Tillamook Estuaries Partnership's Comprehensive Conservation and Management Plan

August 20, 2019 | CCMP Update

Tillamook Estuaries Partnership
A National Estuary Project

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About the Institute for Policy Research and Engagement

The Institute for Policy Research and Engagement (IPRE) is a research center affiliated with the Department of Planning, Public Policy, and Management at the University of Oregon. It is an interdisciplinary organization that assists Oregon communities by providing planning and technical assistance to help solve local issues and improve the quality of life for Oregon residents. The role of the IPRE is to link the skills, expertise, and innovation of higher education with the transportation, economic development, and environmental needs of communities and regions in the State of Oregon, thereby providing service to Oregon and learning opportunities to the students involved.

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Introduction

In 1994, Tillamook Bay was designated as a Bay of National Significance, and thus began the road to the first Tillamook Bay Comprehensive Conservation and Management Plan (CCMP). Completed in 1999 through the efforts of the Tillamook Bay National Estuary Project's (TBNEP) Management Conference, which was comprised of partners, key stakeholders, and interested members of the public, the CCMP was the guiding document supporting the health of Tillamook Bay (Figure 1 - inset). The original CCMP identified 63 actions that targeted four priority problems: key habitat, water quality, erosion and sedimentation, and flooding.

During its first two years, the TBNEP was implemented through a department within the Tillamook County government. The purpose of the Tillamook County Performance Partnership (TCPP), as it was then known, was to provide a dynamic, results-driven mechanism to build relationships, promote economic sustainability, and faciliate coordinated environmental restoration within the County.

What is the NEP?

In 1987, Congress established the National Estuary Program (NEP) as part of the Clean Water Act. The NEP's mission is to protect and restore the health of estuaries while supporting economic and recreational activities. The U.S. EPA administers the program. In April 1992, Oregon Governor Barbara Roberts nominated Tillamook Bay to the National Estuary Program (NEP). In her nomination, the Governor characterized Tillamook Bay as representative of the bays along the Pacific Northwest coast because it provided a vital resource to the local and regional economies, and supported diverse aquatic resources including anadromous fish, shellfish, and waterfowl. (1999 CCMP). In 1994, TBNEP joined 27 other National Estuary Projects around the United States in developing and implementing science- based, community-supported management plans. With issues like high bacteria concentrations affecting the shellfish industry and recreational use of the rivers and bay, sedimentation, declining salmon and trout populations due to loss of key habitats, and flooding, the Tillamook Bay aligned well with the intentions of the National Estuary Program.

TCPP quickly realized the need to include all Tillamook County estuaries and watersheds in its mission and focus area (Figure 1). Because many of the same issues are found throughout the county, applying the general principles of the CCMP beyond Tillamook Bay was a logical step. Linked by proximity, the estuaries share similar challenges and opportunities yet retain their unique characteristics because of the communities and land use that surround and nourish them.

In the Spring of 2002, TCPP re-organized to become a 501(c)(3) non-profit organization, its name was changed to the Tillamook Estuaries Partnership (TEP) to reflect the broadened geographic scope of work, and the various committees (Policy, Management, Citizen Action, Financial Strategies) were consolidated into a Board of Directors. The decision to restructure the organization was based on two factors: (1) as a non-profit, TEP could pursue more diversified and long-term funding to complement the annual EPA base funding, and (2) as a non-profit, the TEP Board of Directors would have greater autonomy over project implementation and financing. Over time, TEP's mission was changed to encompass a landscape-scale scope of work: TEP is dedicated to conserving and restoring Tillamook County's estuaries and watersheds in their entirety.

Figure 1. TEP Focal Area showing the Nehalem, Tillamook, Nestucca, Netarts, Sand Lake, and Neskowin watersheds. The figure also shows the estuary, lower, and upper watershed regions. Inset: Map of the 1999 TEP Focal Area showing the Tillamook Bay watershed (grey).

Key Performance Indicators

The non-profit organizational structure of TEP has proven to be highly successful as shown by these long-term Key Performance Indicators (through December, 2018):

- Since 1997, TEP's Volunteer Water Quality Monitoring Program has collected and analyzed more than 25,000 samples for bacteria levels in Tillamook County rivers, creeks, streams, and bays. Real-time results are posted online through an interactive map available to the public.
- Since 2004, TEP's Backyard Planting crew has planted 57,315 trees and shrubs to enhance 245 acres of riparian habitat (equivalent to 39.9 miles of stream banks) on 147 private landowner properties. Survival rates for post-2011 plantings are 89-94%.
- Over 300,000 native plants have been distributed to restoration projects since TEP assumed management of the native plant nursery in 2014.
- Nearly an entire generation of Tillamook County third and fourth grade students, over 10,200 children since 2001, have received 51,000 hours of science education during TEP's landmark outdoor learning experiences.
- 25 anthropogenic barriers have been replaced through TEP projects to reconnect 25.9 miles of historical salmon-bearing streams.
- TEP and its partners have completed three (3) large tidal-wetland restoration projects in Tillamook Bay that together have returned approximately 566 acres of this highly imperiled habitat type to more natural conditions.
- In total, TEP and its partners have completed 838 habitat-related projects in the focal area since 2001:
    - 416 projects to enhance riparian vegetation along rivers and streams,
    - 208 fish passage barrier removal projects (e.g., culvert and dam removal),
    - 99 in-stream enhancement projects (e.g. large woody debris placement),
    - 38 projects to limit fine sediments entering streams (e.g., road decommissioning),
    - 30 land acquisition efforts,
    - 20 wetland enhancement projects (e.g., tidal channel construction, wetland plantings),
    - 13 invasive plant removal projects,
    - 5 efforts to reintroduce native oysters (shellfish seeding),
    - 4 projects to enhance upper watershed vegetation,
    - 2 large-scale dike removal efforts, and
    - 1 each for projects to control flooding, enhance bird habitats, and remove contaminants.

Sand Lake | Don Best

TEP's action agenda for the upcoming decade (2019-2029) is described in this revised CCMP. This document utilizes the original CCMP as its foundation along with assessments of what has been completed, what is ongoing, what new issues have emerged, and what has lost relevance over the past 20 years. Priority issues from the original CCMP related to erosion, sedimentation, and flooding were broadened to include a full suite of natural hazards and have been integrated into both the water quality and habitat restoration action plans. Climate change stressors and vulnerabilities, which were not explicitly discussed in the 1999 CCMP, are now emerging challenges to TEP, its partners, and the community and have been incorporated throughout this document.

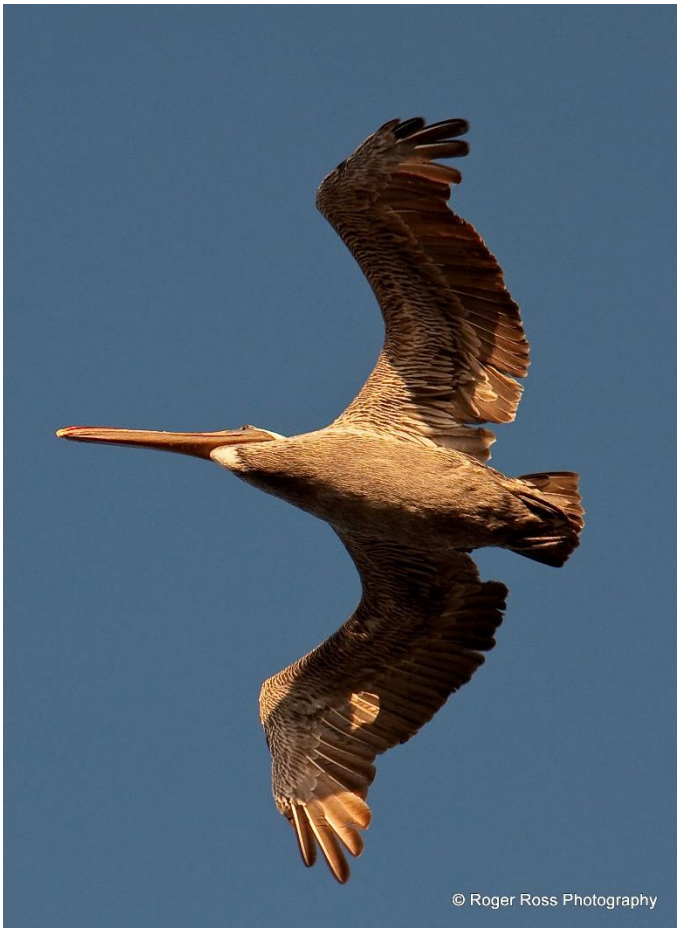

Table 1, Table 2, Table 3, and Table 4 (pp. vii-xv) provide crosswalks between the 1999 and 2019 CCMP action items. Additional information regarding the major accomplishments are provided in each action plan chapter, on the TEP website (https://www.tbnep.org/), and within TEP's Year in Review publications.

This CCMP revision also considers the evolving social, economic, and cultural values of the community. More than six stakeholder meetings and 15 public outreach meetings were held to gather a wide spectrum of input. An online survey asked the public about their interactions with the bays, how the bays are valued, and what challenges may be affecting those values. A draft of the updated CCMP, which included this myriad of perspectives, was posted online for public comment to give all stakeholders the opportunity to have their voices heard before the final document was adopted.

After updating the original CCMP and incorporating feedback received from the community, three new goals, which apply across TEP's entire focus area, have been developed for this Revised CCMP:

- Maintain and improve the beneficial uses of estuaries and watersheds for humans and native aquatic and terrestrial species;
- Conserve and restore ecological functions of Tillamook County's estuaries and watersheds to benefit native aquatic and terrestrial species and the communities that depend on them; and
- Foster awareness of Tillamook County's estuaries and watersheds, engage in problem solving, and take action to conserve and enhance our natural resources.

The corresponding action items exceeds the collective capacity of TEP and its partners to complete during the 10-year lifespan of the CCMP. TEP will work with its partners to prioritize activities based on critical gaps, relevancy, resources, and funding. TEP recognizes that as conditions change so will the CCMP implementation strategies: the CCMP is meant to be dynamic.

The 2019 CCMP focuses on three priority programs: Water Quality (Chapter 1), Habitat Restoration (Chapter 2), and Community Education and Engagement (Chapter 3). Each action item follows the format described in the Anatomy of a CCMP Action on page vi. Chapter 4 includes profiles of the watersheds within TEP's focal area along with a summary of how the CCMP action items will address the natural hazards and climate impacts identified during the recent climate change preparedness strategy development (Table 5).

The CCMP is not a stand-alone document. The habitat restoration and monitoring strategies (Chapter 5), finance strategy (Chapter 6), and the communication strategy (Chapter 7) shall be developed by TEP at later dates and incorporated into this CCMP (Chapters 5, 6, and 7 serve as placeholders). TEP issues a State of the Bays report every five years to monitor progress and changing needs. The Board of Directors and staff of TEP develop strategic plans to guide and prioritize CCMP activities. Annual workplans are established based on these priorities as well as available funding and resources.

The CCMP is also supported by local, state, and federal planning efforts. Specific resource management plans relevant to Tillamook County's estuaries and watersheds include, but are not limited to:

- Tillamook County Comprehensive Plan (1982)
- Oregon Statewide Land Use Planning Goals (1973)
- Oregon Estuary Plan Book (1987)
- Total Maximum Daily Loads: North Coast Sub-basins (2003), Tillamook Bay Watershed (2001) and Nestucca Bay (2002)
- Oregon Senate Bill 1010 (1993, Agricultural Water Quality Management Act)
- Oregon Senate Bill 1517 (2016, Tillamook County Wetland Habitat Restoration)
- Water Quality Status and Action Plan: North Coast Basin (2011)
- ODA North Coast Basin Agricultural Water Quality Management Area Plan (2018)
- Pesticide Management Plan for Water Quality Protection (2011)
- Oregon Northwest State Forest Management Plan (2001, in revision 2019)
- President's Northwest Forest Plan (1994)
- Final ESA Recovery Plan for Oregon Coast Coho Salmon (*Oncorhynchus kisutch*) (2016)
- Tillamook County Multi-Jurisdictional Natural Hazards Mitigation Plan (2017)
- Natural Hazard Risk Report for Tillamook County, Oregon (2018)
- Tillamook County Community Wildfire Protection Plan (2006)
- Tillamook Estuaries and Watersheds Climate Change Vulnerability Assessment (2018)
- Climate Change Preparedness Strategy for Tillamook Estuaries Partnership (2018)

This CCMP revision sets forth an action agenda to coordinate resources, strengthen commitments, and rededicate Tillamook County's resolve to conserve and restore its estuaries and watersheds. Together, TEP and its partners will leverage opportunities to develop projects and make collaborative decisions over strategies and priorities that follow this blueprint for clean water, healthy habitats, abundant wildlife, and vibrant communities.

Table 1 *Water Quality Key Action Plan Accomplishments and Changes Since 1999*

1999 CCMP "Water Quality" and "Erosion and Sedimentation" Action Plan				2019 CCMP "Water Quality" Action Plan	
Action Item	**Description**	**Status**		**Action Item**	**Description**
WAQ-01	Define, Implement, and Enforce Pollution Prevention and Control Measures on Agricultural Lands	ONGOING/REVISED: ODA Water Quality Program strategies have been updated to include changes to the program. OR SB 1010 is being revised. Not many violations are currently reported.		WAQ-01	Improve farm management practices to address water quality
WAQ-02	Implement Voluntary Farm Management Plans	ONGOING/REVISED: CAFO participants required to have plans, non-CAFO ag lands voluntary.			
WAQ-03	Implement Revised Confined Animal Feeding Operation (CAFO) Inspection Procedure	COMPLETE/REVISED: Initial program achieved in 2005. CAFOs are inspected annually. CAFO program needs to be maintained and implementation continued. Program requirements include nutrient management plan.			
WAQ-04	Use Farm-Specific Agronomic Rates for Nutrient Management	ONGOING/REVISED: Need to encourage better use of ODARK.org (record keeping program by CAFOs). Online, nutrient planning tool to create their own plan - for non-permitted facilities record keeping.			
WAQ-05	Provide Farm Management Training Programs	ONGOING/REVISED: OSU Extension provides training, partners include TEP, NRCS, SWCD.			
WAQ-06	Ensure Adequate Wastewater Treatment Capacity	ONGOING/REVISED: Upgrades to the Tillamook WWTP have been accomplished. Upgrades will be needed in other cities as they grow.		WAQ-02	Improve rural residential and urban infrastructure to address water quality
WAQ-07	Expand and improve Sewer Network	ONGOING/REVISED: Limited improvements have been made in the City of Tillamook.			
WAQ-08	Ensure Adequate Urban Runoff Treatment and Retention Strategies	ONGOING/REVISED: Limited improvements have been made (e.g., bioswales, etc.). Includes unincorporated communities.			
WAQ-09	Ensure Properly Functioning On-Site Sewage Disposal Systems	ONGOING/REVISED: County has a program in place and investigating new strategies and partnerships.			
SED-05	Reduce Sedimentation from Non-Forest Management Roads	ONGOING/REVISED: Incudes Public Works and has been initiated some small projects.			

1999 CCMP "Water Quality" and "Erosion and Sedimentation" Action Plan				2019 CCMP "Water Quality" Action Plan	
Action Item	**Description**	**Status**		**Action Item**	**Description**
WAQ-10	Implement Temperature Management	ONGOING/REVISED: Implementation of water quality management plans for the three TMDLs is occurring.	}	WAQ-03	Enhance riparian and in-stream areas throughout the watersheds to improve water quality
SED-01	Implement Road Erosion and Risk Reduction Projects	ONGOING/REVISED: ODF has road guidance that they continue to utilize. ODF roads have been surveyed using LiDAR data.	}	WAQ-04	Restore channel features and hillslope management to improve sediment storage and routing to address water quality
SED-02	Implement Practices That Will Improve Sediment Storage and Routing	ONGOING/REVISED: TEP has and continues to implement LWD, culvert replacement and other restoration project that address sediment issues. (Also achieved through 2019 actions HAB-06, -07, -08, and -13)			
SED-03	Reduce Risks in Landslide-Prone Areas	ONGOING/REVISED: ODF working on post-storm event and mitigation to decrease landslide risk. Areas have been identified in upper watersheds, areas outside of ODF jurisdiction are at risk. DOGAMI has identified risk in all areas within Tillamook County; applicable actions are identified in the Tillamook County Natural Hazards Mitigation Plan.			
WAQ-11	Implement Suspended Sediments Management Strategies	ONGOING/REVISED: Completed for Upper Nestucca, not complete for Tillamook. Focus on need to address lack of numeric standard and strategy. Nestucca TMDL addresses sediment.			
SED-04	Ensure Sufficient Resources to Enforce Forest Practices Act	ONGOING/REVISED: Support ODF stewardship staff who manage project implementation.			
SED-06	Develop and Implement a Stormwater Management Ordinance	NOT STARTED/REMOVED: County has not implemented. Significant political hurdles exist.	X	TEP will implement as applicable via HAB-14.	
WAQ-12	Evaluate Shellfish Growing Area Classifications	ONGOING/REVISED: ODA Food safety is in the lead; TEP aids. Investigation how to update closure information.	}	WAQ-05	Identify status and trends and quantify changing environmental conditions in water quality to inform adaptive management strategies impacting our priority areas
WAQ-13	Update Shellfish Management Plan Closure Criteria	ONGOING/REVISED: ODA Food safety is in the lead and working on legislative policy for shellfish.			

Table 2 Habitat Restoration Key Action Plan Accomplishments and Changes Since 1999

1999 CCMP "Key Habitat" Action Plan				2019 CCMP "Habitat Restoration" Action Plan	
Action Item	**Description**	**Status**		**Action Item**	**Description**
HAB-01	Characterize Riparian and Instream Habitat	ONGOING/REVISED: Federal state and local partners have employed AQI (Aquatic habitat inventory) and RBA (Rapid Bio Assessments) to characterize current conditions and track change related to actions, and a number of management plans have been developed that detail historic and current conditions.		HAB-01	Assess and prioritize estuarine habitats
				HAB-02	Assess and prioritize non-estuarine wetland habitats
HAB-02	Assess and Map Riparian and Wetland Habitat	ONGOING/REVISED: ODF is working on this, may still be doing it. ODFW does AQI (Aquatic habitat inventory, located out of Corvallis): A subset of streams they monitor periodically, including some restoration sites.		HAB-03	Assess and prioritize in-stream habitats
				HAB-04	Assess and prioritize riparian habitats
HAB-03	Prioritize Upland Protection and Enhancement Sites	ONGOING/REVISED: Watershed assessments have been completed for the Nehalem, Tillamook, and the Nestucca watersheds. These prioritize important enhancement sites in higher gradient portions of the watershed.		HAB-05	Assess and prioritize upland habitats
HAB-04	Prioritize Floodplain/Lowland Protection and Enhancement Sites	ONGOING/REVISED: Watershed assessments have been completed for the Nehalem, Tillamook, and the Nestucca watersheds. These prioritize important enhancement sites in the lower and estuarine portions of the watershed.			

1999 CCMP "Key Habitat" Action Plan				2019 CCMP "Habitat Restoration" Action Plan	
Action Item	**Description**	**Status**		**Action Item**	**Description**
HAB-05	Protect and Enhance Upland Riparian Areas	ONGOING/REVISED: Federal, state, and local partners have implemented numerous projects in the upper watershed to improve riparian conditions.		**HAB-06**	**Conserve and restore key habitats in the estuary**
HAB-06	Protect and Enhance Lowland Riparian Areas	ONGOING/REVISED: Federal, state, and local partners have implemented numerous projects in the lower watershed to improve riparian conditions. TEP's Backyard Planting Program is entering its 16th year enhancing lowland riparian areas accomplishing over 250 miles of riparian enhancement work.		**HAB-07**	**Conserve and restore key habitats in the lower watershed**
HAB-07	Protect and Enhance Instream Habitat	ONGOING/REVISED: Federal, state, and local partners implemented several projects to improve in-stream habitat. These include passage barrier removal and replacement, large woody debris placement, stream complexity enhancement, and riparian restoration.		**HAB-08**	**Conserve and restore key habitats in the upper watershed**
HAB-08	Protect and Enhance Freshwater Wetland Habitat	ONGOING/REVISED: Limited progress has been made toward non-estuarine wetland enhancement due to lack of priority among other habitat, lack of comprehensive assessment, and challenges of accessing potential enhancement sites.			
HAB-09	Control Livestock Access to Streams	ONGOING/REVISED: Tillamook County Soil & Water in partnership with TEP's BYPP have implemented numerous fencing and off-channel watering projects eliminating livestock access to streams.	Included in HAB-13		
HAB-10	Stabilize Streambanks Using Alternatives to Riprap	ONGOING/REVISED: TEP's BYPP program and similar programs operated by other estuary partners have used extensive riparian vegetation enhancement to stabilize streambanks naturally reducing the need for rip rap. In addition, project partners such as TBWC and USFS are developing innovative strategies using soft revetment such as LWD structures to accomplish the same goal in-stream.	Included in HAB-13		
HAB-11	Encourage Protection and Enhancement on Private Lands	ONGOING/REVISED: Protection and enhancement of private lands has been a primary focus of project partners. Numerous cooperative projects have resulted highlighted by the 520-acre Southern Flow Land Owner Alternative project in Tillamook Bay.	Included in HAB-06, HAB-07, HAB-08		

1999 CCMP "Key Habitat" Action Plan				2019 CCMP "Habitat Restoration" Action Plan	
Action Item	**Description**	**Status**		**Action Item**	**Description**
HAB-12	Sponsor a Native Vegetation Planting Day	REVISED: Native vegetation has been planted by TEP and its partners for multiple projects and stewardship activities	}	**HAB-10**	**Provide genetically appropriate native vegetation and promote its use among habitat restoration and enhancement partners**
HAB-13	Increase Incentive Program Payments	REVISED: TEP does not lead incentive programs; however, partner-led programs may include incentives.	Included in HAB-13, HAB-14		
HAB-14	Ensure Minimum Streamflows	REVISED: TEP projects may have indirectly affected streamflows through the restoration work accomplished via other CCMP actions.	Included in HAB-13, HAB-14		
HAB-15	Revise Local Ordinances to Increase Protection of Riparian Areas, Wetlands, and Instream Habitat	REVISED: TEP and its partners have worked towards more effective ordinances through a robust outreach and education program but have not directly revised and specific ordinances or other regulations.	}	**HAB-14**	**Encourage the adoption and implementation of policies, ordinances, regulations, and laws that ensure sustainable use and stewardship of natural resources and key habitats**
HAB-16	Effectively Enforce Laws and Regulations	REVISED: TEP advocates for judicious and responsible use of natural resources. Partner agencies lead law and regulation enforcement.			
HAB-17	Characterize Estuarine and Tidal Habitats	ONGOING/REVISED: Estuary Technical Group assessed Tillamook Bay and Nehalem. Process different than what was outlined in CCMP.	Included in HAB-01		
HAB-18	Prioritize Tidal Sites for Protection and Enhancement	ONGOING/REVISED: Prioritization of Tidal Wetland Landward Migration Zones occurred in 2017 as part of a coastwide estuary project.	Included in HAB-01		
HAB-19	Protect and Enhance Tidal Marsh	ONGOING/REVISED: TEP has lead or contributed as a key partner in numerous projects that have resulted in the protection and enhancement of tidal marsh. Primary examples include the Southern Flow Corridor (520 acres), Miami Wetlands (60 acres), and the Kilchis Preserve (150 acres	Included in HAB-06		
HAB-20	Protect and Enhance Eelgrass Habitats	ONGOING/REVISED: EPA and NOAA have done eelgrass studies, roughly a decade ago. Oyster growers may have been involved.	Included in HAB-01, HAB-06, HAB-11		

1999 CCMP "Key Habitat" Action Plan				2019 CCMP "Habitat Restoration" Action Plan	
Action Item	**Description**	**Status**		**Action Item**	**Description**
HAB-21	Remove or Modify Ineffective Tide Gates and Floodplain/Lowland Culverts	ONGOING/REVISED: Numerous assessments and projects have occurred within the focal area accomplishing this goal. These include assessments of passage infrastructure in Nehalem, Tillamook, and the Nestucca watersheds. These have resulted in several high value projects increasing connectivity.	}	HAB-09	Maximize ecosystem connectivity to ensure a landscape array of ecosystem processes and ease of species movement
HAB-22	Enhance Large Wood in Estuary	ONGOING/REVISED: TEP lead a large wood salvage program for several years meant to gather available LWD for projects in the estuary and other portions of the watershed. Numerous challenges exist to placing structures within the estuary including the maintenance of navigation and public safety. In areas where conservation land ownership has been established several LWD placement has been able to occur.	Included in HAB-01, HAB-09		
HAB-23	Update the Estuary Plan and Zoning	REVISED: Partner agencies lead planning and zoning activities. TEP provides technical assistance.	Included in HAB-14		
HAB-24	Reconnect Sloughs and Rivers to Improve Water Flow	ONGOING/REVISED: Several high value projects have occurred including the Southern Flow Corridor (520 acres), Miami Wetlands (60 acres), and the Kilchis Preserve (150 acres).	Included in HAB-09, and HAB-01, HAB-09		
HAB-25	Control Burrowing Shrimp Populations	REVISED: Burrowing Shrimp are a native species with important ecological roles in the estuaries. This effort may have been indirectly affected by restoration work accomplished via other CCMP actions.	Included in HAB-11		
HAB-26	Prevent Introduction and Control Exotic Species	ONGOING/REVISED: Numerous efforts have occurred in all portions of the watershed to target our most aggressive invaders. TEP facilitates the Partnership for Regional Invasive Species Management in Tillamook County.	}	HAB-12	Assess, prioritize, and manage non-native species emphasizing those that have or are likely to have disproportionate negative effects
HAB-27	Effectively Enforce Fishing Regulations	ONGOING/REVISED: ODFW regularly conducts this activity.	Included in HAB-14		
HAB-28	Evaluate Commercial and Sport-Fishing Practices	ONGOING/REVISED: ODFW regularly conducts this activity.	Included in HAB-14		

1999 CCMP "Key Habitat" Action Plan				2019 CCMP "Habitat Restoration" Action Plan	
Action Item	**Description**	**Status**		**Action Item**	**Description**
HAB-29	Implement Essential Fish Habitat Mandates	ONGOING/REVISED: ODFW regularly conducts this activity.	Included in HAB-1 through 12, and HAB-14		
HAB-30	Support the Oregon Plan for Salmon and Watersheds	DELETE: Accomplished through the CCMP.	X		
NEW			+	HAB-11	Assess, prioritize, and enhance key native species populations, emphasizing contribution to ecological function
NEW			+	HAB-13	Assess and implement best management practices for key habitat conservation.
NEW			+	HAB-15	Facilitate the development of pathways, funding sources, and prioritize actions taking place on "working" lands

Table 3 *Community Education and Engagement Key Action Plan Accomplishments and Changes Since 1999*

1999 CCMP "Citizen Involvement" Action Plan				2019 CCMP "Community Education and Engagement	
Action Item	**Description**	**Status**		**Action Item**	**Description**
CIT-01	Implement an OSU Extension Watershed Masters Series	COMPLETE: Replaced by OR Master Naturalist Program implemented through OSU Extension.	✓		
CIT-02	Implement an Associate of Arts Oregon Transfer Degree in Environmental Studies	COMPLETE: Agriculture and Natural Resource Associates Degree through TBCC	✓		
CIT-03	Improve Professional Development for K-12 Teachers	ONGOING/REVISED: OR Coast STEM Hub and OR Environmental Literacy Program	}	CEE-01	Strengthen STEM literacy for K-12
CIT-04	Strengthen Organizational and Institutional Linkages	ONGOING/REVISED: OR Coast STEM Hub and Tillamook School District Teacher on Special Assignment			
CIT-05	Expand Authentic Learning Experience Opportunities	ONGOING/REVISED: Landmark Outdoor Learning Experiences for all grades in Tillamook School District and county-wide for 3rd and 4th grades (TEP's DBTC and CCWF).			
CIT-06	Establish a Land Trust or Conservation Organization	COMPLETE: Lower Nehalem Community Trust and North Coast Land Conservancy.	✓		
CIT-07	Sustain the Tillamook Bay Watershed Council	ONGOING/REVISED: Landmark Capacity Building for Tillamook, Lower Nehalem, and Necanicum Watershed Councils and Lower Nehalem Community Trust	}	CEE-05	Build capacity for partner organizations
CIT-08	Sustain the Tillamook Coastal Watershed Resource Center	COMPLETE: GIS training available through TBCC and OSU Extension. Open access to geographic data online	✓		
NEW			+	CEE-02	Advance STEM-related career opportunities
NEW			+	CEE-03	Foster lifelong learning and environmental awareness
NEW			+	CEE-04	Cultivate community environmental stewardship

Table 4 *Flood Key Action Plan Accomplishments and Changes Since 1999*

1999 CCMP "Flood" Action Plan				2019 CCMP
Action Item	**Description**	**Status**		**Description**
FLD-01	Develop a GIS-Based, Unsteady State Hydrodynamic Model	COMPLETE: FEMA and DOGAMI completed an updated of the countywide flood insurance rate maps. Maps are effective as of 09/28/2018. GIS based data is provided with the updates via FEMA/DOGAMI. In addition, DOGAMI produced a Natural Hazard Risk Report for Tillamook County (IMS-58) in 2018. Furthermore, the County has an effective Natural Hazards Mitigation Plan (9/8/2017) that provides mitigation actions for natural hazards including flood.	✓	
FLD-02	Implement Watershed Drainage Modification Projects	ONGOING/REVISED: See habitat section for status of projects.	}	Included in HAB-06, HAB-07, HAB-08
FLD-03	Elevate and/or Relocate Structures, Livestock and Equipment	ONGOING/REVISED: Several properties have been elevated, demolished, or relocated. Tillamook County has an active Natural Hazards Mitigation Plan. See Tillamook County NHMP for more information on actions to elevate and/or relocate structures, livestock, and equipment.	}	Included in Tillamook County NHMP (2017)
FLD-04	Update Existing Floodplain Map	COMPLETE: Maps are effective as of 09/28/2018	✓	FIS/FIRMs will be adopted once they are effective.
FLD-05	Regulate New Construction and Development in the Floodplain	COMPLETE: Tillamook County and all incorporated cities have flood damage prevention ordinances.	✓	DLCD will assist Tillamook County with adopting a new Natural Hazards (Goal 7) element to their comprehensive plan. New flood damage prevention ordinances will be adopted after the FIS/FIRMs are effective.
FLD-06	Effectively Clear Mapped Lowland Floodways and Floodplain of Hazardous Materials	ONGOING/REVISED: This action is accomplished through enforcement of County/City flood damage prevention ordinances.	}	See County/City flood damage prevention ordinances.

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Action Plans

The Action Plans address the three priority problems (water quality, habitat restoration, and community education and engagement) through 25 specific actions. Each action details the steps required to complete the action; identifies coordinating entities, other partners, and completion dates; estimates costs; identifies metrics to evaluate the success of the action; and shows if the action benefits fish/shellfish/wildlife, natural hazard risk reduction, and climate change.

The 2019 CCMP incorporates many good ideas from relevant resource management plans that focus on their respective parts of the focal area environment. Although not all are specifically referenced, the CCMP includes goals and objectives from these plans and integrates them into a landscape-scale vision for performance-based management. This version of the CCMP includes enhanced information on causes and impacts of natural hazards and climate change.

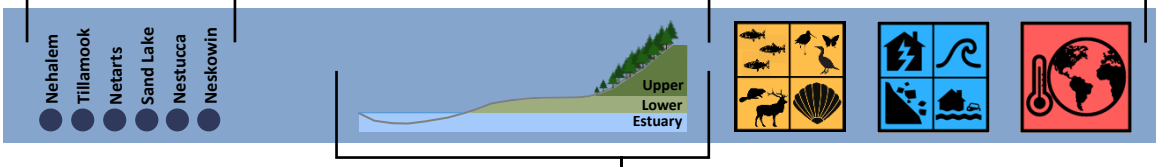
The CCMP includes several types of actions to achieve immediate and long-term goals. It calls for on-the-ground projects to upgrade infrastructure, enhance habitat, reconnect rivers and sloughs, and improve land use practices. The plan also supports effective enforcement of environmental laws and ordinances, and outlines actions to build local capacity for better enforcement and education. Other actions define additional needs for continued research and monitoring to track progress in achieving stated objectives. By integrating on-the-ground projects, stronger enforcement, institutional development, and monitoring efforts, the CCMP presents a responsive and adaptable framework that combines local, state, and federal initiatives into a coordinated management plan for Tillamook County.

Anatomy of a CCMP Action

Shows which of the Tillamook estuaries and watersheds the action impacts.
Note: Solid circles indicate the watersheds to which each action applies.

Symbolizes actions that are beneficial to the health of fish/shellfish/wildlife, reduce risk to natural hazards, and/or reduce impacts from expected climate change.

Action ID Number



Title: Brief description of the action

Shows which region(s) of the watershed benefit from the implementation of the action.

Estuaries include the extremely low gradient area that is influenced by tides and the Pacific Ocean's salinity.

Lower Watersheds (*Lower*) include the areas adjacent to the estuary that are within the rivers alluvial plain.

Upper Watersheds (*Upper*) include the lands of relatively higher elevation that do not flood frequently and therefore do not display wetland characteristics.

What: Detailed description of the action providing information on what will be accomplished during this CCMP cycle.

Lead(s): List of lead agencies responsible for carrying out the implementation of the action.

Partner(s): List of potential partner agencies that will collaborate with the lead(s) to implement the action. Additional partners may be identified at any time.

How

Activity (#): Each activity lists how TEP and/or its partners plan to implement each action. (Cost/Funding Source, Timeline).

Anticipated Costs/Source:

Provides the cost estimate and funding source needed to implement the action. A symbol code ($-$$$$) is used to show the total cost of the action, or in the case of ongoing actions, the typical annual cost:

$	Less than $25,000
$$	$25,000 to $99,999
$$$	$100,000 to $499,999
$$$$	$500,000 or more

A letter code is used to show the anticipated funding source:

E = EPA 320 Grant Funds
F = Federal (non-320) Grants
S = State Grants
P = Partner-funded Project
O = Other Funding Sources (e.g. Foundation Grants, Donations)

Timing:

Ongoing – Action is currently active and expected to continue within the life of the CCMP.

Short-term – Action is expected to begin implementation within two years.

Mid-term – Action is expected to begin implementation within three to five years.

Long-term – Action is expected to begin implementation within ten years

Why: Description of why the action is important and how it accomplishes the goals.

Performance Measures:

✓ Describes how the action will be measured to track progress and determine if the action has been successfully implemented.

Chapter 1: Water Quality Action Plan

Poor water quality can impact human health as well as aquatic life. Bacteria, toxics (e.g., metals, pesticides, microplastics, etc.), sediment (in the form of turbidity), and nutrients are pollutants that can directly affect human health. There are three general ways in which people can be exposed to these pollutants: drinking (surface water and groundwater sources), recreational contact (swimming, boating, and fishing), and the consumption of fish, oysters, clams and crabs.


Roger Ross

Fish and aquatic life can also be affected by poor water quality. Elevated temperature, toxics, sediment, low dissolved oxygen, microplastics, and other emerging water quality concerns in the water column can adversely affect aquatic life in various ways. Aquatic life is in direct and constant contact with water pollution and therefore can be significantly impacted by it.

Human Health

Fecal bacteria (bacteria that occur in the guts of warm blooded animals and humans) concentrations in water are used as indicators of potential for spread of water-borne diseases. When bacteria levels exceed the water quality standards, people experience an elevated risk of exposure to pathogens from direct contact with water or from ingestion of food products, such as shellfish, which have been exposed to contaminated water. Tillamook and Netarts Bay support commercial oyster operations. Tillamook Bay also supports limited commercial clam harvesting. Nehalem, Tillamook, Netarts, Sand Lake, and Nestucca provide opportunities for recreational clamming. Commercial shellfish harvesting in Tillamook Bay is regulated by Oregon Department of Agriculture (ODA) and is periodically closed due to bacterial pollution. Streams, rivers, sloughs, and estuaries regularly exceed recreational use contact criteria for bacteria. Additionally, water contact advisories occur periodically at north coast beaches due to bacterial contamination. Sources of the contamination can include agricultural and dairy operation runoff, failing on-site septic systems, and urban runoff.

In addition to direct exposure to contaminated water while recreating, human health can be affected by contaminated drinking water. A majority of the drinking water in the north coast of Oregon comes from surface water streams and has minimal treatment. These coastal surface drinking water source streams are periodically affected by high turbidity levels levels which may limit a treatment plant's ability to process water or may form toxic pollutants when organics interact with treatment processes. Groundwater wells, used as drinking water sources to a lesser degree, are vulnerable to bacteria and nutrient contamination. Pesticides are an on-going concern related to surface drinking water source streams on the coast. However, preliminary investigations have shown limited impacts from pesticides. Other toxics such as arsenic have been identified in shellfish (softshell clams) at levels of concern. However, agencies have determined with proper preparation of clams, exposure to arsenic can be avoided.

Aquatic Life Requirements

Coho and Chinook salmon, steelhead and cutthroat trout are present throughout most of the streams, sloughs, and estuaries of the TEP focus area. Coho are currently listed as a threatened species and steelhead are listed as

a species of concern. Chum salmon also occupy the lower reaches of some streams, rivers and estuaries. All of these fish have specific habitat requirements and many of the water quality criteria adopted by the State of Oregon are based on providing salmon with their specific life-cycle requirements.

Temperature, sediment, nutrients and dissolved oxygen have been identified as pollutants that affect these fish and other aquatic life when not at appropriate levels. Micro-plastics and other emerging pollutants of concern have the potential to negatively impact fish and aquatic life. Conditions that contribute to elevated water temperature are inadequate streamside shading and vegetation, discharges of warm water from urban and rural landscapes, and point source discharges from industrial or municipal facilities. High temperatures and excessive nutrient and sediment loads can reduce the amount of oxygen in the water. Threatened and sensitive salmon species rely on cold oxygenated water to thrive.

Carbon from the atmosphere has been dissolving in the Pacific Ocean at an ever-increasing rate, changing its acidity (pH). This condition is termed ocean acidification. In addition, nutrient rich and oxygen poor waters with lower pH levels are driven up to the coast of Oregon by seasonal currents. These conditions, combined with nutrient runoff, coalesce in estuaries to negatively affect shellfish, and other aquatic life. The commercial aquaculture and shellfish in general, depend on specific acidity in estuary habitats to grow and mature.

The Challenge

The State of Oregon, TEP, and its partners have determined that the following pollutants are of primary concern in the watersheds of TEP's focal area: bacteria, dissolved oxygen, sediment, and temperature. Toxics and nutrients have been identified as pollutants of possible concern, while the impacts of ocean acidifcation are also a concern. While there has been progress made on addressing bacteria pollution in TEP's focal area, all these parameters remain at levels that are having a negative impact on people and aquatic life.

Existing Efforts in Water Quality

The State water quality standards have been established to be protective of the most sensitive beneficial use. The Oregon Department of Environmental Quality (DEQ) has included the following water quality parameters on the State's 303(d) list of impaired waters: temperature, bacteria, dissolved oxygen, and sediment. In the early 2000s, after the completion of the TEP's 1999 CCMP, DEQ developed Total Maximum Daily Loads (TMDLs) for temperature and bacteria in the North Coast Subbasins (Nehalem), Tillamook Bay, and Nestucca Bay Watersheds. Each TMDL includes a Water Quality Management Plan (WQMP) that outlines how to implement the TMDL for land uses or categories contributing to water pollution. The 1999 CCMP formed the basis for the Tillamook Bay TMDL WQMP. With TEP's focal area expansion, the WQMP from the Nestucca and North Coast Subbasins TMDLs have guided the strategies included in the CCMP Revisions.

In 2011, DEQ completed the North Coast Basin Water Quality Status and Action Plan report based on EPA's Watershed Approach strategy. This report summarized DEQ's knowledge of the water quality conditions and includes an overview of implementation for the North Coast Subbasin, which encompasses the entire TEP focal area. The Action Plan identified issues and gaps that DEQ uses to guide its management of water quality in the future. This report summarizes past management history, water quality studies and assessments. TEP has partnered in the acquisition of much of the information that formed the basis for this assessment. The actions identified in this report have been used to guide the development of issues and actions outlined in the water quality sections of the CCMP, including the goals, objectives, and actions identified below.

The TMDLs and Watershed Approach have identified the water quality issues in the area and outlined strategies to address them. Many Federal, State and local partners have developed and are implementing programs that work to address these water quality issues. TEP has incorporated the most relevant and effective efforts of its partners, alongside its own work, into the Water Quality Actions in the CCMP Water Quality chapter. Actions identified in this chapter are generally designed to address a specific water quality parameter or a suite of

parameters. However, actions that improve one water quality parameter will also provide improvements to additional water quality parameters. TEP has categorized the benefits of these actions as having a "Primary" and "Related" water quality parameter benefit. An example of this benefit category is temperature and dissolved oxygen. Actions taken to limit high water temperatures will also improve dissolved oxygen given that cooler water can hold more oxygen. This distinction is outlined in the Objectives section.

Watershed Commonalities and Variations

It is important to note that water quality issues and strategies (TMDLs and Watershed Approach) and partners' jurisdictions have significant similarities across TEP's focal area. Water quality and pollution sources are affected by the land uses present in a given watershed. There are some minor variations between watersheds within TEP's focal area, driven primarily by land use and land ownership. TEP will implement efforts identified in this section's actions throughout its entire focal area guided by land use and land ownership. Where appropriate TEP will shift its partners or strategies to align with minor variations in water quality issue and partners jurisdictions.

Challenges to Addressing Water Quality

Information Gaps

Regulatory and Compliance: Many programs that implement water qualtiy improvement projects in the region do not have strategies in place or resources to quantify and report the actions taken or the amount of compliance with current regulations. TEP relies on ageny programs to implement water quality improvement but the statistics from these programs are not readly available. There is also limited information to directly link actions taken on the landscape to associated environmental changes measured in the waterbodies.

Water Quality Monitoring: TEP has established an extremely robust and useful Volunteer Water Quality Monitoring Program (VWQMP) that collects bacteria data for use in determining water quality status and trends over time. In addition, TEP has been working closely with DEQ to establish a long-term temperature monitoring plan. There are other water quality parameters that are of concern but no monitoring plans or strategies are in place: dissolved oxygen, sediment, nutrients, and ocean acidification (low pH). There are challenges associated with these parameters, such as lack of numeric standards or understanding of local environmental effects, which have limited TEP and its partners' ability to devise appropriate monitoring strategies. However, without a complete suite of monitoring programs in place, it will be challenging for TEP and its partners to determine if actions are effective at addressing all the water quality parameters of concern.

Barriers

Landowner participation: Many of the programs and projects used to address water quality issues in the area are implemented on a voluntary basis. Without landowner cooperation it can be challenging to reach the critical mass needed on the landscape to measure any environmental effect. This barrier highlights the importance of developing and maintaining a robust community engagement program.

Community Resources: TEP's focal area encompasses a largely rural landscape. There are limited opportunities to engage well-funded partners or donors to assist with the environmental actions and organizational infrastructure required to address the scope and scale of the issues faced in the area. In addition, political will and industry goals can be in conflict with restoration efforts. Individuals in leadership do not always recognize and monetize the ecosystem services provided by healthy and properly functioning watersheds.

Budgets: The State of Oregon is a significant partner in many of the programs identified throughout the CCMP. However, budget and funding limitations have not always allowed State programs to track project implementation and regulatory compliance. Incomplete scientific understanding and lack of political will have led to regulations or implementation strategies that have limited and ineffective requirements.

GOAL

Maintain and improve the beneficial uses of estuaries and watersheds for humans and native aquatic and terrestrial species

Objective **Reduce water pollution from agriculture land use activities.**

Primary Water Quality Parameters: Bacteria, Nutrients, Temperature, Sediment

Related Water Quality Benefit: Dissolved Oxygen

Objective **Reduce water pollution from rural residential and urban infrastructure.**

Primary Water Quality Parameters: Sediment, Nutrients, Bacteria, Toxics

Related Water Quality Benefit: Temperature, Dissolved Oxygen

Objective **Increase properly functioning riparian communities throughout the watershed and across land uses to improve water quality.**

Primary Water Quality Parameters: Temperature, Sediment

Related Water Quality Benefit: Dissolved Oxygen, Nutrients

Objective **Increase restored channel features and hillslope management to improve sediment storage and routing.**

Primary Water Quality Parameters: Sediment

Related Water Quality Benefit: Temperature

Objective **Determine if the beneficial uses of the sloughs, rivers, and estuaries are meeting water quality criteria.**

Primary Water Quality Parameters: Bacteria, Temperature

Related Water Quality Benefit: Sediment, OAH, Nutrients, Dissolved Oxygen, Toxics

List of Actions

WAQ-01	Improve farm management practices to address water quality
WAQ-02	Improve rural residential and urban infrastructure to address water quality
WAQ-03	Enhance riparian and in-stream areas throughout the watersheds to improve water quality
WAQ-04	Restore channel features and hillslope management to Improve sediment storage and routing to address water quality
WAQ-05	Identify status and trends and quantify changing environmental conditions in water quality to inform adaptive management strategies impacting TEP's priority areas

Improve farm management practices to address water quality

What: The Oregon Department of Agriculture (ODA) has established a variety of water quality programs to prevent and control waste and runoff from agricultural activities. These programs include the Agricultural Water Quality Management Program (AWQMP), the Pesticide Program, the Confined Animal Feeding Operations (CAFO) Permit Program, and Soil and Water Conservation Program.

ODA's Water Quality Program uses three major techniques to identify and implement water quality improvement actions and requirements. These are the Agricultural Water Quality Management Area Plans, Strategic Implementation Areas (SIA) and the Coordinated Streamside Management Program. ODA's Water Quality Program targets all agriculture operations and establishes requirements that apply to permitted operations as well as small operations that do not require permits through the CAFO program.

ODA, through its Pesticides Program, has been charged with the regulation and registration of pesticide use for the State of Oregon and has established the Pesticide Management Plan (PMP) that addresses pesticide use and enforcement throughout the state. ODA partnered with several different state agencies to form the Water Quality Pesticide Management Team (WQPMT). The group is responsible for protection of waters of the state from pesticide contamination.

The CAFO Permit Program addresses specific agricultural operations where animals are confined in a prepared area for a certain period and when manure and wastewater generated by the farm is stored under particular conditions. These operations are subject to a National Pollutant Discharge Elimination System (NPDES) General Permit. The permit ensures that specific requirements are met by the operation to manage the facility and its waste.

The ODA Soil and Water Conservation Program provides technical assistance and oversight to the Tillamook County Soil and Water Conservation District (SWCD). The Tillamook SWCD works with local landowners to properly manage natural resources on rural lands through development and implementation of Voluntary Farm Management plans based on Natural Resource Conservation Service (NRCS) management practices. Plans also include requirements set out in the North Coast Basin Agricultural Water Quality Management Area Plan.

Dairies are one of the major agricultural activities in Tillamook County. The Tillamook County Creamery Association (TCCA) is a cooperative of local dairy farms. TCCA encourages member farms to address water quality issues through its Stewardship Program. The Stewardship program works with other partners to assist members and other agricultural producers with infrastructure improvements, land management strategies, and operational efficiencies.

Oregon State University researchers and extension staff are constantly investigating ways to improve farm management practices. Much of the focus between the University and the Extension Office is bringing research to local agricultural communities to assist with issues important to day to day operations and farm management. Getting the latest information to farms can help improve farm management as well as improve water quality. TEP will work with OSU Extension to facilitate community outreach and event coordination. TEP also partners on agricultural related water quality research efforts.

Lead(s): ODA, Tillamook SWCD, TCCA, OSU Extension

Partner(s): TEP, DEQ, OWEB, Watershed Councils, and landowners

How

Activity 1: Implement the ODA Agricultural Water Quality Management Program.

Anticipated Cost/Source: $$$/P

Timing: Ongoing

- ODA actively leads, with the assistance of the North Coast Local Advisory Committee (LAC), the review of the North Coast Basin Agricultural Water Quality Management Area Plan on a biennial basis. Updates occur as needed. The Area Plan includes prevention and control measures (PCMs), also referred to as Area Rules, to ensure that landowners prevent and control manure, nutrients, sediments, pesticides, and other agricultural wastes from entering waters of the state. ODA Water Quality staff will implement the program. TEP will contribute to the LAC process by providing water quality data to inform adaptive management of the Area Plan. TEP will also assist with the implementation of water quality improvement projects where appropriate.
- ODA's Water Quality Program also leads the establishment and execution of the Strategic Implementation Areas program. ODA focuses efforts in these areas to conduct Compliance Evaluations to identify potential sources of pollution from agricultural activities, provide technical and financial assistance as available, and enforce water quality regulations where problems persist. TEP assists ODA with project funding through grant writing and subsequent project implementation. TEP also contributes water quality information on status and trends for applicable parameters.
- Finally, ODA is currently collaborating with sister agencies and local partners to implement the Coordinated Streamside Management Program. The program develops monitoring plans that will be deployed at a watershed scale, partners with local organizations to increase incentive-based conservation in riparian areas and ensures compliance with area rules. TEP assists ODA with project funding through grant writing to the Oregon Watershed Enhancement Board or other funding sources and subsequent project implementation. TEP also contributes water quality monitoring and information on status and trends for applicable parameters.

Activity 2: ODA continues to implement their Pesticide Program.

Anticipated Cost/Source: $$$/P

Timing: Ongoing

- Analyze risk from pesticides use in watersheds,
- Partner to enable water quality monitoring activities and analysis of results,
- Promote pesticide management strategies through outreach and education of local stakeholder groups,
- Facilitate communication with partners at the state and federal levels as well as local producers and others about pesticides and water quality, and
- Implement adaptive management strategies based on results of monitoring and program success.

Activity 3: The Tillamook SWCD will continue to develop and implement Voluntary Farm Management plans based on NRCS management practices. Plans include requirements of the North Coast Basin Agricultural Water Quality Management Area Plan. TEP contributes water quality monitoring and information on status and trends for applicable parameters. In addition, TEP partners with Tillamook SWCD on riparian restoration associated with fencing projects.

Anticipated Cost/Source: $$/P

Timing: Ongoing

- Provide technical assistance and assists in establishment of Voluntary Farm Managements Plans,
- Continue implementation throughout Tillamook County and its focus area as needed,
- Implement Livestock Exclusion Fencing and riparian projects, and
- Provide landowner introductions for other partner programs.

Activity 4: ODA continues to implement the CAFO Permit Program.

Anticipated Cost/Source: $$$/P

Timing: Ongoing

- Maintain compliance with permit requirements,
- Respond to complaints and, where necessary, develop and insure implementation of correction plans in a timely manner,
- Conduct annual inspections at all facilities and unannounced inspections at 10% of CAFOs annually, and
- Where available prioritize CAFO resources to target areas based on water quality information.
- TEP contributes water quality monitoring and information on status and trends for applicable parameters to identify areas that need additional focus. TEP works with the CAFO Program to further information on bacteria source assessments through use of Microbial Source Tracking projects.

Activity 5: The TCCA will implement its Stewardship program throughout Tillamook County to:

Anticipated Cost/Source: $$/P

Timing: Short term

- Promote efficient water use,
- Encourage livestock exclusion fencing and riparian planting projects, and
- Provide technical assistance for land management strategies.

Activity 6: OSU Extension staff will implement educational opportunities in Tillamook County.

Anticipated Cost/Source: $/P

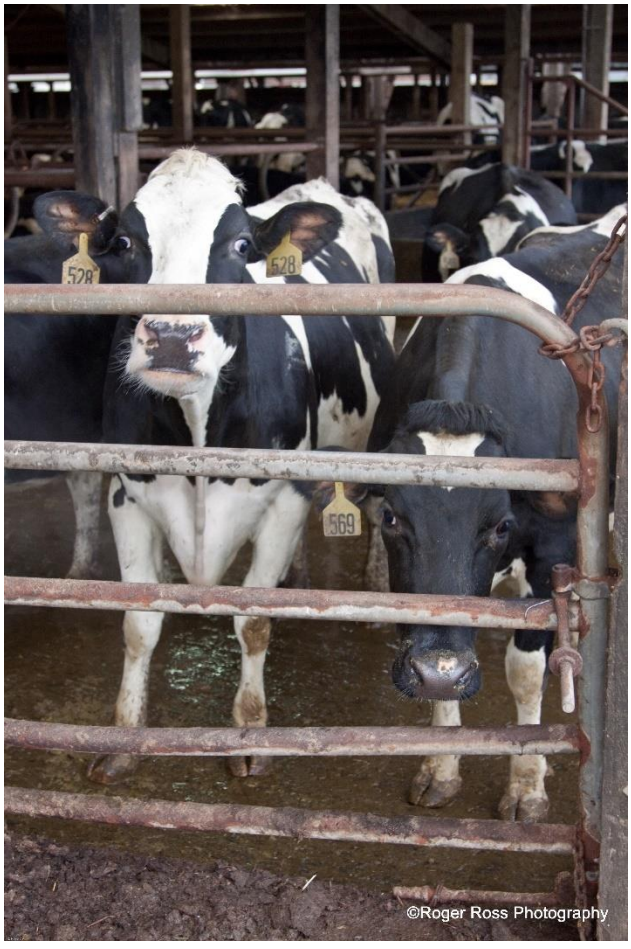
Timing: Short term

- Identify and design farm management curricula suitable for the North Coast Basin,
- Host "How To" Agricultural Communities Events, and
- Write articles for various agricultural publications.

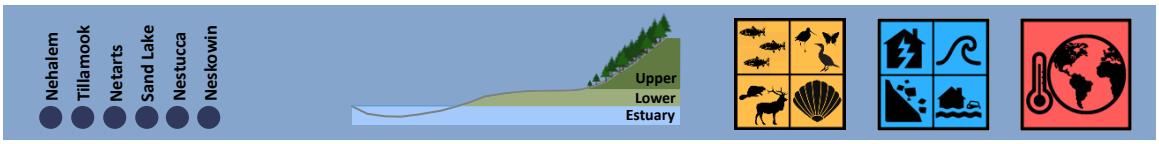
Why: Agriculture land uses have the potential to impact streams, sloughs, and bays within the TEP focal area. Bacteria is a major pollutant associated with agricultural operations. Other water pollutants include sediment, nutrients, and increased water temperature from lack of stream side shade. Some toxics (e.g., pesticides) may also have the potential to be associated with farm activities as local farms produce more crops such as corn. These pollutants can impact human health through water contact and surface drinking water sources. Aquatic life may be directly affected by these pollutants or indirectly when the presence of pollutants contributes to other effects on water quality such as lowering levels of dissolved oxygen in the streams, sloughs and bays. ODA is responsible for ensuring that activities associated with various forms of farming, ranching and other agricultural operations work to achieve water quality standards by limiting water pollution.

Performance Measures:

- ✓ By 2028, TEP VWQMP data will indicate that 50% of the monitoring sites are generally meeting water quality standards based on DEQ assessment methodology.



WAQ-02



Improve rural residential and urban infrastructure to address water quality

What: Pollution can be transported to waterbodies from urban and rural infrastructure. Stormwater runoff from impervious areas (e.g., streets, parking lots, and rooftops) often contain pollutants that can adversely affect water quality. Construction, industrial activities, and municipalities can also impact surface waters from runoff. Wastewater Treatment Plants (WWTPs) collect, treat and discharge water to rivers, sloughs, and bays. National Pollutant Discharge Elimination System (NPDES) permits are required for many activities, facilities and municipalities that have the potential to discharge stormwater.

There are three types of General NPDES Stormwater Permits that are typically found in the TEP focal area. These include permits that cover several industrial activities like WWTPs; permits specific to mining or asphalt/concrete, batch plant activities; and permits that cover construction activities. In addition, seafood processors are covered under NPDES permits and are typically located around estuaries.

Residential septic systems, when not functioning properly, may impact water quality. All homes outside of a public WWTP area treat their wastewater using onsite septic systems. DEQ regulates the siting, design, installation and ongoing operation and maintenance of onsite septic systems. Without careful maintenance, septic systems can fail prematurely, resulting in polluted streams and groundwater.

In the North Coast, DEQ provides oversight of the onsite program that Tillamook County manages under contract with DEQ. DEQ and the County ensure that septic tank pumpers have the necessary equipment to safely pump and transport septage. In addition, DEQ has a certification and licensing program for installers, pumpers, and maintenance providers. DEQ also reviews and approves products such as septic tanks, alternative treatment technologies, and alternative drainfield products.

Lead(s): TEP, DEQ, Tillamook County

Partner(s): TEP, Municipalities, DEQ, OWEB, Tillamook County, and Watershed Councils

How

Activity 1: TEP will assist municipalities with stormwater management improvement.

Anticipated Cost/Source: $$/E,S,O

Timing: Short term

- Collect information and water quality data,
- Share and analyze water quality data,
- Contribute water quality information on status and trends for applicable parameters, and
- Implement stormwater restoration projects (bio swales etc.).

Activity 2: DEQ Implements the NPDES program to address the varied facilities and activities included in the program. The WWTP Permit Program specifically addresses treatment plant upgrades, infrastructure collection improvements, and septic area conversion.

Anticipated Cost/Source: $$$$/P

Timing: Ongoing

- Improve outreach to small communities with aging wastewater infrastructure and integration of Enterococci bacteria limits in marine discharge permits and E. coli limits to freshwater discharge permits and establishing ultraviolet disinfection performance expectations.
- DEQ will work to develop a list of emerging persistent pollutants typically found in WWTP

effluent that have a documented effect on human health, wildlife and aquatic life.
- Presently no municipal source has a pretreatment program in the North Coast. However, if DEQ determines that analytical results show that there are constituents above specific levels, pretreatment may be required.
- DEQ works with domestic wastewater treatment facilities to assure biosolids are adequately stabilized and that land application operations and management meet federal and state regulations. Similar activities and requirements apply to wastewater solids generated by industrial facilities.
- DEQ requires monitoring and reporting on biosolids activities, review monitoring results, take prompt and appropriate action when potential issues arise, provide technical assistance for facility owners and operators when needed.

Activity 3: Tillamook County implements on-site septic program through DEQ designated authority.

Anticipated Cost/Source: $$$/P
Timing: Ongoing

- Track septic system data,
- Complete septic survey on a 10-year schedule,
- Respond to complaints related to failing or improper septic applications, and
- Permit new installations of systems.

Activity 4: TEP acquires and formats information on septic systems for communication and general assessment purposes

Anticipated Cost/Sources: $/E,S,O
Timing: Mid-Term

- Determine number of upgrades,
- Determine number and location of stream side septic systems, and
- Promote issues that are not being met (e.g., inspect drainfield during sale; currently only the tank is inspected).

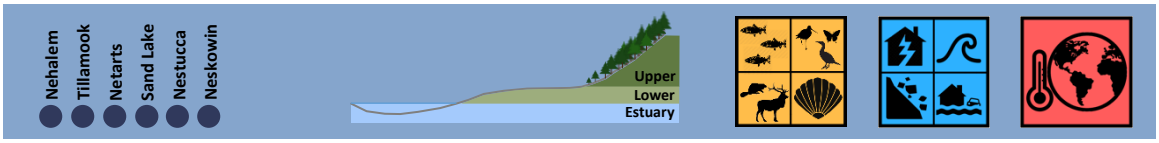
Why: Various components of urban and rural infrastructure can be the source of, or the delivery mechanism for, pollution reaching streams, sloughs, and estuaries within Tillamook County. WWTPs and failing septic systems can be sources of bacteria, nutrient pollution, and toxics such as pharmaceuticals, personal care products, and micro plastics. All these pollutants can affect human health and use of waterways. Bacteria pollution can limit the use of rivers and bays for recreation. It can also contribute to the closure of commercial shellfish harvest in the estuaries in Tillamook County, primarily Tillamook Bay.

Surfaces that collect and transport rainwater to streams as well as facilities that use water for processing can contribute to water quality issues. Pollutants, such as metals, petroleum products, or any other product that collects or is dumped on streets, can enter waterbodies through runoff from stormwater infrastructure. Industrial activities that use water may deliver pollution to waterbodies that receive that effluent. In addition to the pollutants mentioned above, stormwater and industrial discharge water can have a higher temperature than what is required by native salmon and other aquatic life. Runoff and effluent from these sources can contribute to the elevated water temperature in local streams, sloughs and bays.

Performance Measures:

- ✓ Creation of septic system inventory which focuses on properties adjacent to streams, rivers, sloughs, and bays and which may be used to prioritize water quality improvement projects, by 2028.
- ✓ By 2028, TEP VWQMP data will indicate that 50% of the monitoring sites are generally meeting water quality standards based on DEQ assessment methodology.

WAQ-03



Enhance riparian and in-stream areas throughout the watersheds to improve water quality

What: Water temperatures in streams, sloughs, and bays, higher than what is required by salmon and other aquatic life, have been identified throughout TEP's focal area. The focal area includes three TMDL plans that protect for the beneficial use of fish and aquatic life related to temperature, for salmon migration, rearing and spawning.

Most of the land uses in TEP's watersheds are in public and private forestry management. The Oregon Department of Forestry (ODF) manages State forest lands through the Northwest Oregon State Forests Management Plan. ODF also oversees private industrial timber operations through implementation of the Forest Practices Act (FPA).

On federal lands, the US Forest Service follows the Northwest Forest Plan and the Aquatic and Riparian Conservation Strategy (ARCS) for forest management to protect water quality among other goals. In addition, the Bureau of Land Management utilizes the National Riparian Service Team (NRST) to address and coordinate riparian restoration and management on its lands in the Western US. This program works with local partners to implement the Creeks and Communities Strategy (CCS). The CCS provides technical aspects to riparian restoration while incorporating social components to promote collaborative problem solving to address riparian restoration requirements. These processes coalesce in the Resource Management Plans of Western Oregon.

These State and Federal programs require forested buffers and other vegetation be preserved along streams, wetlands, and lakes to protect water quality and fish and wildlife habitat. On agricultural land, Oregon Department of Agriculture implements measures through the North Coast Basin Agricultural Water Quality Management Area Plan (covered in WAQ-1). TEP will work with these partners to establish healthy and mature riparian areas through most appropriate avenues available. To consider a riparian area healthy and mature, it must have a diverse species composition and provide significant vegetation cover and stream shading.

Lead(s): TEP, ODF, USFS, BLM

Partner(s): TEP, Municipalities, Tillamook SWCD, DEQ, OWEB, Watershed Councils, and Private Landowners

How

Activity 1: TEP implements, and partners on, restoration projects that include riparian components.

Anticipated Costs/Source: $$/E,F,S,O

Timing: Ongoing

- Continue to implement Backyard Planting Program,
- Continue to manage and promote TEP's native plant nursery,
- Assist with the implementation of the Nestucca, Neskowin, and Sand Lake Riparian Program and other watershed council efforts,
- Provide technical assistance to partners (Watershed Councils, SWCDs, Municipalities), and
- Implement stream-side wetland restoration, large woody debris (LWD), beaver analogs and other connectivity projects.

Activity 2: ODF implements the Board of Forestry workplan adopted in 2018 to identify efforts on the Tillamook State Forest around forest health and restoration.

Anticipated Costs/Source: $$$/P

Timing: Ongoing

- Implement riparian standards identified in the Forest Management Plan,
- Facilitate restoration activities on private industrial forest lands through the FPA,
- Implement 10 Year and Annual Operations Plans,
- Implement in-stream and riparian restoration work and projects identified in the watershed assessments,
- Implement restoration projects where appropriate to accelerate natural processes, and
- Continue partnerships with watersheds councils for planning, implementation, and in-kind work.

Activity 3: ODF implements Forest Practices Act programs associated with riparian requirements and establishes compliance with the FPA through the Stewardship Forester Program.

Anticipated Costs/Source: $$$/P

Timing: Ongoing

- Review pre-operations plans,
- Oversee operations,
- Ensure reforestation, and
- Investigate complaints and enforce corrective actions when violations occur.

Activity 4: USFS Implements activities identified in the Northwest Forest Management Plan.

Anticipated Costs/Source: $$$$/P

Timing: Ongoing

- Implement applicable components of the ESA Recovery Plan for Oregon Coast Coho Salmon on federal forest land,
- Implement actions identified in the Aquatic and Riparian Conservation Strategy (ARCS),
- Implement projects to enhance native riparian vegetation to provide bank stability and shade stream reaches, and
- Maintain and update Riparian Management Areas (RMAs) and Key Watershed protections.

Activity 5: BLM implements activities identified in the Northwest Forest Management Plan and Western Oregon Resource Management Plans.

Anticipated Costs/Source: $$$$/P

Timing: Ongoing

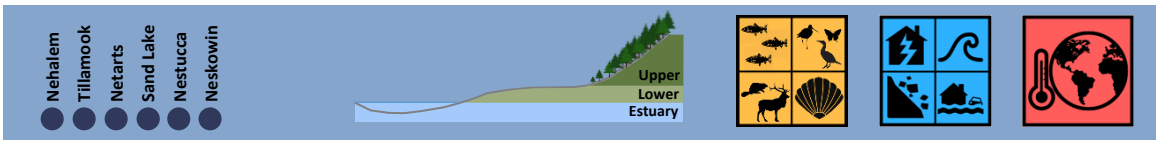
- Implement applicable components of the ESA Recovery Plan for Oregon Coast Coho Salmon on federal forest land,
- Develop and promote Creeks and Communities Strategy with local partners, and
- Implement projects to enhance native riparian vegetation to provide bank stability and shade stream reaches.

Why: Salmon and other native aquatic life require clear cold water to successfully complete their life-cycle. This is a critical factor in maintaining and restoring healthy salmon populations throughout Oregon. Stream temperature is influenced by hydrologic natural processes and two primary sources of heat, increased solar radiation due to lack of a healthy and mature riparian area, and heat from warm water point source and stormwater discharges. Additionally, seasonal warm water from the ocean impacts tidally influenced areas of the estuaries. The State has established temperature criteria that are based on maximum temperatures that will not limit salmon's ability to mature, reproduce, and survive. These criteria are different

depending on location and habitat provided by the waterbody. When temperatures exceed these criteria, salmon experience an increased susceptibility to disease, inability to spawn, reduced egg survival, reduced juvenile growth and survival, increased competition for habitat and food, and inability to compete with species that are better adapted to higher temperatures (often introduced species). Temperature impacts result from alteration to riparian area. This influence can extend from the headwaters of a stream down to its confluence with a larger waterbody. Therefore, it is important to address riparian health throughout a watershed to limit cumulative impacts of temperature. Riparian and stream restoration that improves streamside shade, also reduces sediment, bacteria and other associated pollutants such as dissolved oxygen.

Performance Measures:

- ✓ TEP will restore 15 miles of riparian areas by 2028.
- ✓ Partners will implement an additional 15 miles of riparian restoration projects within TEP's focal area by 2028.



Restore channel features and hillslope management to improve sediment storage and routing to address water quality

What: Sedimentation is the process of particles settling out of the water column and depositing on a streambed or estuary floor. In a healthy system, a balance between sediment deposition and sediment transport is maintained. Many factors affect the sediment balance including stream flow and slope, large woody debris (LWD), bank stability, and riparian, lower and upper watershed conditions. TEP and its partners will take actions to address both in-stream factors as well as landscape conditions that are sources of sediment or create an imbalance in sediment transport.

Sediment delivery to streams can have a negative impact on fish habitat and surface drinking water sources. Forest roads built prior to the current BMPs or development of the Oregon Forest Practices Act (FPA) pose an increased risk of contributing sediment to streams. These roads can be major sources of human-caused sediment runoff in forest areas. Improper road construction and maintenance also has the potential to contribute to landslides, another sediment source. Like forest roads, public roads can contribute fine sediments in streams. Tillamook County and ODOT own and maintain most of the public roads in TEP's focal area. Road authorities can reduce stream sediment impacts by ensuring that roads are designed and maintained to minimize erosion, sedimentation, and practices that lead to sediment accumulating on roadways. Upgrading of substandard roads and management and maintenance of existing roads can reduce sediment production and input to streams, benefiting fish and other aquatic life, and reducing the total amount of sediment transported to the lower rivers and bays.

Sediment sources from the landscape are only one component of the sediment issue. The physical characteristics of a stream can also alter the balance of sediment transport. Bank stability and enough LWD will ensure a balance of sediment deposition and transport. Landslides of the right size and frequency can enhance fish habitat by supplying large woody debris, leading to channel complexity. Encouraging retention of vegetation so that large wood is available to be delivered to channels can reduce adverse effects of landslides. When landslides do occur, large woody debris can help retain and rework debris-torrent materials into productive fish habitat. Retaining healthy and mature trees and vegetation in large riparian areas will also supply future LWD to streams. In addition, it will stabilize bank structure, which will reduce sediment delivery from bank erosion. Both conditions will contribute to a balance sediment load and transport. In addition, placing LWD directly in streams that lack the appropriate quantity of wood will improve retention of sediment in the upper watershed and reduce sediment deposition in the lower watershed.

Lead(s): TEP, ODF, USFS, BLM, ODOT, Tillamook County, Municipalities

Partner(s): TEP, Tillamook SWCD, DEQ, OWEB, Watershed Councils, and Private Landowners

How

Activity 1: ODF, USFS, BLM implement FPA requirements associated with riparian, roads, and landslide requirements to protect water quality.

Anticipated Costs: $$$/P
Timing: Ongoing

- Implement measures required under the Forest Practices Act that retain vegetation and improve the future recruitment of large wood in streams,

- Continue Implementation of Oregon State Forest Management Plan strategies for water quality and riparian protections,
- Improve the management of roads through BMP and FPA regulations by controlling timing and levels of use; road relocation, upgrades and closures and removals,
- Implement improvements of road elements such as road fills, stream crossings, and surface problems to reduce sediment runoff risk and improve fish passage and habitat,
- Continue to participate in the Salmon Super Highway Program,
- Implement road upgrades based on the list of priority sites and work through landowner BMPs and annual management goals and budgets,
- Implement the ODF compliance auditing program to determine the level of compliance with forest practices road maintenance rules. Use this information to determine if actions are needed to improve compliance and identify how compliance problems are best resolved,
- Implement stream-side wetland restoration, LWD, and connectivity projects,
- Implement silvicultural practices resulting in increased vegetation retention along streams, including Type N streams in especially high-risk areas, through the NW Oregon State Forest Management Plan for State Lands, and
- Submit latest scientific findings and recommendations of the Forest Practices Advisory Committee on Salmon and Watersheds to the Board of Forestry for rule review.

Activity 2: Reduce sedimentation from public roads. State and local (county and city) road authorities will evaluate appropriate road activities and functions for sedimentation effects and, wherever practicable, fish passage.

Anticipated Costs/Source: $$$/P

Timing: Ongoing

- Ensure that road authority project development activities (ODOT and County), construction, and long-term development practices meet the guidance in Management Measures for Urban Areas, Construction Activities and Roads, Highways, and Bridges, as required under the CZARA, Coastal Nonpoint Pollution Control Program.
- Tillamook County will work to initiate update of road standards to include stormwater management strategies to reduces sediment and other pollutants
- Tillamook County will investigate and, where appropriate, initiate road realignments to avoid landslide prone areas
- Tillamook County will continue to collaborate with partners to address streams crossings that limit proper sediment transport and fish passage.

Activity 3: TEP implements and partners with others to implement LWD Projects to maintain appropriate gravels, LWD, and sediments sorting and transport which will improve water quality and provide salmon habitat.

Anticipated Costs/Source: $$$/E,F,S,O

Timing: Ongoing

Activity 4: TEP and partners implement Estuary Wetland Restoration Projects to address fine sediment sorting and changes in ocean levels. *See HAB-06 for more information.*

Anticipated Costs/Source: $$$/E,F,S,O

Timing: Ongoing

Activity 5: TEP implements public and forest roads stormwater management and sediment improvement projects.

Anticipated Costs/Source: $$$/E,F,S,O

Timing: Long-Term

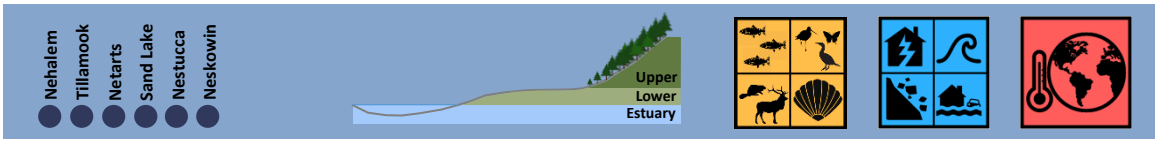
Why: Physical stream channel characteristics and landscape conditions can alter the balance between sediment deposition and transport in streams and bays. This can lead to increased turbidity and deposition of fine sediments in salmon spawning areas. Turbidity and excess fine sediments can also limit drinking water processing capacity and increase costs for public and private drinking water systems. Conversely, the imbalance can also lead to a

depletion of sands and gravels in the upper watershed causing scour and armoring of the stream bed. This scoured material will end up in the bays and estuaries, altering sediment characteristic and limiting habitat. Both conditions can adversely affect salmon egg and fry survival, spawning habitat quality, other aquatic life such as macroinvertebrates, and increase cost of drinking water production.

Performance Measures:

- ✓ TEP will implement five (5) large woody debris (LWD) projects by 2028.
- ✓ Partners will implement an additional five (5) large woody debris (LWD) projects by 2028.

WAQ-05



Identify status and trends and quantify changing environmental conditions in water quality to inform adaptive management strategies impacting TEP's priority areas.

What: TEP and its partners have identified water quality issues that are having a negative effect on the beneficial uses of the stream, rivers, sloughs and estuaries in Tillamook County. TEP and its partners have also developed actions and activities that are designed to address these factors, including a monitoring program to determine if the restoration strategies are having the desired environmental outcomes. Monitoring results will be used to adjust strategies where findings indicate that goals and objectives are not being met.

Lead(s): TEP, DEQ

Partner(s): DEQ, ODA, Tillamook SWCD, NRCS, OWEB, OSU, OHSU, SSNERR, EPA, Watershed Councils, and Private Landowners

How

Activity 1: Determine where and if the beneficial uses of the sloughs, rivers, and estuaries are being met through attainment of water quality criteria.

Anticipated Costs/Source: $/E,S

Timing: Ongoing

- Every two years TEP compiles the bacteria data for the VWQMP and, with the assistance of DEQ, determines the status at each monitoring location, whether bacteria levels meet the State criteria for recreation use at each monitoring location. TEP also works with DEQ to perform a trend analysis for each monitoring site to determine if bacteria concentrations are changing over time.
- TEP continues to partner with DEQ to implement its Long-term Temperature Monitoring program. Collect continuous time-series temperature data for a minimum of 10 years from identified waterbodies rotating through each watershed every two years and determine stream temperature status at each monitoring location as it relates to achieving the applicable water quality temperature standards.

Activity 2: TEP will work with partners to establish baseline information on carbonate chemistry and spatiotemporal patterns of coastal acidification in Tillamook Bay. Through partnerships, TEP will establish the fundamental information necessary to characterize the timing, extent, and persistence of Ocean Acidification and Hypoxia (OAH) processes and watershed drivers within the Tillamook estuary.

Anticipated Costs/Source: $$/E,S,O

Timing: Short term

- Implement initial grant funded project to describe the fundamental relationship between alkalinity and salinity in an estuarine setting. TEP will use alkalinity and salinity as a cost-effective way to track OAH conditions.
- Continue to participate in Oregon Ocean Acidification and Hypoxia Monitoring Group (OR-OMG). The OR-OMG is composed of a diverse group of water quality, ecology, and environmental monitoring professionals and natural resource managers that share an interest in marine or marine-influenced systems and a concern about the impact of Ocean Acidification and Hypoxia (OAH). The OR-OMG is charged with enhancing local partnerships and collaboration

around OAH and coastal acidification monitoring.
- Coordinate and collaborate with Whiskey Creek Hatchery and OSU related to Netarts Bay acidification efforts.

Activity 3: Work with DEQ to establish and implement an appropriate dissolved oxygen (DO) monitoring strategy.

Anticipated Costs/Source: $$/E,S,P

Timing: Mid-Term

Activity 4: Develop a monitoring strategy and restoration actions for Nutrients based on results and outcomes of EPA's ORD Tillamook Bay Project.

Anticipated Costs/Source: $/E,S,P,O

Timing: Long-Term

Activity 5: Continue to partner with EPA Western Ecology Division. Also implement other collaborative projects when and where opportunities arise to provide additional information regarding water quality parameters of concern.

Anticipated Costs/Source: $/E,S,O

Timing: Ongoing

Activity 6: Communicate water quality results to partners and determine effectiveness of current efforts. Work with partners to adjust where needed for continued improvements in management strategies and environmental results.

Anticipated Costs/Source: $/E

Timing: Ongoing

- Evaluate Shellfish Growing Area Classifications.
- Update Shellfish Management Plan Closure Criteria.
- Update North Coast Agricultural Water Quality Management Plan water quality results and inform CAFO Program on progress made and areas of concern.
- Update State of the Bays Health Reports and adjust TEP's restoration strategies where necessary.
- Work to inform municipalities on infrastructure improvements and septic program implementation.

Why: TEP and its many partners are working together to improve water quality, particularly related to parameters of highest priority in the focal area. To determine if the project and restoration strategies that TEP and its partner implement are having the desired effect on water quality. TEP needs to track water quality changes over time. Once results have been established, TEP brings this information to its partners and the public. TEP then works with partners to use the water quality information to adjust partners' actions and restoration strategies. This information exchange is a critical component of TEP's adaptive management strategy.

TEP needs strategies to assess progress towards meeting water quality and habitat goals within TEP's focal area. The assessment will focus on changes in ambient water quality conditions, ecological functions, and biological populations and communities. To effectively evaluate the success of CCMP Actions, it will be necessary to track both the extent to which the actions laid out in the CCMP are being implemented and the environmental effects.

Performance Measures:

- ✓ Maintain VWQMP and long-term temperature monitoring effort.
- ✓ Develop strategic monitoring plan for dissolved oxygen and nutrients by 2028.
- ✓ Complete status and trend analyses at appropriate frequency through 2028.

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Chapter 2: Habitat Restoration Action Plan

TEP and its partners recognize the importance of natural resources to Tillamook County's economy, culture, and quality of life. Without clean water, productive habitats, and an engaged citizenry, Tillamook County would not be the special place it is today. TEP and its partners strive to ensure the wellbeing of the many species and habitats that are the foundation of Tillamook County's natural economy and cultural identity..

For the purpose of this document, TEP has split our focal watersheds into three different managements zones: the Upper Watershed (Upper), Lower Watershed (Lower), and the Estuary (see example in Figure 2). These management zones are distinguished from each other by physical, biological, and anthropogenic characteristics. These differences result in in unique set of conservation issues and opportunities, providing a convenient way of framing conservation actions to be undertaken in the focus area. Specific ways these areas differ include topography, gradient, vegetation and animal communities, and development and land-use patterns.

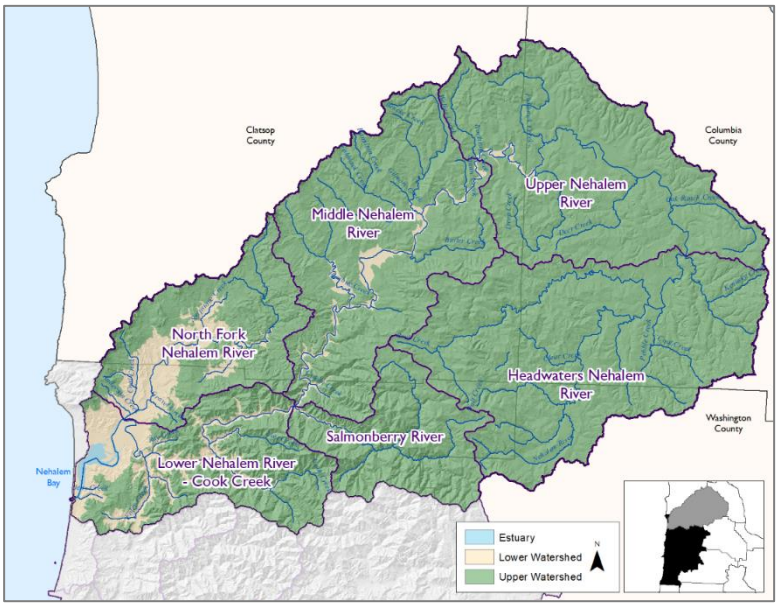


Figure 2. Watershed management zones (Nestucca Watershed).

The upper watershed is dominated by forested, mountainous terrain. Streams in this zone are often small, with high-energy flows and coarse substrates. The predominant land-use in the upper watershed is forestry. Residential and commercial development is limited.

In the lower watershed, gradients are flatter and large alluvial floodplains are present. Portions of this zone are occasionally inundated by high flows in the larger, slower, more sinuous streams found here.. In their unaltered state, lower watersheds support a higher diversity of habitat types than upper watersheds including cottonwood gallery forests, woody and emergent wetlands, and coastal meadows. Due to their relatively flat relief and rich alluvial soils, lower watersheds have been largely altered for agricultural, residential, and commercial development.

The estuarine portion of the watershed is extremely low-gradient and is where the streams that originate in the upper and lower watersheds meet the Pacific Ocean. Tide and the ocean salinity are extremely influential in this zone. This dynamic environment supports a number of rare habitats including woody and emergent tidal wetlands, broad topographically diverse mud and sand flats, and a complex matrix of interwoven tidal channels. Land-uses here are similar to that of the lower watershed, but require levee or dike building coupled with draining to maintain viability. These include agricultural, residential and commercial development; aquaculture (oyster farming); and commercial and recreational fisheries for fish, crabs, and clams.

Within these management zones, a myriad of important habitat types exists. These habitat types are not necessarily exclusive to any one management zone, but often are more or less common in one zone as compared to the other zones. The word "habitat" is defined as a place where an organism or a community of organisms lives, including all living and nonliving factors or conditions of the surrounding environment. However, it is often also used as shorthand terminology to define specific vegetative communities or ecological conditions present in an area. In this document, the term is used in this shorthand fashion. Following are

descriptions of the habitat types TEP works to conserve and restore within its focal area. Depending on the scope of a given project or conservation directive, these habitats may be defined more or less specifically depending on goals. For example, a project may focus on improving environmental conditions estuary wide or may have a specific directive to restore vegetative diversity of low marsh on a specific site in the upper estuary.

Estuaries

As some of the richest and most complex ecosystems on earth, estuaries are important in the life cycle of many fish and wildlife species, some of which form the backbone of Oregon's coastal fishing industry (commercial and recreational). Tidal channels and sloughs, intertidal sand and mudflats, eelgrass beds, and tidal marshes provide structural complexity and abundant food upon which salmon and other species depend. Wetlands within the estuary are tidally influenced and the water can be fresh or saline depending on seasonal variation and their location within the estuary. Over the years, there have been many human impacts to the estuaries of Tillamook County, including dredging, large wood removal, sedimentation, diking, channelization, and other forms of modification. This has resulted in a reduction in ecological services provided by estuaries including flood control and salmon rearing habitat. Since the 1850s, more than 70% of Tillamook's tidal wetlands have been lost or degraded.[1] TEP and its many partners strive to address these challenges by conserving intact wetland tracts, removing or improving tide gates, removing invasive species, and re-establishing native tidal wetland plant communities. While increasingly challenging, these efforts represent the single biggest impact in the goal of restoring the health of estuarine watersheds.

Non-Tidal Freshwater Wetlands

Wetlands are habitats that are greatly influenced by the presence of water at or near the surface of the soil. Due to this frequently saturated condition, the plants and animals that inhabit wetlands are highly specialized, and in many cases do not occur elsewhere. Historically, the important ecological services wetlands provide were unknown or ignored and many Tillamook County wetlands were converted or altered.. As knowledge of ecosystem functions increaseed, the critical services that wetlands provide became apparent. Wetlands act as nature's sponges accepting flood waters, holding them, and redistributing them slowly. Among other things, this helps mitigateflood effects. Wetlands also act as filters - intercepting pollutants, storing them, and breaking them down over time, which protects downstream areas (including drinking water diversions). Wetlands are biological nurseries that provide protection to young salmonids and other aquatic organisms. Realizing the critical role wetlands play, TEP and its many partners are dedicated to their conservation and restoration, not just for the ecological benefits but for social and economic stability as well. Freshwater wetlands occur in all three watershed management zones described above, but are represented more heavily in the lower watershed where the topographical gradient is less. Freshwater wetlands are characterized by their topography, soils, vegetation and water source. Water sources include streams, rainfall and springs, and ponds or lakes. Depending on their specific location, wetlands can be affected by a number of land uses including farming and agriculture, forestry, and residential development. Typical forms of wetland degradation include draining, conversion, and exotic species invasion.

Rivers and Streams

Rivers and streams are the veins of a watershed - supplying water from upslope areas to the lowlands and estuaries. In addition to transporting water, streams move sediment and organic materials, and offer a

[1] Good, James W. Summary and Current Status of Oregon's Estuarine Resources". Oregon State of the Environment Report, Chapter III, Health of Natural Systems and Resources. Change is due to filling and diking between 1870 t0 1970. Restoration of wetlands in recent years has begun to reverse the loss trends. https://www.oregon.gov/DSL/WW/Documents/soer_ch33.pdf.

migratory route for aquatic and terrestrial wildlife. Healthy Pacific Northwest streams are characterized by cold, clean water, varied and abundant gravel, and complex cover from predators and highly-variable flows. Streams also provide a source of clean drinking water to local communities. Stream networks in TEP's focal area have been altered by dredging, large wood removal, stream cleaning, log transport, diking, channelization, and water diversion. Stream habitats are threatened by various factors including elevated pollutant loads entering from adjacent areas and high temperatures in summer due to the removal of healthy riparian forests. These alterations have resulted in degraded water quality, as well as physical and biological simplification of the ecological system. With the goal of protecting important aquatic organisms and ecological processes as well as municipal water supplies, TEP and its partners focus on conservation and restoration efforts that address clean cold water, stream habitat complexity, and organism passage improvements to ensure access is available to as much high-quality stream habitat as possible.

Lower Watershed Floodplains


Roger Ross

The lower watershed includes areas adjacent to the estuary that are within the river's alluvial plain. These areas contain floodplains that tend to be at low elevation and have a very low topographic gradient. Streams within these areas are slower moving, wider, and meandering. Streams within lowland areas overflow onto the floodplain somewhat regularly depositing sediment and organic matter. Severe flooding of lower watershed areas can occur when large winter rain events are combined with high tides in the estuaries. Habitats include cottonwood gallery forests, conifer forests, emergent and woody freshwater wetlands, and coastal prairie. Lower watershed floodplains include most of the urbanized areas, agriculture, and dairy lands within Tillamook County. The largest contiguous area of lower watersheds within the Tillamook County surrounds Tillamook Bay, but there are also extensive areas of lower watershed in the Nehalem and Nestucca River drainages.

Riparian Communities

Riparian communities are vegetation assemblages that occur adjacent to waterways. This close association allows riparian plants to grow larger and lusher than their counterparts farther away from free water. Riparian corridors along Pacific Northwest streams influence in-stream physical and biological processes by providing shade to regulate water temperatures, organic inputs that support the food chain, large woody debris that maintains stream complexity, roots that stabilize banks and reduce erosion, and above ground structure that filters pollutants. Without the nurturing and buffering effects of healthy riparian plant communities, in-stream habitats and aquatic species populations degrade rapidly. As with other habitat types, riparian areas have also been impacted by multiple types of land uses. Banks along many waterways have been cleared of vegetation via residential and agricultural development, and for resource extraction. These changes have impacted the quality of in-stream habitat conditions and the habitat value of the riparian forests themselves. In addition, riparian habitat modification has led to a reduction in water quality, which effects local drinking water resources and negatively effects habitat quality. TEP and its partners are engaging agency and industry representatives as well as private landowners on the importance of riparian ecosystems with the goal of cleaner water, reduced erosion, healthy fisheries, and improved wildlife habitat conditions. This collaborative effort results in innovative win-win solutions that combine healthy and diverse ecosystems and a thriving nature-based economy.

Upland Habitats

Uplands are lands of relatively higher elevation (as compared to stream channel bottoms) that do not flood frequently and, therefore, do not display characteristics associated with great availability of free water. Within TEP's focal area these lands occur predominantly in the upper and lower watershed. They include high marine terraces, alluvial floodplains, and the foothills and mountains of the Coast Range. Habitats include upland

forests, meadows, dunes, and coastal headlands. Within Tillamook County upland habitats are widespread and are used for a number of land uses including forestry, farming and agriculture, and residential development.

Forests

Tillamook County is known for its lush upland rainforests. Forests offer numerous irreplaceable ecological functions crucial for watershed health. Healthy forests stabilize steep slopes, help filter and slow run off, provide inputs of large wood and other organic material, sequester carbon, produce oxygen, and afford habitat for numerous plant and animal species. Upland forests are primarily composed of conifers and various species of hardwoods. Dominant trees include Sitka Spruce, Western Hemlock, Douglas Fir, Big Leaf Maple, and Red Alder. In addition to their habitat value and important ecological services, our forests provide the raw materials to build communities, and have fueled Tillamook County's local economy since the 1880's. Coastal rainforests of the Northern Oregon Coast Range have been altered significantly since first encountered by early European explorers - less than two-percent (2%) of the Coast Range's rainforests remain unaltered or in an "old growth" state. In what is now known as the Tillamook State Forest, from 1933-1951, a series of devastating fires called the "Tillamook Burn" scorched approximately 355,000 acres of forest. Much of the burned old growth timber was salvage logged, a process aided by the construction of miles of forest roads. These devastating burns along with a legacy of logging practices have resulted in higher flood events, decreased summer stream flows, decreased water quality, increased sedimentation rates, fewer organic inputs, amplified carbon levels, and loss of species. While best management practices utilized by industry, governments, and private landowners have vastly improved, these effects continue to be felt today and further progress is needed.

Meadows

Meadows are characterized by non-woody grasses, forbs, sedges, and rushes and therefore have an open low-profile structure vastly different than Tillamook's predominantly forested upland habitats. Given the region's propensity towards dense forests, meadows are relatively rare and require specific environmental conditions to persist without human intervention. Environmental controls that contribute to meadow habitats include physical controls such as geology (substrate) and hydrology, and biological factors such as plant competition and herbivory. Because meadows are dominated by soft grasses and flowering plants and are exposed to direct sunlight, they support a number of important species (including some that cannot persist elsewhere). These include important native pollinators, rodents, and grazers like elk and deer. Included in the diverse array of animals that inhabit Tillamook County's coastal meadows is the endangered Silver Spot Butterfly (*Speyeria zerene hippolyta*). Impacts to meadows include conversion and invasive species. In TEP's focal area, the largest conversion of natural meadows has occurred in the lower watershed and estuarine zones where estuarine and floodplain processes have been altered by activities like levee building and draining. Interestingly, while natural meadows are relatively rare and have been heavily impacted, artificial meadows created by human land-uses, like forestry and agriculture, are widespread. Examples of this include clear-cuts and mowed and/or tilled agricultural fields. These artificial meadows cover thousands of acres and do provide some of the ecological functions of natural meadows, but often lack the native diversity of natural meadows. These artificial meadows are frequently dominated by non-native species, and only persist as long as the human disturbance continues. In keeping with the notion that a healthy watershed is only as healthy as the sum of its parts, TEP looks to accomplish restoration and enhancement of coastal meadows and educate the populace about the ecological, economic, and cultural values of Tillamook County's natural meadows.

Coastal Sand Dunes

Coastal Sand Dunes are large accumulations of drifting sand. Rivers deliver a robust supply of fine sediment to the ocean where it is then redistributed by longshore transport and deposited on nearby beaches by the surf and tides. Once on the beach, prevailing winds take over and push the sand farther up the beach forming large mounds of sand. This mosaic of sand shifts constantly due to the forces of wind. Many specifically adapted species have evolved on the Pacific Northwest's coastal dunes due to the well-drained substrate, salt influence, and disturbance from constantly shifting sand. These dynamic habitats and the host of endemic species that populate them play critical functional roles in the ecosystem and often form a large portion of the habitat directly adjacent to estuaries. Unnatural disturbance to these systems is predominantly caused by residential development, invasive species introduction, stabilization, and recreational use. Probably the most glaring effect on the health and productivity of natural dune systems is the introduction of European Beach Grass. European Beach Grass originated in Europe and North Africa and was introduced to the west coast of the United States in the mid-nineteenth century to stabilize coastal sand dunes. European Beach Grass spread rapidly into dense monocultures choking out precious native vegetation. While introduction of this species succeeded in the goal of stabilizing the dunes, its presence has stifled ecological processes that underpin the community of native plants and animals. When possible, TEP and its partners work to improve and educate the community about coastal dune health especially as it pertains to estuarine processes.

Coastal Headlands


Roger Ross

The wind and ocean pounded rocky outcrops that make up coastal headlands are breathtakingly beautiful. Their resistance to the environmental forces of erosion is due to their geology . Most of the headlands found in TEP's focal area were derived from ancient volcanic eruptions and their subsequent basalt flows that are extremely resistant to the power of wind and wave. Due to the hard composition of the basalt substrate and the exposure to wind, water, and salt, the biology of these sites is unique. These areas support dark wind swept forests, coastal meadows, and bare cliffs and crevices. Tillamook County contains a number of prominent coastal headlands that include Tillamook Head, Neah Kah Nie Mountain, Cape Lookout, Cape Meares, and Cascade Head, all of which harbor unique and precious plants and animals. Three Arch Rocks National Wildlife Refuge off of Cape Meares was established in 1907 by Theodore Rooselvelt and was the first National Wildlife Refuge west of the Mississippi River. The refuge is home to Oregon's largest seabird nesting colony and is an important pupping ground for Steller Sea Lions. Due to their rugged nature, many coastal headlands have avoided wide spread destruction, but habitat modification still remains in the form of residential and commercial forms of development, road building, and invasive species issues. TEP and its partners are always looking for opportunities to improve the health of coastal headlands and recognize their incredible ability to inspire the community to appreciate and protect nature in all of its forms.

The Challenge

Loss and degradation of key habitat features and underlying ecological processes have contributed to declines in salmonids and other aquatic and terrestrial species. Many of these species are important economically or support those that are. When any habitat within the watershed is degraded, whether aquatic or terrestrial, the health of the estuaries, freshwater wetlands, and streams may experience direct and indirect negative

consequences. A watershed must be viewed as a sum of its parts and when parts and, when parts begin to fail, economic viability, environmental health, and quality of life can be negatively affected.

Existing Efforts to Address Habitat

TEP and its partners are dedicated to improving the health and long-term resiliency of the diverse set of habitats, organisms, and the ecological processes that drive them. Beginning in 2001, as required under the Government Performance and Results Act of 1993 (GPRA), TEP has reported CCMP-related projects completed in its focal area to the EPA on an annual basis. Reported projects include those completed by TEP and those of its partners including four watershed councils (Upper Nehalem Watershed Council; Lower Nehalem Watershed Council; Tillamook Bay Watershed Council; and Nestucca, Neskowin, and Sand Lake Watersheds Council), land trusts and other environmental organizations (e.g., North Coast Land Conservancy, Lower Nehalem Community Trust, The Nature Conservancy, Ecotrust, NW Steelheaders, Tillamook Soil & Water Conservation District), several state and federal agencies (e.g., Oregon Department of Forestry, Oregon Department of Fish & Wildlife, Oregon Parks & Recreation Department, Oregon Department of Transportation, US Bureau of Land Management, US Forest Service, US Fish & Wildlife Service, US Natural Resources Conservation Service), Tillamook County, several local municipalities, and a number of private businesses.

A total of 838 projects have been completed between 2001 and 2018. These included 416 projects to enhance riparian vegetation along rivers and streams, 208 fish passage barrier removal projects (e.g., culvert and dam removal), 99 in-stream enhancement projects (e.g. large woody debris placement), 38 projects to limit fine sediments entering streams (e.g., road decommissioning), 30 land acquisition efforts, 20 wetland enhancement projects (e.g., tidal channel construction, wetland plantings), 13 invasive plant removal projects, five efforts to reintroduce native oysters (shellfish seeding), four projects to enhance upland vegetation, two large-scale dike removal efforts, and one each for projects to control flooding, enhance bird habitats and remove contaminants. Figure 3 depicts these reported projects geospatially and by project type.


Roger Ross

To achieve TEP's goals and objectives for habitat conservation and restoration, a framework of 15 actions have been laid out in this CCMP to focus attention on particular issues, streamline decision making, provide adaptability, and ultimately achieve ecological uplift in Tillamook County watersheds.

The first set of actions (HAB 01-08) involve three key organizational steps: assessment, prioritization, and implementation (e.g., conservation and restoration). Assessment involves utilizing existing or new information to understand the most important and pertinent aspects to address in TEP's watershed management zones. It includes evaluation of species, habitats, and ecological processes, but also aims to contextualize these attributes

into a watershed level view that accounts for critical feedbacks between different species and habitats across the watershed. A good example of this is the dependence on salmon-derived nutrients in upland conifer forests and, conversely, the dependence on upland forest-derived organic materials in aquatic ecosystems. Utilizing these contextualized assessments, TEP and its partners can prioritize specific activities to undertake based on ecological need, organizational capacity, cost/benefit, and finances. Armed with a clear understanding of priorities, TEP can implement conservation, restoration, and communication efforts to achieve its goals.

The next set of actions (HAB 09-12) ensure a focus on specific efforts throughout implementation of the CCMP. Included in these are actions dedicated to a species-level approach, rather than a systems-level approach, to ensure the latitude to focus at that level if deemed necessary to protect important ecological, cultural, and economically viable species.

HAB-13 deals with various types of land-use common in Tillamook County, and the best management practices (BMPs) that have been or should be developed to lessen their impact on surrounding natural habitats. Examples of these include streamside riparian buffer strips and constructed wetlands to remove pollutants, improve water temperature, and reduce unnatural erosion. This action was created to distinguish holistic ecological restoration, which is intended to restore natural habitats, from BMPs which are generally designed to minimize impacts of land uses and other human activities. Distinguishing this difference is important to establish clear achievable goals and measure success appropriately.

Finally, actions HAB-14 and 15 are intended to advance and maintain focus on critical areas of policy and strategy important to achieving TEP's overarching goals and objectives. These are largely achieved through concerted efforts to facilitate dialogue and an organizational structure to streamline efforts and create win-win solutions on behalf of all Tillamook County community members.

Roger Ross

TEP and its partners focus on habitat conservation and restoration activities that benefit ecosystems and, in turn, benefit the residents of northwest Oregon. To date, a diverse portfolio of projects has been implemented to improve habitat quality and better sustain wildlife populations that depend on these habitats. Below are some examples of ecosystem attributes and activities that TEP and its partners address to achieve conservation goals.

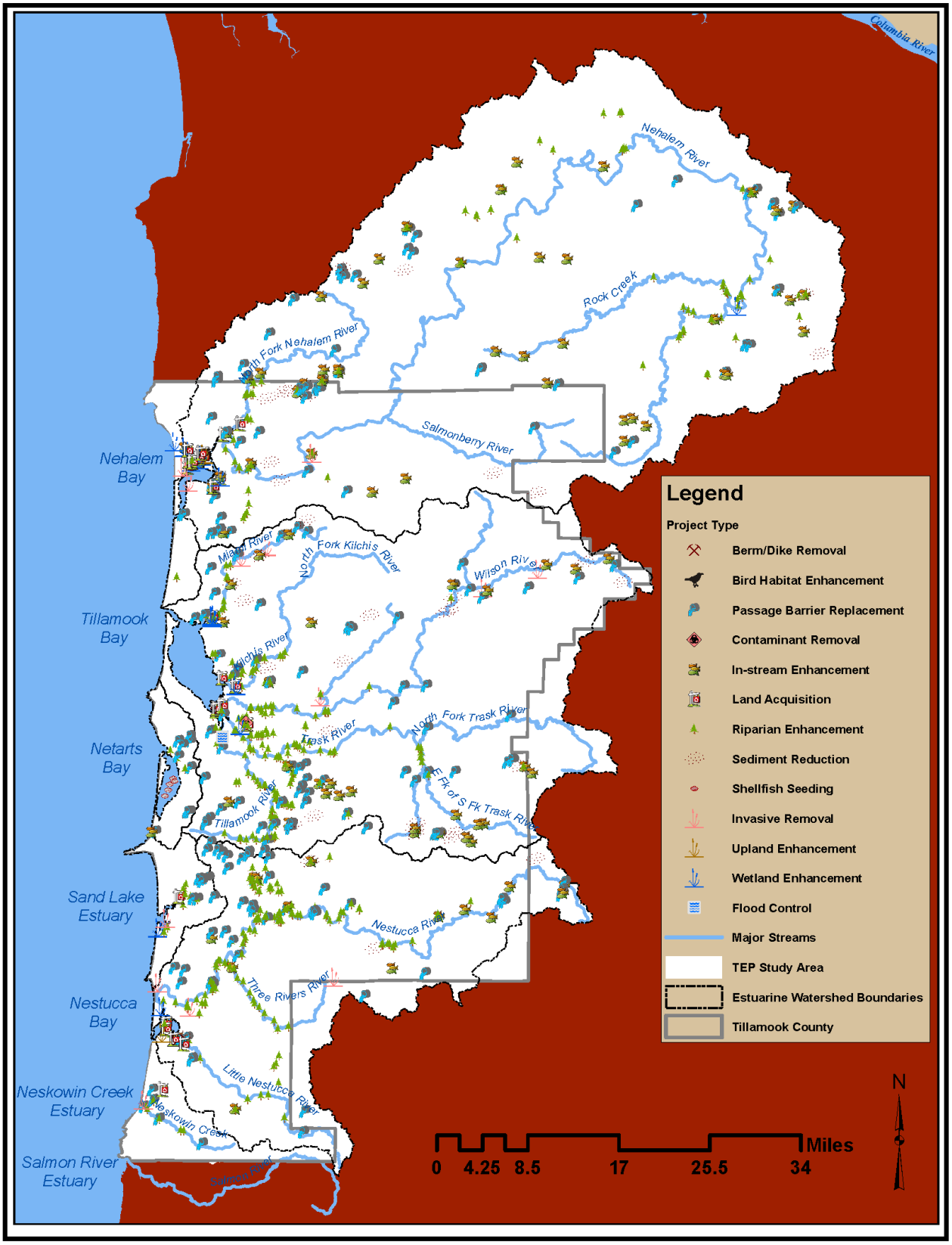


Figure 3. *TEP and partner implemented projects reported to EPA 2001-2018.*

Improve Habitat Connectivity

In order for aquatic and terrestrial organisms to flourish, access to the various environments that support their different life stages must be maintained. Many organisms are not specific to just one form of habitat but, instead, use many organisms use a variety of habitat types for migrating, cover, foraging, breeding, and rearing. If this diverse assemblage of habitats is not available or not adequately interconnected, it can result in species declines and other ecological problems.

Roadways for human transportation can compromise connectivity when passage under or around them are insufficient, often necessitating an improved culvert or bridge for aquatic and terrestrial species to safely pass under the road. In addition, various forms of residential and agricultural development can fragment key habitats and make organism passage between them difficult. Now armed with a better understanding of these inter-habitat requirements and the observed decline of many aquatic and terrestrial organisms, a more strategic approach to removing passage barriers and improving wildlife corridors has begun. TEP and partners are engaged in ongoing watershed scale efforts to identify and prioritize passage barrier culverts and other habitat connectivity issues. While some of these efforts are often cost intensive due to their relationship with civil infrastructure, efforts to address habitat connectivity will pay long-term ecological dividends down the road and, in many cases, improve public safety.

Figure 4. *Fan Creek Culvert Replacement: This project, funded by the BLM and OWEB, replaced two passage barrier culverts on Fan Creek, a tributary in the upper Nestucca River watershed.*

Promote Biological Diversity

Pacific Northwest watersheds are made up of a wide array of habitat types and a web of native plant, animal, fungi, and microbes. Each of these habitats, and the myriad of organisms that inhabit them, play important functional roles within the ecosystem that maintain and ensure community resilience over time. A habitat's ability to recover from natural or human caused disturbance is largely a function of its diversity and connectivity. When habitats are altered, fragmented, or disconnected or species (even inconspicuous ones) are lost, critical ecosystem processes begin to fail. This failure has the potential to harm important culturally and economically viable species and can lead to ecosystem collapse. Diversity also plays an important role in the ability of an ecosystem to adapt to broad-scale changes such as those projected to occur due to global climate change. TEP and its partners are dedicated to promoting diversity through the conservation of existing, highly-diverse habitats and the restoration of degraded habitats using the best science available and a diverse array of high-quality, genetically-adapted plant materials. TEP and its partners also promote ecological diversity through monitoring, education, and outreach programs, which collect, interpret, and disseminate information to stakeholders and the public.

Enhance Habitat Complexity

Habitat complexity refers to the composition and physical structure of an environment. Habitats that are structurally diverse also tend to be biologically diverse. This is because habitats with high structural diversity

provide numerous opportunities or niches and this, in turn, addresses the important biological needs of a wide variety of species. Habitat alterations associated with human land-uses often results in the simplification of habitats (reduced complexity), and this often leads to biologically simple systems. TEP and its partners undertake projects that attempt to restore habitat complexity in Tillamook County's watersheds. Examples include directly adding structural components like large wood or boulders to streams, conserving and restoring habitats that reflect a diversity of species and age-classes, and by conserving or restoring physical processes such as riverine and tidal flooding that add complexity to a system.

Manage Invasive Species

Invasive species are plants and animals that are not indigenous to an area whose introduction causes or is likely to cause economic or environmental harm or harm to human health. Because the species are introduced, they do not have the same biological and environmental pressures in place that keep native communities in relative balance. Therefore, they can rapidly spread and out-compete native species. Their presence can cause severe environmental, economic, and social damage and have dramatic effects on native species through direct competition and altering ecosystem conditions and processes. Exotic species have been introduced onto the landscape through both intentional and accidental mechanism - every species has a unique story. Introductions for food, forage, aesthetic value, and functional value have been many, while other species have simply hitched a ride by ship, plane, or automobile with transporters unaware of their presence until its too late. Others have moved naturally as habitats have changed and shifted as a result of human actions or natural events. Some examples of invasive species in TEP's focal area include reed canary grass, Scotch broom, parrot's feather, Japanese knotweed, nutria, and the New Zealand mud snail. All of these species have caused direct damage to native species and some have been shown to adversely affect native species and/or their habitats. . TEP and its partners' efforts to address the issue include invasive species control as a significant portion of project implementation or as a primary project objective. While in most cases range-wide eradication of an invasive species is infeasible , experience has shown that an understanding of the ecology of an invasive species and a carefully-chosen and focused plan of attack can rid high priority areas of unwanted invaders (or at least greatly reduce their numbers and minimize their negative effects on the environment). Once eradicated (or reduced), if proper care is taken to reestablish native populations, restore natural ecological processes, and prevent reintroduction, success can be long term.

Conservation Acquisition and Easements

Often times the best form of restoration is conservation. Willing landowners who are interested in conserving natural resource values of their land often donate or sell their land to land trusts or other organizations set up to purchase and provide long-termstewardship of conservation lands. Acquisition ensures permanent protection and proper stewardship in accordance with the conservation principles of the receiving organization. Another option available to property owners is a conservation easement which allows the owner to continue to own the land while protecting the habitats of concern for a specified period of time or in perpetuity. By identifying intact, diverse, productive, and resilient community types on the landscape and conserving them, TEP can make a lasting contribution to the future of local ecosystems.

High-value natural areas that are managed for conservation provide a safe haven for numerous species and allow ecosystem processes to occur relatively free of alteration. The benefits of conservation properties often extend beyond their boundaries. Restoration and conservation should not be exclusive of working lands. It is important to consider all of the values of land that is being contemplated for conservation and look for opportunities to combine habitat enhancement activities with existing land uses. Collaborating with diverse stakeholders, TEP and its partners can accomplish the goal of conserving the most critical habitats and species in concert with the community's economic and social needs.

Develop, Promote, and Implement Best Management Practices

Best management practices (BMPs) are structural, vegetative, or managerial practices used to treat, prevent, or reduce water pollution and other forms of habitat degradation. BMPs are recognized as important tool to prevent the impacts of industry and land-use on adjacent natural communities. BMPs can be incorporated voluntarily or as part of regulatory guidelines and are often applied to well-defined point-sources. Agricultural and forestry BMPs utilized in TEP's focal area, including those listed in the Forest Practices Act, involve re-planting practices, vegetative buffers, constructed wetlands, and waste storage, elimination or reprocessing strategies. While BMPs often utilize native species and natural processes to mimic the ecological services key habitats provide in their design, their primary objective is the reduction of human impacts rather than the creation of ecological communities. Over the years, as BMPs for many different types of activities have been developed, case studies have demonstrated not only the success but the flexibility of the BMP approach in controlling or eliminating impacts to receiving water bodies and other key habitats. As part of TEP's effort to conserve and restore key habitats, focus has been placed on implementing and promoting the use of BMPs and facilitating the development of new and innovative BMPs as needed.

Habitat Monitoring and Research

Habitat monitoring and research is necessary to comprehend current conditions in target areas, understand underlying ecological components and processes that sustain them, and determine the effects of land uses and conservation actions. An understanding of historic, current, and probable future conditions allows for prioritization of target communities for conservation and implemention of appropriate restorative actions to achieve desired goals. Monitoring and research focus on biological attributes and the physical attributes that shape the environment (e.g., hydrology, geology).

TEP developed a Project Effectiveness Monitoring Program in 2010. Project-scale effectiveness monitoring measures environmental parameters to determine if habitat enhancement actions are meeting pre-determined objectives. This evaluation process requires both pre- and post-project data collection (and study of control or reference sites, if possible) and allows assessment and comparison of habitat enhancement projects TEP and its partners undertake. TEP uses monitoring protocols that are consistent with other effectiveness monitoring efforts in the region. This decreases the time and effort needed to develop TEP's program and increases its utility beyond the organization by allowing for comparison among projects in a broader regional context.

Special Focus on Salmon Fisheries

Salmonids of the Pacific Northwest are legendary and have sustained humans residing in the area for millennia. Historically, populations of salmon species returning to Tillamook County watersheds were plentiful, and the harvests so robust a sense of inexhaustibility dominated. Things changed in the first half of the 20th-century when salmonid populations began to show a rapid decline due to harvest practices and the loss of stream, estuary, and ocean habitats. Furthermore, as a result of limited understanding of salmon biology and life history strategies, many of the effects of these actions went unrecognized. Today, while salmon populations still face challenges, the scientific understanding of these resilient creatures has improved and efforts to protect and restore their habitats have expanded. Meaningful restoration of salmon populations depends on a comprehensive understanding of many complex physical and biological factors, and a concerted effort by all stakeholders to make it happen. The Oregon Plan for Salmon and Watersheds contains a framework for how stakeholders should assess, monitor, and restore salmonid populations in Oregon. Utilizing the most up to date research and planning tools, TEP and its partners look to prioritize the recovery of salmon while implementing the actions and activities described herein.

Challenges to Addressing Habitat Restoration

Information Gaps

Population Status and Trends: To assess, prioritize, and implement actions that create meaningful progress towards the sustainable health of Tillamook County watersheds, a firm grasp of population status and trends of key species is needed. Ideally, each major estuary and its watershed would have historical population estimates to provide context and current population estimates that are repeatable on an appropriate temporal scale to establish trends through time. In addition to current and historical status, it is also useful to predict future status trends based on known variables that may change (e.g., water or air temperature). These types of data ensure that TEP and its partners have the most up to date understanding of key species upon which to base decisions, allow for greater adaptive management of populations and actions, and provide a measure upon which to base the effectiveness of actions implemented. Species or groups of species chosen for status and trend analysis should provide information that can be used to assess system-wide changes in order to fill any of the data gaps that still exist in TEP's five major watersheds.

Habitat Status and Trends: Similar to population status and trends, information related to key habitat components is also important. Current and historic habitat profiles help to identify temporal trends and to project future conditions. Data that shed light on historic and current habitat conditions will allow TEP and its partners to make more informed decisions about habitat management priorities, as well as monitor the impacts of interventions. A good portion of this status and trend information has already been created and analyzed, but it is important we fill any of the gaps that still exist in TEP's five major watersheds.

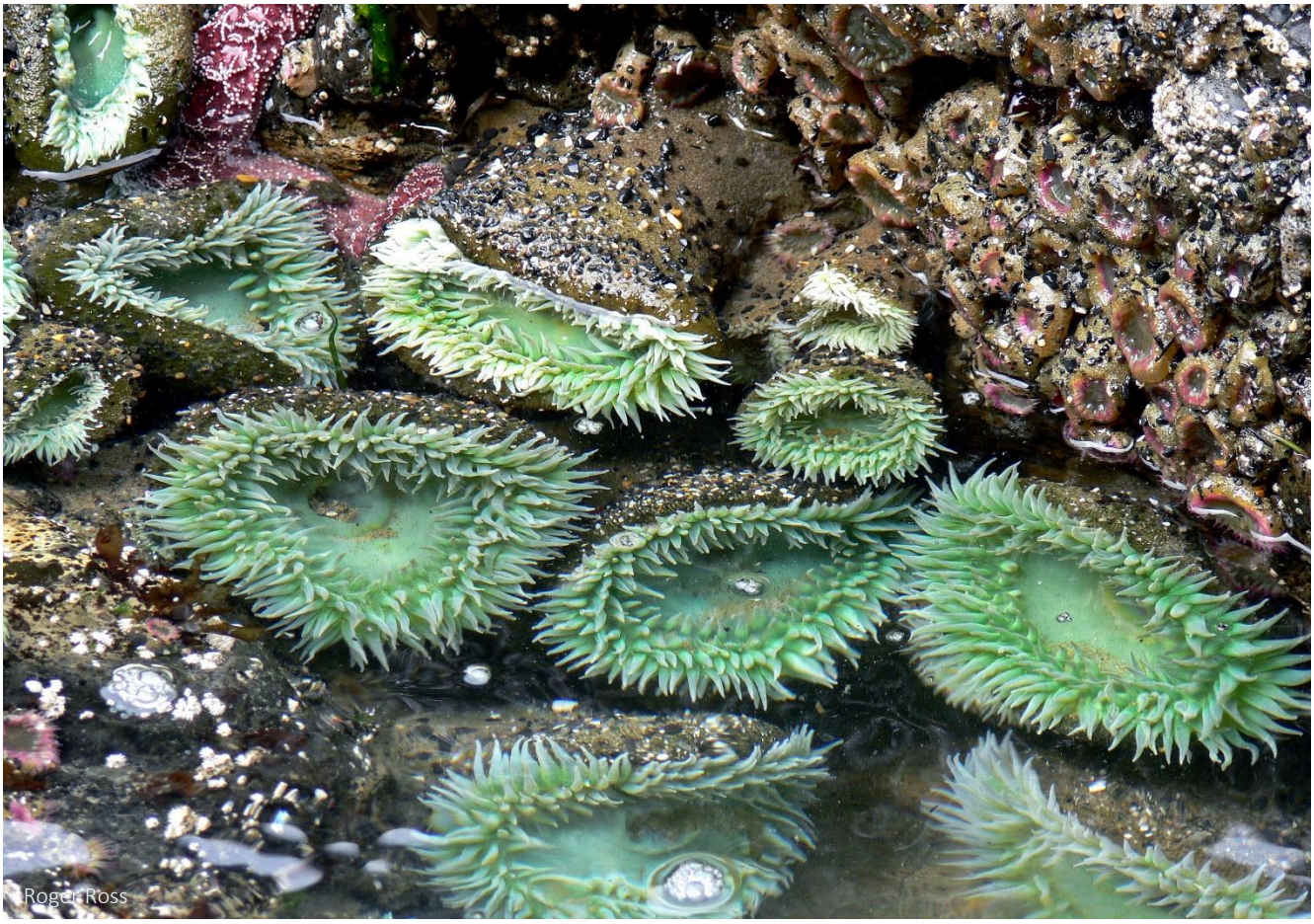
Impact Analysis: It is critical that TEP and its partners understand the specific impacts various land-uses, environmental changes, and other alterations have on key habitats and species, in order to properly prioritize and implement actions to address issues of greatest concern. Many effects of land-uses, such as forestry and agriculture, have already been characterized and have resulted in significant strides to alleviate impacts while continuing to allow these important industries to thrive. However, new threats previously unknown are yet to be investigated. Examples include the impacts of toxic pollutants (e.g., pharmaceuticals and pesticides) anticipated as a result of a warming climate. It is imperative to fill these data gaps to understand any impacts, to determine acceptable thresholds to maintain health, and to prioritize conservation and restoration actions that are most effective at alleviating the impacts.

Barriers

Landowner participation: Many of the programs and projects TEP and partners implement to address habitat issues involve private lands. This requires voluntary landowner cooperation in order to address habitat issues on a watershed scale. A good example of this is noxious weed control. Many noxious weed species spread along watercourses whereby they spread easily from one property to the next. Without full participation of landowners along the length of the watercourse, investments made towards control or eradication would be ineffective and ill-advised. This highlights the importance of developing and maintaining a robust community engagement program and ensuring that all necessary participants are on board prior to investing in some actions.

Community Resources: TEP's focal area encompasses a largely rural landscape; therefore, it is necessary to engage a wide array of partners and funding streams to adequately accomplish the objectives of this CCMP. Given the level of coordination necessary, opportunities can be limited to engage well-funded partners or donors to assist with the environmental actions and organizational infrastructure required to address the scope and scale of the issues faced in the area. In addition, political will and industry goals can be in conflict with restoration and monitoring efforts. Individuals in leadership do not always recognize the value of ecosystem services provided by healthy and properly functioning watersheds.

Regulatory: Federal agencies and the State of Oregon are significant partners in many of the programs identified throughout the CCMP. However, budget and funding limitations have not always allowed Federal and State programs to track project implementation and regulatory compliance. The level of scientific investment, and in a number of cases, political will, have also led to regulations or implementation strategies that have limited effectiveness and ineffective requirements.



Goal

Conserve and restore ecological functions of Tillamook County's estuaries and watersheds to benefit native aquatic and terrestrial species and the communities that depend on them.

Objective Assess, Conserve, and Restore Estuarine Habitats

Large swaths of tidal habitat have been filled, diked, and/or drained for various human uses. These activities have significantly reduced rearing habitat for salmonids, and heavy sediment loads have impacted estuary and floodplain/lower watershed habitats. Protecting and enhancing estuary and slough habitat will help restore viable populations of salmonids and other species.

Objective Assess, Conserve, and Restore Non-Estuarine Wetland Habitats

Non-Estuarine wetlands have been degraded or converted to other uses throughout the upper and lower watershed zones. Wetland conversion to agricultural, urban, infrastructure, and other land uses has reduced off-channel rearing habitat for salmonids and altered stream flows and water quality. Protecting and enhancing non-estuarine wetlands will provide habitat for salmonids and a diverse set of aquatic and terrestrial species, help reduce the effects of flooding and sedimentation, and improve water quality.

Objective Assess, Conserve, and Restore In-stream Habitats

Human activities have severely degraded the quality of in-stream habitats throughout the watersheds in TEP's focal area. Habitats have become structurally less complex, levels of woody debris have declined, flows have been reduced and/or flow regimes altered flow, aquatic organism passage blocked or impeded, and water diverted or impounded. Protection and enhancement of in-stream habitats are needed to restore viable populations of salmonids and other aquatic species.

Objective Assess, Conserve, and Restore Riparian Habitats

Human activities have severely altered or removed riparian vegetation throughout the watersheds in TEP's focal area. This modification has resulted from forestry practices, fires, agricultural activities, road construction, and/or urban development. Protection and enhancement of riparian habitats to more functional conditions along perennial and seasonal streams will improve water quality and salmonid habitat and reduce sediment loading.

Objective Assess, Conserve, and Restore Upland Habitats

Upland habitats within a watershed contribute both biological and physical inputs that are critical to the healthy ecological functioning of aquatic and wetland habitats. These contributions include forage, nutrient input, and habitat connectivity and complexity.

Objective Enhance Health of Salmonid, Shellfish, and Other Aquatic Species Stocks

Degradation of habitats and past and present fishery practices have contributed to the declines of salmonids and other aquatic species. While protecting and enhancing habitats may help stocks recover, fishery practices should also be carefully evaluated and modified as needed to enhance sustainable wild freshwater, estuarine, and marine species populations

Objective Enhance Health of Non-Aquatic Species Stocks

Non-aquatic species within a watershed contribute directly to the ecological health and functionality of aquatic and wetland ecosystems. It is important to protect and restore non-aquatic species stocks with emphasis on those that provide critical contributions to proper ecological functioning at a watershed level.

List of Actions

Assessment and Prioritization

HAB-01	Assess and prioritize estuarine habitats
HAB-02	Assess and prioritize non-estuarine wetland habitats
HAB-03	Assess and prioritize in-stream habitats
HAB-04	Assess and prioritize riparian habitats
HAB-05	Assess and prioritize upland habitats

Conservation and Restoration

HAB-06	Conserve and restore key habitats in the estuary
HAB-07	Conserve and restore key habitats in the lower watershed
HAB-08	Conserve and restore key habitats in the upper watershed
HAB-09	Maximize ecosystem connectivity to ensure a landscape array of ecosystem processes and ease of species movement
HAB-10	Provide genetically appropriate native vegetation and promote its use among habitat restoration and enhancement partners

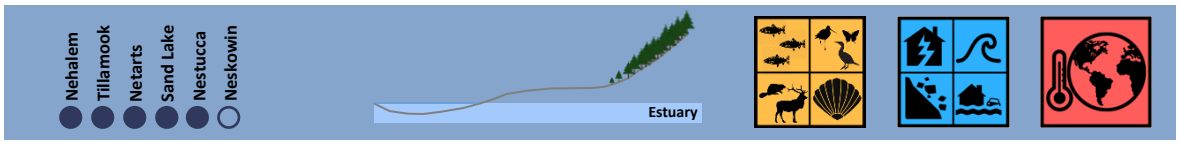
Species Focus

HAB-11	Assess, prioritize, and enhance key native species populations, emphasizing contribution to ecological function
HAB-12	Assess, prioritize, and manage non-native species emphasizing those that have or are likely to have disproportionate negative effects

Land Use & Best Management Practices

HAB-13	Assess and implement best management practices for key habitat conservation.
HAB-14	Encourage the adoption and implementation of policies, ordinances, regulations, and laws that ensure sustainable use and stewardship of natural resources and key habitats
HAB-15	Facilitate the development of pathways, funding sources, and prioritize actions taking place on “working” lands

HAB-01



Assess and prioritize estuarine habitats

What: Assess biological, hydrologic, and geomorphic attributes of key habitats within the estuary to develop a priority list for conservation, restoration, and enhancement actions. Maintain and manage tabular data, GIS layers, and maps produced in a user-friendly format accessible to TEP, conservation partners, educational institutions, and community members to support planning, prioritization, implementation, and monitoring of conservation actions in the estuaries. Assessments will cover biological resources of importance, as well as key physical characteristics including topography, bathymetry, sediment dynamics, and hydrology.

Prioritize key habitats and functions, and specific sites that may be addressed within the estuary for conservation and restoration activities. Prioritizations will utilize the information produced and assimilated in the habitat assessments to evaluate priorities.

Lead(s): TEP

Partners: OSU, UO, USFS, USFWS, NOAA, ODFW, ODA, DEQ, EPA, IAE, CTSI, Watershed Councils, TNC, private landowners

How

Activity 1: Review existing assessments and identify data gaps and outdated information.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 2: Prioritize assessment needs based on critical gaps and relevancy.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 3: Develop a funding strategy and implement priority assessments based on key biological, geomorphic, and hydrologic attributes.

Anticipated Costs: $$

Timing: Short-term

Activity 4: Create a final report summarizing each assessment performed. Report will contextualize the content of all the assessments to ensure they work together in helping achieve CCMP goals and objectives.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 5: Notify all interested parties of assessment availability and make accessing the information easy.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 6: Convene a prioritization committee made up of partners to review assessments and previously completed habitat/ecosystem level prioritizations (anchor habitat, priority watersheds) of estuary habitats conducted for Tillamook County.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 7: Prioritize key habitats and functions, and specific sites that should be addressed with respect to current organizational capacity and opportunities available.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 8: Present estuary priorities to accomplish CCMP goals and objectives at partner and community meetings and in report format made available to all interested parties.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term/Ongoing

Activity 9: Track accomplishment of priority activities and whether the intended outcomes are on trajectory to be achieved.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Why: Habitat conservation and restoration is essential for the recovery of native plant and animal species and the maintenance of critical ecological processes that promote ecosystem health and resiliency. Estuaries are unique environments at the nexus of land and sea and are among the most productive ecosystems in the world. Loss of key estuarine habitats in the Pacific Northwest such as tidal swamp and tidal marsh are key factors in the decline of many species. Humans depend on healthy populations of certain species culturally and economically, and all species represent an indispensable piece of a functional ecosystem. Therefore, it is important that strategies are developed and informed decisions are made to ensure quality habitat and optimum water quality in Tillamook County's estuarine habitats.

Historical descriptions of biologic and geomorphic conditions provide insight on the state of key habitats prior to wide spread alteration, while current assessments provide a critical comparison to evaluate the current state of key habitats. This information helps TEP and its conservation partners identify areas of concern and prioritize species, biologic communities, and habitats sites for conservation and restoration within the estuaries. In addition, the examination of past efforts to improve ecosystem health provide invaluable insight on the practice of restoration and ensures TEP will continually improve its approach moving forward.

Providing a prioritized list of key habitats, ecological processes and functions, and specific sites that should be addressed streamlines project selection, planning, fund acquisition, implementation, and baseline and performance monitoring activities. A well thought out estuary level prioritization also provides a clear path from which to draw conclusions about the cause and effect of conservation and restoration actions across estuarine habitat types and the achievement of TEP's intended objectives.

Performance Measures:

- ✓ Complete or update estuarine assessments for the Nehalem, Tillamook, Netarts, Sand Lake, and Nestucca Estuaries over the next ten years.

Assess and prioritize non-estuarine wetland habitats

What: Inventory current and historic non-estuarine wetlands within TEP's focal area. Assess hydrologic, geomorphic, and biological features of key wetlands to develop a priority list for conservation and enhancement. Non-estuarine wetlands include riverine, palustrine, and lacustrine wetland types. Include evaluation of suitable environmental conditions and specific sites conducive to creating and restoring freshwater wetlands. Maintain and manage all tabular data, GIS layers, and maps produced in a user-friendly format accessible to TEP, conservation partners, educational institutions, and community members to support planning, prioritization, implementation, and monitoring of conservation actions in freshwater wetlands.

Prioritize key habitats, ecological processes and functions, and specific sites that may be addressed in freshwater wetland habitats for conservation and restoration activities. Prioritizations will utilize the information produced and assimilated in the habitat assessments to evaluate priorities.

Lead(s): TEP

Partners: OSU, UO, USFS, USFWS, BLM, ODFW, OPRD, ODF, ODA, DEQ, Tillamook County, Columbia County, Watershed Councils, Municipal Governments, TNC, TCCA, private landowners

How

Activity 1: Update/develop inventories of non-tidal freshwater wetlands within TEP's focal area.

Anticipated Costs: $$/E,F,S,P,O

Timing: Short-term

Activity 2: Use inventories to identify potential freshwater wetlands for further assessment of biological and hydrological features.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 3: Develop list of high priority freshwater wetlands for potential conservation or restoration.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 4: Create a final report summarizing each assessment performed. Report will contextualize the content of all the assessments to ensure they work together in helping achieve CCMP goals and objectives.

Anticipated Costs: $$/E,F,S,P,O

Timing: Following completed assessments

Activity 5: Notify all interested parties of assessment availability and make accessing the information easy

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 6: Convene a prioritization committee made up of partners to review assessments and previously completed habitat/ecosystem level prioritizations (anchor habitat, priority watersheds) of freshwater wetland habitat conducted for Tillamook County.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 7: Prioritize key habitats, ecological processes and functions, and specific sites that should be addressed with respect to current organizational capacity and opportunities available

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 8: Present estuary priorities to accomplish CCMP goals and objectives at partner and community meetings and in report format made available to all interested parties.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term/Ongoing

Activity 9: Track accomplishment of priority activities and whether the intended outcomes are on trajectory to be achieved.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Why: Habitat conservation and restoration is essential for the recovery of significant plant and animal species and the maintenance of critical ecological processes that maintain ecosystem health and resiliency. Freshwater wetlands are unique environments and may represent some of the most impacted forms of wetland in Tillamook County. Impacts are due to the disconnection of streams from their floodplains, the draining of wetland areas for various land uses, and the relative rarity of natural lake systems in Tillamook County. Perennial and ephemeral wetlands are areas that are characterized by extended periods of saturation, which in turn allows the development of hydric soils and establishment of hydrophytic (water-loving) vegetation. They support several rare and ecologically significant species of fish, mammals, invertebrates, and birds. While many species that inhabit freshwater wetlands may be lesser known to the public, these species and their ecological systems support a host of ecological functions and services that support clean water and habitat quality across ecotones.

Historical descriptions of biologic and geomorphic conditions provide insight on the state of freshwater wetlands prior to wide spread alteration, while current assessments provide a critical comparison to evaluate the current state of freshwater wetlands. This information helps TEP and its conservation partners identify issues of concern and prioritize species, biologic communities, and habitats for conservation, creation, and restoration.

Providing a prioritized list of key habitats, ecological processes and functions, and specific sites that should be addressed streamlines project selection, planning, fund acquisition, implementation, and baseline and performance monitoring activities. A well thought out watershed level prioritization also provides a clear path from which to draw conclusions about the cause and effect of conservation and restoration actions across habitat types and the achievement of TEP's intended objectives.

Performance Measures:

- ✓ Assess and prioritize conservation actions in non-estuarine wetlands for all five estuarine watersheds in TEP's focal area over the next ten years.

Assess and prioritize in-stream habitats

What: Review current assessments and metrics collected by partner agencies (e.g., USFS, BLM, ODFW) to determine need for additional in-stream assessments. Address challenges to capacity and funding and facilitate the completion of assessments deemed necessary by partner advisory committee. Schedule follow-up assessments to identify trends and monitor progress of conservation actions consistently into the future. Maintain and manage all tabular data, GIS layers, and maps produced in a user-friendly format accessible to TEP, conservation partners, educational institutions, and community members to support planning, prioritization, implementation, and monitoring of conservation actions.

Prioritize key habitats, ecological processes and functions, and specific sites within in-stream habitats for conservation and restoration activities. Prioritizations will utilize the information produced and assimilated in the habitat assessments to evaluate priorities.

Lead(s): TEP, ODFW, USFS, BLM, ODF, soil and water conservation districts, watershed councils

Partners: OSU, UO, USFS, USFWS, BLM, ODFW, OPRD, ODF, DEQ, Tillamook County, TCCA, private landowners

How

Activity 1: Convene an in-stream advisory group to review the current status of in-stream assessments in Tillamook County, and identify needs and challenges to completing those assessments.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 2: Develop a funding and implementation strategy for creating new and updating out-of-date assessments identified in Activity 1. Strategy shall consider relevance (temporal, content), repeatability, frequency, and cost effectiveness.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 3: Facilitate the completion of assessments according to the strategy identified in Activity 2.

Anticipated Costs: $$/E,F,S,P,O

Timing: Short-term

Activity 4: Create a final report summarizing each assessment performed. Report will contextualize the content of all the assessments to ensure they work together in helping achieve CCMP goals and objectives.

Anticipated Costs: $/E,F,S,P,O

Timing: Following completed assessments

Activity 5: Notify all interested parties of assessment availability and make accessing the information easy.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 6: Convene a prioritization committee made up of partners to review ecosystem assessments and previously completed habitat/ecosystem level prioritizations (anchor habitat, priority watersheds) of in-stream habitat conducted for the focal area.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 7: Prioritize key habitats, ecological processes and functions, and specific sites that should be addressed with respect to current organizational capacity and opportunities available

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 8: Present watershed priorities to accomplish CCMP goals and objectives at partner and community meetings and in report format made available to all interested parties.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term/Ongoing

Activity 9: Track accomplishment of priority activities and whether the intended outcomes are on trajectory to be achieved.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Why: In-stream habitats are complex environments influenced by hydrologic, geologic, chemical, and biological processes. In-stream habitat quality has been degraded by the disconnection of streams from their floodplains, flow diversions, removal of large woody debris, and alteration of surrounding ecosystems (riparian, upland forest, and wetlands) that contribute vital inputs to the system. In-stream habitats support several rare, ecologically significant, and economically important species of fish, mammals, invertebrates, and birds. Among these are a variety of anadromous fish species that depend on high quality in-stream habitat for reproduction and rearing.

Up-to-date in-stream assessments provide a summary of all habitat conditions and highlight problem areas and/or opportunities for protection and enhancement in a complex and dynamic system. This critical information can help plan, prioritize, and implement important in-stream habitat conservation and restoration actions. Using the assessments, in context to the watershed, will result in more cost-effective measures for the recovery of key species.

Providing a prioritized list of key habitats, ecological processes and functions, and specific sites that should be addressed streamlines project selection, planning, fund acquisition, implementation, and baseline and performance monitoring activities. A well thought out estuary level prioritization also provides a clear path from which to draw conclusions about the cause and effect of conservation and restoration actions across habitat types and the achievement of our intended objectives.

Performance Measures:

- ✓ Assess 100 stream miles in priority reaches in the next ten years.


Roger Ross

Assess and prioritize riparian habitats

What: Assess riparian conditions in TEP's focal area to support planning, prioritization, implementation, and monitoring of conservation actions in riparian areas. Assessments will account for high quality, degraded, and restored reaches of streams to provide information on the health of riparian areas in the watersheds. Schedule follow up assessments to track trends and monitor progress of conservation actions consistently into the future. Maintain and manage all tabular data, GIS layers, and maps produced in a user-friendly format accessible to TEP, conservation partners, educational institutions, and community members to support planning, prioritization, implementation, and monitoring of conservation actions of riparian habitats.

Prioritize key habitats, ecological processes and functions, and specific sites within riparian habitats for conservation and restoration activities. Prioritizations will utilize the information produced and assimilated in the habitat assessments to evaluate priorities.

Lead(s): TEP, ODFW, USFS, BLM, ODF, soil and water conservation districts, watershed councils

Partners: OSU, UO, USFS, USFWS, BLM, ODFW, OPRD, ODF, DEQ, Tillamook County, TCCA, private landowners

How

Activity 1: Assess riparian areas in the context of their geomorphic setting to identify areas where restoration and conservation would be beneficial. These assessments should be repeatable, cost efficient, and provide a baseline for performance monitoring in addition to status.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 2: Develop a funding and implementation strategy for completing riparian assessments identified in Activity 1. Strategy shall consider relevance (temporal, content), repeatability, frequency, and cost effectiveness. Ensure proper lead time to coordinate private landowners that have participated in riparian restoration that would be the subject of restoration assessments.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 3: Complete assessments according to the strategy identified in Activity two.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 4: Create a final report summarizing the assessments performed. Report will contextualize the content of all the assessments to ensure they work together in helping achieve CCMP goals and objectives.

Anticipated Costs: $$/E,F,S,P,O

Timing: Following completed assessments

Activity 5: Notify all interested parties of assessment availability and make accessing the information easy.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 6: Convene a prioritization committee made up of partners to review ecosystem assessments and previously completed habitat/ecosystem level prioritizations (anchor habitat, priority watersheds) of riparian habitat conducted for Tillamook County.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 7: Prioritize key habitats, ecological processes and functions, and specific sites that should be addressed with respect to current organizational capacity and opportunities available.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term

Activity 8: Present watershed priorities to accomplish CCMP goals and objectives at partner and community meetings and in report format made available to all interested parties.

Anticipated Costs: $/E,F,S,P,O

Timing: Short-term/Ongoing

Activity 9: Track accomplishment of priority activities and whether the intended outcomes are on trajectory to be achieved.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

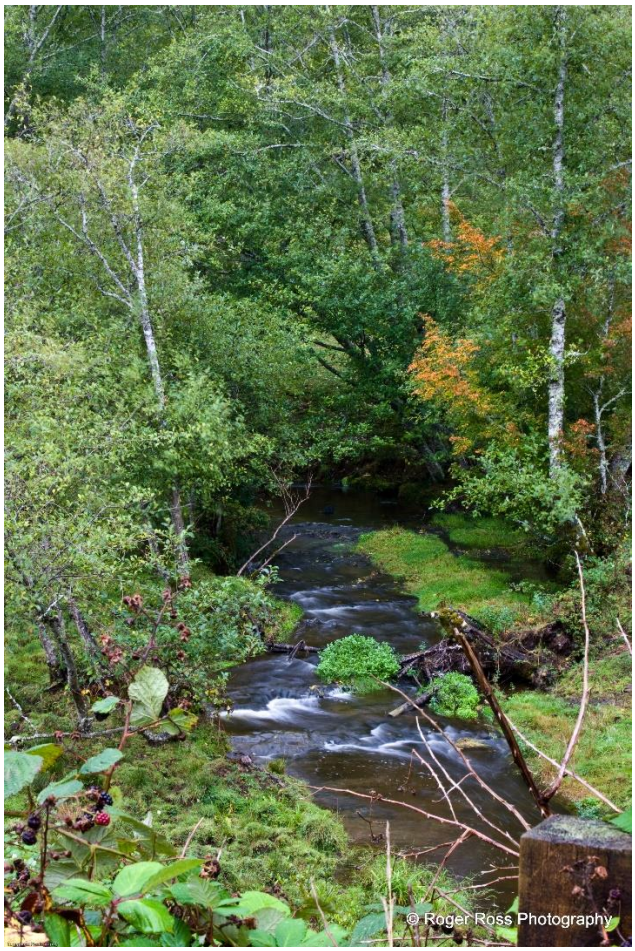
Why: Healthy riparian habitats are biologically diverse. They contribute to the health and functionality of adjacent habitats, including the in-stream habitats they encompass. Riparian habitats have been degraded by the disconnection of streams from their floodplains, flow diversion, outright removal, and the alteration of surrounding ecosystems (streams, upland forest, and wetlands).

Up-to-date riparian assessments provide critical information on the state of habitat conditions and highlight problem areas and/or opportunities for conservation and restoration. This information can help plan, prioritize, and implement important conservation and restoration actions of riparian areas. In addition, an assessment of past restoration actions will provide valuable information on the most successful approaches to take when engaging in conservation and restoration of riparian habitat.

Providing a prioritized list of key habitats, functions, and specific sites that should be addressed streamlines project selection, planning, fund acquisition, implementation, and baseline and performance monitoring activities. A well thought out estuary level prioritization also provides a clear path from which to draw conclusions about the cause and effect of conservation and restoration actions across estuarine habitat types and the achievement of our intended objectives.

Performance Measures:

- ✓ Assess 100 miles of habitat and structural characteristics (e.g., LWD, substrate, pool/riffle ratio) in each of the five focal estuaries in the next ten years.



Assess and prioritize upland habitats

What: Conduct upland habitat assessments to support planning, prioritization, implementation, and monitoring of conservation actions in upland areas. Schedule follow-up assessments to track trends and monitor progress of conservation actions consistently into the future. Maintain and manage all tabular data, GIS layers, and maps produced in a user-friendly format accessible to TEP, conservation partners, educational institutions, and community members to support planning, prioritization, implementation, and monitoring of conservation actions of upland habitats.

Prioritize key habitats, ecological processes and functions, and specific sites within upland habitats for conservation and restoration activities. Prioritizations will utilize the information produced and assimilated in the habitat assessments to evaluate priorities.

Lead(s): TEP, ODFW, USFS, BLM, ODF, soil and water conservation districts, watershed councils

Partners: OSU, UO, USFS, USFWS, BLM, ODFW, OPRD, ODF, ODA, DEQ, Tillamook County, TCCA, private landowners

How

Activity 1: Identify biological and geomorphic aspects of upland habitats and their role in the watershed. These assessments should be repeatable, cost efficient, and provide a baseline for performance monitoring in addition to status.

Anticipated Costs: $/F,S,P,O

Timing: Short-term

Activity 2: Develop a funding and implementation strategy for completing upland habitat assessments identified in Activity 1. Strategy shall consider relevance (temporal, content), repeatability, frequency, and cost effectiveness.

Anticipated Costs: $

Timing: Short-term

Activity 3: Complete assessments according to the strategy identified in Activity 2.

Anticipated Costs: $$/F,S,P,O

Timing: Ongoing

Activity 4: Create a final report summarizing the assessments performed. Report will contextualize the content of all the assessments to ensure they work together in helping achieve CCMP goals and objectives.

Anticipated Costs: $/F,S,P,O

Timing: Following completed assessments

Activity 5: Notify all interested parties of assessment availability and make accessing the information easy.

Anticipated Costs: $/F,S,P,O

Timing: Ongoing

Activity 6: Convene a prioritization committee made up of partners to review ecosystem assessments and previously completed habitat/ecosystem level prioritizations (anchor habitat, priority watersheds) of upland habitat conducted for Tillamook County.

Anticipated Costs: $/F,S,P,O

Timing: Short-term

Activity 7: Prioritize key habitats, ecological processes and functions, and specific sites that should be addressed with respect to current organizational capacity and opportunities available.

Anticipated Costs: $/F,S,P,O

Timing: Short-term

Activity 8: Present watershed priorities to accomplish CCMP goals and objectives at partner and community meetings and in report format made available to all interested parties.

Anticipated Costs: $/F,S,P,O

Timing: Short-term/Ongoing

Activity 9: Track accomplishment of priority activities and whether the intended outcomes are on trajectory to be achieved.

Anticipated Costs: $/F,S,P,O

Timing: Ongoing

Why: Upland habitats are often overlooked when considering conservations actions to improve watershed health. Yet upland habitats make up most of the watershed area. Upland habitats provide numerous inputs that are critical to the functioning of watersheds, some of these include organic debris, sediment, nutrients, food chain support, and water filtration and delivery. Many of the services provided by upland habitats have been degraded due to extensive use for forestry, agriculture, and infrastructure development. These practices and others have altered the structure and biological diversity of the upland system dramatically and these changes have direct negative effects on the function of other habitat types within a watershed. The value of upland systems contributes to a healthy watershed, as such, their restoration is key.

Upland habitat assessments that make clear links between upland habitat health and watershed level function are key to encouraging more conservation and restoration of upland habitats and provide a way to prioritize work to be done. Given the extent and political nature of upland land management, this information can help TEP and its partners make strategic decisions on the conservation and restoration of degraded upland systems. A holistic approach to watershed scale restoration that includes upland habitats is paramount to successfully recovering the most valued species and watershed processes.

Providing a prioritized list of key habitats, ecological processes and functions, and specific sites that should be addressed streamlines project selection, planning, fund acquisition, implementation, and baseline and performance monitoring activities. A well thought out watershed level prioritization also provides a clear path from which to draw conclusions about the cause and effect of conservation and restoration actions across estuarine habitat types and the achievement of our intended objectives.

Performance Measures:

- ✓ Carry out assessments and prioritizations for upland habitat in each of the five focal estuaries over the next ten years.

Roger Ross

HAB-06

Conserve and restore key habitats in the estuary

What: Conserve existing high-quality estuarine habitats and restore historic estuarine habitats by working with landowners on a voluntary basis to secure conservation easements or fee title acquisition. Work with local governments and state government as needed to ensure that regulations intended to protect sensitive lands are working effectively. For high priority restoration areas, work with landowners to undertake restoration actions in tidal marshes, tidal swamps, tidal sloughs/channels, eel grass meadows, mudflats, and estuarine transitional habitats to restore key functions. Restoration actions may include dike breaches, tide gate alteration, hydrologic reconnection, channel creation/modification, habitat structure enhancement, native plant and animal reintroduction, and exotic species control.

Lead(s): TEP, ODFW, USFS, BLM, ODF, soil and water conservation districts, watershed councils

Partners: OSU, UO, USFS, USFWS, NOAA, ODFW, ODA, DEQ, IAE, private landowners

How

Activity 1: Utilize ecological characterizations and prioritizations completed to select logical projects for implementation.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 2: Develop project funding, baseline evaluation, design, implementation, and outreach strategy and timeline.

Anticipated Costs: $$/E,F,S,P,O

Timing: Ongoing

Activity 3: Execute strategy with respect to timeline and the need for adaptive management to effectively conserve and restore key estuarine habitats and processes.

Anticipated Costs: $$$/E,F,S,P,O

Timing: Ongoing

Activity 4: Develop and implement performance monitoring that is consistent with current accepted protocols to evaluate project efficacy, provide similar project comparison, and inform long-term management strategy

Anticipated Costs: $$/E,F,S,P,O

Timing: Ongoing

Activity 5: Disseminate project information (methods and results) to partner organizations, stakeholders, and other interested parties to continually improve conservation and restoration practices in estuarine systems.

Anticipated Costs: $/E,F,S,P,O

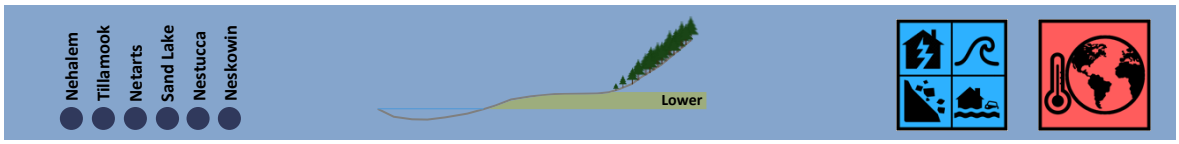
Timing: Ongoing

Why: Estuarine habitats are critical habitats for migrating and overwintering birds; provide spawning, rearing, and cover for anadromous and resident fishes; and are home to an incredible diversity of plants and other wildlife. Estuaries are unique transition zones between salty marine and fresh water riverine systems and their health has been identified as a critical limiting factor in the recovery of several sensitive species including the federally threatened Oregon Coast Coho (an evolutionarily significant unit of coho salmon). Over 80% of Oregon's historical tidal marshes and swamps have been destroyed or severely altered making their conservation and restoration a priority coast wide.

Performance Measures:

- ✓ Conserve 200 acres of healthy estuarine habitat over next ten years.
- ✓ Restore 300 acres of degraded estuarine habitat over the next ten years.

HAB-07



Conserve and restore key habitats in the lower watershed

What: Conserve existing high-quality lower watershed habitats and restore historical lower watershed habitats by working with landowners on a voluntary basis to secure conservation easements or fee title acquisition. Conserve and restore meandering streams; sinuous side channels and sloughs; forested, shrubby, and emergent fresh water wetlands; and mixed riparian gallery forests habitats and functions. Restore the underlying physical processes that maintain key lower watershed habitats over time including floodplain connectivity, freshwater inputs and circulation, sediment regimes, and structural complexity. Restoration actions may include levee breaches, culvert alteration, hydrologic reconnection, channel creation/modification, habitat structure enhancement, native plant and animal reintroduction, and exotic species control. In addition, effective best management practices need to be employed to buffer high-quality habitats from potential degradation associated with the higher rates of development and intensive land use in lower watersheds.

Lead(s): TEP, ODFW, USFS, BLM, ODF, soil and water conservation districts, watershed councils

Partners: OSU, UO, USFS, USFWS, BLM, ODFW, OPRD, ODF, ODA, DEQ, TCCA

How

Activity 1: Utilize ecological characterizations and prioritizations completed to select logical projects for implementation.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 2: Develop project funding, baseline evaluation, design, implementation, and outreach strategies and timelines.

Anticipated Costs: $$/E,F,S,P,O

Timing: Ongoing

Activity 3: Execute strategy with respect to timeline and the need for adaptive management to effectively conserve and restore key lower watershed habitats and processes.

Anticipated Costs: $$$/E,F,S,P,O

Timing: Ongoing

Activity 4: Develop and implement performance monitoring that is consistent with current accepted protocols to evaluate project efficacy, provide similar project comparison, and inform long-term management strategy.

Anticipated Costs: $$/E,F,S,P,O

Timing: Ongoing

Activity 5: Disseminate project information (methods and results) to partner organizations, stakeholders, and other interested parties to continually improve conservation and restoration practices of lower watershed systems.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Why: Habitats and processes in the lower watershed are shaped by low gradient, broad alluvial valley landforms. In these flatter areas the rivers and streams are able to more frequently interact with their floodplains during periods of high water. This dynamic interaction sculpts the alluvial valley floor into a myriad of complex habitat types that include meandering low velocity streams; sinuous side channels and sloughs; forested, shrubby, and emergent fresh water wetlands; and mixed riparian

gallery forests dominated by massive black cottonwoods. Conserving and restoring a highly functioning, healthy array of these habitats to the lower watershed landscape is important to maintain the critical ecosystem services that these habitats provide and upon which the people of Tillamook County depend on for their quality of life. Some of these services include water purification, highly productive agricultural sediment production, and sustainable fish and wildlife populations.

Performance Measures:

- ✓ Conserve and restore 200 acres of lower watershed habitat over the next ten years.

Conserve and restore key habitats in the upper watershed

What: Conserve existing high-quality upper watershed habitats and restore historical upper watershed habitats by working with landowners on a voluntary basis to secure conservation easements or fee title acquisition. Conserve and restore mainstem rivers and tributaries, off-channel aquatic refugia, riverine wetlands, springs, mixed riparian forests, meadows, and diverse upland forest habitats and functions. Restore the underlying physical processes that maintain key upper watershed habitats over time including floodplain connectivity, flow regimes, sediment regimes, and coarse organic debris delivery mechanisms. Restoration actions may include culvert alteration, hydrologic reconnection, channel creation/modification, habitat structure enhancement, native plant and animal reintroduction, and exotic species control. Effective best management practices need to be employed to buffer high-quality habitats from potential degradation associated with resource extraction and rural residential development typical of upper watersheds.

Lead(s): TEP, ODFW, USFS, BLM, ODF, soil and water conservation districts, watershed councils

Partners: OSU, UO, USFS, USFWS, BLM, ODFW, ODF, ODA, DEQ

How

Activity 1: Utilize ecological characterizations and prioritizations completed to select logical projects for implementation.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 2: Develop project funding, baseline evaluation, design, implementation, and outreach strategies and timelines.

Anticipated Costs: $$/E,F,S,P,O

Timing: Ongoing

Activity 3: Execute strategy with respect to timeline and the need for adaptive management to effectively conserve and restore key upper watershed habitats and processes.

Anticipated Costs: $$$/E,F,S,P,O

Timing: Ongoing

Activity 4: Develop and implement performance monitoring that is consistent with current accepted protocols to evaluate project efficacy, provide similar project comparison, and inform long-term management strategy.

Anticipated Costs: $$/E,F,S,P,O

Timing: Ongoing

Activity 5: Disseminate project information (methods and results) to partner organizations, stakeholders, and other interested parties to continually improve conservation and restoration practices of upper watershed systems.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

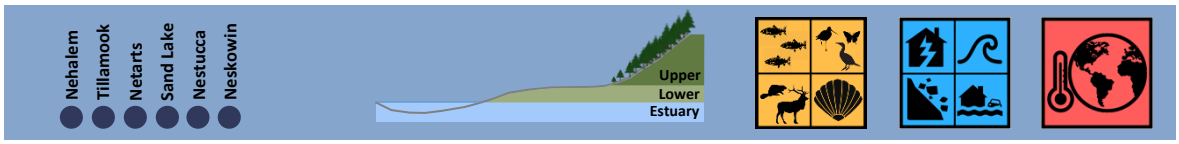
Why: Habitats and processes in the upper watershed are shaped by higher gradient, narrow, coarse sediment dominated landforms. In these steeper areas the rivers and streams are more confined and are characterized by higher velocity, turbulent flow regimes. This high energy environment results in steep rugged valleys prone to landslides. Key habitats include swift mainstem rivers and tributaries, off-channel aquatic refugia, riverine wetlands, springs, mixed riparian forests, meadows, and diverse upland forest. Conserving and restoring

a highly functioning, healthy array of habitats in the upper watershed is important to maintain critical ecosystem services that these habitats provide. Some of these services include clean/cold water production; sediment production and delivery to the lower and estuarine portions of the watershed; spawning gravel for anadromous fish; and sustainable timber, fish, and wildlife populations.

Performance Measures:

- ✓ Restore 200 acres of critical habitat in the upper watershed over the next ten years.

HAB-09



Maximize ecosystem connectivity to ensure a landscape array of ecosystem processes and ease of species movement

What: Conserve and restore lands that provide effective connectivity among and between habitats to allow physical and biological processes to occur that are necessary for healthy ecosystem function. Conservation and restoration shall focus on existing open spaces that encompass viable corridors between habitat types. In addition, it is important to protect areas where high quality habitats transition from one to another. These ecotones are hotbeds of biological diversity and are critical to maintain ecosystem level biological and physical processes. Address manmade barriers like roads, fences, and continuous development to enhance the free flow of organisms and ecological processes through and across them. Develop a watershed-wide characterization that clearly identifies the biological and physical processes that are most critical in and among habitats and where on the landscape they occur and need to be addressed most readily. Based on this characterization, develop priorities for conservation and restoration of the most critical connections.

Lead(s): TEP, ODFW, USFWS, USFS, BLM, ODF, TU, watershed councils

Partners: OSU, UO, USFS, USFWS, NOAA, ODFW, ODA, DEQ, IAE, private landowners

How

Activity 1: Characterize issues that impede the free flow of organisms and ecological processes within and across habitat types and specific areas where they occur.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 2: Develop inventories and prioritizations for connectivity issues that are the most critical to address.

Anticipated Costs: $$

Timing: Ongoing

Activity 3: Carry out conservation and restoration projects that reconnect and enhance organism movement and ecological processes in and between habitat types.

Anticipated Costs: $$$/E,F,S,P,O

Timing: Ongoing

Activity 4: Develop and implement effectiveness monitoring of habitat connectivity projects undertaken.

Anticipated Costs: $$/E,F,S,P,O

Timing: Ongoing

Activity 5: Disseminate project information (methods and results) to partner organizations, stakeholders, and other interested parties to continually improve conservation and restoration practices as they pertain to ecosystem connectivity.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

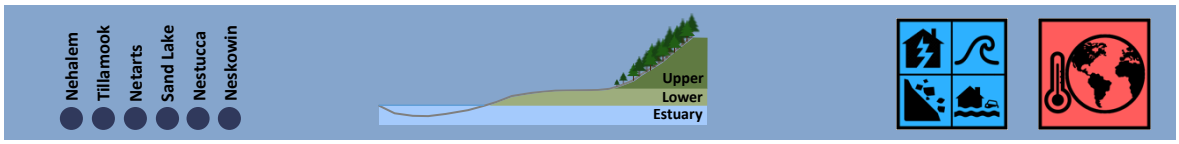
Why: Adequate connectivity in and between habitats is important for the proper functioning of habitats and the survival of the species that depend on them. Connectivity provides long-term resiliency, adaptability to change, and enhances a habitat's ability to recover from manmade and natural disturbances. Important biological processes that occur across ecotones include gene flow and the maintenance of genetic diversity, species movement for colonization and recolonization of habitats, and the flux of valuable organic inputs like leaf litter and

large woody debris. Physical processes that occur across ecotones include the movement of clean water, sediment and nutrient inputs, and environmental influences like temperature moderation. These critical processes, in most cases, are independent of single habitat types in that they only occur effectively when a landscape array of habitats are freely connected; therefore, it is imperative to engage watershed-scale conservation and restoration.

Performance Measures:

- ✓ Implement ten aquatic organism passage projects over the next ten years.
- ✓ Identify 100 acres of critical corridor habitat to be protected over the next ten years.

HAB-10



Provide genetically appropriate native vegetation and promote its use among habitat restoration and enhancement partners

What: Enable the restoration of key habitats and species populations by providing locally sourced, genetically appropriate native plants to partners implementing restoration of key habitats via TEP's Northwest Oregon Habitat Restoration program (NORP) at its native plant nursery. Promote the effective use of native plants through outreach and technical support to partners and the greater community.

Lead(s): TEP

Partners: OSU, UO, USFS, USFWS, NOAA, ODFW, ODA, DEQ, IAE, BLM, ODF, soil and water conservation districts, watershed councils, and private landowners

How

Activity 1: Continue to work towards long-term program sustainability through a variety of funding streams.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 2: Propagate a diversity of locally adapted native plant materials to meet the needs of habitat restoration of all the key habitats found along the north coast of Oregon.

Anticipated Costs: $$$/E,F,S,P,O

Timing: Ongoing

Activity 3: Distribute native plant material to partners and make surplus plant material available to local communities for habitat enhancement and as a mechanism for outreach.

Anticipated Costs: $$/E,F,S,P,O

Timing: Ongoing

Activity 4: Provide technical expertise in native plant propagation, appropriate palette selection, and restoration implementation strategies to partners and interested community members.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 5: Provide opportunities for education, hands-on experience, youth mentorship, and community service in the field of native plants, native plant propagation, and habitat restoration.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

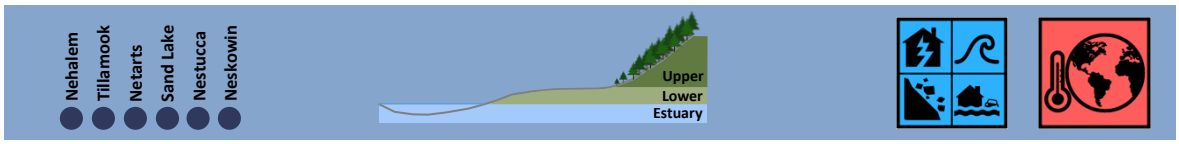
Why: TEP's native plant nursery is the only reliable sources of coastal adapted native plant material for the restoration of estuaries, wetlands, riparian areas, and other key habitat in Northwest Oregon. The nursery propagates plant material and provides it to partners at a low cost which enables the receiving partners to leverage more funding for the implementation of on the ground restoration work. Restoring plant communities with genetically diverse plant populations that are specifically adapted to their environment is a key to successful restoration and ensures the maintenance of genetic integrity in natural plant populations. Genetic diversity and the corresponding unique nature of the plants that make up a given population or sub-population provides species resiliency through disease resistance, increased vigor, adaptability to change, and

resiliency to natural and human caused disturbance. Of special genetic concern are rare plant species or portions of plant populations that are at the periphery of their population distribution. To ensure robust and diverse plant populations into the future and in the face of climate change, it is imperative that TEP and its partners preserve the unique genetic nature of even the most common plant species.

Performance Measures:

- ✓ Supply at least 75,000 native plants to restoration partners annually.
- ✓ Mentor 40 youth annually in the conservation sciences and career field.

HAB-11



Assess, prioritize, and enhance key native species populations, emphasizing contribution to ecological function

What: Assess native plant and animal species within the focal area to identify species populations that need conservation and enhancement utilizing new and established information (i.e., The Oregon Conservation Strategy). Focus on species that are rare, declining, economically significant, and those that exhibit a high relative contribution to the proper functioning of the ecosystem. Common species shall not be overlooked. Using this information, prioritize plant and animal species or specific groups of plant and animal species that are need of conservation and restoration. Develop and implement projects that address the specific needs of target species populations. These projects may include habitat restoration, species reintroduction, exotic species management, outreach, and policy adjustment.

Lead(s): TEP, ODFW, USFWS, USFS, BLM, ODF, TU, watershed councils

Partners: OSU, UO, USFS, USFWS, NOAA, ODFW, ODA, DEQ, IAE, BLM, ODF, soil and water conservation districts, watershed councils, and private landowners

How

Activity 1: Assess the health, status, and functional roles of native plant and animal species in the key habitats. Utilize current information found in conservation and management plans as well as new data and information as needed to paint a comprehensive picture of the focal area's functional ecology.

Anticipated Costs: $$/E,F,S,P,O

Timing: Ongoing

Activity 2: Utilize the comprehensive assessment compiled for Activity 1, prioritize species that are most in need of conservation and enhancement due to their status and/or their relative contribution the ecosystem function.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 3: Develop and implement projects that address the needs of priority species.

Anticipated Costs: $$$

Timing: Ongoing

Activity 4: Disseminate project information (methods and results) to partner organizations, stakeholders, and other interested parties to continually improve conservation and restoration practices of upper watershed systems.

Anticipated Costs: $

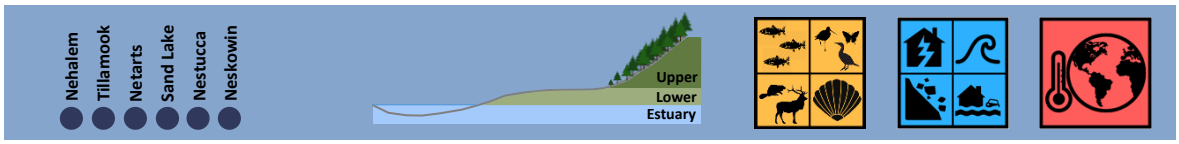
Timing: Ongoing

Why: Ecosystems are made up of a myriad of native plant and animal species that together comprise a functioning ecosystem. Plants and animals play functional roles in a variety of processes including predator/prey relationships, biochemical cycling, and habitat structure modification. While some species may seem insignificant, the functional roles they contribute to the health of the ecosystem may be critical to species with economical or cultural value. Therefore, it is paramount that every species within the ecosystem is treated as a critical piece of the puzzle, and that TEP and its partners strive to understand the significance of their roles even when not clear. The conservation and restoration of species diversity within ecosystems is critical to the maintenance of economically and culturally valuable species and the critical ecosystem services they provide.

Performance Measures:

- ✓ Initiate ten special status species recovery projects over the next ten years.

HAB-12



Assess, prioritize, and manage non-native species emphasizing those that have or are likely to have disproportionate negative effects

What: Assess non-native plant and animal species within Tillamook County to identify species populations that pose potential negative impacts on the ecosystem and native species populations of ecological, cultural, and economic value. Focus on species that exhibit disproportionate negative effects on the proper functioning of the ecosystem currently and those that are likely to do so if allowed to expand. Early detection and rapid response (EDRR) is essential. Using this information, prioritize plant and animal species or specific groups of plant and animal species that need eradication. Develop and implement projects that directly or indirectly reduce the target non-native species populations including the manipulation of habitat conditions suitable for their presence. These projects may include habitat restoration, species reintroduction, exotic species management, outreach, and policy adjustment. Ensure effective collaboration with regional Collaborative Weed Management Areas (CWMA) and Partnership for Regional Invasive Species Management (PRISM) groups.

Lead(s): TEP, ODFW, USFS, BLM, ODF, soil and water conservation districts, watershed councils, private timber

Partners: OSU, UO, USFS, USFWS, NOAA, ODFW, ODA, DEQ, IAE, BLM, ODF, soil and water conservation districts, watershed councils, and private landowners

How

Activity 1: Assess the status and negative effects of non-native plant and animal species on key habitats found in TEP's focal area. Utilize current information found in conservation and management plans as well as new data and information as needed to paint a comprehensive picture of non-native species populations.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 2: Utilize the comprehensive assessment compiled for Activity 1, to prioritize species that are most in need of eradication due to their status and/or their relative negative effects on ecosystem function.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 3: Develop and implement projects that directly or indirectly reduce target non-native species populations.

Anticipated Costs: $$$/E,F,S,P,O

Timing: Ongoing

Activity 4: Disseminate project information (methods and results) to partner organizations, stakeholders, and other interested parties to continually improve efforts to control non-native populations and their corresponding negative effects.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Why: The presence of aggressive, non-native species of plants and animals can have disastrous effects on native species populations, ecosystem function, and local economies. To successfully conserve and restore native populations, ecosystems, ecosystem services, and the natural resources control non-native species present in the ecosystem and prevent the colonization and spread of additional species in the future.

Performance Measures:

- ✓ Develop a strategic plan for invasive species management for each of the five focal estuaries over the next ten years.

Nehalem Bay | Don Best

Assess and implement best management practices for key habitat conservation

What: Assess and implement best management practices used to reduce the impacts of land use on key habitats in the estuarine, lower, and upper portions of the watersheds. Determine the effectiveness and rate of use of current best management practices at reducing impacts on ecosystem processes and function. Through education, outreach, and policy adjustment, encourage the use and further development of best management practices.

Lead(s): TEP, ODFW, USFS, BLM, ODF, soil and water conservation districts, watershed councils, private industry

Partners: OSU, UO, USFS, USFWS, NOAA, ODFW, ODA, DEQ, IAE, BLM, ODF, TCCA, soil and water conservation districts, watershed councils, and private landowners

How

Activity 1: Assess current best management practices used to reduce land use impacts on key habitat.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 2: Utilize information collected to highlight and prioritize opportunities to improve best management practices employed by industry and throughout the landscape.

Anticipated Costs: $$/E,F,S,P,O

Timing: Ongoing

Activity 3: Implement new and established best management practices according to prioritized opportunities.

Anticipated Costs: $$$/E,F,S,P,O

Timing: Ongoing

Activity 4: Encourage the development and use of best management practices through education and outreach.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

Activity 5: Disseminate information on best management practices (methods and results) to partner organizations, stakeholders, and other interested parties to continually improve our understanding of the current state and efficacy of best management practices being employed to mutually benefit ecosystems and industry.

Anticipated Costs: $/E,F,S,P,O

Timing: Ongoing

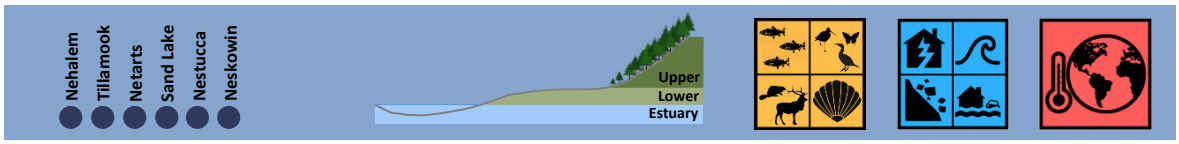
Why: Intensive land and aquatic resource use such as rural development, agriculture, forestry, aquaculture, and fisheries are important to the economic and cultural livelihood of Tillamook County's citizens, but these land uses can also have negative impacts on ecosystem health, water quality, important species, and other natural resources. With expanding populations and a changing climate, the need for natural resources and dependence upon the important ecosystem services that nature provides will increase. To protect important industries while also protecting the natural environment on which they depend, a continuous effort to evaluate, implement, and improve best management practices is necessary. Best management practices are tools, methods, and

strategies that can be incorporated into industries and landscapes that prevent and reduce pollution and other forms of degradation on surrounding natural and human environments.

Performance Measures:

- ✓ Assess the state of BMPs utilized by each major industry in the focal area over the next ten years.
- ✓ Implement at least one BMP associated project annually.

HAB-14



Encourage the adoption and implementation of policies, ordinances, regulations, and laws that ensure sustainable use and stewardship of natural resources and key habitats

What: Through data collection, outreach, and education, encourage the adoption and implementation of policies, ordinances, regulations, and laws that ensure sustainable use and stewardship of natural resources and ecological services provided by key habitats.

Lead(s): State, County, Cities

Partners: OSU, UO, USFS, USFWS, NOAA, ODFW, ODA, DEQ, IAE, BLM, ODF, TCCA, soil and water conservation districts, watershed councils, and private landowners

How

Activity 1: Evaluate the comprehensiveness and effectiveness of policies, ordinances, regulations, and laws that are currently in place to ensure sustainable use of natural resources and key habitats.

Anticipated Costs: $/F,S,P,O

Timing: Ongoing

Activity 2: Develop a list of suggested changes and additions to policies, ordinances, regulations, and laws that may improve management and stewardship of natural resources and key habitats.

Anticipated Costs: $/F,S,P,O

Timing: Ongoing

Activity 3: Evaluate data gaps that, if filled, would lend credence to the adoption or alteration of policies, ordinances, regulations, and laws suggested.

Anticipated Costs: $/F,S,P,O

Timing: Ongoing

Activity 4: Encourage the adoption and implementation of policies, ordinances, regulations, and laws through education and outreach to target audiences.

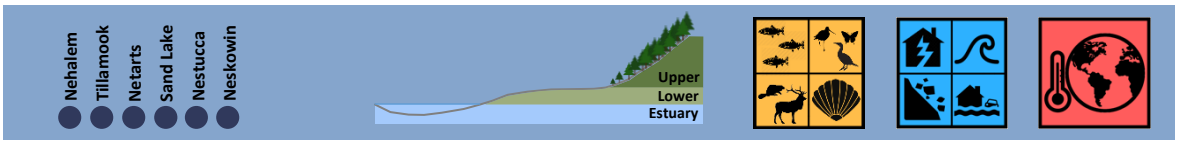
Anticipated Costs: $/F,S,P,O

Timing: Ongoing

Why: The adoption and implementation of policies, ordinances, regulations, and laws are the most proven mechanisms to ensure the judicious, equitable, and sustainable use and stewardship of natural resources and key habitats. These, combined with conservation and restoration, will lead to improved ecosystem functioning and a robust, sustainable return of natural capital.

Performance Measures:

- ✓ Facilitate one educational workshop on environmental policies and regulations in the next 10 years.
- ✓ Comment on federal, state, and local rulemaking efforts as opportunities arise.



Facilitate the development of pathways, funding sources, and prioritize actions taking place on "working" lands

What: Facilitate the development of pathways, funding sources, and prioritize actions that advance the implementation of conservation and restoration activities in and around working agricultural, ranching, and forestry lands to create a sustainable future for the associated industries and natural ecosystems.

Lead(s): ODFW, USFWS, soil and water conservation districts, watershed councils, TCCA

Partners: OSU, UO, USFS, USFWS, NOAA, ODFW, ODA, DEQ, IAE, BLM, OWEB, ODF, TCCA, soil and water conservation districts, watershed councils, and private landowners

How

Activity 1: Evaluate key habitat and ecological functions in relationship to working lands and develop and prioritize projects that work within this nexus.

Anticipated Costs: $/F,S,P,O

Timing: Ongoing

Activity 2: Develop monitoring and research that illuminates and improves the cost/benefit ratio of implementing working lands conservation and restoration activities.

Anticipated Costs: $$$ /F,S,P,O

Timing: Ongoing

Activity 3: Work with funding streams that help implement conservation and restoration projects on and around working lands.

Anticipated Costs: $/F,S,P,O

Timing: Ongoing

Activity 4: Highlight projects where success has been achieved on behalf of working lands and the natural landscape through education and outreach.

Anticipated Costs: $/F,S,P,O

Timing: Ongoing

Activity 5: Convene and facilitate a working group that focuses specifically on the nexus between working lands and natural ecosystems.

Anticipated Costs: $/F,S,P,O

Timing: Ongoing

Why: Working lands are a critical component to the continued livelihood of Tillamook County residents. Many of these working lands and associated industries directly depend on natural resources or are located adjacent to them. To protect important industries while also protecting the natural environment, improving the nexus between industries and natural ecosystems is critical. Often productive working lands and productive natural ecosystems are considered mutually exclusive, but this is not the case. In fact, several local examples prove otherwise. It is important that these examples are shared. To accomplish this, TEP and its partners need to prioritize activities that utilize working groups, ingenuity, and the latest science and technology to break down barriers and succeed in making working lands and healthy ecosystems mutually beneficial rather than exclusive.

Performance Measures:

- ✓ Convene one workshop for key stakeholders on the state and progress of conservation actions on working lands every other year.
- ✓ Implement five working lands conservation projects over the next ten years.

Chapter 3: Community Education and Engagement Action Plan

Environmental education creates informed residents and partners that are an effective force in addressing watersheds' problems. Similarly, deliberate engagement ensures that residents, partners, and visitors play an active role in stewardship, spreading the responsibility of caring for our watersheds. The people of Tillamook County have a tradition of rising to meet challenges and working together to achieve common goals. The Community Education & Engagement Action Plan details how TEP and its partners will strengthen access to environmental education and foster a strong culture of environmental stewardship.

The Challenge

Education in the STEM (science, technology, engineering, and math) fields helps raise environmental awareness and gives residents effective tools to make decisions about watershed stewardship. In rural Tillamook County, however, community members often have limited access to STEM educational resources and other information specific to the Tillamook County watersheds. Education, outreach, and engagement programs for people of all ages must be strengthened in order to create successive generations of environmentally-literate residents who will care for the future vitality of Tillamook's estuaries and watersheds.

Existing Efforts in Community Education and Engagement

Settled within a temperate rain forest, encompassing six watersheds, flowing rivers and streams, and connecting with the Pacific Ocean, TEP's focal area beckons to be an extension of the classroom. Nature can be the most obvious or most subtle teacher and TEP appreciates the education, outreach, and engagement opportunities that exist just outside its door. Since its inception, TEP has been helping people of all ages connect to the natural world. TEP strives to develop life-long learners who continue to embrace education through recreation. Together TEP and its partners are developing a community with a greater sense of stewardship and connection to the environment.

Community Education and Engagement

During its early years, TEP devoted much of its public outreach efforts toward community education about environmental resources, science, and management issues. Included in these first steps were the development of a Citizen Action Committee (CAC) and a strategy for public involvement. Led by concerned citizens and TEP, the CAC designed and managed an extensive education and outreach program that included speaker programs, public events, signs, videos, and printed materials. Over time, TEP has expanded its messaging through its social media network and its partner relationships. By using a multi-media approach, TEP continues to educate residents and visitors about issues impacting the estuaries' watersheds and to involve the public and partners in solutions.

Several long-standing programs that were developed while implementing TEP's original CCMP are still in place today. These will serve as the foundation for the education, outreach, and engagement goals over the next decade.

Landmark Outdoor Learning Experiences

The annual Children's Clean Water Festival (CCWF) began in 2001, inspired by a similar festival in Portland. Every fourth grader from each of the three public school districts, all private schools, and home schools in Tillamook County are invited to this special day of learning. Science and art are mixed together to produce a series of hands-on activities related to clean water and healthy ecosystems.

The annual third grade event, referred to as either Down by the Riverside or Down by the Creekside (DBTC) depending on the venue, began in 2002. This event takes place over multiple days, with approximately 100 children attending each day. Students are introduced to the natural ecosystems through science, art, history, and stewardship.

In the first 17 years of TEP's CCWF and 16 years of the DBTC programs, approximately 10,200 Tillamook County grade school children and over 1,700 volunteers have participated in "learn by doing" activities. By giving students a chance to build a sense of place and increase environmental literacy, TEP and its partners hope to develop a strong stewardship ethic within Tillamook County's youngest residents. Designed to complement the Common Core, Next Generation Science Standards, and Ocean Literacy education standards, the CCWF and DBTC provide a unique opportunity for local grade schools to participate in field based environmental education that is not always possible in traditional classroom settings.

TEP provides reciprocal support to partner-led experiential learning programs such as Outdoor School (6th grade), SalmonWatch (7th grade), Tech Trek (8th grade), Science Tuesdays for home schooled children, and science fairs at local elementary schools. These education partnerships enable K-8 children within Tillamook County to attend at least one outdoor program at each grade level.

K-8 Education Kits

TEP offers outdoor education kits to augment classroom teachers' efforts to increase environmental literacy. These kits include curricula touching on water quality, watershed processes, exploring estuaries, wetland functions, macroinvertebrate communities, animal tracking, intertidal life, bird species of the estuary, and local geology. They contain numerous hands-on activities and are stocked with associated field equipment and supplies. These kits may be checked out by formal and informal educators at no cost. TEP has developed training videos for several of the kits to aid first-time users.

Tillamook County Water Trail Guides

A network of water trails flows through the quiet bays and peaceful rivers within Tillamook County. To encourage responsible recreation among the non-motorized watercraft community, TEP created a series of guidebooks, with inset maps, for the Tillamook County Water Trail (TCWT). Colorful and captivating, these guidebooks convey valuable information on water-safety, appropriate access points, invasive aquatic species, cultural history, stewardship, and etiquette for those who paddle the waterways. The TCWT has been

designated as a National Recreation Trail by the U.S. Department of the Interior. TEP's TCWT is a true success story, empowering people to live, learn, and experience their environment on their own terms, at their own pace.

An interactive map showing the water trails is available online on TEP's website (currently available at https://www.tbnep.org/map.php). The map allows the user to select overlays which show access points, restrooms, wildlife viewing spots, and other points of interest. TEP has added overlay options to highlight its restoration project locations and to share current water quality results (bacteria levels) with the public.

Explore Nature (Education through Recreation)

Activities such as hiking, biking, and kayaking are great platforms for learning about the environment. Since 2016, TEP and its partners have been offering opportunities that connect restoration efforts with the recreation that residents and visitors enjoy. Offerings include kayaking local estuaries, interpretive hikes focusing on local natural history topics, wildlife viewing and photography, and stewardship activities such as invasive species removals and coastal cleanups. This popular program has grown from 16 summer activities to over 60 events between March and November and has engaged participants from nearly 20 states across the country. In 2017, Visit Tillamook Coast presented TEP and its partners with the Shirley Kalkhoven Tourism Excellence Award for Explore Nature.

Community Outreach

TEP strives to be a familiar face at popular Tillamook County public events supporting the community and partners. These local venues provide opportunities for TEP to form lasting relationships and to promote its important message that healthy estuaries and watersheds make for happy, healthy people. Some of the many events that TEP attends include the Tillamook County Fair, Garibaldi Days, and local Farmers' Markets where TEP staff engage the public through interpretive displays and materials, fun hands-on activities, and conservation messaging.

TEP has commissioned a number of interpretive signs which highlight TEP and the importance of estuaries. These signs may be found around Tillamook Bay along coastal walking trails and scenic viewpoints. A series of new signs are being created to replace the aging originals in 2019:

- Where Freshwater & Saltwater Meet
- Hard at Work in the Bay (shellfish)
- A Fish of Two Waters (salmonids)
- Stream-side Security (native riparian plants)
- Stop the Invasions (invasive species)
- At the Bottom of the Bay (crabs)

TEP uses a multi-media messaging approach. A State of the bays report is published every five years. TEP issues electronic newsletters, maintains a dedicated website (https://www.tbnep.org), regularly posts to Facebook, and has burgeoning Instagram and YouTube accounts. Press releases are issued to local newspapers about TEP's landmark outdoor learning events and Explore Nature. TEP also promotes its community on local radio stations.

Volunteer Engagement

Volunteers have played a critical role in helping TEP implement its CCMP and will continue to do so. The following programs are currently the most active and will serve as best-in-class examples as TEP expands upon its community engagement:

Water Quality Monitoring – This group of volunteers collects water samples twice monthly from approximately 80 monitoring locations at rivers, creeks, and bays throughout Tillamook County. This program started in 1997 and some volunteers have been involved for more than 20 years. The data are used by TEP, DEQ, and other State and Federal agencies to make decisions and document trends that impact human health and wildlife such as salmon.

Education – TEP could not host its two landmark outdoor learning experiences, Children's Clean Water Festival and Down By The Creekside, without volunteers. Over 200 teachers, natural resource and education partners, and local citizens volunteer to be guides, activity leaders, exhibitors, and chaperones during these events.

Native Plant Nursery – Adult volunteers, along with youth labor, are vital to the operation of TEP's native plant nursery. The Master Gardeners, undergraduate classes from Tillamook Community College, participants in TEP's Explore Nature program, and local citizens assist with seed collection, sowing, transplanting, and other activities related to the propagation of approximately 75,000 plants used during restoration projects each year.

Capacity Building

TEP helps several of its partner organizations concentrate their efforts on conservation and education programs by providing operational services for which they may be understaffed or lack the expertise. Two examples include:

- Providing fiscal administration for local watershed councils and other non-profit organizations
- Managing marketing grants and contracts for Explore Nature on behalf of TEP and the other seven partners.

Opportunities to Expand Community Education and Engagement

Community Education and Engagement Gaps

- TEP hosts landmark outdoor learning experiences for third and fourth graders throughout Tillamook County. TEP supports several partners who conduct similar programs for elementary school children

including Tillamook School District and Friends of Netarts Bay – WEBS (G1-6), Neah Kah Nie School District (G7), Outdoor School (G6), and Salmonwatch (G7). Tillamook School District has a Teacher on Special Assignment (TOSA) who is responsible for G1-12 programming. However, the other two school districts do not have similar TOSA positions, leaving outdoor experiential learning gaps for many of the grade levels in the northern (Neah Kah Nie) and southern (Nestucca) parts of Tillamook County.

- TEP is actively involved in elementary and middle school outdoor learning but has less involvement at the high school level. TEP engages students from Tillamook and Neah Kah Nie high schools as guides and activity leaders during Children's Clean Water Festival and Down By The Creekside; however, this engagement could be expanded into career technical education (CTE) through internships or for-credit programs.
- TEP is building its relationships with Tillamook Bay Community College and the OSU Extension Office to increase education and engagement opportunities for undergraduate students. TEP currently serves as guest speakers and host field trips to the native plant nursery. These partnerships could be expanded through CTE internships and for-credit field courses/labs.
- TEP's goal is to educate and engage people of all ages. TEP is currently reaching active adults and families through its Explore Nature program, water trail guides, and community outreach. TEP plans to enhance program options for the senior citizen community.

GOAL

Foster awareness of Tillamook County's estuaries and watersheds, engage in problem solving, and take action to conserve and enhance our natural resources

This goal will be achieved through the following five key actions:

CEE-01 Strengthen STEM literacy for K-12

CEE-02 Advance STEM-related career opportunities

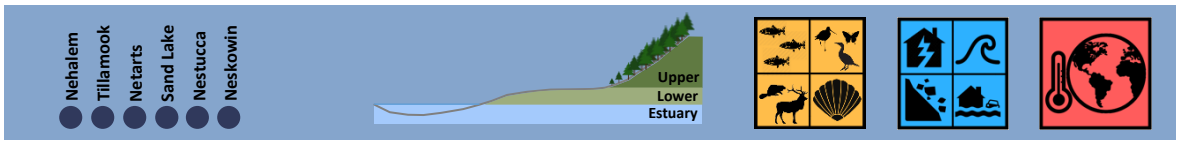
CEE-03 Foster lifelong learning and environmental awareness

CEE-04 Cultivate community environmental stewardship

CEE-05 Build capacity for partner organizations

Relationship to Other CCMP Actions

Community Education and Engagement actions support all other actions in the CCMP. Increasing awareness of environmental issues affecting the watersheds of Tillamook County and providing residents with tools to engage in habitat and water quality improvement will increase the energy directed toward stewardship. This in turn will create progress towards the goals outlined in Habitat Restoration and Water Quality.



Strengthen STEM literacy for K-12

What: Enrich STEM-based community education programs for K-12 students. Integrate Landmark Outdoor Learning Experiences (LOLEs) into classroom lesson plans. Engage in teacher professional development related to STEM, natural history, and resource management. Enhance organizational links between local schools, government agencies (e.g. Department of Education), watershed councils, institutes of higher learning, non-profit environmental organizations, and other entities.

Lead(s): TEP

Partners: School district administrators and teachers, STEM Hubs, Department of Education, Tillamook Bay Community College, state universities, watershed councils, private and home school educators, community organizations, governmental agencies, industry partners, museums, aquaria, and other learning centers.

How

Activity 1: Lead county-wide LOLEs (e.g. Children's Clean Water Festival, Down by the Creekside) and expand reach into private and home school sectors.

Anticipated Cost/Source: $/E, S, O

Timing: Ongoing

Activity 2: Support experiential learning programs led by partner organizations (e.g. Outdoor School, SalmonWatch, Tech Trek, 4-H, science fairs) and expand reach throughout Tillamook County.

Anticipated Cost/Source $/E, P

Timing: Ongoing

Activity 3: Enhance suite of estuary-based experiential learning activities (e.g. education kits) available to schools and the community, ensure linkage to current STEM education standards (e.g. Common Core, NGSS, Ocean Literacy), and increase usage by educators.

Anticipated Cost/Source: $/E, O

Timing: Ongoing

Activity 4: Develop and provide teacher training sessions with estuary/watershed focus during partner-led professional development workshops (e.g. Coastal Learning Symposium).

Anticipated Cost/Source: $/E, P

Timing: Ongoing

Activity 5: Advance regional and national endeavors which promote STEM literacy and experiential learning (e.g. STEM Hubs, Oregon Environmental Literacy Program, ANROSP).

Anticipated Cost/Source: $/E, P

Timing: Ongoing

Why: The children of today are the environmental ambassadors of tomorrow. Experiential learning strengthens comprehension and retention; thereby advancing STEM literacy in K-12. Providing teachers with resources and skills helps them to add more STEM-related activities and lessons into their curricula. Community-based organizations with education and outreach programs can supplement in-class learning.

Performance Measures:

- ✓ 600 students attend TEP's LOLEs for third and fourth graders annually.
- ✓ 3,000 hours of science instruction provided to K-12 students annually.

Advance STEM-related career opportunities

What: Develop career technical education (CTE) and service learning programs for high school, community college, and university students to prepare the next generation of resource managers and local workforce members for careers that may impact the estuaries and watersheds of Tillamook County.

Lead(s): TEP, TBCC, OSU Extension

Partners: School district administrators and high school teachers, Tillamook Bay Community College, OSU Extension, watershed councils, community organizations, governmental agencies, and industry partners.

How

Activity 1: Develop a summer internship program for Tillamook County G11-14 students with work assignments that support TEP's restoration efforts.

Anticipated Cost/Source: $$/E, F, S, O, P

Timing: Short term

Activity 2: Partner with TBCC and OSU Extension to develop and offer college-credit course(s) within the Agricultural and Natural Resources associate degree program.

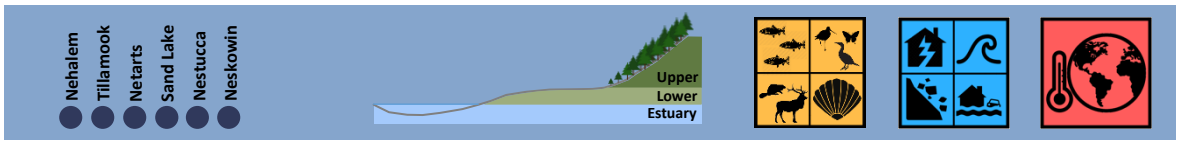
Anticipated Cost/Source: $/E, P

Timing: Mid-term

Why: Hands-on internship and service learning experiences promote estuary awareness and stewardship as well as support TEP with its program implementation (e.g. TEP's native plant nursery). These community members will use their educational backgrounds and work experiences in environmental conservation and sustainability to better embrace and advance healthy estuarine ecosystems in the focal area.

Performance Measures:

- ✓ Grade 11-14 summer intern program established by 2024.
- ✓ Undergraduate for-credit course offered at TBCC by 2024.



Foster lifelong learning and environmental awareness

What: Elevate environmental awareness within the community. Encourage and enable Tillamook visitors and residents to enjoy ecologically responsible recreational activities. Showcase TEP's contributions to healthy estuaries and watersheds, clean water, and habitat restoration.

Lead(s): TEP

Partners: Watershed councils, community organizations, governmental agencies, industry partners, senior centers, donors, tourism sector, and public.

How

Activity 1: Engage community through outreach (e.g. social media, TEP's website, exhibits at community events).

Anticipated Cost/Source: $/E, O, P

Timing: Ongoing

Activity 2: Develop and lead "Education through Recreation" programs (e.g. Explore Nature series).

Anticipated Cost/Source: $$/E, O, P

Timing: Ongoing

Activity 3: Generate and provide public with maps and information for responsible recreation (e.g. Water trail guidebooks, terrestrial trail guides, agro-tourism routes, interactive online water quality database).

Anticipated Cost/Source: $$/E, O, P

Timing: Ongoing

Activity 4: Develop and provide lifelong learning programs that promote estuary/watershed awareness within the senior citizen community (e.g. Elderhostel, senior centers).

Anticipated Cost/Source: $/E. O, P

Timing: Mid-term

Activity 5: Conduct feasibility study to build estuary education center and, if viable, build center, create programs and exhibits, and engage public.

Anticipated Cost/Source: $$/E. F. S. O P

Timing: Short term for feasibility study

Why: As the number of people living within and visiting Tillamook County increases, so will the stressors on the local environment and wildlife. Educating residents and tourists through recreational activities will nurture positive attitudes and behaviors toward natural resources; thereby garnering direct and indirect support for TEP's conservation, restoration, and education endeavors.

Performance Measures:

- ✓ 30% increase in social media followers, website viewers, and newsletter subscribers between 2019 and 2024.
- ✓ 750 people engaged in education through recreation activities annually.
- ✓ Lifelong learning programs developed and offered to seniors by 2027.
- ✓ Feasibility study for estuary education center completed by 2022.

Cultivate community environmental stewardship

What: Encourage and enable community members and visitors to participate in environmental stewardship opportunities that supplement TEP's conservation and restoration endeavors within Tillamook County.

Lead(s): TEP

Partners: Watershed councils, community organizations, governmental agencies, industry partners, volunteer organizations, and public.

How

Activity 1: Expand the network of volunteers who assist with TEP's programs (e.g. water quality sample collection, native plant nursery assistance, K-12 education, G11-14 internships, coastal and riparian cleanups, operations support).

Anticipated Cost/Source: $/E, F, S, O, P

Timing: Ongoing

Activity 2: Develop and direct a citizen science program to assist the native plant nursery and habitat restoration projects (e.g. Earthwatch, Heroes on the Water).

Anticipated Cost/Source: $$/E, F, S, O, P

Timing: Mid-term

Why: Volunteers increase the capacity of TEP to accomplish its restoration, conservation, and education goals. Engaging volunteers builds goodwill and a strong sense of community that help keep Tillamook's estuaries vibrant and healthy.

Performance Measures:

- ✓ 150 volunteers engaged annually.
- ✓ 2,800 volunteer service hours annually.

Build capacity for partner organizations

What: Provide technical expertise to local watershed councils and non-profit environmental organizations.

Lead(s): TEP

Partners: Watershed councils, non-profit organizations, governmental agencies, industry partners, formal and informal educators.

How

Activity 1: Provide professional scientific expertise to restoration and conservation projects.

Anticipated Cost/Source: $$/E, F, S, O, P

Timing: Ongoing

Activity 2: Share citizen science data with partner organizations (e.g. water quality monitoring, wildlife data).

Anticipated Cost/Source: $/E, F, S, O, P

Timing: Ongoing

Activity 3: Enable partners to focus limited resources on the implementation of CCMP restoration and education programs by assisting with their organizations' managerial tasks (e.g. fiscal administration).

Anticipated Cost/Source: $$/F, S, O, P

Timing: Ongoing

Why: Partner organizations are frequently understaffed or may lack the equipment, materials, expertise, or data needed to implement programs that help TEP meet its goal to conserve and enhance natural resources in Tillamook County.

Performance Measures:

- ✓ 200 hours building capacity for partner organizations, enabling additional restoration in Tillamook County estuaries and watersheds annually.

Roger Ross

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Chapter 4: Estuary and Watershed Profiles

A summary of each watershed within the TEP focal area is provided in this chapter. Each profile highlights the efforts of TEP and its partners to improve water quality, restore habitat, encourage environmental literacy, and foster citizen involvement and stewardship throughout TEP's focal area.

Healthy estuaries and watersheds support the community, economy, and ecosystem. This is the balance TEP strives to achieve in furtherance of its mission of restoring and conserving all of Tillamook County's estuaries and watersheds.

Estuarine Habitat Classifications[2]

The following classifications are based on the Coastal and Marine Ecological Classification Standards (CMECS). Individual classification types are given within the profiles below.

Aquatic beds (Benthic/Attached Aquatic Vegetation Beds) include subtidal or intertidal bottoms and any other areas characterized by a dominant cover of rooted vascular plants, attached macroalgae, or mosses, which are usually submersed in the water column or floating on the surface. They may be exposed during low tides. Non-rooted floating vegetation and free floating macroalgae are included with the Planktonic Biota Biotic Setting under the Floating/Suspended Plants and Macroalgae Subclass. These are critical habitat areas that provide food and cover for fish, amphibians, and invertebrates. These habitat areas have declined greatly since 1850 due to river channelization, siltation, and in-filling.

Mudflats (Flats) are often composed of unconsolidated sediments (such as mud or sand). These forms are more commonly encountered in the intertidal or in the shallow subtidal zones. Historically, these were viewed as unimportant and were often dredged to allow for development. However, they support wildlife and are key habitats for many shorebirds, fish, crabs, and mollusks.[3]

Emergent tidal marsh are wetlands characterized by erect, rooted, herbaceous hydrophytes—excluding emergent mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants.

Tidal scrub-shrub wetlands are wetland areas dominated by woody vegetation that is generally less than six (6) meters tall. Characteristic species include true shrubs, young trees, and trees or shrubs that are small or stunted due to environmental conditions. Scrub-Shrub Wetland includes the shrub-dominated portions of high salt marshes.

Forested wetlands are characterized by woody vegetation that is generally six (6) meters or taller. Coniferous swamps, lowland hardwood swamps, and floodplain forests are typical of these habitats.

[2] Federal Geographic Data Committee. Coastal and Marine Ecological Classification Standard (CMECS) version 4.0. 2012. https://www.fgdc.gov/standards/projects/FGDC-standards-projects/cmecs-folder/CMECS_Version_06-2012_FINAL.pdf

[3] "Lower Nehalem Watershed Council." Wetlands. http://lnwc.nehalem.org/?page_id=426.

Non-Estuarine Habitat Classifications[4]

The focal area includes five Level IV Coast Range ecoregions: Coastal Lowlands, Coastal Uplands, Volcanics, Willapa Hills, and Mid-Coastal Sedimentary (Figure 5).

Coastal Lowlands ecoregion covers 114 square miles (6%) of the focal area generally at elevations below 400 feet. The landscape is characterized by low gradient, meandering, tannic creeks and rivers along with beaches, dunes (stabilized by shore pine), estuaries and coastal wetlands, wet forests (spruce, cedar, hemlock, Sitka spruce), and marine terraces. The coast lowlands include agricultural land (pasture), some logging, and much of the areas residential, recreational, commercial, and port development (Garibaldi and Tillamook Bay).

Coastal Uplands ecoregion covers 206 square miles (11%) of the focal area generally at elevations between 400 and 2,500 feet. The landscape is characterized by headlands and low mountains surroundings the Coastal Lowlands with medium to high gradient tannic creeks and rivers. Forests in this ecoregion consist of spruce, cedar, hemlock, Douglas-fir canopy which has replaced much of the Sitka spruce which dominated before logging. The coastal uplands support some pastureland, logging, dairy farming, and has some recreation, rural residential, and commercial development.

Volcanics ecoregion covers 994 square miles (54%) of the focal area, mainly to the east and generally at elevations above 600 feet (but the ecoregion does extend to lower elevations near creeks and rivers). The landscape is characterized by steeply sloping mountains and capes that include higher gradient streams and rivers. The forest canopy is dominated by Douglas-fir and western hemlock. The volcanics contains much of the areas public and private timber land that supports logging, wildlife habitat, recreation, and rural residential development.

Willapa Hills ecoregion comprises 459 square miles (25%) in the northeast part of the focal area within the Nehalem watershed generally at elevations below 1,300 feet. The landscape is characterized by low, rolling hills, and gently sloping mountains with medium gradient creeks and rivers. The forest canopy is dominated by Douglas-fir and western hemlock. The ecoregion has some pastureland but is mostly forest that supports logging and contains some rural communities and residential development.

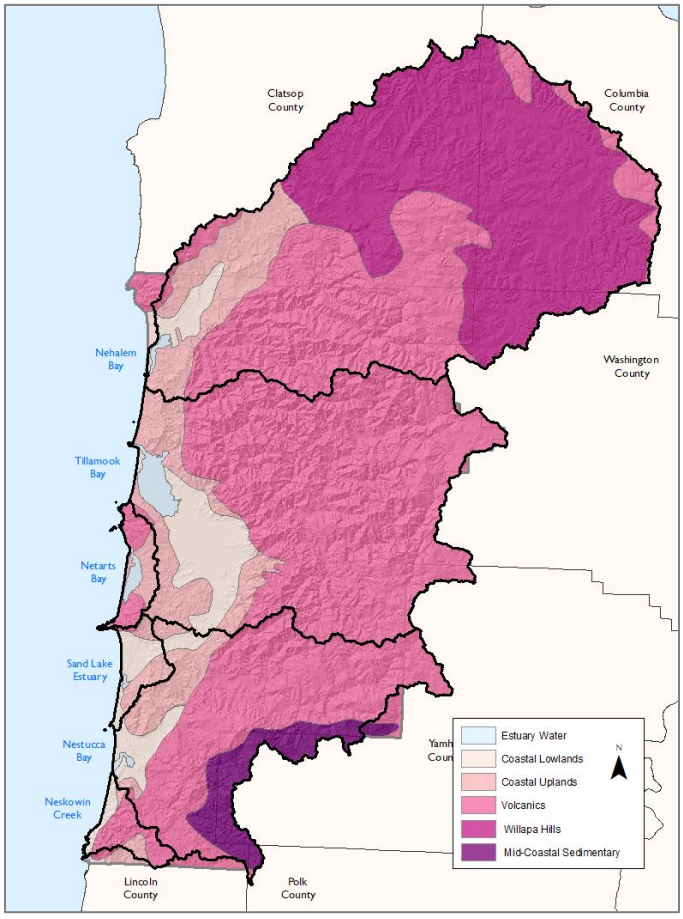

Figure 5. TEP Study Area non-estuarine habitat classifications (Level IV Ecoregions)

[4] Thorson, T.D., Bryce, S.A., Lammers, D.A., Woods, A.J., Omernik, J.M., Kagan, J., Pater, D.E., and Comstock, J.A., 2003. Ecoregions of Oregon (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,500,000).

Mid-Coastal Sedimentary ecoregion covers 58 square miles (3%) of the southeast part of the focal area within the Nestucca watershed generally at elevations between 500 and 2,000 feet (but the ecoregion does extend to lower elevations near creeks and rivers). The landscape is characterized by moderately slopping mountains with medium to high gradient creeks and rivers. The forest canopy is dominated by Douglas-fir and western hemlock. The ecoregion has some pastureland with some rural residential development in valleys but is mostly forest that supports recreation and logging.

Fish and Wildlife

Many of Tillamook County's bays and watersheds have similar fish and wildlife present. Endangered and threatened species such as the Oregon Coast Coho salmon, marbled murrelet, and western snowy plover are known to occur within portions of the focal area. Other common animals found throughout the focal area include a variety of songbirds, shorebirds, water birds and raptors. Elk, deer, black bears, and beavers are commonly found. Tidal areas and streams provide important rearing habitat for anadromous fish including Chinook, coho, and steelhead.[5] In addition, the Oregon silverspot butterfly has historically been found at Cape Mears (Netarts watershed), Mt. Hebo (Nestucca watershed), and is being introduced to the wildlife refuge in the Nestucca Bay National Wildlife Refuge. Band-tailed pigeon mineral sites are found in Nehalem, Tillamook, and Nestucca bays.

There are commercial oyster operations in the Tillamook and Netarts watersheds. Oysters have been grown commercially in Tillamook Bay since the 1930s. Tillamook Bay has been one of the leading oyster producing bays in Oregon, with an average annual production of about 21,200 shucked gallons during the 1970s and 1980s. Beginning in 1990, the level of production dropped off sharply and has remained low due to reduced production by several Oyster Companies.[6] The Whiskey Creek shellfish hatchery in Netarts Bay is the largest shellfish hatchery in the U.S. This shellfish hatchery provides "oyster, clam, and mussel seed for commercial as well as restoration efforts. Whiskey Creek has also been at the forefront of ocean acidification research and adaptation. Beginning in 2007, the hatchery struggled with mass mortalities associated with highly corrosive upwelled water off the Oregon coast. In the last few years, thanks to research and improvements in hatchery monitoring techniques, Whiskey Creek has been able to better predict and respond to changes in ocean chemistry and the negative impacts of those changes on shellfish larvae."[7]

Watersheds within Tillamook County provide habitat for threatened species such as Oregon Coast coho salmon. The Oregon Coast Coho Conservation Plan by the Oregon Department of Fish and Wildlife (ODFW) and the Oregon Coast Coho Recovery Plan by NOAA Fisheries and ODFW. The plans address the legal requirements for conservation planning under Oregon's Native Fish Conservation Policy and provide strategic recovery actions to support coho populations through adaptive management.

[5] Lower Nehalem Community Trust. *Conservation Plan 2013*. http://www.nehalemtrust.org/wp-content/uploads/LNCT_Conservation_Plan-1.pdf.
[6] "Department of Environmental Quality." Tillamook Bay Watershed 1998. https://www.oregon.gov/deq/.
[7] Pacific Shellfish Incorporated, http://www.pacshell.org/oregon.asp

Tidal Wetland Landward Migration Zones (LMZs)[8]

Tidal Wetland Landward Migration Zones (LMZs) are the areas upslope of current tidal wetlands where wetlands may migrate in the future as sea level rises. These are based on a study by the Midcoast Watersheds Council and the Institute for Applied Ecology in 2017 which modeled different LMZ outcomes based on various sea level rise scenarios on the Oregon coast. Knowledge of these areas may assist with planning restoration and conservation opportunities.

Within each of the watershed profiles that follow, figures depict the extent and prioritization of LMZs given a 4.7-foot rise in sea level by year 2100. The 4.7-foot rise scenario is the high end of the range from the West Coast Sea Level Rise study. It is used as the basis for comparison and prioritization since it represents: (a) the earliest scenario that shows a distinct change in the distribution of tidal wetlands compared to the baseline conditions, and (b) a long range planning scenario which may provide coastal groups (such as TEP) adequate time to take action to conserve and restore tidal wetland resources. The maps are based on elevation and projected sea level rise (SLR) and do not consider rates of sediment accretion. This amount of sea level rise could occur earlier or later than the year 2100.

Current v. 4.7 ft SLR scenario

LMZ maps are provided for five of the six estuaries within Tillamook County and show LMZs at 4.7 ft SLR versus the areas that are currently within the vegetated tidal wetland (emergent, shrub, or forested) elevation ranges even if they are not currently tidal wetlands (e.g., areas behind a dike or tide gate). As such, the LMZ maps show areas that would be tidal wetlands or mudflats if they were reconnected to the tides.

Tidal Wetland LMZ Prioritization Maps

The LMZ maps show areas to prioritize, and to support decisions on where to focus efforts for the conservation and restoration of tidal wetlands. The maps show prioritization rankings (high, medium-high, medium-low, and low). Areas that are developed (impervious) are removed from the prioritization rankings.


Photo: John Bauer

Prioritizations of LMZs are based on:

- Future tidal wetland areas (in hectares) at 4.7-foot sea level rise where more future tidal wetlands are given a higher prioritization;
- Area of higher LMZs with 8.2- and 11.5-foot sea level rise;
- Current land use zoning where non-developed land is given a higher prioritization;
- Land ownership where public land is given a higher prioritization;
- Development status where undeveloped land is given a higher prioritization.

Detailed information on how developed areas and infrastructure could be impacted by sea level rise is found on the Oregon Coastal Management Program's Sea Level Rise Exposure Inventory: http://www.coastalatlas.net/index.php/tools/planners/68-slr

[8] Brophy, Laura S. and Michael J. Ewald. "Tidal wetland landward migration zones (LMZs) for 4.7 ft. sea level rise for the Nehalem River Estuary." Oregon State University Scholars Archive. Midcoast Watersheds Council. https://ir.library.oregonstate.edu/concern/technical_reports/fn107413z.

Nehalem River Watershed

The Nehalem River Watershed encompasses 855 square miles or 46% of the focal area. The estuary has the geomorphology of a drowned river mouth and is considered a major shallow draft development estuary under the Oregon Estuary Classification system. The Nehalem River stretches for 118 miles and is Oregon's largest stream contained entirely within the coast range. Along its journey, the Nehalem River flows through dense forests, then quietly meanders by green pastures, small towns and basalt canyons before entering Nehalem Bay. Around the turn of the 20th century, the margins of the bay were abuzz with a bustling community of several thousand residents centered on agricultural products, logging, and a plentiful salmon fishery. Today, the area has a quieter appeal, while still maintaining its charm of old. Tourism is an increasing focus of the local communities, as evidenced by the expansive Nehalem Bay State Park. Work to restore and conserve ecological functions throughout the watershed is buoyed by the active efforts of partners in the upper Nehalem River, lower Nehalem River, and Nehalem Bay.

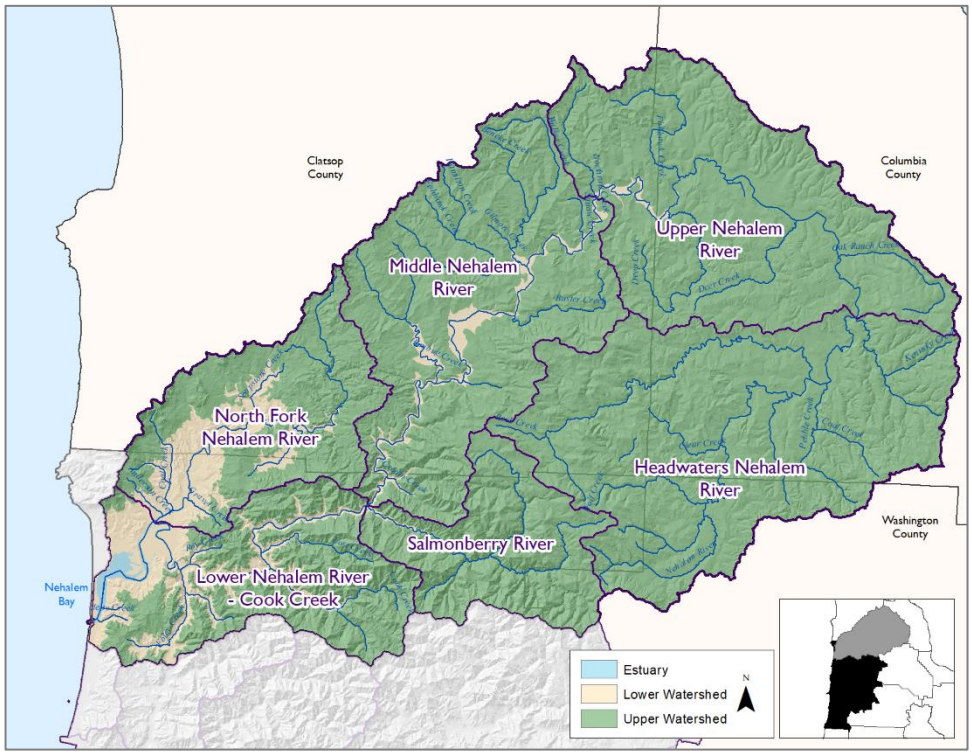

Figure 6. *Nehalem River watershed boundary showing 5th Field HUC sub-watersheds and the estuary, lower, and upper watershed regions.*

Physical Description

Nehalem River watershed is in northern Tillamook County. It lies completely within the temperate coniferous rain forest belt. The upper Nehalem is located upstream of the confluence of the Nehalem and Salmonberry rivers and is located within a geologic area called the Tillamook Highlands which is composed of sedimentary siltstone and sandstone.

Historically, the watershed was dominated by old growth coniferous ecosystems with marshlands in the lower gradient areas and estuary. There are over 935 miles of tributaries and the watershed is divided into six 5th Field HUC sub-watersheds and the estuary: North Fork Nehalem River, Middle Nehalem River, Upper Nehalem River, Headwaters Nehalem River, Salmonberry River, and Lower Nehalem River- Cook Creek (Figure 6). With a range of elevation from sea level to over 3,600 feet, this terrain varies from dunes, salt marsh, Sitka spruce swamps, and scrub shrub wetlands in the lower watershed to a wet temperate rain forest of Sitka spruce, hemlock and Douglas fir in the upper watershed. Nehalem Bay State Park is located on the north spit and is popular for camping, hiking, biking, boating, and fishing.[9]

[9] "Portland State University." Nehalem River Watershed Assessment. http://web.pdx.edu/~maserj/project/project1/acrobat/1intro.pdf

Figure 7 shows the distribution of estuarine habitats including: aquatic beds, mudflats, emergent wetlands, scrub-shrub wetlands, and forested wetlands. In Oregon, 68% of estuarine wetlands have been lost to conversion from 1870 to 1970 – the Nehalem River estuary lost 75%, making it among the most impacted estuaries in Tillamook County.[10]

Figure 8 shows the distribution of non-estuarine habitat (ecoregions). The watershed is within the Coast Range ecoregion (Level III), specifically the Level IV ecoregions Coastal Lowlands, Coastal Uplands, Volcanics, and Willapa Hills. The lower Nehalem is primarily part of the Volcanics ecoregion while the upper Nehalem is primarily part of the Willapa Hills ecoregion.

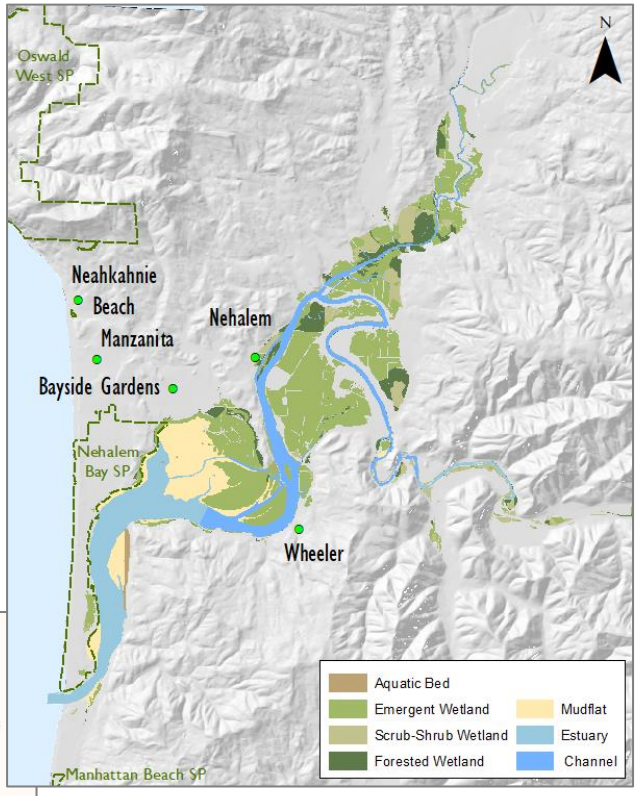

Figure 7. Nehalem watershed estuarine habitat classifications (CMECS)

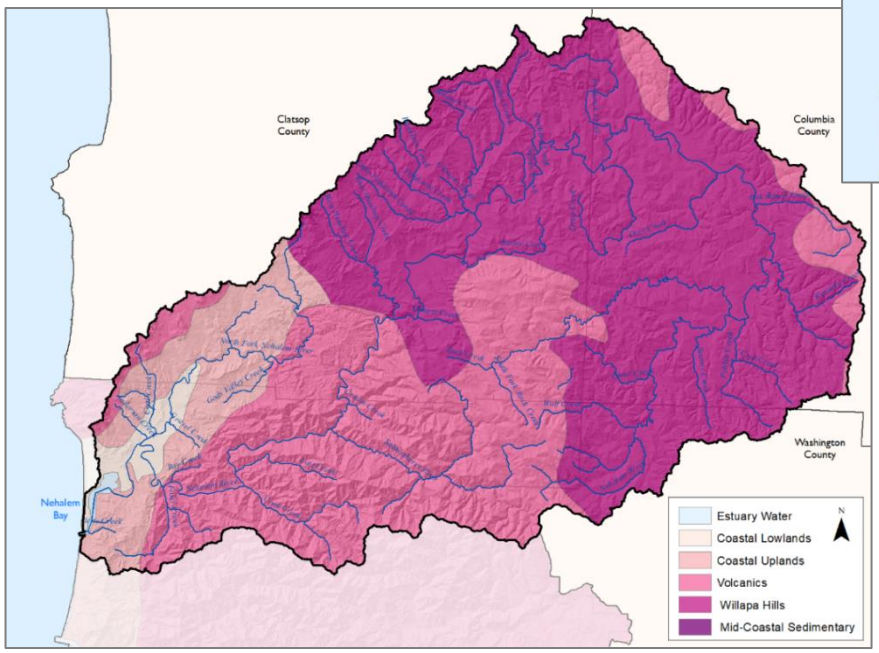

Figure 8. Nehalem watershed non-estuarine habitat classifications (Level IV Ecoregions)

Land Ownership

Much of the land in the watershed is privately or state-owned and 95% is zoned forest land. The upper watershed is primarily used for recreation and timber production, while the lower watershed is primarily used for agriculture, dairy, and residential uses. The estuary is used for commercial and sport fisheries and recreation activities. Most of the public forest lands are managed through the Oregon Department of Forestry (53%). Private timber companies also manage large tracts of land throughout the watershed (40%). Timber production is the main land use activity throughout the watershed, with agriculture representing a minor use (3%).[11] About three percent of the land is zoned for urban or rural development, including land within the cities of Nehalem (pop. 323), Vernonia (pop. 1,895), Wheeler (pop. 422), and the community of Bayside Gardens (pop. 662). In addition, the City of Manzanita (pop. 332) and the community of Neah Kah Nie Beach (pop. 54) are in the northwest portion of the County just outside the watershed.[12]

[10] Good, James W. *Summary and Current Status of Oregon's Estuarine Resources".* Oregon State of the Environment Report, Chapter III, Health of Natural Systems and Resources. Change is due to filling and diking between 1870 to 1970. Restoration of wetlands in recent years has begun to reverse the loss trends. https://www.oregon.gov/DSL/WW/Documents/soer_ch33.pdf.

[11] Ibid.

[12] U.S. Census Bureau, American Community Survey, 5-year estimates, 2012-2016.

Tidal Wetland Landward Migration Zones (LMZs)

Figure 9 shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100. Areas to the north and east of the bay are predicted to experience the greatest impacts from LMZs. The communities of Wheeler and Brighton are not predicted to see much change; however, Nehalem Bay State Park will likely be impacted.

Figure 10 shows the prioritization of LMZs. According to the Midcoast Watersheds Council and the Institute for Applied Ecology report areas to consider as priority for the conservation and restoration of tidal wetlands include Nehalem State Park and the area northeast of Wheeler that score as high or medium-high priority.

For more information visit the report on the Oregon State University Scholars Archive.

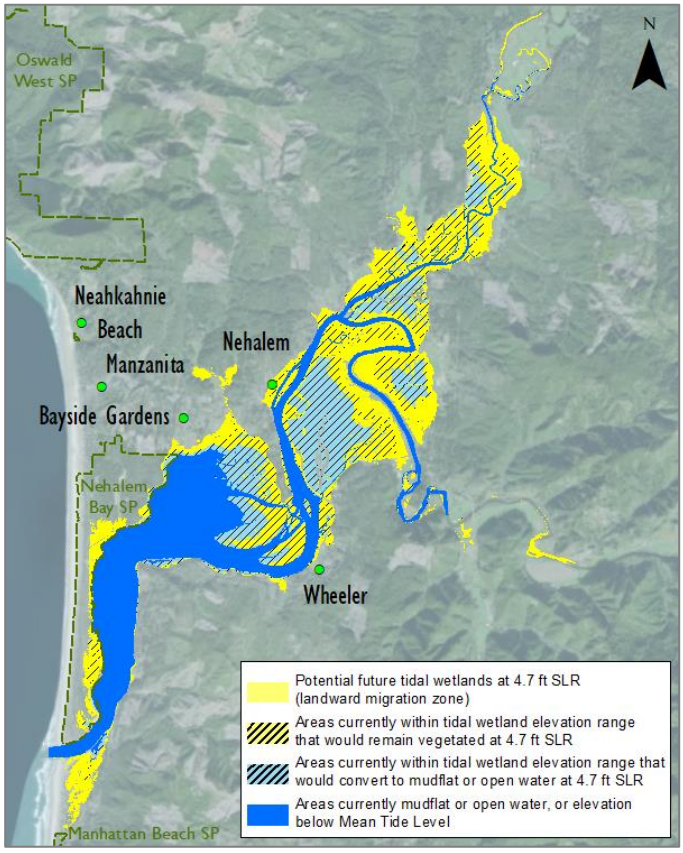

Figure 9. Nehalem Bay predicted landward migration zones (based on 4.7-foot sea level rise by year 2100).

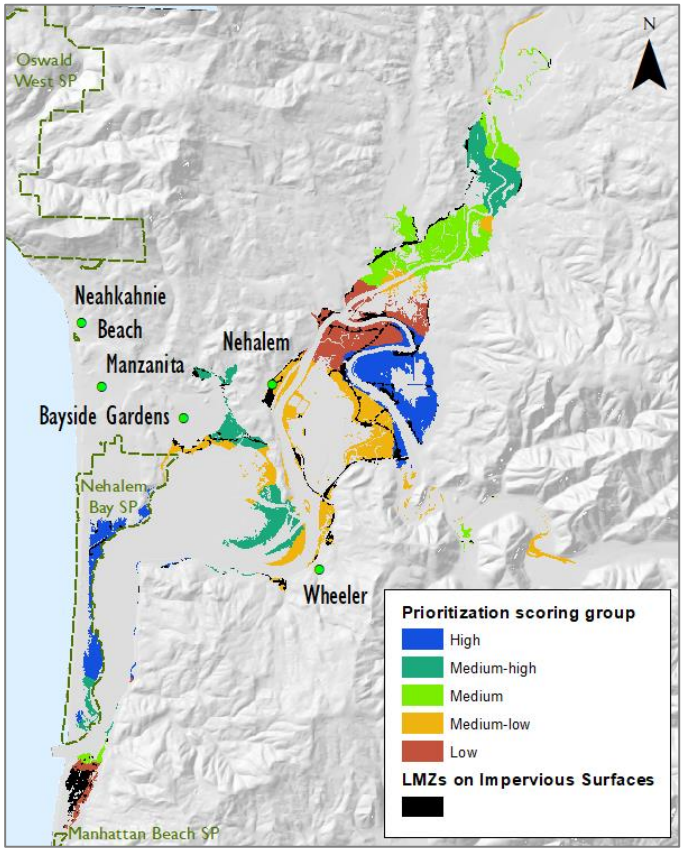

Figure 10. Nehalem Bay landward migration zone prioritization

Tillamook Bay Watershed

Nestled between rugged mountains and the Pacific Ocean with over 570 square miles of rivers and creeks and a bay totaling 13 square miles the Tillamook Bay watershed represents 31% of the focal area. The estuary has the geomorphology of a drowned river mouth and is considered a major shallow draft development estuary under the Oregon Estuary Classification system. Tillamook Bay is Oregon's second largest bay, and one of its most prized resources. 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. TEP, along with many partners, are dedicated to further understanding the mechanisms at work and finding practical solutions to ensure the long-term sustainability of this "Bay of National Significance".

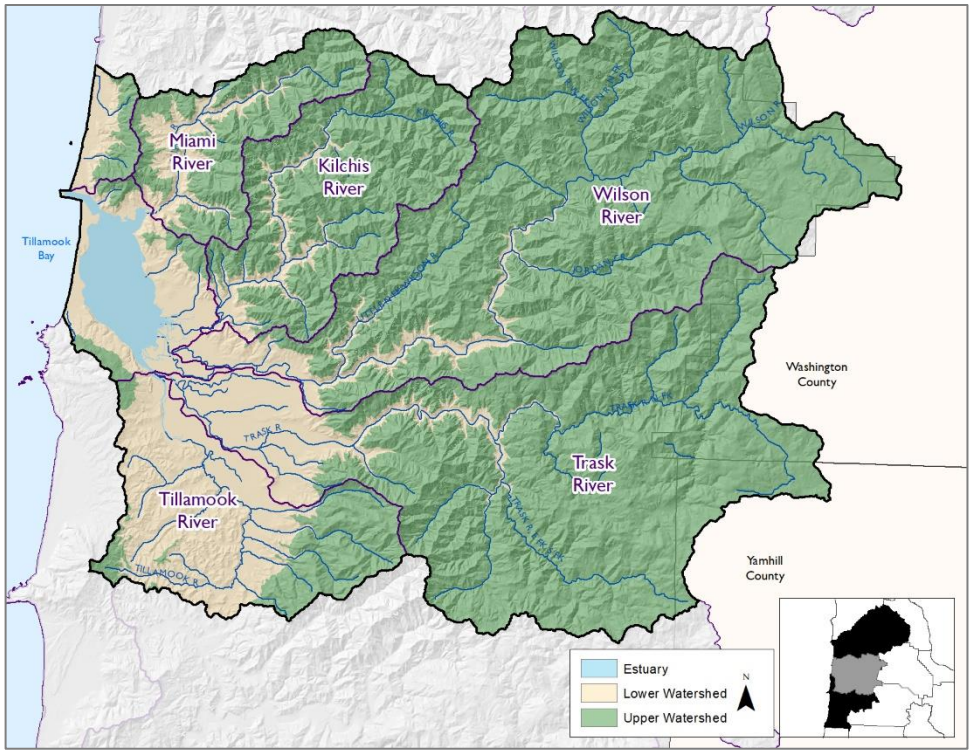

Figure 11. Tillamook Bay watershed boundary showing 5th Field HUC sub-watersheds and the estuary, lower, and upper watershed regions.

Physical Description

Tillamook Bay watershed is in central Tillamook County. The City of Tillamook (pop. 5,183) lies southeast of the estuary. Bay City and Garibaldi also sit on the bay and are directly tied to it. The vast 364,000-acre Tillamook State Forest is east of the bay and is a major area for commercial logging and recreation. Much of the land adjacent to the bay is urbanized or agricultural, private forest land abuts the bay to the south, and the spit to the west includes Bayocean Peninsula Park, a popular recreational destination. The estuary drains the watersheds of five rivers: Miami, Kilchis, Wilson, Trask, and Tillamook (Figure 11).

Figure 12 shows the distribution of estuarine habitats including: salt marshes, aquatic beds, freshwater emergent wetlands, forested wetlands, and mudflats. In Oregon, 68% of estuarine wetlands have been lost to conversion from 1870 to 1970 – the Tillamook Bay estuary lost 79%, making it among the most impacted estuaries in Tillamook County.[13]

Figure 13 shows the distribution of non-estuarine habitat (ecoregions). The watershed is within the Coast Range ecoregion (Level III), specifically the Level IV ecoregions Coastal Lowlands, Coastal Uplands, and Volcanics.

Much of the basin is dominated by the Oregon Coast Range, with much of the watershed classified as a temperate rainforest receiving more than 100 inches of rain annually. Much of the western extent is covered by Sitka spruce, while the eastern extent of the region has more upland varieties such as Douglas fir.[14]

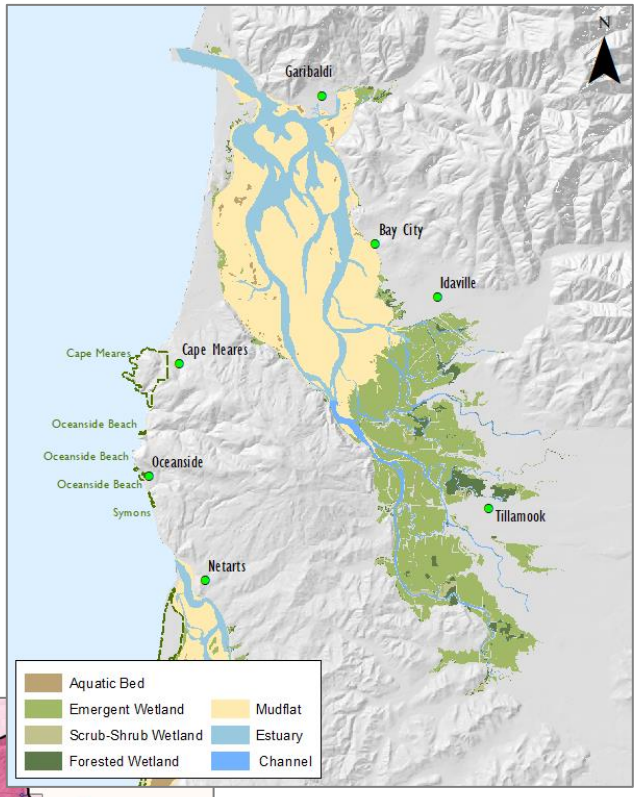

Figure 12. Tillamook Bay estuarine habitat classifications (CMECS)

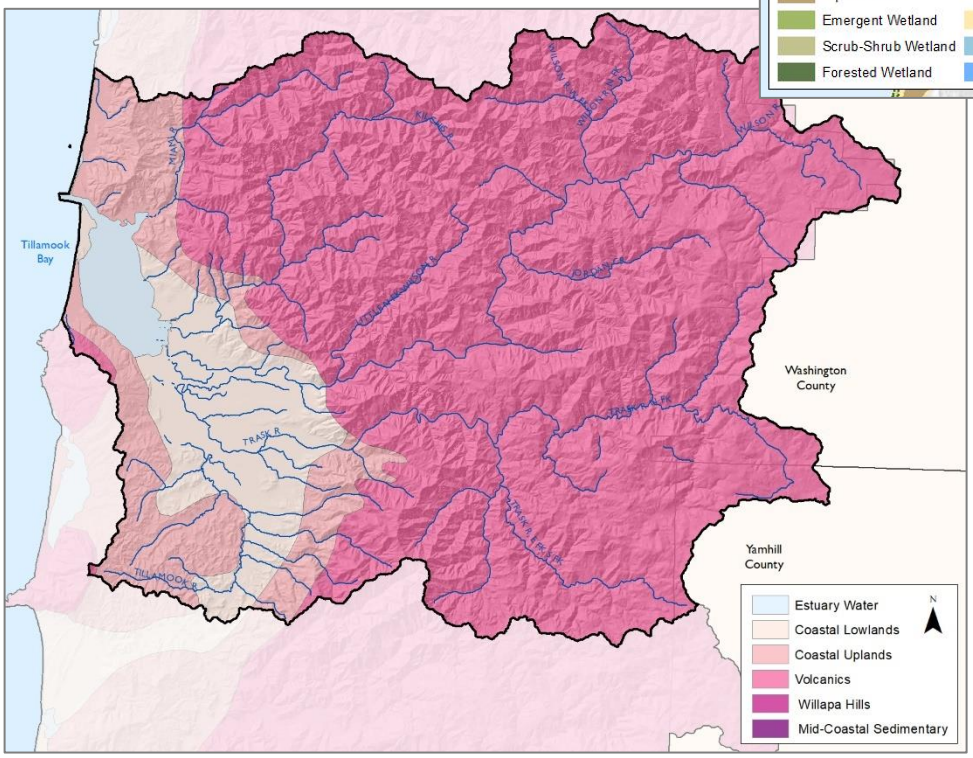

Figure 13. Tillamook Bay watershed non-estuarine habitat classifications (Level IV Ecoregions)

Much of the watershed is composed of volcanic rock types which originated from individual island terranes, although the western Tillamook and Trask sub-basins are mostly surficial glacial melt deposits and sedimentary mud and siltstones.[15] The upper watershed is part of the coastal, temperate rain forest ecosystem and nearly 89% of the total land area is covered with coniferous forests comprised of

[13] Good, James W. *Summary and Current Status of Oregon's Estuarine Resources".* Oregon State of the Environment Report, Chapter III, Health of Natural Systems and Resources. Change is due to filling and diking between 1870 to 1970. Restoration of wetlands in recent years has begun to reverse the loss trends. https://www.oregon.gov/DSL/WW/Documents/soer_ch33.pdf.

[14] "Natural Resource Conservation Service." Lower Tillamook Bay Watershed: Watershed Plan and Environmental Assessment. https://nrimp.dfw.state.or.us/web%20stores/data%20libraries/files/OWEB/OWEB_930_2_Lower%20Tillamook%20Bay%20WS%20Assessment%20pt1of3.pdf

[15] "Tillamook Estuaries Partnership." Tillamook Bay Watershed Sediment and Physical Habitat Assessment 2009.

western red cedar, Douglas fir, and Sitka spruce. Lower watershed habitats are comprised of forests, shrublands, and open grasslands which provide important habitat for a variety of wildlife. The lower watershed is used primarily for dairy and agriculture. Riparian habitat is adjacent to streams and waterways and provides a variety of benefits to fish and wildlife, as well as important services such as stream bank stabilization, large woody debris recruitment, and shade for lowering water temperature.[16]

Land Ownership

Much of the land in the watershed is privately or state-owned and 89% is zoned forest land.[17] The upper watershed is primarily used for recreation and timber production, while the lower watershed is primarily used for agriculture, dairy, and residential uses. The estuary is used for commercial and sport fisheries and recreation activities. Most of the public forest lands are managed through the Oregon Department of Forestry (59%).[18] Private timber companies also manage large tracts of land throughout the watershed (23%). Timber is the main land use activity throughout the watershed, with agriculture representing a lesser use (6%). About six percent of the land is zoned for urban and rural development, including land within the cities of Bay City (pop. 1,495), Garibaldi (pop. 821), Rockaway Beach (1,245), Tillamook (pop. 5,065), and the communities of Cape Mears (pop. 121) and Idaville (pop. 429).[19]

[16] "U.S. Environmental Protection Agency." Tillamook Bay Watershed Health Report 2010. http://19january2017snapshot.epa.gov
[17] DLCD. *"Oregon Zoning 2017"*. Oregon Spatial Data Library. April 28, 2017.
[18] BLM. "*Oregon Land Management 2015*". Oregon Spatial Data Library. January 8, 2015.
[19] U.S. Census Bureau, American Community Survey, 5-year estimates, 2012-2016.

Tidal Wetland Landward Migration Zones

Figure 14 shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100. Areas southeast of the bay, near the City of Tillamook, are predicted to experience the greatest impacts from LMZs. Areas around Garibaldi and the Bayocean Peninsula Park may also undergo LMZ movement.

Figure 15 shows the prioritization of LMZs. According to the Midcoast Watersheds Council and the Institute for Applied Ecology report areas to consider as priority for the conservation and restoration of tidal wetlands include the areas north and west of the bay, much of the City of Tillamook, and the highest priority areas that occur further east that score as high or medium-high priority.

For more information visit the report on the Oregon State University Scholars Archive.

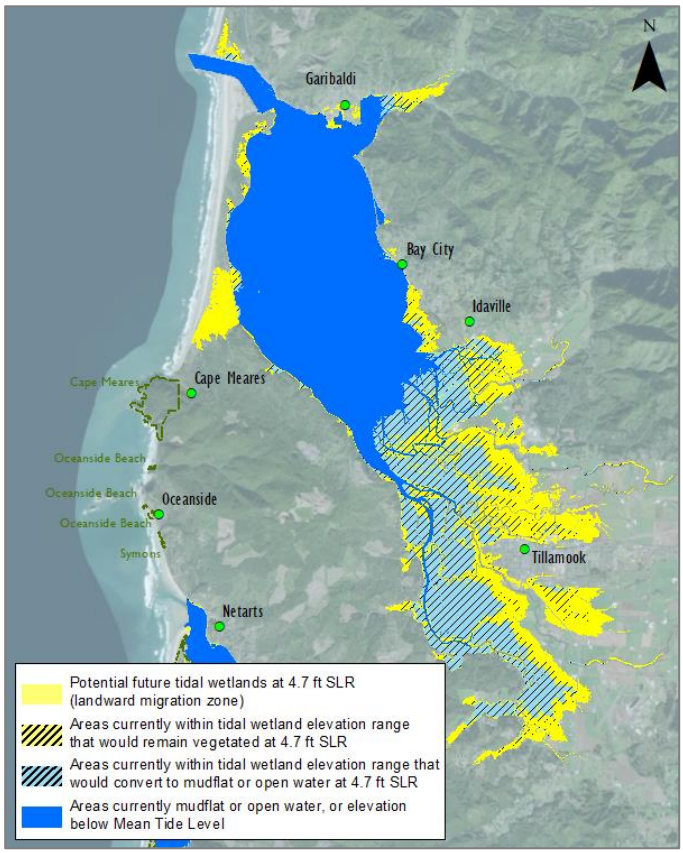

Figure 14. Tillamook Bay predicted landward migration zones (based on 4.7-foot sea level rise by year 2100).

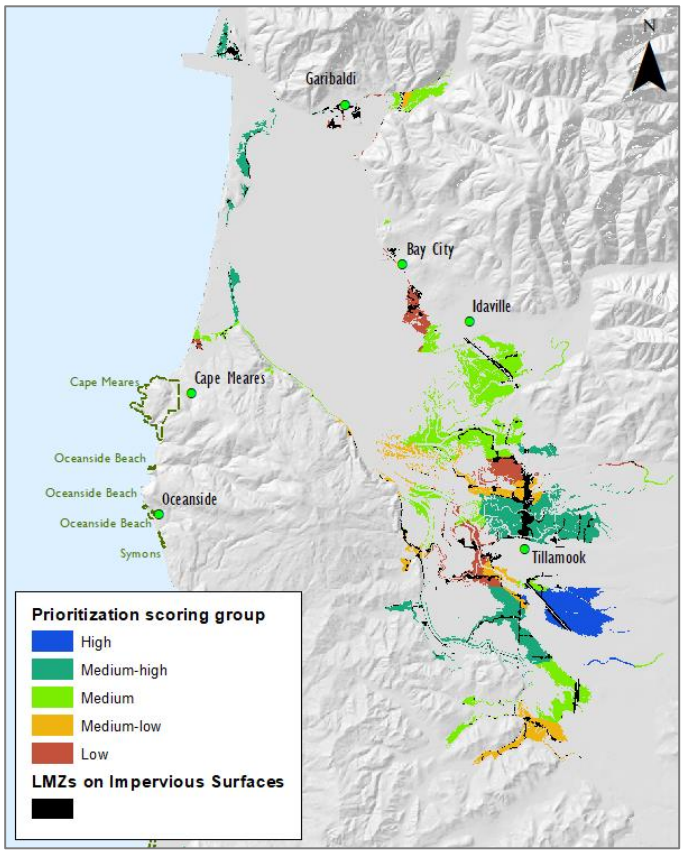

Figure 15. Tillamook Bay landward migration zone prioritization factors.

Netarts Bay Watershed

The Netarts Bay watershed encompasses 26 square miles or just over 1% of the focal area. The geomorphology of the area is that of a bar-built estuary and is considered a major conservation estuary under the Oregon Estuary Classification system. Netarts Bay (along with Sand Lake) boasts a predominately pristine estuarine environment compared to its sister bays in Tillamook County. 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. The bay is approximately 2,325 acres, 812 acres of which are permanently submerged. Despite its size, Netarts Bay is a highly dynamic system that influences coastal erosion throughout its littoral cell. In addition to the many recreational opportunities, Netarts is home to robust commercial oyster operations and an emerging premium sea salt industry. Netarts Bay is a pilot site for a project focused on restoring the Pacific Northwest's native Olympia Oyster within its historical distribution. Because of Netarts relatively unaltered natural state, it is often used as a reference site to compare the water and habitat quality of other estuaries.

Figure 16. Netarts Bay watershed boundary (5th Field HUC sub-watershed) and the estuary, lower, and upper watershed regions.

Physical Description

Netarts Bay watershed is in central Tillamook County. To the south and west of the bay is Cape Lookout State Park which is a popular area for fishing, camping, and sightseeing.

The unincorporated community of Netarts lies northeast of the estuary. The Netarts Bay Shellfish Preserve is located on the south side of the bay. The bay is fed by several small creeks, including Fall Creek, Hodgdon Creek, O'Hara Creek, Yager Creek, Whiskey Creek, Austin Creek, and Rice Creek.[20]

The lower watershed has dune and marsh communities while the upper watershed includes dense stands of Sitka spruce, Douglas fir, and Western hemlock.[21] Much of the forested upper watershed is subject to commercial timber harvest. The Netarts Bay watershed has mixed lithology, but is predominantly composed of

[20] "Advisory Committee to the State Land Board" An Inventory of Filled Lands in Netarts Bay Estuary.
[21] McCallum, Larry D. thesis. Netarts Bay, Oregon: an assessment of human impact on an estuarine system

erodible substrate, although, much of the coast near Cape Lookout and Cape Meares is comprised of volcanic basalts.[22]

Figure 17 shows the distribution of estuarine habitats including: salt marshes, aquatic beds, freshwater emergent wetlands, forested wetlands, and mudflats. In Oregon, 68% of estuarine wetlands have been lost to conversion from 1870 to 1970 - Netarts lost 7%, making it among the least impacted estuaries in Tillamook County.[23]

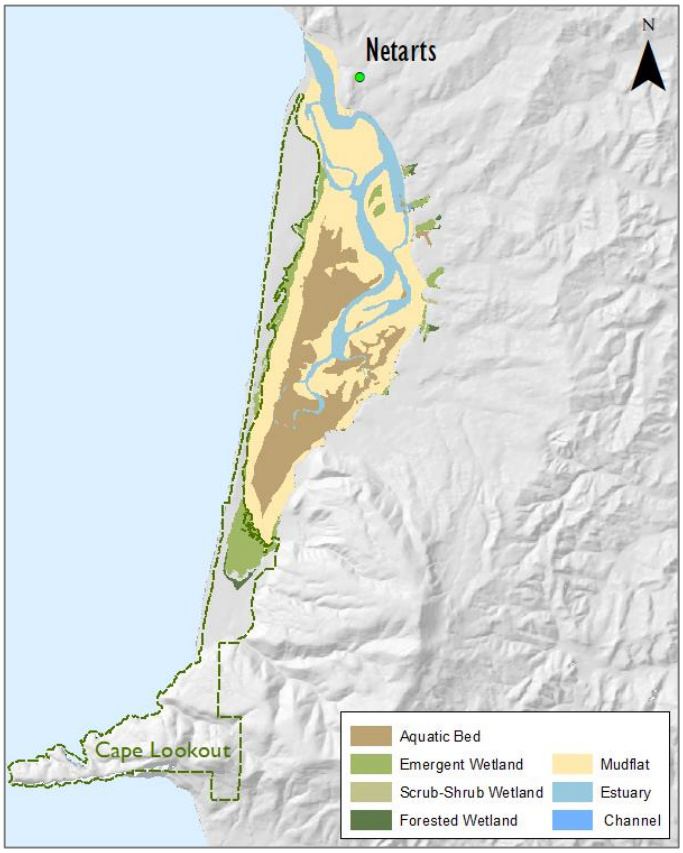

Figure 17. Netarts Bay estuarine habitat classifications (CMECS)

Figure 18 shows the distribution of non-estuarine habitat (ecoregions). The watershed is within the Coast Range ecoregion (Level III), specifically the Level IV ecoregions Coastal Uplands and Volcanics. Non-estuarine habitats include upland forests which are dominated by Sitka spruce, western red cedar, western hemlock, and Douglas fir. Low-lying riparian areas include a variety of sedges, rushes, Red alder, and Oregon maple.[24]

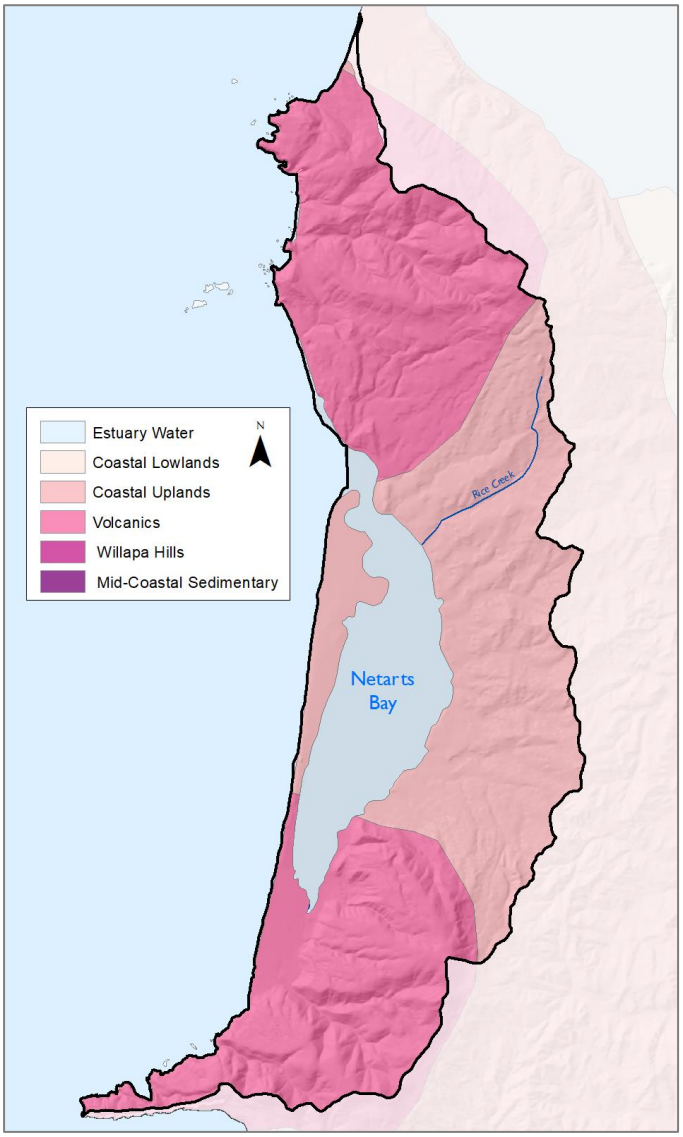

Figure 18. Netarts Bay watershed non-estuarine habitat classifications (Level IV Ecoregions)

[22] "Tillamook Estuaries Partnership." Netarts Watershed Assessment 1999.
[23] Good, James W. *Summary and Current Status of Oregon's Estuarine Resources".* Oregon State of the Environment Report, Chapter III, Health of Natural Systems and Resources. Change is due to filling and diking between 1870 t0 1970. Restoration of wetlands in recent years has begun to reverse the loss trends. https://www.oregon.gov/DSL/WW/Documents/soer_ch33.pdf.
[24] "Tillamook Estuaries Partnership." Netarts Bay Watershed Habitat Study, Restoration Plan, and Limiting Factors Analysis 2008.

Land Ownership

Much of the land in the watershed is privately owned and 75% is zoned forest land.[25] The upper watershed is primarily used for timber production, while the lower watershed is primarily used for residential uses. The estuary is used for sport and shellfish fisheries, and recreation activities. Private timber companies manage most of land throughout the watershed (72% with other areas including state parks (Netarts Spit Park) and federal lands (13%).[26] Timber is the main land use activity throughout the watershed. About 11% of the land is zoned for urban and rural development, including land within the communities of Netarts (pop. 878) and Oceanside (pop. 317).[27]

Netarts Bay | Don Best

[25] DLCD. *"Oregon Zoning 2017"*. Oregon Spatial Data Library. April 28, 2017.
[26] BLM. "*Oregon Land Management 2015*". Oregon Spatial Data Library. January 8, 2015.
[27] U.S. Census Bureau, American Community Survey, 5-year estimates, 2012-2016.

Tidal Wetland Landward Migration Zones

Figure 19 shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100. Areas southwest and west of the bay are predicted to experience the greatest impacts from LMZs.

Figure 20 shows the prioritization of LMZs. According to the Midcoast Watersheds Council and the Institute for Applied Ecology report areas to consider as priority for the conservation and restoration of tidal wetlands include the areas along the spit to the west and east of the bay that score as high or medium-high priority.

For more information visit the report on Oregon State University Scholars Archive.

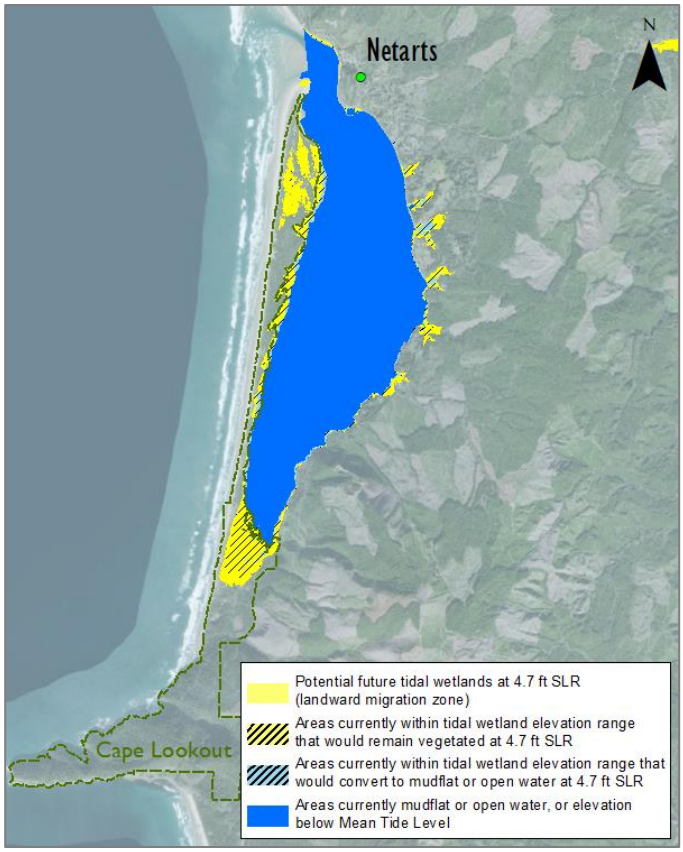

Figure 19. Netarts Bay predicted landward migration zones (based on 4.7-foot sea level rise by year 2100).

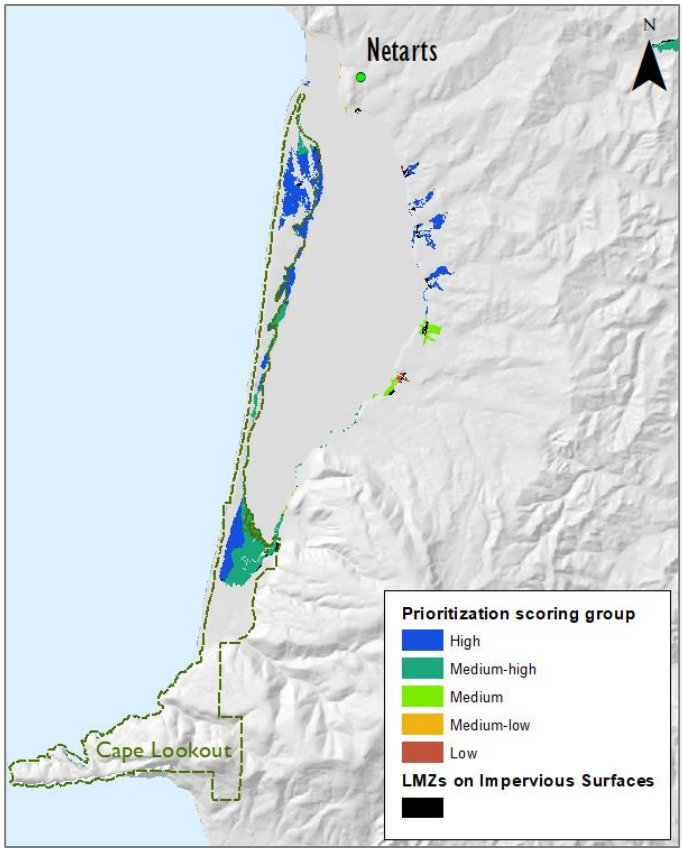

Figure 20. Netarts Bay landward migration zone prioritization factors.

Sand Lake Watershed

The Sand Lake watershed is the smallest in Tillamook County encompassing 25 square miles or just over 1% of the focal area. The geomorphology of the area is that of a bar-built estuary and it is considered a major natural estuary under the Oregon Estuary Classification system. The Sand Lake Estuary is a beautiful, relatively untouched estuarine ecosystem. It is only one of five estuaries on the Oregon Coast designated as a "natural estuary". There is minimal freshwater influence within the estuary from the watershed, as such it is dominated by tidal influence. Much of the land encompassed by the estuary is estuarine marsh which is exposed by tides daily. Because of this, Sand Lake is home to many unique tidal wetland plant species. Thousands of visitors each year enjoy the adjacent Sand Lake Recreation area, the Clay Myers State Natural Area, and one of Oregon State Parks newest acquisition's, the Sitka Sedge State Natural Area on Sand Lake spit.

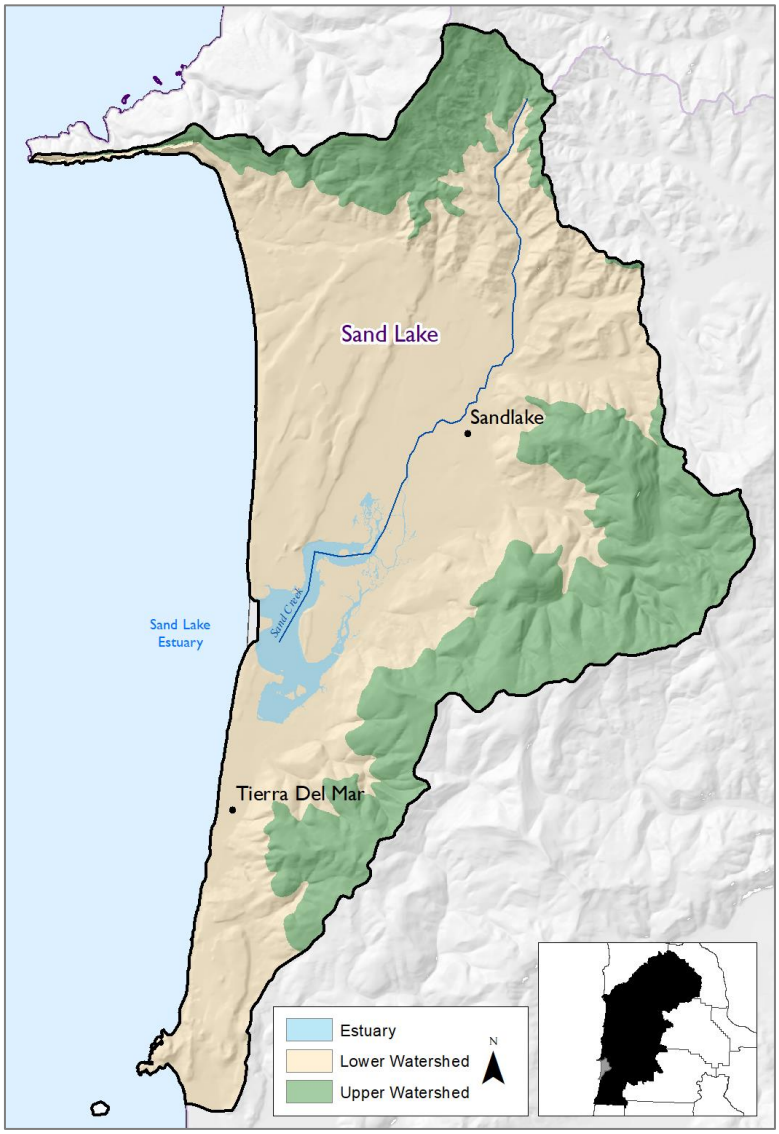

Figure 21. Sand Lake Estuary watershed boundary (5th Field HUC sub-watershed) and the estuary, lower, and upper watershed regions.

Physical Description

The Sand Lake estuary is in south Tillamook County between Pacific City and Cape Lookout. The surface area of Sand Lake is roughly 897 acres making it Tillamook County's second smallest major estuary; the entire watershed totals only 17 square miles. Four small creeks feed into the Sand Lake estuary: Jewell Creek, Sand Creek (most of the freshwater input), Gurtis Creek, and Reneke Creek.

The estuary consists of upper watershed areas to the east, and a small isolated island, Whalen Island, positioned to the south. Whalen Island is composed of a stabilized dune and tidal marsh. The state park located on the island is a popular site for hikers, kayakers, and nature enthusiast alike. To the north, and within the Reneke sub-watershed, Beltz Creek has a dike that retains water and results in a primarily freshwater wetland with some tidal influence through a failing tide gate. The estuarine habitat is largely intact along the western portion of Sand Lake with some agricultural land use activities taking place in the eastern portion of the estuary. 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. The Sand Lake recreation area located further north from the estuary is a popular attraction within the basin offering year-round campgrounds, day use facilities, and off highway vehicle riding (OHV) through many miles of sand dunes.

Sand lake is one of four bar built or restricted mouth estuaries in Oregon and it consists of intertidal salt marsh, tidal streams, barrier islands, and diked tidal flats.

Figure 22 shows the distribution of estuarine habitats including: saltmarshes, freshwater marshes, tidal mudflats, scrub-shrub wetlands, aquatic and submerged plant communities, low vegetation sandy beaches, upland shrub lands, native dunal grasslands, stabilized and semi-stabilized dunes, forest habitat, and pasture land. In Oregon, 68% of estuarine wetlands have been lost to conversion from 1870 to 1970 - Sand Lake lost 2%, making it the least impacted estuaries in Tillamook County.[28]

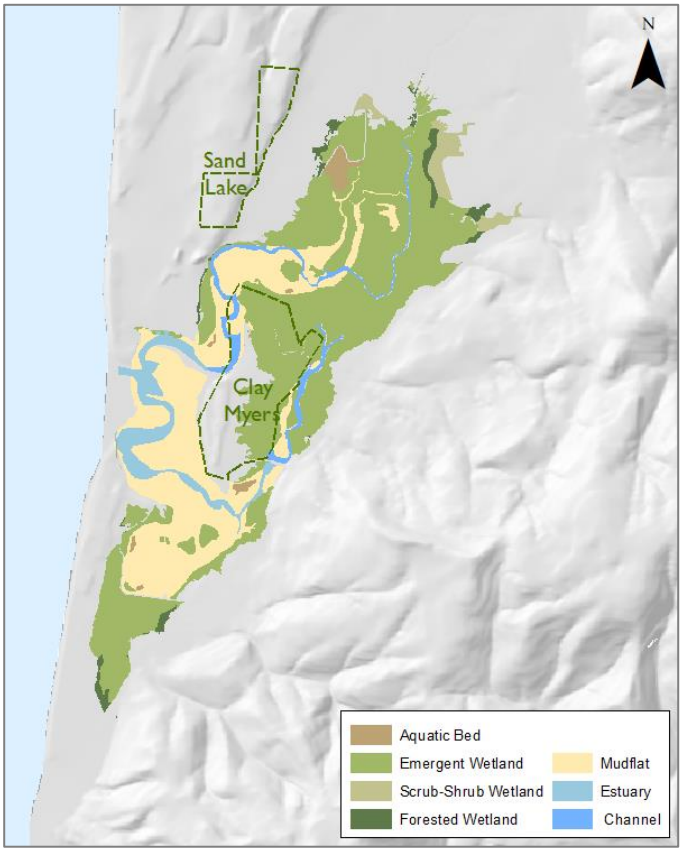

Figure 22. Sand Lake estuarine habitat classifications (CMECS)

Figure 23 shows the distribution of non-estuarine habitat (ecoregions). The watershed is within the Coast Range ecoregion (Level III), specifically the Level IV ecoregions Coastal Lowlands, Coastal Uplands, and Volcanics.

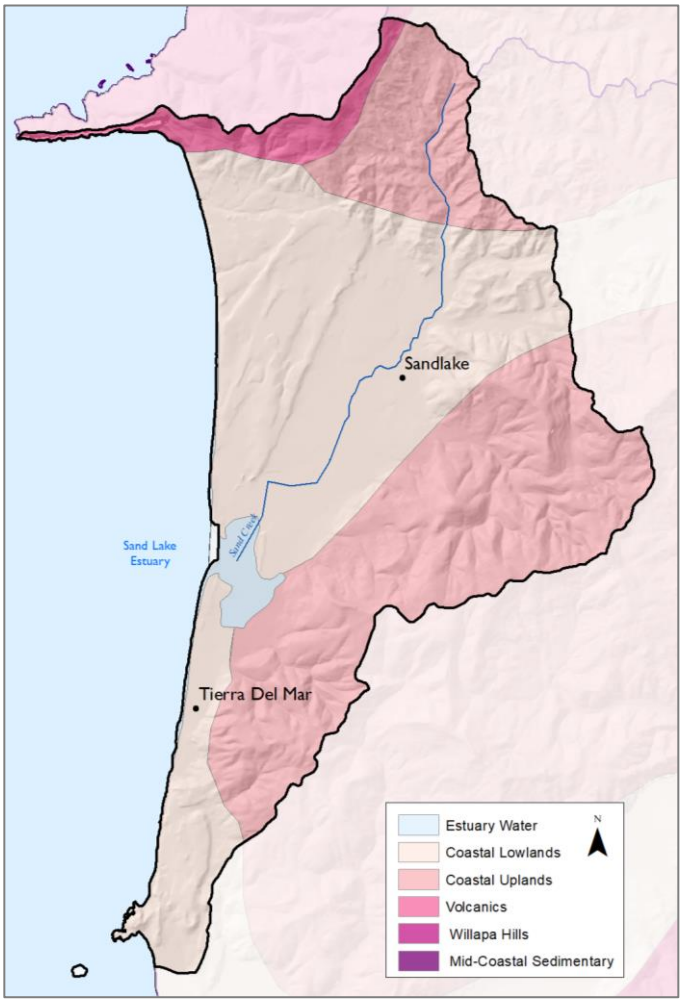

Figure 23. Sand Lake Estuary watershed non-estuarine habitat classifications (Level IV Ecoregions)

Sand Lake is the single remaining estuary of its size on the Oregon Coast that is dominated by such a diverse set of native plant communities due to very little agricultural or commercial development. Tufted Hair Grass and Henderson's Sidalcea are a few examples of common plants found within the high marsh of the estuary. Further up, in the tidally influenced freshwater wetlands, less common plants such as seacoast bulrush and Three-square Bulrush can also be found. The estuary also supports a rare tidally influenced lower watershed

[28] Good, James W. *Summary and Current Status of Oregon's Estuarine Resources".* Oregon State of the Environment Report, Chapter III, Health of Natural Systems and Resources. Change is due to filling and diking between 1870 to 1970. Restoration of wetlands in recent years has begun to reverse the loss trends. https://www.oregon.gov/DSL/WW/Documents/soer_ch33.pdf.

non-linear forested wetland composed of Sitka Spruce and Creek dogwood. According to The North Coast Land Conservancy, the Sand Lake estuary also supports Oregon's largest known remnant stand of old-growth western red cedar swamp.

The native plant association also supports a diverse community of fish and wildlife. Sand Creek offers important rearing habitat for coho, Chinook, and steelhead. Historically chum salmon have also been recorded in the system. The creek connects to three other tributaries (Jewel, Andy, and Davis Creeks). This totals 4.7 miles of spawning reaches. In addition, there are four miles of spawning reaches throughout the rest of the estuary system on adjacent tributaries. The estuary supports a substantial web of other marine organisms such as starry flounder, three spine stickleback, Pacific Herring, Dungeness crab, and many more.

Land Ownership

Much of the land in the watershed is privately or federally-owned and 67% is zoned forest land.[29] The upper watershed is primarily used for recreation and timber production, while the lower watershed is primarily used for agriculture and residential uses. The estuary is used for sport fisheries and recreation activities. Most of the public forest lands are managed through the U.S. Forest Service (42%).[30] Private timber companies also manage large tracts of land throughout the watershed (21%). Timber is the main land use activity throughout the watershed, with agriculture representing a lesser use (10%). About seven percent of the land is zoned for rural development, including land within the community of Sand Lake.

The Sand Lake estuary is composed of a network of privately conserved and publicly owned lands. The North Coast Land Conservancy (NCLC), U.S. Forest Service, and Oregon Parks and Recreation Department all manage land within the estuary and its surrounding area. Oregon State Parks has recently acquired a 357-acre parcel of land on the south end of the estuary once known as Beltz Farm; in partnership with NCLC they have also acquired 167 acres of estuarine habitat that crosses Sand Creek to the North of the estuary. Other parcels of conserved land include hundreds of reclaimed acres of estuarine pasture associated with Clay Myers State Park Natural Area on Whalen Island; and public land managed by the Siuslaw National Forest.

[29] DLCD. *"Oregon Zoning 2017"*. Oregon Spatial Data Library. April 28, 2017.
[30] BLM. "*Oregon Land Management 2015*". Oregon Spatial Data Library. January 8, 2015.

Tidal Wetland Landward Migration Zones

Figure 24 shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100. Areas central to the estuary and moving northeast are predicted to experience the greatest impacts from LMZs.

Figure 25 shows the prioritization of LMZs. According to the Midcoast Watersheds Council and the Institute for Applied Ecology report areas to consider as priority for the conservation and restoration of tidal wetlands include the areas surrounding Sand Lake that score as high or medium-high priority.

For more information visit the report on Oregon State University Scholars Archive.

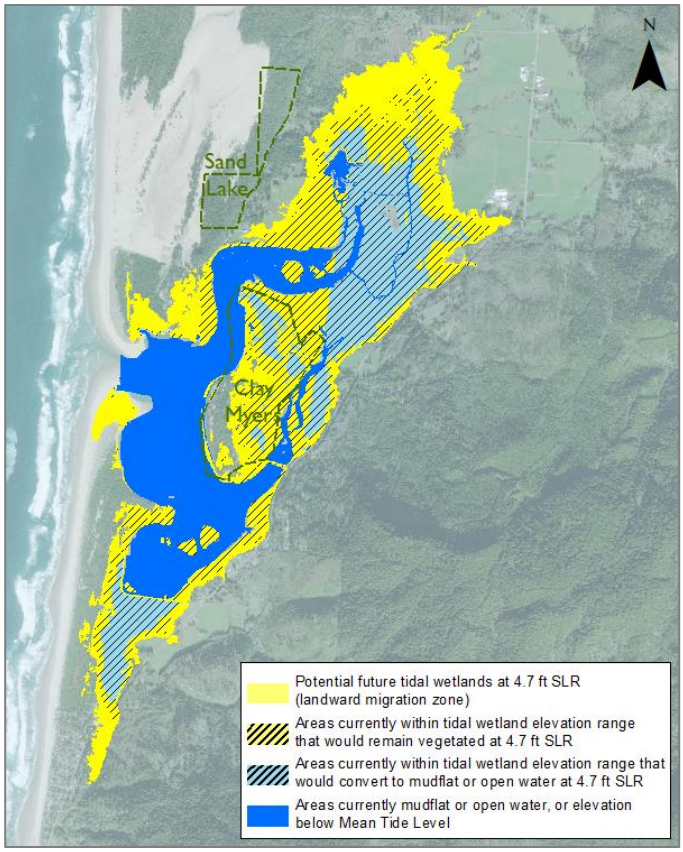

Figure 24. Sand Lake estuary predicted landward migration zones (based on 4.7-foot sea level rise by year 2100).

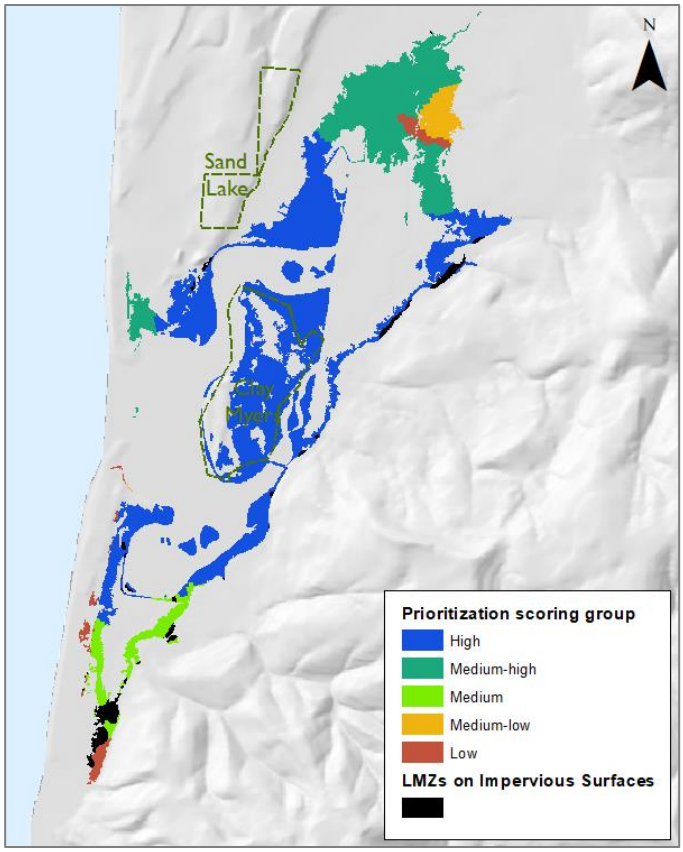

Figure 25. Sand Lake estuary landward migration zone prioritization factors.

Nestucca Bay Watershed

The Nestucca Bay watershed encompasses 319 square miles or 17% of the focal area. The estuary has the geomorphology of a drowned river mouth and is considered a major conservation estuary under the Oregon Estuary Classification system Seasonally, a variably-sized sand bar (spit) forms from the interaction of currents from the ocean and freshwater rivers and separates the bay and the ocean. Part of the bay is contained within the Nestucca Bay National Wildlife Refuge. Like many of the estuaries in Tillamook County, Nestucca Bay is a valuable natural resource supporting an economy dependent on fishing, forestry, tourism, and agriculture. The fishing culture of the Nestucca is highlighted by the century-old beach-launched dory fishery at Cape Kiwanda. Partners in the watershed are working diligently to improve water quality, fish passage, and salmonid habitat in the watershed and bay.

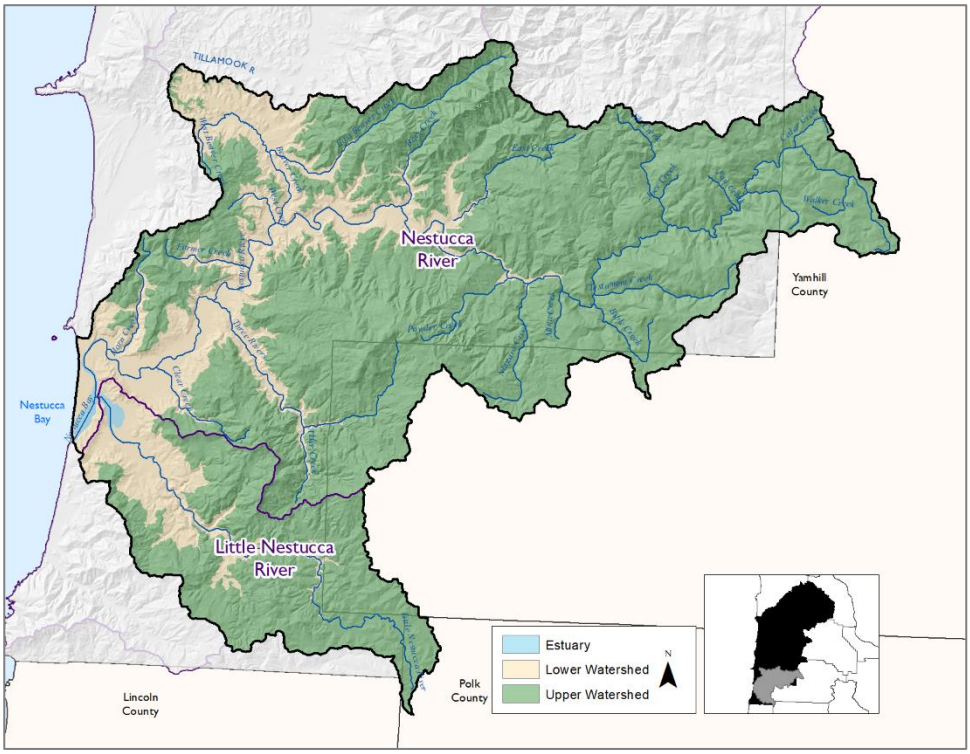

Figure 26. Nestucca Bay watershed boundary showing 5th Field HUC sub-watersheds and the estuary, lower, and upper watershed regions.

Physical Description

Of the 22 major estuaries in the state of Oregon, the Nestucca Bay estuary is one of six estuaries that lacks maintained jetties or channels yet lies adjacent to urban areas which have altered shorelines. The 1,176-acre estuary is located at the confluence of the Pacific Ocean, and the Nestucca, and Little Nestucca rivers in south Tillamook County between Pacific City and Neskowin. The Nestucca River is the larger of the two tributaries 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 mainstem Nestucca River extends upstream to Pacific City, then through farmland up to the community of Cloverdale. Nestucca Bay spit was formed by ocean currents and constitutes the western boundary of the estuary. The estuary also extends east along the little Nestucca River at the Nestucca Wildlife Refuge, into a broad floodplain dominated almost exclusively by wetland pastures, and tidal marsh. The topography of the area ranges from winding rivers and extensive floodplains to steep hills and mountains.

Figure 27 shows the distribution of non-estuarine habitat (ecoregions). The watershed is within the Coast Range ecoregion (Level III), specifically the Level IV ecoregions Coastal Lowlands, Coastal Uplands, Mid-coastal Sedimentary, and Volcanics.

Figure 28 shows the distribution of estuarine habitats including: intertidal salt marsh, tidal streams, mudflats, tidal flats, and estuarine forestland. In Oregon, 68% of estuarine wetlands have been lost to conversion from 1870 to 1970 – Nestucca Bay lost 91%, making it the most impacted estuary in Tillamook County.[31]

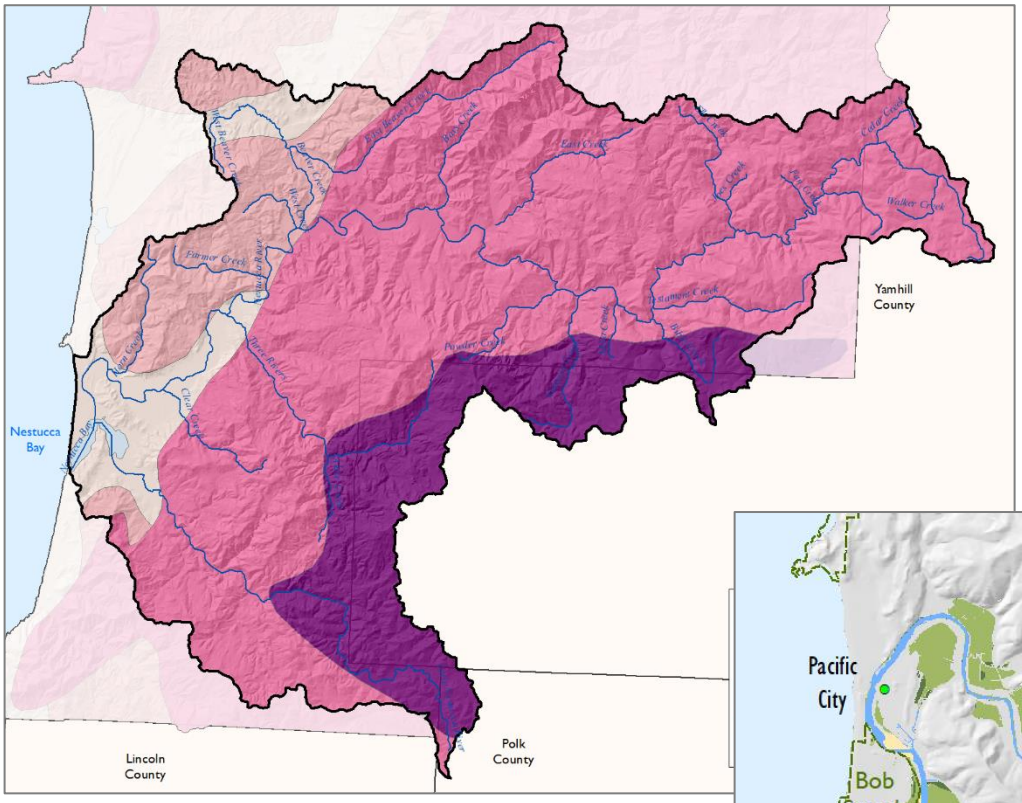

Figure 27. Nestucca Bay watershed non-estuarine habitat classifications (Level IV Ecoregions)

Over 40% of the National Wildlife Refuge is low land pasture that falls 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 agricultural activities.

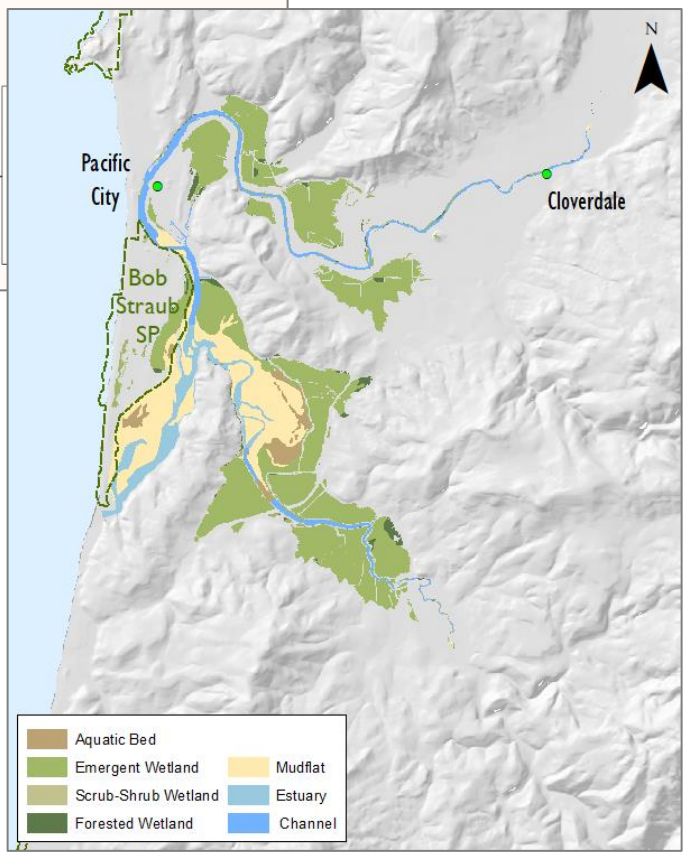

Figure 28. Nestucca Bay watershed estuarine habitat classifications (CMECS)

Additional vegetation surrounding the estuary include freshwater marshes, scrub-shrub wetlands, aquatic and submerged plant communities, low vegetation sandy beaches, upland shrub lands, forested wetlands, grassland, and pasture land. Red alder and big leaf maple dominate along the banks of the watershed while the estuary itself holds several acres of Sitka spruce tidal swamps. Saltmarsh plants are situated at varying levels of salinity throughout the estuary. Plants such as pickleweed and salt grass are important buffers as their densely matted roots stabilize shorelines and absorb pollutants.

Land Ownership

The Nestucca Bay Estuary is composed of a diverse network of public and private land owners due to its

[31] Good, James W. *Summary and Current Status of Oregon's Estuarine Resources".* Oregon State of the Environment Report, Chapter III, Health of Natural Systems and Resources. Change is due to filling and diking between 1870 t0 1970. Restoration of wetlands in recent years has begun to reverse the loss trends. https://www.oregon.gov/DSL/WW/Documents/soer_ch33.pdf.

proximity to Pacific City. Residential and commercial land owners occupy land 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.

Much of the land in the watershed is privately or federally-owned and 89% is zoned forest land.[32] The upper watershed is primarily used for recreation and timber production, while the lower watershed is primarily used for agriculture and residential uses. The estuary is used for sport fisheries and recreation activities. Most of the public forest lands are managed through the U.S. Forest Service (43%) and the Bureau of Land Management (18%).[33] Private timber companies also manage large tracts of land throughout the watershed (20%). Timber is the main land use activity throughout the watershed, with agriculture representing a lessor use (7%). About two percent of the land is zoned for urban and rural development, including land within the communities of Beaver (pop. 170), Cloverdale (pop. 297), Hebo (pop. 238), and Pacific City (pop. 972).[34]

The Nestucca Refuge was established in 1991 to protect and enhance habitat for Dusky Canada Geese with the acquisition of a 384-acre dairy farm, and over the years has expanded to 893 acres. The Nestucca Bay National Wildlife Refuge Actively engages in pasture management with local dairy farmers to offer prime habitat for geese during the winter. Since its founding, there have been several additions to the National Wildlife Refuge that impact the Nestucca Bay Estuary. In 2007, an 83-acre tidal marsh restoration project was completed on the Little Nestucca River Unit of the refuge. The restoration project established a 30% increase in tidal marsh habitat in the estuary. In 2009, the refuge also acquired the 76-acre Martella Tract, located along the Little Nestucca River where the entire subpopulation of Semidi Islands Aleutian Cackling Geese reside during the winter. There is an additional 2,500+ acres still in private ownership that falls within the approved refuge boundary.

Nestucca | Don Best

[32] DLCD. *"Oregon Zoning 2017"*. Oregon Spatial Data Library. April 28, 2017.
[33] BLM. "*Oregon Land Management 2015*". Oregon Spatial Data Library. January 8, 2015.
[34] U.S. Census Bureau, American Community Survey, 5-year estimate, 2012-2016.

Tidal Wetland Landward Migration Zones

Figure 29 shows the extent of LMZs given a 4.7 ft. rise in sea level by year 2100. Areas within Bob Straub State Park, Pacific City, and along the Nestucca Bay and River are predicted to experience the greatest impacts from LMZs.

Figure 30 shows the prioritization of LMZs. According to the Midcoast Watersheds Council and the Institute for Applied Ecology report areas to consider as priority for the conservation and restoration of tidal wetlands include the areas west and north of the bay that score as high or medium-high priority.

For more information visit the report on Oregon State University Scholars Archive.

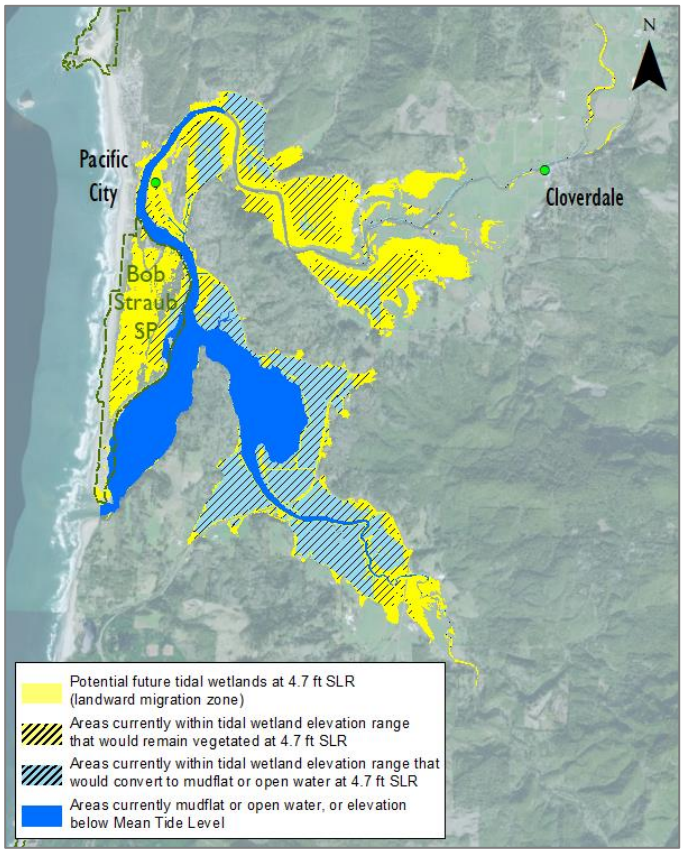

Figure 29. Nestucca Bay predicted landward migration zones (based on 4.7-foot sea level rise by year 2100).

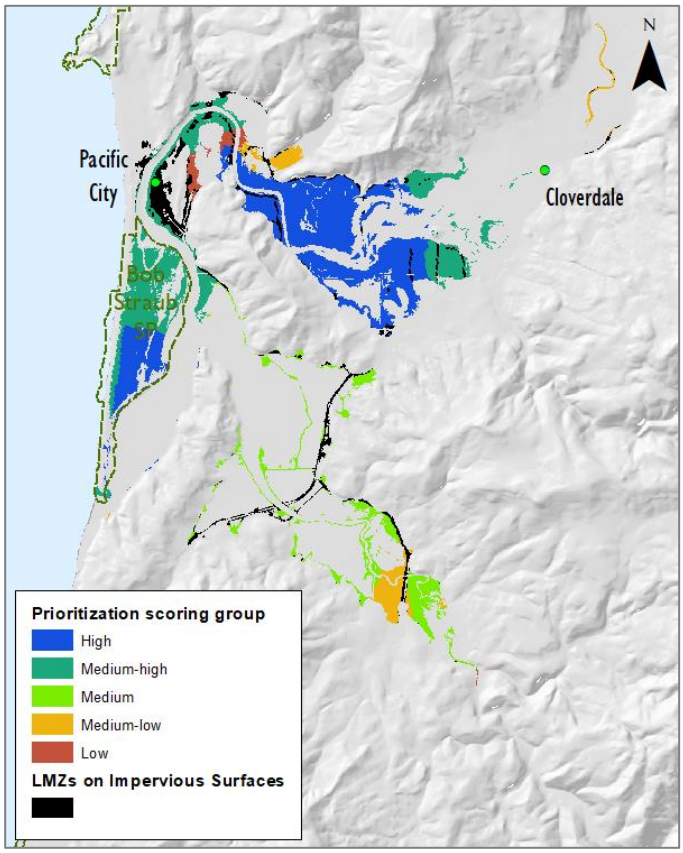

Figure 30. Nestucca Bay landward migration zone prioritization factors.

Neskowin Creek Watershed

The Neskowin Creek watershed encompasses 26 square miles or just over 1% of the focal area. Neskowin Creek estuary is Tillamook County's smallest estuary. Located at the confluence of Neskowin and Hawk Creeks in the heart of Neskowin, the 30-acre estuary offers a brief transition between fresh and saltwater ecosystems. Twice a day saltwater encroaches up the creeks on incoming tides providing saltmarsh, mudflat, and estuarine forest habitats. The estuary is fed by the Kiwanda and Neskowin Creeks which occupy a watershed basin of approximately 12 square miles. The creeks and their accompanying tributaries wind through national forest land, commercial logging property, and various other private entities.

The Neskowin Creek estuary is classified as a minor conservation estuary under the Oregon Estuary Classification system. The mouth of the estuary has no maintained jetties or channels and provides no passage for boats. Most of the estuary lies adjacent to urban areas with developed shorelines. The estuary is also influenced by a tide gate on Butte Creek, approximately two (2) miles above the junction with Hawk Creek.

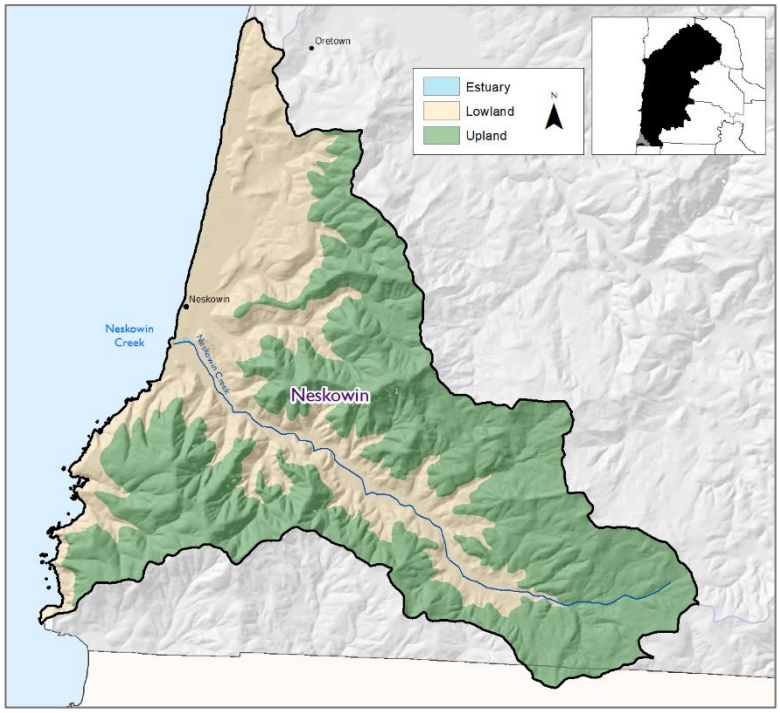

Figure 31. Neskowin Creek watershed boundary (5th Field HUC sub-watershed) and the estuary, lower, and upper watershed regions.

Physical Description

The estuary is composed of a network of public and private land owners due to its location within the Neskowin community. Many private homes, hotels, and businesses are positioned along the estuary banks where the two creeks converge. Further west towards the ocean, the estuary habitat transitions into a sandy beach. This transition lies on public land within the jurisdiction of Oregon Parks and Recreation Department (OPRD) in accordance with the Beach Bill enacted in 1967. To the east, the estuary extends further up the Neskowin Creek and provides important saltmarsh and estuarine forest habitat along its banks. Private land owners are situated adjacent to the creeks north side while highway 101 runs parallel to the creeks south bank.

Further up the Kiwanda Creek, beyond the northern reach of the estuary, the USFWS manages the Neskowin Marsh National Wildlife Refuge. The refuge protects a unique coastal sphagnum bog that houses over 100

native wetland plant species in 23 vegetation associations.[35] Rare species present at Neskowin Marsh include russet cottongrass, native cranberry, and pohlia moss, all of which occur only in sphagnum mires.[36]

Much of the Neskowin watershed is dominated by Sitka spruce and western hemlock. Further inland, Douglas fir and Noble fir communities are firmly established.

Figure 32 shows the distribution of non-estuarine habitat (ecoregions). The watershed is within the Coast Range ecoregion (Level III), specifically the Level IV ecoregions Coastal Lowlands, Coastal Uplands, and Volcanics. Much of the watershed consist of volcanic rocks and marine sediments. The south-central area of the watershed is represented by the Siletz River Volcanics which is composed of claystone, siltstone, and sandstone.[37]

Land Ownership

Much of the land in the watershed is privately or federally-owned and 77% is zoned forest land.[38] The upper watershed is primarily used for recreation and timber production, while the lower watershed is primarily used for agriculture and residential uses. Neskowin Creek estuary is primarily used for recreation activities. Most of the public forest lands are managed through the U.S. Forest Service (52%).[39] Private timber companies also manage large tracts of land throughout the watershed (25%). Timber is the main land use activity throughout the watershed, with agriculture representing a lesser use (2%). About 12% of the land is zoned for urban and rural development, including land within the community of Neskowin (pop. 177).[40]

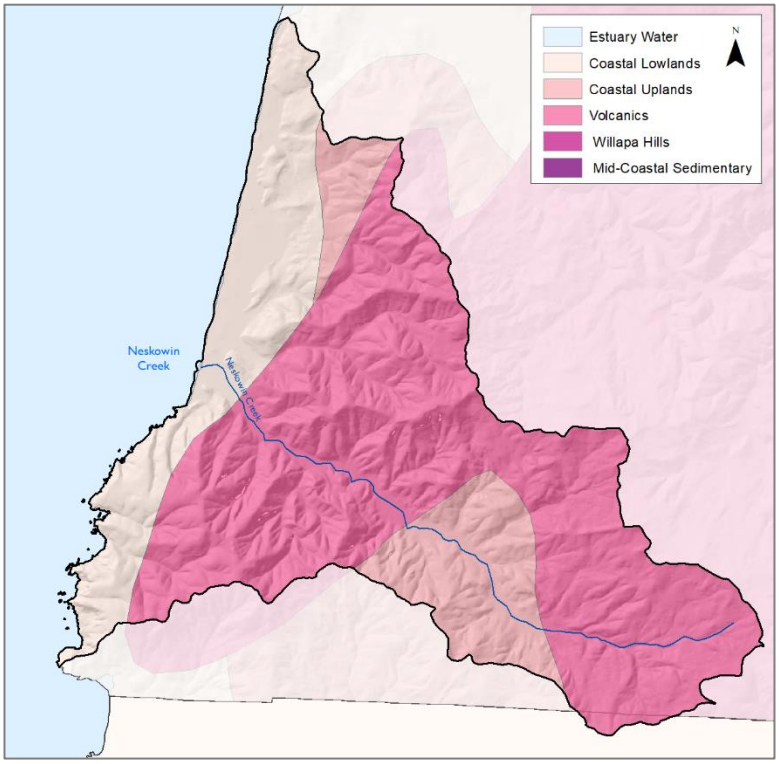

Figure 32. Neskowin Creek watershed non-estuarine habitat classifications (Level IV Ecoregions)

Tidal Wetland Landward Migration Zones

The Mid-Coast Watersheds Council study did not include Neskowin within their study, so there is currently no LMZ data available for the Neskowin Creek estuary.

[35] Christy, J.C. and L.S. Brophy. 2002. Vegetation of Neskowin Marsh Unit, Nestucca Bay National Wildlife Refuge, Tillamook County, Oregon. Prepared for the U.S. Fish and Wildlife Service, Oregon Coast National Wildlife Refuge Complex. 30 pp
[36] Ibid.
[37] "USDA." Salmon-Neskowin Watershed Analysis 1999.
[38] DLCD. *"Oregon Zoning 2017"*. Oregon Spatial Data Library. April 28, 2017.
[39] BLM. "*Oregon Land Management 2015*". Oregon Spatial Data Library. January 8, 2015.
[40] U.S. Census Bureau, American Community Survey, 5-year estimate, 2012-2016.

Natural Hazard and Climate Impacts

This section summarizes potential chronic and catastrophic natural hazard risks and impacts in the focal area. The focal area ecosystems have evolved over time in response to such changes. Therefore, it is important to understand the range of potential impacts as well as the capacity for the focal area ecosystems to deal with those impacts.

The estuaries and lower and upper watersheds that compose TEP's focal area exist within a dynamic and changing landscape. Subject to a range of geologic and climatic forces, the area is constantly subject to both slow and abrupt environmental changes. Flooding, erosion, and storms, among other events, regularly shift the subtle dynamics between the focal area's ecological systems. On rare occasions, large wildfires and massive earthquake and tsunami events result in rapid reorganization of the entire area.

Additional information on natural hazard risks posed to Tillamook County is available within the Oregon Department of Geology and Mineral Industries (DOGAMI) Interpretive Map Series-58 (IMS-58).

Chronic Threats, Impact, and Vulnerability Assessment

The Tillamook County Multi-Jurisdictional Natural Hazards Mitigation Plan (NHMP) provides extensive descriptions and data related to chronic hazards in Tillamook County (Section II: Risk Assessment, Subsection C: Natural Hazards is incorporated herein by reference).[41] The following information presents a summary for relevant hazards. For additional hazard specific information, refer to the Tillamook County NHMP.

Flood

Annual flood events shape the estuary and lower, and upper watershed ecosystems in Tillamook County. Winter storms and prolonged rainfall generate significant amounts of riverine runoff. In addition, coastal flooding from high tides and wind-driven waves occurs on a regular basis. Individually or in combination, these events inundate lowland areas, erode and migrate upper watershed riverine channels, and move significant amounts of sediment throughout the TEP focal area.

There have been 12 "significant" flood events in Tillamook County in the past 30-years. In addition, numerous localized flooding events occur on an annual basis. Importantly, flooding is part of the natural cycle that contributes to the overall health of TEP ecosystems. However, the interplay between human and natural systems changes those natural dynamics. Increased human development within Tillamook County can negatively affect water quality. This occurs through

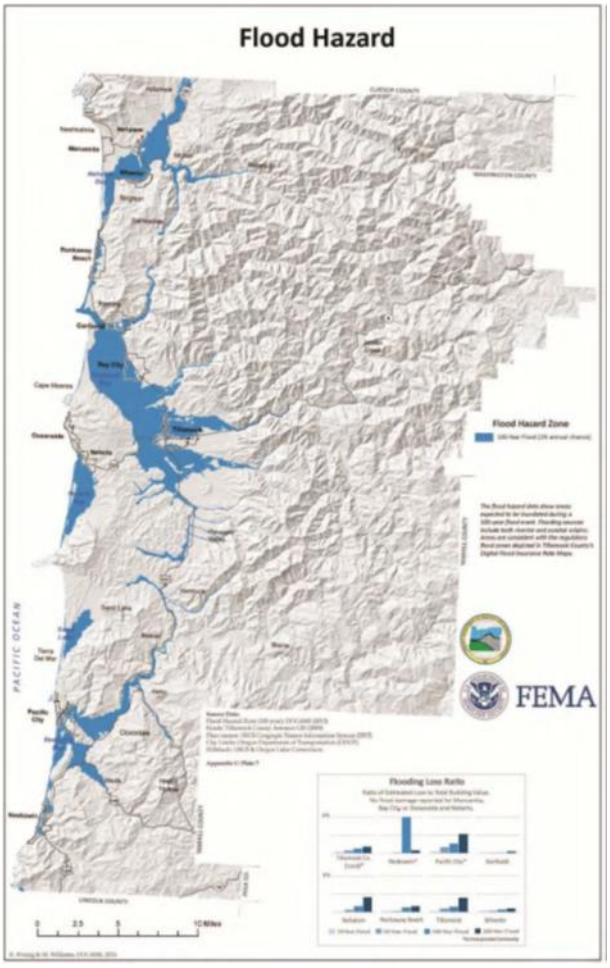

Figure 33. *Flood Hazard in Tillamook County (Tillamook NHMP, DOGAMI, 2016)*

[41] Tillamook County. (2017) Tillamook County Multi-Jurisdictional Natural Hazard Mitigation Plan.

increased sedimentation and the introduction of industrial, agricultural, and human derived pollutants into natural systems.[42] Additionally, higher seasonal flood waters could heighten terrestrially-derived bacteria and nitrogen inputs, which, combined with expected decrease of spring/summer flushing, may create conditions for the development of hypoxic (low dissolved oxygen) zones in estuarine waterways.[43]

Landslide

Characteristics of landslides include a range of slowly- to rapidly-moving rock falls, debris flows, and earth slides. Landslides occur throughout the Coast Range, primarily in areas of steep slopes. While landslides primarily impact upper watershed portions of TEP's focal area, it is important to note that they often occur in conjunction with significant winter storm or rainfall events. Notably, Tillamook County has "one of the highest landslide counts of all the Oregon Counties."[44]

In the past 30-years, there have been eight federally declared disaster declarations in Tillamook County that include landslides or mudslides. Each of these declarations correspond with significant rain events and include lowland/estuarine flooding. Minor landslides occur on an annual basis. The Tillamook NHMP notes that the Port of Tillamook Bay is vulnerable to landslides originating on Anderson Hill.

Landslides contribute to the degradation of the estuary waters through increasing turbidity levels and may also increase remobilization of heavy metals and contaminants from sediments to the water column.[45] Landslide conditions may increase where vegetation and slope stability is impacted by wildfires, logging, and other land clearing activities.

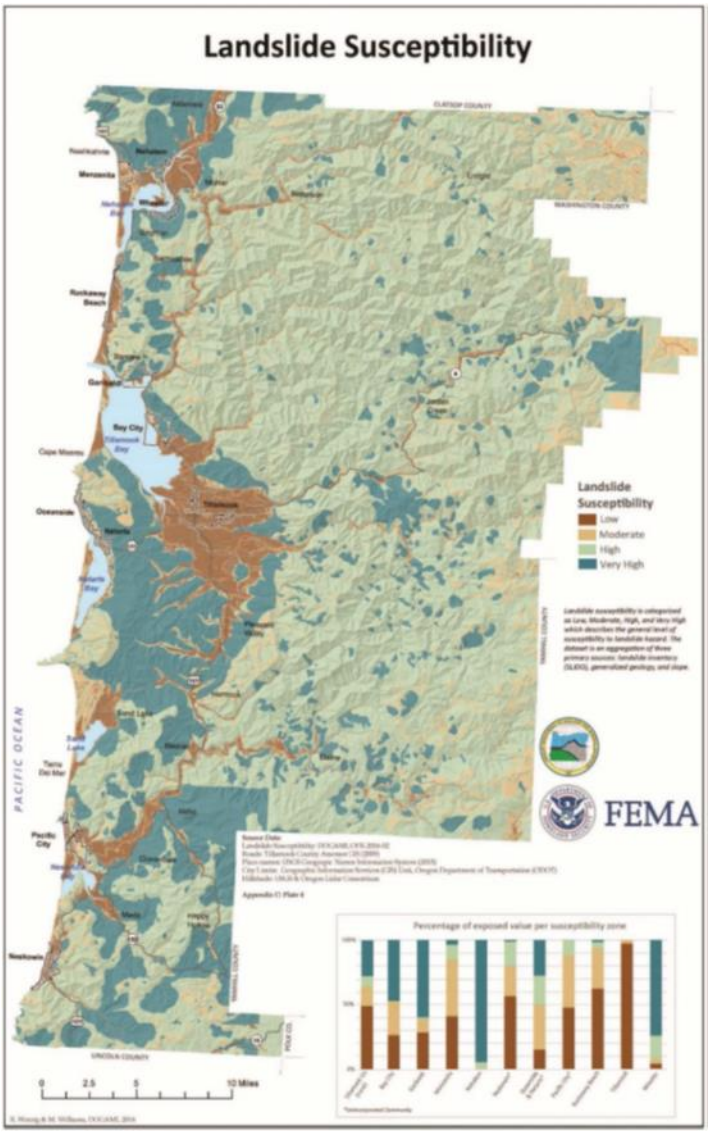

Figure 34. Landslide Susceptibility in Tillamook County (Tillamook NHMP, DOGAMI, 2016)

Drought

The drought hazard occurs primarily during periods of diminished water availability. This can result from reduced snow pack or diminished precipitation. Impacts to TEP systems include reduced stream flows, soil moisture deficits, diminished surface and subsurface water

[42] Koopman, M. E., Geos Institute. (2018) Tillamook Estuaries Partnership Climate Change Vulnerability Assessment.
[43] Scavia, D., J. C. Field, D. F. Boesch, R. W. Buddemeier, V. Burkett, D. R. Cayan, M. Fogarty, et al. 2002. Climate Change Impacts on U.S. Coastal and Marine Ecosystems. Estuaries. 25 (2): 149-164.
[44] Tillamook County. (2017) Tillamook County Multi-Jurisdictional Natural Hazard Mitigation Plan.
[45] Whitehead, P. G., R. L. Wilby, R. W. Battarbee, M. Kernan, and A. J. Wade. 2009. A review of the Potential Impacts of Climate Change on Surface Water Quality". Hydrological Sciences Journal. 54 (1): 101-123.

availability, and an increase in upper watershed forest vulnerabilities ranging from pest infestations to wildfire.

While droughts are not as common along Oregon's coast, they do occur. Significant statewide droughts have affected Tillamook County several times in the past century. Droughts may lead to lower summer flows which, in turn, could lead to decreased oxygen levels and increased temperatures, particularly in the upper estuary reaches. Decreased summer flows, along with increased winter flows, may also affect the estuarine salinity regime and may also heighten terrestrially-derived bacteria and nitrogen inputs, which may create hypoxic zones (low dissolved oxygen) in estuaries.[46] Additionally, dry season salinity can be expected to increase over time, which will change estuarine plant and animal communities, and possibly create openings for the establishment of new or spread of existing invasive species.[47]

Wildfire

Wildfires include any uncontrolled outdoor fire. Like the other hazards discussed in this section, wildfire is a natural part of the local ecology. Even so, wildfires can result in significant impacts to forest, water, and habitat resources. Additionally, wildfires pose a significant risk to life-safety and property. Over the past decade, communities throughout the west are reporting an increased incidence of extreme wildfire behavior.

Figure 35. Tillamook Burn (1933), (Dave Knows)

Tillamook County has a history of wildfire, including several fires larger than 100,000 acres. The "Tillamook Burn" area consists of roughly 350,000 acres burned by multiple large wildfires over two-decades between 1933 and 1951. The largest of these events, fueled by high temperatures and strong east winds grew by approximately 200,000 acres in a 24-hour period. Importantly, the fire boundary includes most of the upper watershed within TEP's focal area. A modern stand replacement fire in this area could significantly alter the ecology of systems throughout Tillamook County.

Wildfires pose a significant risk to infrastructure, natural resources, and the quality of the environment. Potential climate changes may lead to more invasive weeds (e.g., gorse, scotch broom) that are highly flammable. Increased incidence of wildfires may also increase landslide risk in areas where soil conditions are destabilized. As such, water flows will also increase during winter storm events and summer flows may decrease further where water cannot be stored in previously vegetated areas, thereby exacerbating drought conditions.

[46] Scavia, D., J. C. Field, D. F. Boesch, R. W. Buddemeier, V. Burkett, D. R. Cayan, M. Fogarty, et al. 2002. Climate Change Impacts on U.S. Coastal and Marine Ecosystems. Estuaries. 25 (2): 149-164.

[47] Oregon Climate Change Research Institute (OCCRI). 2010. "Chapter 6. Impacts of Climate Change on Oregon's Coasts and Estuaries", in Oregon Climate Assessment Report. K.D. Dello and P.W. Mote (eds). College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, OR.

Catastrophic Threats, Impact, and Vulnerability Assessment

The Tillamook County Natural Hazard Mitigation Plan (NHMP) provides extensive descriptions and data related to catastrophic hazards in Tillamook County. The following information presents a summary for relevant hazards. For additional hazard specific information, refer to the Tillamook County NHMP.

Earthquake

Earthquakes involve movement in the earth's crust. In Tillamook, the primary risk is from a megathrust earthquake along the Cascadia subduction zone. Megathrust earthquakes are extremely powerful with magnitudes ranging from 8.0 to 9.0+ on the Richter scale. Characterized by 4-5 minutes of ground shaking, subduction zone earthquakes can result in coastal subsidence, landslides, soil liquefaction, and deformation of land surfaces. Of principle concern to TEP's focal area is the likelihood of coastal subsidence and related impacts to tide flat, low and high marsh, and forest edge ecosystems.[48] [49]

Megathrust earthquakes occur infrequently along the Oregon coast. The last recorded earthquake was in January of 1700. With a recurrence interval ranging between 240 years (magnitude 8.0-8.5) and 530 years (magnitude 9.0+), the probability of any subduction zone earthquake occurring in the next 50-years ranges from a low of 7% to a high of 43% depending on earthquake size and extent.

Tsunami

Tsunami hazard includes both locally generated and distant events. Tsunamis can result in significant lowland coastal flooding, scouring, sedimentation, sand relocation, saltwater intrusion, vegetation impacts, and habitat contamination from debris. A 2013 USGS study of tsunami impacts on marine ecosystems in California found that, "All low-lying coastal habitats, such as beaches and marshes, will be inundated. Strong currents, massive water flows, and tsunami debris are likely to cause severe ecological harm in many places."[50]

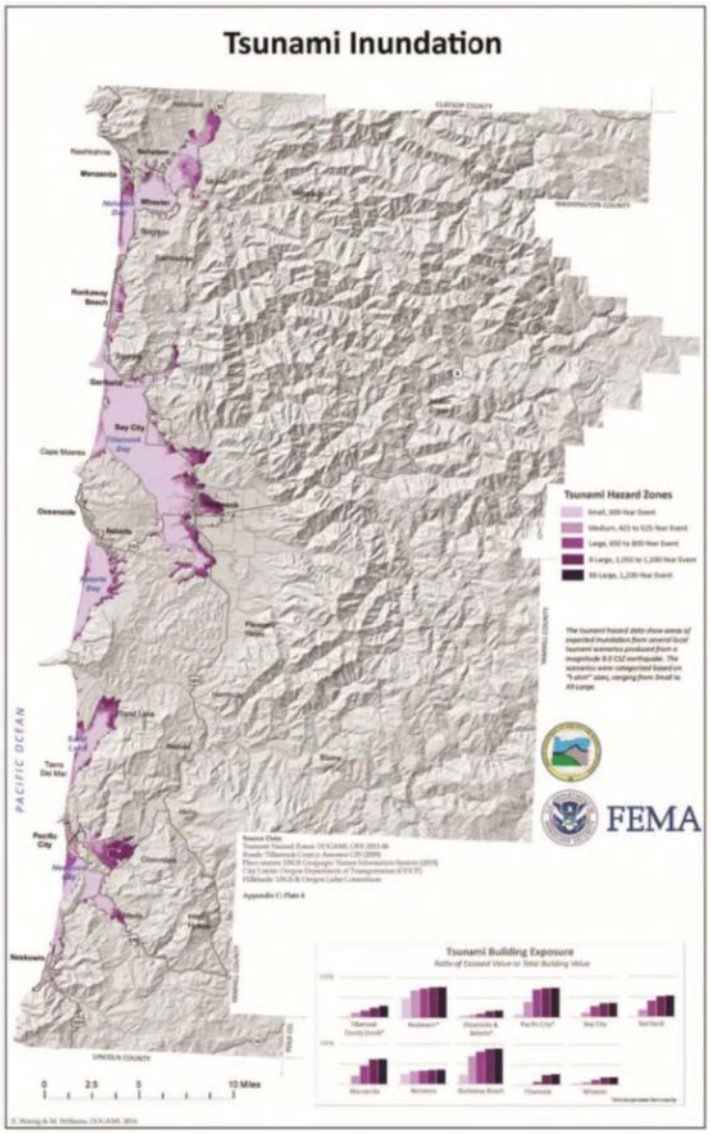

Figure 36. Tsunami Hazard in Tillamook County (Tillamook NHMP, DOGAMI, 2016)

[48] Department of Geology and Mineral Industries. (1997). Open-File Report O-97-05, Estimates of Coastal Subsidence from Great Earthquakes in the Cascadia Subduction Zone, Vancouver Island, B.C., Washington, Oregon, and Northernmost California. (http://oregongeology.org/pubs/ofr/O-97-05.pdf)

[49] Hawkes, A.D., et. al. (2011). Coastal Subsidence in Oregon, USA, During the Giant Cascadia Earthquake of AD 1700. Quaternary Science Reviews. (http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.908.7810&rep=rep1&type=pdf)

[50] United States Geological Survey. (2013) SAFER Tsunami Scenario – Impacts on California Ecosystems, Species, Marine Natural Resources, and Fisheries. (https://pubs.usgs.gov/of/2013/1170/g/pdf/ofr2013-1170g.pdf)

In the case of Oregon, a locally generated tsunami will likely result in impacts to marine and estuarine resources that far exceed those modeled in the California study.

Several distant tsunamis have affected the Oregon coast over the past century. However, impacts in Tillamook County were minimal. The probability of a locally generated tsunami event corresponds with the probability of Cascadia subduction zone earthquake (described above).

El Niño Southern Oscillation

El Niño Southern Oscillation (ENSO) weather patterns can increase the frequency and severity of drought. During El Niño periods, alterations in atmospheric pressure in equatorial regions yield an increase in the surface temperature off the west coast of North America. This gradual warming sets off a chain reaction affecting major air and water currents throughout the Pacific Ocean. In the North Pacific, the Jet Stream is pushed north, carrying moisture laden air up and away from its normal landfall along the Pacific Northwest coast. In Oregon, this shift results in reduced precipitation and warmer temperatures, normally experienced several months after the initial onset of the El Niño. These periods tend to last nine to twelve months, after which surface temperatures begin to trend back towards the long-term average. El Niño periods tend to develop between March and June, and peak from December to April. ENSO generally follows a two to seven-year cycle, with El Niño or La Niña periods occurring every three to five years. However, the cycle is highly irregular, and no set pattern exists. According to the National Weather Service, Climate Prediction Center, 21 El Niño episodes have occurred since 1950, with the two most recent strong El Niño episodes occurring in 1997-98 and 2015-16.[51]

Climate Change Vulnerability Assessment and Preparedness Strategy

In 2018, the GEOS Institute completed the *Tillamook Estuaries and Watersheds Climate Change Vulnerability Assessment* and *Climate Change Preparedness Strategy for Tillamook Estuaries Partnership* covering Tillamook County.

The assessment found that ecosystems within TEP's focal area will experience overall warming of between four- and seven-degrees Fahrenheit over the next 50-years. This will result generally in warmer (wetter) winters and drier summers. Accompanying this temperature increase will be increased climate extremes overall, including higher incidents of extreme heat, precipitation, flooding, and drought.

The reports uncovered that vital resources and habitats within Tillamook County estuaries are impacted by stressors (e.g., pollution, sedimentation, land conversion) that will be exacerbated by climate change impacts (climate stressors).

Considering the predicted climate stressors, TEP, Stakeholders, and other local experts identified and assessed 74 risks to TEP's 1999 CCMP goals. The risks were predominately associated with water quality and key habitat goals, "specifically those to assess, protect, and enhance specific types of habitat (riparian, in-stream, wetland, and estuary and tidal), as well as promoting the beneficial uses of bays and rivers".[52] Risks are ranked as High, Medium, or Low. The risk matrix was used during the development of adaptation strategies and actions.

[51] National Weather Service, "Climate Prediction Center", http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml

[52] Koopman, M.E. 2018. Tillamook Estuaries and Watersheds Climate Change Vulnerability Assessment. GEOS Institute and Tillamook Estuaries Partnership.

Adaptation Strategies and Actions

Following the EPA's *Being Prepared for Climate Change* framework[53], risks to TEP's goals were addressed using four different approaches. These included:

1. **Mitigate** - developing adaptation strategies to reduce the risk
2. **Transfer** - identifying another group or agency responsible for adaptation
3. **Avoid** - changing the original goal to avoid the risk or failure to meet the goal
4. **Accept** - continue as usual, allowing the climate impacts to occur

Local experts and stakeholders identified 23 general strategies and 78 specific actions (35 *high priority* actions) to address the vulnerabilities (Table 5). For each adaptation action, the following variables were addressed:

- **Co-benefits** – Any additional benefits that the action provides, beyond those directly related to the risk being addressed
- **Potential barriers or conflicts** – Major issues that would need to be resolved or that could prevent the action from being successfully implemented or supported
- **Partners** – The local, state, and federal agencies or organizations that could assist in implementing the action
- **Effectiveness** – How effective the action is expected to be in reducing the specific climate risk (ranked as Low, Medium, or High)
- **TEP influence** – The ability of TEP to implement the action and affect the target resource or population (ranked as Low, Medium, or High)
- **Relative cost** – Compared to other actions that TEP implements, the overall cost of the specific actions being considered (ranked as Low, Medium, or High)

These variables allowed potential adaptation strategies and actions to be compared and prioritized. Priority actions were grouped into the 23 adaptation strategies. Table 5 shows how the Strategies and Actions identified within the *Climate Change Preparedness Strategy for Tillamook Estuaries Partnership* relate to the actions identified in this CCMP. As shown in the table, many of the CCMP actions directly address climate change.

[53] EPA. 2014. Being prepared for climate change: A workbook for developing risk-based adaptation plans. https://www.epa.gov/sites/production/files/2014-09/documents/being_prepared_workbook_508.pdf

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Table 5. Climate Change Preparedness Strategies and Actions linked to associated CCMP actions. (Climate Change Preparedness Strategy, Geos Inst., 2018)

Priority	Potential Actions	WAQ-01	WAQ-02	WAQ-03	WAQ-04	WAQ-05	HAB-01	HAB-02	HAB-03	HAB-04	HAB-05	HAB-06	HAB-07	HAB-08	HAB-09	HAB-10	HAB-11	HAB-12	HAB-13	HAB-14	HAB-15	CEE-01	CEE-02	CEE-03	CEE-04	CEE-05
1	Strategy: Limit nutrient inputs																									
High	Point source identification	X																								
High	Storm water management		X							X		X	X	X					X							
High	Bacterial DNA identification to identify source																									
High	Domestic sewage - septic system improvements or upgrades		X																							
High	Farm water quality plans	X																								
High	Water quality monitoring and assessment (for quicker response)	X																								
Medium	Municipal sewage – wastewater treatment plant upgrades		X																							
Low	County level ordinance or rulemaking																				X					
2	Strategy: Agricultural management																									
High	Animal exclusion fencing			X						X		X	X	X					X		X					
High	Off channel watering									X		X	X	X					X		X					
High	Education and outreach on manure management	X																								
High	Manure management	X																	X		X					
Medium	Promote (construct) livestock crossings at bridge/hardened fords																		X		X					
Medium	Improve drainage function of lower tidal wetlands through restoration, thereby improving productivity of upland agricultural areas						X					X							X		X					
Medium	Rainwater collection off barn/ storage roofs for watering		X																X		X					
3	Strategy: Improvements to infrastructure																									
High	Improvements to septic systems		X																							
High	Identify culverts and roads most at risk of failure from high flows (esp. those culverts with insufficient capacity)		X		X		X	X	X	X	X								X							
High	Replace or remove culverts and roads most at risk				X							X	X	X	X				X							

Priority	Potential Actions	WAQ-01	WAQ-02	WAQ-03	WAQ-04	WAQ-05	HAB-01	HAB-02	HAB-03	HAB-04	HAB-05	HAB-06	HAB-07	HAB-08	HAB-09	HAB-10	HAB-11	HAB-12	HAB-13	HAB-14	HAB-15	CEE-01	CEE-02	CEE-03	CEE-04	CEE-05
Medium	Improvements to stormwater infrastructure (including stormwater retention)		X		X							X	X	X	X				X							
Medium	Move/improve (lagoon -> cistern) wastewater treatment lagoons (a few in Nehalem, Bay City, Cloverdale) to reduce risk from overflowing		X																							
Medium	Reduce miles of unmaintained forest roads by fully decom-missioning (remove culverts, pull back unstable slopes, reduce landslide risk)				X						X	X	X	X	X											
4	Strategy: Identify and prioritize areas for restoration																									
High	Identify sites where gravel deposits and downed wood might enhance fish habitat								X	X	X				X						X					
High	Identify areas and prioritize by estuarine and freshwater type. Freshwater wetlands expected to be more vulnerable under drought scenarios.						X	X							X						X					
5	Strategy: Protect existing habitat																									
High	Protect existing healthy riparian vegetation, which provides shade			X								X	X	X											X	
6	Strategy: Improve land management practices in high risk areas																									
Medium	Change policy on ground cover retention on steep slopes to increase cover and re-plant																			X						
7	Strategy: Restore wetlands and floodplains																									
High	Restore floodplain connectivity for freshwater and tidally influenced wetlands and examine underlying influences on hydrology						X	X		X	X	X	X		X											
High	Riparian restoration in stream related wetlands			X						X			X	X											X	
Medium	Planting and restoration of wetlands with species that are better adapted to climate variability						X	X		X		X	X	X		X									X	

Priority	Potential Actions	WAQ-01	WAQ-02	WAQ-03	WAQ-04	WAQ-05	HAB-01	HAB-02	HAB-03	HAB-04	HAB-05	HAB-06	HAB-07	HAB-08	HAB-09	HAB-10	HAB-11	HAB-12	HAB-13	HAB-14	HAB-15	CEE-01	CEE-02	CEE-03	CEE-04	CEE-05
8	Strategy: Habitat improvement																									
High	Large woody debris (LWD) to collect gravels for more subsurface flow and assist catching landslide material			X	X				X	X			X	X												
High	Riparian plantings			X			X			X		X	X	X		X			X		X					
High	Floodplain habitat restoration			X	X		X	X		X		X	X						X		X					
High	Reconnect springs, wetlands, floodplains that can serve as cold water refugia			X	X		X	X		X		X	X	X	X											
Medium	Increase diversity of habitat to create more salmonid life history options			X	X		X	X	X	X		X	X	X	X		X									
Medium	Increase off-channel habitat						X	X	X			X	X	X												
Medium	Stream channel restoration to create more channel complexity				X				X	X			X	X												
Medium	Expand conservation and restoration activities to ensure maintenance of specific types of wildlife habitat						X	X	X	X	X	X	X	X	X		X				X					
Medium	Large scale, holistic floodplain management to maintain and enhance complexity and function			X	X							X	X		X					X	X					
Medium	Address warming caused by inline impoundments																		X							
Medium	Forest management strategy to balance water absorption		X	X	X									X	X				X	X						
Low	Set back dikes to increase channel width and improve floodplain function											X	X		X						X					
9	Strategy: Increase natural upland water storage																									
Medium	Promote beaver habitat in the uplands			X							X			X						X						

Priority	Potential Actions	WAQ-01	WAQ-02	WAQ-03	WAQ-04	WAQ-05	HAB-01	HAB-02	HAB-03	HAB-04	HAB-05	HAB-06	HAB-07	HAB-08	HAB-09	HAB-10	HAB-11	HAB-12	HAB-13	HAB-14	HAB-15	CEE-01	CEE-02	CEE-03	CEE-04	CEE-05
10	Strategy: Reduce impacts of new and existing development on estuaries																									
High	Replace/remove/remediate existing infrastructure and development vital to estuary conservation and ecological functioning over long time frames	X	X			X	X					X			X											
Medium	Make recommendations to County and Planning Department for policies, related to new development, that sup- port estuary conservation and habitat migration						X													X	X					
11	Strategy: Assess and manage for projected change																									
High	Using sea level rise study/ report, assess culverts, dikes, other infrastructure, and natural areas at risk		X				X	X	X	X	X						X	X	X							
High	Protect/restore/conserve areas that will become new habitat with sea level rise						X					X	X							X	X					
Medium	Develop/use models to view stream and estuary conditions 50-100 years out (for planning current and near future actions)						X								X					X	X					
Medium	Education and outreach to promote appropriate standards to all groups (landowners, agencies, Counties, etc.)																		X	X	X					X
Medium	Identify at risk habitats, birds, and species						X	X	X	X	X						X	X								
Medium	Assess precipitation standards for culverts and roads (e.g. 100-year storms) based on climate projections and review current standards						X	X	X	X	X				X											
Medium	Prioritize, replace, remove, and remediate based on the results of the study						X	X	X	X	X				X											
Medium	Re-map estuarine sediments and habitats						X																			
Low	Revise management units to protect estuarine fringe						X	X												X						
Low	Accept loss of current boundaries																									

Priority	Potential Actions	WAQ-01	WAQ-02	WAQ-03	WAQ-04	WAQ-05	HAB-01	HAB-02	HAB-03	HAB-04	HAB-05	HAB-06	HAB-07	HAB-08	HAB-09	HAB-10	HAB-11	HAB-12	HAB-13	HAB-14	HAB-15	CEE-01	CEE-02	CEE-03	CEE-04	CEE-05
12	Strategy: Expand organizational capacity																									
High	Write grant proposals																				X					X
Medium	Extend partnerships																								X	X
Medium	Expand capacity																								X	X
13	Strategy: Manage streamflow																									
Medium	Sustainable water storage and release		X					X		X	X	X	X	X	X				X							
14	Strategy: Reduce water demand																									
High	Education and outreach on water conservation																			X	X	X		X		
15	Strategy: Protect groundwater sources																									
Medium	TBD - protect groundwater sources		X																							
16	Strategy: Increase strategy for invasive management																									
Medium	Aggressive PRISM approach																	X	X					X		
Low	Herbicide use for control	X																						X		
17	Strategy: Improve riparian planting survival																									
High	Plant diverse species in riparian areas						X			X		X	X	X		X			X		X					
High	Replant riparian areas as needed			X								X	X	X		X	X		X							
High	Monitor riparian planting survival			X						X		X	X	X		X	X		X							
18	Strategy: Increase forest diversity and resilience																									
High	Replant with multiple tree species to preserve and enhance diversity									X		X	X	X		X										
Medium	Assess establishment and survivial of tree species post- disturbance and over longer time periods to determine the most suitable species for planting						X	X	X	X	X					X										
19	Strategy: Reduce greenhouse gas emissions																									
Medium	TBD - reduce GHG emissions across the County						X	X		X	X	X	X	X												
20	Strategy: Develop appropriate vegetation management actions if changes are detected																									
Medium	Change in the type of vegetation used in riparian restoration activities															X			X							

Priority	Potential Actions	WAQ-01	WAQ-02	WAQ-03	WAQ-04	WAQ-05	HAB-01	HAB-02	HAB-03	HAB-04	HAB-05	HAB-06	HAB-07	HAB-08	HAB-09	HAB-10	HAB-11	HAB-12	HAB-13	HAB-14	HAB-15	CEE-01	CEE-02	CEE-03	CEE-04	CEE-05
21	Strategy: Continue with current management strategies and monitor for changes																									
High	Continue water quality monitoring					X																	X	X		
Medium	Monitor for changes in vegetation					X	X	X	X	X	X					X	X	X					X	X		
Medium	Maintain Riparian Management Areas (RMAs) strategies			X																X						
22	Strategy: Improve understanding of risks related to wildfire, forest management and climate change																									
Medium	Assess fuels across landscape (wetter coast to drier inland) and manage appropriately						X	X	X	X	X							X	X	X						
Medium	Review riparian practices for areas affected by wildfire						X	X	X	X	X							X	X							
Medium	Based on the results of the assessment, manage fuels for reduced wildfire severity while maintaining ecological values and function.											X	X	X			X	X	X							
Low	Review salvage logging practices for better understanding of how this risk affects the region								X								X	X	X							
23	Strategy: Reduce visitor impacts to bays and rivers																									
High	Education and outreach to share water quality info with stakeholders and users	X	X																					X		
High	Education and outreach on visitor impacts																							X	X	
High	Education and outreach to keep users away from stressed areas																							X	X	

National Disaster Recovery Framework

The Department of the Interior and the Environmental Protection Agency (among others) provide post-disaster recovery assistance for natural and cultural resources following major disasters. Informed by Presidential Policy Directive 8: National Preparedness, the federal government established a National Disaster Recovery Framework (2nd edition, 2016).

The NDRF framework outlines the Natural and Cultural Resources Recovery Support Function (NCR-RSF) as follows:

> *"The NCR RSF facilitates the integration of capabilities of the Federal Government to support the protection of natural and cultural resources and historic properties through appropriate response and recovery actions to preserve, conserve, rehabilitate, and restore them consistent with post-disaster community priorities and in compliance with applicable environmental and historical preservation laws and Executive orders."*[54]

In addition, the NDRF defines eight recovery core capabilities (critical functions to enable preparedness and recovery):

- Planning;
- Public Information and Warning;
- Operational Coordination;
- Economic Recovery;
- Health and Social Services;
- Housing;
- Infrastructure Systems; and
- Natural and Cultural Resources.

At the local level, TEP will be a primary contact for natural resources-based post-disaster recovery activities. Under the framework, local partners should be ready to address post-disaster natural and cultural resource recovery needs. Current planning activities should anticipate the following post-disaster recovery activities:

- TEP focal area post-disaster natural systems recovery needs identification.
- TEP focal area post-disaster preservation, conservation, rehabilitation, and restoration prioritization.
- Development and implementation of sustainable recovery strategies within the TEP focal area.
- Participation in post-disaster planning and networking activities.
- Identification of multi-objective, multi-discipline strategies that consider long-term environmental effects to sensitive natural resources, open spaces, and community well-being.
- Writing a plan for pre-disaster and post-disaster strategic, operational, and tactical actions for natural and cultural resources that is consistent with the NDRF (2nd Ed.) template.

[54] Federal Emergency Management Agency, Natural and Cultural Resources Recovery Support Function. National Disaster Recovery Framework (2nd Ed., 2016). Retrieved from https://www.fema.gov/media-library-data/1466014998123-4bec8550930f774269e0c5968b120ba2/National_Disaster_Recovery_Framework2nd.pdf

Local Economy

Healthy estuaries and watersheds provide many ecological benefits including clean water and habitat for fish and wildlife. But healthy and functioning watersheds and estuaries also have direct social and economic benefits: resiliency against storm damage and flooding, robust sports and commercial fisheries (including oysters and crabs), a vast array of recreational opportunities, and jobs. The "restoration economy" – the labor, materials, and private-sector contracts resulting from financial investment in restoration projects – has gained attention in the economic development community in recent years for its potential to help struggling rural economies. Communities that have relied upon natural resource extraction are increasingly finding ways to use natural resources in new ways that emphasize environmental stewardship and ecological restoration.[55] In a recent study of Oregon's watershed councils, University of Oregon researchers calculated that $1 million of OWEB funds invested in ecological restoration results on average in 16.3 jobs created and $2.3 million in economic output.[56] Restoration projects directly contribute to making Tillamook County's economy more diverse and resilient.

As the health of Tillamook County's watersheds increase, the potential for recreation-related economic activity also expands. In Oregon, the combined expenditures from fish and wildlife recreation related to travel, local recreation, and equipment purchases amounted to $2.5 billion in 2008 (the most recent year with available data).[57] In Tillamook County, travel-generated expenditures for fish and wildlife recreation amounted to $63.4 million in 2008, with an additional $5.2 million from locally-generated recreation.[58] As restoration enhances wildlife and their habitats, visitors and local residents may find more and more reasons to spend their time and money in Tillamook County.

Projects taken on by TEP and its partners will make it possible for local estuaries and watersheds to be healthy and fully functional. Healthy watersheds, in turn, will support a healthy economy for communities in Tillamook County. As Tillamook County and Oregon adjust to the realities of a new, more mechanized natural resource sector, the county and state have a tremendous opportunity to pivot with the times while remaining true to a natural resource heritage. The "new" natural resource economy, supported by the activities of TEP and its partners, will enhance the precious resources of land and water while simultaneously building good local jobs and generating recreation spending.[59]

[55] Hibbard, M. and S. Lurie. 2013. The New Natural Resource Economy: Environment and Economy in Transitional Rural Communities. Society and Natural Resources 26(7): 827-844.
[56] Nielsen-Pincus, M. and C. Moseley. 2013. The Economic and Employment Impacts of Forest and Watershed Restoration. Restoration Ecology 21:2, 207–14.
[57] Dean Runyan Associates. "Fishing, Hunting, Wildlife Viewing, and Shellfishing in Oregon, 2008." Prepared for the Oregon Department of Fish and Wildlife and Travel Oregon. 2009. https://www.dfw.state.or.us/agency/docs/Report_5_6_09--Final%20(2).pdf
[58] Ibid. Table 13 and 14.
[59] Hibbard, M. and S. Lurie. 2013. The New Natural Resource Economy: Environment and Economy in Transitional Rural Communities. Society and Natural Resources 26(7): 827-844.

Chapter 5: Habitat Restoration and Monitoring Strategies

TEP is developing new five-year Habitat Restoration and Monitoring Strategies for consideration and approval by its board and EPA oversight team. This task will be completed by TEP staff working with local partners and appropriate state and federal agencies by 2020.

The Habitat Restoration Strategy will expand upon the actions and activities described in Chapter 2 (Habitat Restoration). The strategy shall encompass:

- Relevant habitat types and key species in the focus area;
- Goals and measurable objectives; and
- Actions that reflect the climate change vulnerability assessment conducted by TEP and its partners (Table 5).

The Monitoring Strategy will expand upon the actions and activites described in Chapter 1 (Water Quality), Chapter 2 (Habitat Restoration), and Chapter 3 (Community Education and Engagement). Monitoring is necessary to measure the effectiveness of the revised CCMP actions and to detect changes and/or improvements of conditions in the TEP focus area. Output monitoring measures programmatic progress related to the implementation of the CCMP. Outcome monitoring focuses on the results of CCMP actions such as changes in ambient conditions, ecological functions, and biological populations (e.g. status and trends in the water quality; health and abundance of Tillamook County's habitats and living resources). TEP's monitoring strategy will include both output and outcome monitoring along with the following elements:

- Current list(s) of indicators and data gaps;
- Inventory of current TEP and partner monitoring efforts in the focus area;
- Methods and frequencies of collecting and reporting monitoring data; and
- Data sharing protocols.

Together, the Habitat Restoration and Monitoring Strategies will:

- Establish priorities of restoration efforts based on impact, relevancy, funding, and resources.
- Focus on the technical aspects of field monitoring data collection, analysis, and application.
- Identify water quality and habitat monitoring strategies to assess the environmental condition of TEP's focal area.
- Evaluate the success of CCMP Actions by tracking the extent to which the actions laid out in the CCMP are being implemented and the environmental effects that may result from those implemented actions.

The Habitat Restoration and Monitoring Strategies shall be living documents intended to evolve as a result of tracking the status and trends of conditions within TEP's focus area, new/modified actions and priorities, and new/modified environmental indicators. Output and outcome monitoring data shall be used to inform the State of the Bays reports (issued every five years by TEP) which shall, in turn, provide direction for updating the Habitat Restoration and Monitoring Strategies. TEP shall continue to work with multiple agencies and partners to obtain, share, and evaluate monitoring data, and to communicate findings to the public, decision makers, and stakeholders.


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Chapter 6: Finance Strategy

Governance History

The Tillamook Estuaries Partnership is a 501(c)(3) non-profit organization. Originally hosted by Tillamook County (local government) upon its completion of the CCMP in 1999, the Tillamook County Performance Partnership (TCPP) as it was known, was considered a quasi-judicial non-regulatory entity. At that time, the NEP was funded with Section 320 dollars. When the organization was re-structured to become a non-profit organization known as the Tillamook Estuaries Partnership (TEP) in 2002, that funding was carried over to the new organization and has been in place since. The CWA Section 320 funding was not impacted by the change in organizational structure. The change also opened up more opportunities for diverse funding that would not have been available to a government entity.

Partner Contributions

The TEP partners are active participants in the implementation of the CCMP to address the priority problems affecting the health and function of Tillamook County's estuaries and watersheds. The partners do not provide a direct cash payment to TEP but rather fund their efforts to implement projects that further the goals of the CCMP. Those efforts provide match and/or leverage as well as build capacity for TEP to accomplish actions it may not be able to complete on its own. The main contributors to our non-federal match efforts include the Oregon Department of Fish and Wildlife, the Oregon Department of Environmental Quality, the Oregon Department of Agriculture, the Oregon Department of Forestry, the Oregon State University Extension, the Oregon Watershed Enhancement Board, Tillamook County, the Port of Garibaldi, Visit Tillamook Coast, and volunteers.

Financing the Plan

TEP has historically and will continue to pursue secure funding to finance operation of the base program and to advance implementation of the CCMP. The updated financing plan includes both dedicated and variable funding sources at federal, state, and local levels as well as private and nonprofit sources.

The major objectives of the financing strategy are:

- Developing dedicated sources of funding to sustain the base operations of the TEP, including personnel, administrative cost, community outreach, and project development and implementation when possible.
- Securing dedicated and variable sources of funding that enhance implementation of the CCMP and maintain adequate progress toward focal area restoration goals.

Dedicated Funding Sources

Currently, the EPA CWA Section 320 dollars provide the primary financial support for TEP's CCMP implementation. Each action plan in the Revised CCMP indicates whether it will be funded under the Clean Water Act Section 320, versus other funding sources. In general, EPA Section 320 dollars support personnel, Other Personnel Expenses (OPE), and overhead whereas projects are generally funded by outside sources. The EPA Section 320 dollars provide a stable base for the organization and allow TEP to engage with partners in meaningful ways. TEP prioritizes spending of these federal funds in its annual workplans. While the specific future annual appropriations under Section 320 are uncertain, the community-based conservation efforts of the National Estuary Program (NEP) have strong Congressional support. In 2016, Congress and the President signed into law the first reauthorization of the NEP since it expired in 2010. While any level of funding cannot be guaranteed, the reauthorization indicates wide-level and long term support.

Individual Donor funds (O). TEP hosts an annual fundraiser to generate unrestricted funds that provide administrative and programmatic support. Expenses which cannot be paid for with federal

money, such as the program's dues to the Association of National Estuary Programs, are also funded through these unrestricted dollars.

Variable Funding Sources

The following funding sources supplement CCMP implementation through local action plans of TEP partners, grants, cooperative agreements and other mechanisms. While variable from year to year, they represent significant funding sources to support both short- and long-term resource needs as identified in the CCMP Actions for TEP and its partners. It is important to note that funding for a restoration project, for example, may also include funding for monitoring and community engagement as components of the project. As a result, many of the funding sources described below will extend beyond the category with which they are associated.

External Grants, Assistance Agreements, and Cooperative Agreements. TEP staff have had significant success partnering with federal, state and local agencies to secure hundreds of thousands of dollars in grants for monitoring, habitat restoration, water quality improvement and environmental education projects as called for in the CCMP. Several of these habitat restoration funded projects also resulted in flood mitigation. The majority of actions led by TEP will be funded by one or more of the following sources. Funding through competitive grant program created in the reauthorization of the National Estuary Program may provide additional opportunities as it is further developed. The list below is not comprehensive as TEP is continually researching and identifying potential funding sources to support its efforts.

Funding sources for habitat restoration include but are not limited to:

EPA Section 320 Grant Funds (E): EPA Section 320.

Federal (non-320) Grants (F): USFWS Habitat Restoration Program, USFWS National Coastal Wetlands Grants Program, NOAA Coastal and Marine Habitat Restoration Project Grants, NOAA Broad Agency Announcement, NOAA Coastal Resilience Grants, US BLM Cooperative Agreements, and USFS Stewardship funding.

State Grants (S): Oregon Watershed Enhancement Board, Oregon Department of Agriculture, Oregon Department of Environmental Quality (Section 319, internal funding streams to provide in-kind assistance), Oregon Department of Fish and Wildlife (Restoration and Enhancement Fund and Fish Screening and Passage grants).

Partner-funded Projects (P): Tillamook County Soil and Water Conservation District; Salmon SuperHwy (a collaborative of local, state, federal, and non-profit organizations).

Other Funding Sources (O): Meyer Memorial Fund, Oregon Community Foundation; private foundations (supporting education, restoration, and capacity building).

Funding sources for water quality actions include but are not limited to:

EPA Section 320 Grant Funds (E): EPA Section 320.

Federal (non-320) Grants (F)

State Grants (S): Oregon Watershed Enhancement Board, Oregon Department of Environmental Quality (Section 319, internal funding streams to provide in-kind assistance), Oregon Department of Agriculture.

Partner Funded Projects (P): Local municipalities and special districts

Other Funding Sources (O)

Funding sources for community engagement include but are not limited to:

EPA Section 320 Grant Funds (E): EPA Section 320.

Federal (non-320) Grants (F): EPA Environmental Education Grants, National Parks Service.

State Funds (S): Oregon State Parks Recreational Trails Program, the Oregon Travel Commission (also known as Travel Oregon).

Partner Funded Projects (P): Visit Tillamook Coast (Tillamook County Transient Lodging Tax), Oregon Community Foundation, private foundations (supporting education, tourism); watershed councils; local school districts.

Other Funding Sources (O): Private Foundations including the Oregon Community Foundation, National Fish and Wildlife Foundation, Meyer Memorial Trust, Gray Family Foundtion.

Funding sources for natural hazards include but are not limited to:

EPA Section 320 Grant Funds (E): EPA Section 320.

Federal (non-320) Grants (F): NOAA, FEMA (hazard mitigation assistance), Federal Highway Administration grants (in partnership with local government).

State Funds (S): Oregon Watershed Enhancement Board, Oregon Emergency Management, the Oregon Department of Land Conservation and Development, Oregon Department of Transportation.

Partner Funded Projects (P): Local governments.

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Chapter 7: Communication Strategy

TEP is developing a new five-year Communication Strategy for consideration and approval by its board and EPA oversight team. This task will be completed by TEP staff working with board members, local partners, and appropriate state and federal agencies by 2020.

The Communication Strategy will:

Identify and rank appropriate community education and engagement issues for TEP to continue, expand, or initiate.

- Evaluate existing TEP community education and engagement programs and products, and identify how existing education campaigns and programs can be enhanced or strengthened.
- Identify and rank potential new education/social marketing campaings which support the CCMP goals to be considered for implementation within the next five years.
- Include goals and objectves, target audiences, activities and implementers, key deliverables, budget and timeframe.

Engaging residents

In developing this CCMP revision, TEP engaged over two-hundred community members. As part of the survey engagement, respondents were asked to explain how they currently interact with environmental organizations in Tillamook County and how they would like to receive information in the future from these organizations.

Current Interactions with TEP, local watershed councils, land trust, or environmental nonprofits in Tillamook County – Respondents indicated that most of their interaction with one or all of the above happens through an online platform, such as:

- Email (52%)
- Looking at the organization's website (51%)
- Interacting through social media (42%)

Preferences for hearing about upcoming educational and outreach events in the Tillamook County watersheds – Most respondents indicated that they prefer online-based communication, though many also preferred written or in person activities. Respondents said that overall, they prefer:

- Social media (54%)
- The TEP website (44%)
- Email listserv (43%)
- Local newspapers (30%)
- Community events (22%)

It is important to note that most of the respondents (84%) were already aware of the Tillamook Estuaries Partnership, and a little over half were aware of the CCMP (61%). This suggests that even those community members who already know about TEP's efforts are not always aware that the CCMP guides TEP's actions.

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Appendix A: Acronyms

ANROSP – Alliance of Natural Resource and Service Programs

ARCS - Aquatic and Riparian Conservation Strategy

AWQMP – Agricultural Water Quality Management Program

BLM – U.S. Bureau of Land Management

BMP – Best Management Practice

CAC – Citizen Action Committee

CAFO – Confined Animal Feeding Operations

CCMP – Comprehensive Conservation and Management Plan

CCWF – Children's Clean Water Festival

CTE – Career Technical Education

DBTC – Down by the Creekside

DEQ – Department of Environmental Quality

DLCD – Department of Land Conservation and Development

DO – Dissolved Oxygen

DOGAMI – Oregon Department of Geology and Mineral Industries

EPA – U.S. Environmental Protection Agency

EPA ORD – EPA Office of Research and Development

ESA – Endangered Species Act

FEMA – Federal Emergency Management Agency

FPA – Forest Practices Act

IAE – Institute for Applied Ecology

LOLE – Landmark on Learning Experiences

LWD – Large Woody Debris

NGSS – Next Generation Science Standards

NCLC - North Coast Land Conservancy

NOAA – National Oceanic and Atmospheric Administration

NORP - Northwest Oregon Habitat Restoration program; Native Plant Nursery

NPDES - National Pollutant Discharge Elimination System

NRCS – Natural Resources Conservation Service

OA – Ocean Acidification

OAH - Ocean Acidification and Hypoxia

ODA – Oregon Department of Agriculture

ODF – Oregon Department of Forestry

ODFW – Oregon Department of Fish and Wildlife

OR-OMG – Oregon Ocean Acidification and Hypoxia Monitoring Group

OSU – Oregon State University

OWEB – Oregon Watershed Enhancement Board

OYA – Oregon Youth Authority

PCMs – Prevention and control measures

pH – Quantitative measure of the acidity or basicity of aqueous or other liquid solutions.

RMA - Riparian Management Areas

SIA – Strategic Implementation Areas

STEM – Science, technology, engineering, and math

SWCD – Soil and Water Conservation District

TBCC – Tillamook Bay Community College

TCCA – Tillamook County Creamery Association

TCWT – Tillamook County Water Trail

TEP – Tillamook Estuaries Partnership

TOSA – Teacher on Special Assignment

USFS – U.S. Forest Service

USFWS – U.S. Fish and Wildlife Service

UO – University of Oregon

VWQMP – Volunteer Water Quality Monitoring Program

WC – Watershed Council

WWTP – Wastewater Treatment Plant

WQPMT - Water Quality Pesticide Management Team