

Oregon Wetland Monitoring & Assessment Strategy



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Executive Summary

Oregon's tidal and non-tidal wetlands have been greatly altered over the past several decades resulting in a 38 percent statewide loss (Dahl 1990). Despite a decrease in the rate of loss, ongoing development and land use activities continue to threaten and degrade these habitats. Large historic losses combined with cumulative effects of continuing small losses are compounded by the fact that where wetlands remain on the landscape, wetland functions and biological quality are often impaired and significantly degraded. These losses and degradation have magnified the importance of effectively managing Oregon's wetland resources.

The Oregon Legislative Assembly recognized that the protection, conservation and best use of the water resources of the state are vital to the economy and well-being of the state and its people and recognized that wetlands provide many functions and values that are essential to the state. Oregon has a no net loss of wetland goal in statute (ORS 196.672 (4) & (5)) that requires the state to "maintain a stable resource base of wetlands," "increase wetland resources by encouraging wetland restoration and creation," and compensate for "functions and values for the waters of the state" for permitted impacts.

Oregon strives to meet these goals through various programs and the Oregon Removal-Fill Law, the primary state law that authorizes the regulation of activities within the waters of the state. In addition to the State's Removal-Fill Program and Wetlands Program, Oregon's wetland resources are regulated, protected, and managed by many natural resource agencies, programs, organizations, and interest groups. Although the State has been working to improve wetland protection and management, information on the effectiveness of these efforts, relative to ongoing loss and degradation from changing land use, has not been readily available and/or has not been quantified because wetland efforts are not coordinated and wetlands are not being systematically monitored.

The need for a comprehensive statewide wetland monitoring program has been recognized and documented in the *Oregon's Wetland Conservation Strategy* (Leibowitz 1995) and the *Oregon State of the Environment Report 2000* (SOER). Through the development of the Oregon Wetland Monitoring and Assessment Strategy, the state is taking the initial step in developing a much needed wetland monitoring program. The State is beginning a cooperative, integrated approach to obtaining wetland data to effectively manage Oregon's wetland resources.

The goal of the Oregon Wetland Monitoring and Assessment Strategy is to guide and coordinate statewide monitoring and assessment efforts in order to improve the States' ability to sustainably regulate, manage and conserve Oregon's wetlands. The strategy provides a framework and direction over the next five years for the Oregon Department of State Lands (DSL) and its state, federal, and Tribal partners to build, strengthen, and guide future efforts in the areas of protocol development, wetland monitoring and assessment activities, and

application of information. Objectives for building interagency coordination and addressing priority data needs were identified as follows:

- Establish an Oregon Wetland Monitoring Workgroup;
- Develop and refine wetland assessment methods and tools to evaluate function, value, and condition of Oregon's wetland resources ;
- Assess, track and report on the status and trends of Oregon's wetlands;
- Evaluate the effectiveness of wetland conservation and restoration actions (voluntary and mitigation) in replacing wetland acreage, functions, and values; and
- Use wetland monitoring and assessment information to inform natural resource agencies, programs, conservation groups, and the general public.

For Oregon to meet the strategy's priority objectives, state, local and federal government agencies, along with private conservation organizations will need to work collaboratively on project coordination, data collection, and data management. Oregon will build on the EPA's recommended Level I, II, and III assessment framework for wetland resources (U.S. EPA 2008) to comprehensively assess wetland quantity and quality. This multi-level approach allows for use of a range of assessment methods to obtain varying levels of data depending on the specific goals and resources available.

Through the formation of an Oregon Wetland Monitoring Workgroup, DSL will work with partners to plan wetland monitoring and assessment activities and identify future monitoring resources needed to fully implement the wetland monitoring strategy. This initial effort needs to be strengthened by continued support for staff participation and leadership in development and implementation of a state wetland monitoring and assessment program.

The following document describes the development and the components of the Oregon Wetland Monitoring and Assessment Strategy. The strategy will be updated by the Wetland Monitoring Workgroup and other appropriate reviewers every five years. Review and update of the strategy will include determining how well the monitoring objectives are being met, how the information collected is being used to support management decisions, and additional priority needs that should be addressed.

INTRODUCTION & BACKGROUND

Oregon's Wetlands

Oregon's tidal and non-tidal wetlands once covered as much as 2.3 million acres as of the late 1700's (Dahl 1990). But extensive agricultural and urban development has greatly affected the extent and quality of Oregon's wetlands, resulting in a 38 percent statewide loss (Dahl 1990). While these landscape-scale changes have provided significant socioeconomic benefits for several generations of Oregonians, they have eliminated and degraded vast areas of wetlands needed by future generations. Data suggest wetland losses in various regions of the state vary from 57 percent in the Willamette Valley to 75 percent in the Klamath Basin, while losses for individual coastal estuaries range from 2 to 94 percent (Good 2000; Morlan 2000). Losses for particular rare wetland types have high losses, such as 99.5 percent of wet prairie and 98 percent of peatland in the Willamette Valley, 88 percent of tidal spruce swamps along the coast and lower Columbia River, and 40 percent of Agate Desert vernal pools in southwestern Oregon (Christy 2010).

The state's regulatory programs have greatly reduced but not eliminated the loss of wetland acreage in Oregon. In the Willamette Valley alone, more than 500 acres of wetlands are lost each year according to the Oregon State of the Environment Report (SOER, Morlan 2000). The large historic losses combined with cumulative effects of continuing small losses are compounded by the fact that where wetlands remain on the landscape, wetland functions and biological quality are often impaired and significantly degraded. These losses and degradation have magnified the importance of effectively managing Oregon's wetland resources.

Currently, Oregon has approximately 1.4 million acres of wetlands (Dahl 1990) that cover approximately 2 percent of Oregon's total land surface. Oregon's wetland characteristics are as diverse as its landscape. They range from subtidal marine algal beds, to frigid glacial meltwater, to scalding hot springs in the middle of arid sagebrush. Vernal pools are home to a variety of rare wetland plants and animals in winter and spring but are parched and shriveled by July. Spring-fed fens on serpentine soils are laced with toxic metals but are habitat to several rare plants. In contrast, there are wetlands so enriched by agricultural and urban runoff that only the hardiest weedy plants and animals can be found in them (Oregon Wetlands Explorer 2012).

The most abundant type of wetland in Oregon is palustrine wetlands (85%), which include non-tidal marshes, wet meadows, swamps, bogs, fens, and shallow ponds. The palustrine wetlands are comprised of emergent (50%), scrub-shrub (25%), forested wetlands (17%), aquatic beds (6%) and moss-lichen (0.4%) wetlands. These wetlands range by ecoregion from the Coast Range non-tidal marshes, swamps, bogs, and ponds; Willamette Valley wet prairies and seasonal flat or depressional wetlands; Klamath vernal pools; and the Eastern Cascade

Mountain seeps and springs. The remainder of Oregon's wetland types are Riverine (5%), Lacustrine (5%) and Coast Range estuarine wetlands that consist of approximately 55,600 acres of tidal fresh marsh and make up about 5% of the total wetlands (Christy 1997).

Wetland Protection and Management in Oregon

Wetlands in Oregon are under the jurisdiction of federal and state governments through the authority of several statutes. Federal authority lies primarily within the National Environmental Policy Act (NEPA) and the Clean Water Act (CWA) (Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.)). Several federal agencies have a role in wetland regulation, including the U. S. Environmental Protection Agency, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration Fisheries, and the Natural Resource Conservation Service.

Oregon has a no net loss of wetland goal in statute (ORS 196.672 (4) & (5)) that requires the state to "maintain a stable resource base of wetlands," "increase wetland resources by encouraging wetland restoration and creation," "meet the requirements of federal law in the protection and management of wetland resources," "promote the protection of wetland values on private lands", and require compensation for "functions and values for the waters of the state" for permitted impacts.

In response to Oregon law, the Department of State Lands manages two integrated programs- one regulatory and the other non-regulatory- to protect and manage Oregon's wetlands.

Oregon's Wetlands & Waterways Regulatory (Removal-Fill) Program

Oregon's state regulatory program dates back to the Removal Law passed in 1967. The regulatory program has matured over the years and now the primary state law that authorizes the regulation of activities within the waters of the state is the Oregon Removal-Fill Law (ORS 196.600 – 196.665, 196.668 - 196.692, 196.795 – 196.990, and 390.805 – 390.925) that is administered by the Department of State Lands, Wetlands & Waterways Conservation Division. In general, the Removal-Fill Law's regulatory authority covers activities such as removal, fill, and other ground altering activities within wetlands. The goal is to maintain a stable wetland resource base through avoidance and minimization of reasonably expected adverse impacts and by compensating for unavoidable wetland impacts. Compensatory mitigation for wetland impacts can be met through:

- Permittee-responsible mitigation through on-and off-site mitigation.
- Purchase of mitigation credits through a mitigation bank, the state and federal In-Lieu Fee Program, and the state Payment-In-Lieu of Mitigation Program.

Oregon's Wetlands Program

The Oregon Legislative Assembly recognized that the protection, conservation and best use of the water resources of the state are vital to the economy and well-being of the state and its people and recognized that wetlands provide many functions and values that are essential to the state. The Oregon Legislature Assembly found that wetlands provide:

- Flood and storm damage protection, which prevent loss of life and property.
- Essential breeding, spawning, rearing, feeding, nesting and wintering habitats for a major portion of this state's fish and wildlife, including threatened and endangered species.
- Essential habitat for waterfowl using the Pacific Flyway and for the rearing of salmon and other anadromous and resident fish.
- Accumulation areas for sediments that retain nutrients and other pollutants.
- Water quality improvement through absorption and filtration of sediments, nutrients, metals, and toxic materials that would otherwise degrade groundwater or the water quality of adjacent rivers, lakes, and estuaries.
- Significant opportunity for public recreation, environmental and ecological research, education, scenic diversity and public recreation and education scenic diversity, and aesthetic value as open space.

As a result of the above legislative findings, Oregon's Wetlands Program was established by the 1989 comprehensive wetlands conservation bill that stressed the importance of wetlands and provided clear policies directed at maintaining the acreage and functions of the state's wetlands (ORS 196.668 and 196.672). The Wetlands Program is administered by the Wetlands & Waterways Conservation Division at Oregon Department of State Lands (DSL). The Program is responsible for:

- Developing and maintaining the Statewide Wetland Inventory.
- Providing wetland planning assistance.
- Developing standards and tools for identifying and assessing wetlands.
- Providing public information and training.
- Providing other non-regulatory wetland management approaches.
- Reviewing and approving wetland delineations for regulatory permitting.

In addition to the Removal-Fill Program and Wetlands Program, Oregon's wetland resources are regulated, protected, and managed by many natural resource agencies, programs, organizations, and interest groups, which include:

- Oregon Department of Environmental Quality (DEQ) administers the 401 Water Quality Certification program. DEQ's Oregon's Water Quality Monitoring Strategy and monitoring programs provide environmental information necessary to support resource

management and water quality policies, standards and permits that protect the quality of Oregon's environment.

- Oregon Department of Land Conservation and Development administers a set of 19 statewide land use planning goals that includes goals that direct local governments to provide some natural resource regulations and protections. Goal 5 administrative rules establish the procedures for wetland planning and require local protection for "significant" freshwater wetlands. Goal 16 prohibits development in 98% of the remaining estuarine wetlands and requires management plans for coastal estuaries. Goal 17 requires protection for major marshes along Oregon's coastal shore lands. Less directly, Goals 6 and 7 may address wetland management for water quality and flood management purposes.
- Oregon Department of Fish and Wildlife's (ODFW) goal is to maintain healthy fish and wildlife populations by maintaining and restoring functioning habitats, prevent declines in at-risk species, and reverse any declines in these resources were possible. The Department's Habitat Resources Program provides habitat mitigation recommendations based on their Fish and Wildlife Habitat Mitigation Policy. The Conservation Program developed the Oregon Conservation Strategy, which is an overarching state strategy for protecting and enhancing fish and wildlife and their habitats.
- Oregon Department of Forestry (ODF) implements the Oregon Forest Practices Act. The Department develops and implements a ten-year State Forests Monitoring Program Strategic Plan and regional state forests management plans to achieve management goals. Rules governing activities in wetlands were first adopted in 1987. Wetlands that are identified by ODF as significant wetlands, stream-associated wetlands, and seeps/springs are protected through riparian management areas and best management practices.
- Oregon Parks and Recreation Department's natural resource management objectives include protecting and restoring native ecosystems and cultural resources. The Department administers the state Scenic Waterways Program that provides protection for special rivers and adjacent lands; enforces the 1967 Beach Bill, which provides protection and preservation of natural resource values found on the ocean shore; and manages state park lands, which includes wetlands.
- Oregon Water Resource Department's (OWRD) mission is to assure sufficient and sustainable water supplies and responsible water management. To better understand and meet Oregon's water quantity, water quality, and ecosystem needs, OWRD is developing an Integrated Water Resource Strategy for Oregon. The strategy identifies the need for collaboration among all agencies to manage Oregon's water resources and supplies. The strategy's proposed actions include: collect information about habitat conditions, improve understanding of ecosystems' needs, evaluate ecosystem health as

it relates to water quality and quantity, identify restoration and mitigation projects with the greatest potential to improve water quality and quantity, monitor changes in surface and groundwater conditions related to climate change, and restore and protect wetlands to increase the capacity for natural water storage.

- Oregon's Indian Tribal communities consist of nine federally recognized Tribes whose Tribal governments manage natural resources in reservation or trust lands that comprise over 875,000 acres, or 1.4 percent of land within Oregon's boundaries. In addition, the Ft. McDermitt Paiute Shoshone Tribe in Nevada has some reservation lands in Oregon. Many of the tribes have recently formed a Pacific Northwest InterTribal Wetland Work Group to support development and implementation of wetland monitoring strategies.
- Oregon Watershed Enhancement Board's (OWEB) is a leader in the conservation of Oregon's natural resources by helping Oregonians take care of streams, rivers, wetlands and natural areas. OWEB accomplishes this mission by providing grants to implement restoration efforts; promoting of recognized, local watershed councils; and providing assistance for development of watershed assessments. OWEB leads the coordination effort for The Oregon Plan for Salmon and Watersheds that recognizes the importance of monitoring the status of environmental factors that affect watersheds and habitat quality. In particular, OWEB offers restoration grants that may be directed to wetland restoration and offers funding for project monitoring.
- U.S. Army Corps of Engineers (Corps) - Portland District is authorized, through the United States Congress, to regulate activities that may impact wetlands and waters of the U.S. This authority is granted and defined under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Federal Water Pollution Control Act Amendments of 1972, also known as the Clean Water Act. The Corps' goal is to have "no net loss" of waters of the United States and their regulatory mission is to protect the nation's aquatic resources while allowing reasonable development. The Corps and Department of State Lands oversee the State's wetland mitigation banks and the In-Lieu Fee Program for compensatory mitigation required for unavoidable impacts.
- U.S. Environmental Protection Agency (EPA) has been working to ensure environmental protection and a healthier environment since its inception in 1970. In addition to EPA's involvement in activities related to Section 404 of the Clean Water Act that involves protection and compensatory mitigation for impacted wetlands, EPA is dedicated to protecting wetland ecosystems through EPA's Wetlands Program. EPA provides guidance and assistance to states through the Enhancing State and Tribal Wetlands Programs Initiative and provides financial assistance to states through the Wetland Program Development Grants. In 2011, EPA conducted, with states assistance, the first National Wetland Condition Assessment to assess the ecological integrity of wetland resources at the national scale.

- USDA Natural Resources Conservation Service (NRCS) implements the Wetland Reserve Program (WRP) whose goal is restoring, protecting and enhancing wetlands for the benefit of migratory birds and other wetland-dependent wildlife and plants, including species of concern and those that are state and federally listed. In addition to providing benefits to wildlife, WRP helps restore active floodplains along creeks and rivers, aids in flood control, and improves water quality by restoring environmentally sensitive, frequently-flooded cropland back to permanent vegetation. Oregon NRCS WRP priorities dovetail with the ODFW Strategic Plan for Oregon. This program currently has approximately 62,242 acres enrolled in Oregon and includes monitoring protocol to periodically review and assess how land enrolled in WRP is meeting program purposes and objectives. Assessments include ecological functioning of the site and the landowner's program compliance.
- U.S. Forest Service has Land and Resource Management Plans (Forest Plans) for the national forest in Oregon. The district Forest Plans are the basis for integrated management of all the forest's resources. Monitoring strategies are designed to address issues in the Forest Plans and to assure compliance with the Northwest Forest Plan. Some Forest Plan monitoring strategies, like the Willamette National Forest, include riparian and wetland habitat diversity.
- U.S. Fish & Wildlife Service (USFWS) initiated a nationwide survey designed to track the status and trends in wetland acreage across the United States, in 1984. Three studies were conducted between 1986 and 2004. A new policy initiated in 2004 request that USFWS begin issuing a wetland status and trends report every five years. In Oregon, USFWS manages and monitors six coastal and eleven inland National Wildlife Refuges for the conservation of fish, wildlife, and plants.
- U.S. Bureau of Land Management has District Resource Management Plans that guides the agency's actions on approximately 16 million acres of public land in Oregon. Several of the plans include the management and monitoring of wetlands, including the Wood River Wetlands Resource Management Plan and the Eugene District Resource Management Plan. The Eugene district plan includes the West Eugene Wetlands Conservation Plan area and the West Eugene Wetlands Mitigation Bank.
- South Slough National Estuarine Research Reserve, one of 28 National Estuarine Research Reserves established in the U.S., is a state-federal partnership whose mission is to improve the understanding and stewardship of Pacific Northwest estuaries and coastal watersheds. The Reserve is actively engaged in tidal and non-tidal wetland restoration and associated long-term monitoring and research to contribute to the development of improved science-based approaches to wetland restoration planning, design and evaluation.

- Institute for Natural Resource (INR) was created by the Oregon Legislature with the Oregon Sustainability Act of 2001. INR is a research institute administered by Oregon State University (OSU). INR works on an array of projects that includes compiling and integrating natural resource datasets and information, providing access to comprehensive natural resource information, and managing interdisciplinary research. INR and OSU created the Oregon Wetlands Explorer, a web-based natural resource digital library, to inform decisions and actions affecting Oregon's natural environment.

The Need for a Wetland Monitoring Program

Needs and Benefits

Although the State has been working to improve wetland protection and management, information on the effectiveness of these efforts, relative to ongoing loss and degradation from changing land use, has not been readily available and/or has not been quantified because wetland efforts are not coordinated and wetlands are not being systematically monitored. We still do not confidently know whether the statutory goal of no net loss of wetland quantity has been reached and have very little data concerning wetland quality, even though federal and state wetland laws require that wetland quality also be monitored, protected and restored.

In the early 1990's many of the various natural resource entities were brought together to develop *Oregon's Wetland Conservation Strategy* (Leibowitz 1995). The strategy's purpose was to establish priorities and actions for improving the effectiveness and efficiency of Oregon's efforts to conserve, restore, and protect wetlands. One of the strategy's basic concepts was the need for the state to develop and implement an integrated state wetland program. The strategy found that "piecemeal regulation, management and conservation of wetland and riparian habitat are ineffective in conserving and sustaining the resource and addressing societal needs for clean water, wildlife habitat, and floodplain protection." The strategy stated, "multiple federal, state, and local programs to regulate, manage, and protect state water have not been fully effective in protecting wetland resources...due in part to...no ongoing program exists to monitor program effectiveness and cumulative effects."

In the *Oregon State of the Environment Report 2000* (SOER), a comprehensive assessment of the status and health of Oregon's environment, identified estuarine (Good 2000) and freshwater wetlands as two of the 18 indicators that provide a strong measure of environmental health. The indicators were recommended for use in guiding the State's basic environmental monitoring program. The primary need identified for freshwater wetlands was "to develop and support a program for measuring and monitoring wetland ecosystem health" (Morlan 2000).

The need to monitor wetlands is escalating as wetlands are increasingly being affected by climate change. The report to congress, *Strengthening the Scientific Understanding of Climate Change Impacts on Freshwater Resources in the United States* (Federal Interagency Panel on Climate Change and Water Data Information 2011), found that “wetlands are a key indicator of climate change and water-resource stress” and that “wetland monitoring needs to be strengthened both in terms of frequency of monitoring and types of data available.”

The following sections of this document discuss the initial step in developing a comprehensive statewide wetland monitoring program through the development of a coordinated wetland monitoring strategy. Through the strategy, the State can begin a cooperative, integrated approach to obtaining wetland data to effectively and sustainably manage Oregon’s wetland resources by beginning to answer wetland resource questions such as:

- Where are the State’s current wetlands and how are the distribution and types of wetlands changing over time?
- What is the overall ambient condition of wetlands statewide and how is this condition changing over time?
- What are the major stressors on wetlands and how are they impacting wetland condition and functions?
- What is the impact of development projects on wetland acreage, ambient condition, and functions at the watershed-scale ?
- What level of wetland protection is needed to sustainably manage watershed health from cumulative wetland impacts from loss or degradation?
- How effective are wetland programs in meeting their objectives for preserving, restoring, or replacing wetland acres and functions?

Elements of a Wetland Monitoring Program

The Environmental Protection Agency (EPA) provides guidance to States on development of wetland monitoring and assessment programs through the *Application of Elements of a State Water Monitoring and Assessment Program for Wetlands* (USEPA 2006). The document provides clarification and further information on how the original *Elements of a State Water Monitoring and Assessment Program* (EPA 2003841-B-03-003) applies to wetlands and recommends ten basic elements of a comprehensive wetland monitoring program:

1. Monitoring Program Strategy
2. Monitoring Objectives
3. Monitoring Design
4. Core and Supplemental Indicators (and Methods)
5. Quality Assurance
6. Data Management
7. Data Analysis/Assessment

8. Reporting
9. Programmatic Evaluation
10. General Support and Infrastructure Planning

MONITORING AND ASSESSMENT STRATEGY

As an initial step in developing a wetland monitoring and assessment program, the Department of State Lands (DSL), the primary agency involved in state wetland activity, initiated a collaborative approach with state, federal, and tribal partners to develop a state monitoring and assessment strategy. The goal of the Oregon Wetland Monitoring and Assessment Strategy is to guide and coordinate statewide monitoring and assessment efforts in order to improve the State's ability to sustainably regulate, manage and conserve Oregon's wetlands.

The strategy provides a framework and direction over the next five years for the Oregon Department of State Lands (DSL) and its state, federal, and Tribal partners to build, strengthen, and guide future efforts in the areas of protocol development, wetland monitoring and assessment activities, and application of information. The strategy identifies priority objectives and an approach to meet the objectives. The strategy will be update every five years but should be considered a work in progress that can be revisited and updated periodically as needed to reflect lessons learned and evolving needs.

MONITORING OBJECTIVES

The strategy for wetland monitoring and assessment was developed with an emphasis on building a statewide coordinated monitoring framework. Meetings were held with resource partners to discuss wetland issues and identify data needs. Development of a coordinated framework and how wetland data could improve wetland protection and management were discussed. A comprehensive list of data needs and applications was created (see Appendix A). The list is intended to be used as a guide for monitoring and assessment planning, and can be updated periodically as the strategy is implemented and the wetland monitoring and assessment program develops.

From the comprehensive list and discussions about priority needs, objectives for building interagency coordination and addressing priority data needs were identified as follows:

1. Establish an Oregon Wetland Monitoring Workgroup - This objective addresses the need to establish a coordinated wetland monitoring and assessment framework to guide, coordinate, and assist efforts of the many agencies, programs, and organizations involved in wetland regulation, protection, restoration, and management. The

workgroup will act as a forum to build and strengthen communication and collaboration, provide an ongoing mechanism for identifying wetland assessment needs and priorities, identify funding sources and partnerships, and help insure that the “right people” are getting information necessary to make informed decisions. The workgroup will oversee the execution of the wetland monitoring and assessment strategy, refine and update the State’s conceptual approach and strategy as needed, and participate in the development and implementation of the strategy elements.

2. Develop and refine wetland assessment methods and tools to evaluate function, value, and condition of Oregon’s wetland resources – This objective will provide assessment methods and tools to better inform regulatory and management practices and decisions on wetland prioritization, restoration, conservation, and protection. The State strategy will support EPA’s recommended three-tier (Level I, II, and III) framework for wetlands monitoring and assessment. This multi-level approach allows for use of a range of assessment methods, based on the specific goals and resources available, to obtain varying levels of data that can be applied at the state, region, or watershed scale.
3. Assess, track and report on the status and trends of Oregon’s wetlands – To accomplish this objective, statewide up-to-date baseline data on wetland quantity and general knowledge of wetland quality needs to be established. Initial efforts will be on restructuring the Statewide Wetland Inventory, updating the NWI, and developing a landscape level assessment of wetland condition. Further assessment efforts will be focused on identified priority basin or watershed areas. This approach allows for general reporting on status and trends and more intense analysis and reporting for selected areas. Data can be used to:
 - Identify where the State’s wetlands are and how the distribution and types of wetlands change over time.
 - Determine the overall ambient condition of wetlands statewide and how condition is changing over time.
 - Associate changes in wetland quantity with possible causal mechanisms, such as urban and rural development, agriculture, conservation programs, and other activities.
 - Identify possible sources of wetland degradation, including impacts to wetlands due to loss and degradation of adjacent upland habitats (buffer zones) and cumulative impacts.
 - Evaluate the effectiveness of regulatory and restoration programs in meeting the State’s no net loss goal for wetlands and assist in determining the effectiveness of regional or watershed plans.
4. Evaluate the effectiveness of wetland conservation and restoration actions (voluntary and mitigation) in replacing wetland acreage, functions, and values – This objective addresses the generation of data that can be used to assess the effectiveness of and improve wetland regulatory and non-regulatory programs and projects, such as:

- Develop metrics to evaluate project performance measures to determine their efficacy.
 - Develop function-based performance standards.
5. Use wetland monitoring and assessment information to inform natural resource agencies, programs, conservation groups, and the general public – This objective will be accomplished by activities, such as:
- Identify and prioritize wetlands for protection and restoration.
 - Develop information management tools to facilitate the distribution and use of data collected through monitoring.
 - Develop approaches to define and inform local land use planning entities of impacts of landscape changes on wetlands and other aquatic resources.
 - Provide relevant findings to State supported programs such as the Governor’s Oregon Solution initiative that promotes collaboration on projects that support sustainable community solutions to environmental issues.
 - Incorporate wetland indicators into the State’s developing environmental monitoring program.
 - Report on the progress of the state’s wetland monitoring and assessment program.

MONITORING DESIGN

Existing Monitoring and Assessment Efforts in Oregon

Descriptions of existing monitoring and assessment efforts, along with discussion of their strengths and shortcomings, used in Oregon to define, categorize, map and assess wetlands are in Appendix B. As part of this strategy, further investigation will be conducted to gather additional existing assessment tools, methods, or research results from partners that can be applied to the wetland monitoring and assessment program needs and objectives.

Multi-level Approach

To comprehensively assess wetland quantity and quality, Oregon will build on the EPA’s recommended Level I, II, and III assessment framework for wetland resources (U.S. EPA 2008). This multi-level approach allows for use of a range of assessment methods to obtain varying levels of data depending on the specific goals and resources available.

Level I – Landscape Assessments use geographic information systems and/or remote sensing techniques to display and analyze wetlands and surrounding land use coverages. An advantage of Level I methods is their ability to assess large areas or numbers of wetlands with minimum resources. The disadvantages to coarse landscape level assessments are that predictions of wetland condition are based on relationships based on correlation and surrogate indicators, which may not always apply to specific wetlands. In addition, the detail of information is limited based on the type of indicators that can be assessed using remote information.

Level II – Rapid Field Assessments are field-scale assessments that require a half-day to one day in the field. Methods are relatively simple and involve using rapid qualitative methods based on simple observational metrics to evaluate condition and/or functions and values. Level II assessments are generally moderately accurate in assessing individual wetlands. The advantage of Level II methods is that many field-scale assessments of individual wetland basins can be made with moderate resource expenditures.

Level III – Intensive Site Assessments involve intensive efforts in the field based on detailed quantitative sampling. Measurements of characteristics of one or more biological assemblages is combined and correlated with measurement of physical and chemical parameters. These assessments are labor and cost intensive, but provide more accurate, higher resolution information than the landscape or rapid assessment methods. Level III methods can be used to validate Level I and Level II assessments.

Details and decisions about the development of monitoring and assessment methods will be made by a Wetland Monitoring Workgroup. To provide the most accurate statewide assessments would require extensive updating to the NWI mapping to be complete first. Unfortunately, mapping updates will take many years due to limited resources. Once the Statewide Wetland Inventory (SWI) is restructured and updated with available mapping, the SWI will be utilized to begin addressing Oregon’s short-term monitoring and assessment objectives. Early efforts will be focused on updating or developing Level I methods, refining Level II methods, and incorporating Level III efforts where needed and feasible.

Level I – Landscape Level Assessments

Wetland quantity and quality monitoring require separate monitoring techniques and methods. The sections below on mapping and assessments describe what Level I efforts will be conducted to achieve the strategy objectives.

Wetland Mapping - Inventory Updates

The USFWS expects to complete the National Wetland Inventory (NWI) mapping of Oregon in 2012 with the conversion of the remaining five scanned quads (26% of the state) into digital GIS data and the mapping of one partial quad (0.06% of the state). In addition, there are some small project area updates currently being conducted.

Current wetland mapping is the critical step towards updating or creating accurate wetland data. However, the majority of Oregon's NWI mapping is based on 1980s aerial photography and older mapping methodologies (see Appendix B for further information). The improved accessibility of GIS tools and remote imagery and the growing ability to use data layers to support wetland planning, management, and regulatory oversight requires wetland maps to be dynamic to keep pace with wetland and landscape changes.

Updating the NWI has become more of individual states' responsibility, since NWI's primary role has changed from data creation to data stewards, due to funding. The NWI continues to partner with states, federal agencies, tribal governments and others to conduct regional mapping projects or to insure that mapping can be included into the database (Awl et al. 2010). There should be opportunities to share the cost of updating and maintaining the NWI, since it is used for a variety of environmental planning purposes at various levels of government as well as conservation groups. Priority areas with high levels of disturbance and development will be identified and an implementation schedule developed. Technical details of how the data layers will be acquired and the type and scale of imagery will depend on funding.

In the last 20 years, there has been a vast improvement in remote-sensing technologies, particularly expansion of imagery band widths, including radar, thermal, multi-spectral, and hyperspectral techniques. Light Detection and Ranging (LiDAR) provides the ability to detect and create fine resolution digital elevation models and LiDAR intensity products. Radio Detection and Ranging (Imaging RADAR) with the ability to see through tree canopies and detect subsurface water is becoming less costly. In addition, traditional CIR imagery is now acquired routinely by airborne or satellite systems and cost has declined.

Technologies must be evaluated to find the most accurate and cost-effective imagery type and analysis method for locating and mapping wetlands. It may be more cost effective to use a combination of the traditional CIR imagery along with some of the new sensors to improve wetland mapping effectiveness and efficiency. Assistance in these efforts can be obtained through the national Wetland Mapping Consortium (WMC), which strives to improve the management of wetland resources through enhanced wetland mapping and monitoring. The WMC fosters collaboration among interdisciplinary groups of wetland scientists and managers interested in mapping and monitoring wetlands with remotely sensed images. Participation in the consortium provides an effective means of investigating what methods and technology other states and resource agencies are using or testing.

In addition to updating the NWI outside of the Local Wetland Inventory areas, the Statewide Wetland Inventory (SWI) (See Appendix B for more information on the SWI) will be restructured and a strategy developed to update and maintain the SWI with current data that meets the Oregon Wetland Mapping Standards. Restructuring of the SWI will allow the Oregon Wetlands Cover to become an integral part of the framework for the SWI. The Oregon Wetlands Cover database was developed by the Institute for Natural Resources (INR) for use on the Oregon Wetland Explorer Portal and currently has more comprehensive mapping than the Statewide Wetland Inventory. However, the INR database will require an internal quality control review by the Department of State Lands' (DSL) for the non-NWI and non-LWI datasets provided by a variety of sources.

Additional methods of updating the SWI will include:

- Conducting pilots to test incorporating wetland delineation. Pilots will be established with wetland consultants to test submittals of digital wetland delineation maps with wetland delineation reports. Another pilot to incorporate wetland delineations and compensatory wetland mitigation polygons will be conducted with the cities of Beaverton and Gresham, who are digitizing records submitted to DSL.
- Updating the Local Wetlands Inventory Standards and Guidelines to incorporate current GIS-based technologies and data.
- Developing a DSL on-line wetland mapper to serve up the GIS-based SWI.

Landscape Assessments Tools

Landscape baseline condition assessment

Landscape condition assessments involve the prediction of wetland condition based on surrounding land use and landscape based indicators that can be remotely detected. Condition is inferred based on certain indicators in the landscape. Oregon can make rapid progress in establishing a landscape level baseline condition assessment by utilizing existing methods, research and data. Methods and tools developed by other states will be evaluated along with existing research within the state. Existing data sets from the restructured Statewide Wetland Inventory, U.S. Geologic Survey Elevation Dataset (NED), USDA 2011 Aerial imagery, LiDAR (where available), and other data sets will be used to establish baseline conditions. Landscape indicators, including stressors will need to be identified along with a scoring protocol. The assessment will provide the framework to associate future changes in wetland quantity and condition with specific causal mechanisms.

Rapid landscape assessment of wetland functions, values and condition

The Department of State Lands' Wetlands Program with WPDG support from EPA will be evaluating and developing, if applicable, an Oregon Rapid Wetland Protocol (ORWAP) landscape level version. The intent is to provide functional assessment profiles over broad geographic areas for local government wetland protection programs. The project will include the analysis of ORWAP's indicators and feedback from ORWAP pilot projects that tested ORWAP's use during the development of six Local Wetland Inventories. The landscape "Inventory ORWAP" will replace the outdated Oregon Freshwater Wetland Assessment Methodology (Roth, et al 1993) and will greatly improve the quality of data used by local governments. Use of ORWAP will increase the ability to target wetland protection programs to meet specific goals, such as mediating specific water quality concerns and providing protection for the most functional and valued wetlands and those in best condition.

Hydrogeomorphic (HGM) landscape profiling

An assessment option that may be investigated and tested through watershed level pilot projects is the enhancement of NWI mapping with HGM modifiers (Tiner 2003). The modifiers identify a wetland's landform, landscape position, surface-water flow-path, and water body type. The additional classification, enables an enhanced 'landscape profile' that describes the spatial distribution and relative abundance of different HGM classes of wetlands in a geographic area. Utilizing this wetland profile, landscape level assessments of wetland functions and ecological health can be predicted and evaluated over time (Tiner 2003). The assessment also provides a baseline foundation for use in site selection for detailed assessments; a restoration planning and management tool for local governments, watershed councils, and other conservation groups; and a tool that could be used by regulatory programs in the review of proposed impacts and compensatory wetland mitigation. This method of assessment is currently being applied by a few states and tested by USFWS and several states.

Reported accuracy of using Geographic Information Systems (GIS) to assign Hydrogeomorphic (HGM) classes is variable. A project conducted in Oregon found a >80% accuracy when using existing spatial data layers and GIS to identify the HGM class of mapped wetlands in the Willamette Valley (Adamus, et al. 2010). A study in Oklahoma to reclassify NWI polygons into HGM classes had an overall accuracy of 60%. The study noted inherent issues with the NWI due to attribute accuracy and spatial accuracy. Map age accounted for >50% of the misclassified sites (Dvoretz et al. 2012).

An example of another use for landscape profiles is a study conducted in Portland, OR (Gwin, et al. 1999). The study used HGM and landscape profiling to classify natural occurring wetlands and mitigation wetlands. The classification of the mitigated wetlands required development of new, atypical HGM classes to describe the unique combinations of site morphology and landscape setting: depression-in-riverine, in-stream-depression, and depression-in-slope because the majority of the mitigation sites did not fit the definitions of the regional HGM classes that represents naturally occurring wetlands on the landscape.

Wetland prioritization tool

A spatial statewide wetland prioritization tool will be developed that will rank wetlands for suitability for conservation, restoration, and mitigation needs. The tool will be developed by the Institute for Natural Resources and The Wetlands Conservancy and become part of the Oregon Wetlands Explorer website. The tool will combine multi-function information on flooding, water quality, hydric soils, mitigation banks, HGM assessments, conservation sites, historical wetlands, and a HUC-4 level index of ecological integrity using current land cover and the degree of fragmentation and disturbance.

Status and Trends studies

Accurately assessing wetland quantity status and trends requires up-to-date inventories but provide valuable information on changes in the distribution and types of wetlands. A status and trends study for the Willamette Valley has been conducted approximately every ten years since 1984 and the next study is due in 2015. Regional status and trends will be targeted at ecoregions that have experienced and continue to experience the most wetland alteration. These regions include the Willamette Valley, the coast, and the Umpqua and Rogue basins in Southern Oregon. Other regional status and trends will be conducted as needed and as resources allow.

Wetland buffer assessment

A pilot study to assess the effectiveness of wetland buffers will be evaluated as resources allow. Understanding the condition of adjacent upland (buffers) around wetlands is one aspect of protecting wetland water quality and habitat. However, wetland buffer protection is not required by state regulation but is required by some local government wetland regulations. Questions about adequate buffer size, effectiveness of buffers, and whether regulatory permit conditions should incorporate buffers have not been addressed. Through landscape analysis, land use in buffer zones of various widths around wetlands can be displayed, described, and quantified. Wetland condition can then be inferred from the results, and correlations to particular land use patterns can be examined. As with all results of a landscape analysis tool, field work is essential in validating the tool to predict wetland condition as a function of buffer zone condition.

Level II – Rapid Assessment Methods

The Oregon Rapid Wetland Protocol

The Oregon Rapid Wetland Protocol (ORWAP) is currently used in the state's permitting program for assessing proposed wetland impact sites, proposed compensatory mitigation sites,

and post-monitoring mitigation assessments. The method is used for mitigation banks and is the “preferred method” by the Portland District of the Corps of Engineers. ORWAP has been selected by the Willamette Partnership as the wetland function assessment to be used for ecosystem credit accounting that is under development.

The Department of State Lands’ Wetlands Program with WPDG support from EPA will be refining ORWAP. Modifications will be made and the new version will be applied at a statistically valid probability sampling of wetland sites. The probability sampling will be done from a landscape level condition assessment of wetlands across a gradient of human-induced disturbance. The EPA National Health and Environmental Effect Research Laboratory (NHEERL) Western Ecology Division will be providing technical assistance for the sampling design. The sampling design will enable ORWAP to better meet the needs for regulatory application by normalizing scores and providing a more robust protocol for ecosystem credit accounting.

In addition, the ORWAP sampling design and assessment data will provide a characterization of wetland condition, function, and value along a gradient of human-induced disturbance resulting in a Level II reference network of 100 wetlands. Data from the 109 reference wetlands established for the Willamette Valley riverine impounding and slope/flats HGM and the 120 reference wetlands for the tidal wetlands of Oregon’s coast may be incorporated into this larger reference dataset.

Utilization of ORWAP by state, federal, local planning agencies and other wetland restoration practitioners will continue to be promoted and explored by DSL. The use of ORWAP will improve the environmental outcomes of wetland regulatory and voluntary restoration in the state by providing a consistent and repeatable wetland assessment method.

Rapid condition assessments

An analysis will be conducted to compare rapid wetland condition assessments conducted during the National Wetland Condition Assessment (NWCA) 2011 field work. The wetland condition results from NWCA’s USA-RAM and the Oregon Rapid Wetland Assessment Protocol (ORWAP) were applied at the National Wetland Condition Assessment (NWCA) sites. The results will be compared to determine potential use of USA-RAM components for monitoring and assessment in Oregon.

Pilot watershed studies

Pilot studies on targeted watersheds (e.g., selected watersheds in the Willamette, Umpqua, and Rogue River Basins) will be conducted to test new landscape profile characterizations, landscape functional assessments, and other potential watershed tools.

Oregon Wetland Plant Community Classification

The Oregon Wetland Plant Community Classification will be updated and refined. Any new rare wetland plant communities will be incorporated into the compensatory wetland mitigation rules for wetland preservation, the Oregon Rapid Wetland Assessment Method's Wetland Type of Conservation Concern, and the Oregon Explorer's Wetland Priority Areas.

Level III – Intensive Site Assessments

There have been very few intensive assessments conducted in Oregon, other than in the State's estuaries. Monitoring and assessment at the intensive site level requires significant money, time, and technical expertise. However, intensive assessments are often needed to answer certain questions, validate results for Level I and II methods, refine baseline information, and establish direct relationships between the response of biological communities and different human-induced stressors. Level III efforts will be considered where feasible.

Coastal assessments

An example of the many monitoring activities being conducted by various estuary programs and coastal organizations is the activities of the South Slough National Estuarine Reserve Research Reserve (SSNERR). The SSNERR participates in the National Estuarine Research Reserve System Monitoring Program. SSNERR will be developing a systematic process to assess ecological health of the South Slough Reserve and associated watersheds to inform coastal management decisions.

SSNERR is building a monitoring infrastructure to characterize the short-term variability and long-term changes associated with a variety of estuarine wetland and watershed attributes and processes. The expanded foundation of information will enable the Reserve to:

- evaluate the status of estuarine wetland restoration projects with much greater confidence, characterize some of the local effects of climate and land use changes.
- provide more complete watershed and estuarine wetland status assessments to local decision-makers.
- contribute to the refinement of a suite of predictive models that will help decision-makers understand the range of possible future outcomes resulting from conservation or development actions or various climate-related scenarios.

In addition, the Reserve will become a "sentinel" site as part of a new nationwide climate network to track long-term changes in atmospheric trends, including rainfall and temperature. The site will provide valuable information about climate change to Oregon's coast.

Floristic Quality Assessment

A wetland quality method that will be evaluated for possible development is a Floristic Quality Assessment Index (FQAI). This method has been extensively tested and used in other states. A Floristic Quality Assessment provides an intensive measure of wetland biological integrity at a site based on the condition of the plant community. The method assesses the degree to which the floristic elements that evolve with natural ecological communities are present at a site based on the presence of “conservative” species of vascular plants whose ecological tolerance are limited (USEPA 2002). The method has been found to be very good at detecting disturbance in wetlands in several states (USEPA 2003) and can be used as a biotic wetland condition indicator to identify reference conditions for plant communities, assess ambient wetland biological conditions and changes, and monitor restoration effects and success.

Network of reference sites

A subset of the Level II network of reference sites could be established as sentinel sites. The sites would be monitored to collect detailed quantitative sampling data to refine the network of reference sites’ baseline data for wetland health along a gradient of human disturbance. The data could also be utilized to validate results from Level I and II tools.

National Wetland Condition Assessment (NWCA) intensification study

EPA’s National Wetland Condition Assessment (NWCA) is a baseline assessment of the quality of our nation’s wetlands to accompany the U.S. Fish and Wildlife Service’s Status and Trends Study. Oregon’s DEQ and DSL staff participated in NWCA’s 2011 field-data collection by conducting field work at Oregon’s twelve designated sites. Oregon will investigate the feasibility of conducting a National Wetland Condition Assessment (NWCA) intensification study in a targeted Oregon region (i.e. Willamette Valley). The project would occur after the NWCA 2011 data has been analyzed and the effectiveness of the various indicators determined.

Growing season study

DSL and NRCS are collaborating on a wetland growing season study at four sites in the Willamette Valley along a north-south gradient (Portland, Salem, Corvallis and Eugene) to assist in making wetland determinations per the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region. The study began in 2010 and is continuing with weekly DSL field visits in late winter through early spring to monitor above-ground growth and development of vascular plants. NRCS staff conducted soil profile descriptions and installed soil temperature recording devices (HOBOS) at 12 inches and 20 inches below the ground surface to monitor soil temperature as an indicator of microbial activity in the upper soil profile.

DEQ water quality monitoring

Oregon does not currently have wetland water quality standards, however, initial efforts for wetland monitoring is being planned. DEQ will begin to collect water quality, sediment and tissue data in perennial wetlands to assess risks from toxic contaminants to aquatic life uses; collect data on mercury, methyl mercury and methylation potential in riparian wetlands; and develop potential biocriteria for wetland condition assessments.

Summary and Timeline for Implementation

Wetland monitoring and assessment activities detailed in this strategy will be evaluated or phased in over the next five years, as resources allow. A schedule for proposed timelines is in Appendix C.

INDICATORS

Oregon's monitoring and assessment program is in the early phases of development, although some assessment methods and tools have been developed. Identification of core and supplemental indicators will occur as monitoring designs, which best serve the monitoring objectives, are developed. Existing research and monitoring efforts in other states will be examined for likely indicators. In addition, climate change adaptation data needs identified by the Oregon Climate Assessment Report (Oregon Climate Change Research Institute 2010) and The Oregon Climate Change Adaptation Framework (Oregon Department of Land Conservation and Development 2010) will be considered.

QUALITY ASSURANCE

Quality Assurance Project Plans (QAPPs) will be developed for each phase of wetland monitoring in accordance with EPA requirements and appropriate state policies to ensure scientific validity of all monitoring activities. QAPPs will reflect the level of data quality appropriate for specific data uses (e.g., reporting status and trends, prioritizing restoration activities, and assessing the performance of restoration projects). The QAPPs may include tasks such as project organization, training, data generation and acquisition, sampling design, sampling methods, quality control, equipment testing, data management, data analysis, data verification and validation, and reporting

DATA MANAGEMENT

Individual data management systems are in place for the various resource agencies and programs. These management systems were developed according to specific program needs and have not yet been integrated across most programs. A long-term goal for the wetland monitoring program is a wetland data management system that meets the needs of state resource programs while supporting integrated data analysis and facilitating access to data and assessment information. From the existing data management systems, and with guidance from EPA and examples from other states, an appropriate management and analysis system will need to be designed for wetland monitoring and assessment electronic and geospatial data.

In the meantime, agency and program databases may need refinements to record and track wetland monitoring data. The Department of State Lands will be developing an accessible electronic data management system within an interactive GIS framework to manage and store the Statewide Wetland Inventory data and the statewide wetland condition (Level I) assessment data. The Oregon Explorer Wetland Portal database, managed by the Institute for Natural Resources Oregon State University, may be able to store, manage, and disperse wetland monitoring data. Data storage and analysis requirements, as well as staff and funding requirements, need to be reviewed.

DATA ANALYSIS / ASSESSMENT

Appropriate data analyses will be determined during implementation of the wetland monitoring plan according to the objectives being addressed and the level of effort used to gather data. At the landscape-level, GIS will be used to manage and to analyze data. During implementation of Level II and Level III efforts, appropriate sample design and analyses will need to be established by the Wetland Monitoring Workgroup, possibly with the assistance of the EPA NHEERL Western Research Division. Appropriate data analysis and assessment will require the assistance of personnel trained in statistics, data management and analysis.

REPORTING

The goal of wetland monitoring and assessment is to provide meaningful information about wetlands in order to improve protection, restoration, and management decisions for all wetlands. Information on the quantity and quality of wetlands in Oregon is intended to be shared (available via the web) with state, federal, tribes, local government, and other organizations responsible for or interested in the regulation, protection, restoration, and management of wetlands. In addition, the data will be analyzed in various ways to provide

meaningful and easily understood information about the state of Oregon's wetland resources for the general public.

EVALUATION

Periodic reviews of the monitoring and assessment activities and timelines will be conducted by the Wetland Monitoring Workgroup to evaluate whether the monitoring and assessment objectives are being met. The wetland monitoring strategy will be updated by the Wetland Monitoring Workgroup and other appropriate reviewers every five years. Review and update of the strategy will include determining how well the monitoring objectives are being met, how the information collected is being used to support management decisions, and additional priority needs that should be addressed. Proposed timelines and required resources will also be evaluated.

GENERAL SUPPORT AND INFRASTRUCTURE PLANNING

There is widespread interest in wetland monitoring and assessment in Oregon, both within the Department of State Lands (DSL) and among partners. Interagency coordination has been initiated through the development of the Oregon Wetland Monitoring and Assessment Strategy. For Oregon to meet the strategy's priority objectives, state, local and federal government agencies, along with private conservation organizations will need to work collaboratively on project coordination, data collection, and data management. Through the Oregon Wetland Monitoring Workgroup, DSL will work with partners to plan wetland monitoring and assessment activities and identify future monitoring resources needed to fully implement the wetland monitoring strategy. This will include state and federal funding, potential grant sources from non-governmental organizations, and partnerships with universities, and non-profits.

This initial effort needs to be strengthened by continued support for staff participation and leadership in development and implementation of a state wetland monitoring and assessment program. DSL will work, with support from EPA's Wetland Program Development grant funds, to plan and implement a wetland monitoring and assessment program in Oregon.

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APPENDIX A: Data Needs and Management Applications

Data Needs and Management Applications for Wetland Monitoring and Assessment

- Develop a coordinated wetland monitoring framework
- Establish baseline data on wetland quantity, quality, and functionality by wetland class (type) statewide
- Assess future changes (trends) on wetland quantity, quality, and functionality by wetland class (type) statewide
- Prioritize wetlands:
 - identify pristine areas for conservation or avoidance and degraded areas for recovery work
 - for implementation of priority actions based on climate change evaluations (i.e. vulnerable wetland types)
- Strategic placement of voluntary restoration, mitigation, and mitigation bank sites
- Identify causes and sources of wetland degradation (landscape level)
- Identify potential threats
- Document degree of connectivity between wetlands and with other aquatic resources and upland habitats
- Improve establishment and long-term management of mitigation sites
- Create tools to better inform the regulatory and management processes to make them more adaptive and performance-based
- Develop function-based performance standards
- Develop key vegetation community metrics
- Update classification schemes
 - Oregon Wetland Plant Community Classification
 - Coastal Habitat Classification Scheme
- Oregon Wetland Plant Community Classification
- Develop tools to assist local governments
 - conduct Local Wetland Inventories
 - address flood storage issues
 - determine effectiveness of local wetland protection measures
- Evaluate the performance (effectiveness) of restoration activities (voluntary and mitigation) in replacing wetland acreage and function

- Improve the success of wetland restoration (voluntary and mitigation)
- Improve the site-specific management of wetland resources
- Track type, acres, and functions of wetlands being restored
- Conduct land use and land cover mapping at regular intervals
- Monitor and assess a set of sentinel sites statewide
- Incorporate intensive monitoring efforts where needed and feasible
- Establish a statewide network of reference sites that reflects all wetland types in all eco-regions based on a gradient of human disturbance and ecological integrity
- Sample biological indicators of wetland condition at reference sites
- Develop assessment methods that evaluate the condition and functions of the resource relative to reference condition and functions
- Monitor and assess causes and sources of wetland degradation including:
 - loss and degradation of adjacent buffer zones
 - cumulative impacts
- Develop a database of information necessary to evaluate wetland trends
- Develop a data management system and processes that enables data sharing, supports integrated data analysis, and facilitates access to data and assessment information
- Monitor and assess long-term changes in response to climate change
- Develop wetland water quality standards
- Integrate monitoring and assessment data into watershed level management strategies
- Determine effective buffer widths and incorporate buffer zones into protection and permitting conditions
- Evaluate the effectiveness of wetland management and permitting programs with respect to wetland condition and functions
- Identify program and policy changes needed to improve overall wetland integrity statewide

APPENDIX B: Existing Monitoring and Assessment Efforts in Oregon

Wetland Quantity

Wetland Definitions, Classifications and Mapping Standards

Wetland Definition

A single definition of wetlands for the state's Removal-Fill regulatory program and statewide planning goals was established, per Oregon's Legislative Assembly policy. Wetlands are defined as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." The definition is the same used by the U.S. Army Corps of Engineers (Federal Register 1982) and the EPA (Federal Register 1980) (US Army Corps of Engineers 1987).

The U.S. Fish and Wildlife Service's Cowardin definition of wetlands are "lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water." Wetlands are identified by one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year (Cowardin et al. 1979).

Wetland Classifications

The Cowardin classification system (Cowardin et al. 1979) is used for National Wetland Inventory (NWI) mapping and has been used for wetland mapping and monitoring efforts in Oregon. The classification relies heavily on vegetation life forms, as well as geomorphology, chemistry, and hydrology to describe different wetland classes (Mitsch & Gosselink 2000).

A hydrogeomorphic (HGM) classification system has been developed for Oregon's wetlands. *The Guidebook for Hydrogeomorphic (HGM)-based Assessment of Oregon Wetland and Riparian Sites: Statewide Classifications and Profiles* (Adamus 2001a) describes Oregon's wetland types, their functions and potential values, and potential indicators of these functions. The classification consists of 6 HGM classes and 14 HGM wetland/riparian subclasses that occur in 10 different ecoregions. It describes 13 different functions expected to be provided at some level by those sites, and also describes their sensitivities to various human and natural disturbances. The development of the statewide HGM classification framework provides a

framework for assessing wetland functions and the selection and classification of reference sites.

The Oregon Department of Fish and Wildlife developed a habitat classification and inventory method for the management of Oregon estuaries. The inventories and habitat classification was used for development of estuary management plans to meet the requirements of the Oregon Land Conservation and Development's Estuarine Resource Goal. The classification system modified and expanded the USFSW Cowardin system to include estuary and subsystem types as well as habitats (Bottom et al.1979)

Mapping Standards

In 2009, the Federal Geographic Data Committee (FGDC) approved the National Standards for Wetlands Mapping and Classification (Federal Geographic Data Committee 2009) that added national standards for mapping wetlands and adopted techniques used by the NWI. All federal grants involving wetland mapping will be required to meet the FGDC standards to for mapping consistency. The standard ensures that such mapping by states and others can be added to the NWI's master geospatial database.

In 2006, as part of the Oregon Geographic Information Council's (OGIC) data content standards development, the Oregon Wetland Mapping Standard (OWMS) was developed (Oregon Geographic Information Council 2010). The standard was later revised to conform as closely as possible to the new national mapping standards. As part of OWMS's data content standards development, the FGDC's Content Standard for Digital Geospatial Metadata was adopted as the Oregon Metadata Standard (Oregon Geospatial Enterprise Office, unknown).The mapping and metadata standards provide a consistent and maintainable data structure necessary to adequately describe, develop, exchange, integrate, and use geospatial wetland data in Oregon.

For state regulatory permitting purposes, wetlands are identified and mapped at the project scale using the 1987 U.S. Army Corps of Engineer Wetlands Delineation Manual and Regional Supplements and the Department of State Lands' administrative rules for wetland delineation report requirements.

Wetland Mapping, Inventories, and Sampling Efforts

National Wetland Inventory

For more than 30 years, the U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI) Program has been providing maps and basic characteristics data of the nation's wetlands using the Cowardin classification system. The NWI has proven to be an extremely valuable resource in Oregon over the years for wetland regulatory purposes, policy development, and land use

and environmental planning activities. Although USFWS and Oregon have made significant strides in NWI mapping over the last decade, the mapping and digitizing for Oregon is still incomplete and ongoing for the state.

Even as NWI mapping and updating efforts continue for Oregon, much of the information has become outdated. The majority of Oregon's NWI mapping was completed through a cost-share agreement with USFWS in 1989 and is based on aerial photography from the 1980s. In the mid-1980's, the NWI used high-altitude, small-scale 1:58,000 black-and-white photography and then changed to 1:40,000 scale color infrared aerial (CIR) photographs in 1987. In 2007 – 2009, most of the completed maps were scanned, digitized, and rectified through an Oregon Watershed Enhancement Board partnership with USFWS.

The 1980's CIR aerial imagery were interpreted using stereoscopic pairs and wetlands were delineated as polygons on acetate overlays. Data were transferred to Mylar overlays attached to standard 1:24,000 USGS topographic quad maps. As computer technology evolved, the NWI maps were digitized using geographic information system (GIS). Mapping techniques and technology have improved over the years and now nearly all the NWI data collection and map production are created through an integrated operation executed on-screen by photo interpreters.

Mapping accuracy and quality varies widely across Oregon due to range of time the dataset is being created, the inconsistent capture techniques across the lifetime of the dataset, accuracy and availability of imagery and inconsistencies of the time of year the imagery was collected. The older mapping methods limit accuracy and older aerials do not reflect current conditions as landscapes continue to change due to natural succession, human activities, and development impacts.

Statewide Wetland Inventory

The Department of State Lands' (DSL) Wetlands Program developed Oregon's Statewide Wetlands Inventory per the wetland conservation additions to the Removal-Fill Law set forth by the 1989 Oregon legislature. The conservation policy directs the Wetlands Program to:

- Compile, maintain, and update a comprehensive Statewide Wetland Inventory for planning and regulatory purposes.
- Make the inventory available to state agencies, local governments, and other organizations to facilitate better management of wetland resources and closer coordination of local, state, and federal wetland programs.
- Inform and educate the general public about wetland functions and values, the wetland inventory, and the status and trends of Oregon's wetlands (ORS 196.672 – 196.688).

The NWI forms the basis of the Statewide Wetlands Inventory (SWI), which is used across the state for regulatory and non-regulatory environmental planning and management. There are limitations to NWI's use at state and local levels because it was established to assess decadal

and longer-term changes in wetland acreage across the nation. This broad scale effort meant that the minimum mapping target was two acres resulting in the exclusion of many smaller wetlands; the map scale prevented mapping accuracy greater than 30-50 feet; wetlands that were cultivated and cropped were not included; tree-obscured wetlands were easily missed; and seasonal or groundwater saturated wetlands were missed due to interpretation methods that largely rely on visible water and/or wetland vegetation (Oregon Department of State Lands 2004).

Local Wetland Inventories (LWIs) augment the SWI in urban and urbanizing areas where more detailed resource inventory information is needed. LWIs are required as base information for city or county wetland planning under the Oregon Department of Land Conservation and Development's (DLCD) Statewide Planning Goal 5 (protecting natural resources) and Goal 17 (coastal shorelands resources) wetland protection programs. The Department of State Lands (DSL), in coordination with DLCD, developed standards and rules for these community-based inventories (OAR 141-086-0180 through 0240, and 141-086-0300 through 0350). DSL assists local government planners in LWI development and conducts a formal review and approval process of the inventories before they are adopted and added to the SWI. Once added to the Statewide Wetland Inventory, the LWI's replace the NWI for those specific areas.

LWIs map and field-verify wetlands at least 0.5 acres or larger at an accuracy of approximately five meters (16.4 feet). In addition, all potential waters of the state, including streams, ponds, and irrigation canals are included in the maps. The LWIs provide information about the inventory area and individual wetlands, including the location, approximate size, and classification of each wetland type; description and quality of each mapped wetland; and acreage of each wetland type in the inventory area. The LWI mapped wetlands are classified using the Cowardin Classification System (Cowardin et al. 1979) and Oregon's statewide hydrogeomorphic (HGM) classifications (Adamus 2001a).

Currently, 84 inventories have been completed, 11 inventories are in progress, and 12 inventories have stalled, generally due to limited resources. A list of the inventories is in Appendix D. GIS data for LWIs was not required until 2001 and, therefore, only available for 36 of the 84 inventories. Another limitation is that the data are not integrated into one geodatabase due to differences in naming conventions and attributes have not been standardized. LWI information is available to the public on DSL's web site in PDF files for older maps and digital data by request for the newer inventories.

See <http://www.oregonstatelands.us/DSL/WETLAND/lwi.shtml>.

The Statewide Wetland Inventory does not, as a whole, meet the federal or state mapping standards. Mapping varies across the inventory due to differences in the vintage and resolution of the imagery upon which the inventory is based, differing levels of digital production, and state standards in place at the time of mapping. Some portions of the inventory are based on imagery that is older and taken at lower resolution than the standards recommend.

Oregon Wetlands Explorer Portal

The Oregon Wetlands Explorer Portal, a site embedded within Oregon Explorer, was launched in 2009 to support the conservation and restoration of Oregon's wetlands. The Oregon Explorer was developed through a partnership between the Institute for Natural Resources (INR) and the Oregon State University Library to create a web-based natural resources digital library with a single online source for all natural resource information. The wetlands portal contains various types of wetland information and the Oregon Wetlands geodatabase, which was created for planning and research purposes.

The geodatabase includes the "Oregon Wetlands Cover" that is a compilation of polygon data from several data sources. The wetland cover used all digital data available from the NWI as a base and added draft NWI mapping completed by INR, Local Wetland Inventories (GIS data and digitized maps), Oregon Department of Transportation mapping of wetlands along state highways, and mapping of individual sites by a variety of federal, state, academic, and nonprofit sources (<http://spatialdata.oregonexplorer.info/GPT9/catalog/main/home.page>). The data can be used in an "online GIS" Advanced Mapping Tool or downloaded for use in ArcGIS software. Although this wetland coverage represents the most comprehensive dataset available, the dataset cannot currently be used to represent the Statewide Wetland Inventory without completing a quality control review of non-LWI and non-NWI datasets.

USFWS Status and Trends

In 1984, the USFWS initiated a nationwide survey specifically designed to track the status and trends in wetland acreage across the United States. This survey used aerial photography of over 4,000 randomly selected four-square-mile plots across the country. The survey has been conducted roughly every 10 years (Dahl and Johnson 1991, Dahl 2000). Beginning in 2005, the status and trends report will be scheduled for every five years beginning. The USFWS Status and Trends survey has only focused on wetland quantity and has not included any measures of wetland quality or condition. Because it is designed as a national survey, the USFWS Status and Trends survey does not adequately represent the status and trends of Oregon's wetlands with acceptable statistical precision. Future Status and Trends studies aim to incorporate the NWCA data to start to understand changes in wetland quality, in addition to wetland quantity.

Oregon Status and Trends

Limited studies have been targeted to the Willamette Valley where key environmental problems are concentrated and where a high level of industrial and urban development and agricultural impacts occur. The first study was the *Wetland and Land Use Change in the Willamette Valley, Oregon: 1982 to 1994* (Daggett et al. 1998) that was published by the Department of State Lands. The second study was *The Wetland and Land Use Change in the Willamette Valley, Oregon: 1994 to 2005* (Morlan et al. 2010) that was published in 2010 by the Department of State Lands and U.S. Fish and Wildlife Service. These studies have provided

valuable information about specific changes and trends (see Appendix E) and are the most comprehensive assessments of the current status of the Willamette Valley wetlands.

A status and trends of Coastal wetlands: 1985 – 2001 was to provide a complete census and mapping of coastal lowland wetlands based on 1:24,000 scale aerals. The project mapping has been completed but due to timing differences in the tidal cycle of aerals, a change analysis was not feasible.

Wetland Tracking

The Portland District of the U.S. Army Corps of Engineers maintains a database, called the Ombill Regulatory Module (ORM), which tracks wetland permit actions regulated under the Clean Water Act Section 404. The Department of State Lands (DSL) maintains the Land Administrative System (LAS) database to administer the state’s Removal-Fill Law. LAS tracks permitted impacts to waters of the state, compensatory mitigation, permit compliance, and violations. LAS is the primary data source that is used to track progress toward meeting the state’s no net loss and net gain goals. DSL reports the wetland acres gained or lost through permits and mitigation to the Oregon Progress Board, which in turn reports to the state legislature through Environmental Benchmarks 78a and 78b.

DSL has historically tracked information on acres of wetlands converted to uplands through permitted impacts and acres of compensatory mitigation. Although DSL started requiring wetland functional assessments for impact and mitigation sites in 2006, recording and tracking has not been complete or consistent. Changes in data processing in 2008 and 2009 provided for consistent recording of Cowardin and HGM classes of impacts and mitigation; conversions of wetland types, and in the case of voluntary restoration projects, the conversion to upland (i.e. berms and levees to impound water); and violations and their resolutions. Starting in 2009, mitigation projects were required to conduct a post-project delineation and functional assessment at the end of the five year monitoring period, which helps the program determine the extent to which functional or spatial replacement has been achieved. Database changes in 2010 and 2011 have provided for more consistent data entry and for post-project “as-built” data to be recorded.

In addition to regulatory compensatory mitigation, thousands of wetland acres every year are voluntarily restored by landowners and conservation organizations under a variety of conservation programs and grants administered by federal and state agencies and nonprofit organizations, often working in partnerships. Most of the projects require state Removal-Fill General Authorization permits, but there are exempted restoration activities. Restoration efforts are also tracked by each participating agency and organization involved, independent of other partners using different methods. Some restoration projects are funded entirely by landowners, without financial or technical assistance from conservation agencies or

organizations may not be tracked at all. Some efforts have been made to track wetland restoration projects and activities statewide (e.g., see Appendix F) but these efforts are not useful for tallying wetland gains and losses because the restoration acres (acreage gain) are self-reported and may actually meet DSL's definition of wetland enhancement (existing wetland), rather than wetland restoration. Additionally, they do not gather information on impacts that result in conversion of wetland to upland or conversion within wetland types.

No data collection standard or coordination process exist that would enable the collection and compilation of the data from various data sources to report a complete and accurate statewide assessment on wetland types and quantities. Some of the known problems in relying on regulatory accounting and voluntary restoration accounting are:

Regulatory accounting:

- Does not account for wetlands filled or drained by unregulated actions, including exempted activities (e.g. fills or excavation of less than 50 cubic yards, a broad range of exempted agricultural activities, and some restoration activities) and wetlands illegally impacted.
- Does not always accurately reflect what happens on the ground — more or less wetland acreage may be lost or restored than described in permit applications. Staff resources for regulatory review, monitoring and enforcement cannot adequately address this issue.
- Does not adequately account for temporal loss of wetlands. Temporal loss results when an activity removes wetlands from the landscape before the replacement wetland is mature and fully functioning. A National Academy of Sciences (2001) review of wetland mitigation and restoration cited temporal loss as a leading reason the nation was not meeting the federal no net loss policy.
- Mitigation for wetland losses may include wetland preservation or enhancement of existing wetlands, which does not reflect actual wetland replacement acres.
- Current permit tracking does not fully account for indirect changes in the quality of wetland adjacent or downslope from a permitted impact. Wetland stresses such as altered water regimes or fragmentation can change the character and frequently the classes (type) of wetland present, often degrading wetland health or ecological condition.

Voluntary restoration accounting:

- It is difficult to get an accurate count of wetland acres restored under conservation and incentive programs because many restoration projects are completed as public-private partnerships involving many organizations. This can result in the same project acres being credited more than once.
- The term “restoration” is widely interpreted and reported to include any type of activity that increases the condition of the land for the specific project objectives. Many times projects include enhancing (re-habilitating) the condition and functions of the existing wetland, converting existing wetland Cowardin types to another type (e.g. changing a seasonal saturated palustrine emergent wetland into a seasonally or permanently flooded) or to an atypical HGM classes (e.g. depressional wetland constructed in slope wetlands), and converting portions of existing wetland to upland (e.g. berms and roads). These activities make tracking of actual acres gained (conversion of upland to wetland and prior wetlands restored) unachievable.

Wetland Quality

National and state goals for no net loss of wetlands pertain not only to wetland acreage but also to functions and values that wetlands provide naturally. Oregon’s Removal-Fill Law and the December 2002 Regulatory Guidance Letter pertaining to Section 404 of the Federal Clean Water Act both require that wetland functions and values must be considered and replaced through compensatory mitigation when permitting results in impacts to wetlands.

Nonetheless, compared to wetland quantity estimates, very little is known about wetland quality (condition, functions, and values) trends in Oregon. Agencies and programs responsible for the regulation and management of wetlands have focused on measuring net change of wetland acreage. Reasons are usually due to the lack of assessment methods, appropriate databases and tracking capabilities, and funding resources. As a result, little information exists or is tracked and readily available about wetland condition or changes in functions and values that result from the mitigated wetlands or the degradation of the remaining wetlands.

Wetland Condition, Functions, and Values

Wetland quality can be looked at in terms of the wetland’s condition and by the functions and values that characterize wetland ecosystems and their importance. The condition of a wetland is the integrity of its physical and biological structure, which is dependent on the status of the ecosystem drivers (controlling factors) responsible for maintaining the site’s integrity (e.g.,

hydrology). Condition assessments use biological and physical attribute information to interpret how degraded a wetland is with regard to its ability to support aquatic life.

A function is one of the roles wetlands play in its ecosystem, especially the hydrologic, geochemical, and biological processes it performs. The levels and types of functions that wetlands provide are determined by the processes and disturbances that affect the movement and other characteristics of water, soil/sediment, plants, and animals (Zedler & Kercher 2005, Euliss et al. 2008). Functional assessments can identify which functions a wetland is capable of performing and how well the wetland is actually performing those functions.

Values are the economic, ecological, and social expressions of a function as a result of the opportunity to provide the function based on its location and the likely significance of the function to local and regional users or resources (Adamus, et al. 2001). Functions and values are generally independent of one another. For example, in some situations a wetland's "water storage" function (ability) may be low but the value may be considered high for "partial control of downstream flood damage" if the wetland is situated above homes that are subject to runoff (Adamus et al. 2010).

Wetland Assessment Methods and Tools

Some of the wetland assessment methods and tools currently being use in Oregon are listed and discussed below:

Oregon Rapid Assessment Protocol (ORWAP)

Oregon developed the *Oregon Rapid Assessment Protocol* (ORWAP) (Adamus et al. 2010) with funding from USEPA. The protocol was first developed in May 2009 and later revised in July 2010. The primary driver for ORWAP's development was the need for a rapid function and value assessment that could be used for regulatory purposes on all wetland types. However, the protocol was developed as a standardized method for rapidly assessing wetlands for multiple assessment purposes. ORWAP assesses the functions, values, and condition of wetlands and is applicable to wetlands of any type anywhere in Oregon, and thus, can be used to compare wetlands of different types. The resultant scores reflect a wetland's ability to support 16 functions and 14 values. In addition, Provisioning Services, Public Use and Recognition, Sensitivity, and Stressors are scored and HGM class is estimated. Additional information on the protocol is in Appendix G.

Hydrogeomorphic (HGM) assessment methods

Three regional hydrogeomorphic (HGM) assessment methods have been developed for parts of Oregon that have high land use. The methods generally comply with guidelines for developing

regional HGM methods as issued by the U.S. Army Corps of Engineers in coordination with other agencies. The Willamette Valley Ecoregion HGM (Adamus et al. 2001b) is applicable to two types of sites most common in this region, slope/flat wetlands and riverine impounding sites and evaluates 13 functions. The Oregon Coast HGM (Adamus et al. 2006) covers Oregon's tidal wetlands and evaluates 12 functions. In addition, a HGM Judgmental Method was developed in conjunction with the Willamette Valley HGM that can be used for freshwater wetland in other areas of the state.

The Agate Desert Vernal Pool Functional Assessment Methodology (Environmental Science Associates 2007) was developed for wetland conservation planning in the Agate Desert area in southwest Oregon. The method was developed and applied in conjunction with the Agate Desert Wetland Conservation Plan Inventory. The method is consistent with Oregon's Willamette Valley HGM method by (1) identifying the HGM class and regional subclass settings; (2) incorporating hydrogeomorphic principles for characterizations; (3) using a similar scoring scale (0.0 – 1.0); and (4) using scoring models as representations of relationship.

The Oregon Watershed Assessment Manual

The Oregon Watershed Assessment Manual (Watershed Professionals Network 1999) was prepared for the Oregon Watershed Enhancement Board (OWEB). The Manual provides guidance to watershed councils and conservation groups on conducting a broad-scale screening evaluation of watersheds. Evaluations are based on stream geomorphology in relation to ecoregion conditions. The information gained through the evaluation can be used to identify the areas with the highest potential for improvement, high-priority areas for restoration, and the types of improvement actions that will be most effective.

An Estuary Assessment module (Brophy 2007) was developed as an addition to OWEB's Watershed Assessment Manual. The method locates current and former (historic) tidal wetlands within an entire estuary, determines alterations to those wetlands, and prioritizes conservation and restoration actions within the estuary using criteria that constitute broad indicators of current and potential tidal wetland functions.

Oregon Freshwater Wetland Assessment Methodology

The Oregon Freshwater Wetland Assessment Methodology (OFWAM) (Roth et al. 1996) was developed for local government wetland planning and protection policies. The method assesses four wetland ecological functions, three social functions, and two wetland conditions. The planning-level assessment tool was designed to assess relative qualities of wetlands in a community-planning context and is not suitable for detailed evaluation of individual wetlands. The method is becoming outdated and no longer provides the level of detail that many local governments increasingly need. The development of a landscape ORWAP will be evaluated to replace the OFWAM.

Human Disturbance Assessment

The Human Disturbance Assessment (HAD) is a rapid method to render basic wetland assessments from five aspects of anthropogenic stressors. The method was developed using a modification of a rubric developed by Gernes & Helgen for wetland assessment in Minnesota (U.S. EPA 2002b). The HDA components also follow recommendations of Rader and Shiozawa (2001) in developing criteria for defining reference conditions. The HDA assesses five site aspects:

- Buffer landscape disturbance (land use within 50 ft./15 m of wetland)
- Immediate landscape influence (500 ft./150 m of surrounding land)
- Habitat alteration, immediate landscape (500 ft./150 m of surrounding land)
- Hydrologic alteration, immediate landscape (500 ft./150 m of surrounding land)
- Chemical & Sediment Inputs

Each aspect can be rated as Excellent (0 points), Moderate (5 points), Fair (10 points), or Poor (15 points). The site HDA score is calculated by summing the rating for each section. Thus, an absolute pristine site would receive an overall score of 0, while a completely impaired site would receive 75 points.

Tidal Wetland Monitoring Protocol

The tidal wetland monitoring protocol is designed to characterize reference conditions for estuarine wetlands in Oregon. The protocol focuses on parameters needed for classification of plant communities and their associated abiotic environments.

Wetland Profiles of Oregon's Coastal Watersheds and Estuaries

This study was conducted to provide information about the quantity of coastal wetland acreage, location, and general characteristics. The report provides tabular and narrative summaries and interpretations – by watershed and estuary – of the distribution, properties, and geomorphic settings of wetlands (not just tidal wetlands) as derived from GIS analyses of available spatial data layers (Adamus et al. 2005).

Pilot database of reference conditions at least-disturbed tidal wetland sites

The pilot was a collaborative effort of South Slough NERR, Green Point Consulting, NOAA/NGS, OSU's College of Oceanic and Atmospheric Sciences, and the Oregon Natural Heritage Information Center. The reference conditions database for Oregon tidal wetlands covers four most commonly restored habitat classes (low marsh, high marsh, scrub-shrub, and forested wetlands) at least-disturbed tidal wetlands. Monitoring focused on key structural parameters (controlling factors or “drivers”) – tidal inundation regime, groundwater regime, salinity, and soil characteristics – as well as associated plant communities and macroinvertebrate

assemblages. More information can be found at <http://www.oregonexplorer.info/wetlands/DataCollections/ReferenceSiteData>.

Invertebrate-based Index of Biological Integrity (I-IBI)

Xerces Society for Invertebrate Conservation conducted a 2007 pilot study to develop an invertebrate-based Index of Biological Integrity (I-IBI) for riverine and flat wetlands in the Willamette Valley. A draft I-IBI was developed but due to a high level of variability in invertebrate communities, a complete IBI was not feasible. Additional data collection over a longer period of time will be needed.

The study resulted in developing an effective wetland sampling method for macroinvertebrates, a more extensive database of macroinvertebrate taxa in riverine and flat wetlands of the Willamette Valley, and identification of biological attributes of the macroinvertebrate community.

Effectiveness Monitoring Protocols for Riverine and Flat Wetlands in the Willamette Valley

In 2010, the Oregon Watershed Enhancement Board completed a pilot study that included effectiveness monitoring of restored and enhanced riverine and flat wetland types in the Willamette Valley. Protocols for sampling vegetation, soils, water chemistry, and birds were developed and tested

APPENDIX C: Proposed 5-year timeline for wetland monitoring and assessment activities in Oregon

Core Element: Monitoring and Assessment

Goal: To guide and coordinate statewide monitoring and assessment efforts in order to improve the State’s ability to sustainably manage and conserve Oregon’s wetlands.

Objective: Develop and maintain a wetland monitoring and assessment coordinated framework for Oregon, to monitor the status of wetlands in the state of Oregon consistent with *Elements of a State Water Monitoring and Assessment Program for Wetlands* (EPA 2006) by using EPA’s three-tier approach, and to provide decision makers with the best possible information on the extent, type, and health of our state’s wetlands and the ecosystem services they provide.

Action (a): Develop and maintain a wetland monitoring and assessment coordinated framework for Oregon					
Activity	2011-12	2013	2014	2015	2016
Collaborate with state and federal aquatic resource partners to identify mutual data needs and uses, shared goals and objectives, and program decisions and environmental outcomes that would benefit from a statewide wetlands monitoring and assessment program	X				
Develop a five-year monitoring and assessment strategy that will guide and coordinate statewide efforts	X				

Establish an Oregon Wetlands Monitoring Workgroup to continue refinement and implementation of the strategy; to build and strengthen interagency participation; and to provide an ongoing mechanism for identifying common assessment needs, priorities, and funding resources	X	X			
Evaluate and develop monitoring standards, methods, protocols that best serves the monitoring objectives of the state	X	X	X	X	X
Work toward integrating wetland monitoring efforts with other aquatic monitoring efforts	X	X	X	X	X
<ul style="list-style-type: none"> Collaborate with the Pacific Northwest Aquatic Monitoring Partnership, which provides a forum for coordinating state, federal, and tribal aquatic habitats and monitoring of aquatic resources 	X	X	X	X	X
Coordinate with the USFWS's North Pacific Landscape Conservation Cooperative, who provides scientific and technical support for landscape conservation in an adaptive management framework geared toward climate change and other biological stressors	X	X	X	X	X
Establish a data management approach for coordinated data standards, storage, management, and dissemination of monitoring and assessment data				X	X
Collaborate with and support the Institute for Natural Resources, the Wetlands Conservancy, and Oregon State University in the continued development of the Oregon Wetlands Portal to integrate and share wetland information and provide online wetland tools, such as the support tool for applying the Oregon Rapid Wetland Assessment Protocol (ORWAP)	X	X	X	X	X

Action (b): Continue wetland mapping efforts and development of Level 1 Landscape Assessments and tools					
Activity	2011-12	2013	2014	2015	2016
Participate in the National Wetland Mapping Consortium, which strives to support the management of wetland resources through enhanced wetland mapping and monitoring	X	X	X	X	X
Quality control the Wetlands of Oregon database, developed by the Institute for Natural Resources, to use as the framework for an updated Statewide Wetlands Inventory			X		
Develop an approach and schedule, in coordination with USFW and other partners, for updating the NWI statewide		X	X		
<ul style="list-style-type: none"> Investigate the feasibility of incorporating Local Wetland Inventories into the NWI master geodatabase using FGDC mapping standards 	X				
Conduct Status and Trends studies:		X	X	X	X
<ul style="list-style-type: none"> Status and Trends Report – Willamette Valley Wetland Change Study 2005-2014 			X		
<ul style="list-style-type: none"> Status and Trends Report – Complete the stalled Oregon Coastal Wetland Change Study 1985 – 2001 		?			
<ul style="list-style-type: none"> Investigate conducting other regional studies 				X	X

Develop an ORWAP “lite” assessment method for use by local governments in the significant wetlands analysis during their Goal 5 wetland planning	X	X			
Develop statewide baseline Level 1 data on wetland condition, which includes investigation of existing data, identifying data gaps, determining indicators, and developing a scoring protocol			X	X	
Investigate the utility of enhancing NWI maps with LLWW descriptors and/or the feasibility of incorporating ORWAP results that could identify wetlands types and provide functional assessments profiles over broad geographic areas or across wetland types	X	X			
Conduct pilot studies to develop and test watershed-based wetland characterizations including functional assessment tools for wetlands and streams	X	X	X	X	X
Develop spatial assessment tools that can be used to: rank wetlands based on their suitability for conservation, restoration, and mitigation needs; ascertain strategic siting of restoration projects to provide the greatest ecological benefits; determine conservation/restoration priorities areas; identify, avoid or protect high quality wetlands; identify ecological connections; evaluate surrounding land use effects; identify cases and sources of degradation; identify potential threats; and determine cumulative effects of impacts	X	X	X	X	X
Action (c): Development and refinement of Level 2 Rapid Assessment methods and tools					
Activity	2011-12	2013	2014	2015	2016
Apply the Oregon Rapid Wetland Assessment Protocol (ORWAP) to the National Wetland Condition Assessment (NWCA) sites to compare condition results with the USRAM results	X				
Refine the Oregon Rapid Assessment Protocol (ORWAP) in order to facilitate the protocols use in ecosystem credit accounting : (a) analyze and adjust indicators, (b) apply the new version to a statistical sample of wetland sites statewide, and (c) scale all function from 0 to 10	X	X	X		

Coordinate and participate in 6 ORWAP pilot projects, including the Lane Council of Government's efforts with 4 Willamette Valley cities (determine feasibility of using ORWAP to replace the outdated Oregon Freshwater Wetland Assessment Methodology when identifying Locally Significant Wetlands)	X				
Analyze ORWAP condition and functional results from the statistical sampling of wetland sites			X		
Update and refine the Oregon Wetland Plant Community Classification that is utilized in the state compensatory mitigation rules for wetland preservation, the Oregon Wetland Rapid Assessment Method's Wetland Types for Conservation Concern, and the Oregon Explorer's Special Areas of Concern	X				
Establish a wetland reference network that reflects a human-induced disturbance gradient for Oregon's wetland types <ul style="list-style-type: none"> Interpret HGM scores from reference datasets for tidal wetlands in the coastal ecoregion and for riverine impounding and slope/flats in the Willamette Valley Ecoregion 	X	X	X	X	X
		X			
Continue to develop and improve effectiveness monitoring methods <ul style="list-style-type: none"> Evaluate the utility of a Floristic Quality Assessment Index as a biotic condition indicator for wetland condition 	X	X	X	X	X
			X		
Action (d): Develop Level 3 Intensive Site Assessment methods and tools					
Activity	2011-12	2013	2014	2015	2016
Identify a set of core indicators that are relevant for established monitoring objectives for intensive site assessments			X	X	X

Develop monitoring design(s) and site selection approach(s) for the statewide monitoring effort			X	X	X
Incorporate climate change adaptation data needs identified by the Oregon Climate Assessment Report, The Oregon Climate Change Adaptation Framework, and other relevant sources into monitoring efforts	X	X	X	X	X
Develop a systematic process to assess ecological health of the South Slough Reserve and associated watersheds to inform coastal management decisions	X	X	X	X	X
Build a monitoring infrastructure to characterize the short-term variability and long-term changes associated with a variety of estuarine wetland and watershed attributes and process	X	X	X	X	X
<ul style="list-style-type: none"> Set up SSNERR (South Slough National Estuarine Reserve Research Reserve) as a 'sentinel' site to provide information about climate change to Oregon's coast 	X				
Investigate the feasibility of completing a stalled statewide coastal Habitat Classification Scheme		X			
Continue and expand the collaborative DSL and NRCS's wetland growing season study related to wetland determination efforts	X	X	X	X	X
Participate in the National Wetland Condition Assessment and in the National Wetlands Monitoring and Assessment Work Group	X	X	X	X	X
Explore the feasibility of conducting a NWCA intensification study in a targeted Oregon region (i.e. Willamette Valley)			X		

APPENDIX D: Oregon's Local Wetland Inventories

Cities and Areas with Approved Local Wetlands Inventories

Albany East of I-5
Albany North Area
Albany Oak Creek/Calapooia Area
Albany SE Industrial Area
Arch Cape
Ashland
Bandon
Bay City
Beaverton
Cannon Beach
Cascade Locks
Clackamas County North Urban Area
Clatskanie
Coburg
Cornelius
Corvallis
Cottage Grove
Creswell
Damascus
Depoe Bay
Deschutes County, Southern area
Dunes City
Eugene
Eugene, West (Wetland Conservation Plan)
Florence
Forest Grove
Gearhart
Gold Beach
Grants Pass
Gresham
Happy Valley (expansion update)
Happy Valley (West)
Harrisburg
Hillsboro

Hillsboro East Evergreen
Hood River
Hubbard
Junction City
Keizer/Salem (see Salem/Keizer)
Klamath Falls
La Grande
La Pine/Wickup Junction
Lakeside
Lincoln City
Lowell
Medford
Mill City
Molalla
Monroe
North Plains
Oregon City
Philomath
Port Orford
Prineville
Reedsport
Rockaway Beach
Salem/Keizer
Sandy
Scappoose
Scio
Seaside
Sherwood
Silverton
Springfield
Springfield Glenwood
Stayton
St. Helens
Sutherlin
Sweet Home
Talent
Tangent
Tigard
Tillamook
Toledo

Tualatin
Turner
Veneta
Vernonia
Waldport
Warrenton
West Linn
Wilsonville
Winston
Woodburn

Other Approved Inventories

Agate Desert Vernal Pools

Cities and Areas with Pending Local Wetlands Inventories

Adair Village
Bull Mountain area, Washington Co.
Dunes City expansion update
Estacada (small portion)
Florence
Hermiston
Monmouth
Newport
North Bethany area, Washington Co.
Pendleton
Yachats

LWI's Not Approved or Incomplete

Astoria
Banks
Bend
Detroit
Falls City
Idanha
Lake Oswego
Lakeview

Rockaway Beach update
Scotts Mills
Springwater
White City

APPENDIX E: Oregon Status and Trends Studies

Wetland and Land Use Change in the Willamette Valley, Oregon: 1982 to 1994

The first Willamette Valley study was published for the Department of State Lands (Daggett et al. 1998). The key finding was a loss of wetland (to upland) of approximately 6,549 acres (2.5% of the total acreage) during the report time period. The major causes of loss were agriculture 64% and rural development 23%.

A follow-up comprehensive investigation of the regulatory implications of the documented changes was conducted to look more closely at the role of wetland permit programs in the loss. The study 'Wetland Regulatory Compliance in the Willamette Valley, Oregon: 1982 to 1994' (Shaich 2000) found that 66% of the urban type conversions requiring a state permit were permitted, whereas none of the agricultural conversions were permitted.

The Wetland and Land Use Change in the Willamette Valley, Oregon: 1994 to 2005

The second Willamette Valley study was published in 2010 by the Department of State Lands and U.S. Fish and Wildlife Service (Morlan, et al. 2010). The study found that:

- Palustrine Unconsolidated Bottom (PUB) and Palustrine Unconsolidated Shore (PUS) were the only wetland types with net gain.
 - Palustrine Unconsolidated Bottoms (PUB) increased by 1,512 acres (More than double the pond gain shown in the previous 1982-1994 study)
- Wetland to wetland conversions:
 - Palustrine farmed (Pf) to Palustrine Unconsolidated Bottom (PUB) of 76 acres
 - Palustrine Emergent (PEM) to Palustrine Unconsolidated Bottom (PUB) of 1,372 acres (More than four times the 334 acres in the 1982-1994 study)
- Hydrogeomorphic (HGM) Class changes:
 - Flats experienced the most net loss at 3,743 acres
 - Net gain occurred only in Riverine Impounding (8 acres) and Depressional (859 acres)

APPENDIX F: Statewide Voluntary Restoration Tracking in Oregon

Oregon Watershed Restoration Inventory

The Oregon Watershed Restoration Inventory (OWRI) is the single largest database containing information about completed restoration projects in the western United States and is managed by the Oregon Watershed Enhancement Board (OWEB) (OWEB, 2010). OWEB administers the state's Watershed Enhancement Program whose primary mandate is to help protect and restore healthy watersheds and natural habitats. OWEB operates a grant program that helps Oregonians restore and protect rivers and wetlands. Initiated in 1995, the database originated as the means to track detailed information about restoration efforts undertaken in the name of the Oregon Plan for Salmon and Watersheds. The database currently contains over 12,000 records of restoration projects completed throughout Oregon. The database contains information about projects funded by OWEB, including wetland acres restored or enhanced, and voluntary restoration projects permitted by DSL. However, the majority of the OWRI entries represent voluntary actions of private citizens and landowners, working in partnership with federal, state, and local groups to improve aquatic habitat and water quality conditions. An example is the voluntary actions completed by private landowners through the Oregon Department of Forestry's Private Forest Program. Information provided to OWRI has been used to report on Oregon Plan accomplishments, support monitoring of restoration activities, and support watershed assessments and future restoration project planning and prioritization.

Through OWEB's partnership with the Institute for Natural Resources (INR) and the Oregon State University Library in 2007, OWRI's data can now be accessed through the Oregon Explorer, a web-based natural resource digital library. A Watershed Restoration Tool was created to show the location of and information from the OWRI database. The interface provides tracking of restoration projects throughout the state by project type and location, and contains details about each project in linked tables. In addition, tabular and GIS data can be accessed from this website. The Watershed Restoration Tool is at <http://www.oregonexplorer.info/wetlands/MappingTools>.

Conservation Registry

The Conservation Registry is an online centralized database that records, tracks, and maps on-the-ground conservation projects across the U. S. Inspiration for the Conservation Registry emerged from a stakeholder group assisting the Oregon Department of Fish and Wildlife in the development of its state wildlife action plan. Defenders of Wildlife researched other databases

around the world and worked with partners to determine how best to build a registry that could serve the needs of policy-makers, resource agencies, foundations, conservation groups and landowners (Registry, 2010).

The initial Registry launch (June 2008) was in Oregon, Washington, and Idaho. The purpose of the Registry is to help users understand the context, distribution, and effectiveness of collective efforts to protect and restore ecosystems. The database was designed to record a variety of information about many different types of environmental restoration projects. The Registry is a synthesis tool that gathers project information from multiple sources. Project data can be manually entered or electronically transferred into the Registry. Some agencies now have directives to submit their projects to the Registry.

An additional 9,872 projects from the Oregon Watershed Enhancement Board's Oregon Watershed Restoration Inventory (OWRI) database were added to the Registry in April 2010. The OWRI data fields were matched—or cross walked—to fields the Registry captures and displays. Because the Registry supports a broader view of conservation work and has broadly-defined data standards, there was some data in the Oregon Watershed Restoration Inventory that the Registry could not incorporate.

The Registry captures three project types. The first type is a project designed to protect or restore habitat, fish and wildlife, or an ecological process. It can be as ambitious as replanting thousands of acres of land with native plants, reintroducing an endangered species, and restoring the hydrology of a wetland, or as simple as placing bluebird boxes along a trail. The second type of project is a change in land designation to enhance the focus on conservation management. Projects could include acquiring land for conservation purposes, designating a refuge, or recording a conservation easement. The third category includes monitoring, research and education projects tied to a location.

By choosing to focus on conservation across the landscape, the Registry provides a user-friendly format where it is possible to visualize the broadest extent of Oregon's investments in habitat and wildlife. The data shows the range of where conservation-related activities are occurring, what priorities are being met, and where new investments need to be made. The Registry has many benefits, including: assists in determining the degree to which actions are taking place within identified priority areas; determining if projects are effectively conserving habitat for at-risk species; providing a means to learn from the successes and challenges experienced by others doing similar projects; helping conservationists find partners, funding, and advice. The Registry can also act as a project management tool for those agencies and organizations that do not have the resources to build their own tracking database or still track projects on paper, because the on-line database and mapping system allows searching and mapping of conservation projects.

Summary

Both the OWRI database and the Conservation Registry provide a means to track wetland restoration projects, and with the release of OWRI data to the Oregon Explorer, both provide wetland restoration data to the public in a user-friendly format. However, these databases are not appropriate for tracking and reporting the state's wetland status. Neither verifies the reporting of acres of restoration (acreage gain) versus enhancement (an unclear distinction to many "restoration" practitioners) and they do not gather information on impacts that result in conversion of wetland to upland or conversion within wetland types.

The OWRI database records more detailed project data while the Conservation Registry has broadly-defined data standards that only ask for acreage related to project size. OWEB requires detailed data and disseminates OWRI data to both the Conservation Registry and the Oregon Wetland Explorer.

APPENDIX G: Oregon Rapid Assessment Protocol (ORWAP)

The Oregon Rapid Wetland Assessment Protocol assesses the following 16 specific functions and values:

- Water Storage & Delay	- Anadromous Fish Habitat
- Sediment Retention & Stabilization	- Non-anadromous Fish Habitat
- Phosphorus Retention	- Amphibian & Reptile Habitat
- Nitrate Removal & Retention	- Waterbird Feeding Habitat
- Thermoregulation	- Waterbird Nesting Habitat
- Carbon Sequestration (function only)	- Songbird, Raptor, & Mammal Habitat
- Organic Matter Export (function only)	- Pollinator Habitat
- Aquatic Invertebrate Habitat	- Native Plant Diversity

ORWAP generates scores between 0 and 10 directly from the scoring models that use 140 indicators. The scoring models are based on scores from 221 wetlands that were assessed during the development of the protocol. Due to the site selection design, the scores could not be adjusted to “normalize” the scaling. The outcome of the scoring for the 221 wetlands was summarized (DSL, et. al. 2010) to provide a minimum, maximum, median and mean scores for the function, values, conditions, stressors, and sensitivity outputs.

The Oregon Wetlands Explorer Portal also includes an Oregon Rapid Wetland Assessment Protocol (ORWAP) section. This portion of the portal was developed as a support tool for ORWAP. The tool provides easy access to site-specific information that is needed to answer some indicator questions. The data improves the accuracy and comprehensiveness of the wetland assessment. Users locate their project site on a map by geographic coordinates to obtain information such as pre-settlement vegetation, protected and priority areas, and known proximity of rare species. Map layers are activated to retrieve additional information on habitat, land cover, position in the watershed, elevation, wetlands, and soils. The portal also allows users to upload their wetland assessment results.