Appendix I: Federal and state policies and programs pertaining to Mid-Coast water management

This appendix provides an overview of federal and state policies and programs that pertain to the management and maintenance of water supplies and water quality in the mid-coast of Oregon. Much of the material is either paraphrased or drawn verbatim from a report and companion OSU Extension publication entitled *Trees to Tap: How Forest Management Affects Oregon's Municipal Water* (Souder et al. 2021).

The overview includes sections on:

- Relationships between landownership, regulatory framework, and riparian area protection
- Regulation and management of drinking water in Oregon (the Clean Water Act; Safe Drinking Water Act and Source Water Assessments)
- The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and implementation in Oregon
- Federal forest land management and drinking water
- The Coastal Nonpoint Pollution Control Program (CZARA)
- The Oregon Forest Practices Act

Relationships between landownership, regulatory framework, and riparian area protection

Hillslopes, headwater tributaries, and larger downstream waterways that comprise a particular watershed are all elements of a fundamentally connected and integrated hydrological system (Bracken and Croke 2007; Nadeau and Rains 2007). Headwater streamflow is routed efficiently downstream, meaning that management, weather, or climate-induced changes in streamflow parameters will accumulate downstream (Reiter et al. 2009; Bywater-Reyes et al. 2017; Bywater-Reyes et al. 2018). Because fine sediment and other pollutants can be readily transported downstream, changes in upstream and headwater inputs of these constituents may be directly linked to conditions downstream, e.g., at a municipal drinking water intake.

In contrast to this inherent hydrologic connectivity from smaller to larger tributaries and into mainstem channels, landownership across forested watersheds in coastal Oregon is often fragmented and discontinuous. Regulatory goals and protection for riparian areas vary in fundamental ways across different public and private forest, agricultural and rural residential land ownerships and land uses, and also according to stream attributes (e.g., stream size, whether or not they are fish bearing).

Policy and regulatory mechanisms for protecting riparian areas may be either *prescriptive* or *outcome-based* (Boisjolie 2016). Prescriptive approaches proactively set specific standards for which activities are allowed in riparian areas and which are not. Both federal forestland and

private industrial timberland in the NFCR basin are subject to prescribed rules designed to prevent degradation of water quality before it happens. These rules are considerably more protective on federal forest lands compared to private, most notably in regard to where riparian buffers are required, the width of these buffers, and the amount of harvesting or other activities allowed within them. Riparian area management is regulated on federal BLM lands under the Northwest Forest Plan Aquatic Conservation Strategy and on private industrial timberlands under the Oregon Forest Practices Act Administrative Rules for water protection (Table 1).

Table 1. Regulatory frameworks, goals, criteria and implementation standards for riparian areas under different landownerships in Oregon

Land Ownership	Regulatory Framework/Approach	Regulatory and policy goals for riparian areas	Regulatory criteria, standards, and implementation
Federal (BLM)	Northwest Forest Plan - Aquatic Conservation Strategy *Prescriptive*	Halt declines in watershed condition; protect watersheds containing high-quality water, habitat, and healthy fish populations. Develop a network of functioning watersheds that support populations of aquatic and riparian-dependent organisms	Fish-bearing, streamflow duration, site-potential tree-height. Land-management standards: Direct land-use activities based on conservation goals, allow occasional feathering, salvage, and thinning. Riparian buffers 100-500 feet
Private Forest	Oregon Forest Practices Act Administrative Rules - Water Protection Rules *Prescriptive*	Provide resource protection during timber operations adjacent to and within streams so that, while continuing to grow and harvest trees, the protection goals for fish, wildlife, and water quality are met.	Fish-bearing, mean annual flow, domestic water use, streamflow duration. Land-management standards: Specify retention requirements for live and dead trees, no-cut buffers 0-100 feet
Private Agricultural	Agricultural Water Quality Mgmt Plan *Outcome-based*	To prevent and control water pollution from agricultural activities and to achieve applicable water-quality standards.	Standards implemented voluntarily or because of repeated violation of water-quality standards. Land-management standards: None.

Adapted from content in Boisjolie et al. 2019.

In contrast to forestlands, riparian protection standards and allowable management activities are not prescribed for agricultural lands in Oregon. Instead, the Oregon Department of Agriculture (ODA) promotes voluntary best management practices (BMPs) to meet water quality goals but leaves management decisions to individual landowners. For the Oregon mid-coast, these BMPs are provided in the Mid Coast Agricultural Water Quality Management Area Plan (ODA 2019). Guidance in the Area Plan is neither regulatory nor enforceable. Under this *outcome-based* approach, agencies intervene only after the fact if there is a violation of water quality standards (or more commonly, repeated violations) that can be clearly linked to a specific landowner (Boisjolie 2016; Boisjolie et al. 2019). A key challenge with this largely reactive approach to enforcement is that linking downstream water quality exceedances to specific upstream land management practices is often difficult, usually involving extensive monitoring.

The variable patterns of public (mainly USFS federal), private industrial forest, private small woodland, agricultural, and rural residential landownership across mid coast watersheds results in riparian area management goals and protection standards that can fluctuate substantially from stream segment to stream segment (Boisjolie et al. 2017). This variation in the level of policy and regulatory protection provided along different stream reaches and areas guides and shapes the various strategies available to protect and improve drinking source water quality.

Regulation and management of drinking water in Oregon

This section discusses federal statutes and regulations that pertain to drinking water, how these statutes are coordinated to address different but complimentary aspects of drinking water protection, and Oregon's administrative framework for interpreting and implementing them. The Oregon Department of Environmental Quality (DEQ) provides reports, general information, and technical assistance regarding surface water systems, while the Oregon Health Authority (OHA) supplies these services for groundwater systems (Oregon DEQ 2018b). In addition, the OHA regulates the treatment and distribution of potable water under the Federal Safe Drinking Water Act, while the DEQ has regulatory authority under the Federal Clean Water Act for point and non-point sources of pollution.

The Clean Water Act

The Clean Water Act (CWA) provides the basic structure for regulating discharges of pollutants into U.S. waters via national water quality criteria recommendations developed and administered by the USEPA and mostly delegated to the States and Tribes for implementation. This regulatory framework makes a key distinction between *point* sources and *nonpoint* sources of pollution. The CWA made it unlawful to discharge any pollutant from a point source into waters unless a permit is obtained from USEPA or an authorized State or Tribe under the National Pollutant Discharge Elimination System (NPDES) permit program. Point sources are discrete conveyances such as pipes or human-made ditches (USEPA 2018a).

The USEPA defines nonpoint source (NPS) pollution as pollution from diffuse sources resulting from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modifications. (USEPA 2018b.) NPS pollution is caused by rainfall or snowmelt moving over and through the ground, where it picks up and carries natural and human-made pollutants, depositing them into surface waters and ground waters. Logging operations are typically dispersed across large areas and affected by natural variables such as weather, channel morphology, or geology and soil characteristics of the watershed. This presents challenges in clearly distinguishing harvesting impacts from natural factors. Thus, it was relatively straightforward for the USEPA to define silvicultural activities such as thinning, harvesting, site preparation, reforestation, prescribed fire, wildfire control and pest control as NPS sources (USEPA 2018c). The USEPA also defines forest road construction, use and maintenance as NPS sources, which has been more controversial.

Due to its generally dispersed nature, NPS pollution is addressed through area-wide management planning processes and voluntary incentive-based, quasi-regulatory, or regulatory programs. Oregon and other western states have had regulatory programs to address NPS pollution from forest operations (in the form of forest practice acts) since the 1970s. Because NPS pollution causes about 60% of water quality impairments, Congress amended the CWA in 1987 to establish the Nonpoint Source Pollution Management Program under Section 319, which provides States and Tribes with grants to implement controls described in their approved NPS pollution management programs (USEPA 2018c).

The Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) was enacted in 1974, and significantly expanded in 1996, specifically to protect drinking water quality. The SDWA focuses on all U.S. surface water or groundwater sources actually or potentially used for drinking and requires USEPA to establish and enforce standards to protect tap water. The USEPA National Primary Drinking Water Regulations (NPDWR) are legally enforceable standards, treatment techniques and water-testing schedules that apply to public water systems. The NPDWR place legal limits - "maximum contaminant levels" (MCLs) - on over 90 drinking water contaminants. The MCLs are levels that protect human health and that water systems can achieve using the best available technology. Regulated contaminants are grouped as follows:

- Microorganisms
- Disinfectants
- Disinfection Byproducts (DBPs)
- Inorganic Chemicals
- Organic Chemicals
- Radionuclides

The USEPA also established National Secondary Drinking Water Regulations (NSDWRs) that set non-mandatory water quality standards for 15 so-called “nuisance” contaminants. These

"secondary maximum contaminant levels" (SMCLs) serve as guidelines to assist public water systems in managing their drinking water for aesthetic effects (e.g., taste, color, odor), cosmetic effects (e.g., skin or tooth discoloration) and technical effects (corrosion, staining, scaling or sedimentation in distribution systems or home plumbing). These contaminants can result in significant economic impacts, e.g., by reducing the efficiency of distribution systems, but are not considered to be human health risks at the SMCL (USEPA 2017a, b).

The USEPA uses the Unregulated Contaminant Monitoring Rule (UCMR) program to collect occurrence data for contaminants suspected to be in drinking water, but for which health-based standards have not been set under the SDWA. These data are collected to support USEPA decisions regarding whether to regulate particular contaminants to protect public health. Every five years USEPA reviews the list of unregulated contaminants, largely based on the Contaminant Candidate List (CCL), a list of contaminants that 1) are not regulated by the NPDWR; 2) are known or anticipated to occur at public water systems and, 3) may warrant regulation under the SDWA (USEPA 2017c).

In 2006, based on evidence that *Cryptosporidium* and other microbial pathogens are highly resistant to traditional drinking water disinfection practices (usually chlorination), and that the disinfectants themselves can react with naturally occurring materials in water to form byproducts that may pose health risks, the USEPA enacted updated rules to balance the risks of microbial pathogens and disinfection byproducts (DBPs). Under these rules - the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) and Stage 2 Disinfection Byproduct Rule (Stage 2 DBPR) - surface water systems are required to monitor source water for *Cryptosporidium, E. coli*, and turbidity, and to identify and monitor locations in their distribution systems likely to have high levels of DBPs. If source waters do not meet standards, surface water systems must select from an array of "microbial toolbox" treatment options to meet treatment requirements. Locations identified as DBP "hotspots" are to be monitored for compliance with maximum residual disinfectant levels (MRDLs) for disinfectants, and DBP MCLs established under the Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR) (USEPA 2005, 2017a; NACWA 2006).

The SDWA allows individual states to set and enforce their own drinking water standards if the standards are at a minimum as stringent as USEPA's national standards. The USEPA delegates primary enforcement responsibility for public water systems to states and Indian Tribes if they meet certain requirements. Oregon implements these primary (health-related) standards for USEPA, and also encourages attainment of secondary standards (nuisance-related) (USEPA 2018d).

How CWA and the SDWA overlap

In the past, the CWA and SDWA had mostly separate goals and functions. The CWA focused on environmental protection and maintaining "fishable/swimmable" waters, primarily by identifying and regulating sources of pollution in waterways. In contrast, the SDWA focused on municipal

water treatment standards and providing clean drinking water at the tap. Over time, rising demand for surface water, driven by population growth and associated development, has been accompanied by increases in wastewater and stormwater, and reduced in-stream flow volumes available to keep these wastes diluted. These changes can, in turn, escalate loadings of sediment, nutrients, bacteria, and other pollutants in community water sources. In response to the increasingly interrelated nature of watershed management and provision of safe drinking water, the SDWA evolved to encompass environmental as well as consumer protection, resulting in overlaps with the CWA, and greater emphasis on cooperation and holistic water management among agencies charged with implementing the two statutes (NACWA 2006).

Coordination across the CWA and SDWA is motivated by potential synergisms among goals and outcomes of these policies. Efforts driven by the SDWA to reduce contamination of drinking water sources can also protect aquatic ecosystems and wildlife and provide higher quality and safer water-based recreation opportunities. Conversely, using the CWA to develop Ambient Water Quality Criteria that are protective of aquatic life can also help achieve and maintain safe drinking water (ASDWA 2021). Among implementers of both statutes, preventing contamination is widely understood to be much more cost effective at providing safe drinking water than removing contaminants or finding alternative water sources after the fact.

Collaboration among CWA and SDWA implementers also facilitates more effective action to reduce disinfection byproducts (DBPs) in drinking water. These DBPs can form when a disinfectant (e.g., chlorine, chloramine, chlorine dioxide) reacts with organic matter– often decomposing plant matter - in source water (USEPA 2005). Total trihalomethanes and haloacetic acids are widely occurring DBPs which have been linked with increased cancer risk, problems with reproductive systems and other human health risks (USEPA 2006). Dissolved organic matter (DOM) from forest detritus is a major precursor to DBPs in drinking water sources (Bardwaj 2006, Karanfil and Chow 2016). Thus, forest management activities that influence the quantity and mobility of this source of DOM in source waters can influence the potential for DBPs to form during water treatment. Addressing DBP issues efficiently requires coordination across the entire drinking water production chain from source water to tap.

The SDWA Source Water Assessment Program

In 1996, Congress significantly expanded the SDWA to facilitate prevention of contamination through an increased focus on drinking water source protection. The 1996 revisions were instrumental in pushing the SDWA into the realm of the CWA, most notably via the SDWA's new Source Water Assessment Program. This program, along with the UCMR Program and the LT2ESWTR (discussed above), extended the SDWA's largely post-hoc emphasis on regulating water treatment to include environmental protection focused on source waters (NACWA 2006). The 1996 SDWA revisions required states to develop USEPA-approved programs to carry out Source Water Assessments (SWAs) for all public water systems in the state. The SWAs focused on delineation of drinking water sources, identification of the origins of USEPA-regulated contaminants (and any additional contaminants selected by the state) in those source waters,

and providing water utilities, community governments, and other stakeholders with information needed to protect drinking water sources. The 1996 amendments outline six steps for conducting SWAs for public water systems (PWSs).

Step 1 – **Delineate the source water protection area** (SWPA). Delineation shows the area to be protected based on the area from which the PWS draws its drinking water supplies.

Step 2 – **Inventory known and potential sources of contamination**. The contaminant source inventory lists all documented and potential contaminant sources or activities of concern that may be potential threats to drinking water supplies.

Step 3 – **Determine the susceptibility of the PWS to contaminant** sources or activities within the SWPA. Determining susceptibility of the PWS to inventoried threats relates the nature and severity of the threat to the likelihood of source water contamination.

Step 4 – **Notify the public** about threats identified in the contaminant source inventory and what they mean to the PWS. Effective programs ensure that the public has information necessary to act to prevent contamination.

Step 5 – **Implement management measures** to prevent, reduce, or eliminate risks to your drinking water supply. The assessment information can support formulation and implementation of measures to protect the source water. These measures can be tailored to address each threat or array of risks specific to each PWS.

Step 6 – **Develop contingency planning strategies** that address water supply contamination or service interruption emergencies. Water supply replacement strategies are an indispensable part of any drinking water protection program in the event of short- or long-term water drinking water supply disruption.

The 1996 revisions also authorized voluntary source water protection partnerships between state and local governments focused on reducing contaminants in drinking water, opportunities for financial and technical assistance, and developing long-term source water protection strategies, usually documented in Source Water Protection Plans (NACWA 2006; Tiemann 2017).

Programs for local source water assessment and source water protection planning

In 2015, Congress enacted the Grassroots Rural and Small Community Water Systems Assistance Act, reauthorizing and revising the small water system technical assistance program included in the 1996 SDWA expansion. Under this act, the Source Water Protection Program (SWPP) is coordinated jointly by USDA Farm Service Agency (FSA) and the National Rural Water Association (NRWA), a non-profit water and wastewater utility membership organization. The SWPP is designed to help prevent pollution of drinking water sources for rural residents. Participation in the program is voluntary. Rural source water technicians work with specialists from the USDA Natural Resources Conservation Service (NRCS) and state and county staff to identify areas where pollution prevention is most needed. These technicians then work with

state rural water associations to form local teams comprised of citizens and representatives from federal, state, local, and private organizations. They collaborate on Rural Source Water Protection plans to promote clean source water through voluntary actions that local landowners can implement to prevent contamination. The goal is to work at the grassroots level to educate and inform rural residents about practical steps to prevent water pollution and improve water quality.

The Oregon Association of Water Utilities (OAWU) is a nonprofit, independent association of about 700 mostly smaller and rural public and private community water utilities in the state. The OAWU represents their members' interests in the Oregon legislature and coordinates with the National Rural Water Association (NRWA) which represents rural water systems at the national level. The OAWU also plays an important role in addressing drinking water issues at the local water system level, through onsite technical assistance in areas such as SDWA and CWA regulations, water treatment technology, distribution system operation and maintenance, and wastewater treatment and collection. The OAWU Source Water Specialist deals specifically with drinking water protection, working directly with local water systems to prepare drinking water protection plans that address all state and federal requirements including specifically addressing potential contaminants through education of local management authorities and best management practices to help reduce the likelihood of contamination.

The American Water Works Association (AWWA) mission is to support water utilities in evaluating and improving their water quality, operations, maintenance, and infrastructure. The AWWA has developed detailed guidance for local municipalities to use in developing their SWAs and protection plans - Utility Management Standard G300, Source Water Protection (AWWA 2014). This American National Standards Institute (ANSI)-approved standard and its accompanying operational guide (Gullick 2017) outline six primary components of successful source water protection (SWP) programs and requirements for meeting the standard:

- A SWP program vision and stakeholder involvement
- Source water characterization
- SWP goals
- SWP action plan
- Implementation of the action plan
- Periodic evaluation and revision of the entire SWP program

How Oregon agencies coordinate to provide safe drinking water

In Oregon, the SDWA is directly implemented by Oregon Drinking Water Services (DWS), within the Environmental Health Section of the Public Health Division, Oregon Health Authority (OHA) under ORS 338.277 and 448.273. Under SDWA, DWS is primarily involved with administering and enforcing drinking water quality standards for public water systems, but also with source water protection, primarily for groundwater systems. The Oregon Department of Environmental Quality (DEQ) implements CWA authorities to address pollutants that affect the quality of

drinking water source waters, primarily surface waters. In practice, the DEQ Drinking Water Protection Program coordinates with OHA's DWS through an interagency agreement to carry out provisions of the two acts and jointly provide clean drinking water. Although OHA is the primary implementer of the SDWA, DEQ took the lead on the SWAs mandated by the 1996 SDWA revisions, conducting all surface water assessments and assisting on the groundwater assessments.

The DEQ also administers the Oregon Coastal Nonpoint Pollution Control Program (CNPCP). Coastal states are required to develop such programs to be eligible for federal funding to mitigate nonpoint source pollution under the federal Coastal Zone Management Act Reauthorization Amendments of 1990 (CZARA). Coastal states are also required to implement a set of management measures based on guidance published by the USUSEPA. These programs are designed to restore and protect coastal waters from nonpoint source pollution and to mitigate impacts to beneficial uses of these waters, including use for municipal drinking water. Oregon's CNPCP was developed in cooperation with the Oregon Department of Land Conservation and Development (DLCD) Oregon Coastal Management Program (OCMP). The CZARA, and how it intersects with drinking water protection in Oregon, are discussed in more detail below.

The DLCD also coordinates with DEQ to offer guidance to communities who may wish to enhance protection of their source watersheds through improved land use regulations such as comprehensive plan and zoning ordinance updates (Oregon DEQ 2017).

Source Water Assessments in Oregon

As stipulated by SDWA and Oregon Regulations (OAR 333-061-0020(125)), Source Water Assessments (SWAs) were completed between 1996 and 2005 for community water systems in Oregon serving at least 15 hookups or more than 25 people year-round (OAR 333-061-0020(25). Under the SDWA, smaller systems and transitory uses are also called public water systems (see OAR 333-061-0020(107) for a definition of these), but these are beyond the scope of this report. In following years, Oregon agencies significantly expanded their capabilities for analyzing natural characteristics and potential pollutant sources. With this expanded capacity, Updated Source Water Assessments (USWAs) with more detailed data, maps, and technical information were completed for roughly 50% of these systems in 2016-2017.

The assessments 1) defined groundwater and surface water source areas which supply public water systems, 2) inventoried each area to determine potential sources of contamination, and 3) determined the most susceptible areas at risk for contamination. For surface water systems, DEQ prioritized the 52 coastal community water systems under the rationale that these systems are challenged by geographic setting, climate and geology, and seasonal tourism in ways that other areas in Oregon do not necessarily experience. For watersheds with more than one intake, Oregon completed the original SWAs by stream or river segment. Each SWA represents the area from the public water system's intake to the next intake upstream. All protection areas for

intakes upstream of a water system's intake are included in its drinking water source area. Activities and impacts in the source area for upstream water users also have the potential to impact downstream water users (Oregon DEQ 2021).

As part of the USWAs, DEQ developed a statewide land use/ownership Geographic Information Systems (GIS) layer to evaluate land cover in drinking water source areas. Maps for each individual public water system are provided in that system's USWA report. Information from the SWAs for surface water systems is available to the public via a database maintained jointly by the DEQ and OHA. In 2018, after consulting with stakeholders, the DEQ also finalized a Surface Water Resource Guide to provide additional technical assistance and information to surface water community water systems (Oregon DEQ 2018c). This document (and a companion Groundwater Resource Guide) will continue to be updated and improved as source water protection efforts in Oregon move forward. The USWAs and Resource Guides are ultimately intended to assist public drinking water providers, community governments, and others in the development of community-based Drinking Water Protection Plans to protect their upstream source waters.

Several rural water providers in Oregon have voluntarily worked with the Oregon Association of Water Utilities (OAWU) to take advantage of the USDA-FSA SWPP. Most of utilize groundwater, but some are surface water systems. The protection plans are based on interviews with water utility personnel, local managers and landowners, information from the SWA or USWA, and a visit to the source water intake and source watershed. The plans include:

- A map of the planning area;
- An inventory of potential contaminant sources, and characteristics and sensitivity of the source water;
- A definition of areas and community profile that align with participating local entities and organizations;
- A definition of voluntary measures and best management practices that may be initiated;
- Identification of public education initiatives, entities and resources to facilitate plan implementation and sustainability; and
- A contingency and emergency response plan in the event of problems with the local drinking water supply. (Collier 2018.)

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Pesticides are products used to control pests - organisms that are harmful to humans or human concerns. Target pests include weeds, insects, plant pathogens, molluscs, birds, mammals, fish, nematodes and microbes that impact crops or other property, displace or harm native species, or spread disease. The term pesticide encompasses herbicides, insecticides, rodenticides, nematicides, fungicides, molluscicides, piscicides, avicides, bactericides, insect repellents, animal

repellents and antimicrobials. Herbicides applied to control weeds or other unwanted plant species account for approximately 80% of all pesticide use.

In addition to providing a range of benefits, pesticides can also be toxic to humans and other species. Potential human risks range from short-term toxicity to long-term effects such as cancer and reproductive system disorders. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requires that any product used to kill or otherwise control pests cannot be sold, distributed or used unless it is registered (licensed) by EPA. This registration is a scientific, legal, and administrative procedure through which EPA examines

- The ingredients of the pesticide;
- The particular site or crop where it is to be used;
- The amount, frequency, and timing of its use; and
- Storage and disposal practices.

In evaluating a pesticide registration application, EPA assesses a wide variety of potential human health and environmental effects associated with use of the product. The company that wants to produce the pesticide must provide data from studies that comply with EPA testing guidelines. EPA develops risk assessments that evaluate the potential for 1) harm to humans, wildlife, fish, and plants, including endangered species and non-target organisms; and 2) contamination of surface water or ground water from leaching, runoff, and spray drift (USEPA 2021a).

The primary objective of FIFRA is to ensure that, when used in accordance with their approved labeling, pesticides will not generally cause unreasonable adverse effects to human health or the environment.

To reach this objective, FIFRA requires EPA to establish a range of standards and requirements for pesticides once they are registered, including their labeling and packaging, worker protection standards, and the authority of states to implement, augment and enforce FIFRA.

The FIFRA stipulates that all registered pesticide products must display labels that show the following information clearly and prominently:

- Name, brand, or trademark product sold under
- Name and address of the producer or registrant
- Net contents
- Product registration number
- Producing establishment's number
- Ingredient statement
- Warning or precautionary statements
- Directions for use
- Use classification

Directions for use often include specific instructions regarding use of the pesticide in proximity to streams and other water bodies, intended to minimize the chance of pesticide drift or movement through surface or subsurface flow into the water body. A key Best Management Practice (BMP) for pesticide use is to adhere to these instructions rigorously (Michael 2004).

Individual states may further restrict the sale or use of any registered pesticide but may not permit any sale or use prohibited by FIFRA. A State may register additional uses of a federally registered pesticide to meet local needs unless EPA previously denied, disapproved, or canceled such use. States have primary enforcement responsibilities for pesticide use violations if EPA determines that the state has adopted and is implementing adequate pesticide use laws and regulations, enforcement procedures, and recordkeeping and reporting requirements. It is unlawful for States to impose or continue in effect any requirements for labeling or packaging in addition to or different from those required under FIFRA (USEPA 2021a).

FIFRA and the SDWA

Disinfectants that are sold to treat drinking water must be registered as pesticides under FIFRA.

Other examples of pesticides that must be registered include piscicides (substances used to kill fish) used to pre-treat water, and algaecides, bactericides and molluscicides. The label of a registered pesticide will state whether the pesticide can be used in drinking water.

Under SDWA, public water systems are required to treat drinking water for bacteria, among other contaminants. Public water systems that use disinfectants to treat for microorganisms such as bacteria must ensure that the disinfectant is registered under FIFRA. Registration/compliance under FIFRA does not mean that a product meets the requirements of other environmental and public health protection statutes, including the SDWA, or vice versa. Further, FIFRA registration/compliance does not mean that the product meets state or tribal laws regarding drinking water products for use by PWSs.

The Safe Drinking Water Act (SDWA) generally imposes requirements on Public Water Systems (PWSs), not on product manufacturers. As a result, there is no disinfectant product approval, registration, or license under the SDWA. However, some states, tribes or territories may have such requirements. For example, many states require that products used for treating drinking water be certified by the National Sanitation Foundation (NSF) International. NSF International does not confirm a product's registration status as a part of its certification process (USEPA 2021b).

EPA Human Health Benchmarks for Pesticides (HHBP)

Advanced testing methods now enable the detection of pesticides in water at very low levels. Small amounts of pesticides detected in drinking water or drinking water sources do not necessarily indicate a health risk. EPA has developed human health benchmarks for 430 pesticides to aid in assessing: (1) whether the detection level of a pesticide in drinking water or

drinking water sources may indicate a potential health risk; and (2) the prioritization of water monitoring efforts.

The HHBP table includes noncancer benchmarks for exposure to pesticides that may be found in surface or ground water sources of drinking water. Noncancer benchmarks for acute (one-day) and chronic (lifetime) drinking water exposures to each pesticide were derived for the most sensitive life stage, based on the available information. The table also includes cancer benchmarks for 48 pesticides that have toxicity information that indicates the potential to lead to cancer. The HHBP table includes pesticides for which EPA's Office of Pesticide Programs has available toxicity data but for which EPA has not yet developed either enforceable National Primary Drinking Water Regulations (e.g., maximum contaminant levels) or non-enforceable Drinking Water Health Advisories (USEPA 2021c).

Implementation of FIFRA in Oregon

The Oregon Department of Agriculture (ODA) is the state's lead agency for pesticides, including implementation of FIFRA. In addition to ODA, state agencies with statutory authority for development and enforcement of water quality policies related to pesticides include the Oregon Department of Environmental Quality (DEQ), the Oregon Department of Forestry (ODF), the Oregon Health Authority (OHA), and the Oregon Watershed Enhancement Board (OWEB). Under FIFRA, the EPA encourages states to develop and implement pesticide management plans (PMPs). Oregon's Water Quality Pesticide Management Team (WQPMT) - comprised of representatives from the state agencies listed above and from Oregon State University (OSU) - completed the state's PMP and EPA approved it in 2011. The plan outlines the roles, policies, and legal authorities of each government agency with the responsibilities for protecting Oregon's water resources from pesticides and the process by which these activities will be coordinated.

The WQPMT currently facilitates and coordinates water quality activities such as monitoring, analysis and interpretation of data, effective response measures, and management solutions. WQPMT goals and objectives:

- Identify and prioritize higher risk pesticides, use patterns, and watersheds
- Facilitate water quality monitoring plans, resources, and activities
- Annually evaluate pesticide water monitoring results
- Facilitate management solutions and outreach and educational activities through local stakeholder groups to prevent or reduce pesticide contamination in water
- Improve communication with state and federal agencies, farmers, commodity groups, OSU Extension, environmental groups, industry, local water entities, and others about pesticides and water quality
- Measure progress and try new strategies if necessary

Pesticide stewardship partnerships (PSPs) in Oregon use local expertise combined with water quality sampling results to promote voluntary changes in pesticide use practices that result in improvements to water quality that benefit human health and aquatic life. There are currently nine PSPs in Oregon, mainly in areas with significant industrial agriculture other than forestry. Statewide, most pesticide monitoring is conducted under these nine PSPs. There is currently not a PSP in the MCWPP planning area (ODA 2021).

Pesticides of concern in Oregon

Nationwide, state agencies originally compiled a list of 57 active ingredients or groups of active ingredients that were most likely to affect water quality. The WQPMT added additional pesticides that had the potential to raise concerns in Oregon, for a current total of 72. Of these 72 active ingredients, WQPMT annually selects a subset of this list for further evaluation.

In 2019, the WQPMT modified its methodology to assess the status of pesticides detected in Oregon's waterbodies, based on the concentration of a pesticide and the frequency at which it is detected. The analysis is conducted for each watershed participating in a PSP and provides for watershed-specific designations of *Pesticides of High Concern* (PHC), *Pesticides of Moderate Concern* (PMC), and *Pesticides of Low Concern* (PLC). If a pesticide is determined to be a PHC in 30% or more of the participating watershed, it is designated as a statewide PHC (ODA 2021).

Statewide pesticides of High Concern, 2018-20

Chlorpyrifos
Diazinon
Diuron
Imidacloprid
*Metsulfuron-methyl
Oxyfluorfen

Statewide pesticides of Moderate Concern, 2018-20

*Atrazine
Bifenthrin
Carbaryl
Chlorothalonil
Dimethenamid-p
Dimethoate
Ethoprop
*Glyphosate
Linuron
Malathion
Metolachlor
Pendimethalin
Prometryn
Pyripoxfen
Simazine
*Sulfometuron methyl
2,6-dichlorobenzamide (degradate of Dichlobenil)
AMPA (degradate of Glyphosate)

Pesticides and forestry: The Forest Activity Electronic Notification and Reporting System

Aside from industrial forestry, commercial agriculture is limited within the MWCPP planning area. Pesticides marked with an asterisk* in the lists above, all of which are herbicides, are used in industrial forestry in western Oregon. These herbicides are applied almost exclusively just prior to and/or just after harvesting in order to reduce vegetation that competes with tree seedlings planted to re-establish the forest stands. Re-establishing forest stands on clearcut industrial forestland within 24 months after harvest is required by Oregon state law under the Forest Practices Act (FPA) (Souder et al. 2021).

The Oregon Forest Practices Act (FPA) requires forest landowners and operators to notify the ODF at least 15 days before they begin forest operations on any nonfederal lands in Oregon. "Forest operations" include a range of harvesting, road work, site preparation actions, and also application of forest chemicals including pesticides. The Notification of Operations and Application for Permit (NO/AP) process is conducted through the ODF Private Forests and Protection from Fire divisions. In 2014 the ODF updated the NO/AP process by implementing its Forest Activity Electronic Notification and Reporting System (FERNS), a web-based, centralized database of all forestry operations subject to ODF oversight. The FERNS application is integrated with the state's GIS system. Any interested person or party can subscribe to FERNS and receive electronic notifications of pending forest operations, including applications of chemicals, in their area. Subscribers can also review and submit official comments about the forest operation work plans. Online subscriptions to FERNS are free.

The Pesticide Analytical and Response Center (PARC)

The EPA defines a *pesticide incident* as any exposure or effect from a pesticide's use that is not expected or intended. Pesticide spills can also be a type of incident. To address pesticide incidents, Oregon's Pesticide Analytical and Response Center (PARC) was created in 1978 and reauthorized in 1991 under the ODA. The PARC is mandated to perform the following activities with regard to pesticide-related incidents in Oregon that have suspected health or environmental effects:

- Collect incident information
- Mobilize expertise for investigations
- Identify trends and patterns of problems
- Make policy or other recommendations for action
- Report results of investigations
- Prepare activity reports for each legislative session.

The PARC has no regulatory authority. Its primary function is to coordinate investigations to collect and analyze information about reported pesticide incidents. This information is used to identify trends and patterns then make recommendations, when warranted, to state agencies including public education and industry consultation, regulatory and legislative changes, and

other actions. Member agencies usually conduct the investigations and take any necessary enforcement action(s). These agencies are: Oregon Health Authority (OHA), Oregon Department of Fish and Wildlife (ODF&W), Oregon Department of Environmental Quality (DEQ), Oregon Department of Forestry (ODF), Oregon Occupational Safety and Health Administration (OR OSHA), Office of the State Fire Marshal (SFM), Oregon Poison Center (OPC), and Oregon Department of Agriculture (ODA).

Federal forest land management and drinking water

Overview

From the 1950s through the 1980s, much of the federal forest land base was managed with a focus on timber production. In the 1990s, federal forest management shifted toward aquatic and terrestrial habitat protection, and provision of ecosystem services such as high-quality water. The following section outlines the increasingly detailed guidance for protection and maintenance of municipal drinking water sources on federal forest land that has accompanied this shift in management focus.

The Northwest Forest Plan and Aquatic Conservation Strategy

The 1994 Northwest Forest Plan (NWFP) marked a major reorientation in management focus for central and western Oregon national forests from timber production to ecosystem-based, landscape-level biodiversity and habitat conservation. These goals are addressed via an extensive network of riparian and old-growth reserves with some timber harvest allowed on intervening lands where it is still an important, but usually secondary objective. Today, timber harvested on lands within the NWFP area comes mostly from thinning rather than regeneration cutting, and represents only a small percentage of pre-NWFP harvest volumes (Simončič et al. 2015; Thomas et al. 2006).

The Aquatic Conservation Strategy (ACS) guides management of riparian and aquatic ecosystems on federal forest lands within the NWFP area. The goals of the ACS are to 1) maintain and restore ecological processes that create and maintain habitat for native aquatic and riparian species; and 2) provide sources of high-quality water, recreation, and other ecological benefits. The ACS has five components: 1) watershed analysis; 2) riparian reserves; 3) key watersheds; 4) watershed restoration; and 5) standards and guidelines for management activities (USDA and USDI 1994).

Riparian reserves encompass watershed areas that are ecologically closely linked with streams and rivers. The reserves are two site potential tree-heights wide (minimum of 300') on fish-bearing streams and one site-potential tree-height wide on non-fish-bearing streams. On some larger waterways, the 100-year floodplain serves as the reserve boundary. *Tier 1* key watersheds (a total of 141, covering 8,154,500 acres) are refugia for aquatic organisms or have high

restoration potential. *Tier 2* key watersheds (a total of 23, covering 1,112,000 acres) are sources of high-quality water (USDA and USDI 1994). Most Tier 2 watersheds were designated based on their value as drinking water sources.

The 2012 planning rule for national forests

This rule sets out updated requirements for National Forest System (NFS) unit management plans and includes several provisions related to drinking water. Every plan must identify lands within the planning area that are not suitable for timber production, and watersheds that are a priority for maintenance or restoration. The plan must include components (e.g. standards or guidelines) to maintain or restore public water supplies, source water protection areas and other drinking water sources, including prevention or mitigation of impacts to quantity, quality, and availability. Plans must establish width(s) for riparian management zones around all lakes, perennial and intermittent streams, and open water wetlands, giving special attention to land and vegetation 100' from the edges of all perennial streams and lakes. The plan must ensure implementation of national water quality BMPs established by the USFS Chief in the Forest Service Directive System. When developing plan components for integrated resource management, public water supplies and associated water quality must be considered (National Forest System Land Management Planning 2012).

USDA Forest Service Manual Direction

The Forest Service Manual (FSM) codifies authorities, objectives, policies, responsibilities, and guidance that USFS line officers and staff use to plan and execute assigned programs and activities. FSM 2500 (Watershed and Air Management), Chapter 2540 (Water Uses and Development), Section 2542 (Municipal Supply Watersheds) lists the objective to manage National Forest System (NFS) lands for multiple uses by balancing present and future resource use with domestic water supply needs. Managers are directed to meet this objective by identifying watersheds serving as principal community water sources and developing case-specific prescriptions for each. Specific policy direction is given to "not rely on management practices to provide pure drinking water", but rather to "use only proven techniques in management prescriptions for municipal supply watersheds" (USDA Forest Service 2007).

Forest supervisors must maintain detailed, up-to-date inventories of municipal watersheds, including number of users in each, total acres of the watershed and percent in USFS ownership, amount and percent of annual flow withdrawn, alternative sources available to users, and any contingency plans for emergencies. Supervisors also develop and coordinate measures necessary for management of these watersheds, and post and inform the public of restrictions in them, including reasons for the restrictions. Factors to be evaluated in forest planning where municipal supply watersheds are an issue include:

- Existing water resource conditions as determined by a hydrologic investigation.
- Current uses, values, and management requirements for other resources in the watershed.

- Projection of use in the watershed under multiple-use management practices.
- Current and proposed handling and treatment of water by the municipality, or other water user, after water is diverted from the municipal supply watershed.
- The extent to which use within the watershed can be regulated, including percent of national forest land within the watershed, accessibility, private land development, and mining activity.
- Adjustments of normal multiple-use management practices required to meet municipal water supply needs; and economic effects of modifying normal management practices.

Forest management plans must show municipal supply watersheds as special management areas when management intensity and timing differ from other areas. The plans must also include:

- A statement of objectives for managing the water resources on and flowing from the watershed, including quality, quantity, and timing criteria for the water resource.
- A display showing the proportion of total streamflow used for municipal purposes, the location and size of the municipal supply watershed and associated reservoirs, and the type and amount of permitted public uses at water-supply reservoirs.
- Guidelines for protection, management, use, and development, together with coordinating requirements for other uses and activities within the watershed.
- Guidelines for monitoring uses, activities, and water quality characteristics that may be affected by forest management activities.

When a municipality desires protective actions or restrictions not specified in the forest plan, it must apply to the USFS for consideration of these needs. If deemed appropriate by the Regional Forester, requested restrictions may be incorporated in the forest plan without written agreements. In other cases, when multiple-use management fails to meet municipality needs, the forest supervisor may consider formal agreements under 36 CFR 251.9 - Management of Municipal Watersheds. Such agreements to assure protection of water supplies are used only when requested by the municipality and deemed necessary by the Regional Forester. A special use authorization may be needed which specifies the types of uses, if any, to be restricted; the nature and extent of any restrictions; any special land management protective measures and/or any necessary standards and guidelines needed to protect water quality or quantity; and resources to be provided by the municipality. Special use authorization is required for the municipality to use subject lands, restrict public access, or control resource uses within the watershed (USDA Forest Service 2007).

FSM Section 2532 – Water Quality Management – lists the specific objective to ensure safe drinking water for public use on national forests, and a policy to establish and apply the National Best Management Practices (BMPs) Program to all land and resource management activities as the method of control for non-point sources of water pollution to achieve Federal, State, Tribal, or local water quality goals. The National BMP Program consists of: 1) a set of

National Core BMPs, 2) standardized monitoring protocols to evaluate BMP implementation and effectiveness, 3) corresponding national direction in the Forest Service Directive System, and 4) a data management and reporting structure. Much of this guidance is coordinated and consistent with EPA standards and protocols for water quality protection, monitoring and data archiving. The BMPs are described in the National Core BMP Technical Guide (USDA Forest Service 2012) and are often adapted for specific local conditions and needs.

All USFS agency-owned drinking water systems operated by permittees or by USFS personnel must be operated in compliance with the SDWA and requirements of the state in which each system is located. This guidance is contained in Forest Service Manual chapter 7420 (USDA Forest Service 2010a) and a regional supplement for USFS Pacific Northwest Region 6 (USDA Forest Service 2010b.) Requirements for USFS-owned drinking water systems evolve over time as new laws and regulations are implemented to assure the safety of drinking water.

The USFS National Watershed Condition Framework

Introduced in 2010, the National Watershed Condition Framework (WCF) is a strategic and systematic approach to guiding USFS watershed restoration programs and activities. Initially, the state of physical and biological characteristics and processes that affect soil and hydrologic functions supporting aquatic ecosystems in the watershed is assessed and the watershed is classified as 1) functioning properly; 2) functioning at risk; or 3) functioning impaired. Depending on current function and uses, values affected, restoration potential, the urgency of actions needed, partner interests and other local factors, watersheds are then prioritized for maintenance and restoration. Local-level decision making and implementation enable communities to determine how to best steward their forests and capitalize on the benefits of improving watershed condition. Protection of municipal drinking water sources is a key consideration in many WCF projects (USDA Forest Service 2018a.)

The Drinking Water Providers Partnership is a collaboration of the Geos Institute, USFS Region 6 (Oregon and Washington), Oregon DEQ, the Washington Department of Health, U.S. EPA Region 10, the U.S. Bureau of Land Management OR/WA Office, and WildEarth Guardians. Since 2016, this program has provided 22 grants in Oregon to cooperatively fund watershed restoration projects in WCF Priority Watersheds that are sources of drinking water. These projects jointly improve fish habitat.

Drinking water source protection provisions in the 2018 Farm Bill

The farm bill is an omnibus, multiyear law that governs an array of agricultural, food and conservation programs and provides policymakers an opportunity to comprehensively address emerging issues. The 2018 Farm Bill amended the 2003 Healthy Forests Restoration Act (HFRA) with a new Water Source Protection Program (Title VIII, Subtitle D, SEC. 8404) targeted toward protection and restoration of drinking water sources on National Forest System land. The bill authorized appropriation of $10 million in funding to carry out the new program for each fiscal year 2019-2023.

The USFS uses the SDWA definition of a municipal watershed: an area that serves a public water system that provides water for human consumption, has at least 15 service connections, or regularly provides water to at least 25 people. Designation of municipal watersheds on USFS lands recognizes the need to protect public water supplies. For some communities, wells outside the national forest are the primary water source, but wellhead protection zones may extend onto USFS lands.

Municipal watersheds on USFS land may be managed for multiple uses so long as management activities do not degrade water quality. All USFS agency-owned drinking water systems must be operated in compliance with the SDWA and requirements of the state in which each system is located. This policy applies to both USFS owned water systems operated by permittees and those operated by USFS personnel. This guidance is contained in Forest Service Manual chapter 7420 (USDA Forest Service 2010a) and a regional supplement for USFS Pacific Northwest Region 6 (USDA Forest Service 2010b.) Requirements for USFS-owned drinking water systems evolve over time as new laws and regulations are implemented to assure the safety of drinking water.

Agreements between the USFS and the State of Oregon to protect drinking water sources

The USFS Region 6 and the state of Oregon have an MOU to cooperate and coordinate in implementing the CWA and SDWA and protect, restore and maintain the physical, chemical and biological conditions of Oregon's "Waters of the State" that support beneficial uses, including drinking water (USDA Forest Service 2014). Some municipal watersheds on USFS land in Oregon are managed under agreements between the local municipality supplied by that watershed and either the Secretary of Agriculture or the USFS. In such cases, actions that could degrade water quality are either prohibited or are subject to approval by the respective city (USDA Forest Service 2018b). These agreements can take different forms, depending on the history and issues specific to each municipality and watershed. Formal agreements under 36 CFR 251.9 - Management of Municipal Watersheds – are summarized above.

The Endangered Species Act (ESA)

Overview

The federal Endangered Species Act (ESA) of 1973 provides a regulatory framework to conserve, protect and recover endangered and threatened species and the ecosystems upon which they depend. When a species is listed as *endangered* under the ESA, it means that species is in danger of extinction throughout all or a significant portion of its range. Being listed as *threatened* means the species is likely to become endangered within the foreseeable future. *Candidate* species have been studied and warrant being proposed for listing as threatened or endangered.

Sensitive species need special management to maintain and improve their status and prevent a need for listing under the ESA.

The ESA requires that listing determinations be based solely on the best scientific and commercial (e.g., catch data) information available. Consideration of economic impacts when making species listing determinations is prohibited. For terrestrial and freshwater organisms, the ESA is administered primarily by the U.S. Fish and Wildlife Service (USFWS). For marine species including whales and other mammals, and also anadromous fish such as salmon, the ESA is administered by the U.S. Department of Commerce National Marine Fisheries Service (NMFS). After 1970, when it was moved to Commerce's newly formed National Oceanic and Atmospheric Administration (NOAA), the NMFS has been referred to as NOAA Fisheries.

Concurrently with listing a species, the ESA requires these agencies - "to the maximum extent prudent and determinable"- to designate *critical habitat* for the species. Critical habitat determinations must be based on the best science information available but differ from listing determinations in that they must also account for economic effects. Critical habitat is the area occupied by the species when it is listed that contains physical or biological features essential to conserving the species and that may require special management or protection, as well as specific areas not occupied by the species when it is listed that are essential for conserving the species. Critical habitat designations affect only federal agency actions or federally funded or permitted activities. The law requires other federal agencies, in consultation with the USFWS and/or NOAA Fisheries, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species.

The ESA also prohibits under Section 9(a)(1) any action that causes a "taking" of any listed species of endangered fish or wildlife. "Take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." Section 4(d) of the ESA requires the agencies to promulgate regulations specifically tailored to protect threatened species. These regulations often simply extend the prohibitions for endangered species to threatened ones, except that prohibitions on taking the species may be limited by a cooperative agreement with a state. The USFWS promulgated a rule - the "blanket 4d rule" - which extends the prohibitions for endangered species to threatened species unless the agency promulgates a specific Section 4(d) rule for the species. NOAA Fisheries has taken a different approach and aims to promulgate a specific Section 4(d) rule for each threatened species (Ward 2019).

Many species in need of protection are composed of multiple subspecies. In these cases, a key goal is to identify and protect diversity within the species to maintain viable populations. Recognizing this, Congress amended the ESA in 1978 to permit the listing of "distinct population segments" as well as entire species. But Congress provided little guidance on how to distinguish these distinct population segments. In the 1990s, NOAA Fisheries biologists charged with assessing populations of Pacific Northwest salmonids refined a framework to do so based on

evolutionarily significant units (ESUs) within these species. An ESU is a population of organisms that is considered distinct for purposes of conservation. To be considered an ESU the population had to 1) be "substantially reproductively isolated" from other populations, and 2) represent "an important component in the evolutionary legacy of the species." Using a combination of geographic, ecological, and genetic data, these biologists described 51 ESUs for the 7 species of anadromous Pacific Northwest salmonids (DeWeerdt 2002).

The ESA's ultimate goal is to "recover" species so they no longer need protection and can be removed from being listed as endangered or threatened. Recovery plans describe the steps needed to restore a species to ecological health. USFWS or NOAA Fisheries biologists write and implement recovery plans with the assistance of species experts; other Federal, State, and local agencies; Tribes; nongovernmental organizations; academia; and other stakeholders (USEPA 2021d; USFWS 2021).

ESA considerations within the MCWPP planning area

Prohibition of certain activities to protect species listed as threatened or endangered under the ESA could affect mid-coast water planning and water supplies in various ways. Maintenance of good water quality is usually integral to ESA provisions aimed at protecting habitats for aquatic species, and also a key goal for municipal water users. Abell et al. (2019) note that protecting drinking water at its source relies primarily on maintaining nature's ability to capture, infiltrate, store, and filter water and that these functions are also critical for numerous riparian and aquatic species. They found that areas that serve as drinking water sources also often have high biodiversity values and point to the efficiencies that may accrue from optimizing for multiple benefits simultaneously. Abell et al. (2019) focused on conserving biodiversity by leveraging investments in drinking water source protection. But this synergy can work both ways- their work also indicates the potential to leverage investments in aquatic habitat improvement to help protect drinking water quality.

However, in other instances ESA provisions for aquatic habitat protection may not be as consistent with the goals of water users. For example, protection of instream flow volumes to maintain aquatic habitat quality may result in restrictions on the amount of water available for withdrawal from some streams. Any such issues or conflicts would likely be most acute in late summer when seasonal low flows and the greatest risk for stream temperature exceedances that impact ESA listed fish intersect with what is often the time of greatest water demand in coastal Oregon communities.

The most common and significant intersections of the ESA and mid-coast water planning are likely to be in the realm of actions taken to protect and restore the Oregon Coast Coho salmon *(Oncorhynchus kisutch)* ESU. This and other salmon species are iconic and both culturally and economically significant in Oregon but have been drastically reduced in abundance due to a combination of freshwater habitat alteration and loss, overharvesting, effects of hatchery fish, and other factors. Because salmonids range from the open ocean through estuaries to

headwater streams over their life histories, addressing these issues is very complex. Defining distinct populations, then assessing their viability and future prognoses is difficult, controversial, and fraught with uncertainty, as indicated by the shifts in ESA policies related to the Oregon Coast Coho salmon ESU summarized below.

After a comprehensive status review in 1995, NOAA Fisheries proposed listing the Oregon Coast Coho salmon ESU as threatened. Since then, the agency completed several additional status reviews for the species, and its ESA listing classification has changed back and forth between threatened and not warranted for listing several times. These shifts occurred in response to new science information and to legal determinations under lawsuits by plaintiffs both supportive of listing (Oregon Natural Resources Council; Trout Unlimited) and against listing (Alsea Valley Alliance). At issue in these lawsuits were the status of hatchery fish in relation to the ESU, the future prognosis of the ESU, and what constituted "best available science" used to support agency decisions. Also during this time, the State of Oregon sought to avoid listing of the Oregon Coast Coho salmon ESU, while still working to recover the species. These efforts included the 1997 Oregon Coastal Salmon Restoration Initiative, later renamed the Oregon Plan for Salmon and Watersheds (Oregon Plan), the 2002 Oregon Native Fish Conservation Policy, the 2005 Oregon Coastal Coho Assessment, and the 2007 Oregon Coast Coho Conservation Plan.

Despite the State's efforts, in 2008 NOAA Fisheries once again found that listing the Oregon Coast Coho salmon ESU as threatened was warranted and designated critical habitat for the species at this time. Critical habitat includes reaches in dozens of streams in the following watersheds that are within or drain into the MCWPP planning area:

- Salmon River/Siletz/Yaquina Bay Watershed
- Upper Yaquina River Watershed
- Middle Siletz River Watershed
- Lower Siletz River Watershed
- Upper Alsea River Watershed
- Lower Alsea River Watershed
- Beaver Creek/Waldport Bay Watershed
- Yachats River Watershed
- Lower Siuslaw River Watershed

In 2008, NOAA Fisheries also established protective regulations that apply under ESA Section 4(d) including ESA section 9(a)(1) take and other prohibitions. The agency has a policy to identify, to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of Section 9 of the ESA. Activities that may harm the Oregon Coast coho ESU resulting in a violation of the Section 9 take and other prohibitions that may also intersect with water quality include, but are not limited to:

- Land-use activities that degrade habitats for the Oregon Coast coho ESU (e.g., logging, grazing, farming, urban development, road construction in riparian areas and areas susceptible to mass wasting and surface erosion);
- Destruction/alteration of the habitats for the Oregon Coast coho ESU, such as removal of large woody debris and "sinker logs" or riparian shade canopy, dredging, discharge of fill material, draining, ditching, diverting, blocking, gravel mining, or altering stream channels or surface or ground water flow;
- Discharges or dumping of toxic chemicals or other pollutants (e.g., sewage, oil, gasoline) into waters or riparian areas supporting the Oregon Coast coho ESU;
- Violation of discharge permits;
- Application of pesticides affecting water quality or riparian areas for the Oregon Coast coho ESU.

Actions that NOAA Fisheries concluded would not, to the best of their knowledge, result in violation of the Section 9 take and other provisions include federally funded or approved projects that involve activities such as silviculture, grazing, mining, road construction, dam construction and operation, discharge of fill material, stream channelization or diversion for which ESA Section 7 consultation has been completed, and when activities are conducted in accordance with any terms and conditions provided by NMFS in an incidental take statement accompanying a biological opinion.

In 2011, after another status review, the agency issued a final determination to retain the threatened listing. In making these determinations, NOAA Fisheries indicated that the capacity of, and efforts being made to by the State of Oregon to protect the species did not provide sufficient certainty of implementation or effectiveness to mitigate the assessed level of extinction risk. The threatened listing for the Oregon Coast Coho salmon ESU was retained under the most recent status review in 2016 and remains in effect at this writing, as do the critical habitat designations and protective regulations for the species.

In coordination with ODFW, NOAA Fisheries developed the Oregon Coast Coho Salmon Recovery Plan, finalized in December 2016. In that plan, NOAA Fisheries indicates that out of 28 west coast salmonids listed under the ESA, the Oregon Coast coho is one of the closest to recovery. Since the species was listed in 1998, key threats such as hatchery practices and harvesting have been abated through concerted efforts by numerous parties. While annual returns fluctuate greatly with variable ocean conditions, as of 2016 more native coho were returning to the Oregon Coast than at the time of listing. NOAA Fisheries anticipates that a focused, effective recovery implementation strategy could serve as the final catalyst for recovering and delisting the species (NFMS 2016b).

Coastal Nonpoint Pollution Control Program

The 1972 Coastal Zone Management Act (CZMA) provides a formal structure to address the challenges of continued population growth and development in coastal areas. The CZMA is focused on ensuring access to clean water and healthy ecosystems that support strong coastal economies by integrating science, technology, and public policy. Administered by the National Oceanic and Atmospheric Association (NOAA), the goals of the CZMA are to "preserve, protect, develop, enhance, and restore where possible, the coastal resources" (NOAA 2018).

The Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) included a new Section 6217, "Protecting Coastal Waters", requiring each state with a coastal zone management program approved under section 306 of the CZMA to develop and implement a Coastal Nonpoint Pollution Control Program (Coastal Nonpoint Program) to prevent and control polluted runoff. Oregon's Coastal Nonpoint Program is administered by the Department of Land Conservation and Development (DLCD). Most regulations in the program were developed as state rules not related to CZARA, such as Department of Environmental Quality (DEQ) water quality regulations; Department of State Lands (DSL) Wetland Program; the Oregon Forest Practices Act (OFPA); Department of Agriculture (ODA) water quality management plan requirements; and Water Resources Department (WRD) requirements for water use, and dam construction and operation (DLCD 2021).

Section 6217 of the CZARA requires coastal states to implement nonpoint source pollution management measures developed by the EPA. These measures are organized into two tiers and encompass activities in farming, forestry, urban areas, marinas, areas near rivers and streams, and wetlands. The first tier is intended to protect coastal waters generally and therefore is not linked to specific water quality problems. If the first tier does not enable coastal waters to meet water quality standards and protect designated uses, then the state must implement a second tier of management measures. The second tier of "additional" management measures is targeted specifically at restoring coastal waters so as to attain and maintain applicable water quality standards under section 303 of the Clean Water Act (CWA) and to protect beneficial water uses designated by the state (NOAA and EPA 1993). Beneficial uses are designated for each of Oregon's waters in the Oregon Administrative Rules for water quality standards. These "waters of the state" include all surface waters except those on private land which do not include or border any natural waters. (Oregon Legislative Counsel Committee 2017.) For Oregon's coastal waters, designated beneficial uses include "public domestic water supply" in all streams and rivers inland from the estuary or head of tidewater influence (Oregon DEQ 2018).

Section 6217 also requires each coastal state to submit their coastal nonpoint program - which lays out how they intend to implement their pollution management measures - to the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA) for approval. Failure to submit an approvable program can result in a state losing a portion of its Federal funding under section 306 of the CZMA and section 319 of the CWA.

As required by the CZARA and CWA, Oregon submitted its Coastal Nonpoint Program in 1995. In 1998, the NOAA and EPA conditionally approved Oregon's program. Full approval was to be granted if and when the state met a number of specific conditions. The conditions required application of EPA management measures to address impacts stemming from a range of activities including agriculture, forestry, urban development, highways and bridges, marinas, stormwater and waste management, and construction sites. In regards to forestry, the NOAA and EPA found that the following additional management measures were necessary to meet applicable water quality standards and fully protect beneficial uses:

- Protect riparian areas for medium-sized and small fish-bearing (type "F") streams and non-fish-bearing (type "N") streams
- Address the impacts of forest roads, particularly so-called "legacy" roads
- Protect high-risk landslide areas
- Ensure adequate stream buffers for the application of herbicides, particularly on non-fish bearing streams

These measures were specifically focused on protecting streams from timber harvesting impacts, controlling runoff from old forest roads and landslide-prone areas, and guarding streams against aerial herbicide spraying (House 2016). In their rationale for the forestry related findings, the federal agencies focused on water quality standards necessary for spawning and survival of salmonid fish, and on protecting beneficial uses, which include municipal water supplies (NOAA and EPA 1998). In more recent documentation regarding the need for the additional measures, the agencies explicitly referred to impacts on drinking water quality in their discussion of aerial application of herbicides (NOAA 2015).

Working with the federal agencies, Oregon subsequently met nearly all of the conditions laid out in 1998 by incrementally modifying its program over time. But the state faced challenges in meeting conditions related to development, onsite sewage disposal, and forestry. In 2009, Northwest Environmental Advocates (NWEA) sued the NOAA and EPA for violating CZARA provisions requiring the agencies to withhold a percentage of CWA and CZMA funding from states that fail to submit approvable nonpoint source programs. The plaintiffs alleged that despite Oregon's failure to submit an approvable program, the federal agencies had not disapproved the program or withheld grant funds (as required by CZARA) and that as a consequence, Oregon had not improved its forest practices sufficiently to protect coastal water quality (NWEA 2010). In 2010, the Oregon US District Court directed the NOAA and EPA to either fully approve or disapprove Oregon's nonpoint program by May 15, 2013 (NWEA v. Locke et al. 2010).

In 2013, the NOAA and EPA signaled their intent to find that the state had not fully satisfied the conditions related to new development, onsite sewage disposal systems, and additional management measures for forestry. In 2014, Oregon supplied additional documentation in

support of its nonpoint program. In 2015, the federal agencies found that the state had met the conditions for new development and onsite sewage disposal systems, but not for forestry. As a result, the agencies disapproved Oregon's Coastal Nonpoint Program, triggering a 30% holdback of Oregon's Section 306 funds – a loss of $1.2 million from roughly $4 million in annual federal grant funding that the state had been using to address coastal pollution (NOAA 2015; House 2016). These funds will be withheld until the state's coastal nonpoint program is approved. The EPA and NOAA also expressed concern over the Oregon Department of Agriculture (ODA) enforcement program for nonpoint source pollution on agricultural lands. This concern was not used as a basis for disapproval, but the agencies stated they will revisit the issue the next time they review the state's program for compliance.

In a 2016 review of Oregon's coastal program, NOAA found that owing to the funding cut, Oregon has not been able to fill staff and technical support positions, and that the program can no longer provide planning or technical assistance grants to coastal local governments with Section 306 funding. The coastal program may also have less funding and technical assistance to support other state agency projects to improve coastal management (NOAA 2017). Programs affected are DEQ's nonpoint source reduction program, and Oregon Coastal Management Program (OCMP) planning assistance grants for local governments in the coastal zone. The DLCD reported the loss of two staff positions and $2.6 million accumulated loss of funding for these programs by spring 2019 (Oregon DLCD 2021).

In April 2017, the Oregon Board of Forestry adopted new rules to increase shade buffers on small and medium salmon, steelhead and bull trout fish-bearing streams. Oregon has described the strategies in place to address the remaining additional management measures, but to date the EPA and NOAA have not found them to be acceptable. Discussions have continued between the state and the federal agencies, but no formal assessment has been done since 2015. It is not known when the state will seek a reassessment from EPA and NOAA (Oregon DLCD 2021).

The Oregon Forest Practices Act

The Oregon Forest Practices Act (FPA) is the state's primary regulatory framework for addressing the environmental impacts of forest operations on state and private industrial and non-industrial forest lands. The Forest Practices Act sets standards for all commercial activities involving the establishment, management and harvest of trees in the state. The seven-member Oregon Board of Forestry (BOF) has primary responsibility for interpreting the FPA and setting enforceable forest practice rules "in the public interest" (ORS 527.630(2)). Under ORS 468B.110(2), ORS 527.765, and ORS 527.770, the BOF establishes Best Management Practices (BMPs) or other control measures by rule that, to the maximum extent practicable, will ensure attainment and maintenance of water quality standards.

The Oregon Environmental Quality Commission is a five-member panel of Oregonians appointed by the governor for four-year terms to serve as Oregon Department of Environmental Quality's policy and rule-making board. The Commission has the authority to request rule changes to rules in the FPA, including strengthening protections for soil and waterways. If the Commission does not believe that the FPA rules will accomplish this result, it is authorized to petition the BOF for more protective rules.

When passed in 1971, the FPA was the first legislation of its kind in the U.S. The FPA's first rules were implemented in 1972 and emphasized Best Management Practices (BMPs), which have since been revised repeatedly in response to emerging environmental concerns and science findings. Rules for pesticide use were strengthened in 1977 and again in 1996. In 1983, new rules focused on road and log landing parameters were added in response to heightened concern over road-related landslides in western Oregon. Rules to address landslide risks associated with harvesting in steep areas were more controversial, but were enacted two years later. The issue of linkages between forestry and landslides on steep slopes surfaced again 1996, one of the wettest years on record, when impacts from numerous slides in western Oregon increased public attention on the matter. In 1997, additional restrictions focused on public safety were placed on logging on steep slopes near roads or where people might be present (OFRI 2018a, Langridge 2011). Langridge (2011) describes scientific and policy debates associated with the 1997 rule changes and how the issue was framed primarily in terms of human safety while environmental protection was de-emphasized. As of August 2021, the FPA does not have any water quality protection provisions for operations in landslide-prone areas.

Rules associated with riparian vegetation and buffer strips have arguably been the most contentious and have evolved to the greatest degree. Riparian rules were modified in 1987 and again, more significantly, in 1994. Increasingly comprehensive and integrated science reports on topics such as the cumulative effects of forest practices (Beschta et al. 1995) and the status of salmonids and their habitat (Botkin et al. 1995), coupled with federal direction to mitigate dwindling salmon runs kept pressure on the forestry board to further restrict harvesting in riparian and landslide-prone areas. But the studies also demonstrated the inherent complexity of these issues (Hairston-Strang et al. 2008).

In 2003, Forest Practices Act rules were updated to require the use of higher quality rock or the suspension of log hauling during very wet weather, based on findings from an Oregon Department of Forestry monitoring study on wet season use of forest roads (Robben et al. 2003, ODF 2003).

The most recent Forest Practices Act rule changes were in 2016 and 2017, and include 60-foot no-spray buffers for aerial herbicide use around homes and schools; a new salmon-steelhead-bull trout category of stream classification and wider riparian buffer strips that must be left around these streams, and additional protections for bald eagles (OFRI 2018b). The salmon-steelhead-bull trout rules are the first change to Forest Practices Act riparian rules since 1994. As

of August 2021, The FPA still lacks provisions to protect small, non-fish-bearing, ephemeral and intermittent streams during harvesting.

Forest Practices Act administration and compliance monitoring

Oregon Department of Forestry (ODF) stewardship foresters administer Forest Practices Act rules by working with forest landowners and operators to help them comply with Forest Practices Act requirements. The Oregon Forest Resources Institute publishes a detailed manual to assist with planning and execution of timber harvests that comply with the FPA (Cloughesy and Woodward 2018). The ODF Forest Practices Monitoring Program reviews the effectiveness of the Forest Practices Act and its rules. This program provides science information for adapting regulatory policies and management practices, delivers education and training on FPA rules, assesses whether FPA rules and voluntary guidance sufficiently protect natural resources, and evaluates whether FPA rules are complied with and if voluntary measures are implemented. If FPA violations are identified, ODF starts with education and notices of correction before going into formal enforcement. Citations may be issued requiring cessation of the violating practice until agreement is reached on a mitigation strategy, and a legally binding consent order signed (ODF 2019).

Since 2013, compliance monitoring has been conducted through the ODF Private Forests Monitoring Unit using contractors who audit FPA rules for road construction and maintenance, timber harvesting, some riparian management area measures, measures for small wetlands, and rules for operations near waters of the state. Audits through 2016 found 97% overall compliance (ODF 2018).

The Forest Practices Act also requires forest landowners and operators to notify the ODF at least 15 days before they begin forest operations on any nonfederal lands in Oregon. As defined in the Forest Practices Act, forest operations include timber harvesting, road construction and reconstruction, site preparation, slash treatment, woody biomass removal, chemical application, land use changes, and certain noncommercial forest activities. In addition, permits are required for any operation using power-driven machinery or fire. The Notification of Operations and Application for Permit (NO/AP) process is conducted through the ODF Private Forests and Protection from Fire divisions. In 2014 the ODF updated the NO/AP process by implementing its Forest Activity Electronic Notification and Reporting System (FERNS), a web-based, centralized database of all forestry operations subject to ODF oversight. The FERNS application is integrated with the state's GIS system. Any interested person or party can subscribe to FERNS and receive electronic notifications of pending forest operations in their area. Subscribers can also review and submit official comments about the forest operation work plans. Online subscriptions to FERNS are free.

About 60% of Oregon's forestland is owned by the federal government, about 34% is privately owned (of which 22% is held by owners with 5,000 acres or more and 12% with less than 5,000 acres), 3% is owned by the state, 1% by local government, and 2% by tribes (OFRI 2017).

Because the Forest Practices Act and its rules apply only to nonfederal forestland in Oregon, and to ensure that consistent minimum standards are met, the ODF, U.S. Forest Service, and U.S. Bureau of Land Management agreed that Oregon's forest practice rules would be met or exceeded on federal land in Oregon (Hairston-Strang et al., Adams and Ice 2008). The Clean Water Act requires federal land managers to ensure that their practices will meet state water quality standards, laws, and rules (consistency review). In addition, state forests owned by the Department of State Lands and the forestry board typically exceed Forest Practices Act requirements through their management plans.

Oregon Forest Practices Act rules with particular relevance for drinking water

Arguably, the original Forest Practices Act and most subsequent revisions to it were intended primarily to maintain or improve water quality. But certain sections are more directly related to drinking water than others. Minimizing soil disturbance and erosion potential to protect water quality is fundamental to nearly all Forest Practices Act rules for timber harvesting (Division 630). Other Forest Practices Act sections that are relevant for drinking water include:

Division 620 — Chemical and other petroleum product rules
Division 625 — Forest road construction and maintenance, and several divisions of the water protection rules
Division 635 — Purpose goals, classification and riparian management areas
Division 642 — Vegetation retention along streams
Division 645 — Riparian management areas and protection measures for significant wetlands
Division 650 — Riparian management areas and protection measures for lakes
Division 655 — Protection measures for "other wetlands," seeps and springs
Division 660 — Stream channel changes

Provisions relating to riparian management areas, streamside buffers, and stream crossings for forest roads are often focused on maintaining conditions for coldwater fish species, but domestic water use is also explicitly referenced in the Forest Practices Act stream classification system. Protection of water quality to benefit fish and maintaining safe drinking water sources for humans are not mutually exclusive goals — measures targeted toward either goal often produce benefits for the other (Abell et al. 2019).

The Oregon Forest Practices Act Stream Classification System

The Forest Practices Act protection goal for water quality is to ensure that, to the maximum extent practicable; nonpoint source discharges of pollutants resulting from forest operations do not impair the achievement and maintenance of the water quality standards (ODF 2018, p. 53).

The Forest Practices Act uses a stream classification system to align the physical flow characteristics and beneficial uses of a water body to a set of appropriate protection measures. This classification system, and methods by which streams are classified, have been refined over time to reflect new science knowledge or policy imperatives. A Type F stream is any stream used seasonally or year-round by anadromous fish, game fish, or fish listed as threatened or endangered under the federal or state endangered species acts. Type F streams may also serve as community water sources. In July 2017, the salmon, steelhead and bull trout (Type SSBT) category was added along with modified stream buffer rules to better protect the cooler water quality temperatures needed by these fish (Groom et al. 2018). A Type D stream is any stream which does not contain fish (as defined above) and is located within a specified distance upstream of any domestic water intake for which an Oregon Water Resources Department permit has been issued. All other streams are classified as Type N.

The distance upstream from an intake that Type D (domestic water use) classification applies varies according to whether the intake meets Oregon's definition for a community water supply: has 15 or more service connections used by year-round residents, or which regularly serves 25 or more year-round residents. If the intake meets one of these criteria, Type D classification initially applies to the length of stream that was designated Class I under the classification system in effect on April 22, 1994 (as shown on district water classification maps). If the intake is not for a community water supply (as defined above) Type D classification initially applies for the shortest of 1) the distance from the intake upstream to the farthest upstream point of summer surface flow, 2) half the distance from the intake to the drainage boundary, or 3) 3000 feet upstream from the intake. Type D classification also applies to tributaries off the main channel as long as the above conditions hold.

Streams are further classified by size:

Small — average annual flow of 2 cubic feet per second (cfs) or less
Medium — average annual flow greater than 2 but less than 10 cfs
Large — average annual flow of 10 cfs or greater.

Criteria for establishing average annual flows are explained in Forest Practices Technical Note Number 1 (ODF 1994). Actual measurements of average annual flow may substitute for the calculated flows described in the technical note. Any stream with a drainage area less than 200 acres is assigned to the small stream category regardless of the flow calculated.

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Appendix J. Oregon's Mid-Coast estuaries

Salmon River Estuary. This is classified as a Natural Estuary and has little residential, commercial, and industrial development. The entire estuary and its associated wetlands are part of the Cascade Head Experimental Forest and Scenic Research Area, which is owned and managed by the US Forest Service. The entire Cascade Head area is 11,890 acres; the estuary comprises 205 acres.

Areas of Ecological Importance and Critical Habitat Designations: Habitat areas include wetlands, mudflats, emergent herbaceous wetlands, and intertidal marsh. The estuary provides transitional habitat between freshwater and saltwater for upstream spawning migrations for anadromous fish and rearing areas for juveniles and smolts. The Salmon River Estuary is part of the Salmon River Estuary-Cascade Head Conservation Opportunity Area.

Species of Interest: In addition to providing habitat for salmon, the Salmon River Estuary was nominated as an Important Bird Area for brown pelican, bald eagle, and peregrine falcon, and for its abundance of shorebirds, including western sandpipers.

Siletz Bay Estuary. Siletz Bay is classified as a Conservation Estuary by the Oregon Land Conservation and Development Department. It lacks jetties or channels, but is near Lincoln City, which has altered some of the shoreline near the estuary. The US Fish and Wildlife Service (USFWS) manages a 568-acre portion of the bay as a national wildlife refuge, which includes coastal conifer and hardwood forest, estuarine tidelands, and freshwater riparian habitats. The estuary was formerly diked to drain land for raising dairy cows. The USFWS is managing the refuge to allow the salt marsh to return to its natural state, where tides inundate the refuge twice daily. The Siletz Bay is a Conservation Opportunity Area.

Species of Interest: The Siletz Bay Wildlife Refuge provides nursery habitat for coho and Chinook Salmon, Steelhead and Cutthroat Trout, and other anadromous species. Spring Chinook usually arrive to the refuge in May, and American shad arrive between late April to the end of May. The refuge is also home to red-tailed hawks, bald eagles, barn owls, red-shouldered hawks, ospreys, turkey vultures, merlins, and peregrine falcons as well as estuary-dependent birds, including great blue herons, great egrets, Virginia rails, eared grebes, brown pelicans, buffleheads, common mergansers, wood ducks, northern shovelers, American wigeon, green-winged teals, and double-crested cormorants. Mammals at the refuge include Roosevelt elk, black-tailed deer, harbor seals, mink, river otter, muskrat, and beaver. Siletz Bay has native, common eelgrass as well as exotic *Zostera japonica,* which was introduced with non-native oysters.

Depoe Bay Estuary. Depoe Bay estuary is about 25 acres and is classified as a Shallow-Draft Development Estuary. The estuary is landlocked, with the exception of the harbor entrance, which was developed to support fishing, tourism, lumber, and agriculture. The bay supports bald eagle nesting sites and black oystercatchers, among other species. Depoe Bay is a Conservation Opportunity Area.

Yaquina Bay Estuary. Yaquina Bay is a 4,300-acre estuary located in the City of Newport. It is classified as a Development Estuary. Current human uses of Yaquina Bay include fishing and fish processing, logging, shipping, tourism, aquaculture, and agriculture. The estuary has been dredged and filled at several locations to support these uses and to allow for development. Oregon State Parks owns the Yaquina Bay State Recreation Site, a 32-acre parcel of land overlooking the mouth of Yaquina Bay. There are large, cultivated shellfish operations in the Yaquina estuary.

Areas of Ecological Importance and Critical Habitat Designations: Yaquina Bay is listed as critical habitat for Green Sturgeon. Yaquina Bay State Recreation site is a spruce and pine forested bluff. Lower Yaquina Bay has little freshwater influence and is popular for shellfish harvesting. The Wetlands Conservancy has identified high salt marsh, tidal Sitka spruce swamp, and non-tidal Sitka spruce swamp as the highest priorities for habitat restoration. The estuary also has eelgrass beds, and nesting eagles and osprey. Spruce swamps are located in the upper estuary along Elk Creek and Little Elk Creek and areas for potential restoration of high salt marsh are located in Boone Slough and Nute Slough. Currently, there is an eelgrass mitigation project in the eastern portion of Marina Bed. Yaquina Bay is a Conservation Opportunity Area.

Alsea Bay Estuary. Alsea Bay is designated as a Conservation Estuary, is one of only six estuaries in Oregon that is managed for conservation under the Coastal Zone Management Act, and does not have jetties at the ocean entrance. Recreational fishing and clamming are allowed in Alsea Bay and species present include cockles and purple varnish clams, softshell clams, and Dungeness crabs. There are two public boat launches at Alsea Bay, including the Port of Alsea boat launch and McKinley's Marina.

Species of Interest: Alsea Bay supports Green Sturgeon as well as a diversity of other species.

Areas of Ecological Importance and Critical Habitat Designations: The east side of Alsea Bay has more than 400 acres of undisturbed marsh habitat and additional marsh habitat in the lower reaches of Drift Creek, a Forest Ecosystem Management Assessment Team (FEMAT)-designated key watershed. Additional tidal high marsh habitat that is recovering from previous grazing disturbance is found west of Barclay Meadows and east of Eckman Lake. The Bayview Oxbow has about 150 acres of diked former tidal marsh. Barclay meadows contains small areas of diked former tidal marsh. Bain Slough is a forested wetland located at River Mile 9 that has well-developed remnant tidal channels. A tidegate, ditching, and residential development all reduce tidal influences at Bain Slough, which was likely a spruce tidal swamp at one time. Alsea Bay has been identified as a Conservation Opportunity Area.

Yachats River Estuary. Yachats River Estuary is about 40 acres, is a minor estuary, and is classified as a Conservation Estuary. The Yachats River Estuary is part of the Yachats River Area Conservation Opportunity Area. It is a designated Important Bird Area of Oregon and includes marbled murrelet and spotted owl nesting sites.