By 2028, at least 5 priority landowners each in the Yaquina and Alsea Estuaries have signed landowner agreements to restore tidal wetlands on their lands.

3.1.2. Objective: By Dec. 31, 2028, at least 1 priority property landowner in each OCCEC area estuary recruited following coordinated outreach, have signed landowner agreements to restore tidal wetlands on their lands.

3.1.2.1. Develop and implement landowner outreach plans (All as appropriate)

3.1.2.2. OCCEC partners will keep each other informed of outreach to landowners who could cross estuary boundaries or where working areas overlap with other partners (All)

3.2. Strategy: Explore and better understand tide gates and tidal wetland restoration in working landscapes

3.2.1. Objective: By 2025, gather information from on-going efforts and new assessments needed to identify 5 priority working lands projects ready for implementation.

3.2.1.1. Action: Work with NRCS & other agencies (SWCD) to identify opportunities and potential project types (TEP)

3.2.1.2. Action: Investigate/assess conservation value of "fish-friendly tide gates" (All)

3.2.1.3. Action: Test Working lands pilots in LMZ areas (TEP, NNSL)

3.2.1.4. Action: Collaborate with statewide tide gate engineering work group to develop engineering analysis of tide gate function under SLR scenarios tool kit (see TNC New Hampshire tool) (TEP)

3.2.1.5. Action: Complete Estuary-wide assessments of tide gates and restrictive culverts in estuaries including location, ownership, condition, and responsibility including maintenance requirements and prioritize for project selection. (see TNC Oregon tide gate prioritization tool) (TNC, TEP, NNSL, ETG, MCWC, Lower Nehalem WC) (in progress)

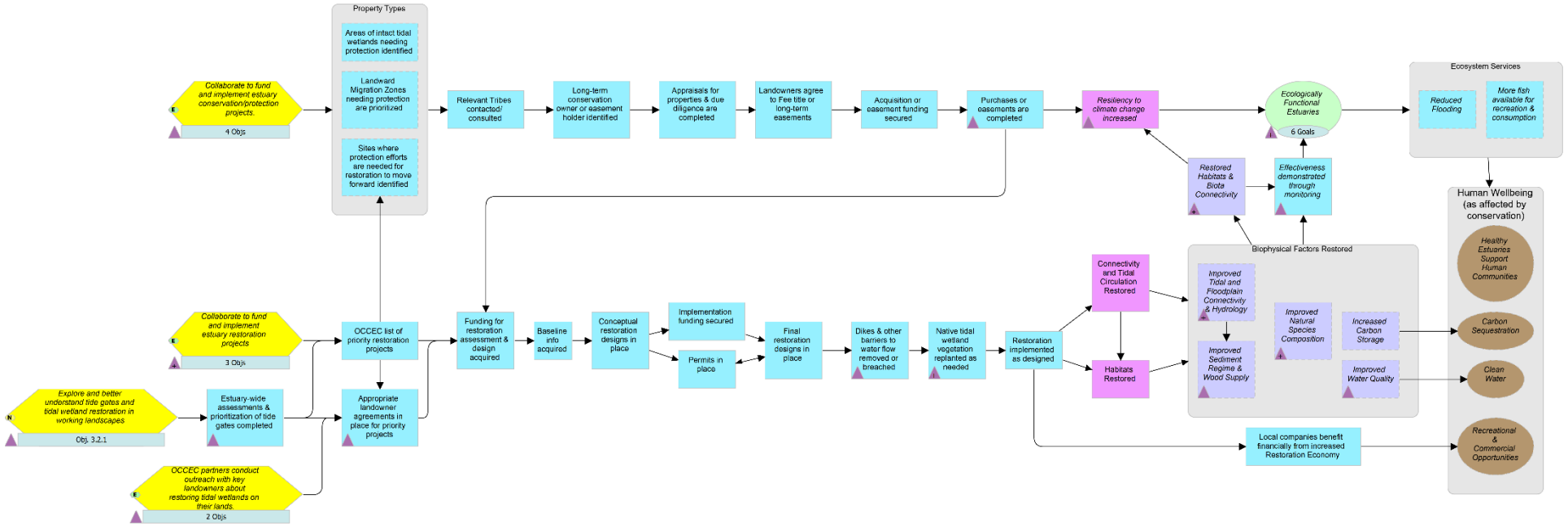
3.2.1.6. Action: Stay informed of, and participate as appropriate, in state Tide Gate Coalition and its work groups (TNC, NNSL, DU)

Theory of Change for Project-Level Actions

Through participation in the Or. Central Coast Estuary Collaborative, practitioners will collaborate to identify and prioritize potential estuary restoration projects (including utilizing information from new tide gate inventories) and acquire necessary landowner agreements. Properties that need to be protected for conservation purposes will also be identified, including remaining intact tidal wetlands (especially swamps), potential future tidal wetlands in priority landward migration zones, and current tidal wetlands where restoration can't happen unless it is brought into conservation ownership. For acquisition projects, relevant Tribes will be consulted, and appropriate long-term conservation entities identified. That will result in appraisals and other due diligence steps being completed and the current landowners agreeing to the purchase or easement terms. With those things in place, funding to complete the land deals can be secured and the purchases completed. For properties needing restoration, funding for assessments and designs will be secured, baseline data gathered, and conceptual restoration designs completed. The initial designs will allow applications to be submitted for implementation funding and lead to

acquisition of necessary permits. With some anticipated back-and-forth with permitting agencies, final restoration designs will be completed. This will lead to removal or breaching of impediments to water flow, wetland vegetation being replanted as needed, and the restoration plans being implemented as designed. This will reduce the threats of altered hydrologic connectivity and habitat destruction and increase resiliency to climate change impacts by restoring the key ecological attributes that define a healthy functioning estuary. Restoration effectiveness will be demonstrated through monitoring and will help advance human well-being interests in some instances by reducing flooding and helping fuel the local economy through support to the restoration economy.

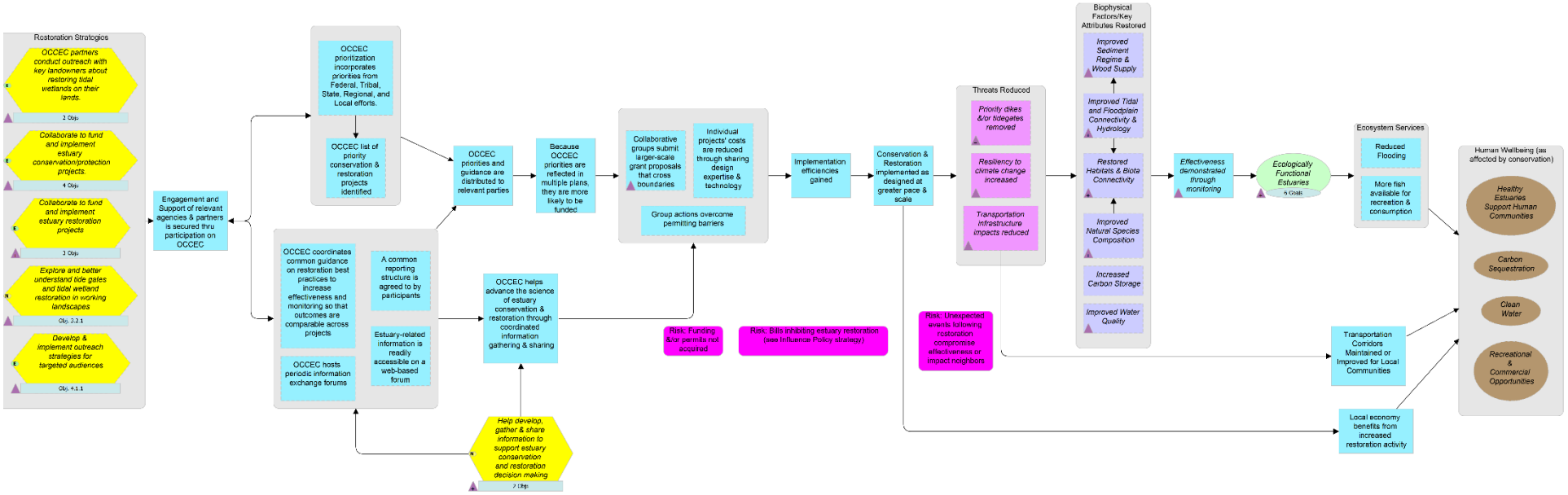
Project-Level Results Chain Diagram:



Theory of Change for OCCEC Partnership-Level Actions

Better engagement and support of agencies and partners thru participation in the Or. Central Coast Estuary Collaborative will result in: shared priorities, identification of restoration projects that can be integrated into working landscapes, common guidance on restoration best practices, a common monitoring and reporting structure, and an accessible web-based forum for information exchange. This will help advance the science of estuary conservation and restoration and lead to projects that are more likely to be funded. As a result, implementation of larger-scale projects will be facilitated, and implementation efficiencies will be realized thus increasing the pace and scale of estuary restoration on the central coast.

Partnership-Level Results Chain Diagram:



4. **OUTCOME/GOAL: Through science, collaboration, and engagement with community members and decision makers, there will be improved opportunities to advance estuary conservation, restoration, and resiliency on the Central Oregon Coast.**
   - **4.1. Strategy: Develop and implement outreach strategies for targeted audiences** (TEP)
     - **4.1.1. Objective:** Provide <u>coordinated</u> engagement opportunities across the OCCEC focus area to a variety of audiences including at least one annual speaker presentation on an estuary topic in each estuary.
       - **4.1.1.1.** Action: Determine outreach needs for priority strategies 1st (TWC, SWC, CTSI, TNC)
       - **4.1.1.2.** Action: Work with contractor to develop social media toolkit for estuary messages, making the outreach materials as relevant to local communities as possible (TNC, TWC, SWC, CTSI) (see also Obj. 4.2.2)
         - 4.1.1.2.1. Highlight how functioning estuaries benefit human communities
         - 4.1.1.2.2. Highlight economic benefits of estuary restoration activities (e.g., contractors, local retail, etc.), fishing, hunting, recreation, more rearing habitat for fish, & focus on positives (TWC)
         - 4.1.1.2.3. Eelgrass and kelp ocean acidification mitigation benefit & blue carbon (OAH bill funding?)
         - 4.1.1.2.4. Research/share beaver benefits & alternatives to take (TWC)
       - **4.1.1.3.** Action: Keep library of relevant articles, papers, and other resources up to date on Basecamp (All)
       - **4.1.1.4.** Action: Implement outreach to key audiences for priority strategies (All)
       - **4.1.1.5.** Action: Implement Southern Flow Corridor outreach plan with coordinated messaging (TEP)
       - **4.1.1.6.** Action: Engage with OSU & NOAA as well as partner groups for speaker presentations
         - 4.1.1.6.1. Coordinate with Hatfield Marine Science Center agencies/programs to present on their relevant research projects (ODFW)
       - **4.1.1.7.** Action: OCCEC may want to capitalize (e.g., advertise, participate) on the estuary presentation Lincoln County will be doing next year on the Yaquina Estuary Plan update. (DLCD)
   - **4.2. Strategy: Help develop, gather & share information to support estuary conservation and restoration decision making**

4.2.1. Objective: Initiate one new project a year that improves decision-makers' understanding of estuary function and restoration and/or fills a key data gap. (TEP, NNSL)

4.2.1.1. Action: List information needs and develop outreach materials to address bills that inhibit restoration

4.2.1.2. Action: Help develop consistently used metrics for tracking restoration effectiveness in tidal wetlands (TNC, NNSL, MCWC, ODFW, SWC, TEP, ETG)

4.2.1.3. Action: Develop Salinity models for our estuaries that incorporate climate change factors (ETG)

4.2.1.3.1. Encourage work by EPA & USGS to gather the required data inputs and then run hydrodynamic models using current vs. predicted future levels for our estuaries

4.2.1.4. Action: Pull together information on carbon sequestration rates in Oregon tidal wetlands and eelgrass beds and the potential for carbon mitigation funding for OCCEC projects.

4.2.1.5. Action: Conduct a Coho Strategic Action Plan project for Tillamook Bay in partnership with Wild Salmon Center and partners (TEP)

4.2.1.6. Action: Conduct a Coho Strategic Action Plan project for Siletz Bay in partnership with Wild Salmon Center and partners (MCWC, CTSI)

4.2.1.7. Action: Conduct Limiting Factors Analysis or other data gathering for restoration prioritization in Sand Lake Estuary (NNSL, USFS)

4.2.1.7.1. Use LFA and Restoration Prioritization to guide restoration actions in basin (NNSL, USFS, TEP, OPRD- In Process)

4.2.1.8. Action: Conduct management-oriented studies to inform restoration, maintenance, and protection activities in the Siletz & Nestucca estuaries (USFWS Refuges, TWC, CTSI, ETG, MCWC).

4.2.1.8.1. Examples include: water resources assessment, development of a national Vegetation Classification Standard vegetation data layer for GIS, baseline assessment and monitoring of water chemistry to determine acidification rates, estuary assessment (characterization of conditions at current and former tidal wetland sites; prioritization of conservation and restoration opportunities)

4.2.1.9. Action: Conduct hydrologic study to determine effects of tsunami evacuation trail (old roadbed) on water flow in Nestucca Wildlife Refuge (USFWS Refuges).

4.2.1.10. Action: Comprehensive Water Quality Tests to help determine the causes of acidification in estuaries (e.g., chemicals, algae toxins, warm water conditions, PH imbalance, etc.).

4.2.1.11. Develop a list of potential opportunities for mitigation sites in our estuaries.

4.2.2. Objective: Work with PMEP and others to develop outreach information to create and maintain a system that fosters a favorable economic and political climate in support of estuary conservation, restoration, and resiliency. (TEP, ODFW, NNSL)

4.2.2.1. Implement actions to achieve Outreach: media releases, survey's, direct contact, public meetings, coastal caucus, emails, brochures, attend and support partners with information booths, YouTube page for Sea Levels Rising, Video's (e.g., compare Estuary area un-restored, then restored), economic advantages of restoration and other actions determined by goals.

4.2.2.2. Action: Work with contractor to develop social media toolkit for estuary messages, making the outreach materials as relevant to local communities as possible (TNC, TWC, SWC, CTSI)

4.2.2.3. Action: Find grant funding sources for Outreach to achieve OCCEC goals. (see potential funders spreadsheet)

4.3. Strategy: Inform other planning processes to incorporate ecological function and climate change considerations

4.3.1. Objective: Updated local estuary plans incorporate current data and climate change adaptation planning by 2035.

4.3.1.1. Action: Participate in Yaquina Estuary Plan update as appropriate (MCWC, Audubon)

4.3.1.1.1. Utilize ODFW shellfish and eelgrass data to help inform decision-making (ODFW)

4.3.1.1.1.1. OAH/Ocean chemistry bill HB3114 Ocean Science Trust project funding

4.3.1.2. Action: Get involved/provide info in new DLCD estuary planning & Climate Change resilience efforts (TEP, ETG)

4.3.1.3. Action: See if there are opportunities to put more detail into State Climate Change plan (PSMFC)

4.3.1.4. Action: Participate in local visioning efforts as appropriate (TEP, NNSL)

4.3.1.5. Action: Track and provide input on other types of plans that could influence estuaries (e.g., ag. water management plans, integrated water resource plans, fill & removal permits) (NNSL)

4.3.1.6. Action: OCCEC folks involved in estuary projects connect with Blue Carbon working group and see how we can interact (ETG, TWC)

4.3.1.6.1. Opportunities for data collection

4.3.1.6.2. OCCEC connect with BCWG to investigate blue carbon financing for restoration projects.

4.3.1.7. Action: Complete assessment of Sea Level Rise impacts to human infrastructure (coast-wide with focus on estuaries) (DLCD - Done)

4.3.1.7.1. OCCEC participants review results to design projects/protection as human infrastructure is to be updated/relocated/developed to avoid impacts

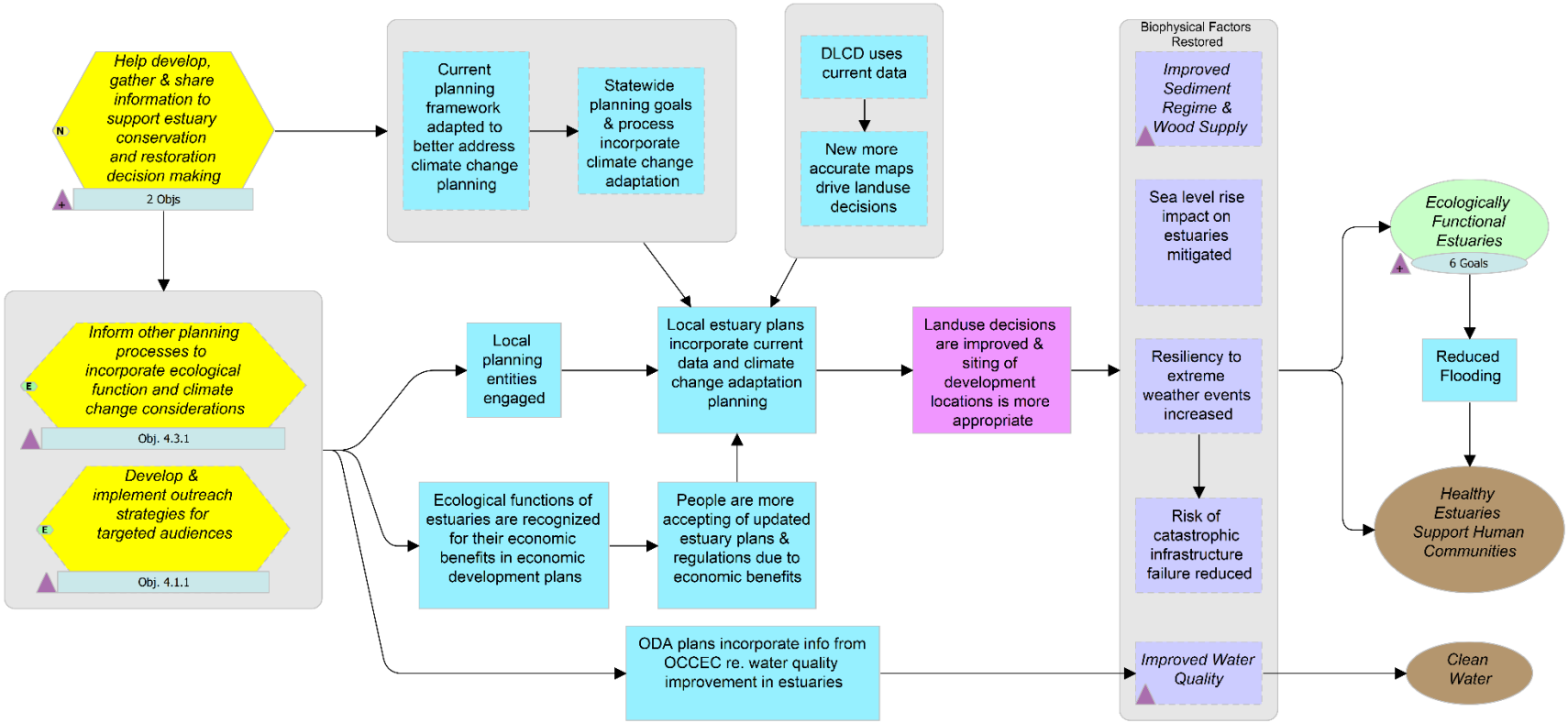
4.3.1.8. Action: Coordinate with communities & planners/commissions (local govt.) to incorporate climate change & natural resource issues into their comprehensive plans.

4.3.1.9. Action: Apply for funding to have estuary expertise available to DLCD as needed

Theory of Change

By engaging with local planning entities and highlighting the economic benefits of estuaries' ecological functions, we expect people to be more accepting of updated estuaries plans and regulations. That, in combination with more accurate estuary maps and planning goals/process that incorporate climate change adaptation, will result in local estuary plans that incorporate current data and climate change adaptation planning. As a result, land use decisions will be improved and developments will be sited in more appropriate locations. This will lead to more ecologically functional estuaries through more functional sediment regimes, less impact from sea level rise, increased resiliency to extreme weather events, reduced risk of catastrophic infrastructure failure, improved water and sediment quality, and reduced flooding in coastal communities.

Results Chain Diagram:



4.4. Strategy: Promote policy that benefits estuary health

4.4.1. Objective: Initiate or participate in one policy project a year that helps engage community decision makers on policies that affect estuary restoration or protection.

4.4.1.1. Action: Track and inform OCCEC about estuary related legislative proposals (TNC)

4.4.1.2. Action: Help design engagement messages related to estuary legislation and distribute to key decision makers

4.4.1.3. Review Global Warming Commission proposal to OR. Legislature on natural and working lands and consider how to align recommendations with OCCEC work (TNC, ETG)

4.4.1.4. Action: Find ways for Private Property Owners to be financially motivated to participate (e.g., tax breaks, direct payments, cash incentives for critical estuary habitats) (TWC & NRCS)

4.4.1.5. Action: Track & engage as appropriate discussions of new Eelgrass protection policy (TWC)

4.4.2. Objective: Help secure a future for tidal wetland protection and restoration activities in Tillamook County.

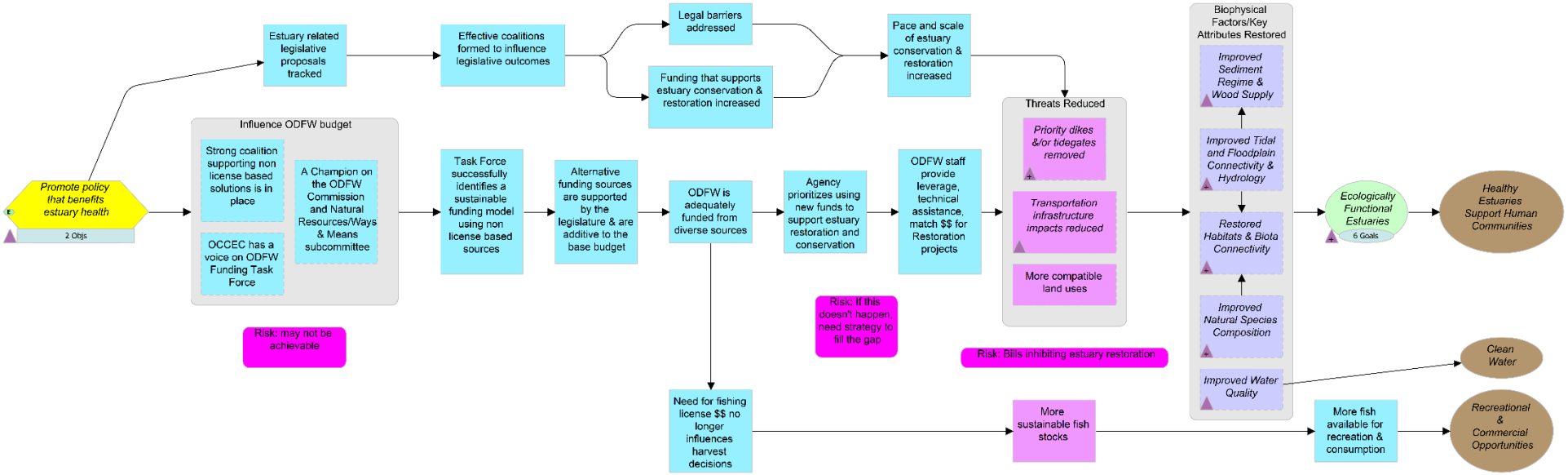
4.4.2.1. Participate in AAR and identifying ways to improve the process for future estuary restoration (TNC, TEP)

4.4.2.2. Support pilot project permit process & participate in public hearings etc. (TNC, PSMFC, TWC, TEP)

Theory of Change

Actions by the Oregon legislature have the potential to help or hinder estuary restoration and protection efforts. By tracking those and building coalitions to address them as appropriate, we can facilitate estuary conservation. Many OCCEC participants have been impacted by the loss of key ODFW staff due to limited budgets. We believe that finding alternative funding sources, that do not rely on hunting and fishing license fees, is a key to more sustainable ODFW funding. This will result in more stable staff resources who can provide technical assistance and match for estuary restoration projects. Less reliance on fishing license fees may also lead to more sustainable fish stocks.

Results Chain Diagram:

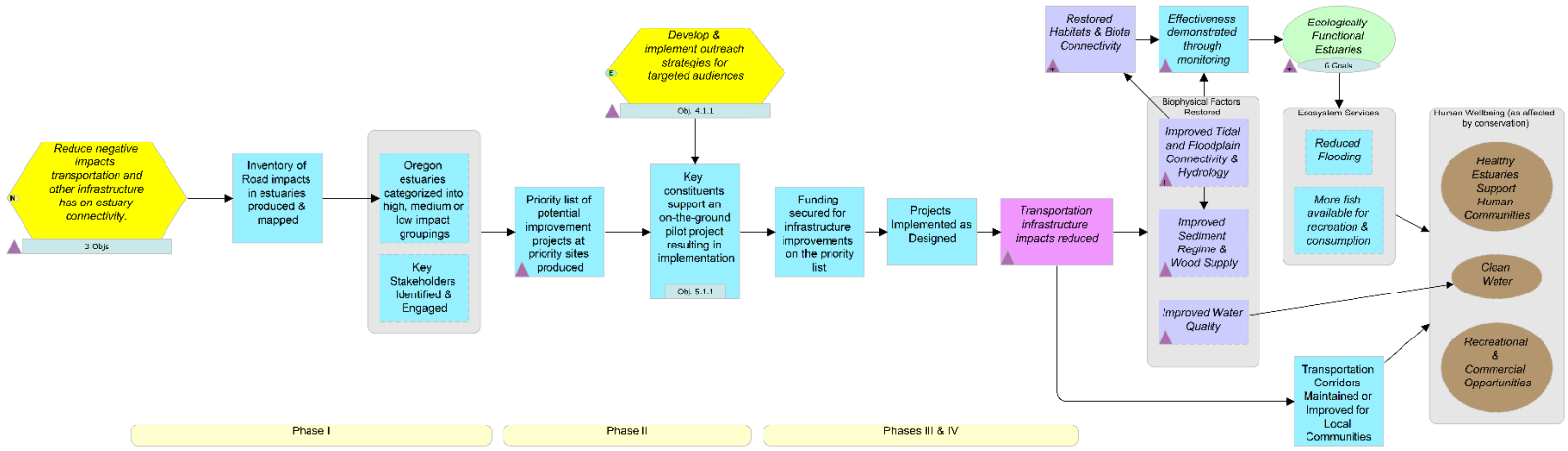


5. **OUTCOME/GOAL: By 2035, at least 5 priority transportation or other infrastructure impact project sites have increased hydrologic connection to tidal flows.**
   - **5.1. Strategy: Reduce negative impacts transportation and other infrastructure has on estuary connectivity.**
     - **5.1.1. Objective**: By 2028, implement at least one priority on-the-ground co-benefit pilot project that upgrades transportation infrastructure and improves estuary health
       - **5.1.1.1.** Action: Submit a competitive Focused Investment Partnership (FIP) application to OWEB
       - **5.1.1.2.** Action: Implement at least one transportation improvement project under the FIP Initiative in the Yaquina from 2022 to 2028
       - **5.1.1.3.** Action: Work with the Port of Alsea to lay the groundwork for designing a preferred alternative for a tidal wetland improvement project by 2028
     - **5.1.2. Objective:** By 2035, Implement at least 4 priority transportation projects utilizing lessons learned from the pilot.
       - **5.1.2.1.** Action: Develop priority list of potential improvement projects at priority sites.
       - **5.1.2.2.** Action: Identify sources & secure funding for infrastructure improvements on the priority site list beyond the pilot project.
       - **5.1.2.3.** Action: Conduct alternative routes study – identify alt. road access around estuaries and prioritize maintenance of these routes (USFS)
       - **5.1.2.4.** Action: Implement priority transportation improvement projects. (TEP, NNSL)
     - **5.1.3. Objective:** Institutionalize use of the assessment by at least 1 transportation entity (if feasible).
       - **5.1.3.1.** Action: Explore feasibility of a programmatic approach, including agency prioritization (STIPs) and funding sources
       - **5.1.3.2.** Action: Funding and possible policy proposals for the Transportation Bill, etc., highlighting the “triple bottom line”

Theory of Change

In Phase I of our strategy to Address Transportation Impacts to Estuaries, we believe that conducting an inventory to identify the estuaries that are most highly impacted by roads and engaging with ODOT during that process will help identify sites where projects might have the most ecological benefit. Overlaying the ecological priorities with ODOT infrastructure upgrade priorities and local community interests in Phase II, will result in a priority list of potential improvement project areas that have broad support. This phase will also require implementation of outreach strategies targeted to key audiences for this project. By combining ecological benefit, needed infrastructure upgrades, and local community interests, we expect to be able to draw on diverse funding sources to pay for these generally high-cost projects in Phases III & IV. Implementation of the projects will improve connectivity to tidal wetlands and fish passage. This will also benefit local communities through ecosystem services provided by more ecologically functional estuaries and by improved or more secure transportation corridors.

Results Chain Diagram:

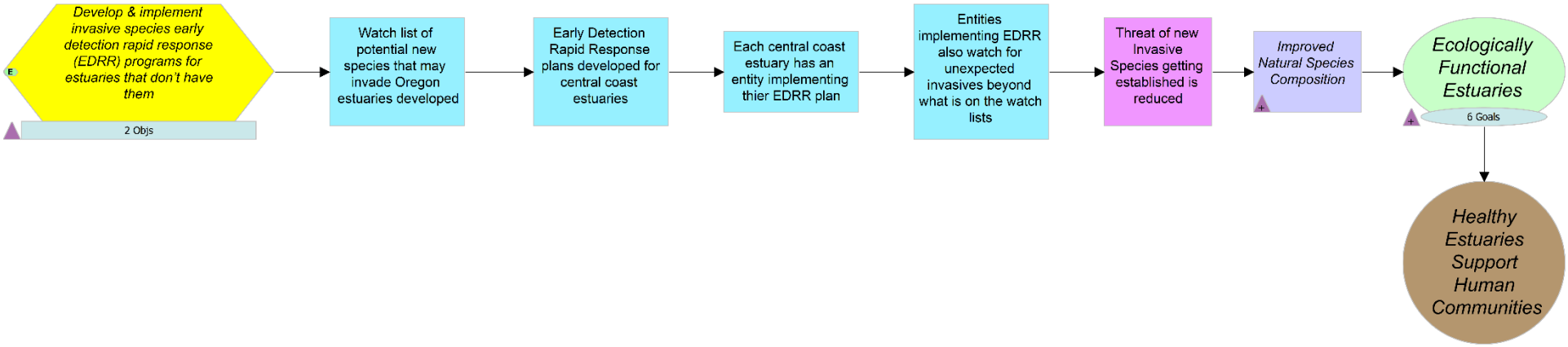


6. **OUTCOME/GOAL: By 2035, each Central Coast estuary has an invasive species Early Detection Rapid Response program in place to catch new invasions early.**
   - **6.1. Strategy: Develop and implement invasive species Early Detection Rapid Response (EDRR) programs for estuaries that don't have them**
     - **6.1.1. Objective:** Three different estuaries have developed EDRR plans by 2025.
       - **6.1.1.1.** Action: Identify which groups already have these and which species
       - **6.1.1.2.** Action: Identify any gaps and figure out if we can help fill them with resources &/or dedicated staff for the whole focus area
       - **6.1.1.3.** Action: Host a working group to develop a common EDRR protocol for OCCEC estuaries (TEP, TNC)
       - **6.1.1.4.** Action: Prepare & implement EDRR plans for Siuslaw estuary (TNC, SWC)
       - **6.1.1.5.** Action: Prepare & implement EDRR plans for Tillamook and Nehalem estuaries (TEP)
     - **6.1.2. Objective:** Remaining estuaries have developed and implemented EDRR plans by 2030. (Various)
       - **6.1.2.1.** Action: Prepare & implement EDRR plans for Siletz and Nestucca estuaries (USFWS Refuges, TEP)
       - **6.1.2.2.** Action: Prepare & implement EDRR plan for Yaquina, which is at high-risk due number of ships and boats (MCWC)

Theory of Change

By setting up Early Detection Rapid Response programs in each estuary on the central Oregon coast, potential new invaders will be found early before they are able to get well established leading to more effective control. Thus, the health of the estuaries will be protected from degradation.

Results Chain Diagram:



9 PROGRESS MONITORING FRAMEWORK

The OCCEC has established a monitoring subcommittee that is drafting a restoration effectiveness monitoring framework to guide development of project monitoring plans. This framework is expected to be finalized in 2022. At least a basic level of monitoring is recommended for all projects, with monitoring complexity based on the questions to be addressed by the monitoring for that project. More complex and costly monitoring will be done as needed to evaluate progress towards specific project objectives. The draft monitoring framework document is intended to guide all estuary collaborative partners in developing site-specific restoration effectiveness monitoring plans. The OCCEC monitoring subcommittee will review restoration monitoring plans to determine if they are designed to answer important monitoring questions for desired ecological outcomes in each habitat type. The OCCEC Monitoring Subcommittee can be a technical resource for project managers developing project specific monitoring plans, finding suitable reference sites, and analyzing data. The collaborative can also share other resources, tools, and equipment to support partners in restoration effectiveness monitoring as needed.

Baseline data collected at the project site and at suitable reference sites shall be collected for at least one year prior to restoration. Although the use of nearby reference sites that are monitored in the same way is highly recommended, data from ongoing reference site monitoring in other similar locations may be substituted if methods are comparable. Success will be measured by how closely the restoration site trends toward reference site conditions.

For each project, the local monitoring team or project manager will submit a monitoring plan to OCCEC prior to project implementation. Additionally, annual progress reports will include summarized monitoring results. The raw data will be held by the program responsible for project development and implementation. Each specific metric included in the OCCEC monitoring guide has a minimum monitoring duration recommended to demonstrate desired restoration effects. The OCCEC monitoring framework includes instructions for analysis of each metric and guidance on interpreting results, but project-specific adjustments may be needed depending on site characteristics. The project's monitoring team or project manager will analyze data to determine whether restored site conditions are on a trajectory towards reference site conditions and answer the project's monitoring questions. It is expected that the implementing programs will make monitoring reports available on their websites as appropriate.

Outputs

Implementation Results (outputs)	Objective	Metric
• OCCEC groups submit larger-scale grant proposals that cross boundaries • Dikes & other barriers to water flow removed or breached • Native tidal wetland vegetation replanted as needed • Channels restored • Large wood installed • Monitoring implemented	**Objective 1.1.1:** Implement restoration projects on about 900 acres in the Yaquina and Alsea estuaries by 2028. **Objective 1.1.2:** At least five prioritized estuary wetland habitat restoration projects, covering ~400 acres, implemented in OCCEC estuaries outside the FIP area by 2028. **Objective 1.1.3:** Implement additional priority tidal wetland habitat restoration projects to bring the cumulative total of acres restored between 2021 and 2040 to at least 2010 acres.	• FIP proposal submitted • # or linear feet of barriers to tidal flow removed or breached • Acres planted or seeded with native tidal wetland vegetation • Linear feet of channels restored • Number of nurse logs placed & planted • Key biophysical factors monitored (e.g., surface water elevation, salinity, planting survivorship, water temperature, channel & wetland elevation)
• Areas of intact tidal wetlands needing protection identified • Sites where protection efforts are needed for restoration to move forward identified	**Objective 2.1.1:** Protect 100-440 acres of remaining tidal swamp habitats and priority Landward Migration Zone (LMZ) lands in the Yaquina and Alsea estuaries by 2028.	• Acres protected by conservation ownership or easement • % of tidal wetland Landward Migration Zone (LMZ) lands permanently protected

• Feasible medium to high priority LMZ lands assessed and protected • Relevant Tribes contacted/consulted	**Objective 2.1.2:** By 2028, bring 400-700 acres in the Yaquina and Alsea estuaries into conservation ownership to allow for future restoration. **Objective 2.1.3:** Protect at least 100 acres of remaining tidal swamp habitats in the OCCEC estuaries outside the FIP area by 2035. **Objective 2.1.4:** By 2028, bring at least 250 acres in OCCEC estuaries outside the FIP area into conservation ownership to allow for future restoration **Objective 2.1.5:** 5% of tidal wetland Landward Migration Zone (LMZ) lands protected by 2035	
Appropriate landowner agreements in place for priority projects	**Objective 3.1.1:** By 2028, at least 5 priority landowners each in the Yaquina and Alsea Estuaries have signed landowner agreements to restore tidal wetlands on their lands. **Objective 3.1.2:** By Dec. 31, 2028, at least 1 priority property landowner in each OCCEC area estuary recruited following coordinated outreach, have signed landowner agreements to restore tidal wetlands on their lands.	# of recruited landowners with signed agreements
OCCEC list of priority working lands projects identified	**Objective 3.2.1:** By 2025, gather information from on-going efforts and new assessments needed to identify 5 priority working lands projects ready for implementation.	• # of estuaries with prioritized tide gate inventories • # of priority working lands projects ready for implementation
• Annual engagement opportunities identified, and schedule created, by OCCEC participants • Social media toolkit created	**Objective 4.1.1:** Provide coordinated engagement opportunities across the OCCEC focus area to a variety of audiences including at least one annual speaker presentation on an estuary topic in each estuary.	• # of engagement opportunities provided and # of people attending • # or organizations using estuary facts social media toolkit
• A common monitoring framework and reporting structure is agreed to by participants • Estuary related information is readily accessible on a web-based forum	**Objective 4.2.1:** Initiate one new project a year that improves decision makers' understanding of estuary function and restoration and/or fills a key data gap.	• # of decision maker engagement projects initiated • Data consistency and accessibility improved
OCCEC helps advance the science of estuary conservation & restoration through coordinated information gathering & sharing	**Objective 4.2.2:** Work with PMEP and others to develop outreach information to create and maintain a system that fosters a favorable economic and political climate in support of estuary conservation, restoration and resiliency.	# of informational products produced &/or data gaps filled
Land use decisions are improved & siting of development locations is more appropriate	**Objective 4.3.1:** Updated local estuary plans incorporate current data and climate change adaptation planning by 2035.	# estuary plans with current data and climate change adaptation
• Estuary related legislative proposals tracked • Effective coalitions formed to influence legislative outcomes	**Objective 4.4.1:** Initiate or participate in one policy project a year that helps engage community decision makers on policies that affect estuary restoration or protection.	# of policy projects with community decision makers.

	Objective 4.4.2: Help secure a future for tidal wetland protection and restoration activities in Tillamook County	
Road infrastructure improved at priority sites	**Goal 5.** By 2035, at least 5 priority transportation or other infrastructure impact project sites have increased hydrologic connection to tidal flows.	Project(s) implemented to increase tidal connection across road section in high impact estuary
	Objective 5.1.1: By 2028, implement at least one priority on-the-ground co-benefit pilot project that upgrades transportation infrastructure and improves estuary health	
	Objective 5.1.2: By 2035, Implement at least 4 priority transportation projects utilizing lessons learned from the pilot.	
Each central coast estuary has an entity implementing their EDRR plan	**Objective 6.1.1:** Three different estuaries have developed EDRR plans by 2025.	# of estuaries with implemented EDRR plans
	Objective 6.1.2: Remaining estuaries have implemented EDRR plans by 2030.	

Social Outcomes

Limiting Factor Reduction or Intermediate Ecological Outcome	**Outcome**	**Metric**
Human perceptions or attitudes that hinder estuary restoration/protection are reduced	**Goal 3:** By 2030 there will be increased landowner acceptance and understanding of the ecological benefits estuaries provide and the projects that restore them.	Change in perceptions about estuaries & restoration based on polling results
• Legal barriers addressed • Funding that supports estuary conservation & restoration increased • Pace and scale of estuary conservation & restoration increased	**Goal 4.** Through science, collaboration, and engagement with community members and decision makers, help facilitate opportunities to advance estuary conservation, restoration, and resiliency on the Central Oregon Coast.	• # of policies that inhibit or facilitate estuary conservation or restoration • Funding levels (over the previous 5-10 years)

Ecological Outcomes

Limiting Factor Reduction or Intermediate Ecological Outcome	**Outcome**	**Metric**
• Improved sediment regime • Improved Tidal and Floodplain Connectivity & Hydrology • Improved natural species composition • Increased carbon storage • Improved water quality • Priority dikes &/or tide gates removed • Transportation infrastructure impacts reduced	**Goal 1:** By 2040, the percent of functional tidal wetlands across the OCCEC Focus Area will be increased from current 43% to desired > 60% by increasing hydrologic connections to tidal flows, restoring channels, and replanting native tidal wetland vegetation as needed.	• Diked estuarine area as a percentage of current & historical tidal marsh and swamp • Acres with increased tidal connectivity and complexity

Resiliency to climate change increased	**Goal 2:** By 2040, key estuary lands will be protected through fee title acquisitions or long-term easements to conserve current, and potential future, tidal wetland areas that are likely to withstand sea level rise into the future.	• Acres protected by conservation ownership or easement • % of tidal wetland Landward Migration Zone (LMZ) lands permanently protected

10 ADAPTIVE MANAGEMENT

Monitoring data will be used to track implementation of actions and progress towards our SAP objectives. It will also inform us as to how well restoration sites are progressing towards key ecological benchmark values and reference conditions. Annual review meetings after the field season will include a review of any changes in action implementation, review of interim monitoring data, a discussion of lessons learned and whether any changes should be made going forward.

Approximately every five years, monitoring data will be evaluated and used to assess progress towards goals and objectives in the Strategic Action Plan and to update the plan. Included will be clarifications and recommendations for plan improvement as we adaptively respond to changes in the ecological, political, and socio-economic environment influencing estuarine restoration and protection. This will be a formal opportunity to reassess if our strategies are advancing our goals as we anticipated in our theory of change and results chains or if adjustments need to be made. This could occur earlier than five years if conditions change or if there is new scientific information that should be incorporated. As monitoring data show the achievement of goals and objectives, new goals and objectives will be developed to continue to build on these successes.

11 SUSTAINABILITY

In our scoring criteria for selecting projects, we prioritize projects that restore ecological function without the need for long-term management. If future stewardship is required, we prioritize projects that have a champion willing to invest energy into long-term management.

The sustainability of the OCCEC partnership is illustrated by its stability over the past 10 years and continued participation in the collaborative by a diversity of entities. Clearly it is still providing a useful forum and fulfilling a need for estuary conservation and restoration practitioners. We will continue to gauge interest and strive to improve our effectiveness by tracking levels of participation and through periodic surveys.

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13 PARTNERSHIP CERTIFICATION – Core Group

CERTIFICATION: I certify that this strategic action plan is a true and accurate representation of the proposed work and that I am authorized to sign as the Partner Representative or Co-Representative(s).

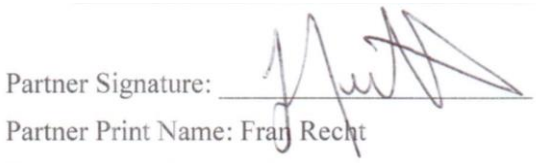
Partner Signature: 

Partner Print Name: Evan Hayduk

Title: Council Coordinator

Organization: MidCoast Watersheds Council

Date: 1/13/2022

Partner Signature: 

Partner Print Name: Fran Recht

Title: Board Member

Organization: Salmon Drift Cr. Watershed Council

Date: January 7, 2022

Partner Signature: 

Partner Print Name: Katie Ryan

Title: Executive Director

Organization: The Wetlands Conservancy

Date: 1/12/2022

Partner Signature: 

Partner Print Name: Rosemary Pazdral

Title: Executive Director

Organization: Siuslaw Watershed Council

Date: 1/12/2022

Partner Signature: 

Partner Print Name: Kristi Foster

Title: Executive Director

Organization: Tillamook Estuaries Partnership

Date: 1/12/2022

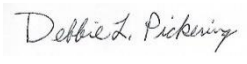
Partner Signature: 

Partner Print Name: Laura S. Brophy

Title: Director

Organization: Estuary Technical Group, Institute for Applied Ecology

Date: 1/12/2022

Partner Signature: 

Partner Print Name: Debbie L. Pickering

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Organization: The Nature Conservancy

Date: 1/12/2022

Partner Signature: 

Partner Print Name: Dave Shively

Title: Executive Director

Organization: Nestucca, Neskowin, & Sand Lake Watersheds Council

Date: 1/13/2022

GLOSSARY

Activities: A set of specific result-oriented actions, typically done in a certain order, undertaken by project staff and/or partners as part of implementing a strategy in service of achieving specified outcomes or intermediate results.

Biophysical Factor: a generic term that encompasses the biological and physical effects resulting from a direct threat and influencing the health of a conservation target.

Direct Threat: The proximate human activities or processes that are causing or may cause stresses or impacts and thus the destruction, degradation, and/or impairment of conservation targets (for example, unsustainable fishing practices, unsustainable logging practices).

Goal: High-level summary of the main outcomes and key strategies relative to the scale of an important conservation need or challenge.

Indicator: Measurable entity related to a specific information need (for example, the status of a key aspect of conservation target or value, change in a pressure, or progress toward an objective or ultimate outcome). Indicators can be collected using quantitative or qualitative methods. They are the specific data you will collect to assess, directly or indirectly, progress toward project outcomes.

Indirect Threat: Contributing factors identified in an analysis of the project situation that are drivers of or increase the severity of direct threats. They are often an entry point for conservation actions (for example, incompatible logging policies or unsustainable demand for fish).

Intermediate Results: essential precursors to achieving outcomes. Intermediate results are often the near-term focus of strategies and activities and serve as important early “wins” and evidence that our overall theory of change is playing out as expected.

Measures: Refers to a wide variety of information a project or program manager collects, analyzes, and uses. They are a way of communicating information about changes in the condition of an item of interest and are often based on monitoring data. The term “measures” is sometimes used as a synonym for “indicators”.

Opportunities: Contributing factors identified in the situation analysis that carry the potential of having a positive effect on conservation targets or outcomes, either directly or indirectly. They are often an entry point for conservation actions (for example, demand for sustainably harvested timber).

Outcomes: Describe the major results we intend to achieve as a result of our strategies and within the scope and timeframe of a plan or project. Outcome statements include context, are measurable, and are the basis of most reporting measures.

Primary Interests: A statement of "what matters" to NGOs, influential actors, or important stakeholders. Some, but not all, primary interests will be converted into outcomes during planning.

Results Chain: Results chains are one type of logic model diagram that map out a theory of change in a series of causal statements that link intermediate outcomes in an “if…then” fashion. Results chains are similar to Situation Analysis diagrams; they start with selected strategies and change the boxes to result-oriented descriptions that capture the presumed consequences of taking actions. A results chain diagram shows the desired future condition of the project.

Risks: Risks are specific uncertain events that might have a negative effect on conservation outcomes and strategies, or that may pose a risk to conservation organizations. They often focus on enabling conditions. Our ability to deliver conservation outcomes is influenced by our capacity to assess the risks associated with our investments, and by our ability to manage these risks through time.

Scope: Statement that defines expectations and makes explicit a project's strategic, geographic, and temporal boundaries.

Situation Analysis: An assessment that weighs the key factors affecting primary interests in a place or problem, including the political, socioeconomic, institutional, and ecological factors creating impacts or threats, driving change, and providing opportunities for conservation intervention.

Stakeholders: Individuals, groups, or institutions who have a vested interest in the natural resources of the project area and/or who potentially will be affected by project activities and have something to gain or lose if conditions change or stay the same.

Strategy: A broad course of action with a common focus designed (alone or together with other strategies) to achieve specified outcomes and related intermediate results. Strategies focus on "means" – the "how" for achieving particular results. Strategies arise from the situation analysis and are backed by a robust theory of change.

Target: A value, asset, entity, or element of biodiversity or human welfare that a project team is ultimately trying to change, restore, or conserve. Biodiversity targets are ecological entities such as species, habitats, or ecological systems chosen to represent or encompass the broader suite of biodiversity within a project area or scope. Targets for thematic, environmental problem-oriented projects may describe particular environmental conditions (e.g., average global temperature for a project dealing with global warming). Human welfare targets are aspects or values of human well-being that a project chooses to focus on. (The Millennium Ecosystem Assessment defines human well-being as including: necessary material for a good life; health; good social relations; security; and freedom and choice.)

Task: Discrete, time-bound steps in a work plan required to implement activities, a monitoring plan, or other components of a CBP. Tasks are often assigned to a particular person to complete by a specific point in time.

Theory of Change: Explanation of how and why our strategies will achieve intended outcomes. Logic models in diagrams or narrative form are often used to describe the linkages among important drivers, trends, issues, and actors, and the logic of how we believe our strategies will lead to ultimate outcomes over time. The theory of change also identifies important intermediate results that must be achieved.

Vision: A vision is a succinct and compelling statement about an important and relevant conservation challenge, the urgent need and opportunity for change, and how we propose to make a profound

APPENDICES

Appendix I. Primary Interests

At the start of our planning process, we brainstormed a list of the Primary Interests of conservation groups as well as our perception of other key stakeholders' interests.

Primarily Conservation Interests

- Wildlife habitat
  - Beaver
  - Shellfish
  - Juvenile fish
  - Marine fish & invertebrates
  - Avian species
  - Keystone species
  - Marine mammals
  - ESA-listed species & other rare species
- Habitat connectivity
  - Between ocean and estuary
    - Sand spit management
    - Marine reserves/MPAs
  - Aquatic species passage
- Natural shoreline integrity
- Natural processes
  - Floodplain processes
- Cover
  - Large wood
- Channel complexity
- Vegetation community diversity
  - Eelgrass beds
  - Sitka spruce tidal swamps
  - Rare habitats
- Sediment supply/regimes
- Substrate diversity
- Life history diversity
- Genetic diversity
- Research
- Alteration from historic condition
- Invasive species

Primarily Social Interests

- Fisheries
  - Commercial
  - Recreational
  - Other non-commercial
- Recreation opportunities
- Passing-on lifestyle to children
- Navigability
- Economics of estuaries (see also below)
  - LNG (liquefied natural gas)
  - Industries
  - $$$
- Aesthetics
- Dredging and dredge material disposal
- Wastewater treatment
- Loss of Ag. Land
  - Grazing
- Mosquitos
- Salinity intrusion into:
  - Farmland
  - Water supplies
- Government planning processes

Equally Relevant to Both Types of Interests

- Water Quality
- Climate change resilience
  - Landward migration
- Upslope land use
- Freshwater inputs
  - Upslope water control structures
- Tsunami & earthquake hazards
  - Hazardous waste storage
- Education of youth
- Community engagement
- Economics of estuaries (continued)
  - Restoration economy
  - Ecosystem services
  - Carbon sequestration & markets

Infrastructure in Estuaries

- Residential development
- Diking & tide gates
- Road/highway infrastructure
- Jetties
- Pilings and docks
- Marinas and boat basins

Appendix II. Table A. Characteristics of the 11 largest estuaries in the OCCEC Focus Area.

* Includes open water, tide flats, and current and historical tidal wetlands. Source: Brophy et al. (2019).

** Unless otherwise noted, data in this table are from Brophy (2019), whose analysis of tidal wetland loss primarily used diked areas from OCMP's 2014 CMECS mapping. OCMP's diked areas may not include areas disconnected from tidal influence by features other than dikes, e.g., other restrictive culverts, fill material, roads, etc. Therefore, tidal wetland losses are generally higher than shown.

Estuary Name	Estuary Size (acres)*	Area of Historical Tidal Marsh and Tidal Swamp (acres)	Diked Former Tidal Wetland Area (acres)	% Loss of Historical Tidal Marsh and Swamp due to Diking	% loss of Historical Forested Tidal Swamp Due to Diking and Vegetation Conversion	Current Area of Tidal Marsh and Tidal Swamp (acres)	Minimum Desired Area of Tidal Marsh and Tidal Swamp (acres) (60% of historical)	Difference (Current – Desired Area) (acres)	Ideal Desired Area of Tidal Wetlands (acres) (80% of historical)	Difference (Current – Ideal Area) (acres)
Nehalem	5253	2481	1362	54.9	87.1	1404	1489	-85	1985	-581
Tillamook	14,028	4636	3319	71.6	92.3	2090	2782	-692	3709	-1,619
Netarts	2634	301	0	0	88.0	274	181		241	
Sand Lake	1177	568	67	11.7	90.5	615	341		454	
Nestucca Bay	2766	1621	1270	78.3	99.3	376	973	-597	1297	-921
Salmon River	882	657	7	1.2	80.4	618	394		526	
Siletz Bay	2711	1072	222	20.9	78.1	825	643		858	-33
Yaquina	6649	2575	1404	54.5	92.3	909	1545	-636	2060	-1,151
Beaver Creek	240	222	0	0	99.6	203	133		178	
Alsea Bay	3562	1100	252	22.9	90.8	791	660		880	-89
Siuslaw	6320	2693	1003	37.2	96.0	1967	1616		2154	-187
Totals	**46,222**	**17,926**	**7,635**	**42.6**	**92.3**	**10,072**	**10,757**	**2,010**	**14,342**	**4,581**

Appendix II. Table B. Characteristics of smaller estuaries on the Central Oregon Coast.

* includes open water, tide flats, and current and historical tidal wetlands. Sources: PMEP 2018, Brophy et al. (2019)

** includes areas which do not fully drain to the estuary. Source: PMEP 2018

Estuary Name	**CMECS Estuary Type** (Heady et al. 2014)	**EPA 2010 Classification**	**Estuary Size (acres)***	**Estuary Drainage Areas (acres)****
Lake Lytle	Lagoonal	Coastal Lagoon	83	
Rockaway Beach Creek	Riverine	Tidally Restricted Coastal Creeks		
Rockaway Clear Lake	Riverine	Tidally Restricted Coastal Creeks		
Smith Lake	Lagoonal	Coastal Lagoon	2.7	
Rover Creek	Riverine		0.24	
Chamberlain Lake	Lagoonal	Coastal Lagoon	6	
Sears Lake	Lagoonal	Coastal Lagoon	14	
Miles Creek	Riverine	Tidally Restricted Coastal Creeks		
Daley Lake	Riverine	Tidally Restricted Coastal Creeks	21	16,640
Neskowin Creek	Riverine	Tidally Restricted Coastal Creeks	11	16,640
Devils Lake	Riverine		1	10,880
Fogarty Creek (also called School House Creek)	Riverine		2	
Depoe Bay	Riverine	Marine Harbors/Coves	12	13,440
Little Creek	Riverine		12	16,640
Big Creek (N) (Lincoln County)	Riverine	Tidally Restricted Coastal Creeks	25	10,880
Yachats River	Riverine	Tidally Restricted Coastal Creeks	63	28,160
Tenmile Creek	Riverine	Tidally Restricted Coastal Creeks	4	14,720
Rock Creek	Riverine		Estuary mouth connection area	
Big Creek (S) (Lane County)	Riverine		4	25,600
China Creek	Riverine		0.8	
Cape Creek	Riverine		1	25,600
Berry Creek	Riverine	Tidally Restricted Coastal Creeks	1	14,720
Sutton Creek	Riverine	Tidally Restricted Coastal Creeks	30	14,720

Appendix II. Table C. CMECS definitions for Estuarine Types of the Central Oregon Coast (Lanier et al. 2014)

Riverine Estuaries	Estuaries that tend to be linear and seasonally turbid (especially in upper reaches), and which can be subjected to high current speeds. These estuaries are sedimentary and depositional, so they may be associated with a delta, bar, barrier island and other depositional features. These estuaries also tend to be highly flushed (with a wide and variable salinity range) and seasonally stratified. Riverine estuaries have moderate surface-to-volume ratios with a high watershed-to-water-area ratio—and they can have very high wetland-to-water-area ratios. These estuaries are often characterized by a V-shaped channel configuration and a salt wedge. High inputs of land drainage can promote increased primary productivity, which may be confined to the water column in the upper reach, due to low transparency in the water column. Surrounding wetlands may be extensive and healthy, given the sediment supply and nutrient input. This wetland perimeter may be important in taking up the excess nutrients that are introduced to the system. Physically, the system may tend to be stratified during periods of high riverine input, and the input of marine waters may be enhanced by countercurrent flow."	All estuaries in the central coast are considered riverine estuaries except the 7 listed below
Lagoonal Estuaries	CMECS describes these estuaries as usually having a very high surface-to-volume ratio, a low-to-moderate watershed-to-water-area ratio, and can have a high wetland-to-water ratio. The flushing times tend to be long relative to riverine estuaries and embayments because the restricted exchange with the marine-end member and the reduced river input lengthen residence times. As such, there tends to be more benthic-pelagic interaction, enhanced by generally shallow bathymetry. Additionally, exchange with surrounding landscapes (often riparian wetland and palustrine systems) tends to be enhanced and more highly coupled than in other types of estuaries. Occasionally, a lagoon may be produced by the temporary sealing of a river estuary by a barrier (e.g. Sand Lake Estuary). Such lagoons are usually seasonal and exist until the river breaches the barrier; these lagoons occur in regions of low or sporadic rainfall."	Lake Lytle Smith Lake Chamberlain Lake Sand Lake Sears Lake Fogarty Creek (School House Creek)
Embayment/Bay Estuary	"A water body with some level of enclosure by land at different spatial scales. These can be wide, curving indentations in the coast, arms of the sea, or bodies of water almost surrounded by land. These features can be small—with considerable freshwater and terrestrial influence— or large and generally oceanic in character." "This class of estuary tends to be shallow, highly enclosed, and have reduced exchange with the ocean. They often experience high evaporation, and they tend to be quiescent in terms of wind, current and wave energy."	Netarts

Appendix II. Table D. Implemented Estuarine Restoration Projects as of 2017

(does not include: projects that are only planting, weed control, clean-up, or large wood placements; and conservation acquisitions unless restoration also included)

Estuary Name	Project Name	Restoration Action	Year Completed	Tidal Wetland Acres Restored	Managing Entities
Nehalem	Alder Creek Farm	Dike removal & channel restoration?	2005	35?	Lower Nehalem Community Trust
Tillamook	OWEB grant 97-811	3 Tide gates replaced or modified	1998		Tillamook Bay National Estuary Project/TCPP
Tillamook	OWEB grant 99-016	8 Tide gates replaced or modified	2000		Tillamook Bay National Estuary Project/TCPP
Tillamook	Tillamook Tide gates (Blaser #1&2)/OWEB grant 99/336	2 Tide gates replaced or modified	2001		Tillamook County Performance Partnership
Tillamook	Tillamook Tide gates (Hathaway #1 & 2)	2 Tide gates replaced or modified	2001		
Tillamook	Tillamook Tide gates (Schriber #2)	1 Tide gate replaced or modified	2001		
Tillamook	Tillamook Tide gates (Fuhrman, Blind Slough) /OWEB grant 99/336	3 Tide gates replaced or modified	2001		Tillamook County Performance Partnership
Tillamook	Miami River Restoration Project	Ditches filled, tidal channels re-created, large wood installed	2011	44	Tillamook Estuaries Partnership
Tillamook	Miami Wetlands Restoration Plantings OWEB 213-1053-10602	Estuarine vegetation planted	2014	17	The Nature Conservancy
Tillamook	Kilchis Estuary Restoration	Dike removal, ditch filling, channel creation, slough reconnection; planting is ongoing	2015	66	The Nature Conservancy
Tillamook	Southern Flow Corridor	Dike and tide gate removal, ditch filling, channel restoration, road and fill removal, structure removal, large woody debris placement, plantings	2017	521	Tillamook Co, USFWS, OWEB
Netarts	Netarts Oyster Restoration Project OWEB 207-043	Existing estuary improved by reintroduction of native animal species	2008	3	The Nature Conservancy
Nestucca Bay	Millport Slough – Jackson & Gray Tracts	Estuarine connection restored by dike or berm modification / removal	2003	200	DU
Nestucca Bay	Little Nestucca Tidal Marsh Restoration	Estuarine connection restored by dike or berm modification / removal; Tide gate removed and not replaced	2007	82	USFWS/DU
Salmon River	Tidal Marsh Restorations (Mitchell, Y Marsh, etc.)	Dike removal	1976,1987, 1996	150 acres	U.S. Forest Service
Salmon River	Tamara Quays Dike Removal and Rowdy Cr. Fish Passage Culvert	Estuarine connection restored by dike or berm modification / removal; Existing estuary improved by channel modification; Tide gate removed and not	2010	13	Salmon Drift Creek Watershed Council & USFS

Estuary Name	Project Name	Restoration Action	Year Completed	Tidal Wetland Acres Restored	Managing Entities
	OWEB 208-1040/208-1061-7658	replaced; Culverts/ structures/ fords replaced with open bottom arch culverts; Estuarine vegetation planted			
Salmon River	Pixieland Phase I –Restoration OWEB 208-1061-8288	Main stream channel modified / created; Estuarine connection restored by dike or berm modification / removal	2011	40	Salmon Drift Creek Watershed Council & USFS
Salmon River	Pixieland Restoration Phase II	Estuarine connection restored by dike or berm modification / removal; Existing estuary improved by channel modification; Tide gate removed and not replaced	2014	10	Salmon Drift Creek Watershed Council & USFS
Salmon River	Lower Salmon River Lessons Learned Report and Crowley Creek Restoration OWEB 208-1061-9664	Estuarine connection restored by dike or berm modification / removal; Wetland vegetation planted; Wetland treated for non-native or noxious plant species; Culverts/structures/ fords replaced with culverts placed embedded or flat	2014	3	USFS & Salmon Drift Creek Watershed Council
Salmon River	Boat Basin Salmon River and Mink Creek Restoration OWEB 214-1003/208-1061-11234	Existing estuary improved by channel modification; Estuary treated for non-native or noxious plant species; Estuarine vegetation planted; Estuarine connection restored by dike or berm modification / removal	2014	2.5	Salmon Drift Creek Watershed Council
Salmon River	Fraser Tidal channel restoration	Installed new culvert under Hwy 101, reconfigured channel, and filled ditch	2017	40	Salmon Drift Creek & MidCoast Watersheds Councils/USFS/ODOT
Siletz Bay	Keys / Kernville Marsh	Restore Tidal estuary by removing portions of levees, removing culverts, and creating channels	2002	85	DU / USFWS
Siletz Bay	Siletz Tidal Salt Marsh Connectivity and Fish Passage OWEB 212-1013	Culverts replaced with culverts placed embedded or flat; Estuarine connection restored by estuarine culvert modification / removal; Large wood placed	2013	40	Lincoln SWCD
Siletz Bay	Alder Island	Two dike breaches with culverts placed in dike surrounding Alder Island for fish passage, 0.3 miles of tidal channel created, 4 acres of tidally influenced wetlands partially improved tidal flow	2016	4	USFWS – Siletz Bay NWR/DU
Yaquina	Yaquina Estuarine Wetland Restoration /OWEB 99-452	Dike breaching, channel formation	2001	70	MidCoast Watersheds Council, OWEB, Fish America Foundation, PSMFC, Green Diamond Resource Company, Georgia Pacific Fish America Foundation

Estuary Name	Project Name	Restoration Action	Year Completed	Tidal Wetland Acres Restored	Managing Entities
Yaquina	35th St. Fish Passage OWEB 210-1004	Estuarine connection restored by estuarine culvert modification / removal; Culverts/ structures/ fords replaced with culverts placed embedded or flat	2010	6	ODFW, OWEB
Yaquina	Poole Slough		2016	2.25	MCWC/OWEB/Lincoln Co., The Wetlands Conservancy
Yaquina	Oregon Oyster	1400 ft. Dike removal and estuarine channel encouragement	2016	8.2	The Wetlands Conservancy
Alsea Bay	Lower Drift Restoration Project	Acquisition of property by USFS, education outreach with charrette program, dike removal and breaching, removal of concrete drains	2005	82	USFS, MCWC, NOAA, Rocky Mountain Elk Foundation
Alsea Bay	3 phase restoration Lint Slough-Alsea Bay Restoration OWEB 98-105, 208-1054; monitoring 208-1062	Estuarine habitat created from non-estuarine/non-wetland area; Estuarine connection restored by dike or berm modification / removal; Existing estuary improved by channel modification	2000, 2009	80 acres tidal marsh; 50 acres mudflat	ODFW, USFWS, OWEB, City of Waldport, Port of Alsea, USFS, MidCoast Watersheds Council, DU
Alsea Bay	Lower Drift Creek OWEB 205-159	5.6 miles of planting and fencing to exclude livestock, stabilize streambanks, plant 7,000 trees and replace two barrier culverts on small tributaries to Drift Creek.	2009	50	USFS/MCWC/Alsea WC
Siuslaw	North Fork Siuslaw Estuary Tide Channel Restoration Project WY009 – Estergard	Dike breaching	2001	85	Siuslaw SWCD
Siuslaw	North Fork Restoration, ODOT mitigation	Dike breaching, ditch filling, tidal channel construction, planting	2007	7 acres	ODOT (mitigation for North Fork Bridge)
Siuslaw	Karnowsky Creek	Channel re-grade and re-meander (estuary and upstream)	2001	1 mile estuarine	USFS, Siuslaw SWCD, SI, SWC
Siuslaw	Wilbur Mitigation Bank (?)	Dike breaching and ditch filling	2010	162 acres	Private
Siuslaw	Siuslaw South Slough Tide gate and Culvert Project OWEB 03-02-002	Tide gate replaced or modified	2003		Siuslaw Watershed Council
Siuslaw	Phey Passage	1 Tide gate replaced or modified	2010		ODFW

Appendix III. Major Estuary Profiles

Nehalem Estuary

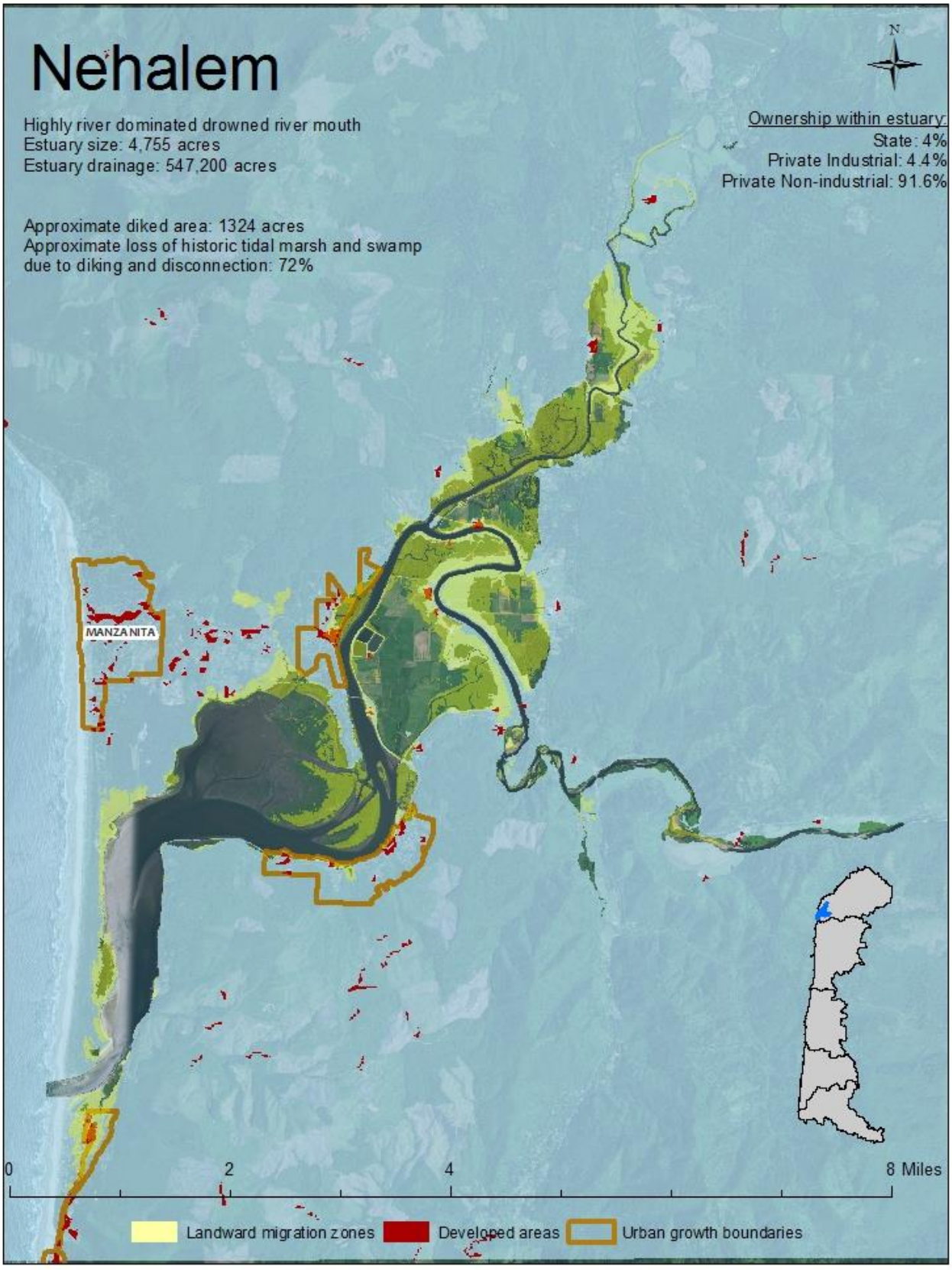
The Nehalem Estuary is a river-dominated mixing bowl at the confluence of the Pacific Ocean that collects waters of 105 river miles draining 855 square miles of watershed. Water passes through four counties on its way to the estuary. Once there, water mixing is highly stratified during winter high flow and moderately stratified during summer low flow (Adamus et al. 2005). The head of tide is approximately 13 miles from the mouth. Ownership is largely corporate timber, state forest, agriculture and smaller areas of urban development. The Nehalem Basin, which is the source of all fresh water arriving in the estuary, has been called the most aquatically diverse basin on the North Oregon coast (Nehlson 1997). Upon its arrival, it is often sediment laden, too warm, and has levels of fecal coliform bacteria that exceeds Oregon Dept. of Environmental Quality standards. Though it is estimated 72% of the associated wetlands and salt marshes have been lost due to diking, ditching, and levees (Brophy & So 2005), the heavy and rapid sedimentation largely due to logging has added some salt marsh along the west side of Dean's Point and West Island. Stewart Schultz (1990) posits in his book *The Northwest Coast: A Natural History* that estuaries of Nehalem's gradient (low) and design, (drowned river mouth) will in time lose their wide quiet waters to channelization as sedimentation continues to build marsh and narrows the flow of water to high velocity. However, sea level rise could be a mitigating factor.

The estuary itself is embraced by three small communities. Nehalem and Wheeler are physically adjacent, with the city of Nehalem considered the river town and Wheeler, further downstream, the bay front. The City of Manzanita is generally not physically connected to the estuary except for a few parcels in its Urban Growth Boundary, but it is the gateway to Nehalem Bay State Park, which forms the western boundary of the estuary. Dairy is the dominant industry in the upper reaches of the estuary, while tourism and second home sales and construction are the economic engines of the 3 "urban communities." This is especially true for the full and many part time residences in Manzanita and the unincorporated area to the north, Neahkahnie. The Bayside Gardens unincorporated area, which lies on the estuary's north edge between Manzanita and Nehalem, is sometimes referred to as "Contractor Village." Many service industry employees and some long-time local families reside in either Nehalem or its downstream neighbor Wheeler. Three marinas and a marine repair shop make up the only water related industries and are located along the bay front from Wheeler to the South jetty. It should be noted that the three communities have joined together to support a comprehensive cleanup of the Nehalem Estuary every two years for the past twenty.

The Estuary is home to an elk herd, deer, otter, black bear, coyote, beaver, mink, raccoon and the occasional cougar passing through. Seals make their year-round perch on the sandspit just upstream of the North Jetty and have on occasion been attacked by killer whales. Never less than 3 nesting pair of bald eagles and a multitude of shorebirds and other waterfowl count on this estuary for food and nesting habitat. The estuary supports a recreational Dungeness crab and clam fishery, and a salmonid population that includes, steelhead and cutthroat trout, coho, chum, and chinook salmon, all of which use the estuary for metabolic transition and some for extended "nursery" stays before entering the ocean. Sand shrimp, sculpin, perch, sole and other small non-salmonids make up about 95% of the total fish population. All species are supported by the diverse vegetation of the many types of tidal wetlands in the estuary, which range from low and high salt marsh to scrub-shrub and forested tidal wetlands. For example, the salt marsh plant community provides predator cover and the beginnings of the long and necessary food chain that relies upon detritus from the low and high salt marsh community. Protecting what is left and restoring what has been lost are the highest priorities of the Lower Nehalem Community Trust, which has already gained title to most of the north edge of the undeveloped portion of the bay.

Landward Migration Zones (LMZs) are the areas upslope of current tidal wetlands where wetlands may migrate in the future. These are based on sea level rise scenarios as the future tide range will predict the possible future extent of tidal wetlands. The following map shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100 (Brophy and Ewald 2017). Areas along the North Fork and east of the junction of the mainstem Nehalem with the North Fork are expected to have the largest LMZs in the future.

Notes for All Maps in this Section:
Unshaded areas represent the estuary boundary according to DLCD's CMECS mapping (Lanier et al. 2014)
See Appendix II. Table A for Citations for estuary size, diked area and % loss
Data Sources include: ESRI; NAIP imagery; Or. Dept. of Land Conservation & Development; Estuary Technical Group, Institute for Applied Ecology; MidCoast Watersheds Council; & The Nature Conservancy



Tillamook

Tillamook Bay is located in central Tillamook County between the towns of Rockaway Beach and Netarts. The city of Tillamook (pop. 5,183) lies southeast of the estuary. Nestled between rugged mountains and the Pacific Ocean with over 597 square miles of rivers and creeks and a bay totaling 13 square miles, Tillamook Bay is Oregon's second- largest bay. The bay supports a thriving oyster industry and some of the best runs of salmon and steelhead on the West Coast. In addition, broad fertile floodplains play host to rich dairy lands which produce world-class cheese. A healthy and functioning Tillamook Bay is essential to not only honor our cultural landscape and crucial natural resources, but to the overall vitality of its surrounding communities.

The estuary drains the watersheds of five rivers: Miami, Kilchis, Wilson, Trask, and Tillamook. It is a river dominated estuary but the predominant source of sediments or nutrients is ocean derived (Adamus et al. 2005). Waters are highly stratified during summer low flow but vertically homogeneous during winter high flow. Head of tide is approximately 17 miles from the mouth. Wetland habitats in and around the estuary include: salt marshes, aquatic beds, freshwater emergent wetlands, forested wetlands, and mudflats. The Wetlands Conservancy has designated the Tillamook estuary as one of Oregon's Greatest Wetlands.

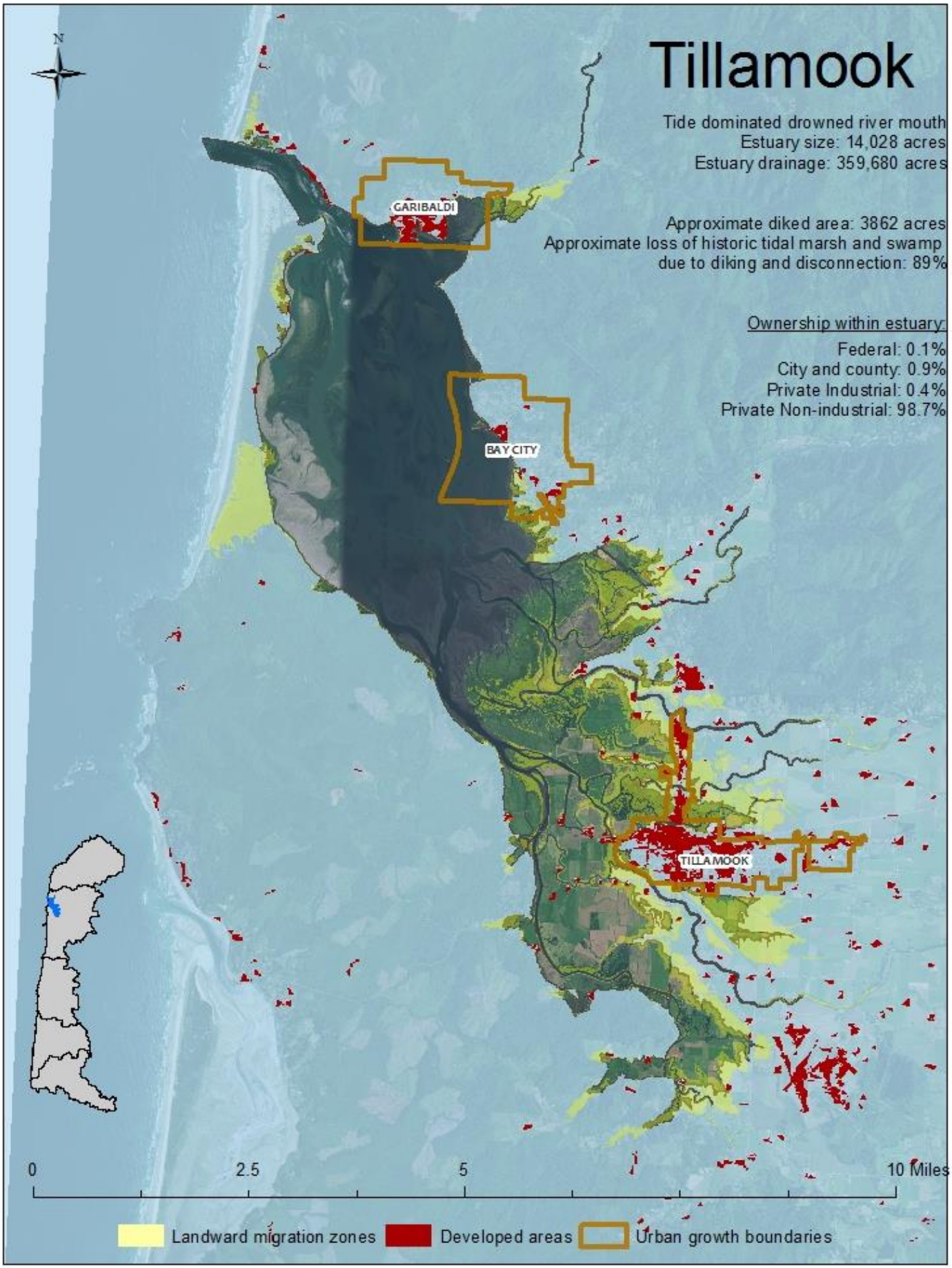
Much of the land in the watershed is privately or state-owned. The vast 364,000-acre Tillamook State Forest is east of the bay and is a major area for commercial logging and recreation. The uplands are primarily used for timber production, while the lowlands are primarily used for agriculture, dairy, and residential uses. The estuary is used for commercial and sport fisheries and other recreation activities.

Water temperature and toxics continue to be areas where improvements are needed. Bacteria, sediment, and dissolved oxygen are all improving throughout the watershed, which indicates a positive effect on water quality in the bay.

The rivers and bay provide important habitat for coho, Chinook and chum salmon, steelhead and cutthroat trout, and a variety of estuary-dependent species including forage fish, juvenile groundfish, marine invertebrates and waterbirds. Tillamook Bay supports close to 25 percent of Oregon's northern- and central-coast wintering waterfowl population and is designated as an Important Bird Area (Audubon 2018). It is consequently recognized by the Northern Pacific Coast Regional Shorebird Management Plan for shorebird migration (Drut & Buchanan 2000). The Tillamook Basin is a north coast stronghold for Pacific salmon species, including the federally threatened Oregon coho; the estuary environment is essential for salmon health, particularly for species that rear in lower river reaches (coho and chum) or spend months in the estuary (Chinook). The Kilchis River is known for having one of the last sustaining chum salmon runs in Oregon.

The disconnection of tidal wetlands from adjacent stream channels has been identified as one of the most critical limiting factors to the persistence of anadromous fish (Bottom et al. 2005; Brophy 2007), migratory waterfowl (Audubon 2018), and declining coastal wetland plant communities (Brophy 2007). It is estimated that 89% of historic tidal marsh and swamp habitats have been lost in Tillamook due to diking and disconnection (Ewald & Brophy 2012).

Landward Migration Zones (LMZs) are the areas upslope of current tidal wetlands where wetlands may migrate in the future. These are based on sea level rise scenarios as the future tide range will predict the possible future extent of tidal wetlands. The following map shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100 (Brophy and Ewald 2017). Areas southeast of the bay, near the city of Tillamook, are predicted to have the largest LMZs in the future. Areas around Garibaldi and the Bayocean Peninsula Park may also undergo LMZ movement in the future.


Tillamook
Tide dominated drowned river mouth
Estuary size: 14,028 acres
Estuary drainage: 359,680 acres
Approximate diked area: 3862 acres
Approximate loss of historic tidal marsh and swamp due to diking and disconnection: 89%
Ownership within estuary:
Federal: 0.1%
City and county: 0.9%
Private Industrial: 0.4%
Private Non-industrial: 98.7%
GARIBALDI
BAY CITY
TILLAMOOK
N
0
2.5
5
10 Miles
Landward migration zones
Developed areas
Urban growth boundaries

Netarts Bay

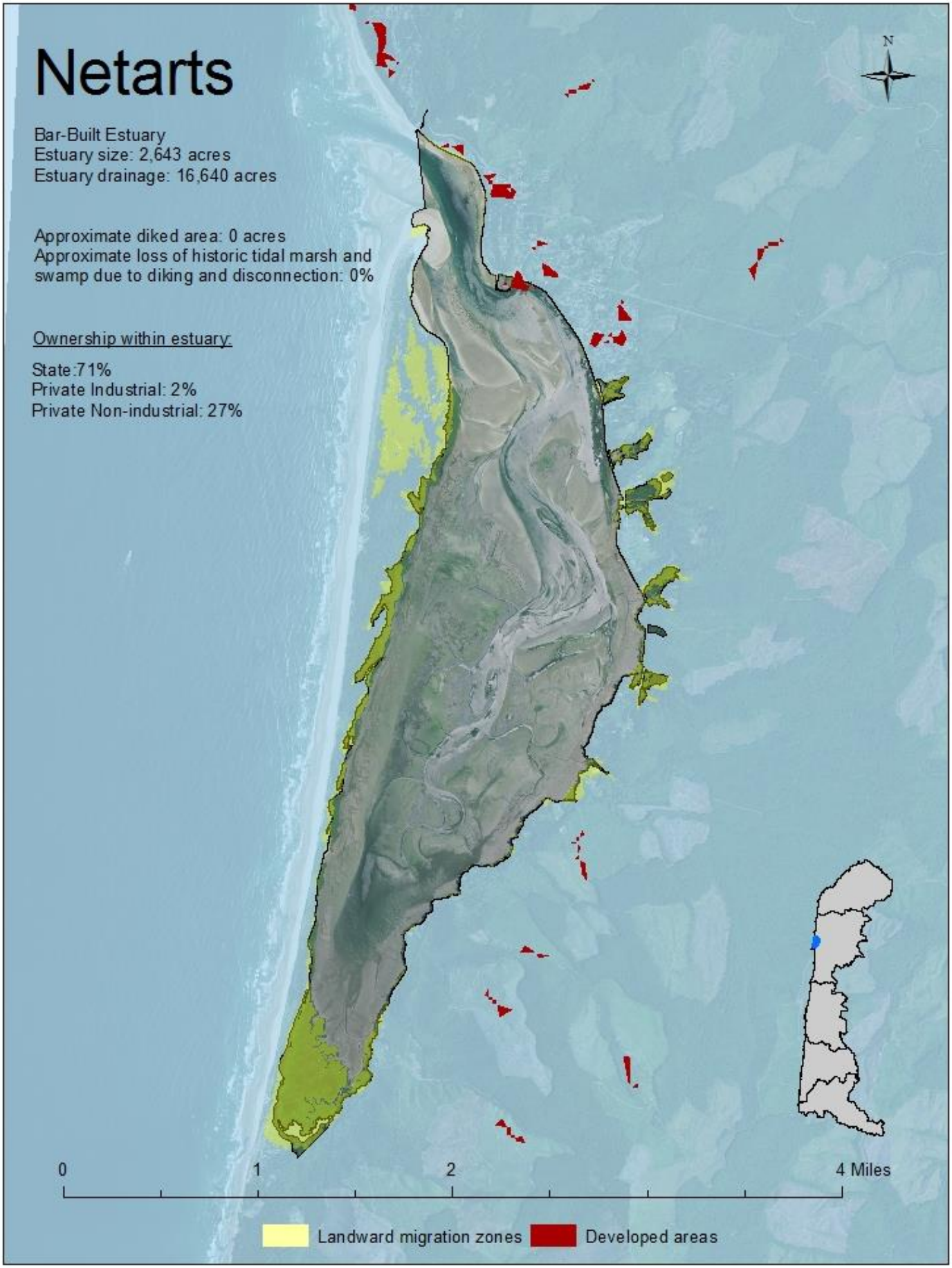
Netarts Bay is located in central Tillamook County between the communities of Netarts and Sand Lake. The Bay boasts a predominately pristine estuarine environment compared to its sister bays in Tillamook County with no diked areas (Lanier et al. 2014). This is due to the relatively light influence of development along its shores and throughout its watershed. Rather than being fed by larger rivers, Netarts Bay is fed by 16 smaller direct-to-bay creeks so it is an ocean dominated system. However, the predominant source of sediment or nutrients is land-derived, especially during fires of 1900 and logging of the 1950s and 60s (Adamus et al. 2005). Mixing of waters is vertically homogeneous during both winter high flow and summer low flow. The bay and estuary are approximately 2,643 acres, 812 of which are permanently submerged and 275 in tidal wetlands. Netarts is shallow compared to other Oregon estuaries. The watershed has dune and marsh communities in lowland areas. Wetland habitats in and around the estuary include: salt marshes, aquatic beds, freshwater emergent wetlands, forested wetlands, and mudflats. In spite of its size, Netarts Bay is a highly dynamic system that influences coastal erosion throughout its littoral cell.

Much of the land in the watershed is privately or state-owned. To the west of the bay is Cape Lookout State Park which is a popular area for fishing, camping, and sightseeing. The unincorporated community of Netarts (pop. 748) lies northeast of the estuary. The uplands are primarily used for timber production, while the lowlands are primarily used for residential uses. The estuary is used for commercial and sport fisheries and other recreation activities. In addition to the many recreational opportunities, Netarts is home to robust commercial oyster operations and an emerging premium sea salt industry. The Netarts Bay Shellfish Preserve is located on the south side of the bay, which includes areas both open and closed to commercial fishing and harvesting. Because of Netart's relatively unaltered natural state, it is often used as a reference site to compare the water and habitat quality of other estuaries.

The Netarts watershed is home to salmonids such as chum, coho, winter steelhead, cutthroat trout and chinook which require a range of habitat types: freshwater for spawning, estuaries for adaptation to salt water, and marine habitats for rearing. Coho salmon, winter steelhead, cutthroat trout, and chum are all currently listed species either federally or through the state which requires special consideration be given to habitat. Other common species include a variety of migratory and resident waterfowl and songbird species, elk, beaver, and black bear. The Audubon Society considers Netarts Bay an Important Bird Area; "Netarts Bay hosted an average of 43% of Oregon's wintering population of Black Brant during January counts 1996-2002. During two counts of shorebirds during 1988-1991, the peak count at Netarts Bay was 4,818 shorebirds in fall." (Audubon 2018).

Native oysters are important in estuary function as they improve water, provide habitat complexity for other species in their shell reefs, and serve as prey for other species. Little effort has been directed at restoring functionality to estuaries through the restoration of marine species populations that formerly played an important keystone species role in estuaries. However, Netarts Bay is a pilot site for a project focused on restoring the Pacific Northwest's native Olympia Oyster within its historical distribution.

Landward Migration Zones (LMZs) are the areas upslope of current tidal wetlands where wetlands may migrate in the future. These are based on sea level rise scenarios as the future tide range will predict the possible future extent of tidal wetlands. The following map shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100 (Brophy and Ewald 2017). Areas southwest and west of the bay are predicted to have the largest LMZs in the future.


Netarts
Bar-Built Estuary
Estuary size: 2,643 acres
Estuary drainage: 16,640 acres
Approximate diked area: 0 acres
Approximate loss of historic tidal marsh and swamp due to diking and disconnection: 0%
Ownership within estuary:
State:71%
Private Industrial: 2%
Private Non-industrial: 27%
N
0
1
2
4 Miles
Landward migration zones
Developed areas

Sand Lake Estuary

The Sand Lake Estuary, located in southern Tillamook County, empties into the Pacific Ocean between Cape Lookout and the community of Tierra del Mar. The estuary drains 16,000 acres and has freshwater inputs primarily from groundwater and four small creeks: Sand Creek, Jewel Creek, Gurtis Creek, and Reneke Creek. These creeks contribute very little towards the character of Sand Lake Estuary because of their limited freshwater inflow in comparison to tidal inputs. The predominance of marine inputs combined with the restrictive effect of the estuary's sand bar create a lagoonal estuary type. Head of tide is located approximately 4.5 miles from the mouth. Estimated mean annual freshwater inflow to the estuary is 109 cfs, and during an average winter flood tide freshwater inflow constitutes about 6% of the tidal inflow (Kreag 1979). Sand Lake Estuary is a bar built estuary with extensive marshes and a major island directly east of its mouth. Whalen Island was formed through dune and tidal marsh stabilization. Several other active dunes also exist in the Sand Lake drainage area. The mouth of the estuary is flanked by dynamic sand spits. USFS (1998) analysis of historic channel locations west of Whalen Island show that they have moved dramatically from wave forces and seasonal erosion in this high energy area.

Sand Lake Estuary is classified as a “natural” estuary by the Oregon Land Conservation and Development Commission (ODLCD Coastal Atlas 2018), indicating it is to be managed to preserve its natural resources and avoid constraining the dynamic ecosystem processes. The estuary is estimated to have lost only 11% of its historic tidal marsh and swamps due to diking and disconnection. Approximately 67 acres of the estuary is diked (Brophy 2019). There are three dike-type structures in the estuary (ODSL 1972): a county road that accesses Whalen Island, a flood control dike along the northern shore of the estuary, and Beltz Dike on the estuary’s southern shore.

There are no major population centers around the estuary. The village of Tierra del Mar sits on its southern edge along the Pacific Coast and several ranches and low-density residences lie along the shore lands. In the early 1900s cranberry bogs were cultivated in the Sand Lake estuary, bringing families to the area for harvest. The fertile valleys and extensive dunes of the Sand Lake basin offer pristine land for dairy farmers as well as other agriculture and recreation land users. Today the estuary has several popular recreational areas offering year-round campgrounds, day use facilities, and off highway vehicle riding (OHV) through many miles of sand dunes, including: Cape Lookout State Park to the north, USFS Sand Lake Recreation Area at the estuary mouth, Whalen Island County Park, and the Sitka Sedge State Natural Area.

Sand Lake Estuary has historically excellent starry flounder and Dungeness crab recreational fishing and abundant duck and geese use during migration and wintering periods. Anadromous fish species historically found in Sand Lake include steelhead trout, cutthroat trout, coho salmon, chum salmon, Chinook salmon and Pacific lamprey. There was a commercial fishery for chum salmon in the estuary and a private chum salmon hatchery on Sand Creek until the 1950s. Shrimp burrows, small cockle and Baltic macoma have been documented on the flats and unconsolidated bottom habitat types that dominate the estuary (Kreag 1979). Patches of eelgrass and algae provide important food and shelter for aquatic organisms. The southern spit provides important habitat for the Western Snowy Plover, a threatened bird that nested in the sand along this spit in 2016, the first time since 1984. A unique *Sphagnum* fen along the northern edge of the estuary was documented in 1953 containing the northernmost occurrence of *Darlingtonia californica* (Christy 2005). It is not uncommon to find elk, deer, black bears, beavers, and the occasional cougar in the Sand Lake estuary along with 43 different bird species. The Wetlands Conservancy has designated Sand Lake as one of Oregon’s Greatest Wetlands.

Currently the dike and bridge to Whalen Island is being replaced with an enlarged bridge, which will improve water circulation on the east side of the island and improve sediment and nutrient transport processes. The Salmon SuperHwy partnership is working to inventory all the potential fish passage barriers in the watershed and the Nestucca, Neskowin and Sand Lake Watersheds Council has led the restoration of several passage barriers on Jewel Creek. The Sand Lake Working Group is collaborating to gather more information about additional restoration priorities in the watershed.

The following map shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100 (Brophy and Ewald 2017). Areas along the north, south, and west are predicted to have the largest LMZs in the future.

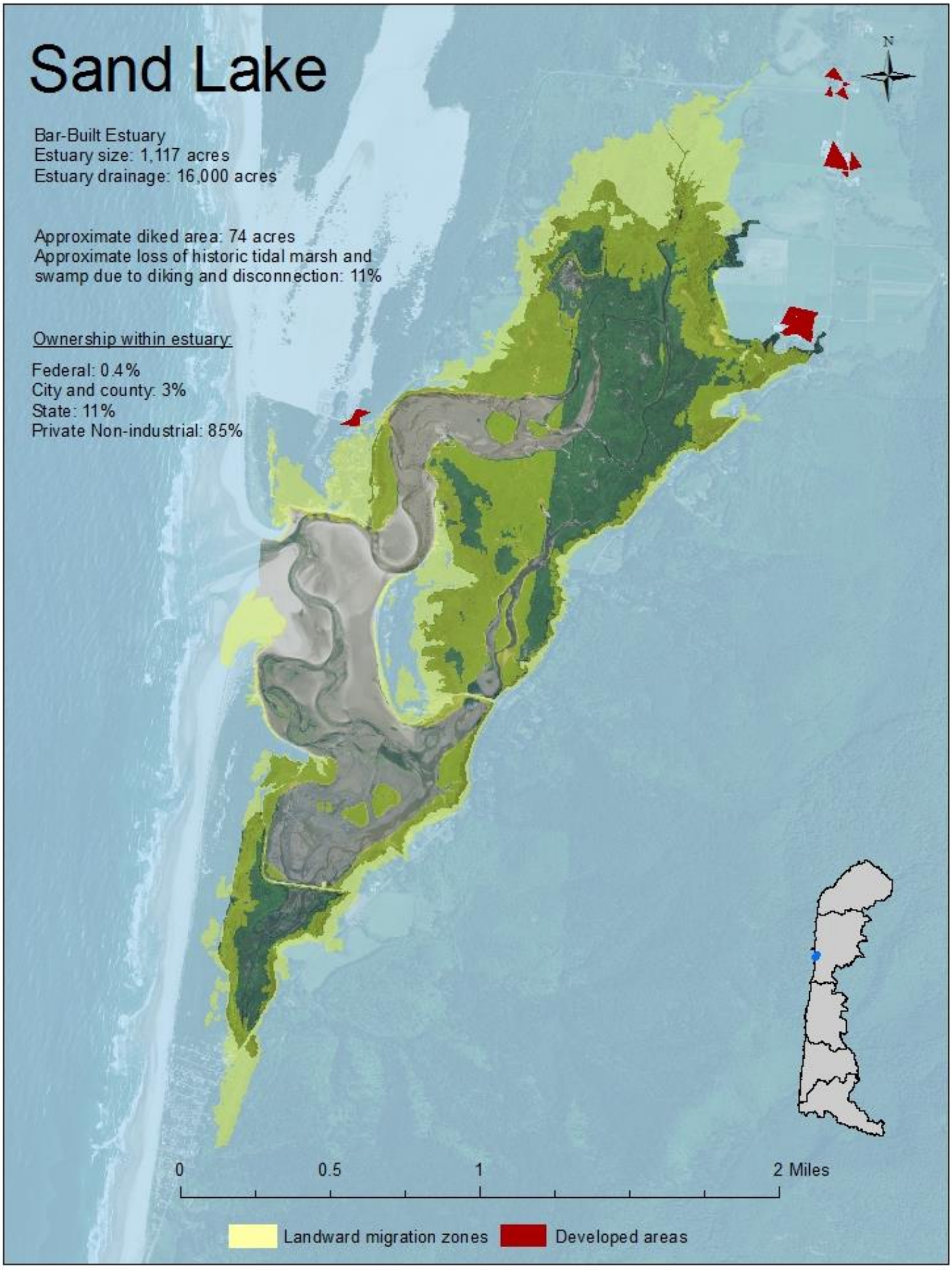
Sand Lake

Bar-Built Estuary
Estuary size: 1,117 acres
Estuary drainage: 16,000 acres

Approximate diked area: 74 acres
Approximate loss of historic tidal marsh and swamp due to diking and disconnection: 11%

Ownership within estuary:

Federal: 0.4%
City and county: 3%
State: 11%
Private Non-industrial: 85%



Nestucca Bay Estuary

Of the 22 major estuaries in Oregon, Nestucca Bay is one of six without maintained jetties or channels. It is ocean dominated and the head of tide is about 8.6 miles from the mouth. The estuary is located at the confluence of the Pacific Ocean and two main tributaries: the Nestucca, and Little Nestucca Rivers in south Tillamook County between Pacific City and Oretown. The Nestucca River is the larger of the two and flows 53 miles east-northeast with a watershed that extends over 258 square miles. The smaller Little Nestucca flows approximately 18 miles southeast of the estuary mouth and has a basin of approximately 64 square miles. The Nestucca fork of the estuary extends from the farm fields north and east of Pacific City to the undeveloped, Nestucca Bay spit which constitutes the western boundary of the estuary. The estuary also extends east along the Little Nestucca River into a broad floodplain dominated almost exclusively by wetland pastures and tidal marsh.

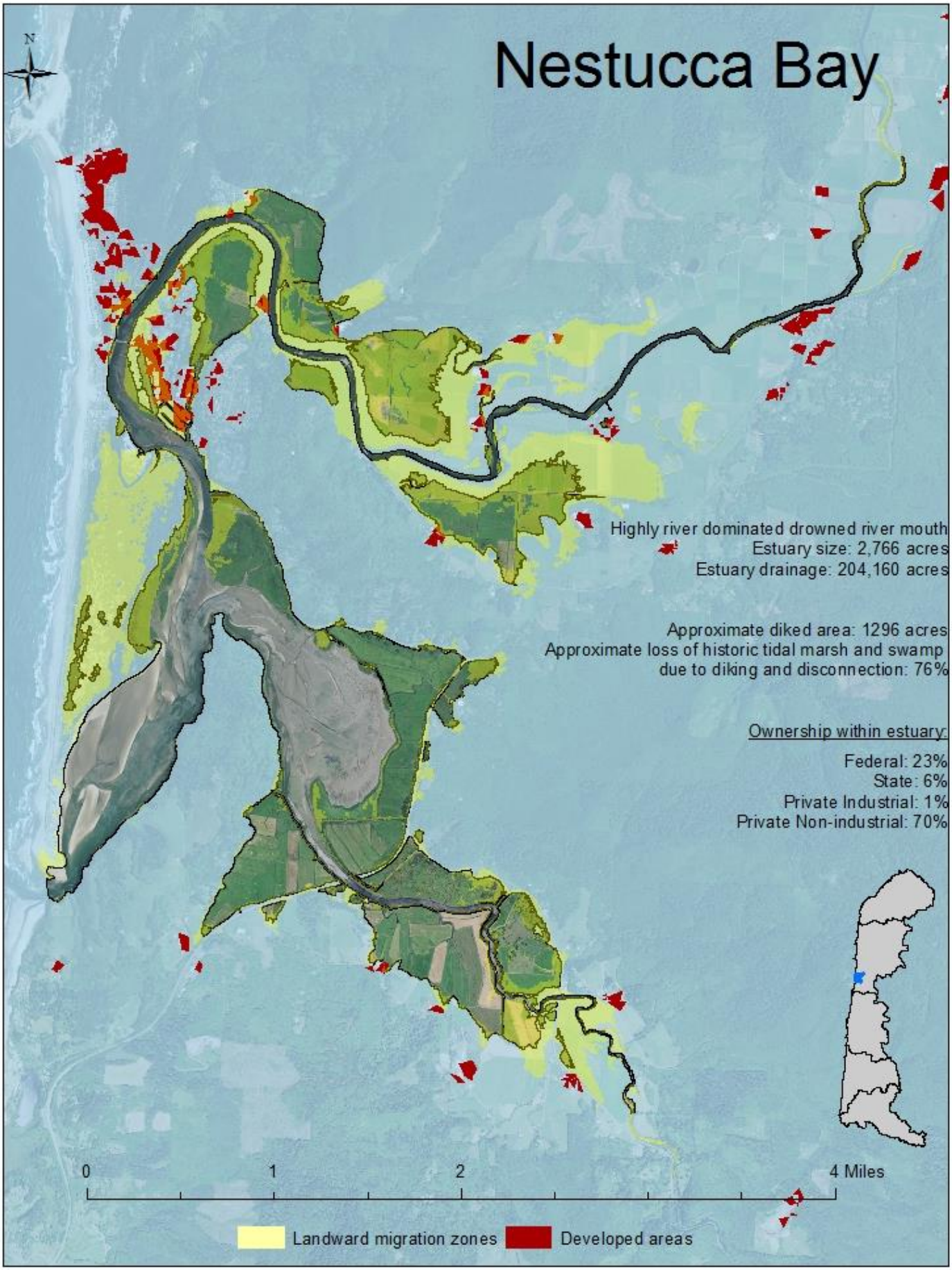
The Nestucca Bay Estuary is composed of a diverse network of public and private landowners due to its proximity to Pacific City. Residential and commercial landowners occupy several acres within the estuary that fall within the city limits of Pacific City. However, most of the critical estuarine habitat is located south of Pacific City where the two rivers converge and falls under the governance of the USFWS Oregon Coast National Wildlife Refuge Complex. The Nestucca Bay Wildlife Refuge (NBWR) protects and enhances habitat over 893 acres for Dusky Canada Geese. The NBWR engages in pasture management with local dairy farmers to offer prime habitat for geese during the winter. In 2007, an 83-acre tidal marsh restoration project resulted in a 30% increase in tidal marsh habitat in the estuary. In 2009, the refuge acquired 76-acres where the entire subpopulation of Semidi Islands Aleutian Cackling Goose resides during the winter. There is an additional 2,500+ acres still in private ownership that falls within the approved refuge boundary.

The Nestucca Bay estuary has the geomorphology of a drowned river mouth and contains habitat types that include intertidal salt marsh, tidal streams, mudflats, diked tidal flats, and estuarine forestland including several acres of Sitka spruce tidal swamps. Saltmarsh plants are found in areas with higher levels of salinity; these include plants such as pickleweed and saltgrass, which form important buffers as their densely matted roots stabilize shorelines and absorb pollutants. Over 40% of the National Wildlife Refuge is lowland pasture located behind either dikes &/or tide gates. Following European settlement, diking and draining estuarine and wetland habitat became the standard practice along the Nestucca and Little Nestucca Rivers to create usable land for cattle grazing resulting in a 76% loss of historic tidal wetlands.

The diverse habitats within Nestucca Bay support a great diversity of wildlife; most notably six subspecies of wintering Canada geese. The freshwater wetlands and estuarine habitats support thousands of migratory shorebirds and waterfowl earning it an Important Bird Area designation (Audubon 2018). Peregrine Falcon and Bald Eagles observations are numerous throughout the year. The recently de-listed California Brown Pelican also uses the open waters of the estuary as foraging habitat during summer and early fall.

The Nestucca Bay estuary and its two tributaries also provide essential habitat for Chinook, chum, and threatened coho salmon, and steelhead and coastal cutthroat trout. Historical data suggest that at one point the Coho salmon population was over 107,000 within the river. Mammals such as Oregon voles, marsh shrews, muskrats, mink, beaver, raccoons, and river otter can be found in the marshes and wetter pastures. Harbor seals forage over flooded tide flats and can be found resting at the mouth of the river. Roosevelt elk and deer graze the marsh and pasture lands. Long-toed and Pacific giant salamanders, Pacific chorus frogs, and rough-skinned newts are common throughout the area. Marine invertebrate such as crabs and clams are also abundant throughout the estuary. Wood-boring crustaceans and bivalve mollusks are abundant in the lower salt marshes and subtidal wetlands. These invertebrates play an important role breaking down large woody debris and are important links in the food chain.

The following map shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100 (Brophy and Ewald 2017). Areas west of the bay and northeast along the Nestucca River are predicted to see some advancing tidal wetland (LMZ) in the future, while significant areas currently within tidal wetland elevation range along the Little Nestucca are predicted to convert to mudflat or open water.


Nestucca Bay
N
Highly river dominated drowned river mouth
Estuary size: 2,766 acres
Estuary drainage: 204,160 acres
Approximate diked area: 1296 acres
Approximate loss of historic tidal marsh and swamp due to diking and disconnection: 76%
Ownership within estuary:
Federal: 23%
State: 6%
Private Industrial: 1%
Private Non-industrial: 70%
0
1
2
4 Miles
Landward migration zones
Developed areas

Salmon River

The Salmon River Estuary lies between Neskowin to the North and Lincoln City to the South. It is classified as a drowned river mouth estuary because it formed in the mouth of a flooded river valley, allowing a great deal of tidal flushing to occur. The total estuary area is 204 acres with head of tide located approximately 4.3 miles from the mouth. The mouth of the river is partially exposed to ocean waves, but the historically dynamic sand spit along the south end of its inlet has been stabilized over the past several decades by invasive European beachgrass and shorepine. Cascade Head, the prominent landform above the estuary, was formed by the uplift of underwater volcanic basalt flows.

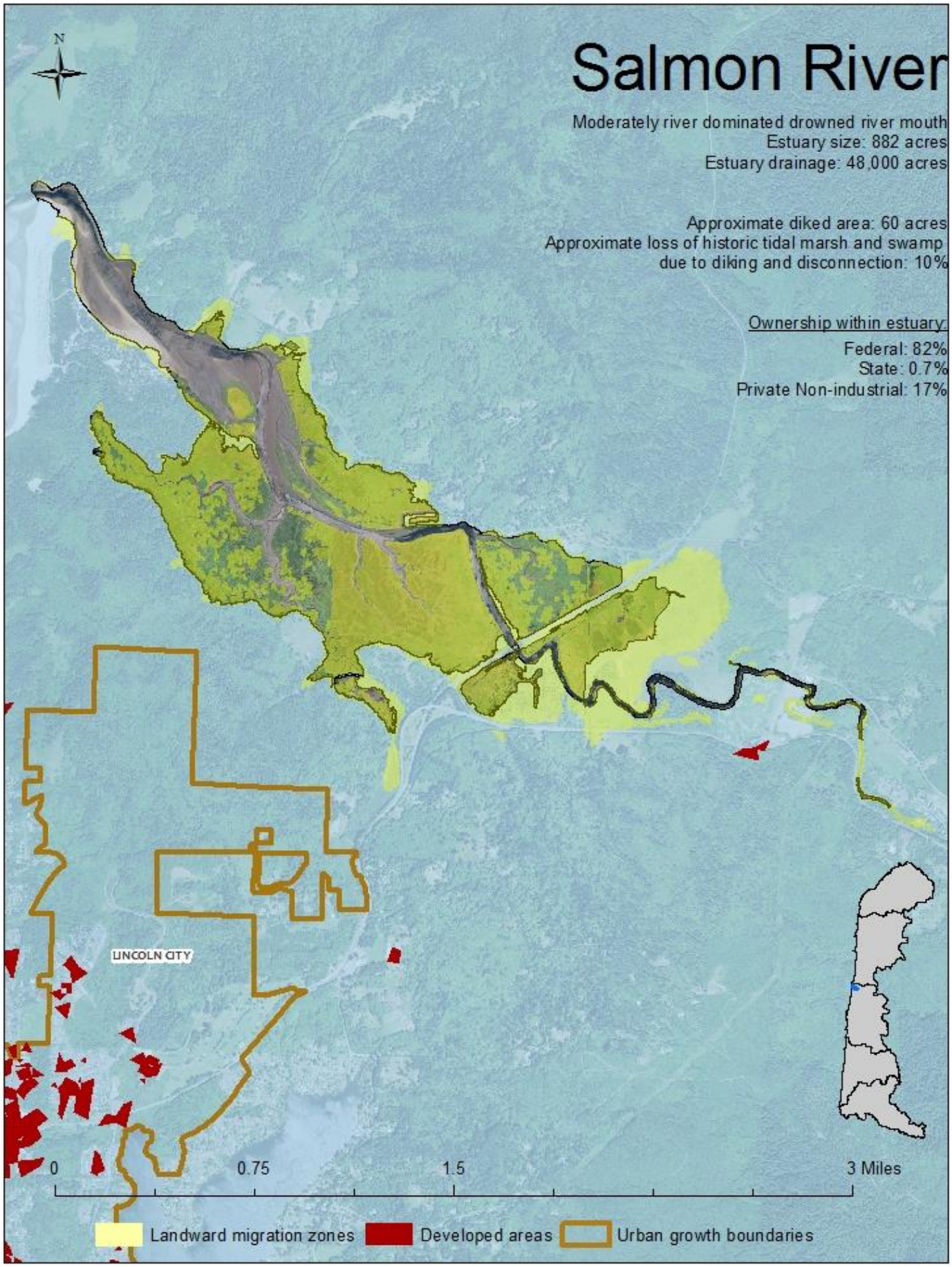
The Salmon River Estuary is currently used by 387 species: 230 birds, 56 mammals, 12 amphibians, 6 reptiles, and at least 74 fish. Three native species, the California Condor, the wolf, and the sea otter were eliminated from the area before 1915. Birds are the most numerous and conspicuous animals. The Salmon River Estuary is designated as an Important Bird Area for Brown Pelican, Bald Eagle, Peregrine Falcon, and for the presence of 1,000 or more shorebirds (mostly Western Sandpipers) at any given time (Audubon 2018). Examples of wildlife commonly seen here are mammals such as elk, deer, fox, beaver, raccoons, porcupine, rabbits, skunks, seals and sea lion, as well as red legged frogs, rough skinned newts, and garter snakes. The Salmon River has long been known for its abundance of fish. Chinook, coho, and chum salmon dominated the catches in the river and stories of catching fish by the dozens were not uncommon. Research done in 2000-2002 in the Salmon River estuary found Chinook salmon fry disperse into the estuary in the early spring and many move into restored tidal marsh habitat for an extended period of time. The results of this and later studies indicate that wetland restoration has increased estuarine rearing opportunities for juvenile Chinook and coho salmon and improved the resilience of salmon populations by providing suitable habitats for a variety of salmonid life history strategies (Jones et al. 2014).

The Salmon River (or Nechesne) Tribe occupied the estuary for at least 500 years prior to EuroAmerican settlement (Beckham 1984). They spoke a distinct dialect of Salish known as Neschesne. A trade route, known as the Salmon River Trail, from Sheridan to the Salmon River was well established and was mapped in 1850. This trail was used by inland tribes to reach the coastal rivers and waters via the Salmon River. European settlers began moving into the Salmon River area in the mid-1800s. Dairy production was the mainstay for many pioneer families once transportation became more reliable.

Due to its ecological significance, Cascade Head Preserve and surrounding national forest and other lands totaling 9,760 acres, have won recognition as the Cascade Head National Scenic Research Area (CHSRA). CHSRA was established when President Ford signed Public Law 93-535 on Dec. 22, 1974. This is the first scenic research area designated in the United States. In 1980 the entire CHSRA was designated a Biosphere Reserve as part of the United Nations Biosphere Reserve Man and Biosphere Program.

Between 1954 and 1974 most of the estuary was diked, ditched and tide gated to create pastures, and the construction of U.S. Highway 101 also disconnected the estuary. Estuary restoration work, primarily removing dikes and tide gates, began in 1978 and continues today. In the summer of 2006, a team of students developed a comprehensive restoration plan for the Salmon River estuary that identified six site-specific, high priority projects. Restoration work proceeded with the first of these identified projects in 2007 at the Tamara Quays trailer park development; the project returned the site back to tidal marsh and restored function to Rowdy Creek. Next, Pixieland, an abandoned amusement park, was restored to tidal marsh and forested tidal swamp, and a new channel for Fraser Creek was excavated. Crowley Creek was restored in 2012 restoring function to the lower tidal zone, and Boat Basin, a marina which was carved into the marsh floor was restored in 2014 reconnecting Mink Creek back to the Salmon River (Ellingson & Ellis-Sugai 2014). In 2015, Fraser Creek was reconnected under Highway 101 to the excavated channel at the Pixieland site and the Fraser Creek ditch was filled in 2017.

Landward Migration Zones (LMZs) are the areas upslope of current tidal wetlands where wetlands may migrate in the future. These are based on sea level rise scenarios as the future tide range will predict the possible future extent of tidal wetlands. The following map shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100 (Brophy and Ewald 2017). Areas along the eastern edge of the current estuary are predicted to have the largest LMZs in the future.


N
Salmon River
Moderately river dominated drowned river mouth
Estuary size: 882 acres
Estuary drainage: 48,000 acres
Approximate diked area: 60 acres
Approximate loss of historic tidal marsh and swamp due to diking and disconnection: 10%
Ownership within estuary:
Federal: 82%
State: 0.7%
Private Non-industrial: 17%
LINCOLN CITY
0
0.75
1.5
3 Miles
Landward migration zones
Developed areas
Urban growth boundaries

Siletz

The Siletz Bay estuary, which covers approximately 2,711 acres, including open water, tide flats, and current and historical tidal wetlands, has a watershed of about 373 square miles. Estuarine influence extends inland about 24 miles but fluctuates considerably due to the geomorphology of this watershed (Adamus et al. 2005). The estuary is river dominated and its waters are moderately stratified during both winter high flow and summer low flow. Based on a 2001 assessment, the estuary contains a total of 623 acres of tidal and formerly tidal marshes and swamps (Brophy 2001). A preliminary comparison of 1850s historic vegetation with recent vegetation mapping (Brophy 2011) indicated a 47% loss of tidal marsh and 84% loss of tidal swamp within the estuary.

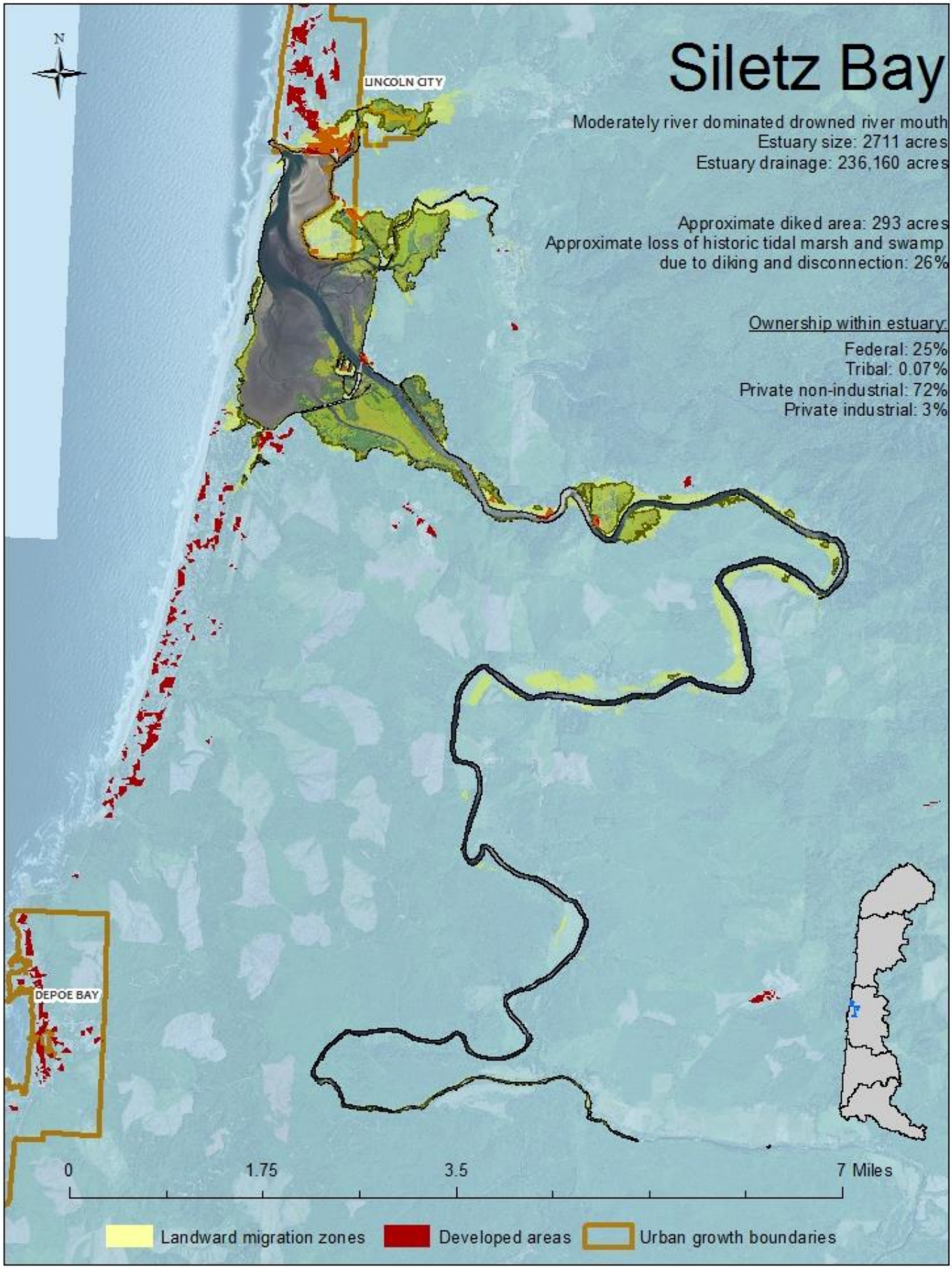
Most of the estuary is composed of either intertidal, muted tidal, or diked tidal marshes draining into the Siletz River, Millport Slough, Drift Creek, or directly into Siletz Bay. Remaining wetlands west of U.S. Highway 101 are largely intact, with natural tidal hydrology. However, old dikes located on the Siletz Keys parcel affect tidal exchange. East of Highway 101 and on the south bank of the Siletz River, the 10-acre Schoen Tract contains a perimeter dike that prevents tidal flows except during extreme high tides. The Millport Slough marshes contain both natural and restored tidal marsh areas. The marsh to the north of Millport Slough is a relatively undisturbed tidal marsh with intact tidal hydrology (i.e., with highly sinuous, dendritic, deep, and steep-sided tidal channels). Millport Slough South is a tidal wetland that was diked and managed as pasture for many decades until dike failures occurred in the 1980s and 1990s. Upstream of these marshes the mainstem Siletz formerly was flanked by narrow bands of tidal marsh and spruce-dominated tidal swamp. Most of these have been diked, and much of the acreage has been filled. (USFWS 2012)

Siletz Bay tidal wetlands also include the lower portions of Drift and Schooner Creeks, both east and west side of U.S. Highway 101. East of the highway on Drift Creek, these are primarily muted tidal wetlands dominated by Lyngby's sedge and slough sedge. Historically, these areas were comprised of tidal marsh and tidal swamp dominated by Sitka spruce. These areas were diked and drained and converted to pastureland for grazing of livestock. A severe flood event in the late 1990s resulted in the complete loss of the water control structure on private land located adjacent to the southeast corner in an area known as the Shaffer Tract. The loss of this water control structure, along with subsequent breaches in the dikes adjacent to Drift Slough and along Drift Creek, now allow significant but muted tidal flows on the property.

The Siletz Bay and river system supports large runs of anadromous fish including Chinook and threatened coho salmon (Oregon Coast ESU), coastal cutthroat trout, and steelhead. Large numbers of migratory birds use the marshes and tidal slough areas. Annual mid-winter waterfowl surveys are conducted in this area and in 2009 over 1,200 waterfowl were counted in the Siletz Bay area (USFWS unpublished data). Waterfowl species such as mallard, northern pintail, American wigeon, green-winged teal, bufflehead, red-breasted merganser, hooded merganser, and Canada geese feed and rest on the marshes. Siletz Bay is designated an Important Bird Area. Eelgrass, which grows in dense stands in shallow areas on mud, gravel, or sand, is rare along the Oregon coast. The largest concentrations of eelgrass occupy the southern end of Siletz Bay, with small patches occurring at the mouth of the bay, mouth of Schooner Creek, and the southern end of Snag Alley. Other listed species known to occur in the estuary include marbled murrelet, Pacific smelt, and green sturgeon.

Historically, native people settled small communities around Siletz Bay and subsisted by harvest of berries, tubers, plants, shellfish, fish, and animals. Native Americans burned portions of the forest to clear land of thick vegetation and create open areas. After 1850, permanent Euro-American settlements became established, with homesteading around the bay and upstream. After World War II, the shoreline of the bay became further altered through numerous dredge and fill operations such as the U.S. Highway 101 realignment and establishment of the Siletz Keys residential development. Commercial and residential encroachments onto coastal wetlands increased resulting in lost habitat, increased pollution and human activity, and lower water quality. The lumber and fishing industries were gradually replaced by tourism and recreation as the most important economic industry. Demand for construction of recreation and tourist associated facilities continues today (USFWS 1990).

The following map shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100 (Brophy and Ewald 2017). Areas along Drift and Schooner Creeks and the mainstem Siletz are predicted to have the largest LMZs in the future.


N
LINCOLN CITY
DEPOE BAY
Siletz Bay
Moderately river dominated drowned river mouth
Estuary size: 2711 acres
Estuary drainage: 236,160 acres
Approximate diked area: 293 acres
Approximate loss of historic tidal marsh and swamp due to diking and disconnection: 26%
Ownership within estuary:
Federal: 25%
Tribal: 0.07%
Private non-industrial: 72%
Private industrial: 3%
0
1.75
3.5
7 Miles
Landward migration zones
Developed areas
Urban growth boundaries

Yaquina Estuary

The Yaquina River is approximately 59 miles long and drains an area of 252 square miles in the Oregon Coast Range. It is one of the three Oregon estuaries classed for deep water development because of maintained jetties and a main channel dredged to deeper than 22 feet (Audubon 2018). The Yaquina watershed is made up of a drowned river channel and adjacent sloughs as well as smaller creeks and streams that are not tidally influenced. The two primary branches of the river are Big Elk Creek and Upper Yaquina River, which converge at Elk City. These branches provide approximately two-thirds of the freshwater runoff into the Yaquina River. The Yaquina River downstream of Elk City is tidally influenced and has substantial seasonal variation in salinity (Bauer et al. 2011 and Janousek 2013). The head of tide varies from 20-27 miles from the mouth depending on river flows; during the summer and early fall, the volume of salt-water intrusion substantially exceeds the volume of fresh water discharged into the estuary from the river (Adamus et al. 2005). In the summer months, when precipitation is low, saline water penetrates nearly to Elk City. In the winter, when precipitation is high, saline water is found much lower in the system, below the City of Toledo. Waters in the estuary are moderately stratified during both winter high flow and summer low flow (Adamus et al. 2005).

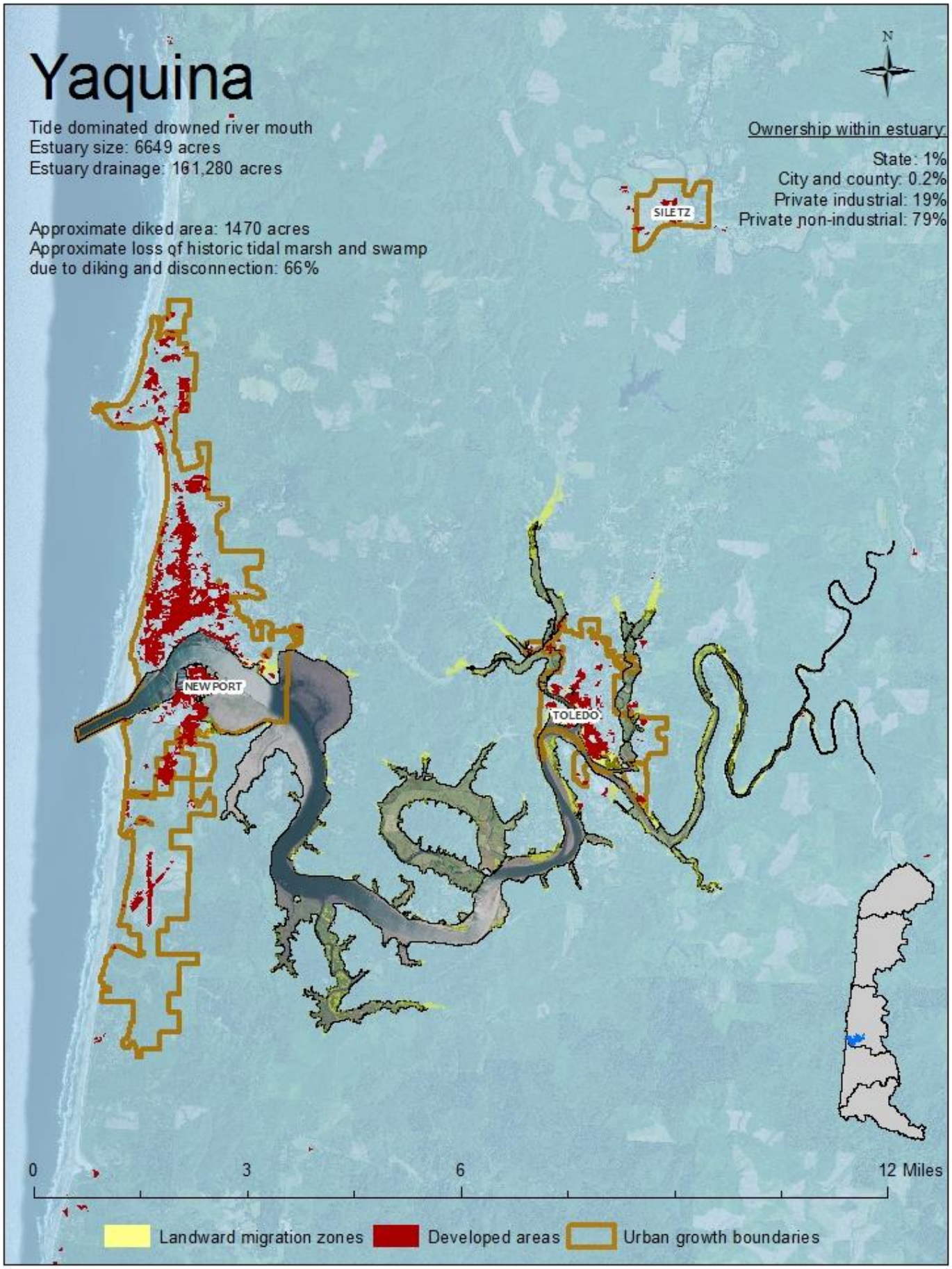
Vegetation in the Yaquina estuary is primarily brackish and marine intertidal high and low marsh. Forested and scrub-shrub tidal wetlands were once predominant in the brackish to freshwater tidal reaches of the middle and upper estuary, but only small remnants of these habitat classes remain; most were converted to agricultural uses (primarily diked pastures). Sitka spruce and other forest species such as red huckleberry (*Vaccinium parvifolium*) and other *Vaccinium* species are found on nurse logs throughout the intertidal zone.

Thirty species of conservation concern occur in the Yaquina Basin. Taxa include one amphibian, seven birds, one bryophyte, four fish, four fungi, four invertebrates, one mammal, one marine alga, and seven vascular plants. Five taxa are federally listed, and six are state listed. Of the 30 species of conservation concern, six (green sturgeon, chum salmon, coho salmon, steelhead, Gmelin's saltbush, and Point Reyes bird's beak) occur in the estuary and are the taxa most affected by the estuarine processes, indicators, and threats outlined in this plan. Bald eagle (*Haliaeetus leucocephalus*) is no longer a federally listed species but remains on state lists as a threatened species. Yaquina Bay regularly hosts thousands of waterfowl and shorebirds and is designated as an Important Bird Area (Audubon 2018).

Anadromous fish, particularly coastal coho salmon (*Oncorhynchus kisutch*), have been the focal species for riparian and wetland habitat restoration projects throughout the basin. Usage of the estuary and freshwater streams by anadromous salmonids varies by species and their life stages. Critical habitat for four of the five listed species (green sturgeon, Oregon Coast coho ESU, northern spotted owl, marbled murrelet) has been designated by US Fish and Wildlife.

Commercial forestry dominates much of the upland areas but is limited within the estuary. Land use zoning indicates that 87% of the basin is managed for forestry, but management differs by land ownership. In general, private forestland is managed on shorter rotations than on federal and state land and has less stringent regulations protecting riparian zones and older age classes. Agriculture occupies only 6% of the basin, while aquaculture in the form of oyster farming occurs in the Yaquina River mainstem between Oneatta Point and Oysterville.

Landward Migration Zones (LMZs) are the areas upslope of current tidal wetlands where wetlands may migrate in the future. These are based on sea level rise (SLR) scenarios as the future tide range will predict the possible future extent of tidal wetlands. The following map shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100 (Brophy and Ewald 2017). LMZs are very limited in this scenario; the largest areas are in tributary systems near Toledo (e.g., Depot Slough and Olalla Slough). Overall, the Yaquina is projected to lose 46% of its tidal wetland acres at 4.7' SLR, unless restoration efforts allow tidal flow and sediment accretion to occur.


Yaquina
Tide dominated drowned river mouth
Estuary size: 6649 acres
Estuary drainage: 161,280 acres
Approximate diked area: 1470 acres
Approximate loss of historic tidal marsh and swamp due to diking and disconnection: 66%
Ownership within estuary:
State: 1%
City and county: 0.2%
Private industrial: 19%
Private non-industrial: 79%
N
SILETZ
NEWPORT
TOLEDO
0
3
6
12 Miles
Landward migration zones
Developed areas
Urban growth boundaries

Beaver Creek

The Beaver Creek estuary, located in Lincoln County, sits roughly equidistant between the cities of Newport and Waldport. Beaver Creek has a beach-impounded estuary, with 240 total acres of estuary and an approximately 21,760-acre drainage area. Oregon State Parks and Recreation Department and The Wetlands Conservancy jointly own over 1,200 acres of land in Lower Beaver Creek. Approximately 11,000 acres of the watershed are managed by the U.S. Forest Service for old-growth forest conditions. Overall, 40 percent of the watershed is currently managed for conservation.

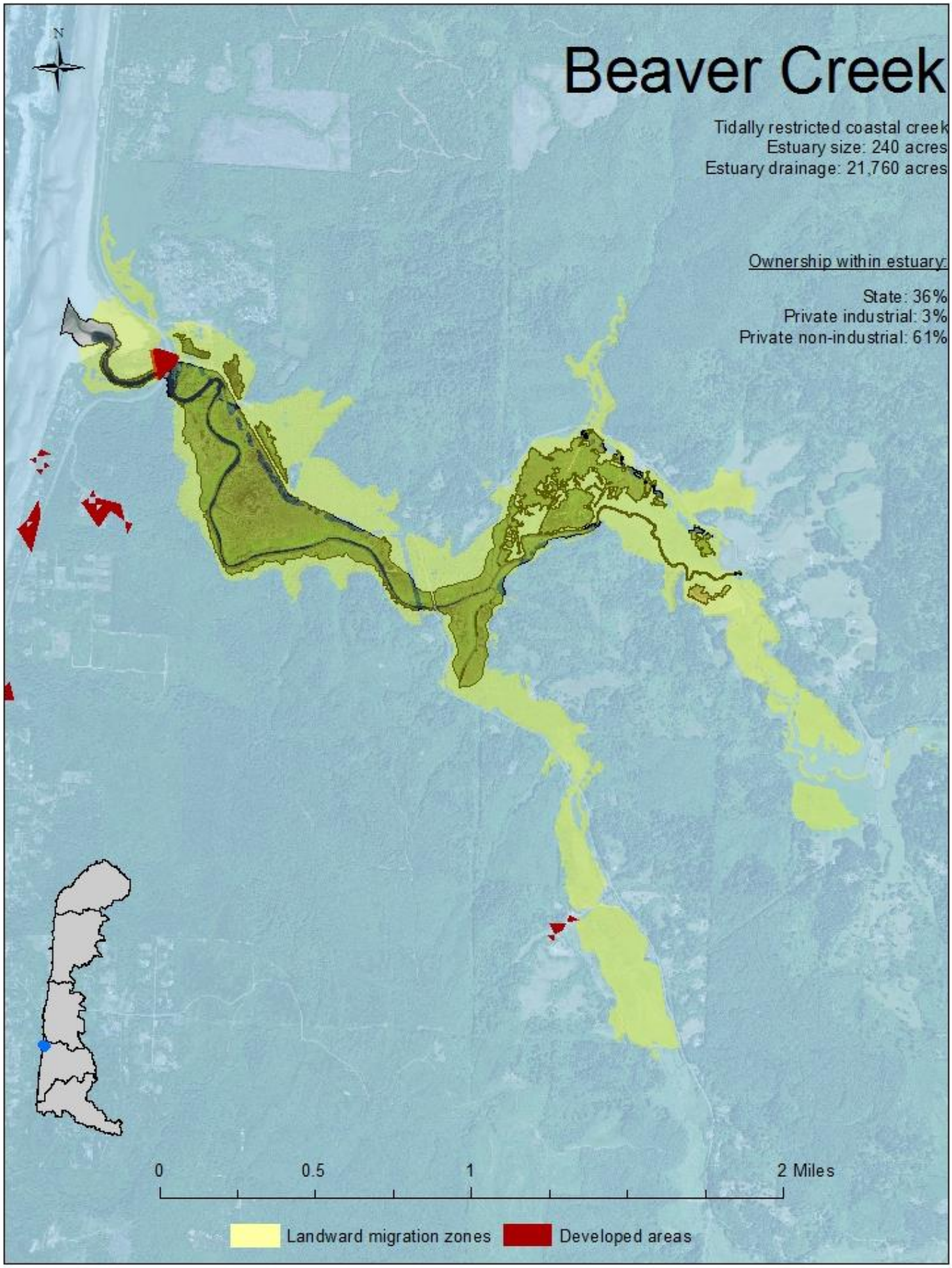
The mouth of Beaver Creek enters the Pacific Ocean over a beach berm, which typically has an elevation of about 8 feet above Mean Low Water. Thus, marine waters enter the estuary only on spring tides (tides associated with new and full moons) and on storm-driven high tides. As a result, the estuary has little tidal fluctuation, but water surface is maintained at or just above the elevation of the beach berm, extending inland almost 2 miles from the beach. The estuary is largely occupied with freshwater marshes, with deep stream channels cut through them. When ocean water does flow over the berm it tends to pool in the stream channel and becomes stratified. Limited data are available on salinity in the wetlands east of Highway 101; however, elevated salinity (into the mesohaline range) has been documented in the main channel upstream as far as the first bridge on South Beaver Creek Road, 2.2 river miles upstream from the beach.

Several tributary drainages flow into the Beaver Creek estuary. The north and south forks of Beaver Creek are the largest. The next largest tributary is Simpson Creek, which flows from the north and empties into Beaver Creek within the Brian Booth State Park a short distance upstream from its confluence with the south fork. Several other small unnamed stream drainages flow to the marsh from the park uplands. The hydrology of the lower estuary has been altered by past land use practices in various places by channelization, diking and road construction. Evidence of diking and channelization on lands now within the State Parks area is most apparent along Beaver Creek's main channel, and along Simpson Creek which flows through a straight ditch to its confluence with Beaver Creek.

Beaver Creek wetlands and watershed have been prioritized for protection in several federal, regional, state, and local conservation plans. The estuary and freshwater wetland complex supports a diversity of migratory and resident birds and waterfowl, and is a critical habitat component for anadromous salmonids populations in the basin. Beaver Creek has played a critical role in the science and politics of Oregon Coastal coho listing, management, and recovery decisions. It is the smallest basin classified as having an "independent" coho population, but this has been healthier than nearby larger populations. The adjacent uplands support a range of habitats from meadows to early seral stage Sitka spruce /western hemlock forest to older forest suitable for nesting by the ESA listed marbled murrelet. At-risk fish and wildlife species include coho salmon, winter run Oregon Coast ESU steelhead, bald eagle, marbled murrelet, northern spotted owl, and red-tree vole. Locally important species include American beaver and Oregon Coast ESU coastal cutthroat trout.

Most of the land near the Beaver Creek Estuary is forestland, much of it owned by or under easement to Oregon State Parks and/or The Wetlands Conservancy. The Siuslaw National Forest, which has been managed largely for natural resource values since adoption of the 1994 Northwest Forest Plan, begins about two miles to the east of the estuary and extends inland to the crest of the coast range. Much of the Beaver Creek bottomland and some of the toe slopes are used for farming, mainly for livestock pasture. Properties near or adjacent to the streams include a mix of residential, farmland, and private commercial timberlands. Seal Rock Water District is in the process of developing a water intake on Beaver Creek, just downstream of the confluence of north and south Beaver Creeks.

Landward Migration Zones (LMZs) are the areas upslope of current tidal wetlands where wetlands may migrate in the future. These are based on sea level rise scenarios as the future tide range will predict the possible future extent of tidal wetlands. The following map shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100 (Brophy and Ewald 2017). Areas throughout the current estuary are predicted to see increases in tidal wetlands in the future.


Beaver Creek
Tidally restricted coastal creek
Estuary size: 240 acres
Estuary drainage: 21,760 acres
Ownership within estuary:
State: 36%
Private industrial: 3%
Private non-industrial: 61%
N
0
0.5
1
2 Miles
Landward migration zones
Developed areas

Alsea Bay

The Alsea Estuary is located along the central Oregon coast near the town of Waldport and drains the west slope of the Coast Range. The adjacent mountains are composed of uplifted marine sandstones and mudstones, which have been eroded to form relatively wide river valleys with low gradients. The Alsea River drains a watershed of about 470 square miles containing landscapes that range from heavily forested hillsides to open pastures along the lowlands and riverbank. Land use in the watershed is primarily timber production with some agriculture, development, and municipal uses. The Alsea Estuary is drowned river valley that connects to the Pacific Ocean through an inlet, which is always maintained open by tidal flows. Head of tide is at approximately 15 miles from the mouth and waters in the estuary are moderately stratified during both winter high flow and summer low flow (Adamus et al. 2005). McKenzie (1975) estimated that ocean-sourced sand forms most of the bed from the mouth to 1.5 miles inside the estuary. Upstream of 2.5 miles from the river mouth, river sediments dominate the bed. Between these two points, the bed is composed of a blend of riverine and ocean sediment.

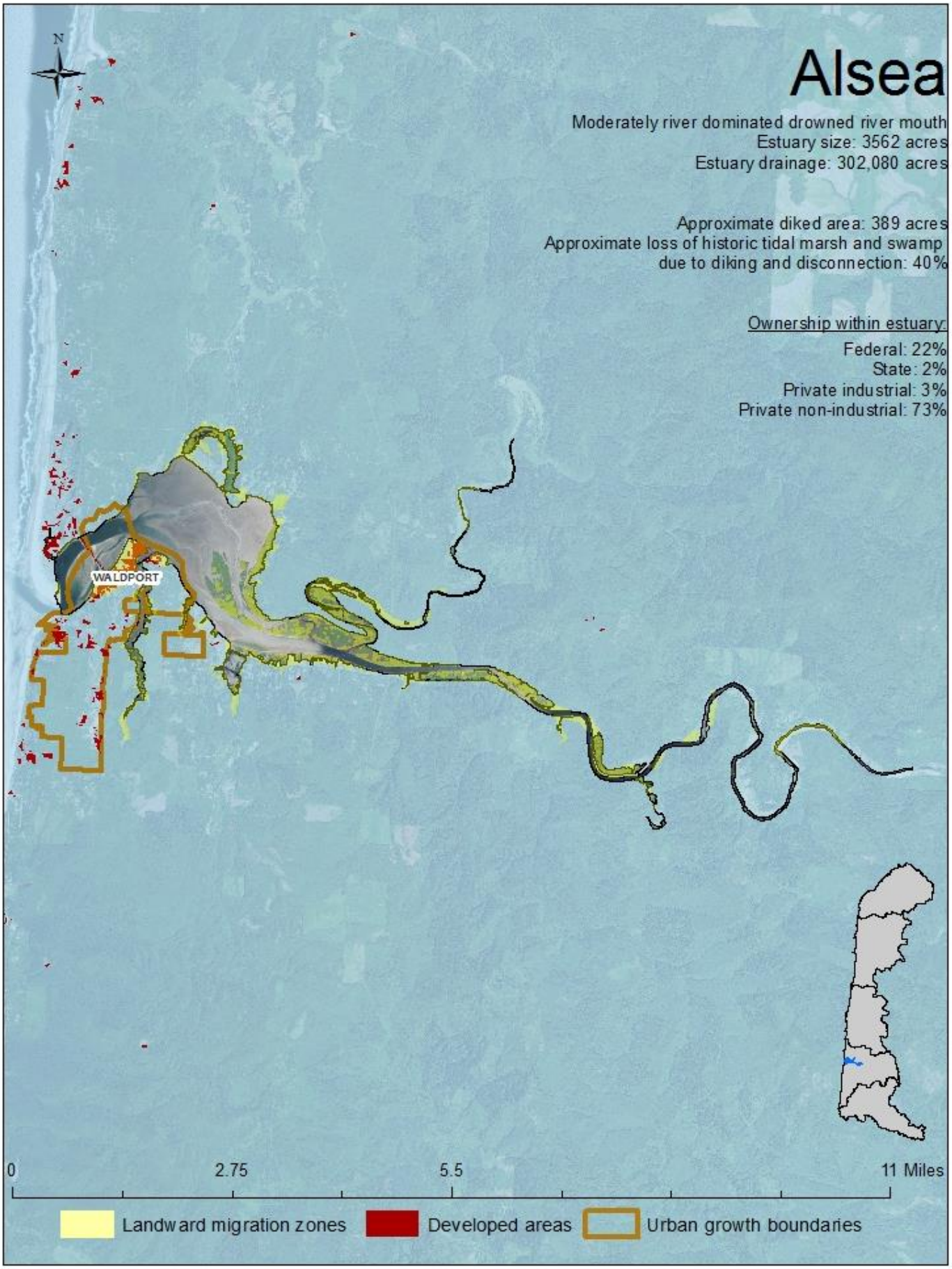
In the 1960s and 1970s, efforts were made to block flow to the northern channel in Alsea Bay in the hopes that re-directing additional flow into the southern channel would help maintain its depth for navigation. This channel management may have encouraged some net deposition in the north part of Alsea Bay, but McKenzie concluded that the shallowness of the bay is natural.

The estuary is predominantly open water overlaying subtidal or unvegetated intertidal areas. Nearly 700 acres of wetlands edge the estuary. Approximately 150 acres of historic wetlands have been filled. The marsh habitat along the lower reaches of this creek enhances its value to fish and wildlife. The Western Rivers Conservancy and the U.S. Forest Service and partners breached 1600 feet of dike and restored hydrology to 82 acres of former marsh habitat in 2005. The Wetlands Conservancy's Bayview Oxbow Preserve is down river from this restoration area; additional land acquisition and proposed tidal reconnection will allow the extension of the conservation benefits and further ecological connectivity. The Drift Creek complex is considered one of The Wetlands Conservancy's Oregon's Greatest Wetlands.

The Alsea Estuary had been a prolific salmonid fishery, yielding more than 100,000 pounds of fish in the 1930s to commercial fisherman, which was processed by canneries at the estuary's mouth. This yield placed it at the top of the list for coho spawning among Oregon estuaries (Brophy 1999). Because of declining yields, fishing has since been limited only to sport fishing and yields are now orders of magnitude smaller. The Alsea watershed is now being managed for wild coho salmon following closure of the Fall Creek hatchery. The wild coho population has rebounded since hatchery closure and improved ocean conditions. The primary limiting factor for coho in the Alsea is low gradient winter habitat. Protection of these marsh habitats will help sustain the coho produced in the Alsea system.

The uplands in the estuary are primarily forested areas in federal or private industrial forest ownership. The watershed was subject to large-scale, infrequent fire in the 1850s. Historically, the lower Alsea landscape pattern consisted of large patches of single seral stages over most of the area. Today, landscape patterns are fragmented across the Alsea watershed. Major tree species include Douglas-fir and western hemlock, with Sitka spruce along the coast and noble fir at higher elevations. The upland habitats in the Alsea watershed support a range of habitats from meadows to early seral stage Sitka spruce/western hemlock forest to older forests suitable for nesting by the ESA-listed marbled murrelet.

Landward Migration Zones (LMZs) are the areas upslope of current tidal wetlands where wetlands may migrate in the future. These are based on sea level rise (SLR) scenarios as the future tide range will predict the possible future extent of tidal wetlands. The following map shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100 (Brophy and Ewald 2017). LMZs are very limited under this scenario; the largest areas are along Drift Creek and in the floodplains of other tributary systems such as Lint Slough. Overall, the Alsea is projected to lose 28% of its tidal wetland acres at 4.7' SLR, though tidal restoration at Bayview Oxbow could help the area accrete sediment that might allow it to keep up with rising sea levels.


N
Alsea
Moderately river dominated drowned river mouth
Estuary size: 3562 acres
Estuary drainage: 302,080 acres
Approximate diked area: 389 acres
Approximate loss of historic tidal marsh and swamp due to diking and disconnection: 40%
Ownership within estuary:
Federal: 22%
State: 2%
Private industrial: 3%
Private non-industrial: 73%
WALDPORT
0
2.75
5.5
11 Miles
Landward migration zones
Developed areas
Urban growth boundaries

Siuslaw Estuary

The Siuslaw is a drowned river mouth estuary with marine, bay, slough, and riverine components. The mouth of the river is flanked by sand dunes and migrated regularly until being constrained by jetties in the late 1800s. The estuary, extending upstream from the bay at the confluence of the Siuslaw River mainstem and the North Fork of the Siuslaw, occupies progressively narrowing valleys through head of tide (about 23 miles from the mouth but reduced to 6 miles during winter high flows; Adamus et al. 2005). Water is delivered to the estuary from the 504,000 acres of the Siuslaw watershed via a network of streams that cut through the Coast Range, traveling over a substrate primarily composed of relatively soft sandstone, generating large amounts of sediment, deposition of which has resulted in the development of broad floodplains in the estuary. The estuary is river dominated with waters that are highly stratified during winter high flow, but vertically homogeneous during low summer flow (Adamus et al. 2005). The river has been dredged to maintain an 18-foot depth to RM 0.2, then 16-foot depth to RM 5. There has been no dredging above that since 1976 but dredging the channel to 12 ft. depth through RM 15 is authorized.

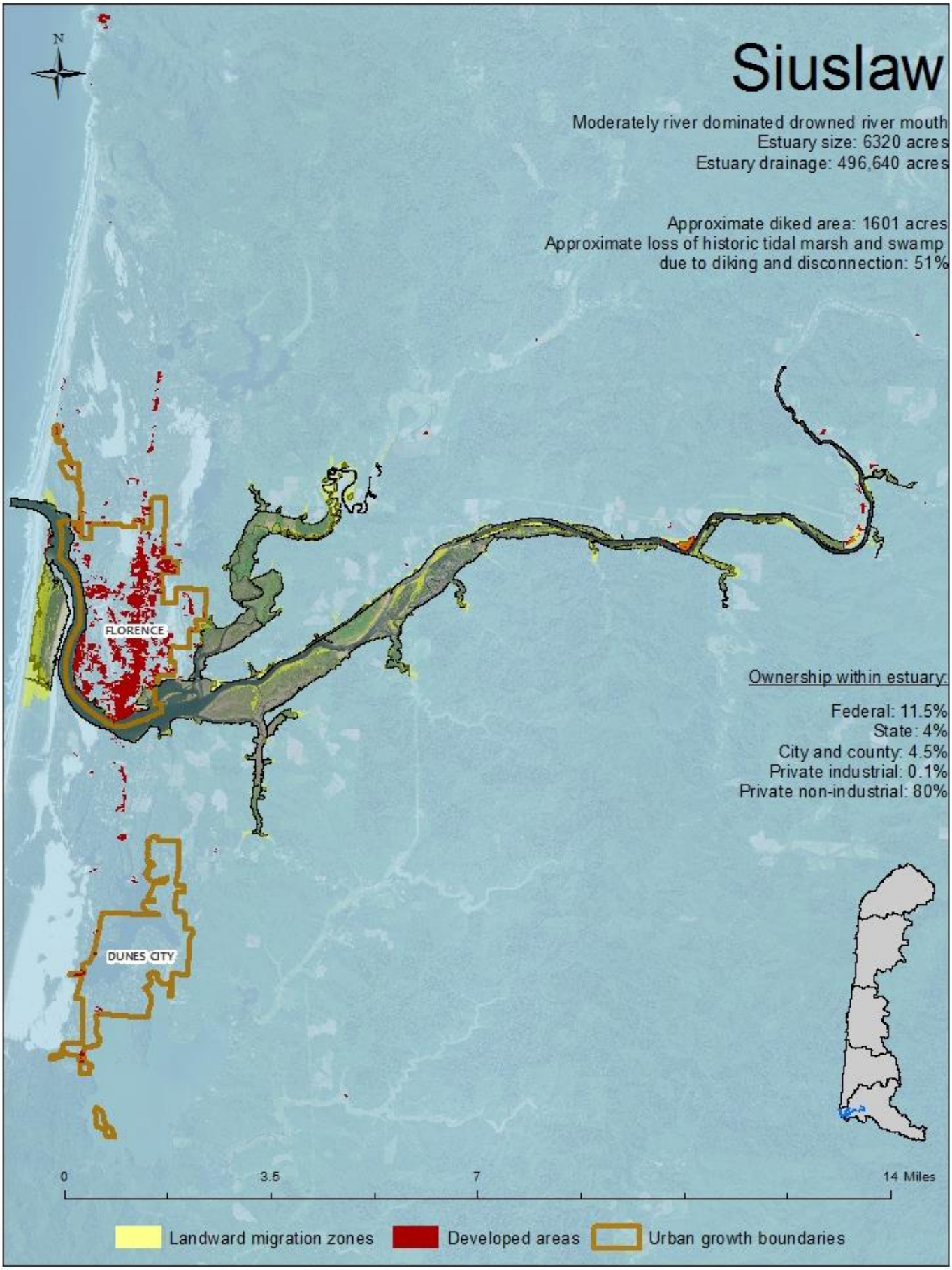
Tidally influenced wetlands within the estuary include aquatic beds, emergent marsh, scrub-shrub swamp and forested wetlands. The surrounding uplands are steep, heavily forested hillslopes. The Shayuushtl'axan, or Siuslaw People, now confederated with their southerly neighbors, the Coos and Lower Umpqua Tribes and known collectively as the Confederated Tribes of the Coos, Lower Umpqua, & Siuslaw Indians (CTCLUSI), inhabited and continue to reside to this day on the shores and upland slopes of this once rich and productive estuarine ecosystem. Also known as the 'Salmon People', a term that resonated with many tribal communities on the Pacific Northwest Coast, the CTCLUSI take great care and give much respect to all species, especially the salmon which holds great prestige within the Tribe. Pacific Lamprey are also another important subsistence food. Unfortunately, due to their diminishingly low returns year after year, the local Tribes are unable to harvest these once plentiful and prestigious resources.

Beginning in the late 1800s, resource extraction, focused on timber and fish harvest, and small-scale agriculture dominated the economic activity in the Siuslaw. The river was the primary means of transport for goods and people until a rail line was completed through the Siuslaw Valley in 1915, followed by a road in the 1930s. Isolated settlers required space for subsistence and commercial agriculture, and the flat floodplain and tidally influenced land in the estuary were both conveniently located adjacent to the river, and flat. These areas were however, subject to tidal and riverine flooding, so settlers constructed levees to isolate their property from the river. Land protected by levees served successfully as small-scale agricultural land from the early 1900s; however, without the annual addition of organics and sediments associated with tidal wetland habitats, and as soils are drained allowing oxidation of the organic-rich sediments below the surface, soils compact at a fast rate. This has resulted in the significant settling of the leveed land, increasing the portion of time that it is wet, making it less agriculturally productive over time. This change in the landscape, coupled with local and regional economic forces limiting profits from agriculture, fishing, and logging, has led landowners to reconsider the way that they use property in the estuary, and to consider conservation and restoration as viable financial and cultural choices. As a result, over the last 30 years, several estuarine properties in the Siuslaw estuary have been conserved or restored, and opportunities for conservation and restoration continue to be identified (Brophy 2005). The North Fork area is considered one of TWC's Oregon's Greatest Wetlands.

The Siuslaw estuary supports a diverse biotic community, including fish such as Chinook, coho, steelhead, sea-run cutthroat trout, lamprey, marine species, and migratory and resident bird populations (it is designated as an Important Bird Area). Prior to settlement, the Siuslaw River had significant populations of salmonid species. A combination of aggressive harvest and large-scale habitat alterations such as the isolation of tidal marshes via levee-building and upstream habitat-limiting actions have severely impacted population numbers.

Economic health in the Siuslaw watershed declined as a result of the decline in fishing and timber harvest, a move toward urbanization and export of raw natural resources, and the national recession beginning in 2008. Industrial jobs declined and contracted toward population centers. The largest population center in the watershed is Florence, located near the mouth of the Siuslaw River. Unlike several other population centers along the Oregon Coast, the bulk of urban Florence is not centered on the estuary and urbanization has not been a primary force in the loss of estuary acreage. There are numerous small towns upstream, almost all of which are in valley bottoms near streams. Many of those towns were historically associated with mills that are now closed. The economy in Florence is diversifying, however the small towns throughout much of the rest of the watershed remain economically depressed. Most respondents to area surveys report they highly value the natural beauty and health of the watershed, however there is significant resistance to change associated with conserving and restoring property that has recently been utilized for agricultural or timber harvest purposes, particularly among those whose families have resided in the watershed for generations.

The following map shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100 (Brophy and Ewald 2017). Significant areas currently within the tidal wetland elevation range are predicted to convert to mudflat or open water under this scenario, but some LMZs are located along the floodplain of the North Fork Siuslaw River and on the sand spit south of the river mouth.


N
Siuslaw
Moderately river dominated drowned river mouth
Estuary size: 6320 acres
Estuary drainage: 496,640 acres
Approximate diked area: 1601 acres
Approximate loss of historic tidal marsh and swamp due to diking and disconnection: 51%
FLORENCE
DUNES CITY
Ownership within estuary:
Federal: 11.5%
State: 4%
City and county: 4.5%
Private industrial: 0.1%
Private non-industrial: 80%
0
3.5
7
14 Miles
Landward migration zones
Developed areas
Urban growth boundaries

Appendix IV. Addendum to Action Plan

Changes Made to Plan in 2020/21 Update:

- Outcomes/Goals were revised to reflect more recent data on current conditions, use clearer language, and re-ordered by priority.
- Moved the results chains from former Appendix II to Section 8.
- Updated Appendix II, Table A, and associated descriptions elsewhere in the plan, with new data from Brophy 2019.
- Added a new Human Wellbeing Target of "Carbon Sequestration" to the Situation Diagram in Figure 3 to reflect the potential for functioning estuaries to provide this important ecosystem service to help mitigate climate change impacts.
- Updated actions in Section 8 to indicate current status, new actions and participating entities.
- Added new references.
- Made some corrections to appendix II. Table B.
- Dropped some sections that are no longer needed

Actions removed from Section 8 that have been completed:

- Establish a web-based information exchange forum (Done)
- Action: Complete mapping of estuarine LMZs (ETG & MidCoast WC – Done)
- Action: Include this factor (LMZ) in project ranking criteria (Done)
- Action: Outreach to Tierra Del Mar community about Sand Lake restoration with coordinated messaging (OPRD, NNSL) (Done)
- Submit OWEB TA grant proposal in 2016 (NNSL – Done)
- Form Sand Lake Working Group (NNSL – Done)
- Conduct Limiting Factors Analysis and Restoration Prioritization (NNSL- Done)
- Update Tillamook Estuaries Partnership's Comprehensive Conservation Management Plan covering Tillamook County estuaries. (TEP - Done)
- Utilize Roads component in Transportation assessment in Obj. 2.1.1 (TNC – Done)
- Action: Gather coarse-scale GIS metrics (such as miles of road in estuaries) (TNC – Done)
- Action: Categorize estuaries into high, medium or low impact groupings (TNC – Done)
- Action: With ODOT, overlay sites needing transportation upgrades with the list of sites ranked high for estuary impacts (TNC & ODOT – Done)
- Action: Identify vulnerable communities and existing info related to highway infrastructure from an economic and safety perspective (TNC – Done)
- Action: Investigate potential conceptual design solutions that meet transportation needs while allowing increased tidal flow through the road prism. (TNC & U. of Portland - Done)
- Produce a marketing version of the roads & estuaries assessment and other materials to share results with key parties by June 2018. (TNC - Done)
- Action: Conduct Vulnerability Assessment and develop Climate Change adaptation strategies for the estuaries and watersheds in Tillamook County (TEP) (Done)