USDA United States Department of Agriculture

Pacific Northwest Region Aquatic Restoration Project

Environmental Assessment

Forest Service Pacific Northwest Region Portland, Oregon November 2019

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Contents

List of Tables

List of Figures

Acronyms

ARBO II	Programmatic biological opinion for aquatic restoration activities in the States of Oregon, Washington and portions of California, Idaho, and Nevada (NMFS 2012 and USFWS 2013)
INFISH	Decision Notice and Environmental Assessment for the Interim Strategies for Managing Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and Portions of Nevada (USDA and USDI 1995b), commonly known as Inland Native Fish Strategy.
PACFISH	Decision Notice and Environmental Assessment for the Interim Strategies for Managing Anadromous Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of Northern California (USDA and USDI 1995a)
NFMS	National Fisheries Marine Service (also known as NOAA Fisheries)
TMDL	Total Maximum Daily Load
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service

Introduction

The Forest Service Pacific Northwest Regional Office has prepared this environmental assessment to analyze the potential effects of 1,800 proposed aquatic restoration activities across 16 national forests and the Columbia River Gorge National Scenic Area in Oregon and Washington (hereafter called the "project area"). These activities are proposed to start in 2019 and would occur during a 15-year period. The aquatic restoration activities were derived from 19 activity categories and associated project design criteria listed in the Aquatic Restoration Biological Opinions (commonly referred to as ARBO II) issued by the National Marine Fisheries Service (NMFS 2012) and U.S. Fish and Wildlife Service (USFWS 2013). Additional project design criteria were developed to address issues beyond those addressed by ARBO II. See figure 1 for a map of the area applicable to this analysis.

We prepared this environmental assessment to provide sufficient evidence and analysis to determine whether to prepare an environmental impact statement or a finding of no significant impact.[1] This analysis addresses the four requirements of an environmental assessment identified in the Code of Federal Regulations: need for proposal, alternatives, environmental impacts, and listing of persons and agencies consulted.[2] As required, analysis sections of this document are summarized from supporting data and documentation (including references cited), which can be viewed on the project website[3] or requested from the project record.

Need for the Proposal

The Forest Service has a backlog of aquatic restoration opportunities essential to the protection and recovery of rare aquatic species and water quality, but has limited resources (both personnel time and funding) to address the backlog in a timely fashion. There is a need to increase efficiency of project planning in order to accelerate the pace of aquatic restoration project implementation. Currently, a substantial portion of personnel, time, and funding is spent on National Environmental Policy Act (NEPA) planning for individual aquatic restoration projects. The time and funding dedicated to such planning and analysis is particularly important since there are existing tools in place (ARBO II and a programmatic 401 permit) that enable streamlined implementation of projects under the Endangered Species Act and the Clean Water Act.

The Forest Service recognizes the need to accelerate the pace and scale of aquatic restoration in the Pacific Northwest to address legacy impacts to aquatic and riparian habitat. We have a responsibility to restore federally listed fish populations, restore water quality, and manage for biodiversity. Management direction in our forest plans amended by the Northwest Forest Plan and PACFISH/INFISH does a good job protecting aquatic and riparian habitat, but legacy impacts remain, and in many cases, we will not meet our restoration responsibilities without active restoration.

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[1] See 40 CFR 1508.9
[2] 40 CFR 1508.9 (b) and 36 CF 220.7 (b)
[3] https://data.ecosystem-management.org/nepaweb/nepa_project_exp.php?project=53001

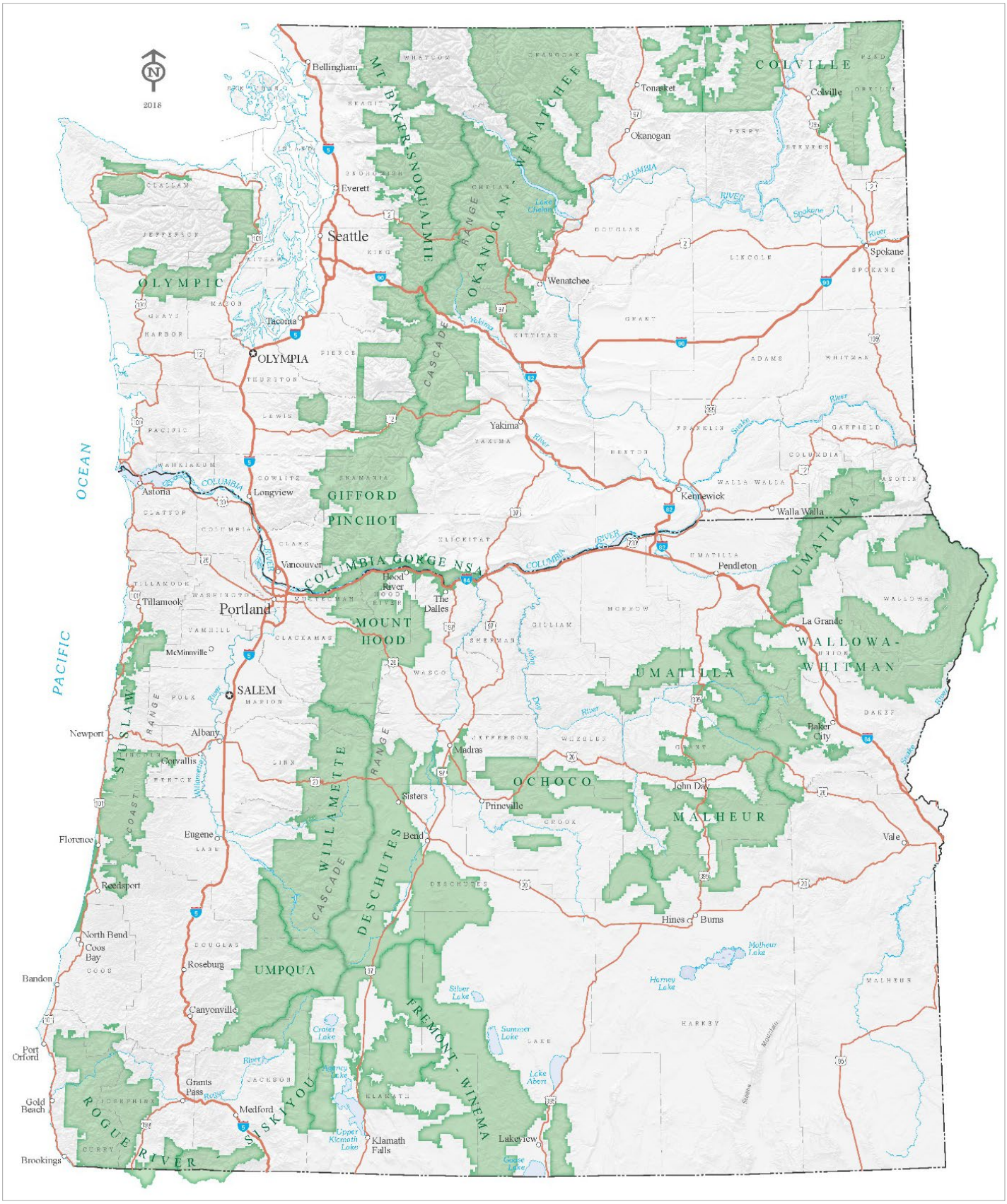

Figure 1. Locations of the areas under analysis

The Region's restoration needs are extensive. Many streams and rivers are lacking wood from past cleanout efforts, past logging and fire suppression in riparian areas, barriers to downstream wood migration, and streamside roads. Streams and rivers have been channelized and straightened from past agricultural or other drainage activities. Roads and trails encroach upon rivers and streams, restrict floodplain access, increase sedimentation, and decrease wood input and shade. Riparian vegetation has been affected by past timber harvest, fire suppression, recreation, livestock grazing, and other past management activities. Fish migration and river hydrology have been affected by legacy instream structures such as culverts, dams, diversions, tide gates, and others. Watershed restoration action plans have been developed to address a variety of degraded conditions. These can be viewed on the watershed condition framework interactive map at https://apps.fs.usda.gov/wcatt/

The backlog of restoration needs is immense. For example, our regional fish migration barrier database indicates there are more than 3,000 fish migration barriers (primarily undersized culverts) in perennial streams within the region. Over the last decade, on average 40 barriers a year have been fixed. We estimate at our current pace of restoration, it will take well over a century to complete essential restoration work in the Region. This is an unacceptable pace and needs to be accelerated. Aquatic restoration, which primarily targets restoration of watershed processes in riparian areas, is needed on National Forest System lands to aid in the recovery of federally listed fish and to improve water quality, among other needs.

Diversity and Extent of Federally Listed Fish and Water Quality Limited Streams on National Forest System Lands

Endangered Species Act Listings and Critical Habitat: The National Marine Fisheries Service is responsible for listing and delisting anadromous fish species, and the U.S. Fish and Wildlife Service is responsible for listing and delisting freshwater fish. Within the proposed project areas, 20 listed fish are anadromous: 6 Chinook, 2 chum, 3 coho, and 2 sockeye salmon, 6 steelhead trout, and the Eulachon. Four listed fish are resident species: bull trout and three species of suckers. All fish species that are addressed in this analysis are provided in aquatic species tables, located on the project website at: https://data.ecosystem-management.org/nepaweb/nepa_project_exp.php?project=53001.

Once a fish is listed as threatened or endangered under the Endangered Species Act, the National Marine Fisheries Service and U.S. Fish and Wildlife Service designate critical habitat for the species. Critical habitat is defined as:

1. specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and
2. specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation.

In Oregon and Washington, 25,518 stream miles are designated as critical habitat, and 5,982 of these miles occur on National Forest System lands; this constitutes 23.4 percent of the total, far more than any other landowner or manager.

Water Quality Limited Streams: The Clean Water Act of 1972 was created "to restore and maintain the chemical, physical, and biological integrity of the Nations waters." Under section 303(d) of the Act, State agencies are required to establish water quality standards and develop

lists of streams that do not meet such standards. Consequently, the Oregon Department of Environmental Quality and Washington Department of Ecology have placed 5,550 miles of streams on National Forest System lands on a water quality impaired list, commonly known as the 303(d) list. The water quality standard cited most frequently is stream temperature, a parameter to determine the ability of a waterbody to sustain healthy fish populations.

Key Role of the Forest Service in Achieving Federally Listed Fish and Water Quality Recovery Goals

Recovery Planning for Federally Listed Fish: The National Marine Fisheries Service and U.S. Fish and Wildlife Service developed recovery plans for the federally listed fish species in Oregon and Washington, and such plans are specific to recovery domains for anadromous species and recovery units for resident species. In simple terms, recovery domains and units consist of geographic areas based primarily on species and ecosystem boundaries. The National Marine Fisheries Service[4] has issued nine recovery plans that encompass 13 of the national forests and the scenic area, while the U.S. Fish and Wildlife Service[5] has created one that includes 11 of the national forests and the scenic area. Combined, the recovery plans of these two agencies make restoration recommendations for all 16 of the national forests and the scenic area in the Pacific Northwest Region. Refer to the list of recovery plans applicable to the project area located on the project website at:
https://data.ecosystem-management.org/nepaweb/nepa_project_exp.php?project=53001.

The Forest Service plays a vital role in implementing recovery plan recommendations. For example, the National Forest System lands represent the largest land base in the Upper Columbia Basin, managing spawning and rearing streams through several guiding documents that amended forest plans, including the Northwest Forest Plan, the Inland Native Fish Strategy and the Pacific Anadromous Fish Strategy (INFISH and PACFISH; UCSRB 2007, p. 12). Along the Oregon coast, the National Marine Fisheries Service recognizes that the Forest Service conducts programs that contribute greatly to the recovery of Oregon Coast coho salmon (page 202, NMFS 2016). Authors of the Puget Sound Recovery Plan stated that federally listed fish recovery depends, in part, on the Forest Service implementing aquatic restoration and achieving objectives listed in the Northwest Forest Plan[6] (2007, p. 403). In short, the Forest Service has been and continues to be recognized as an important contributor and partner in recovery of federally listed fish in Oregon and Washington.

Water Quality Management Planning for Water Quality Limited Streams: As directed by the Clean Water Act, each State agency must develop a total maximum daily load (TMDL) for all the waters identified on the section 303(d) list of impaired waters. A TMDL determines pollutant reduction targets and usually covers a basin or subbasin. In instances where TMDLs include National Forest System lands, the Forest Service is listed as a designated management agency responsible for developing a water quality restoration plan identifying strategies and actions to attain water quality standards. The development and implementation of a water quality restoration

[4] http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/recovery_planning_and_implementation/index.html

[5] https://www.fws.gov/pacific/bulltrout/

[6] The Northwest Forest Plan is described under "Forest Service Land Management Plan Direction" on page 4 below.

plan is the primary mechanism to address and restore impaired waters on Forest Service lands and to support State development and implementation of TMDLs on those lands.

Forest Service Implementation of Recovery Plans and Water Quality Management Plans: Because recovery plans for federally listed fish do not provide site-specific actions for the vast majority of geographic areas, the National Marine Fisheries Service and U.S. Fish and Wildlife Service rely upon locally developed plans that identify site-specific actions to be carried out by community-based entities.[7] Likewise, State agencies rely on designated agencies, such as the Forest Service, to develop water quality management plans aimed at restoring water quality.

The Forest Service is actively involved with implementing federally listed fish recovery plans and water quality management plans. Since 2013, for instance, the Forest Service implemented 450 aquatic restoration projects (averaging 90 per year) across the project area. These projects targeted recovery of federally listed fish habitat, water quality, or both. Refer to table 1 for the number and miles of habitat restoration projects that have occurred in the project area between 2013 and 2017.

Table 1. Habitat restoration completed under the ARBO II on National Forest System lands from 2013-2017

Protection and Restoration Categories	Number of projects	Quantity of Treatments
Aquatic organism passage	108	281 miles
Instream, side-channel, and floodplain	234	527 miles
Riparian and upland vegetation	54	9,845 acres
Road decommissioning and stormproofing	54	130 miles

*Riparian area protection is not a project listed in the Aquatic Restoration Biological Opinion; it is passive restoration directed under the Northwest Forest Plan, PACFISH and INFISH.

The vast majority of the 450 projects listed above are focused on implementing federally listed fish recovery plans and Clean Water Act water quality management plans. Currently, the 16 national forests and the scenic area are guided by 66 watershed restoration action plans, which target subwatersheds[8] that include federally listed fish, impaired water quality, or both. The watershed restoration action plans document watershed processes, disruptions to those processes, and essential actions needed to restore such processes, along with timelines and costs. This collection of 66 watershed plans has identified approximately 2,000 projects. Once actions in a watershed plan are completed, typically in 5 to 10 years, the associated subwatershed is generally classified as "functioning properly," an official Forest Service designation indicating the subwatershed has the capacity to function at more natural conditions.[9] From that point, national forest or scenic area staff will complete additional watershed restoration action plans for other subwatersheds with an ultimate objective of creating a network of appropriately functioning watersheds on National Forest System lands throughout Oregon and Washington, informed by federally listed fish recovery plans and Clean Water Act water quality management plans. From 2012 to 2018, the National Forest System units in the region completed all essential restoration

[7] National Marine Fisheries Service 2007 (Puget Sound Recovery Plan, p. 353) and 2009 (Middle Columbia River Steelhead Distinct Population Segment Recovery Plan, p.7-4)

[8] Subwatersheds are defined by a 12-digit hydrologic unit code and generally contain acreage values between 10,000 and 40,000 acres.

[9] The subwatershed may be classified as "functioning at risk" in some limited circumstances where the full suite of needed restoration actions cannot be implemented due to social, economic, legal or other factors.

projects outlined in restoration plans for 26 subwatersheds. Based on accomplishments in recent years, the region estimates that restoration will be completed in another 50 to 60 subwatersheds in the next 10 years and 75 to 90 subwatersheds in the next 15 years.

Key Role of the Forest Service in Conserving Non-listed Species and Protecting Water Quality

Beyond facilitating the recovery of listed species and restoration of impaired waters, the Forest Service plays a critical role in conserving species that are not federally listed and protecting and maintaining the quality of waters where relevant standards are already being met. As such, many of the 450 projects listed in table 1 improved habitat for non-listed species.

Forest Service Land Management Plan Direction

This project is guided by direction from the 16 individual national forest land management plans (also called "forest plans") and the Columbia River Gorge National Scenic Area Management Plan. This analysis is consistent with the final environmental impact statements for these plans and incorporates the plans by reference.

The plans were amended by three records of decision that direct aquatic restoration on these National Forest System units and include the following:

1. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (USDA and USDI 1994), commonly known as the Northwest Forest Plan;
2. Decision Notice and Environmental Assessment for the Interim Strategies for Managing Anadromous Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of Northern California (USDA and USDI 1995a), commonly known as PACFISH; and
3. Decision Notice and Environmental Assessment for the Interim Strategies for Managing Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and Portions of Nevada (USDA and USDI 1995b), commonly known as INFISH.

Northwest Forest Plan (1994)

The Northwest Forest Plan amended all forest plans in the Pacific Northwest Region of the Forest Service within the range of the northern spotted owl, primarily those National Forest System lands west of the east base of the Cascade Mountains. The primary portion of the Northwest Forest Plan providing guidance for this project is the Aquatic Conservation Strategy, which includes objectives, riparian reserves, standards, guidelines, and direction for watershed restoration. The Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems on public lands the Northwest Forest Plan applies to. Important elements of the Northwest Forest Plan include:

- **Aquatic Conservation Strategy Objectives** (page B11): Nine objectives guide management on National Forest System lands to maintain or restore natural watershed processes promoting important attributes, such as stream connectivity, hydrologic and sediment regimes, water quality, and plant and animal species diversity.
- **Riparian Reserves** (pages B12-17)**:** Riparian reserves bound all streams, lakes, wetlands, and unstable and potentially unstable lands on National Forest System lands. Conservation of

aquatic or riparian-dependent resources receive primary emphasis in these areas. They are also important for some terrestrial species. Reserves are at least 300 feet wide on either side of fish-bearing streams, at least 150 feet wide on perennial non-fish-bearing streams, and 100 feet wide on non-fish-bearing seasonally flowing or intermittent streams (pages C30, 31).

- **Key Watersheds** (page B12, B18-19): Key watersheds are a long-term network of large refugia comprising watersheds that are crucial to at-risk fish species and stocks and provide high quality water.
- **Watershed Restoration** (page B12, B30-31): Watershed restoration is a comprehensive, long-term program to restore watershed health and aquatic ecosystems, including the habitats supporting fish and other aquatic and riparian-dependent organisms. The most important components of watershed restoration actions address restoration of instream habitat complexity, restoration of riparian vegetation, and control and prevention of road-related runoff and sediment. Key watersheds are the focus of restoration actions over the long-term. Priority watersheds are generally a subset of this large network, wherein restoration planning and implementing occurs in the near-term (5 to 10 years).
- **Watershed Analysis** (B12, B20-30): Watershed analysis is a process for evaluating geomorphic and ecologic processes operating in specific watersheds. It provides a basis for watershed planning, management and restoration to achieve Aquatic Conservation Strategy objectives and potentially refine riparian reserve widths.
- **Standards and Guidelines** (pages C31-38)**:** Standards and guidelines require activities (such as timber, road, grazing, and recreation management) to meet or not prevent attainment of Aquatic Conservation Strategy objectives.

PACFISH (1995)

The National Forest System lands in the Pacific Northwest Region generally east of the Cascade Mountains that contain anadromous fish are covered under PACFISH. PACFISH includes riparian goals, riparian management objectives, riparian habitat conservation areas, standards, and guidelines. It also identifies watersheds that are priorities for conservation.

- **Riparian Goals** (page C-4): The goals establish expectations for healthy, functioning watersheds, riparian areas, and associated habitats.
- **Riparian Management Objectives** (pages C-4 to C-6): Riparian management objectives serve as quantifiable measures of stream and streamside conditions that define good anadromous fish habitat. Examples include pool frequency, water temperature, large woody debris, bank stability, lower bank angle, and width-to-depth ratio.
- **Riparian Habitat Conservation Areas** (pages C-6 to C-8): PACFISH designated riparian habitat conservation areas along all streams, wetlands, lakes, ponds and unstable and potentially unstable areas. Riparian habitat conservation areas are analogous to Northwest Forest Plan riparian reserves (described above) and have comparable widths.
- **Standards and Guidelines** (pages C-9 to C-18): Standards and guidelines apply to all riparian habitat conservation areas and to activities in areas outside riparian habitat conservation areas that have been identified through environmental analysis as potentially degrading riparian habitat conservation areas. The standards and guidelines are comparable to those identified under the Northwest Forest Plan.

INFISH (1995)

National Forest System lands in the Pacific Northwest Region generally east of the Cascade Mountains that do not contain anadromous fish are covered under INFISH. INFISH riparian goals, riparian management objectives, riparian habitat conservation areas, standards, and guidelines are comparable to those found in PACFISH.

No Action and Proposed Action

We sent information on the proposed action to the public and to local, State and Tribal governments and other Federal agencies for comments and feedback. In the comments we received, [10] none generated issues that would prompt us to develop additional alternatives. [11] In addition to the proposed action, evaluating a no-action alternative provides a baseline for comparing effects of proposed activities with existing conditions.

No Action

For the Pacific Northwest Aquatic Restoration Project, the no-action alternative represents the current, on-going aquatic regionwide restoration program. Across the Pacific Northwest Region, we implement about 90 aquatic habitat improvement projects annually. The number of actions and related miles of habitat restored in table 1 generally represent the program of work that would continue in the future without the Pacific Northwest Aquatic Restoration Project.

Proposed Action (Modified)

During the scoping period and the public notice and comment period, we received a spectrum of input both internally and from the public. This input helped shape the proposed action. The highlights of those improvements are listed below. For context, the highlights are most often described in relation to the actions as they are defined in ARBO II as these were the starting point for developing the environmental assessment. The last few bullets, are not specific to individual actions, but instead highlight issues raised that are pertinent to a variety of the actions:

- **Dam, tidegate, and legacy structure removal:** ARBO II does not limit the size of dams that can be removed. In the modified proposed action, dam removal is limited to dams that are no more than 10 feet high and 15 acre-feet in reservoir capacity and is included under a new category—small dam removal. Tidegates have been dropped because of limited use of the category. Legacy structure removal is now in a category of its own. This action remains consistent with ARBO II.
- **Channel Reconstruction and Relocation:** Stage zero[12] projects as allowed under ARBO II are not included in the modified proposed action.
- **Reduction and Relocation of Recreation Impacts:** ARBO II allows closures and relocation of recreation infrastructure along streams and within riparian areas. The modified proposed

[10] See the public comments summary on the project website at: https://data.ecosystem-management.org/nepaweb/nepa_project_exp.php?project=53001.
[11] "When there are no unresolved conflicts concerning alternative uses of available resources . . . , the [environmental assessment] need only analyze the proposed action and proceed without consideration of additional alternatives" (36 CFR 220.7(b)(2)(ii)).
[12] See Cluer and Thorne (2013) for definition and discussion of Stage 0.

action does not include the closure and relocation of developed recreation sites or established dispersed sites established through travel management decisions.

- **Livestock Fencing, Stream Crossings, and Off-Channel Livestock Watering:** ARBO II allows fencing to exclude grazing in riparian reserves and riparian habitat conservation areas. The modified proposed action allows fencing to protect aquatic restoration projects from other land uses. Fence construction for any other purpose, such as the construction of riparian grazing pastures, is not included. Further, off-channel livestock watering is excluded.
- **Road and Trail Erosion Control and Decommissioning:** ARBO II addresses closing or decommissioning road and trails. The modified proposed action limits decommissioning to non-system (unauthorized) routes, consistent with each Forest's travel management decisions and associated motor vehicle use map. Travel management subparts A and B must be in place for these actions to occur and no system roads or trails would be decommissioned.
- **Nonnative Invasive Plant Control:** This category has been dropped from the modified proposed action because national forest units have or will complete environmental analysis and make local decisions on invasive plant treatments.
- **Juniper Removal:** ARBO II includes juniper tree removal in riparian reserves and riparian habitat conservation areas and adjoining uplands. For this modified proposed action, juniper removal is excluded for upland areas and is limited to riparian areas where they have encroached due to stream downcutting and fire suppression. If felled, they would be retained on site or used in stream for restoration. Use of chaining for juniper removal, which is allowed under ARBO II, is not included in the modified proposed action.
- **Beaver Habitat Restoration:** ARBO II includes two subcategories—in-channel structures and habitat restoration. The modified proposed action breaks the two subcategories into two separate categories—beaver dam analogs (in-channel structures) and beaver habitat restoration (vegetation treatments). Project design criteria remains the same.
- **Riparian Vegetation Treatment:** Clarification and project design criteria have been added to the environmental assessment regarding thinning that may occur as part of riparian vegetation treatments. The environmental assessment now clarifies that riparian thinning will only be noncommercial in nature, and can only occur where it is necessary to adjust fuel loads to implement a moderate-severity burn to promote growth of deciduous trees such as aspen.
- **Reduction and Rehabilitation of Recreation Impacts:** Project design criteria have been added that require advanced notification and consultation with representatives of recreation user groups and outfitter guides for projects occurring in/around developed and dispersed sites. The environmental assessment also requires notifications of project proposals to be posted at trailheads and river access sites.
- **Pre-project Notification, Public Review, and Forest Service Response:** The notification process has been revised to include a step where the Forest Service unit sends (via email) interested parties pre-project notification reports at least 60 days prior to planned project implementation. Further, interested parties would be allowed 20 days to provide site-specific comments on project design, found in appendices 1 and 2 (Aquatic Restoration Categories, Descriptions, and Design Criteria and General and Resource Project Design Criteria), and effects to communities, species, and the environment. The responsible official may use the comments to continue, modify, or stop the project.

- **Cultural Resource Surveys:** The scoping document stated that programmatic agreements would be pursued with the Oregon State Historic Preservation Office and the Washington Department of Archaeology and Historic Preservation to allow post-decision surveys. The Forest Service, in consultation with the Advisory Council on Historic Preservation, Oregon Station Historic Preservation Office (Oregon SHPO) and the Washington Department of Archeology & Historic Preservation (Washington DAHP) has determined that this EA is programmatic in nature and the application of existing programmatic agreements can be utilized. For all projects analyzed under this EA, the Section 106 processes outlined in the *2004 Programmatic Agreement Among the United States Department of Agriculture Forest Service Pacific Northwest Region (Region 6), and the Oregon State Historical Preservation Officer Regarding Cultural Resources Management In the State of Oregon by the USDA Forest Service* and the *1997 Programmatic Agreement Among the United States Department of Agriculture Forest Service Pacific Northwest Region (Region 6), and the Washington State Historic Preservation Officer Regarding Cultural Management In the State of Washington* are two documents that clearly outline the Section 106 process that can be applied to the projects analyzed under this EA. If either PA is revised and replaced from the date of the final EA, the most current programmatic agreement for each state would be followed. All Section 106 compliance will be completed prior to project implementation.
- **Private Property Rights, including Water Rights**: Clarification and project design criteria have been added to the environmental assessment to ensure that the proposed action will not harm valid existing water rights or other property rights that may be associated with existing structures. Specifically, design criteria have been added that require identification and evaluation of potential effects on existing valid water rights through coordination with the Oregon Department of Water Resources and the Washington Department of Ecology; and to design and implement projects in a manner that does not harm those rights. Comparable project design criteria have also been added to the environmental assessment to prevent other private property from being affected by the proposed action (appendix 2, p. 88).

Types of Aquatic Restoration Proposed

This proposed action includes 19 aquatic restoration categories, all of which are covered under the National Marine Fisheries Service and U.S. Fish and Wildlife Service Aquatic Restoration Biological Opinions (ARBO II; NMFS 2013 and USFWS 2013). The actions would occur in riparian reserves or riparian habitat conservation areas[13] on National Forest System lands in Oregon, Washington, and a small portion of northwest California. This project does not cover actions that extend outside riparian reserves and riparian habitat conservation areas, with the exception of non-system road and trail decommissioning in areas already covered by 36 CFR 212 Subpart A and B travel decisions. Appendix 1 "Aquatic Restoration Categories, Descriptions, and Design Criteria" contains detailed descriptions of individual restoration categories and associated project design criteria. (Additional project design criteria are provided in Appendix 2 – General and Resource Project Design Criteria.)

[13] Riparian reserves under the Northwest Forest Plan (USDA Forest Service 1994) and riparian habitat conservation areas under PACFISH and INFISH (USDA 1995a and 1995b) are those portions of watersheds where riparian-dependent resources receive primary emphasis. These areas include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems.

Aquatic Organism Passage Categories

- **Fish Passage Restoration:** Replace or remove culverts at road crossings.
- **Small Dam Removal:** Remove unauthorized, abandoned, or agency small dams that are no more than 10 feet high and 15 acre-feet capacity. Remove channel-spanning weirs and abandoned diversion and other water retention structures. Third-party dams can also be removed when coordination has occurred and agreement has been reached with the owner.

Instream, Side-channel, and Floodplain Categories

- **Beaver Dam Analogs:** Install in-channel structures to aggrade streams and/or encourage beavers to build dams in incised channels and across floodplain surfaces.
- **Bull Trout Protection:** Remove brook trout or other nonnative fish species via electrofishing or other manual means to protect bull trout from competition, hybridization, or both.
- **Channel Reconstruction and Relocation:** Reconstruct or relocate altered stream channels in a manner that mimics natural gradient, bankfull width, and sinuosity.
- **Fencing to Protect Aquatic Restoration Projects:** Construct fences to protect aquatic restoration projects from other land uses.
- **In-channel Nutrient Enhancement:** Place salmon carcasses, carcass analogs (processed fish cakes), or inorganic fertilizers in streams to help return stream nutrient levels back to historical levels.
- **Large Wood, Boulder, and Gravel Placement:** Place large wood, boulders and gravel in stream channels and adjacent floodplains in a manner that mimics natural conditions and locations.
- **Legacy Structure Removal:** Remove past structures, such as rock gabions and other in-channel and floodplain structures that are inconsistent with current science and watershed processes. These structures are commonly associated with past projects intended to stabilize or restore waterways.
- **Off- and Side-Channel Habitat Restoration:** Reactivate and restore relic side channels by removing manufactured fill and plugs.
- **Piling and other Structure Removal:** Remove unauthorized, abandoned, or agency untreated and chemically treated wood pilings, piers, boat docks as well as similar structures comprised of plastic, concrete, and other material. Third-party structures can also be removed when coordination has occurred and agreement has been reached with the owner.
- **Reduction and Rehabilitation of Recreation Impacts:** Remove or improve infrastructure associated with designated campgrounds, dispersed campsites, day-use sites, foot trails, and off-road vehicle roads and trails to improve riparian resources in riparian reserves or riparian habitat conservation areas.
- **Set Back or Removal of Existing Berms, Dikes, and Levees:** Remove or set back berms, dikes, and levees which were constructed for flood control to reconnect fresh-water deltas to inundation, stream channels with floodplains, and estuaries to tidal influence.
- **Streambank Restoration:** Restore streambanks that have been artificially altered to more natural conditions.

Riparian Vegetation Categories

- **Beaver Habitat Restoration:** Restore aspen and other deciduous vegetation, required to support beaver colonies, through noncommercial thinning and controlled burning.
- **Juniper Tree Removal:** Reduce juniper densities in riparian areas to help restore plant species composition and structure that would occur under natural fire regimes.
- **Riparian Vegetation Planting:** Plant native riparian grasses, shrubs, and trees to restore native vegetation disturbed by aquatic restoration or past management actions.
- **Riparian Vegetation Treatment (Controlled Burning):** Reintroduce low and moderate severity fire to help restore plant species composition and structure expected under natural fire regimes. Conduct noncommercial conifer thinning as needed to adjust fuel loading in order to reduce burn intensity and achieve desired treatment results. Wood produced through this action will not be commercially sold, but would be available for riparian and aquatic restoration projects.

Non-System Road and Trail Decommissioning Category

- **Non-system Road and Trail Decommissioning:** Decommission non-system roads and trails in areas covered by 36 CFR 212 Subpart A and B travel management decisions to hydrologically disconnect such routes from stream networks.

Consideration of Additional Alternatives

We did not analyze additional alternatives. There was a suggestion to remove the category of restoration activities regarding vegetation management. The suggestion was based on the commenter's concern that this activity covered commercial logging. No commercial logging is included in the proposed action, so no additional alternatives were analyzed.

Connected Actions

Placement of Large Wood

Aquatic organism passage and instream, side-channel, and floodplain aquatic restoration activities may require large trees to be brought in from outside of the riparian reserves or riparian habitat conservation areas when trees are not available on site. Trees or tree segments would be transported (via truck or helicopter) and placed along existing roads and landings where an aquatic restoration project would occur. On average, about 109 logs would be needed for each stream mile of restoration. Logs generally range from 15 inches to 36 inches diameter at breast height and are generally 30 feet long or greater. With an average project length of 1.3 stream miles, about 141 logs would be delivered to each project.

To the extent possible, Forest Service units would rely on large wood from areas with existing decisions authorizing tree removal, and acquisition of danger or hazard trees from road or developed recreation site maintenance. These actions would be covered under categorical exclusions for road and recreation maintenance.[14] If wood is not available from these sources, a stand-alone environmental analysis and decision may be required.

[14] 36 CFR 220.6 (d)(3) and 220.6 (d)(5), respectively.

Invasive Plant Treatments

Most Forest Service units in the Pacific Northwest Region have existing decisions that cover invasive plant treatments across the unit, including new infestations. Aquatic restoration projects could either occur where there are existing invasive plant infestations, or the disturbance and equipment use at the project site may introduce or promote introduction and establishment of invasive plants. In either case, Forest Service units with existing decisions that cover the project site may control the infestation by following their implementation planning process. The existing environmental analysis documents cover a large suite of control methods, including herbicide use, and manual, mechanical, and cultural removal methods. Therefore, within an area covered by existing decision documentation, the typical control methods are covered.

As new sites or infestations are discovered, the unit would need to determine if the riparian site type is included in the environmental analysis, and whether the treatment methods are included. The scale of the treatment would generally conclude that potential effects are consistent with what has already been analyzed. In addition, the unit would ensure there are no special circumstances that would lead to effects beyond those included in the analysis. If the team concludes that the new site and infestation are consistent with site types and effects disclosed in the invasive plant analysis and decision, then control measures may proceed without additional analysis. For sites that are not covered by existing invasive plant treatment decisions, or for Forest Service units that don't have such decisions, site-specific environmental analysis and a subsequent decision would need to be made prior to any invasive plant treatments.

Project Locations

Figure 2 shows the Pacific Northwest Region focus watersheds and priority subwatersheds, with multi-scale priorities for watershed and aquatic restoration based on the Pacific Northwest Region's Aquatic Restoration Strategy[15] and National Watershed Condition Framework[16]. These priorities at the river basin, watershed, and subwatershed scales strategically focus the restoration program at regional and national forest levels, respectively. Specific restoration projects are defined in watershed restoration action plans developed for each priority subwatershed. The watershed restoration action plans document local watershed processes, disruptions to those processes, and actions needed to restore such processes.

Most projects (approximately 80 percent) would occur in 50 focus watersheds[17] designated by the 16 Forest Service units as being important to the recovery of federally listed fish, water quality, or both; the current set of 66 priority subwatersheds[18] designated through the Forest Service Watershed Condition Framework process; and/or future priority subwatersheds, which will generally be located within focus watersheds. Restoration within priority subwatersheds is guided by watershed restoration action plans, which can be viewed at https://apps.fs.usda.gov/wcatt/.

[15] https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_025441.pdf
[16] https://www.fs.fed.us/naturalresources/watershed/condition_framework.shtml
[17] Watersheds defined by a 10-digit hydrologic unit code.
[18] Watersheds defined by a 12-digit hydrologic unit code; smaller than 10 digit code watersheds.

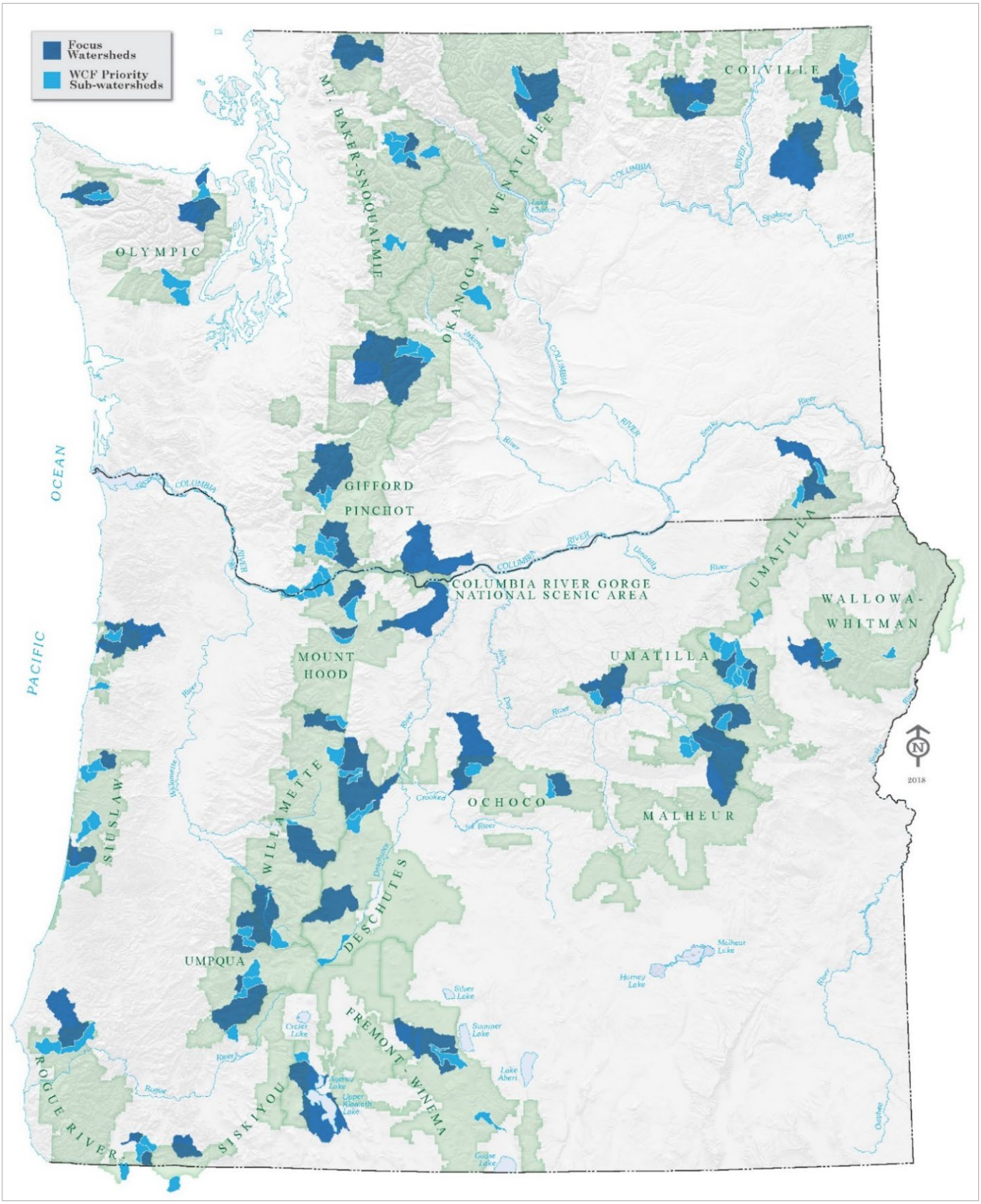

Figure 2. Pacific Northwest Region focus watersheds and priority subwatersheds

Fewer projects (approximately 20 percent) would occur outside of focus watersheds and priority subwatersheds. These areas would still likely contain federally listed fish, 303(d) listed streams, or both. Regardless of watershed location, all projects (with a few exceptions related to non-system road decommissioning) would be confined to riparian reserves or riparian habitat conservation areas.

Number and Occurrence of Projects

This proposed action covers up to 1,800 projects consisting of the 19 activity categories described above.[19] No more than 180 projects would be accomplished in a year throughout the region and no more than 25 projects would occur on any given national forest or in the scenic area.[20] A single project can include two aquatic restoration categories: a primary action and a complementary action. For instance, a culvert removal project conducted under the fish passage restoration category would be considered a primary action while large wood placement in the area once occupied by the removed culvert would constitute a complementary action.

The actual outputs and outcomes would ultimately be limited by resources that are available to do watershed restoration work in the future. Under the proposed action, we believe process efficiencies have been created that will enable greater amounts of work to be accomplished under similar funding levels (up to the limits of work which is described in the action alternative). Simply put, with environmental analysis complete, we expect streamlined project planning and implementation, and thus greater efficiency in producing results given available resources.

The aquatic restoration categories are distributed among four project groups characterized as having unique impacts to the terrestrial and aquatic environments:

- aquatic organism passage projects;
- instream, side-channel, and floodplain projects;
- riparian vegetation projects; and
- non-system road and trail decommissioning projects.

A review of similar ARBO II projects completed from 2013 to 2017 and watershed restoration action plans from the Forest Service units in the project area suggests that instream, side-channel and floodplain group projects would occur the most and the riparian vegetation group projects would occur the least. Table 2 shows the expected occurrence of each restoration group.

Table 2. Aquatic restoration group types and percentage of expected occurrence

Aquatic Restoration Group	Expected Occurrence (%)*
Aquatic Organism Passage	20
Instream, Side-channel & Floodplain	42
Riparian Vegetation	12
Non-system Road Decommissioning	26

*Future percentages may vary.

[19] Appendix 5 displays the number of proposed projects to be implemented each year along with associated impacts and total proposed projects and impacts over 10 to 15 years

[20] The Crooked River Grasslands will be covered under the Ochoco National Forest.

Project Identification, Compliance, Notification & Public Review, Implementation & Monitoring, and Completion

The Forest Service offices within the Pacific Northwest Region of the USDA Forest Service seldom identify, plan, and implement aquatic restoration projects independently. Whether it be other Federal, State, county, or city agencies, nongovernmental organizations, collaborative groups, or neighboring landowners, there are always partners involved planning and implementing aquatic restoration projects. Frankly, we wouldn't be able to achieve our aquatic restoration without that external input and support. However, we see a need in this proposal to enhance that public input to our projects. To ensure that individual restoration projects comply with all aspects of this proposal, each Forest Service unit would follow a five-step process. This is a key part of this proposal and critical to its success. It is important that interested and affected parties are informed about upcoming projects and have the opportunity to provide their input. Refer to figure 3 to see the five-step implementation process and general timelines described below.

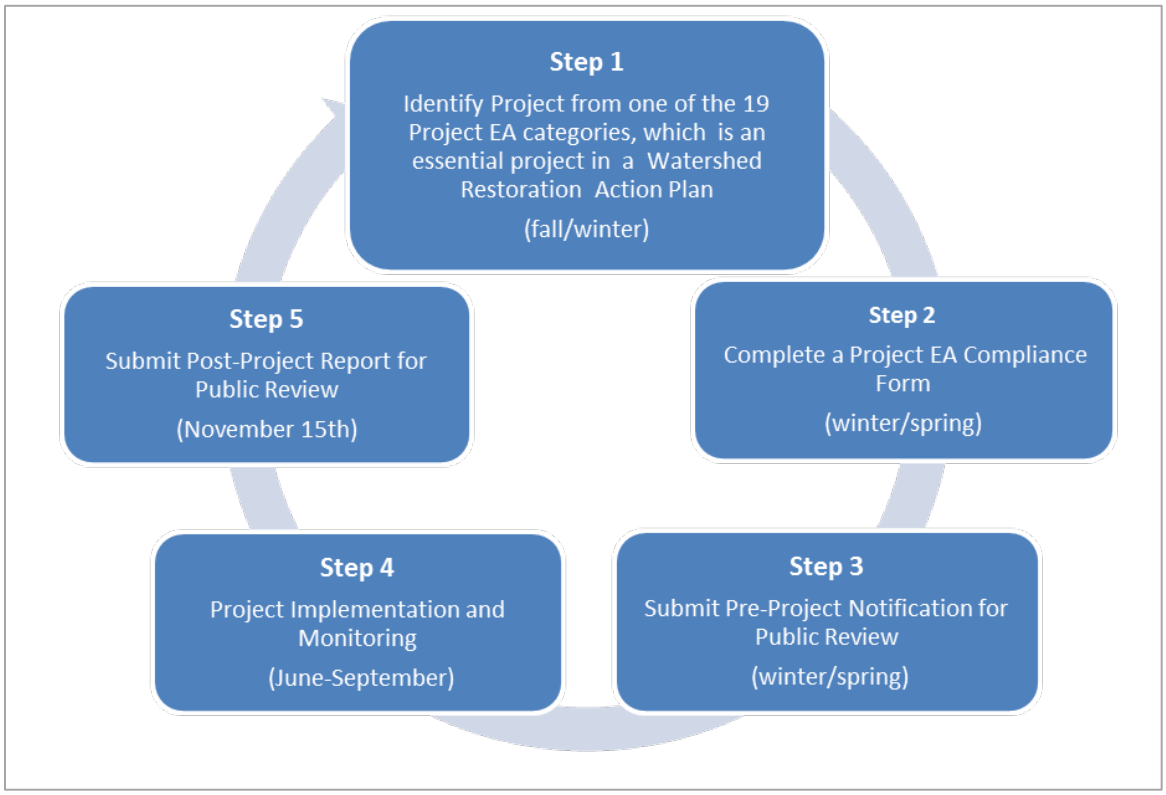

Figure 3. Five-step implementation process and general timelines

Step 1 – Identify Project

In the first step, a project intended to restore the structure and function of watersheds would be identified. Typically, a project would be listed in a watershed restoration action plan if the action were to occur in priority watersheds. The project must be one of 19 aquatic restoration categories listed above and designed according to Appendix 1 – Aquatic Restoration Categories, Descriptions, and Design Criteria, and Appendix 2 – General and Resource Project Design Criteria.

Step 2 – Complete Project Environmental Assessment Compliance Form

A local interdisciplinary team would determine if a project is compliant with this environmental assessment by verifying whether the project is consistent with appendices 1 and 2, this document's effects determinations, and ultimately with the decision associated with this analysis. The project team would record its findings on a project compliance form, typically completed by specialists from fisheries, watershed, wildlife, botany, soils, cultural resources, engineering, silviculture, recreation, range and other relevant disciplines. Further, any unusual site-specific conditions identified by the project team, requiring attention prior to implementation, would be included on the form. Refer to Appendix 4 – Project Environmental Assessment Compliance Form.

If the project is determined to be compliant with the analysis in this environmental assessment, the resource specialists would provide justifications and signatures, followed by a district ranger's or other responsible official's signature. For those projects found to be noncompliant, the project team would revise the project to a level of compliance or not implement that particular project. The project team would complete the compliance form during the winter or spring prior to a summer construction season.

Step 3 – Pre-project Notification, Public Review, and Forest Service Response

A pre-project notification, public review, and Forest Service response would be conducted in the following manner.

Pre-Project Notification

It is important to note this does not replace or affect the collaborative nature in which our aquatic restoration projects are typically conceived, planned, and implemented. As in the past, project collaboration with other interested parties, commonplace in the fisheries biologist and hydrologist communities, would continue. Under this proposal, national forest or scenic area staff would submit a pre-project notification to interested individuals and organizations at least 60-days prior to expected project implementation. Interested individuals would be identified from the Forest Service unit's list of individuals and organizations who are interested in aquatic restoration. Project notifications would include information provided below along with a completed compliance form as described above in step 2:

- **Action identifier** – The same unique identification number is necessary for each project's Pre-Project Notification and Project Completion Report.
- **Project Name** – (for example, Jones Creek Culvert Replacement).
- **Location** – The 6th-field watershed, stream name, and location defined by latitude and longitude (decimal degrees)
- **Agency Contact** – National forest or scenic area project lead name, email, and phone number.
- **Timing** – Projected start and end dates.
- **Activity Type** – As one or more of the 19 activity categories.
- **Project Description** – Brief narrative of project and objectives.
- **Extent** – Number of stream miles restored to fish passage; and stream miles, road miles, or acres to be treated.

- **Species Considered** – Information about threatened, endangered, or other federally listed fish, invertebrate, plant and wildlife species, critical habitat, and essential fish habitat that may be affected by the project.
- **Date of Submittal**
- **Site Assessment for Contaminants** – For any action requiring a site assessment for contaminants, a copy of the report explaining the likelihood that contaminants are present at the site must be included.
- **Approval Correspondence** – For any action requiring a National Marine Fisheries Service hydrological fish passage review and approval and a restoration review team review, a copy of the approval correspondence must be included.
- **Signature** – Signature of the responsible official is required on the compliance form.

Twenty-Day Public Review and Input

Public entities would have 20 days from the date they receive the notification to contact the project lead or responsible official to learn more about a project, provide relevant suggestions, or question the consistency of the project with this environmental assessment and the decision notice. Comments or questions directed at project consistency should relate to appendices 1 and 2 and the scope of effects analyzed in the "Environmental Impacts of the Proposed Action" section of this document. Public entities who claim that a project is inconsistent with the analysis in this document should identify how the project differs from appendices 1 and 2, the scope of effects described, or is inconsistent with the relevant forest plan.

Fifteen-Day Response to Public Input

The local unit would reply to public input within 15 days after the public review and input period. The district ranger or other responsible official would consider the input from the project team and the public and adjust the project proposal, stop the action, or proceed with the project as proposed.

Step 4 – Project Implementation and Monitoring

The project would be implemented according to the pre-project notification and any modification resulting from public input. The project lead or other representative would apply project design criteria as outlined in appendices 1 and 2.

Aquatic restoration projects implemented through this environmental analysis will be monitored several different ways. Implementation monitoring will be documented in the ARRRS (ARBO) Database and, for passage projects, the Regional Fish Migration Barrier Database. Clean Water Act 401 certification monitoring will occur for these projects because they will be implemented through the Clean Water Act programmatic permit between the Forest Service, U.S. Army Corps of Engineers, and State Lands. In addition, Best Management Practices monitoring and effectiveness monitoring will occur on a subset of projects implemented through this environmental analysis. At a broad scale, the overall effectiveness of the agency's aquatic restoration efforts will be monitored through long term forest plan monitoring, including the Aquatic and Riparian Monitoring Project (monitoring for the NW Forest Plan) generally on the west side of the Cascade Mountains and the PACFISH/INFISH Biological Opinion (PIBO) monitoring generally on the east side of the Cascade Mountains.

Step 5 – Submit Project Completion Report for Public Review

After project completion, Forest Service staff would submit a project completion report to interested individuals, via the Aquatic Restoration Reporting System website[21] no later than November 15 of each year. The national forest or scenic area staff would also submit a report to the public even when a project is not implemented. In addition to the information submitted in step 3 above, the project lead would include the following information to fulfill completion requirements:

- **Nesting Information** – Number of northern spotted owl, or marbled murrelet nests disrupted and disturbed during critical nesting period.
- **Aquatic Organism Pursuit and Capture** – When a project biologist pursues, handles, and inadvertently kills fish, amphibians, and mollusks, they will describe removal methods, stream conditions, and the number of organisms handled, injured, or killed. More information will be required for excessive mortality. This report will likely be limited to fish passage, dam removal, and channel restoration and relocation projects.
- **State-specific Clean Water Act 401 Certification Monitoring Results** – The project lead would describe effects and any remedial actions if protocol conditions were not met.
- **Post Project Assessment** – Effects not considered and remedial actions taken, including any dates work ceased due to high flows.
- **Date of Submittal**

Administration at the Regional Level

To further ensure proposed actions will comply with the analysis in this document and the final decision notice, regional office staff would complete an annual report, convene and conduct an annual internal coordination meeting, and provide annual trainings to the Forest Service units implementing the projects.

Annual Assessment of Aquatic Restoration Projects

The Fisheries staff of the Pacific Northwest Regional Office—in coordination with botany, planning, soils, watershed, wildlife, and other regional office staff—would complete an annual assessment report and post it on the Aquatic Restoration Reporting System website by February 15 of each year. The report will include the following information:

- A list of actions and number of actions carried out per national forest and scenic area.
- A map showing the location and type of each action carried out by each Forest Service unit.
- An assessment of overall activity, including but not limited to the success of each Forest Service unit in achieving requirements listed under the five-step process described above.
- Data or analyses the Forest Service deems necessary or helpful to assess project compliance with this environmental assessment and habitat trends as a result of actions carried out.

[21] http://fswebgstc.gsc.wo.fs.fed.us/services/data_management/ARRRS/index.php

Annual Coordination

The fisheries staff of the Pacific Northwest Regional Office will arrange an annual, internal coordination meeting with botany, planning, soils, watershed, wildlife, and other staff from the Regional Office, each national forest, and the Columbia River Gorge National Scenic Area to discuss the annual report and any actions that will help ensure future project compliance with this document.

Annual Training

The Fisheries staff of the Pacific Northwest Regional Office—in coordination with botany, planning, soils, watershed, wildlife, and other regional office staff—will provide an annual, internal training to national forests and scenic area staff before the start of each field season. The training curriculum will include refresher summaries of the proposed action, activity categories, project design criteria, and the five-step implementation process. Annual report findings and coordination meeting results would help inform training content.

Environmental Impacts

This analysis addresses the environmental impacts of implementing up to 1,800 aquatic restoration projects over the course of 15 years. The purpose of an environmental assessment is to determine whether to prepare a finding of no significant impact or to prepare an environmental impact statement. This analysis is focused to allow the responsible official to make that determination. Effects that would be minor or have no bearing on the determination or the decision are not addressed in the analysis. Supporting documentation for the analysis is included on the project website and is incorporated by reference.

We acknowledge that during a 15-year timeframe, new information or changed conditions could occur. If so, it may require we conduct a supplemental analysis to determine whether a new decision is needed.

No-action Alternative

Across the Pacific Northwest Region, the Forest Service implements about 90 aquatic habitat improvement projects annually that were approved with support of the Aquatic Restoration Biological Opinions (commonly referred to as ARBO II) issued by the National Marine Fisheries Service (NMFS 2012) and U.S. Fish and Wildlife Service (USFWS 2013). The number of actions and related miles of habitat restored in table 1 reflect the program of work that would likely continue in the future without the Pacific Northwest Region Aquatic Restoration Project. This is considered the no-action alternative. The continuation of this program of work would result in fewer short-term adverse impacts and fewer habitats restored relative to the proposed action. These tradeoffs are further described below for each of the relevant resource areas.

Effects to Aquatic Species and Water Resources

With the current approved aquatic restoration projects, the effects associated with stream turbidity, water temperature, and fish captured, injured or killed under the current program would remain unchanged. These effects fall under Federal Clean Water Act and Endangered Species Act compliance thresholds. However, because additional restoration projects that improve degraded watershed process and associated habitats would not be implemented, the number of watersheds

that reach properly functioning conditions via completion of watershed restoration action plans would be less than numbers achieved under the proposed action.[22]

Effects to Wildlife

Relative to the proposed action, the no-action alternative (ongoing aquatic restoration projects) would result in fewer potential effects to wildlife, which include disturbance to individuals and their habitats. Not implementing additional aquatic restoration activities would prevent associated disturbance from equipment and personnel above current existing levels.

Conversely, animals would not benefit from additional long-term positive effects of increased restoration associated with the proposed action. Excessive road densities and the associated unauthorized activities occurring on these non-system roads would continue to fragment contiguous habitat and reduce wildlife movement across landscapes at greater rates compared to the proposed action. Fewer aquatic organism passage, instream, side-channel and floodplain, and riparian vegetation projects would result in more impaired streams that affect a variety of animals. Restoration of early seral vegetation through prescribed burns and other vegetation treatments would occur at reduced rates, reducing availability of herbaceous forage. Juniper in undesired locations would continue to encroach into riparian habitat. With no action, beaver would not benefit from habitat improvements.

Effects to Soils

Given ongoing aquatic restoration activities, short-term detrimental soil conditions associated with ground-disturbing activities would occur at current rates and result in approximately 2,129 acres of detrimental soil conditions, 3,085 less than the proposed action. Through implementation of these actions, the Forest Service would complete long-term improvements on 14,185 acres as a result of restoration actions.

Effects to Botany

With current aquatic restoration projects, short-term effects would be extremely rare since all rare plant populations would be avoided or impacts mitigated similar to the proposed action. As such, the no-action alternative would forgo, without a corollary decrease in effects, at least 12,500 acres of restored soil and habitat conditions at the site and watershed scale under the proposed action.

Effects to Cultural Resources

Given ongoing aquatic restoration activities, effects to cultural resources would likely be minimal as projects are typically designed to avoid or mitigate effects to known cultural resource sites.

Effects to Recreation

Existing management of recreation settings, facilities and access would continue with the no-action alternative. The existing frequency of restoration actions within dispersed campsites would likely continue, with the potential of affecting the experience of those individuals using the sites. Over time, it would be expected that soil erosion, soil compaction, increased stream sedimentation, impaired hydrologic function, dewatered wetlands, and displaced riparian wildlife

[22] Refer to Watershed Condition under the Effects to Aquatics Species and Water Resources section.

may cause unwanted impacts to riparian areas and associated waters with ongoing recreation use levels and activities.

Proposed Action

Acres Impacted by Activity Group

The effects analysis in this document is based on the proposed action and associated impacts connected to each of the aquatic restoration activity categories as described in appendix 5. Impacts are related to the use of heavy machinery, such as excavators, and include acres of ground disturbance, increased stream turbidity, and noise. An additional impact includes potential injury and death to aquatic organisms during fish protection and relocation conducted during aquatic organism passage and channel reconstruction and relocation projects.

Cumulative Effects Background

The baseline condition for cumulative effects is the current condition, which has been influenced by past actions.[23] Throughout the analysis area, forest management practices, starting in the early 1900s, have altered watershed, riparian, and aquatic habitat conditions and functions. The dominant management practices included ground-based logging and road construction on national forests west of the Cascade Mountains, while east of the mountains these actions were coupled with livestock grazing. Recreation use within riparian areas throughout the project area became common, starting in the 1950s. Aquatic management practices, such as installation of rock gabions and removal of large wood from streams, also occurred.

The cumulative effects analysis builds upon the existing condition assessment by considering the incremental contribution of direct and indirect effects of the proposed action when added to the past, present (ongoing), and reasonably foreseeable future actions. Actions that contribute to cumulative effects for this proposal are generally actions that occur within the riparian reserves or riparian habitat conservation areas: aquatic restoration, vegetation restoration (thinning and prescribed fire), recreation, livestock grazing, mining and roads and trails.

With respect to present and reasonably foreseeable future actions, the Northwest Forest Plan Aquatic Conservation Strategy (1994), PACFISH (1995), and INFISH (1995) conservation strategies directed Forest Service units within the region to address ongoing and legacy impacts and restore watershed functions that support healthy riparian areas and aquatic habitats. These conservation strategies provide comprehensive management frameworks, including rigorous standards and guidelines, to guide forest practices (for example, logging, road management, and grazing) so that impacts are negated or minimized. Specifically, projects in the Northwest Forest

[23] The Forest Service National Environmental Policy Act Regulations (36 CFR 220.4(f) (July 24, 2008) state, in part: "CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effect of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present and reasonable foreseeable future actions) on the affected environment…The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simple because information about past actions may be available or obtained with reasonable effort, does not mean that it is relevant and necessary to inform decisionmaking. (40 CFR 1508.7)"

Plan area must be designed to meet Aquatic Conservation Strategy objectives, while projects elsewhere must strive to move the landscape toward or not retard attainment of PACFISH and INFISH riparian goals and riparian management objectives.

Types of activities from ongoing and reasonably foreseeable future actions[24] that represent the kinds of effects considered in the cumulative effects analysis for this proposal are provided below. The list is not intended to be an exhaustive list of all actions. Each Forest Service unit is represented by at least one project to provide a range of environmental settings in which cumulative effects may occur.

Examples of the types of present and reasonably foreseeable future actions considered for cumulative effects analysis include:

- **Riparian thinning and prescribed fire** – These projects may include removing a portion of the trees in riparian areas to improve forest stand conditions using heavy equipment, prescribed burning to reduce the risk of high-severity fire, or cutting and leaving trees in dense conifer stands.
- **Recreation** – Proposals may include improving recreation sites located in or near riparian areas to reduce impacts from the public and to enhance recreation opportunities or settings for the public. On-going activities by the public and special use outfitters and guides include fishing, camping, rafting, other water sports, and off-highway vehicle use.
- **Grazing** – Grazing allotments often have streams, lakes, ponds, and riparian areas within them. Livestock grazing can contribute to streambank erosion, sediment loading, and trampling of vegetation.
- **Aquatic Restoration Projects** – Restoration projects are designed to improve fish and wildlife habitat in aquatic systems and riparian areas, reduce barriers to aquatic species migration, reduce excessive sediment input, enhance hydrologic function, and restore overall ecological functions in riparian and aquatic ecosystems.
- **Mining** – Some mining activities occur in and along streambeds as claimants excavate these areas, use suction dredging and other mineral extraction techniques, or install roads to access their areas of activity. Streambeds are sometimes reconfigured, causing hydrologic flows and aquatic habitat to be altered from their natural states.
- **Roads** –Past actions may have constructed temporary roads that were not decommissioned, affecting soil displacement, compaction, nutrient loss, instability and sedimentation of streams. Use of existing system roads and road maintenance may also generate dust and cause soil displacement.

[24] Reasonably foreseeable future action: Those Federal or non-Federal activities not yet undertaken, for which there are existing decisions, funding, or identified proposals. Identified proposals for the Forest Service are described in 36 CFR 220.4(a)(1) (36 CFR 220.3 definitions).

Effects to Aquatic Species and Water Resources

Summary

Threatened and Endangered Species:
A "may affect, likely to adversely affect" determination was made by the National Marine Fisheries Service (2013) and U.S. Fish and Wildlife Service (2013).

In the long term, restoration projects carried out in federally listed fish critical habitat will improve the condition of that habitat at the site and, over time, at the watershed scale. In watersheds where multiple restoration projects are carried out, greater improvement of the condition of critical habitat at the watershed scale will be realized. Therefore, these beneficial effects will improve abundance, spatial structure, and productivity of the fish populations, resulting in a decreased risk of extinction for all of the species addressed by the Aquatic Restoration Biological Opinion II (ARBO II) and this analysis (National Marine Fisheries Service 2013; U.S. Fish and Wildlife Service 2013).

Dominant short-term effects (a few hours to one year or a few years) are related to increased stream sedimentation and turbidity primarily during construction activities, with subsequent turbidity emanating from disturbed areas. Fish disturbance, injury, and death may occur with projects that use heavy equipment, especially during projects that rely on stream isolation and fish capture.

Pacific Northwest Region Sensitive Species:
The intended purpose of the actions is to benefit aquatic species. For sensitive species, aquatic restoration projects proposed in this analysis may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species.

In the long term, restoration projects carried out will improve habitat condition at the site and watershed scale. In watersheds where multiple restoration projects are carried out, greater improvement of habitat condition at the watershed scale will be realized. Therefore, these beneficial effects will improve abundance, spatial structure, and productivity of sensitive aquatic and riparian-related species populations.

Watershed Condition (sediment, turbidity, and temperature):
Implementation of the majority of the proposed aquatic restoration actions would be concentrated in 50 focus watersheds in the region; the current set of 66 priority subwatersheds; and/or future priority watersheds, which will generally be located within focus watersheds. In the long-term, overall watershed condition scores are expected to improve in at least 90 subwatersheds in Oregon and Washington. This would increase the total number of subwatersheds rated as properly functioning from 982 subwatersheds to approximately 1,072 subwatersheds (from 50 percent of the region's subwatersheds to 55 percent), assuming conditions in other watersheds are not degraded. This assumption is soundly based on the demonstrated success of the Northwest Forest Plan Aquatic Conservation Strategy, PACFISH, and INFISH in halting the degradation and enabling the recovery of aquatic habitats and watershed conditions since they were adopted in the mid-1990s (Roper 2014, Archer and Ojala 2016, Miller et al. 2017, Reeves et al. 2018, Kershner et al. 2018). These improvements stem from both passive restoration (natural recovery) and active restoration (implementation of restoration actions such as those covered in this project).

Multiple restoration activities being implemented in priority watersheds, combined with ongoing natural recovery and passive restoration, would be expected to result in improved conditions related to stream sediment and turbidity in the long term. The proposed activities are designed

and would be implemented to restore important natural watershed processes that influence the production, transport, and deposition of sediments throughout watersheds and their stream and river networks.

As with aquatic species, the intended purpose of the actions is to improve watershed condition. Proposed actions could result in slight, short-term sedimentation and turbidity impacts at the project scale. Short-term inputs of sediment could result from instream structure placement, opening of side channels, road treatments, dam removal, stream reconstruction, and other activities that occur inside the bankfull channel. Some additional erosion and sedimentation would be possible up to a couple years after some activities (such as stream channel reconstruction), as streams adjust to newly established site conditions. Sedimentation and turbidity impacts to domestic water supplies would not be expected because water supply intakes are generally located far enough downstream from restoration activities that the expected turbidity levels are not expected to adversely affect water treatment systems.

The proposed action could cause slight, short-term increases in stream temperature due to disturbance of riparian vegetation and stream channels and in some limited cases, increased stream length. Improved stream temperatures or at least reduced rates of warming associated with climate change are expected over the long term (that is, years to a decade or more) because the restoration activities would restore numerous natural watershed processes that govern stream temperature.

Analysis

There are approximately 100,000 miles of streams and rivers, of which approximately 25,000 miles are fish bearing in the National Forest System lands of the Pacific Northwest Region. There are 1,961 subwatersheds in the 16 national forests and Columbia River Gorge National Scenic Area in the region. Overall, 50 percent of the subwatersheds were rated as functioning properly, 48 percent were rated as functioning-at-risk, and 2 percent were rated as having impaired function.

One-hundred and twelve aquatic animal species of special conservation concern occur in project area waterways. Twenty-four are fish listed as either threatened or endangered under the Endangered Species Act (1973), including six Chinook salmon stocks, two chum salmon stocks, three coho salmon stocks, two sockeye salmon stocks, six steelhead stocks, five bull trout populations, three sucker populations, and the eulachon. Twenty fish species are listed on the Pacific Northwest Region's sensitive species list: Chinook salmon, steelhead, cutthroat and redband trout, whitefish, chub, dace, minnow, roach, sculpin, suckers, and lamprey. In addition, 32 mollusks, 1 crustacean, 16 macroinvertebrates, and 12 amphibians are designated as sensitive species. Refer to the project website for lists of sensitive aquatic species analyzed.[25]

A large portion of the streamflows in Oregon and Washington originates on National Forest System lands (Lute and Luce 2016). As such, these lands are critical to sustaining the diverse set of beneficial uses of water, both on and downstream of these lands, that have been designated by the States of Oregon and Washington for the waterbodies within their jurisdictions. These uses include water supply, aquatic life, recreation, hydropower and other uses. Given their importance

[25] https://data.ecosystem-management.org/nepaweb/nepa_project_exp.php?project=53001

and their sensitivity to changes in water quality and quantity, water supplies and aquatic life uses are perhaps the most relevant to management of National Forest System lands.

Except during the first few years after severe fires, the quality of water from forests is generally high and suitable for most uses (National Research Council 2008). This is largely true of water from National Forest System lands in the Pacific Northwest. Nonetheless, 5,550 miles of stream on National Forest System lands in the region (about 5 percent of all streams on National Forest System lands) have been listed as "water quality impaired" under section 303(d) of the Federal Clean Water Act of 1972. The Forest Service has developed and is implementing agreements with the States of Oregon and Washington that outline programs and processes, including best management practices and monitoring, to protect and restore key beneficial uses and the water quality that sustains them. Importantly, the agreements recognize the critical role of watershed restoration in meeting water quality standards over time. In addition, both States allow for short-term degradation of water quality for some activities, including restoration of waterbodies and riparian areas, so long as there is a net ecological benefit to the actions and reasonable measures, such as best management practices, are used to minimize the degradation.

Direct and Indirect Effects

Threatened and Endangered Species

National Marine Fisheries Service (2013) and U.S. Fish and Wildlife Service (2013) personnel concluded the 19 restoration activity categories included in this environmental assessment have predictable, short-term adverse and long-term beneficial effects to federally listed threatened and endangered species and their habitats, regardless of where on National Forest System lands they are executed.

The long-term beneficial effects include the following:

- restoration of fish access to historical habitats through removal of impassable barriers
- creation of more complex habitats through the addition of wood and boulder structures to streams and floodplains
- increased stream length, floodplain connectivity, and riparian vegetation corridors through channel reconstruction, reconnection of side channels and removal of berms, dikes, and levees
- reduction or elimination of impacts to streams and riparian areas from roads and recreation
- restoration of riparian plant species composition through planting, noncommercial thinning, and controlled burning
- reduction or elimination of nonnative fish that compete with native species
- habitat restoration for recolonization of beaver.

Forest Service staff may capture and relocate aquatic organisms[26] while conducting aquatic organism passage projects, stream channel relocation and reconstruction, and other projects. Some organisms would be injured or killed during capture and relocation; some would be disturbed, injured, and killed through inadvertent crushing by heavy equipment during implementation of other instream, side-channel, and floodplain restoration projects. However,

[26] The primary focus of this section is the federally listed fish due to the precarious nature of these populations. Other aquatic organisms are discussed in the "Pacific Northwest Region Sensitive Species" section.

National Marine Fisheries Service (2013) and U.S. Fish and Wildlife Service (2013) personnel concluded permitted numbers for capture, injury, and mortality of federally listed fish species allowed in ARBO II projects is far too few to affect the abundance, productivity, distribution, or genetic diversity of any salmon, steelhead, and other fish populations. At project locations throughout the region from 2013 to 2017, the number of fish handled, injured, or killed during aquatic organism passage construction, stream channel relocation and reconstruction, and other projects was well below the threshold numbers permitted under ARBO II (National Marine Fisheries Service 2013; U.S. Fish and Wildlife Service 2013).

Pacific Northwest Region Sensitive Species

Sensitive species lists are designated by the Regional Forester and generally represent species for which a viability concern exists. Implementing the proposed aquatic restoration projects may impact sensitive species individuals or habitat but will not likely contribute to a trend toward Federal listing or cause a loss of viability to the population or species.

The actions proposed are intended to improve the quality and quantity of the aquatic and riparian habitat, so over the long term, the proposed action would benefit the sensitive species that depend on this type of habitat (Alexander and Allen 2007, Bednarak 2001, Burchsted et al. 2010, Major et al. 2012, Palmer et al. 2005, Powers 2015, Pollock et al. 2015, USDA Forest Service 2008, Walter et al. 2012).

In the short term, individuals within populations of these species could be captured, injured, and killed, particularly if there is a large amount of restoration activity within their habitat. An example would be dewatering a stream segment to implement an aquatic organism passage project. Sensitive species would be captured, injured, and killed during salvage. Aquatic species could be desiccated (dried out) during dewatering, and some individuals, particularly macroinvertebrates, could be overlooked during salvage operations due to their size and location. The species occurring below the streambed surface (Bo et al. 2007) could survive during the construction period if there was enough interstitial water and flow available. If individuals are impacted, the limited surface area of project disturbance in relation to the overall distribution of the species and the diverse life history of the species would further sustain the population over the short term, with a long-term benefit as the habitat improves because of the project.

Given the limited effects within individual restoration activity areas, the limited geographic scope of these activities, and the fact that individual actions would be dispersed in time and space within a watershed, impacts on aquatic life, including sensitive species, are not expected (National Marine Fisheries Service 2013; U.S. Fish and Wildlife Service 2013).

Watershed Condition

Implementation of the Watershed Condition Framework over the next 15 years is expected to improve overall watershed condition scores in at least 90 subwatersheds in Oregon and Washington. This would increase the total number of subwatersheds rated as properly functioning from 982 subwatersheds to approximately 1,072 subwatersheds (from 50 percent of the region's subwatersheds to 55 percent), assuming conditions in other watersheds are not degraded.

This conclusion that watershed conditions will improve is supported by the work of Roni et al. (2008), who found that many restoration techniques (such as reconnecting isolated habitats, restoring floodplains, and placing instream structures) have improved habitat and water quality and increased local fish abundance. Other techniques (such as riparian rehabilitation, road

improvements, dam removal and stream flow restoration) show promise in restoring critical watershed processes. Roni et al. (2002) came to similar conclusions, rating most restoration treatments as having a moderate to high probability of success generally within 1-5 years for most types of treatments, but extending into one to two decades for a few others. The work of O'Neal et al. (2016) provides additional supporting evidence for restoration projects being implemented in Washington and Oregon.

Importantly, the proposed restoration work is expected to have long-term benefits because the process by which it is being planned and implemented addresses the shortcomings identified with some watershed and aquatic restoration work (Roni et al. 2002, Beechie et al. 2010, Rieman et al. 2015). Specifically, the restoration actions are one component of broader, landscape-level aquatic conservation strategies intended to maintain and restore aquatic and riparian conditions and key watershed processes at landscape scales. As such, the finer-scale (reach to watershed) active restoration work is built on a foundation of passive restoration and natural recovery at the landscape scale (millions of acres).

Beyond these improvements in overall conditions at the watershed scale, these restoration actions are expected to increase the quantity and quality of wetlands on National Forest System lands in the region in the near-term (immediately to within a few years) and even more so over the long-term. Restoration of incised meadow streams, channel reconstruction, beaver dam analogs and beaver habitat restoration, for example, have all been demonstrated to improve the quality and quantity of wetlands and the ecological functions they provide (Demmer and Beschta 2008, Bouwes et al. 2016, Weber et al. 2017, Nash et al. 2017). In the near-term, however, restoration actions may result in limited adverse effects to wetlands (such as localized disturbance of vegetation, soils and hydrologic processes). The project design criteria and Clean Water Act, section 404 permit conditions, however, will ensure that these effects are localized and of limited duration (weeks to months, up to a year or so). Monitoring has shown that the design criteria and permit conditions are being implemented and the effects are of limited scope and duration.

Some research (e.g., Hammersmark et al. 2008, Nash et al. 2017) suggests that some of these projects may result in localized decreases in the magnitude and duration of summer baseflows in some systems, leading Pilliod et al. (2017) to speculate that flow effects could raise water rights concerns in some locations. Other research in other areas (e.g., Tague et al. 2008, Beechie et al. 2012, Majerova et al. 2015, Hunt et al. 2018), however, points towards increased summer baseflows in periods of low flow when water is in highest demand. The proposed action will not injure valid existing water rights because the project design criteria require Forest staff: to identify and evaluate potential effects on existing valid water rights, through coordination with the Oregon Department of Water Resources and the Washington Department of Ecology; and to design and implement projects in a manner that does not injure those rights. Comparable project design criteria will also prevent other private property from being affected by the proposed action.

Sediment and Turbidity: Over the long term, implementation of proposed activities would improve conditions related to stream sediment and turbidity. Studies indicate road decommissioning on National Forest System lands (including decommissioning of non-system roads in areas already covered by 36 CFR 212 Subpart A and B travel management decisions, the only type of decommissioning included in this project) would reduce human-caused sediment to streams. For example, Black and others (2017) noted an 80 percent reduction in sediment delivery to streams in the Pacific Northwest, Northern, and Intermountain Regions. These findings are

generally consistent with studies of roads on National Forest System lands in other locations, such as Colorado (Sosa-Pérez and MacDonald 2017). Other proposed activities (for example, stream channel reconstruction or relocation; streambank restoration; large wood placement; off and side-channel habitat restoration; beaver habitat restoration; and removal of berms, dikes, and levees) would also alter erosion rates to more natural levels and facilitate deposition and storage of sediment in key parts of streams and floodplains. In addition, dam removal projects help restore natural processes that route and store sediment through stream networks (Roni et al. 2008, Beechie et al. 2010).

Proposed actions may result in slight, short-term sedimentation and turbidity impacts at the project scale. For example, short-term inputs of sediment could result from instream structure placement, opening of side channels, road treatments, dam removal, stream reconstruction, and other activities that occur inside the bankfull channel. Resulting sediment plumes would be most concentrated within, and immediately downstream of, the immediate project area (generally less than hundreds to several thousand meters) during project activities, the duration of which can generally range from days to several weeks or months.

Sediment could also be delivered from disturbed and exposed ground adjacent to stream channels created by heavy equipment use and moderate-severity controlled burns. Delivery from these areas would occur during storm events, generally starting in the fall. Best management practices and project design criteria would minimize these effects and ensure water quality standards were attained.

Some additional erosion and sedimentation is possible up to a couple of years after some activities (such as stream channel reconstruction), as streams adjust to newly established site conditions. Proper design, as assured by the project design criteria (see appendix 1) would eliminate or minimize these effects. It is anticipated all project-related sediment would be flushed out during the first high flows after project completion, and site restoration measures would be expected to prevent future project-related sediment inputs into the streams.

Sedimentation and turbidity impacts to domestic water supplies would not be expected because water supply intakes are generally located far enough downstream from restoration activities that the expected turbidity levels, as described above, are not expected to adversely affect water treatment systems. If unique circumstances are present (for example, intakes for sensitive treatment systems are close to projects), the interdisciplinary team associated with the specific proposed project would work with water suppliers to consider and manage potential impacts within the scope of the analysis in this environmental assessment or evaluate and manage effects via a separate environmental analysis and decision.

Our findings regarding sedimentation impacts are supported by the fact that the States of Oregon and Washington have issued 401 programmatic water quality certifications that conclude that these actions will protect and restore sediment-sensitive aquatic life and other beneficial uses of water. They are further supported by monitoring required ARBO II and Clean Water Act Section 404 permits with the Army Corp of Engineers and Oregon Division of State Lands and associated section 401 water quality certifications from the States. Lastly, recent best management practices monitoring (Clifton and Coffin 2018) conducted after restoration projects are implemented provides additional supporting evidence.

Temperature: Given the limited effects within individual restoration activity areas, the limited geographic scope of these activities, and the fact that individual actions will be dispersed in time

and space within a watershed, stream temperature impacts on aquatic life in the short term are not expected (National Marine Fisheries Service 2013; U.S. Fish and Wildlife Service 2013). This is supported by the fact that the States of Oregon and Washington have issued section 401 programmatic water quality certifications that conclude that these actions will protect and restore temperature sensitive aquatic life and other beneficial uses of water.

The proposed actions, combined with the ongoing natural recovery and passive restoration, would be expected to have long-term, beneficial effects on stream temperature by restoring riparian vegetation, channel conditions, surface-groundwater interaction, and other critical watershed processes that influence water temperature. Activities would improve streamside shade through revegetation of riparian areas; restore stream channel morphology in channels that are currently unnaturally wide and shallow or lack pools; improve surface water-groundwater interactions and hyporheic exchange; reduce stream heating associated with small dams; and reduce unnatural channel widening and associated loss of stream shade associated with overuse of streamside recreation sites and the presence of legacy structures (for example, channel-spanning weirs).

Large wood augmentation can increase the frequencies and depths of pools, which create critical thermal refugia for fish (Roni and Quinn 2001). Restoration of side-channels provides fish access to areas that can be substantially cooler than the mainstem. Dam removal is also generally expected to decrease stream temperatures by decreasing the surface area of water exposed to direct sunlight, as well as the duration of this exposure (Bednarek 2001). Dam removal effects on stream temperature may require additional study, however. Foley and others (2017) noted relatively few dam removal projects have been rigorously evaluated and where they have, reduced stream temperatures were observed at fewer sites than expected.

The proposed action may result in slight, short-term temperature increases at the project scale. These increases could result, for example, from decreased shade as a result of removal or disturbance of vegetation in riparian areas for various activities (for example, stream channel reconstruction/relocation, large wood placement, controlled burning, fish passage). In addition, stream reconstruction/relocation projects often increase the sinuosity of stream channels to better reflect natural conditions. This can increase the length of stream exposed to solar radiation.

The project design criteria are expected to minimize stream temperature effects and limit them to the short term, thereby ensuring compliance with State water quality standards and protecting critical aquatic life beneficial uses. For example, they specify that live conifers and other trees can be felled, pulled or pushed over in riparian areas for in-channel large wood placement only when conifers and trees are fully stocked. In addition, trees removed for large wood projects must be dispersed. They also specify that disturbance of riparian vegetation from project activities is to be minimized and staging areas must be located away from streams. Collectively, these and other project design criteria will minimize effects on stream shade and thus stream temperatures.

Stream channel reconstruction and relocation projects could potentially increase temperature slightly in some cases, because newly created stream channels may be exposed to increased solar radiation. However, these projects generally involve restoring streams that are currently incised, shallow and over-widened, and have highly altered riparian vegetation due to decreased water tables. As such, these streams currently provide poor quality habitat for fish and often have unnaturally elevated stream temperatures. Moreover, while these projects can increase the length of exposed stream, the widths of the new channels are often narrower, which reduces solar exposure. In addition, projects that also restore a range of other natural processes can reduce or more than offset potential temperature effects associated with increased stream length, such as

increased surface water-ground water interaction and hyporheic exchange. Lastly, recovery of shade-producing riparian vegetation (overhanging herbaceous vegetation, woody plants) in these systems is relatively fast (no more than a few years).

Given these limited effects within individual restoration activity areas, the limited geographic scope of these activities, and the fact that individual actions will be dispersed in time and space within a watershed, consequential stream temperature impacts on aquatic life in the short-term are not expected (NMFS 2013; USFWS 2013). This is supported by the fact that the States of Oregon and Washington have issued section 401 programmatic water quality certifications that conclude that these actions will protect and restore temperature sensitive aquatic life and other beneficial uses of water.

Cumulative Effects

Potential direct and indirect adverse effects associated with the proposed action, including slightly altered sediment and stream temperature regimes and the injury or killing of aquatic organisms, will be of limited magnitude, duration and extent. This is due to:

- the restorative nature of the activities;
- the limited number and size of the activities and the fact that they are highly dispersed in time and space;
- the extensive set of proven project design criteria and permit conditions that govern project design and implementation; and
- inclusion of an activity-specific assessment and planning process at the Forest level that will address any unique local circumstances.

Decades of successful agency implementation of these activities and formal project-specific monitoring of restoration actions (such as regional best management practices monitoring, Endangered Species Act compliance monitoring, Clean Water Act section 404 monitoring) has demonstrated that project design criteria are being consistently implemented and are effective and substantially limiting adverse effects to those evaluated and documented in this analysis and in other documents (NMFS 2013; USFWS 2013). Importantly, those effects were agreed to by multiple Federal and State water quality and fisheries agencies as sufficient to protect water quality and aquatic habitats in the near-term, while facilitating recovery over the long term.

As described previously in this document, the longer-term direct and indirect beneficial effects of the proposed action will far outweigh any limited, short-term adverse effects. These beneficial effects include improved aquatic habitat conditions, water quality, stream sediment and temperature regimes and the watershed processes needed to sustain them. This conclusion is strongly supported by extensive research and monitoring (Roni et al. 2002, Roni et al 2008, O'Neal et al. 2016). It is further supported by the explicit recognition of the overall benefits of the restoration actions via numerous supporting laws, regulations, policies and funding programs being implemented by multiple fisheries and water quality agencies in Oregon and Washington.

Other management activities on National Forest System lands and adjacent lands would continue as the activities covered under this project are implemented. These ongoing and reasonably foreseeable actions include various forms of vegetation management (such as riparian thinning), road management, grazing, recreation at developed and dispersed sites, mining, fire and fuels management, and other watershed and aquatic restoration actions not covered under this project

(such as decommissioning of system roads). All of these activities have the potential to have one or more of the same kind of effects as those associated with this project. As such, there is a potential that the effects of this project and those associated with other activities could overlap in time and space, and thus generate cumulative effects.

However, the potential for any substantial cumulative effects to occur is very low given the limited effects of the project and that these and all other management activities will be planned and implemented according to the three comprehensive aquatic conservation strategies in the region (Northwest Forest Plan Aquatic Conservation Strategy, PACFISH, and INFISH) or potential updated versions of those strategies (such as those included in pending or future forest plan revisions, which are expected to provide comparable protection of aquatic and riparian resources). In particular, these strategies require all management activities to move landscape conditions towards or not retard attainment of Aquatic Conservation Strategy objectives, PACFISH and INFISH riparian goals and riparian management objectives, or other comparable outcomes. As such, the magnitude, duration and extent of any adverse effects, including cumulative effects, are severely constrained.

Importantly, as previously described, current research and monitoring suggests that these strategies appear, over the last several decades, to be achieving their goals of maintaining or restoring aquatic and riparian habitats and key ecological processes at watershed and larger scales (Roper 2014, Archer and Ojala 2016, Miller et al. 2017, Reeves et al. 2018, Kershner et al. 2018). Implementation of this project's active restoration in targeted areas, combined with broad-scale passive restoration, would very likely result in a continuation and perhaps an acceleration of those positive recovery trends. Climate change, however, is likely to adversely affect aquatic and riparian resources, creating some uncertainties about future conditions.

Effects to Wildlife

Summary

In general, aquatics restoration activities would have short-term negative effects and long-term positive effects on most wildlife species and their habitats. The goal and demonstrated outcome of aquatic restoration activities is to restore the ecological function of the aquatic corridor, which contributes to the overall health of the riparian ecosystem. Improvement of impaired watersheds is expected to result in improved wildlife habitat resiliency and connectivity (Seavy et al 2009). This in turn results in improved wildlife habitat, which supports species reproduction, dispersal and viability. During implementation of restoration activities, there would be disturbance to wildlife individuals and their habitats, which could result in the killing of individuals. Negative effects would be reduced by implementing design criteria developed as part of this analysis. For example, seasonal timing restrictions would be required to avoid breeding and nesting seasons and restrictions on tree removal in marbled murrelet and spotted owl suitable habitat (see appendix 1).

Threatened and Endangered Species: Impacts of the 19 restoration actions included in this environmental analysis were previously analyzed as part of the ARBO II Programmatic Endangered Species Act consultation (U.S. Fish and Wildlife Service 2013). Determinations for wildlife species were as follows:

- For two bird species, the marbled murrelet and northern spotted owl, the aquatic restoration projects may affect or are likely to adversely affect these species.

- For Canada lynx, gray wolf, grizzly bear, and woodland caribou, aquatic restoration activities conducted may affect, but are not likely to adversely affect those species.
- For all species, aquatics restoration projects will not adversely affect designated critical habitats.

Further, the consultation found implementation of the species-specific project design criteria in ARBO II would reduce the possibility of adverse effects to an extent that is discountable for both the species and their critical habitats (see appendices 1 and 2). See the biological opinion (ARBO II, U.S. Fish and Wildlife Service 2013) for a detailed rationale of determinations for threatened and endangered species.

Sensitive Species: Effects from aquatic restoration projects could include crushing, and mortality (annelids, mollusks, insects); loss of hiding cover (amphibians and reptiles); disturbance, displacement, and loss of individuals (bats, small mammals); disturbance and nest abandonment (birds); displacement, changes in habitat structure, loss of habitat and cover for prey species (larger mammals); and disturbance (ungulates). Long-term benefits would include functioning watersheds, proper nutrient cycling, and reduced sedimentation into waterbodies; an increase in roosting and nesting sites as trees are girdled, burned, or damaged; an increase in young herbaceous vegetation for mammals to consume as vegetation recovers; and decreased disturbance to individuals and reduced habitat fragmentation (from road decommissioning).

For all of the sensitive wildlife species that occur in the project area or in adjacent habitat, the aquatic restoration projects may impact individuals and/or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species. The project design features in appendices 1 and 2 are key to reducing or eliminating impacts and not contributing to a trend toward federal listing. The action is expected to have long-term benefits for wildlife species that are riparian associates or obligates.

Analysis

It is estimated over 85 percent of the 59 native reptiles and amphibians in the Pacific Northwest breed in riparian areas. Most of these species forage in riparian areas at least 50 percent of the time. Over 70 percent of birds use freshwater, riparian, and wetland habitats and close to 80 percent of inland birds of the Pacific Northwest breed in riparian and wetlands (Kaufman et al. 2001 *in* chapter 14 Johnson and O'Neil). Native mammals in the Pacific Northwest use riparian areas 50 percent of the time for some critical life requirement stage.

Estimated acreages used for potential wildlife habitat impacted were based on acres of ground disturbance identified and displayed in the soils analysis (see "Soils" section). The potential for habitat removal or disturbance as well as disturbance to species would be commensurate with the acres of ground disturbed upon implementation of projects. Average terrestrial habitats impacted would be 15 acres per year from implementation of aquatic organism passage projects; 217 acres per year from instream, side-channel, and floodplain projects; 16 acres per year from riparian vegetation projects; and 273 acres per year from non-system road decommissioning projects for a total of 521 acres annually. Over the 10-year period, habitat impacted is not expected to exceed 5,214 acres.

Direct and Indirect Effects

Threatened and Endangered Species

Threatened and endangered species consultation has been previously completed for the 19 restoration actions included in this analysis (ARBO II; US Fish and Wildlife Service 2013). Species consulted upon included marbled murrelet, northern spotted owl, Canada lynx, gray wolf, grizzly bear, and woodland caribou. Since the 2013 consultation was completed, additional species listings have occurred. They include wolverine, western snowy plover, yellow-billed cuckoo, Oregon spotted frog, pacific fisher, Taylor's checkerspot butterfly, and Oregon silverspot butterfly. This analysis brings forward findings of the 2013 consultation, but does not include analysis for more recently listed species. Analysis for these species should be conducted on a case-by-case basis in project planning and may trigger separate environmental analysis and Endangered Species Act consultation.

Marbled Murrelet and Northern Spotted Owl

Marbled murrelets and northern spotted owls could be affected by noise disturbance during critical breeding times. Project design criteria are intended to schedule activities outside the breeding season or during the late breeding season (August 7 to September 15) for marbled murrelet, and March 1 through July 15 for northern spotted owl, respectively.

Some projects could occur during the nesting period that may adversely affect northern spotted owls. Adverse effects on spotted owl suitable habitat and 2012 designated critical habitat are not expected because most construction activities would occur in the road prism and in poor quality riparian habitat (such as pre-commercial thinning in plantations).

Adverse effects on marbled murrelet suitable or potential habitat or designated critical habitat are not expected to occur because nest trees and primary constituent element 1 would be avoided and limited impacts to primary constituent element 2 would not modify the function of stands in those areas.

Canada Lynx

Potential effects to Canada lynx would be disturbance. Most construction activities would occur in the road prism or poor quality riparian habitats where vegetation has been previously degraded or removed. By requiring project design criteria that will establish distance buffers around known lynx dens and minimize disturbance, the aquatic restoration projects may affect, but are not likely to adversely affect lynx.

Gray Wolf

Gray wolves are currently rare or nonexistent throughout most of the area where the aquatic restoration projects will be implemented, and it is unlikely locations would directly impact any animals or active den sites. Projects would be of relatively short duration and should not affect prey availability or disturb wolves if animals are present in the area. If the action meets recovery plan direction for den and rendezvous sites (no projects or activities within 1 mile of den or rendezvous sites scheduled to occur between April 15 and June 30) the projects may affect, but are not likely to adversely affect gray wolves.

Grizzly Bear

Potential effects of the projects on grizzly bears include habitat loss and disturbance. However, the amount of habitat removal or degradation near aquatic restoration activities is expected to be minimal (less than 1 acre of low quality riparian habitat for any project). Work would not occur in

areas that may affect bears during sensitive time periods when animals could be present. With implementation of project design criteria to avoid or minimize effects, the activities may affect, but are not likely to adversely affect the grizzly bear.

Woodland Caribou

Potential effects of the proposed action on woodland caribou include habitat loss and disturbance. The amount of habitat removal or degradation near project sites in the caribou recovery area in the Selkirk Mountains is expected to be minimal and would not displace caribou or result in short-term degradation of riparian areas in caribou habitat. Implementation of the projects may affect, but are not likely to adversely affect the woodland caribou.

Sensitive Species

There are 130 wildlife species designated as Regional Forester-designated sensitive species within the Pacific Northwest Region. Due to the large number of sensitive species, animals were grouped by the major taxon type: annelid and mollusk, amphibian and reptile, bird, insect, and mammal. Taxon grouping represent a group of organisms inferred to be phylogenetically related and have similar characteristics in common to each other.

Mammals were further broken down into subgroups: bats, mid-size to large mammals, small mammals, and ungulates.[27] Because the restoration actions are focused in riparian areas, only the sensitive species that use riparian habitat for part or all of their lifecycle are included in this analysis.[28]

There is one sensitive annelid (Giant Palouse earthworm). This subterranean species is found in loamy soils (WDFW 2013; Johnson-Maynard and Baugher 2015), silt loam soils (Xu et al. 2013), and sandy loam and sandy clay loam soils (Johnson-Maynard and Baugher 2015) of grass prairies of the Palouse region. This earthworm (USDA 2016) will not be affected by the aquatics restoration activities, as projects will not occur in grass prairies where this species occurs.

There are 24 terrestrial snails and slugs that are sensitive species. Many of the snails and slugs found within the region are endemic to the area. Many can be found near moist areas such as seeps and springs, under logs, ferns and other features that provide a cool, moist microclimate. Due to their cryptic coloration and small size, it is difficult to find and relocate individuals prior to project implementation as it may be for larger aquatic organisms such as fish. Accordingly, effects to individual snails and slugs include crushing, and mortality as equipment and personnel are working in the project area. Egg masses that are hidden in litter and soil may also be destroyed during restoration activities such as prescribed burning, blasting, and vegetation manipulation. While mortality of individuals is likely, the amount of mortality is unquantifiable and projects are not expected to result in complete loss of localized populations as project planning areas are in general small compared to the total amount of suitable and occupied habitat for these animals. In the long term, actions are expected to benefit these species by increasing resiliency of riparian areas, and restoring the diversity and complexity of the habitats these species depend upon.

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[27] A list of wildlife species analyzed can be found here: https://data.ecosystem-management.org/nepaweb/nepa_project_exp.php?project=53001

[28] Lists of wildlife species analyzed can be found here: https://data.ecosystem-management.org/nepaweb/nepa_project_exp.php?project=53001

There are 13 amphibians. Diurnal frogs spend time in both upland and aquatic habitats during their lifecycle. Restoration actions are expected to have some negative short-term effects on sensitive amphibians. This includes death of individuals, short-term loss of hiding cover (down woody debris, woodpiles, and dense vegetation) and breeding pools, as well as water temperature fluctuations and increased turbidity. Changes in water turbidity, loss of breeding pools and water temperature fluctuations may negatively affect amphibian breeding success for that breeding season. The spread of the amphibian fungal pathogen, *Batrachochytrium dendrobatidis* (Bd) (also known as chytrid fungus), that has contributed to massive deaths of amphibians has been attributed to contaminated footwear working in aquatic systems. This concern will be reduced with the implementation of project design criteria for decontamination procedures. As the site is recovered, the long-term function of the riparian area will increase to include proper nutrient cycling, reduced sedimentation, and improved water temperature. Amphibians are highly associated with and dependent upon riparian and aquatic habitats. The goals and outcomes of the restoration actions have been demonstrated to have clear benefits to the species. Specific benefits include improvement of wetland and side channel habitats and reduction in stream temperature flux, which play a critical role in the life history, success, and persistence of these species. Additionally, since many of the species disperse throughout waterways during some portion of their life history, they stand to benefit greatly from aquatic organism passage projects. The projects are expected over the long-term to increase the resiliency, diversity, and complexity of the habitats that these species depend upon.

Four reptiles are sensitive species. Similar to amphibians, restoration actions are expected to have short-term negative effects on reptiles. Effects include disturbance to habitat adjacent to waterbodies. Short-term loss of hiding cover and basking structures is expected. Snakes may be disturbed by the presence of hand crews and equipment if in the vicinity, but can avoid detection if cover is available. If prey bases (small mammals) avoid the area, then snakes may generally avoid the project area. Avoidance may lead to decreased opportunities to forage. This can alter their ability to forage, breed, or thermoregulate (Jain-Schlaepfer et al. 2016). Design criteria to protect rocks and logs from disturbance by equipment will help limit potential impacts to individuals and their habitat, and effects are limited to individuals. Aquatics restoration activities will not affect reptiles at a population or species level.

Five bats are sensitive species. Bats will be minimally disturbed by aquatics restoration activities, as activities will only occur during the daylight hours. Consequently, for sensitive bat species, neither the short-term negative impacts nor the long-term positive effects of aquatic restoration actions are likely to be pronounced. Bat species that use snags or trees for roosting would be disturbed and displaced as snags or trees are removed as part of riparian vegetation activities. Death of individuals may occur if snags are destroyed in prescribed burns or removed as hazard trees. At the site-specific project level, a wildlife biologist as part of the interdisciplinary team would help guide and identify the location of trees desired for wildlife retention, including those used by bats. Human disturbance of known bat roosts has been shown to cause abandonment of roost sites for many species, but data is largely anecdotal (Arroyo-Cabrales and de Grammont 2017).

Bats often forage over waterbodies. The temporary loss of insects from aquatic restoration projects is not expected to be substantive, but could result in temporary reduced foraging opportunity. Smoke generated from prescribed burns may discourage adults from roosting in the area. There are no anticipated short-term positive effects from aquatic restoration activities for these mammals. Although there are short-term negative effects, they would be insignificant.

Death of individuals and disturbance is expected to be minor and for the most part, bats can simply avoid the area when and where the project is occurring. The areas affected by aquatic restoration projects is very small compared to the amount of available habitat for bats on individual Forest Service units. Any short-term negative effects to individuals would have no impact on the species as a whole. Creating landscapes with healthy function riparian areas that are more resilient to fire and changes in climate are beneficial to bat biodiversity in the long term.

There are 49 sensitive bird species. Not all 49 species occur within riparian areas. The sensitive species table (located in the project file) identifies which species do not occupy riparian habitats and will not be analyzed as part of this analysis. Two species are considered riparian obligates. The most substantive negative effect to sensitive bird species would be inadvertent destruction of a nest or nest abandonment due to disturbance. Implementation of the seasonal timing restrictions to avoid breeding and nesting seasons (see appendix 2, project design criteria) would decrease the likelihood of these impacts. The proposed aquatic restoration activities could also cause auditory and visual disturbance that affect birds' ability to communicate and defend territories. Limiting activities in known areas of species nesting would minimize the number of individuals disturbed. Habitat changes that occur as a result of aquatic restoration projects may also affect birds. Depending on the type of activity, changes may include loss of shrub habitat, canopy cover, and preferred nesting sites as well as some temporary changes to food source availability. These vegetative changes may benefit some birds, but have negative impacts on others. Project design criteria for timing restrictions and tree removal (see appendices 1 and 2) would minimize these short-term effects. Few of the sensitive bird species are riparian obligates and the amount of habitat involved in restoration projects are a small fraction of the habitat used by the species through their range. Any short-term negative effects to individuals would have no impact on species viability. Creating more resilient and functioning aquatic and riparian habitats would be beneficial to these species in the long term.

There are 54 insects on the sensitive species list. Forty insects (bees, butterflies and grasshoppers) are considered terrestrial and would not be affected by aquatic restoration activities that occur directly within the waterway, as they do not occupy waterbodies. However, several species of sensitive butterflies have an affinity for wet areas and could be found in riparian habitat where restoration actions are likely to occur. Riparian vegetation projects would directly affect insects through disturbance and changes in habitat structure. Equipment can crush host or nectar plants, thereby reducing foraging and reproduction opportunities for the species. Equipment can also crush insect larvae and egg masses that are on the plants. Adult butterflies would easily avoid disturbance and fly to other places. However, displacement of adults could also lead to mortality if displaced adults do not find nearby nectar or pollen sources, mates, or host plants to lay eggs. Prescribed burning would have similar impacts to sensitive butterflies. Restoration actions could in general have similar impacts to any of the sensitive insect species; mortality of individuals; crushing of egg masses, larvae and diapaused individuals; and disturbance of the microsites or habitats occupied by the insects. The design criteria for aquatic restoration actions includes direction that is expected to reduce impacts to sensitive insect species. In general, insects occupy a wide range of habitats across the Pacific Northwest. Riparian habitat is a small percentage of the habitat where insects and host and nectar plants can be found. There are no short-term beneficial impacts expected to occur as a result of restoration actions. While death of individuals and other negative short-term impacts are expected, the impacts will not affect species viability across the range of the animal. Creating more resilient landscapes are beneficial to insect biodiversity in the long term.

There are 13 small mammals on the sensitive species list. Small mammals identified as sensitive, inhabit a multitude of habitats, including riparian areas. Rodents and insectivores are fairly adaptive, and while none is a riparian obligate species, small mammals can use riparian areas as travel corridors and foraging areas if there is suitable cover. Accordingly, sensitive small mammal species can be affected by riparian vegetation projects. Rodents can be negatively affected from presence of equipment and personnel, and noise from aquatic restoration projects. Generally, small mammals would temporarily avoid the activity area if disturbed. It is possible that mortality of small mammals will occur as a result of aquatic restoration activities. Small mammals are not as mobile as birds and bats, but more so than some of the other species (such as mollusks) where crushing by equipment is more likely to occur. Mortality of individuals is expected to be minimal and have no effect on long-term population dynamics or viability of any sensitive small mammal species. Long-term benefits from prescribed burning may include an increase in young herbaceous vegetation for mammals to consume as vegetation recovers. Creating more resilient, diverse, and productive riparian habitats would benefit small mammals in the long term.

Projects that improve in-stream channel flow, riparian vegetation, and road decommissioning would have positive short-term and long-term benefits to beaver, the only aquatic mid to large-size mammal. Direct mortality is not expected to occur, though some activities may create enough disturbance to temporarily displace beavers. Some of the restoration actions such as beaver habitat improvement and beaver habitat analogs are designed specifically to increase riparian habitat suitability for beaver. While beaver reintroduction is not a part of the proposed action, aquatic restoration projects would make the habitat more suitable for beaver expansion and reintroduction. Thus, aquatic restoration actions are likely to benefit beaver once the projects are completed.

The other seven sensitive species in the mid- to large-size mammal group are not considered to be riparian obligates, and can be found in various habitat types across the region. Like many mammals, they are adaptable and may use riparian corridors and adjacent upland habitats for dispersal, foraging and even denning if suitable conditions exist. There is potential for disturbance to or abandonment of a den that was not detected in the project area. Otherwise, the likelihood of direct effects to the species in this group is minimal. Most of the species in this group have expansive home ranges and can avoid the areas disturbed by restoration activities; either during implementation or in the short time period following implementation when recovery takes place. Indirect effects to species in this group may occur from habitat changes that in turn impact prey abundance and availability. Affected prey species may include small mammals, birds, insects, and eggs. Project design criteria for vegetation, snags, seasonal restrictions, down wood, and other design criteria are expected to reduce effects to small prey species. The effects to sensitive species in this group would be limited to individuals and not the population as a whole. As with other species groups, the long-term benefit of the actions that restore riparian function, and resiliency, would be beneficial to the sensitive species in this group.

Ungulates

Ungulates (such as deer and elk) as a group are likely to be minimally affected, both negatively and positively. Ungulates would benefit from road decommissioning projects, though the extent they benefit will be dictated mainly by the overall location and density of roads in the project area, and not necessarily by an individual road closure focused mainly on aquatic benefits. Ungulates may be displaced by activities themselves, including noise, smoke, and presence of equipment and personal implementing the actions. However, the amount of area affected is minimal compared to the overall amount of habitat available for ungulates. Changes to vegetation

are likely to have minimal impacts on ungulates either positively or negatively. Again, this is largely due to the small size of projects areas relative to the larger habitat tracts that ungulates occupy. Nevertheless, vegetation response from controlled burns may benefit ungulates, providing forage and release of new buds and leaves following prescribed fire. Fencing to protect riparian projects from livestock grazing can have negative impacts on ungulates as fences pose a physical hazard to animals who can be tangled and caught in the wires. The use of wildlife-friendly fencing standards would decrease negative effects of fencing on ungulates (Paige 2012).

Migratory Bird Treaty Act

The effects to migratory birds are expected to be the same as the effects described for birds that are sensitive species. In summary, there are negative effects expected to occur to individuals but not to the species or populations. The Pacific Northwest Region has issued guidance to complete analysis in order to comply with the Migratory Bird Treaty Act. The 2017 guidance, "Incorporating Migratory and Resident Bird Concerns in the National Environmental Policy Act Process Region Six Forest Service and OR/WA Bureau of Land Management" includes the following:

- Evaluate and balance long-term benefits of projects against any short- or long-term adverse effects.
- Pursue opportunities to restore or enhance the composition, structure and juxtaposition of migratory bird habitats in the project area.
- Consider approaches to the extent practicable for identifying and minimizing take that is incidental to otherwise lawful activities such as altering the season of activities to minimize disturbance during breeding season and retaining snags for nesting.

There are three different Bird Conservation Regions in the Pacific Northwest Region. Within each Bird Conservation Region there are specific species of birds that have been identified as birds of conservation concern. None of the birds of conservation concern identified in the three involved Bird Conservation Regions are riparian obligates; however, four species (willow flycatcher, bald eagle, yellow-billed cuckoo, and solitary sandpiper) have an affinity for riparian areas and wetlands where aquatic restoration activities may occur. The rest are species that use more generalized habitat, including riparian areas, or species that would not be expected to be found in riparian areas at all (for example, pelagic species). As indicated, aquatic restoration projects will be focused almost exclusively in riparian areas. Only a few projects associated with non-system roads and trails would occur outside riparian areas, and those are in areas of previous disturbance. Therefore, there is a very small subset of birds of conservation concern (the four mentioned above) that are most likely to be affected by aquatic restoration activities.

Likewise, there are five Partners in Flight bird conservation plans for Oregon and Washington. Each plan identifies species that represent a specific forest condition and habitat attribute within their planning areas.

Cumulative Effects

The cumulative effects of an action on listed species must be analyzed under the Endangered Species Act and the National Environmental Policy Act. Cumulative effects under the Endangered Species Act (50 CFR 402.02) are the effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation. As indicated previously in this section, programmatic

Endangered Species Act consultation for aquatic restoration projects was completed in 2013 (ARBO II programmatic consultation). Collectively the direct, indirect, and cumulative effects analyzed for wildlife species led to the determinations identified earlier in the analysis (no jeopardy to the species and no adverse modification of critical habitat). There were only two species that received "likely to adversely affect" determinations; spotted owl and marbled murrelet. The primary focus of the analysis on these two species was on disturbance effects as impacts due to habitat alteration were not identified as an issue. These were discussed in the context of direct and indirect effects. Negative effects specific to several fish species were the only species-specific cumulative effects that were identified.

Actions in the regional aquatic restoration environmental assessment are very similar to those analyzed under ARBO II. Design criteria included in the regional aquatic restoration environmental assessment are more restrictive than those analyzed in ARBO II, since the analysis addresses legal requirements and resources in addition to Endangered Species Act listed species. Therefore, cumulative effects of restoration actions in the environmental assessment are expected to be similar to slightly less than those described in ARBO II. Also as indicated, there have been subsequent species listing, and analysis on those species should be conducted on a case-by-case basis in project planning and may trigger separate Endangered Species Act consultation and further environmental analysis and decisions.

Under the National Environmental Policy Act, cumulative impacts are those caused by past, present, and reasonably foreseeable future federal, state, and private actions. The cumulative effects boundary for wildlife can vary from species to species, based on factors such as mobility, home range, and population size. Because this action involves so many species, the cumulative effects boundary is considered to be all occupied and suitable habitat on the Forest Service units in the Pacific Northwest Region. It also includes other non-federal areas adjacent to the areas where projects may be implemented.

The aquatic restoration actions proposed in this document will occur almost entirely within riparian areas. The only exception would be road and trail decommissioning of non-system roads in areas with 36 CFR 212 Subpart A and B travel management decisions. These actions involving non-system roads and trails would be implemented where non-system roads and trails are impacting aquatic health. Thus, even the actions that do occur outside riparian areas, are likely to occur in close proximity to riparian areas. Accordingly, this analysis considers cumulative effects first in the context of other actions occurring in riparian areas, and then in the context of actions occurring in the broader landscapes (both on and outside of National Forest System lands) where the actions will take place.

Numerous Forest Service activities occur within riparian areas. Activities on National Forest System lands that affect wildlife include recreational activities such as camping, biking, hiking, equestrian use, target shooting, and hunting; off-highway vehicle use; road maintenance; livestock grazing; mining and prospecting; vegetation management including fuelwood cutting; Native American products gathering; and fire suppression. Cumulative wildlife effects from these Forest Service projects and activities include mortality, disturbance, and displacement; reduced foraging, reproduction, and dispersal opportunities; and alteration of occupied, suitable, or potentially suitable habitat. These are discussed in more detail below by activity type.

Forest Service units within the Pacific Northwest Region have implemented and are planning to implement a variety of vegetation management projects in both upland and riparian areas. In riparian areas, projects consist mainly of thinning and burning activities. Vegetation management

(including thinning and prescribed burning) creates noise disturbance and habitat alteration. Animals may be temporarily displaced from suitable habitat and their behavior is affected by the presence of personnel and equipment. If vegetation project implementation occurs over multiple years, animals may abandon the area completely due to the extended disturbance. Prescribed burning, timber harvest, and mastication of shrubs can alter the amount of available habitat for animals in these areas for multiple years. Those changes may be beneficial to some wildlife and detrimental to others, depending on their habitat needs and preferences.

Livestock grazing on National Forests continue to have impacts to wildlife and their habitats: both in uplands and in riparian areas. Effects include changes to vegetation composition, fencing, and the presence of livestock. Wildlife may be deterred by the presence of cattle or sheep, or forced to compete for limited vegetation and water (especially during drought conditions). Wildlife entanglement in fences is one of the more serious impacts that may occur in association with grazing practices, particularly for wild ungulates. The potential for disease transmission between domestic and wild ungulates may have serious impacts, particularly for wild sheep where opportunities for contact between wild sheep and domestic sheep exist.

Recreational activities create disturbance and displacement and may result in habitat alteration that is detrimental to wildlife. Human presence may lead to displacement or non-use of available habitat. Recreational use may also result in habitat alterations. These include removal of snags in established recreation sites, user-created routes, and vegetative change at dispersed use areas. Concentrated use at developed and dispersed sites may also result in the presence of garbage and other wildlife attractants that have a variety of well know detrimental outcomes, such as increased use by corvids which in turn have impacts to other bird species.

Activities associated with mining can create disturbance and alter habitat. Mining operations themselves can create noise disturbance, for example from motorized equipment and blasting. Vegetative removal and excavation can alter or destroy habitat and displace soil and habitat for ground burrowing species. Roads and trails used to access facilities may also have negative impacts to include disturbance and displacement.

Overall, riparian areas represent a small portion of the landscape within the Pacific Northwest. Aquatic restoration activities analyzed in this document would occur within a small portion of the riparian areas throughout the region. The proposed action indicates that 1,800 projects could be implemented, resulting in disturbance of 2,190 acres. This represents less than 0.01 percent of the National Forest System lands in the region. Additionally, the projects would be implemented over a 15-year period, with individual projects generally completed within a single operating season. Thus, the duration of the disturbance from aquatic restoration projects is much shorter when compared to ongoing actions such as grazing or timber removal, which may take several years to implement and many years to recover from.

Across the region, all forest plans have been amended to adopt aquatic conservation strategies, developed for specific areas within the region and beyond; these are the Northwest Forest Plan Aquatic Conservation Strategy, the Interim Strategies for Managing Anadromous Fish-producing Watersheds (PACFISH), and the Inland Native Fish Strategy (INFISH). All projects and activities occurring in riparian areas on National Forest System lands, including aquatic restoration activities, must be implemented in accordance with these strategies. Current research and monitoring suggests these strategies are achieving their goals of maintaining or restoring aquatic and riparian habitats and key ecological processes at watershed and larger scales. See the “Aquatic Species and Water Resources” section for more information and detail on these trends.

Based on these findings, it can be deduced that cumulative effects of actions occurring under these strategies have been reduced to levels where overall aquatic health is being maintained or improved.

In addition to the controls contained within these aquatic strategies, the proposed action also includes an extensive suite of design criteria for aquatic restoration projects that are expected to further reduce the scope and scale of short-term negative effects that might occur, including effects to wildlife. Collectively, the design criteria in appendices 1 and 2, and the aquatic conservation strategies that amended plans constrain the magnitude, duration, and extent of any adverse effects to riparian function and wildlife. It is expected that cumulative effects have and will continue to be reduced in a manner that provides for maintenance and improvement of aquatic function.

The effects of projects occurring on National Forest System lands outside of riparian areas are similar to those described above. Though they are not as directly governed by the Northwest Forest Plan Aquatic Conservation Strategy, PACFISH, and INFISH, there are other plan level conservation measures and amendments in place to ensure that actions will not collectively cause a trend toward federal listing or a loss of species or population viability. Examples include, establishment of a late successional reserve network under the Northwest Forest Plan and the 1994 Regional Forester Plan Amendment 1, commonly referred to as East-side screens. Both of these decisions contain very specific direction that limit the scope, scale and magnitude of detrimental effects to wildlife.

Perhaps one of the most notable factors affecting wildlife are the landscape changes brought about by large-scale and intense wildfire. These impacts that occur both on and off National Forest System lands are influenced by a variety factors, including a warming climate. These disturbance events have effects on wildlife that far exceed effects of aquatic restoration projects. As with most vegetation changes, some wildlife benefit and some do not from the changes. It can be deduced, however, that actions that create resiliency and proper landscape function aide in sustainability and species persistence. The aquatic restoration activities analyzed in this document are designed, and have been demonstrated, to restore function and create resiliency of riparian ecosystems.

Many of the same suite of activities (grazing, vegetation management, recreation, etc.) occur outside of National Forest System lands in areas adjacent to locations where aquatic restoration activities would occur. In general, actions implemented outside of National Forest System lands would have similar types of effects on wildlife. Because activities outside National Forest System lands do not have the same controls to reduce or minimize impacts to wildlife, the magnitude of impacts to wildlife may be greater than anticipated for similar actions that occur on National Forest System lands.

In summary, the effects to wildlife (mortality, disturbance, displacement, and habitat alteration) from the 19 aquatic restoration actions are relatively small in scope, compared to other actions occurring across all National Forest System lands and adjacent lands of other ownerships. They are expected to impact individuals but not create a trend toward listing or loss of viability of the species. Over the long term, the actions are expected to restore function and resiliency of riparian areas on National Forest System lands, thereby buffering negative impacts that may occur outside riparian areas on or off National Forest System lands as well as natural events such as wildfire.

Effects to Soils

Summary

Effects to soils from management activities are different from other resources because direct effects of activities on soil are limited to the area of disturbance. Aquatic restoration activities would be designed to contribute to the long-term productivity of soils in riparian ecosystems, especially in areas where past management has led to detrimental soil conditions (such as compaction, loss of organic matter, severely burned soils, and erosion). Although there would likely be short-term effects to soils during restoration actions, restoration projects would be conducted according to project design criteria and Pacific Northwest Region direction that limits detrimental soil conditions to no more than 20 percent of an area. This approach would help restore sites where individual projects occur, leading to long-term recovery of soil properties and function.

All analyzed actions would make progress to improve soil functions in the riparian areas with non-system road decommissioning in areas with 36 CFR 212 Subpart A and B travel management decisions as the only proposed action that restores soils back into the productive land base from an impaired non-productive state. These long-term improvements in soil function are anticipated for approximately 25,357 acres or more within the region, approximately five times the amount of acres having short-term detrimental soil conditions. Restoring soil productivity and quality achieves requirements of the Multiple Use-Sustained Yield Act, the National Forest Management Act, and other Forest Service policies and requirements.

Analysis

Soils are an integral part of ecosystems, ecosystem function, and the above and below ground interaction of organisms. Soil quality is the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation and ecosystem health. Soil productivity is the inherent capacity of the soil resource to support appropriate site-specific biological resource management objectives, which include the growth of desirable plant species, plant communities, or a sequence of plant communities, all to support multiple land uses and ecosystem services (Adhikari and Hartemink 2016; Greiner et al 2017). Six soil functions have been identified by the Forest Service for maintenance of soil quality and productivity: soil biology, soil hydrology, nutrient cycling, carbon storage, soil stability and support, and filtering and buffering. In order to provide multiple uses and ecosystem services in perpetuity, these six soil functions need to be active and effectively working. These functions all contribute to ecological resilience, especially in riparian systems. In most areas where restoration actions are being proposed, at least one of these soil functions has been impacted or impaired by prior management activities.

Direct and Indirect Effects

This analysis focuses on the amount of soil in acres affected in the short term by potential restoration actions, compared to the acres of improved soil quality and productivity that will result in the long term.

Much of the current soil condition at sites needing restoration actions are related to past management resulting in both physical changes in the soils as well as altered disturbance regimes in the systems. Management activities that have affected soil condition include timber harvesting, site preparation, mechanical fuels treatments, prescribed fires, road construction and use,

recreation facility maintenance and use, grazing, and special uses, among others. Physical changes in the soils from these activities include compaction, loss of organic matter, severely burned soils, and erosion. All of these disturbances have impacted the soils and soil function to varying degrees. Factors such as flooding and soil deposition as well as ecosystem disturbances (such as lack of wildfire) has caused these systems to change.

Projects that restore natural flooding and sediment deposition regimes include the majority of the aquatic organism passage and the instream, side-channel, and floodplain projects. In a natural or restored environment, seasonal flooding contributes to fine sediment deposits, which promote riparian growth of vegetation with propagules, seeds, and organic matter. The sediment amends soil physical function by increasing water-holding capacity and providing a substrate for seedlings to establish. Reestablishment of these processes allows soil hydrologic, biologic, and nutrient-cycling functions to be restored and maintained in these riparian areas (Gregory et al 1991; Poff et al 1997; Stromberg et al 2007; Tabacchi et al 1998).

There are 1,110 individual aquatic organism passage and instream, side-channel and floodplain projects proposed to be completed within a decade. Several acres of riparian habitat per project would have improved soil function as a result. For example, replacing an undersized culvert with a properly designed stream simulation structure would allow the passage of debris and flood flows to downstream reaches and restore soil functions in adjacent riparian floodplain soils. Approximately 18,295 acres of riparian soil function would be restored through these projects.

All the riparian vegetation projects would restore the natural vegetation dynamics into the riparian systems by removing overstocked vegetation using prescribed fire or mechanical methods, or restoring the natural vegetation structure and composition. Restoring the vegetation and natural disturbance mechanisms in riparian systems will also restore the biological and nutrient cycling functions of the soils (Tabacchi et al 1998). Soil biology and nutrient cycling is highly tied to the aboveground plant community and vegetation dynamics of a site. The belowground soil organism populations are closely tied to the vegetation found on the site. By restoring the aboveground vegetation, the belowground soil biology will result in improved biological and nutrient cycling functions (Barrios 2007; Bever et al 1997; Ettema 2002). Riparian vegetation projects would result in 4,053 acres of restored soil function in the riparian areas.

Non-system road decommissioning would have the largest beneficial impact on soil quality and productivity of all the activities. Non-system roads are typically severely compacted with limited soil functions and impaired soil productivity. Soil structure, water infiltration, aeration, root penetrability, and soil biological activity improvements are observed with road decommissioning techniques (Lloyd et al. 2013). Combined with a long-term reduction in erosion and mass wasting, an overall increase of soil quality and productivity can be attributed to road decommissioning (Foltz et al 2007; Grace and Clinton 2007; Switalski et al 2004). It is anticipated that 2,606 acres would be directly converted from nonproductive lands with permanent soil impairment to productive sites with restored soil function with over a decade of implementation.

Short-term detrimental soil conditions are anticipated to occur with all the activity types causing ground disturbance with heavy equipment or fire. These include all analyzed activities with the exception of beaver habitat restoration. Detrimental soil conditions include soil disturbance that results in a short-term impairment of soil productivity and function such as compaction, puddling, displacement, severely burned soils, and eroded sites. These impacts are associated with the use of heavy machinery and fire (Page-Dumroese et al 2000; Reeves et al 2011, 2012). By following

project design criteria, detrimental soil conditions should be limited to the footprint of the projects in both scope and scale. Within 10 years, projects across the region would have temporarily caused detrimental soil conditions on approximately 5,214 acres. Through restorative actions as required, these short-term impacts should be recovered within 15 years to productive sites from the time of project implementation (Fleming et al 2006; Lloyd et al 2013; Page-Dumroese et al 2006; Powers et al 2005; Tan et al 2005).

Cumulative Effects

Analysis of the proposed actions meet Forest Service policy and direction as soils should not have permanent and substantial impairment as a result of cumulative effects from past, ongoing and future actions. Detrimental soil conditions generated from proposed management activities would not exceed Pacific Northwest Region thresholds used to indicate potential impairments to soil productivity.[29] Actions taken for aquatic restoration would alleviate legacy impacts from past management as described in the Direct and Indirect Effects section. However, not all of the disturbed sites across the landscape in riparian areas would be restored as a result of this proposal. Ongoing and foreseeable actions within the proposed activity areas consist of additional watershed improvement projects as well as recreation, grazing, mining, and forest thinning. As described above, these restoration projects often include a short-term effect offset by a long-term benefit. Considering the limited degree and geographic extent of these short-term detrimental effects occurring during project implementation, and how they are offset by the long-term benefits of the projects, cumulative effects are unlikely to occur with the implementation of this decision. Though difficult to determine measurably, the actions would improve site conditions as compared to existing conditions.

There is potential to have cumulative detrimental soil impacts from vegetation management, livestock grazing and mining projects occurring at aquatic restoration project sites. Mechanical vegetation management results in soil disturbances like compaction and displacement, especially along skid trails and landings. By applying standard best management practices for vegetation management, these impacts would be limited within regional and forest plan standards. Monitoring of vegetation management activities through forest plan monitoring and national best management practices monitoring has shown that soil and water protections are used to meet plan guidance. The primary soil disturbance mechanisms from livestock grazing is hoof action causing compaction and streambank erosion. Mining results in loss of soil productivity from displacement and removal of soil horizons. In the cases where aquatic restoration actions overlap in time and space with livestock grazing and mining, the restorative nature of the projects may be limited and additional recovery time may be needed for detrimental soil disturbance to recover.

Effects to Botanical Resources

Summary

Although botanical project design criteria allow for limited short-term deleterious effects, the design criteria ensure there will be no long-term degradation of plant populations or their habitats during the life of this project. Project design criteria for plants address potential direct and indirect impacts, avoiding them entirely or mitigating them to insignificance. In particular, the requirement for certified botanists to consult on project activities, the absolute necessity of avoidance of impacts as the mitigation of choice, the emphasis on habitat enhancement, and the

[29] Forest Service Manual 2520 R6 Supplement 2500-98-1

considerations and requirements for maintenance or improvement of ecological site integrity for both rare plants and special habitats all ensure that projects will provide long-term benefits to rare plants in the Forest Service units of the region.

The analysis has determined that in riparian reserves and riparian habitat conservation areas, project activities may impact individuals or habitat, but will not likely contribute to a trend toward Federal listing or cause a loss of viability to the population or species. While these impacts may occur, they are unlikely since the design criteria are generally planned to avoid impacts to sensitive plant species. In areas of road decommissioning, there would be no impact. Proposed activities would comply with the National Forest Management Act requirements to maintain viable populations of species, individual land management plans for the Forest Service units in the region, and Forest Service policies and directives related to sensitive species and rare plant management.

Analysis

The National Forest System lands of this region have many rare and special plant species that are designated by the Regional Forester as sensitive for management purposes. The 2018 Regional Forester sensitive species list (USDA Forest Service 2018) has 490 sensitive plant species including 387 vascular plants, 49 bryophytes, 28 fungi, and 26 lichens. Our overall responsibility for these species is to ensure that management actions do not contribute to a loss of viability of species or populations, or cause a trend toward Endangered Species Act federal listing (USDA Forest Service 2005). Because federally listed species are addressed under ARBO II (U.S. Fish and Wildlife Service 2013), they are not discussed further here.

There are at least 339 sensitive plant species in the project area including 262 vascular plants, 39 bryophytes, 19 fungi, and 19 lichens. The number of known occurrences by species within the project area ranges from 1 to 11 across the region, and it is noteworthy that 220 (65 percent) of these taxa are represented across the entire region by only one known population in the project area. In addition to the 339 taxa with known locations in the Pacific Northwest Region, there are 21 plant taxa designated sensitive on the 2018 Regional Forester sensitive species list that cannot be excluded from this analysis based on their known habitats (we have not looked for them because they are newly designated as sensitive, so there are no confirmed localities on National Forest System lands in the project area. These 21 are also included in this analysis bringing the total number of taxa considered to 360 (283 vascular plants, 39 bryophytes, 19 fungi, and 19 lichens). Refer to the project website[30] for a list of plant species analyzed.

Direct and Indirect Effects

This analysis focuses on the degradation or elimination of rare plant populations or their habitat during aquatic restoration activities. The use of heavy equipment in riparian corridors—a feature of nearly all proposed project activities—is the primary concern for rare plants since most are small and easily crushed or obliterated by heavy wheeled and bladed vehicles. Also, any vegetation management for improved riparian function (such as riparian vegetation treatment and controlled burning) can remove habitat and eliminate arboreal taxa including lichens, bryophytes, and fungi.

[30] https://data.ecosystem-management.org/nepaweb/nepa_project_exp.php?project=53001

Whereas ordinarily plant surveys are conducted in advance of designing a project to mitigate and analyze impacts based on those surveys, this project authorizes post-decision/pre-implementation plant surveys. Final project locations and activities will be flexibly determined in part based on project design criteria, which help identify the right scope, scale, mix, and mitigation of approved work following a signed decision.

Of the sensitive plant taxa that occur within the region, 65 percent (220) are only known from a single occurrence across the region, and given the dispersed nature and overall modest number of projects proposed (about 1,800 over 15 years), as well as the very small ground-disturbing footprint for most aquatic restoration activities, it follows that most of the taxa analyzed will not be encountered or affected by this project. However, given the uncertainty associated with post-decision rare plant surveys, lack of complete knowledge of rare plants and their distribution and abundance, unknown individual project activity locations, and the unpredictability of final implementation, we can't say that there would be absolutely no impact.

There would be no short-term impacts associated with non-system road decommissioning in uplands since rare plants and unique habitats are extremely unlikely to be encountered on roadbeds, and active or passive restoration would improve habitat in the long run.

In the long term, restoration projects carried out would improve habitat condition at the site and watershed scale. While the project focus is on improving aquatic and riparian function, the project design criteria for plants ensure that botanists will incorporate terrestrial habitat restoration where it is needed, thus improving rare plant population persistence and viability. Eventually rare plants may recolonize some decommissioned roads so modest benefits may accrue.

Effects Determination: In riparian reserves and riparian habitat conservation areas, project activities may impact individuals or habitat, but will not likely contribute to a trend toward Federal listing or cause a loss of viability to the population or species. In areas of road decommissioning, there would be no impact.

Cumulative Effects

Past, present and reasonably foreseeable future actions that are especially relevant to plants include forest vegetation improvement and fuels reduction work, aquatic restoration, and grazing allotment reauthorization. Review of recent projects show that their effects determinations for plants range from beneficial impact to no impact or may impact individuals and habitats. Detrimental effects to rare plants described in project analyses can include the loss of some individuals due to ground disturbance or herbivory or trampling from livestock. Sensitive habitats such as soil crust or moss mats are vulnerable to disturbance and may take years or decades to recover. Certain special habitats like fens or aspen groves are degraded by livestock or changes in fire regimes. However, all projects employ avoidance as well as project design features to reduce or avoid direct effects to rare plants and special and unique habitats. Furthermore, detrimental effects for most projects are local and short term, and in most of this work, botanical resources are left in the same condition upon project completion. For many regional projects, an effects determination of "may impact habitats or individuals" is concluded out of an abundance of caution or due to uncertainty (for example, where fungal surveys are impractical), yet generally long-term impacts to botanical resources are avoided even for these projects.

The determinations and outcomes for this regional aquatic restoration project are similar to most projects in the region where botanical resources are analyzed. Because we anticipate only long-

term neutral to potentially beneficial consequences for rare plants and their habitats from this proposed action, we anticipate negligible or mildly positive cumulative effects.

Effects to Management Indicator Species

Summary

The National Forest Management Act implementing regulations of 1982 require that management indicator species be identified as part of the forest plan. Management indicator species are unique to individual forest plans within the Pacific Northwest Region; to the plan area itself and the management actions to be implemented under the plan. Additionally, each forest plan establishes objectives that maintain and improve habitat for the management indicator species identified in the plan.

Appendix 2 of this document contains design criteria common to all 19 aquatic restoration categories. Along with other requirements, it specifies that projects must follow the forest plans where the projects are to be implemented. This would include all of the requirements associated with management indicator species. Thus, interdisciplinary teams must ensure that all requirements for management indicator species are met when planning, designing and implementing any of the 19 restoration activities; thus ensuring that effects to those management indicator species would be consistent with those described in the individual forest plans.

The management indicator species selected by Forest Service units fall within the same groupings of species established in this analysis for purposes of analyzing sensitive species. In fact, some of the management indicator species identified in various forest plans across the region are also sensitive species. Therefore, the effects analyzed and disclosed for sensitive species throughout this document would also be expected to occur for management indicator species. Those effects are described in the fisheries, botany and wildlife sections of the documents. In summary, the aquatic restoration actions analyzed can be expected to have short-term effects that may negatively impact individuals, but will not cause a trend toward listing or a loss of viability at the species or population levels. Species, particularly those that are aquatic or riparian obligates or associates, are expected to benefit from the actions over the long term as the function, resiliency and health of riparian areas improve.

Effects to Survey-and-Manage Plant and Animal Species

Summary

There are just under 300 plant and animal species designated as survey-and-manage species. They are closely associated with late-successional or old-growth forest and managed through a specific set of standards and guidelines associated with the 1994 record of decision for the Northwest Forest Plan. For descriptions of species habitats and a current survey and manage species list, see the Survey and Manage website[31] and the Interagency Special Status and Sensitive Species Program website[32] for survey protocols, management recommendations, species fact sheets, or conservation assessments.

As a result of legal rulings, exemptions to survey and manage requirements apply to all but four aquatic restoration activities (bull trout protection, fencing to protect aquatic restoration projects,

[31] https://www.blm.gov/or/plans/surveyandmanage/
[32] https://www.fs.fed.us/r6/sfpnw/issssp/

juniper removal, and controlled burning in riparian areas). For the 15 actions that are exempted from survey and manage requirements we conclude that impacts to species would be minimal and within a range that would ensure the survey and manage objective of providing for reasonable assurance of species persistence to be met. For the other four actions, if suitable habitat for a survey and manage plant or animal species occurs within the project area and the activity is considered to be habitat-disturbing, the activity or project would be modified or the location moved (see appendix 2). Therefore, the survey-and-manage persistence objective of providing for a reasonable assurance of species persistence would be met.

Analysis

The January 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines amended all land management plans within the range of the northern spotted owl (also known as the Northwest Forest Plan area). These standards and guidelines require pre-disturbance surveys prior to habitat-disturbing activities and management of known sites for certain categories of survey-and-manage fauna and flora species. Legal rulings (as ordered by Judge Pechman, January 9, 2006, and subsequent changes to that order on October 10, 2006) modified the requirements exempting surveys and site management for four categories of projects. Two of the exempted categories of projects (culvert removal or replacement and riparian and stream improvement projects) apply to 15 of the 19 aquatic restoration actions proposed in this project; therefore, the January 2001 record of decision and standards and guidelines do not apply to these activities and no further analysis is needed for survey-and-manage species in relation to these 15 aquatic restoration actions. Based on the legal negotiations that resulted in the Pechman exemptions, it can be inferred that risks to species persistence was assumed to be low with implementation of the exempted activities without conducting pre-disturbance surveys and managing known sites. It can also be inferred that individuals may be impacted, but the overall objective of providing for a reasonable assurance of species persistence would still be met with application of the Pechman exemptions.

Direct, Indirect and Cumulative Effects

Four of the 19 actions included in this analysis do not fit within the Pechman exemptions. The four actions are bull trout protection, fencing to protect aquatic restoration projects, juniper removal, and riparian vegetation treatment (controlled burning). For these four aquatic restoration activities, project design criteria in appendix 2 specifically states, ". . . if suitable habitat for a survey and manage fauna or flora species occurs within the project area and the activity is considered to be habitat-disturbing, the activity or project must be modified or the project location moved to avoid the species' habitats" (see appendix 2). By avoiding the survey-and-manage species habitats, there would be no likelihood of species occurrence and the need for surveys and known site management.

Because survey-and-manage habitat would be avoided for these four types of actions, we would provide for a reasonable assurance of species persistence and there would be no direct, indirect or cumulative effects to the species or their habitats. The proposed actions would comply with the January 2001 Record of Decision and Standards and Guidelines as modified by Judge Pechman's January 9, 2006 order and subsequent modification of that order on October 10, 2006.

Effects to Cultural Resources

Summary

The project design criteria for each proposed action would minimize and mitigate impacts to sites in order to preserve the site condition and integrity. However, there is potential for eligible sites to be impacted. Forest Service personnel would conduct surveys for cultural sites and consult with appropriate Tribes regarding traditional cultural properties prior to implementation of each project. If cultural resource sites which are listed on, or have the potential to be listed on, the National Register of Historic Places are identified, they would either be avoided or any potential impacts would be mitigated following processes developed in consultation with the appropriate State Historic Preservation Office and any other interested parties, including American Indian Tribes. The proposed action is consistent with Forest Service Handbook 2309.12, the implementing regulations for the National Historic Preservation Act (36 CFR 800), and other relevant laws.

Analysis

In the Pacific Northwest Region, the Forest Service has documented over 40,000 cultural resource sites, which include archaeological sites, historic structures, traditional cultural properties, and historic properties of religious and cultural significance to Indian Tribes.

Adverse effects for cultural resources are impacts to the integrity of a property, destroying a portion or all of the property and the information that it could yield, or destroying characteristic features of the property. These effects can be direct or indirect. A direct adverse impact occurs during the activity itself, such as when a road is built through a historic property and the construction process destroys the site. An indirect adverse impact can occur as a side effect of the activity or after the activity is complete, such as runoff from a road that eventually erodes a historic property adjacent to it.

According to Federal regulations for the protection of historic properties,[33] the Forest Service, "may use a phased process to conduct identification and evaluation efforts" because specific locations will not be identified prior to the project decision. The Forest Service, in consultation with the Advisory Council on Historic Preservation, Oregon Station Historic Preservation Office (Oregon SHPO) and the Washington Department of Archeology & Historic Preservation (Washington DAHP) has determined that this EA is programmatic in nature and the application of existing programmatic agreements can be utilized. For all projects analyzed under this EA, the Section 106 processes outlined in the *2004 Programmatic Agreement Among the United States Department of Agriculture Forest Service Pacific Northwest Region (Region 6), and the Oregon State Historical Preservation Officer Regarding Cultural Resources Management In the State of Oregon by the USDA Forest Service* and the *1997 Programmatic Agreement Among the United States Department of Agriculture Forest Service Pacific Northwest Region (Region 6), and the Washington State Historic Preservation Officer Regarding Cultural Management In the State of Washington* are two documents that clearly outline the Section 106 process that can be applied to the projects analyzed under this EA. If either PA is revised and replaced from the date of the final EA, the most current programmatic agreement for each state would be followed. All Section 106 compliance will be completed prior to project implementation.

[33] 36 CFR 800.4 (2)(b)

If cultural resource sites which are listed on, or have the potential to be listed on, the National Register of Historic Properties are identified, they would either be avoided or any potential impacts would be mitigated following processes developed in consultation with the appropriate State Historic Preservation Office and any other interested parties, including American Indian Tribes

Under the regulations, an adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a cultural resource that qualify the property for inclusion in the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

Direct and Indirect Effects

There is potential for eligible sites to be impacted. Potential direct impacts could affect eligible sites, historic district or traditional cultural properties, or historic properties of religious and cultural significance. The hydrologic corridors (rivers, streams, tributaries) all are considered high probability areas for cultural resources throughout the region, these areas have high site density. There are multiple areas where there are potential effects to eligible sites due to unknown information related to project locations and specifics. However, the project design criteria developed for individual projects at the forest-level, are intended to minimize and mitigate impacts to sites in order to preserve the site condition and integrity. Examples of potential project design criteria are listed below:

- pre-implementation surveys to determine whether sites exist;
- ensuring compliance with section 106 of the National Historic Preservation Act and concurrence with State Historic Preservation Offices;
- avoiding sites and properties listed or having the potential to be listed on the National Register of Historic Places;
- consultation with associated American Indian Tribes; and
- halting work if previously unidentified sites are discovered during project implementation.

By following project-specific design criteria, direct and indirect effects to cultural resources should be minimal to nonexistent.

Cumulative Effects

Throughout the region there are multiple projects occurring that could contribute to cumulative impacts to cultural resources. These include, but are not limited to vegetation management, fire and fuels, road decommissioning, mining and recreation and have the potential for effects to overlap with effects from the activities in the proposed action.

The Section 106 process requires the federal agency to follow the steps in 36 CFR 800 to consider the effects of projects on historic properties. However, with the use of project specific design criteria and the programmatic agreements as stated in the direct and indirect effects section would result in minimal to no effects. Therefore, there would be no adverse cumulative effects to cultural resources.

Effects to Low Income and Minority Populations

Summary and Analysis

Executive Order 12898 requires Federal agencies to identify and address the disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations. We have not identified any low income or minority populations that would be adversely affected by this proposal. Improving watersheds and aquatic resources would provide beneficial effects for communities near or downstream from the proposed aquatic restoration projects. Fisheries resources are oftentimes highlighted as a first food to many tribal communities.

Fisheries resources provide subsistence to many tribal communities throughout the region and can have an additional cultural importance. Currently, in the region, the Forest Service works in collaboration with several Tribes to co-manage fisheries resources. The proposed project would have a positive effect on fish population and habitat, which would be an overall benefit to the resource and the tribal community.

Effects to Recreation

Summary

The project design criteria for each proposed action would minimize and mitigate impacts to recreation sites to preserve recreation access and opportunities. Activities associated with any proposed aquatic restoration activities that occur in riparian areas located near or adjacent to developed recreation sites, dispersed recreation sites, or trailheads, or on, alongside or adjacent to forest roads that access those recreation sites, may cause temporary loss of access or delays of access for the recreating public. Dispersed (user created) campsites may be temporarily or permanently inaccessible if located in, or within close proximity to riparian areas or adjacent to project locations.

Analysis

The National Forest System lands in the Pacific Northwest Region offer a broad range of recreation opportunities. The potential impacts to recreation opportunities and experiences is unknown based on the lack of individual project locations, timing and/or duration. Additionally, for some forms of recreation (such as dispersed camping in undeveloped campsites), there is not a comprehensive inventory within the Pacific Northwest region; however there are thousands of traditional dispersed campsites scattered throughout. Although recreation-related project design criteria allow for limited short-term deleterious effects, the design criteria ensure there will be no long-term degradation of recreation resources during the life of this project.

Direct and Indirect Effects

There are multiple areas where there are potential effects to recreation resources due to unknown information related to project locations and specifics. However, the project design criteria listed in appendix 2 are intended to minimize and mitigate impacts to recreation resources in order to preserve recreation opportunities and associated experiences. These include:

- Provide advance notification and consultation with representatives of recreation user groups and outfitter-guides for projects occurring in/around developed and dispersed recreation areas.

- Post notification of proposed project at trailheads and river access sites.

By following these design criteria, direct and indirect effects to recreation resources should be minimal to nonexistent. Providing advanced notification and consultation with potentially affected recreation user groups and outfitter-guides and addressing their input to specific projects will ensure that existing recreation opportunities and experiences are adequately addressed at the appropriate scope and scale depending on project location, timing and duration.

Cumulative Effects

The past, present and reasonably foreseeable activities that would contribute to the accumulation of effects in conjunction with this project are those that would alter the set of recreation opportunities, and experiences that are currently available to the public. These opportunities and experiences are generally provided by the recreation opportunity spectrum that establishes the level of development, sense of place and appropriate types of motorized and non-motorized activities.

The determinations and outcomes for this regional aquatic restoration project are similar to most projects in the region where recreation resources are analyzed. Because we anticipate only long-term neutral to potentially beneficial consequences for recreation opportunities and associated experiences from this proposed action, we anticipate negligible or mildly positive cumulative effects.

Agencies and Persons Consulted

The following agencies, organizations, and individuals were consulted or provided input on this project and environmental analysis.

State and Federal Agencies

- Oregon State Historic Preservation Office
- Washington Department of Archeology and Historic Preservation
- Forest Service Tribal Relations Liaison
- Oregon Water Resources Department
- Washington Department of Ecology
- Forest Service specialists and natural resource staff from the Columbia Gorge National Scenic Area and the 16 national forests within the Pacific Northwest Region of the Forest Service

Tribes

Consultation with Tribes in the Pacific Northwest Region is an ongoing process as part of regular Government-to-Government consultation.

Appendix 1. Aquatic Restoration Categories, Descriptions, and Activity-Specific Design Criteria

Introduction

This appendix is divided into a description section and a design criteria section. There are four broad project categories (listed below): aquatic organism passage; instream, side-channel and floodplain; riparian vegetation; and road and trail decommissioning. Each category is refined by type of project. For example, aquatic organism passage includes fish passage projects and small dam removal. The design criteria in this appendix are organized by project type.

Descriptions

Aquatic Organism Passage Projects

There are two types of aquatic organism passage projects: fish passage and small dam removal.

Fish Passage Restoration includes the following:

- total removal of culverts or bridges
- replacing culverts or bridges with properly sized culverts and bridges
- replacing a damaged culvert or bridge
- resetting an existing culvert that was improperly installed or damaged
- stabilizing and providing passage over headcuts
- removing, constructing (including relocations), repairing, or maintaining fish ladders
- replacing, relocating, or constructing fish screens and irrigation diversions

Such projects will take place where fish passage has been partially or completely eliminated through road construction, stream degradation, creation of small dams and weirs, and irrigation diversions. Equipment such as excavators, bull dozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

Small Dam Removal includes removal of unauthorized, abandoned, or agency small dams, channel-spanning weirs and abandoned diversion and other water retention structures. Projects will be implemented to reconnect stream corridors, floodplains, and estuaries, reestablish wetlands, improve aquatic organism passage, and restore more natural channel and flow conditions. Equipment such as excavators, bull dozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects. Third-party dams can also be removed when coordination has occurred and agreement has been reached with the owner.

Instream, Side-channel, and Floodplain Projects

The 12 types of projects in this category are described below.

Beaver Dam Analogs include installation of in-channel structures to aggrade streams and/or encourage beavers to build dams in incised channels and across potential floodplain surfaces. The dams are expected to entrain substrate, aggrade the bottom, and reconnect the stream to the floodplain. Equipment such as excavators, dump trucks, front-end loaders, pile driver machines, and similar equipment may be used to implement projects.

Bull Trout Protection includes the removal of brook trout or other nonnative fish species in riparian habitat conservation areas and riparian reserves [34] via electrofishing or other manual means to protect Bull trout from competition, hybridization, or both. Piscicides are included as a removal method.

Channel Reconstruction or Relocation projects include reconstruction of existing stream channels through excavation and structure placement (large wood and boulders) or relocation

[34] Bull trout protection in riparian reserves is not covered under the Pechman exemptions, which guide management of Northwest Forest Plan survey-and-manage species. Therefore, this project will be excluded from riparian reserves when suitable habitat occurs for survey-and-manage species.

(rerouting of flow) into historical or newly constructed channels that are typically more sinuous and complex. This proposed action applies to stream systems that have been straightened, channelized, dredged, or otherwise modified for the purpose of flood control, increasing arable land, realignment, or other land use management goals or for streams that are incised or otherwise disconnected from their floodplains resulting from watershed disturbances. This activity type will be implemented to improve aquatic and riparian habitat diversity and complexity, reconnect stream channels to floodplains, reduce bed and bank erosion, increase hyporheic exchange, provide long-term nutrient storage, provide substrate for macroinvertebrates, moderate flow disturbance, increase retention of organic material, and provide refuge for fish and other aquatic species. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

Fencing to Protect Aquatic Restoration Projects will be implemented in riparian habitat conservation areas[35] to protect active aquatic restoration projects from livestock. Fence construction for any other purpose, such as the construction of riparian grazing pastures, is not included under this category. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

In-channel Nutrient Enhancement includes the placement of salmon carcasses, carcass analogs (processed fish cakes), or inorganic fertilizers in stream channels to help return stream nutrient levels back to historical levels. This action helps restore marine-derived nutrients to aquatic systems, thereby adding an element to the food chain that is important for growth of macroinvertebrates, juvenile salmonids, and riparian vegetation. Application and distribution of nutrients throughout a stream corridor can occur from bridges, stream banks, boats, or helicopter.

Large Wood, Boulder, and Gravel Placement includes large wood and boulder placement, engineered log jams, porous boulder weirs and vanes, gravel placement, and tree removal in riparian areas for large wood projects. Such activities will occur in areas where channel structure is lacking due to past stream cleaning (large wood removal), riparian timber harvest, and in areas where natural gravel supplies are low due to anthropogenic disruptions. These projects will occur in stream channels and adjacent floodplains to increase channel stability, rearing habitat, pool formation, spawning gravel deposition, channel complexity, hiding cover, low velocities, and floodplain function. Equipment such as helicopters, excavators, dump trucks, front-end loaders, full-suspension yarders, and similar equipment may be used to implement projects. Grade-control, engineered log jams are designed to arrest channel downcutting or incision by providing a grade control that retains sediment, lowers stream energy, and increases water elevations to reconnect floodplain habitat and diffuse downstream flood peaks.

Legacy Structure Removal includes the removal of past projects, such as large wood, boulder, rock gabions, and other in-channel and floodplain structures that, according to current aquatic restoration science, are inappropriate for the geomorphic and watershed settings. Projects will be implemented to restore natural channel conditions. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

Off- and Side-Channel Habitat Restoration projects will be implemented to reconnect historical side-channels with floodplains by removing off-channel fill and plugs. Furthermore,

[35] Fencing and stream crossing construction in riparian reserves is not covered under the Pechman exemptions, which guide management of Northwest Forest Plan survey-and-manage species. Therefore, this project will be excluded from riparian reserves when suitable habitat occurs for survey-and-manage species.

new side-channels and alcoves can be constructed in geomorphic settings that will accommodate such features. This activity category typically applies to areas where side channels, alcoves, and other backwater habitats have been filled or blocked from the main channel, disconnecting them from most if not all flow events. These project types will increase habitat diversity and complexity, improve flow heterogeneity, provide long-term nutrient storage and substrate for aquatic macroinvertebrates, moderate flow disturbances, increase retention of leaf litter, and provide refuge for fish during high flows. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

Piling and other Structure Removal include the removal of unauthorized, abandoned, or agency structures including untreated and chemically treated wood pilings, piers, boat docks as well as similar structures comprised of plastic, concrete, and other material. Piling and other structure removal from waterways will improve water quality by eliminating chronic sources of toxic contamination and associated impacts to riparian dependent species. Pilings and other structures occur in estuaries, lakes, and rivers and are typically used in association with boat docks and other facilities. Equipment such as boats, barges, excavators, dump trucks, front-end loaders, and similar equipment may be used to implement projects. Third-party structures can also be removed when coordination has occurred and agreement has been reached with the owner.

Reduction and Rehabilitation of Recreation Impacts is intended to better control dispersed and designated campgrounds and other recreation infrastructure along streams and within riparian areas. This includes removal or improvement of infrastructure associated with designated campgrounds, dispersed campsites, day-use sites, foot trails, and off-road vehicle roads and trails in riparian reserves or riparian habitat conservation areas. Campground closure or relocation is not permitted under this project environmental assessment. The primary purpose is to eliminate or reduce recreational impacts to restore riparian areas and vegetation, improve bank stability, and reduce sedimentation into adjacent streams. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

Set-back or Removal of Existing Berms, Dikes, and Levees which were constructed for flood control will be conducted to reconnect historical fresh-water deltas to inundation, stream channels with floodplains, and historical estuaries to tidal influence as a means to increase habitat diversity and complexity, moderate flow disturbances, and provide refuge for fish during high flows. Other restored ecological functions include overland flow during flood events, dissipation of flood energy, increased water storage to augment low flows, sediment and debris deposition, growth of riparian vegetation, nutrient cycling, and development of side channels and alcoves. Such projects will take place where estuaries and floodplains have been disconnected from adjacent rivers through drainpipes and anthropogenic fill. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

Streambank Restoration: Restore streambanks that have been artificially altered to more natural conditions.

Riparian Vegetation Projects

There are four types of projects in this category: beaver habitat restoration, juniper tree removal, riparian vegetation planting, and riparian vegetation treatment (controlled burning).

Beaver Habitat Restoration will be conducted in riparian reserves and riparian habitat conservation areas to help restore plants species composition and structure that would occur

under natural conditions, including historical fire regimes, and are required to support beaver colonies. Target plant species include willow, aspen, cottonwood and other native riparian deciduous trees and shrubs. Equipment would include manual planting tools, chainsaws, drip torches, along with fire suppression vehicles and equipment.

Juniper Tree Removal will be conducted in riparian habitat conservation areas[36] riparian areas to help restore plant species composition and structure that would occur under natural fire regimes. Juniper removal will occur where juniper have encroached into riparian areas as a result of fire exclusion or stream down cutting and have replaced more desired riparian plant species such as willow, cottonwood, aspen, alder, sedge, and rush. Felled juniper can be placed in downcut streams to help elevate the bed and allowing stream access to floodplains, restoring moisture to the riparian area for riparian plants. This action will help restore composition and structure of desired riparian species, thereby improving ground cover and water infiltration into soils. Equipment to remove junipers may include chainsaws, pruning shears, winch machinery, feller-bunchers, and slash-busters. Chaining is not permitted under this project environmental assessment.

Riparian Vegetation Planting includes the planting of native riparian species in riparian reserves and riparian habitat conservation areas that would occur under natural disturbance regimes. Activities may include the following: planting conifers, deciduous trees and shrubs; placement of sedge and or rush mats; gathering and planting willow cuttings. The resulting benefits to the aquatic system can include desired levels of stream shade, bank stability, stream nutrients, large wood inputs, increased grasses, forbs, and shrubs, and reduced soil erosion. Equipment may include excavators, backhoes, dump trucks, power augers, chainsaws, and manual tools.

Riparian Vegetation Treatment (Controlled Burning) includes reintroduction of low- and moderate-severity fire into riparian habitat conservation areas[37] to help restore plant species composition and structure that would occur under natural fire regimes. This activity is permitted in dry forest types east of the Cascade mountain crest and southwestern Oregon. Further, this can be applied to more localized fire-dependent ecosystems, such as oak woodlands, west of the Cascade mountain crest. Noncommercial conifer thinning may be required to adjust fuel loads for moderate-severity burns to regenerate deciduous trees and shrubs. Resulting benefits include restoration of desired levels of stream shade, bank stability, soil erosion and stream turbidity, stream nutrients, large wood inputs, or a combination of these things. Additional benefits include maintenance of late-seral (old-growth) trees, which serve as sources of large wood to streams. Equipment would include drip torches and chainsaws, along with fire suppression vehicles and equipment.

Non-System Road and Trail Decommissioning Projects

Non-system Road and Trail Decommissioning includes hydrologically decommissioning non-system roads and trails in areas with 36 CFR 212 Subpart A and B travel management decisions; for example, culvert removal in perennial and intermittent streams. Such actions will occur inside

[36] Juniper removal in riparian reserves is not covered under the Pechman exemptions, which guide management of Northwest forest plan survey-and-manage species. Therefore, this project will be excluded from riparian reserves when suitable habitat occurs for survey-and-manage species.

[37] Controlled burning is not covered under the Pechman exemptions, which guide management of Northwest forest plan survey-and-manage species. Therefore, this project will be excluded from riparian reserves when suitable habitat occurs for survey-and-manage species.

and outside riparian reserves and riparian habitat conservation areas, targeting those non-system roads that contribute sediment to streams, block fish passage, disrupt floodplain and riparian functions, or a combination of these things. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects. It is important to note, this restoration type is only authorized for non-system roads in areas with 36 CFR 212 Subpart A and B travel management decisions in this environmental assessment.

Activity-Specific Design Criteria

Aquatic Organism Passage Projects

The following design criteria apply to different fish passage projects. Fish passage restoration has four components: stream simulation culvert and bridge projects, headcut and grade stabilization, fish ladders, and irrigation diversion replacement or relocation and screen installation or replacement.

Fish Passage Restoration

Stream Simulation Culvert and Bridge Projects

Stream simulation culvert and bridge projects have five components: culvert criteria, bridge design, crossing design, National Marine Fisheries Service review and approval of the fish passage, and opportunity for individual level 1 consultation. All road-stream crossing structures shall simulate stream channel conditions per "Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings" (USDA Forest Service 2008).[38]

Culvert Criteria

Within the considerations of stream simulation, the structure shall, at a minimum, accommodate a bankfull wide channel plus constructed banks to provide for passage of all life stages of native fish species (for more information, reference chapter 6, page 35 of the Forest Service's "Stream Simulation Guide"). The following crossing-width guidance applies to specific ranges of entrenchment ratios as defined by Rosgen (1996):

1. Non-entrenched streams: If a stream is not fully entrenched (entrenchment ratio of greater than 1.4), the minimum culvert width shall be at least 1.3 times the bankfull channel width. This is consistent with the "NOAA Fisheries Anadromous Salmonid Passage Facility Design" (section 7.4.2 "Stream Simulation Design;" NMFS 2011).[39] However, if the appropriate structure width is determined to be less than 1.3 times the bankfull channel width, processes for variances are listed in the "Review and Approval by the National Marine Fisheries Service" and "Opportunity for Individual Level 1 Consultation" discussions.
2. Entrenched streams: If a stream is entrenched (entrenchment ratio of less than 1.4), the culvert width must be greater than bankfull channel width, allow sufficient vertical clearance to allow ease of construction and maintenance activities, and provide adequate room for the construction of natural channel banks. Consideration should be given to accommodate the floodprone width. Floodprone is the width measured at twice the maximum bankfull depth (Rosgen 1996).

[38] http://stream.fs.fed.us/fishxing/aop_pdfs.html
[39] http://www.nwr.noaa.gov/Salmon-Hydropower/FERC/upload/Fish-Passage-Design.pdf

Bridge Design

1. Bridges with vertical abutments—including concrete box culverts, which are constructed as bridges—shall have their stream channels, including width, designed according to culvert guidelines.
2. Structure material must be concrete or metal. Concrete must be sufficiently cured or dried before coming into contact with stream flow. The use of treated wood for bridge construction or replacement is not allowed under this project environmental assessment.
3. Riprap must not be placed within the bankfull width of the stream. Riprap may only be placed below bankfull height when necessary for protection of abutments and pilings. However, the amount and placement of riprap should not constrict the bankfull flow

Crossing Design

1. Crossings shall be designed using an interdisciplinary design team consisting of an experienced engineer, fisheries biologist, and hydrologist or geomorphologist.
2. Crossing structures with widths that exceed 20 feet or with costs that exceed $100,000 shall be reviewed by the USDA Forest Service aquatic organism passage design assistance team or a Bureau of Land Management equivalent.
3. At least one member of the design team shall be trained in a week-long aquatic organism passage course based on the USDA Forest Service's guide, "Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings" (USDA Forest Service 2008).[40]
4. Bankfull width shall be based on the upper end of the distribution of bankfull width measurements as measured in the reference reach to account for channel variability and dynamics.
5. Legacy pressure-treated and creosote soaked wood components of crossings shall be removed during road-stream crossing modifications.

Review and Approval by the National Marine Fisheries Service

If the structure width is determined to be less than the established width criteria as defined above, a variance may be requested from the Portland office of the National Marine Fisheries Service Habitat Conservation Division for consistency with criteria in National Marine Fisheries Service (2011).

Headcut and Grade Stabilization

Headcut and grade stabilization each have specific components. Headcuts often occur in meadow areas typically on Rosgen C and E channel types. Headcuts develop and migrate during bankfull and larger floods, when the sinuous path of Rosgen E type streams may become unstable in erosive, alluvial sediments, causing avulsions, meander cut-offs, bank failure, and development of an entrenched Rosgen G gully channel (Rosgen 1996).

Stabilize Headcuts

1. Armor headcut with sufficiently sized and amounts of material to prevent continued up-stream migration of the headcut. Materials can include both rock and organic materials that

[40] http://stream.fs.fed.us/fishxing/aop_pdfs.html

are native to the area. Material shall not contain gabion baskets, sheet pile, concrete, articulated concrete block, and cable anchors.

2. Focus stabilization efforts in the plunge pool, the headcut, as well as a short distance of stream above the headcut.
3. Minimize lateral migration of channel around headcut ("flanking") by placing rocks and organic material at a lower elevation in the center of the channel cross section to direct flows to the middle of channel.
4. In streams with current or historical fish presence, provide fish passage over stabilized headcut through constructed riffles for pool/riffle streams or a series of log or rock weir structures for step/pool channels as described in the "Grade Stabilization" section below.
5. Short-term headcut stabilization (including emergency stabilization projects) may occur without associated fish passage measures. However, fish passage must be incorporated into the final headcut stabilization action and be completed during the first subsequent in-water work period.
6. In streams without current or historical fish presence, it is recommended to construct a series of downstream log or rock weirs as described in part ii below to expedite channel aggradation.

Grade Stabilization to Promote Fish Passage Associated with Headcut Stabilization

1. National Marine Fisheries Service hydro fish passage review and approval – If headcut stabilization and channel spanning non-porous weirs create discrete longitudinal drops greater than 6 inches, the national forest or scenic area personnel will ensure the action is individually reviewed by the Portland office of the National Marine Fisheries Service Habitat Conservation Division for consistency with criteria in NOAA fisheries anadromous salmonid passage facility design (NMFS 2011).[41]
2. Provide fish passage over stabilized headcut through constructed riffles for pool/riffle streams or a series of log or rock weir structures for step/pool channels. If large wood and boulder placement will be used for headcut stabilization, refer to the "Large Wood, Boulder, and Gravel Placement" section.
3. Construct weirs in a V shape, oriented with the apex upstream, and lower in the center to direct flows to the middle of channel.
4. Key weirs into the streambed to minimize structure undermining due to scour, preferably at least 2.5 times their exposure height. The weir should also be keyed into both banks—if feasible greater than 8 feet.
5. If several structures will be used in series, space the weirs at the appropriate distances to promote fish passage of all life stages of native fish. Incorporate state fish passage criteria (jump height, pool depth, etc.) in the design of weir structures. Recommended weir spacing should be no closer than the net drop divided by the channel slope (for example, a 1-foot high weir in a stream with a 2 percent gradient will have a minimum spacing of 50 feet).

[41] http://www.nwr.noaa.gov/Salmon-Hydropower/FERC/upload/Fish-Passage-Design.pdf

6. Include fine material in the weir material mix to help seal the weir/channel bed, thereby preventing subsurface flow and ensuring fish passage immediately following construction if natural flows are sufficient.
7. If a project involves the removal of multiple barriers on one stream or in one watershed over the course of a work season, remove the most upstream barrier first if possible.

Fish Ladders

1. Forest Service personnel will ensure the action is individually reviewed by the Portland office of the National Marine Fisheries Service' Habitat Conservation Division for consistency with criteria in NOAA fisheries anadromous salmonid passage facility design (NMFS 2011).[42]
2. Fish ladders include, in order of preference, the vertical slot ladder, the pool and weir ladder, the weir and orifice ladder, the pool-chute fish ladder, and other similar ladder types. See National Marine Fisheries Service anadromous salmonid passage facility design (2011 or the most recent version) for guidelines and design criteria.
3. If a project involves the removal of multiple barriers on one stream or in one watershed over the course of a work season, remove the most upstream barrier first if possible.

Irrigation Diversion Replacement or Relocation and Screen Installation or Replacement

1. National Marine Fisheries Service hydro fish passage review and approval – The national forest or scenic area personnel will ensure the action is individually reviewed by the Portland office of the National Marine Fisheries Service Habitat Conservation Division for consistency with criteria in NOAA fisheries anadromous salmonid passage facility design (NMFS 2011).[42]
2. Diversion structures—associated with points of diversion and future fish screens—must pass all life stages of threatened and endangered aquatic species that historically used the affected aquatic habitat.
3. Water diversion intake and return points must be designed (to the greatest degree possible) to prevent all native fish life stages from swimming or being entrained into the diversion.
4. National Marine Fisheries Service fish screen criteria (NMFS 2011) applies to federally listed salmonid species under their jurisdiction as well as bull trout, Oregon chub, shortnose sucker, Lahontan cutthroat trout, Lost River sucker, Modoc sucker, and Warner sucker under U.S. Fish and Wildlife Service jurisdiction. Includes screens in temporary and permanent pump intakes.
5. All fish screens will be sized to match the irrigator's state water right or estimated historical water use, whichever is less.
6. Size of bypass structure should be big enough to pass steelhead kelt and migratory bull trout back into the stream.
7. Abandoned ditches and other similar structures will be plugged or backfilled, as appropriate, to prevent fish from swimming or being entrained into them.

[42] http://www.nwr.noaa.gov/Salmon-Hydropower/FERC/upload/Fish-Passage-Design.pdf

8. When making improvements to pressurized diversions, install a totalizing flow meter capable of measuring rate and duty of water use. For non-pressurized systems, install a staff gage or other measuring device capable of measuring instantaneous rate of water flow.
9. Multiple existing diversions may be consolidated into one diversion as long as there is new instream construction or structures and if the consolidated diversion is located at the most downstream existing barrier.
10. Conversion of instream diversions to groundwater wells will only be used in circumstances where there is an agreement to ensure that any surface water made available for instream flows is protected from surface withdrawal by another water-user.
11. For the removal of diversion structures constructed of local rock and dirt, the project sponsor will dispose of the removed material in the following manner:
    a. Material more than 60 percent silt or clay will be disposed in uplands, outside of the active floodplain.
    b. Material with more than 40 percent gravel will be deposited within the active floodplain but not in wetlands.
    c. Material with more than 50 percent gravel and less than 30 percent fines (silt or clay) may be deposited below the ordinary high water mark.

Small Dam Removal

1. Structure dimensions – Small dams or other channel spanning structures that were constructed to impound water shall be less than 10 feet high and impound less than 15 acre-feet.
2. Design review
    a. National Marine Fisheries Service hydro fish passage review and approval – The national forest or scenic area personnel will ensure the action is individually reviewed by the Portland office of the National Marine Fisheries Service Habitat Conservation Division for consistency with criteria in NOAA fisheries anadromous salmonid passage facility design (NMFS 2011). [42]
    b. Restoration review team – During the project design phase, the national forest or scenic area will ensure that this highly complex action is individually reviewed by the restoration review team, comprised of skilled restoration designers and practitioners.
3. Information needs: The project sponsor should provide the following information, plus any additional information requested:
    a. A longitudinal profile of the stream channel thalweg for 20 channel widths downstream of the structure and 20 channel widths upstream of the reservoir area (outside the influence of the structure) shall be used to determine the potential for channel degradation.
    b. A minimum of three cross-sections – one downstream of the structure, one through the reservoir area upstream of the structure, and one upstream of the reservoir exclusion area (outside the influence of the structure) to characterize the channel morphology and quantify the stored sediment.
    c. Sediment characterization to determine the proportion of coarse sediment (more than 2 millimeters) in the reservoir exclusion area.

d. A survey of any downstream spawning areas that may be affected by sediment released by removal of the water control structure or dam. Reservoirs with a d35 greater than 2 millimeters (65 percent of the sediment by weight exceeds 2 millimeters in diameter) may be removed without excavation of stored material, if the sediment contains no contaminants; reservoirs with a d35 less than 2 millimeters (65 percent of the sediment by weight is less than 2 millimeters in diameter) will require partial removal of the fine sediment to create a pilot channel, in conjunction with stabilization of the newly exposed streambanks with native vegetation.

e. If a project involves the removal of multiple barriers on one stream or in one watershed over the course of a work season, remove the most upstream barrier first if possible

Instream, Side-channel, and Floodplain Projects

Beaver Habitat Restoration

In-channel structures

1. Consist of porous, channel-spanning structures comprised of biodegradable vertical posts (beaver dam support structures) approximately 0.5 to 1 meter apart and at a height intended to act as the crest elevation of an active beaver dam. Variation of this restoration treatment may include post lines only, post lines with wicker weaves, construction of starter dams, reinforcement of existing active beaver dams, and reinforcement of abandoned beaver dams (Pollock 2012).
2. Place beaver dam support structures in areas conducive to dam construction as determined by stream gradient, historical beaver use, or both.
3. Place in areas with sufficient deciduous shrub and trees to promote sustained beaver occupancy.

Bull Trout Protection

1. For brook trout or other nonnative fish species removal, staff experienced in the specific removal method shall be involved in project design and implementation.
2. When using electrofishing for removal of brook trout, other nonnative fish species, or both, use the following guidelines:

    a. Electrofishing shall be conducted using the methods outlined in the National Marine Fisheries Service's guidelines[43] (NMFS 2000). Those guidelines are available from the National Marine Fisheries Service Northwest Region, Protected Resources Division in Portland, Oregon.

    b. Electrofishing equipment shall be operated at the lowest possible effective settings to minimize injury or mortality to bull trout.

    c. To reduce adverse effects to bull trout, electrofishing shall only occur from May 1 (or after emergence occurs) to July 31 in known bull trout spawning areas. No electrofishing will occur in any bull trout habitat after August 15.

[43] http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf

d. Electrofishing shall not be conducted when the water conditions are turbid and visibility is poor. This condition may be experienced when the sampler cannot see the stream bottom in 1 foot of water.

e. Electrofishing will not be conducted within core areas that contain 100 or fewer adult bull trout.

3. Other removal methods, such as dip netting, spearing, and other means can be used.

Channel Reconstruction or Relocation

General Project Design Criteria

1. Design Guidance

   a. Construct geomorphically appropriate stream channels and floodplains within a watershed and reach context.

   b. Design actions to restore floodplain characteristics—elevation, width, gradient, length, and roughness—in a manner that closely mimics, to the extent possible, those that would naturally occur at that stream and valley type.

   c. To the greatest degree possible, remove nonnative fill material from the channel and floodplain to an upland site.

   d. When necessary, loosen compacted soils once overburden material is removed. Overburden or fill comprised of native materials, which originated from the project environmental assessment, may be used within the floodplain where appropriate to support the project goals and objectives.

   e. Structural elements shall fit within the geomorphic context of the stream system. For bed stabilization and hydraulic control structures, constructed riffles shall be preferentially used in pool-riffle stream types, while roughened channels and boulder weirs shall be preferentially used in step-pool and cascade stream types.

   f. Material selection (large wood, rock, gravel) shall also mimic natural stream system materials.

   g. Construction of the streambed should be based on Stream Simulation Design principles as described in Section 6.2 of the 2008 Forest Service document "Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings" or other appropriate design guidance documents.

2. National Marine Fisheries Service hydro fish passage review and approval – During the project design phase, the national forest or scenic area personnel will ensure the action is individually reviewed by the Portland office of the National Marine Fisheries Service Habitat Conservation Division for consistency with criteria in NOAA fisheries anadromous salmonid passage facility design (NMFS 2011).[44]

3. Restoration review team – During the project design phase, the national forest or scenic area personnel will ensure the action is individually reviewed by the restoration review team, comprised of skilled restoration designers and practitioners.

[44] http://www.nwr.noaa.gov/Salmon-Hydropower/FERC/upload/Fish-Passage-Design.pdf

Project Documentation

Prior to the design review by the restoration review team and the National Marine Fisheries Service hydro/fish passage coordinator, the project contact will provide the National Marine Fisheries Service Habitat Conservation Division and restoration review team with the following documentation:

1. Background and problem statement
    a. site history
    b. environmental baseline
    c. problem description
    d. cause of problem
2. Project description
    a. goals and objectives
    b. project elements
    c. sequencing, implementation
    d. recovery trajectory –how does it develop and evolve?
3. Design analysis
    a. technical analyses
    b. computations relating design to analysis
    c. references
4. River restoration analysis tool – This tool (restorationreview.com) was created to assist with design and monitoring of aquatic restoration projects. The following questions taken from the tool must be addressed in the project documentation:
    a. Problem identification
        - Is the problem identified?
        - Are causes identified at appropriate scales?
    b. Project context
        - Is the project identified as part of a plan, such as a watershed action plan or recovery plan?
        - Does the project consider ecological, geomorphic, and socioeconomic context?
    c. Goals and objectives
        - Do goals and objectives address problem, causes, and context?
        - Are objectives measurable?
    d. Alternatives and options evaluation
        - Were alternatives and options considered?
        - Are uncertainties and risk associated with selected alternative acceptable?
    e. Project design
        - Do project elements collectively support project objectives?

- Are design criteria defined for all project elements?
- Do project elements work with stream processes to create and maintain habitat?
- Is the technical basis of design sound for each project element?

f. Implementation

- Are plans and specifications sufficient in scope and detail to execute the project?
- Does plan address potential implementation impacts and risks?

g. Monitoring and management

- Does monitoring plan address project compliance?
- Does monitoring plan directly measure project effectiveness?

Monitoring

Develop a monitoring and adaptive plan that has been reviewed and approved by the restoration review team and the Services. The plan will include the following:

1. Introduction
2. Existing monitoring protocols
3. Project effectiveness monitoring plan
4. Project review team triggers
5. Monitoring frequency, timing, and duration
6. Monitoring technique protocols
7. Data storage and analysis
8. Monitoring quality assurance plan
9. Literature cited

Fencing to Project Aquatic Restoration Projects

Fencing

1. Fence placement should allow lateral movement of a stream and allow establishment of riparian plant species**.** To the extent possible, fences will be placed outside the channel migration zone but not into upland areas.
2. Minimize vegetation removal, especially potential large wood recruitment sources, when constructing fence lines.
3. Where appropriate, construct fences at water gaps in a manner that allows passage of large wood and other debris.
4. Fencing shall not extend beyond riparian habitat conservation area boundaries.

Stream Crossings

1. The number of livestock crossings will be minimized.
2. Locate crossings or water gaps where streambanks are naturally low. Livestock crossings or water gaps must not be located in areas where compaction or other damage can occur to sensitive soils and vegetation (for example, wetlands) due to congregating livestock.
3. To the extent possible, crossings will not be placed in areas where federally listed species spawn or are suspected of spawning (for example, pool tailouts where spawning may occur) or within 300 feet upstream of such areas.
4. Existing access roads and stream crossings will be used whenever possible, unless new construction would result in less habitat disturbance and the old trail or crossing is retired.
5. Access roads or trails will be provided with a vegetation buffer that is adequate to avoid or minimize runoff of sediment and other pollutants to surface waters.
6. Essential crossings will be designed and constructed or improved to handle reasonably foreseeable flood risks, including associated bedload and debris, and to prevent the diversion of streamflow out of the channel and down the trail if the crossing fails.
7. If necessary, the streambank and approach lanes can be stabilized with native vegetation, angular rock, or both to reduce chronic sedimentation. The stream crossing or water gap should be armored with sufficient sized rock (for example, cobble-size rock) and use angular rock if natural substrate is not of adequate size.
8. Livestock crossings will not create barriers to the passage of adult and juvenile fish and amphibians. Whenever a culvert or bridge—including bridges constructed from flatbed railroad cars, boxcars, or truck flatbeds—is used to create the crossing, the structure width will be consistent with the project design criteria listed for stream simulation culvert and bridge projects on page 60.
9. Stream crossings and water gaps will be designed and constructed to a width of 10 to 15 feet in the upstream-downstream direction to minimize the time livestock will spend in the crossing or riparian area.
10. When using pressure-treated lumber for fence posts, complete all cutting and drilling offsite (to the extent possible) so treated wood chips and debris do not enter water or flood-prone areas.
11. Riparian fencing is not to be used to create livestock handling facilities or riparian pastures.

In-channel Nutrient Enhancement

1. In Oregon, projects are permitted through Oregon Department of Environmental Quality. Use carcasses from the treated watershed or those certified disease free by an Oregon Department of Fish and Wildlife pathologist.
2. In Washington, follow Washington Department of Fish and Wildlife protocols and guidelines for distributing salmonid carcasses, salmon carcass analogs, and delayed-release fertilizers to enhance stream productivity in Washington State (2004 or most recent edition).
3. Ensure relevant streams have the capacity to capture and store placed carcasses.
4. Carcasses should be of species native to the watershed and placed during the normal migration and spawning times that would naturally occur in the watershed.

5. Do not supplement nutrients in eutrophic or naturally oligotrophic systems.
6. Ensure the nutrient addition method has been tried and monitored elsewhere, reported upon, and is appropriate for the target waters.

Large Wood, Boulder, and Gravel Placement

Large Wood and Boulder Projects

1. Place large wood and boulders in areas where they would naturally occur and in a manner consistent with channel, valley, and forest type. For example, boulder placement may not be appropriate in low-gradient meadow streams.
2. Structure types shall simulate disturbance events to the greatest degree possible and include, but are not limited to, log jams, debris flows, wind-throw, and tree breakage.
3. The size or shape of large wood and boulder structures must be within the range of natural variability of a given location and should not block passage of fish and other aquatic organisms.
4. Projects can include grade control and bank stabilization structures, while size and configuration of such structures will be commensurate with scale of project site and hydraulic forces.
5. The partial burial of large wood and boulders is permitted and may constitute the dominant means of placement. This applies to all stream systems but more so for larger stream systems where use of adjacent riparian trees or channel features is not feasible or does not provide the full stability desired.
6. Large wood includes whole conifer and hardwood trees, logs, and rootwads. Large wood size (diameter and length) should account for bankfull width and stream discharge rates. When available, trees with rootwads should be a minimum of 1.5 times bankfull channel width, while logs without rootwads should be a minimum of 2.0 times bankfull width.
7. Structures may partially or completely span stream channels or be positioned along stream banks.
8. Stabilizing or key pieces of large wood must be intact, hard, with little decay, and if possible have root wads (untrimmed) to provide functional refugia habitat for fish. Consider orienting key pieces such that the hydraulic forces upon the large wood increases stability
9. Anchoring large wood – Anchoring alternatives may be used in preferential order:
    a. use of adequate sized wood sufficient for stability
    b. orient and place wood in such a way that movement is limited
    c. ballast (gravel, rock, or both) to increase the mass of the structure to resist movement
    d. use of large boulders as anchor points for the large wood
    e. Pin large wood with rebar to large rocks to increase its weight. For streams that are entrenched (Rosgen F, G, A, and potentially B) or for other streams with very low width-to-depth ratios (less than 12), an additional 60 percent ballast weight may be necessary due to greater flow depths and higher velocities.

Engineered Log Jams

These are structures designed to redirect flow and change scour and deposition patterns. To the extent practical, they are patterned after stable natural log jams and can be either unanchored or anchored in place using rebar, rock, or piles. Engineered logjams create a low-velocity zone downstream that allows sediment to settle out. Scour holes develop adjacent to the logjam. While providing valuable fish and wildlife habitat, they also redirect flow and can provide stability to a streambank or downstream gravel bar.

1. National Marine Fisheries Service hydro fish passage review and approval – For non-porous engineered log jams that occupy more than 25 percent of the bankfull area, the national forest or scenic area personnel will ensure the action is individually reviewed by the Portland office of the National Marine Fisheries Service Habitat Conservation Division for consistency with criteria in NOAA fisheries anadromous salmonid passage facility design (NMFS 2011).[45]
2. Engineered log jams will be patterned, to the greatest degree possible, after stable natural log jams.
3. Stabilizing or key pieces of large wood that will be relied on to provide streambank stability or redirect flows must be intact, solid (little decay). If possible, acquire large wood with untrimmed rootwads to provide functional refugia habitat for fish.
4. When available, trees with rootwads attached should be a minimum length of 1.5 times the bankfull channel width, while logs without rootwads should be a minimum of 2.0 times the bankfull width.
5. The partial burial of large wood and boulders may constitute the dominant means of placement, and key boulders (footings) or large wood can be buried into the stream bank or channel
6. Angle and offset – The large wood portions of engineered logjam structures should be oriented so the forces on the large wood increases stability. If a rootwad is left exposed to the flow, the bole placed into the streambank should be oriented downstream parallel to the flow direction so the pressure on the rootwad pushes the bole into the streambank and bed. Wood pieces oriented parallel to flow are more stable than pieces oriented at 45 or 90 degrees to the flow.
7. If large wood anchoring is required, a variety of methods may be used. These include buttressing the wood between riparian trees, the use of manila, sisal or other biodegradable ropes for lashing connections. If hydraulic conditions warrant it, structural connections (rebar pinning or bolted connections) may be used. Rock may be used for ballast but is limited to that needed to anchor the large wood.

Porous Boulder Weirs and Vanes

1. Full-channel-spanning boulder weirs are to be installed only in highly uniform, incised, bedrock-dominated channels to enhance or provide fish habitat in stream reaches where log placements are not practicable due to channel conditions (not feasible to place logs of sufficient length, bedrock-dominated channels, deeply incised channels, artificially constrained reaches, etc.), where damage to infrastructure on public or private lands is of

[45] http://www.nwr.noaa.gov/Salmon-Hydropower/FERC/upload/Fish-Passage-Design.pdf

concern or where private landowners will not allow log placements due to concerns about damage to their streambanks or property.

2. Install boulder weirs low in relation to channel dimensions so they are completely overtopped during channel-forming flow events (approximately a 1.5-year flow event).
3. Boulder weirs are to be placed diagonally across the channel or in more traditional, upstream-pointing "V" or "U" configurations with the apex (narrow end) oriented upstream.
4. Boulder weirs are to be constructed to allow upstream and downstream passage of all native fish species and life stages that occur in the stream. Plunges shall be kept less than 6 inches in height.
5. The use of gabions, cable, or other means to prevent the movement of individual boulders in a boulder weir is not allowed.
6. Rock for boulder weirs shall be durable and of suitable quality to assure long-term stability in the climate in which it is to be used. Rock sizing depends on the size of the stream, maximum depth of flow, planform, entrenchment, and ice and debris loading.
7. The project designer or an inspector experienced in these structures should be present during installation.
8. Full-channel spanning boulder weir placement should be coupled with measures to improve habitat complexity and protection of riparian areas to provide long-term inputs of large wood.

Gravel Augmentation

1. Gravel can be placed directly into the stream channel, at tributary junctions, or other areas in a manner that mimics natural debris flows and erosion.
2. Augmentation will only occur in areas where the natural supply has been eliminated or substantially reduced through human-caused disruptions, or it will be used to initiate gravel accumulations in conjunction with other projects, such as simulated logjams and debris flows.
3. Gravel to be placed in streams shall be a properly sized gradation for that stream, clean, and non-angular. When possible, use gravel of the same lithology found in the watershed. Reference "Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings" (USDA Forest Service 2008)[46] to determine gravel sizes appropriate for the stream.
4. Gravel can be mined from the floodplain at elevations above bankfull. Crushed rock is not permitted.
5. After gravel placement in areas accessible to higher stream flow, allow the stream to naturally sort and distribute the material.
6. Do not place gravel directly on bars and riffles that are known spawning areas. This may cause fish to spawn on the unsorted and unstable gravel, potentially resulting in redd destruction.
7. Imported gravel must be free of invasive species and nonnative seeds. Gravel must be free of *Batrachochytrium dendrobatidis* or *Batrachochytrium salamandrivorans* spores, which serve as disease vectors to native amphibians. If necessary, wash gravel prior to placement.

[46] http://stream.fs.fed.us/fishxing/aop_pdfs.html

Tree Removal for Large Wood Projects

1. Tree removal will be limited to riparian reserves and riparian habitat conservation areas.
2. Live conifers and other trees can be felled or pulled or pushed over in riparian areas only when conifers and trees are fully stocked. Trees or pieces of trees can also be pulled from reservoirs each year as they float downstream. If green trees are standing, their selection will be dispersed. Trees will only be used for riparian and aquatic restoration and will not be commercially sold. Tree felling shall not create excessive stream bank erosion or increase the likelihood of channel avulsion during high flows.
3. Danger trees and trees killed through fire, insects, disease, blowdown, and other means can be felled and used for in-channel placement regardless of live-tree stocking levels.
4. Trees may be removed by cable, ground-based equipment, horses, or helicopters.
5. Trees may be felled or pushed or pulled directly into a stream, floodplain, or both.
6. Trees may be stockpiled for future instream restoration projects.
7. The project manager for an aquatic restoration action planned under this project environmental assessment will coordinate with an action-agency wildlife biologist in tree-removal planning efforts.
8. In northern spotted owl and marbled murrelet habitat, meet the following requirements:
    a. The following project design criteria applies to tree removal within the range of marbled murrelets and the northern spotted owl in Douglas-fir dominated stands less than 80 years old that are not functioning as foraging habitat within a spotted owl home range nor do they contain murrelet nesting structure. It does not apply to tree selection in older stands or hardwood-dominated stands unless stated otherwise. The purpose of these criteria is to ensure there would be no removal or adverse modification of suitable habitat for marbled murrelet or northern spotted owl.
        i. A wildlife biologist must be fully involved in all tree-removal planning efforts and be involved in making decisions on whether individual trees are suitable for nesting or have other important listed bird habitat value.
        ii. Trees can be removed to a level not less than a relative density of approximately 35, which is considered as fully occupying a site. This equates to approximately 60 trees per acre in the overstory and a tree spacing averaging 26 feet. Additionally 40 percent canopy cover would be maintained in northern spotted owl or marbled murrelet critical habitat within 300 feet of occupied or unsurveyed murrelet nesting structure and when dispersal habitat is limited in the area.
        iii. Trees to be removed can be live, hazard trees or trees killed through fire, insects, disease, blowdown, and other means. Down trees and snags should only be removed if the stand will retain Northwest Forest Plan standards post removal.
        iv. Trees may be removed by cable, ground-based equipment, horses, or helicopters. They may be felled or pushed or pulled directly into a stream. Trees may be stockpiled for future instream restoration projects.
        v. Tree species removed should be relatively common in the stand (not minor tree species).

vi. Snags and trees with broad, deep crowns ("wolf" trees), damaged tops or other abnormalities that may provide a valuable wildlife habitat component should be reserved.

vii. No gaps (openings) greater than 0.5 acre will be created in spotted owl critical habitat. No gaps greater than ¼ acre will be created in murrelet critical habitat. No gaps shall be created in riparian reserves that contain federally listed fish habitat.

b. The following project design criteria apply to tree removal within the range of marbled murrelet and the northern spotted owl in Douglas-fir dominated stands greater than 80 years old or that are functioning as foraging habitat within a northern spotted owl home range, contain marbled murrelet nesting structure, or both. Also see table 3 and table 4 for the allowable distance and timing of activities to northern spotted owl and marbled murrelet habitat during various breeding periods.

   i. Individual trees or small groups of trees should come from the periphery of permanent openings (roads etc.) or from the periphery of nonpermanent openings (for example, plantations, along recent clearcuts, etc.). Groups of trees greater than 4 trees shall not be:

      - within marbled murrelet suitable stands
      - within stands buffering (300 feet) marbled murrelet suitable stands
      - buffering (300 feet) individual trees with marbled murrelet nesting structure.

      A minimum distance of one potential tree height feet should be maintained between individual or group removals.

   ii. Trees up to 36 inches in diameter may be felled in any stands with agreement from a wildlife biologist that the trees are not providing marbled murrelet nesting structures or providing cover for nest sites. No known northern spotted owl nest trees or alternate nest trees are to be removed. Potential northern spotted owl nest trees may only be removed in limited instances when it is confirmed with the wildlife biologist that nest trees will not be limited in the stand after removal.

   iii. To minimize the creation of canopy gaps or edges, groups of adjacent trees selected should not create openings greater than ¼ acre within 0.5 mile of marbled murrelet occupied habitat or within murrelet critical habitat. Gaps will be restricted to 0.5-acre openings or less within northern spotted owl critical habitat, within stands greater than 80 years old, or within stands providing foraging habitat to northern spotted owl home ranges. Gaps shall not be created in riparian reserves where federally listed fish occur.

Legacy Structure Removal

1. If the structure being removed contains material (large wood, boulders, concrete, etc.) not typically found within the stream or floodplain at that site, remove material from the 100-year floodplain.
2. If the structure being removed contains material (large wood, boulders, etc.) typically found within the stream or floodplain at that site, the material can be reused to implement habitat improvements described under "Large Wood, Boulder, and Gravel Placement" on page 70.

Table 3. Northern spotted owl disturbance distances and time periods

Disturbance Source	Disturbance Distances During the Breeding Period[1] (Mar 1 - Sep 30)	Disruption Distances During The Critical Breeding Period[1, 4] (Mar 1 - Jul 15) (Mar 1 - Jul 7 ONCPP)[5]	Disruption Distances During the Late Breeding Period[1] (Jul 16-Sep 30) (Jul 8 - Sep 30 ONCPP)
Use of chain saws	440 yards (0.25 mile)	65 yards	0 yards
Heavy equipment	440 yards (0.25 mile)	35 yards	0 yards
Tree climbing	440 yards (0.25 mile)	35 yards	0 yards
Burning	440 yards (0.25 mile)	440 yards (0.25 mile)	0 yards
Use of type I helicopter[2]	880 yards (0.5 mile)	440 yards (0.25 mile)	440 yards (0.25 mile)
Use of type II, III or IV helicopter[3]	440 yards (0.25 mile)	120 yards	0 yards
Use of fixed-wing aircraft	440 yards (0.25 mile)	120 yards	0 yards
Pile driving	440 yards (0.25 mile)	60 yards	0 yards

1. Noise disturbance and disruption distances were developed from a sound threshold. Estimates of distances at which incidental take of murrelets and spotted owls due to harassment are anticipated from sound-generating, forest-management activities in Olympic National Forest). Smoke disturbance and disruption distances are based on a U.S. Fish and Wildlife Service white paper (USFWS 2008. Observations of Smoke Effects on Northern Spotted Owls. Compiled by J. Thrailkill, Oregon Department of Fish and Wildlife).
2. Type I helicopters seat at least 16 people and have a minimum capacity of 5,000 lbs. Both a CH 47 (Chinook) and UH 60 (Blackhawk) are Type I helicopters. Kmax helicopters are considered “other” for the purposes of disturbance. Sound readings from Kmax helicopter logging on the Olympic NF registered 86 dB at 150 yards (Piper. 2006. Pers. comm. Sound Measurements for Harris Timber Sale, Olympic National Forest).
3. All other helicopters (including Kmax).
4. Dates may vary slightly depending on site-specific conditions.
5. ONCPP= Oregon North Coast Planning Province

Table 4. Distances and time periods required for marbled murrelet habitat (from ARBO II)

Disturbance Source	Disturbance Distances During the Breeding Period[1] (Apr 1 – Sep 15)	Disruption Distances During The Critical Breeding Period[1,4] (Apr 1 – Aug 5)	Disruption Distances During the Late Breeding Period[1] with Daily Timing Restrictions,* Unless Noted Otherwise (Aug 6-Sep 15)
Road repair such as culvert replacement	440 yards (0.25 mile)	100 yards	0 yards
Use of chain saws	440 yards (0.25 mile)	100 yards	0 yards
Heavy equipment	440 yards (0.25 mile)	100 yards	0 yards
Tree climbing	440 yards (0.25 mile)	100 yards	0 yards
Burning	440 yards (0.25 mile)	440 yards (0.25 mile)	0 yards
Use of type I helicopter[2]	880 yards (0.5 mile)	440 yards (0.25 mile)	440 yards (0.25 mile)
Use of type II, III or IV helicopter[3]	440 yards (0.25 mile)	120 yards	0 yards
Use of fixed-wing aircraft	440 yards (0.25 mile)	120 yards	0 yards
Pile driving	440 yards (0.25 mile)	100 yards	0 yards

* Activities would not begin until 2 hours after sunrise and ending 2 hours before sunset.

1. See note 1 in table 3 above.
2. See note 2 table 3 above.
3. All other helicopters (including Kmax). Dates may vary slightly depending on site-specific conditions.
4. Standard 14 from ARBO II requires daily timing restrictions* during the entire breeding period, when adjacent to suitable habitat and potential nesting structure for projects (see standard 14 for exemptions).

3. If the structure being removed is keyed into the bank, fill in key holes with native materials to restore contours of stream bank and floodplain. Compact the fill material adequately to prevent the soil from washing out during over-bank flooding. Do not mine material from the stream channel to fill in key holes.
4. When removal of buried log structures may result in substantial disruption to riparian vegetation, the floodplain, or both, consider using a chainsaw to extract the portion of log within the channel and leaving the buried sections within the streambank.
5. If the legacy structures (log, rock, or gabion weirs) were placed to provide grade control, evaluate the site for potential headcutting and incision due to structure removal. If headcutting and channel incision are likely to occur due to structure removal, additional measures must be taken to reduce these impacts.
6. If the structure is being removed because it has caused an over-widening of the channel, consider implementing other project environmental assessment restoration categories to decrease the width-to-depth ratio of the stream to a level commensurate with the geomorphic setting.

Off- and Side-Channel Habitat Restoration

1. National Marine Fisheries Service hydro fish passage review and approval – When a proposed side channel will contain more than 20 percent of the bankfull flow, national forest or scenic area personnel will ensure the action is individually reviewed by the Portland office of the National Marine Fisheries Service Habitat Conservation Division for consistency with criteria in National Marine Fisheries Service (2011).
2. Data requirements – Data requirements and analysis for off- and side-channel habitat restoration include evidence of historical channel location, such as land use surveys, historical photographs, topographic maps, remote sensing information, or personal observation.
3. Allowable excavation – Off- and side-channel improvements can include minor excavation (10 percent or less of volume) of naturally accumulated sediment within historical channels. There is no limit to the amount of excavation of human-created fill within historical side channels as long as such channels can be clearly identified through field photographs, aerial photographs, or both. Excavation depth will not exceed the maximum thalweg depth in the main channel. Excavated material removed from off- or side-channels shall be hauled to an upland site or spread across the adjacent floodplain in a manner that does not restrict floodplain capacity.

Piling and Other Structure Removal

Removing an Intact Pile

1. Install a floating surface boom to capture floating surface debris.
2. To the extent possible, keep all equipment (for example, bucket, steel cable, vibratory hammer) out of the water, grip piles above the waterline, and complete all work during low water and low current conditions.
3. Dislodge the piling with a vibratory hammer, whenever feasible. Never intentionally break a pile by twisting or bending.
4. Slowly lift piles from the sediment and through the water column.

5. Place chemically-treated piles in a containment basin on a barge deck, pier, or shoreline without attempting to clean or remove any adhering sediment. A containment basin for the removed piles and any adhering sediment may be constructed of durable plastic sheeting with sidewalls supported by hay bales or another support structure to contain all sediment.
6. Fill the holes left by each piling with clean, native sediments located from the project area.
7. Dispose of all removed piles, floating surface debris, any sediment spilled on work surfaces, and all containment supplies at a permitted upland disposal site.

Removing a Broken Pile

1. If a pile breaks above the surface of uncontaminated sediment or less than 2 feet below the surface, every attempt, short of excavation, will be made to remove it entirely. If the pile cannot be removed without excavation, excavate sediments and saw the stump off at least 3 feet below the surface of the sediment.
2. If a pile breaks above contaminated sediment, saw the stump off at the sediment line; if a pile breaks within contaminated sediment, make no further effort to remove it and cover the hole with a cap of clean substrate appropriate for the site.
3. If dredging is likely in the area of piling removal, use a global positioning system (GPS) device to note the location of all broken piles for future use in site debris characterization.

Reduction and Rehabilitation of Recreation Impacts

1. Design remedial actions to restore floodplain characteristics—elevation, width, gradient, length, and roughness—in a manner that closely mimics, to the extent possible, those that would naturally occur at that stream and valley type.
2. To the extent possible, nonnative fill material shall be removed from the floodplain.
3. Overburden or fill comprised of native materials from the project area can be used to reshape the floodplain, placed in small mounds on the floodplain, used to fill human-caused holes, buried on site, disposed into upland areas, or a combination of these things.
4. Consider decompaction of soils and vegetation planting once overburden material is removed.
5. Place barriers—boulders, fences, gates, etc.—outside of the bankfull width and across traffic routes to prevent off-road vehicle access into and across streams.

Set-back or Removal of Existing Berms, Dikes, and Levees

Floodplains and Freshwater Deltas

1. Design actions to restore floodplain characteristics—elevation, width, gradient, length, and roughness—in a manner that closely mimics, to the extent possible, those that would naturally occur at that stream and valley type.
2. Remove drain pipes, fences, and other capital projects to the extent possible.
3. To the extent possible, remove nonnative fill material from the floodplain to an upland site.
4. Where it is not possible to remove or set-back all portions of dikes and berms, or in areas where existing berms, dikes, and levees support abundant riparian vegetation, openings will be created with breaches. Breaches shall be equal to, or greater than, the active channel width to reduce the potential for channel avulsion during flood events. In addition to other breaches,

the berm, dike, or levee shall always be breached at the downstream end of the project, at the lowest elevation of the floodplain, or both to ensure the flows will naturally recede back into the main channel thus minimizing fish entrapment.

5. Elevations of dike and levee setbacks shall not exceed the elevation of removed structures
6. When necessary, loosen compacted soils once overburden material is removed. Overburden or fill comprised of native materials from the project area may be used within the floodplain to create set-back dikes and fill human-caused holes provided floodplain function is not impeded.

Estuary Restoration

1. Project implementation shall be conducted in a sequence that will not preclude repairing or restoring estuary functions once dikes and levees are breached and the project area is flooded.
2. Culverts and tide gates will be removed using the design criteria and conservation measures, where appropriate, as described in appendix 2, Hydrologist/Watershed Specialist and Fisheries Biologist section.
3. Roads within the project area should be removed to allow free flow of water. Material will be placed in a stable area above the ordinary high water line or highest measured tide or be used to restore topographic variation in wetlands.
4. To the extent possible, remove segmented drain tiles placed to drain wetlands. Fill generated by drain tile removal will be compacted back into the ditch created by removal of the drain tile.
5. Channel construction may be done to recreate channel morphology based on aerial photograph interpretation, literature, topographic surveys, and nearby undisturbed channels. Channel dimensions (width and depth) are based on measurements of similar types of channels and the drainage area. In some instances, channel construction is simply breaching the levee. For these sites, further channel development will occur through natural processes. When required, use project design criteria in the "Channel Reconstruction and Relocation" category (page 66).
6. Fill ditches constructed and maintained to drain wetlands. Some points in an open ditch may be over-filled, while other points may be left as low spots to enhance topography and encourage sinuosity of the developing channel.

Streambank Restoration

1. Without changing the location of the bank toe, restore damaged streambanks to a natural slope and profile suitable for establishment of riparian vegetation. This may include sloping unconsolidated bank material to a stable angle of repose or using benches in consolidated, cohesive soils.
2. Complete all soil reinforcement earthwork and excavation during dry conditions. When necessary, use soil layers or lifts strengthened with biodegradable fabrics and penetrable by plant roots.
3. Include large wood to the extent it would naturally occur. If possible, large wood should have untrimmed root wads to provide functional refugia habitat for fish. Wood already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.

4. Rock will not be used for streambank restoration, except as ballast to stabilize large wood.
5. Use a diverse assemblage of vegetation species native to the action area, including trees, shrubs, and herbaceous species. Vegetation, such as willow, sedge, and rush mats, may be gathered from local sources (for example, within the seed zone area), including abandoned floodplains, stream channels, etc.
6. Do not apply surface fertilizer within 50 feet of any stream channel.
7. Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
8. Conduct post-construction monitoring and treatment or removal of invasive plants until native plant species are well established.

Riparian Vegetation Projects

Beaver Habitat Restoration

1. Drainages historically occupied by beaver, but which may be currently unsuitable for relocations, may require management for improvement and recovery. Restoration activities may include planting native riparian hardwood species (such as willow, red osier dogwood, and alder) and building exclosures (such as temporary fences) to protect and enhance existing or planted riparian hardwoods until they are established.
2. Maintain or develop grazing plans that will ensure the success of beaver habitat restoration objectives.
3. As a means to restore desired native vegetation (for example, aspen, willow, alder, cottonwood) associated with quality beaver habitat in riparian habitat conservation areas, follow project design criteria in the "Noncommercial Thinning Associated with Moderate-Severity Burns" section on page 81.[47]

Juniper Tree Removal

1. Remove juniper to natural stocking levels where national forest personnel determines juniper trees are expanding into neighboring plant communities to the detriment of other native riparian vegetation, soils, or streamflow.
2. Do not cut old-growth juniper, which typically has several of the following features: sparse limbs, dead limbed or spiked-tops, deeply furrowed and fibrous bark, branches covered with bright-green arboreal lichens, noticeable decay of cambium layer at base of tree, and limited terminal leader growth in upper branches (Miller et al. 2005).
3. Retain approximately 10 percent of the juniper treatment area in uncut patches.
4. Felled trees may be left in place, lower limbs may be cut and scattered, or all or part of the trees may be used for streambank or wetland restoration. For example, felled trees may be manipulated to protect riparian or wetland shrubs from grazing by livestock or wildlife or used to restore ecological function in floodplain, riparian, and wetland habitats.

[47] Controlled burning in riparian reserves is not covered under the Pechman exemptions, which guide management of Northwest forest plan survey and manage species. Therefore, this project will be excluded from riparian reserves when suitable habitat occurs for survey and manage species.

5. Where appropriate, cut juniper may be placed into stream channels and floodplains to provide aquatic benefits. Juniper can be felled or placed into the stream to promote channel aggradation as long as such actions do not obstruct fish movement and use of spawning gravels or increase width to depth ratios.
6. On steep slopes, south-facing slopes, or both where ground vegetation is sparse, leave felled juniper in sufficient quantities to promote reestablishment of vegetation and prevent erosion.
7. If seeding is a part of the action, consider whether seeding would be most appropriate before or after juniper treatment.
8. When using feller-buncher and slash-buster equipment, operate equipment in a manner that minimizes soil compaction and disturbance to soils and native vegetation to the extent possible. Equipment exclusion areas (buffer areas along stream channels) should be as wide as the feller-buncher or slash-buster arm.

Riparian Vegetation Planting

1. Experienced silviculturists, botanists, ecologists, or associated technicians shall be involved in designing vegetation treatments.
2. All riparian seeding and plantings shall follow Forest Service direction described in Forest Service Manual 2000, National Forest Resource Management (Chapter 2070 – Vegetation Ecology, 2008; Forest Service Manual 2472 – Reforestation, 2014)
3. Species to be planted will be of the same species that naturally occur in the project exclusion areas. Acquire native seed, plant sources, or both following guidance from geneticists and established seed zones and plant movement guidelines for the species being revegetated.
4. Tree and shrub species, willow cuttings, as well as sedge and rush mats to be used as transplant material shall come from outside the bankfull width, typically in terraces (abandoned flood plains), or where such plants are abundant.
5. Sedge and rush mats should be sized to prevent their movement during high-flow events.
6. Concentrate plantings above the bankfull elevation.
7. Removal of native and nonnative vegetation that will compete with plantings is permitted. For instance, native grasses adjacent to deciduous tree plantings can be removed.
8. Exclosure fencing to prevent utilization of plantings by deer, elk, and livestock is permitted.

Riparian Vegetation Treatment (Controlled Burning)

Low and Moderate Severity Burns

1. Experienced fuels specialists, silviculturists, fisheries biologist, and hydrologists shall be involved in designing prescribed burn treatments.
2. Prescriptions will focus on restoring the plant species composition and structure that would occur under natural fire regimes.
3. Burn plans are required for each action and shall include, but not be limited to, the following: a description of existing and desired future fire classifications, existing and target stand structure and species composition (including basis for target conditions); other ecological objectives, type, severity, area, and timing of proposed burn; and measures to prevent destruction of vegetation providing shade and other ecological functions important to habitat.

4. Low-severity burns will be used except where the objective is to restore deciduous trees, as described below in #5, with a goal of creating a mosaic pattern of burned and unburned landscape. Low-severity burns, as defined in the National Fire Plan (2002), are characterized by the following: low soil heating or light ground char occurs where litter is scorched, charred, or consumed, but the duff is left largely intact. Woody debris accumulation is partially consumed or charred. Mineral soil is not changed. Minimal numbers of trees, typically pole-sized and saplings, will be killed.
5. Moderate-severity burns are permitted only where needed to invigorate decadent aspen stands, willows, and other native deciduous species and may be targeted in no more than 20 percent of the area within riparian habitat conservation area or riparian reserves per 6th-field hydrologic unit code watershed per year. Such burns shall be contained within the observable historical boundaries of the aspen stand, willow site, other deciduous species, and associated meadows; additional exclusion areas outside historical boundaries may be added to create controllable burn boundaries. Moderate severity, as defined in the National Fire Plan (2002), is characterized by the following: moderate soil heating or moderate ground char occurs where the litter on forest sites is consumed and the duff is deeply charred or consumed, but the underlying mineral soil surface is not visibly altered. Light colored ash is present. Woody debris is mostly consumed, except for logs, which are deeply charred.
6. Fire lines will be limited to five feet in width, constructed with erosion control structures (such as water bars), and restored to pre-project conditions before the winter following the controlled fire. To the extent possible, do not remove vegetation providing stream shade or other ecological functions that are important to streams.
7. Ignition can occur anywhere within the riparian reserves and riparian habitat conservation area as long as project design criteria are met.
8. Avoid water withdrawals from fish-bearing streams whenever possible. Water drafting must take no more than 10 percent of the stream flow and must not dewater the channel to the point of isolating fish. Pump intakes shall have fish screens consistent with National Marine Fisheries Service fish-screening criteria (NMFS 2011).

Noncommercial Thinning Associated with Moderate-Severity Burns[48]

1. Noncommercial tree thinning and slash removal is allowed only as required to adjust fuel loads to implement a moderate-severity burn to promote growth of deciduous trees and shrubs, such as aspen, cottonwood, willow, other deciduous species, and associated meadows.
2. Thinning is allowed only in dry forest types (east of the crest of the Cascade Mountains and southwestern Oregon). Further, this can be applied to more localized fire-dependent ecosystems west of the Cascade Mountain crest, such as oak woodlands.
3. To protect legacy trees, thinning from below is allowed. If conifers are even-aged pole, sapling, or mid-seral with no legacy trees, thin existing trees to the degree necessary to promote a moderate-severity burn.
4. No slash burning is allowed within 30 feet of any stream. To the extent possible, avoid creating hydrophobic soils when burning slash. Slash piles should be far enough away from

[48] Because thinning and moderate-severity burns are coupled, thinning was not separated into its own project design criteria section.

the stream channel so any sediment resulting from this action will be unlikely to reach any stream.

5. Apply project design criteria in the National Fire Plan salmonid criteria (2005) for limits on mortality to residual overstory vegetation.
6. Only hand equipment (such as chainsaws, axes, and Pulaskis) may be used for felling.
7. Where livestock grazing, wildlife grazing, or both could be a threat to restoration of aspen, cottonwood, willow, alder, and other deciduous vegetation and an immediate moderate-severity burn would consume large amounts of felled trees, consider delaying the burn and leaving felled trees in place to create grazing barriers to help assure plant growth.
8. All projects in this category shall be accompanied by livestock grazing practices that promote the attainment of moderate-severity burn objectives.

Non-System Road and Trail Decommissioning Projects

1. For road and trail decommissioning projects within riparian areas, recontour the affected area to mimic natural floodplain contours and gradient to the extent possible.
2. When obliterating or removing segments immediately adjacent to a stream, use sediment-control barriers between the project and stream.
3. Dispose of slide and waste material in stable sites out of the flood-prone area. Native material may be used to restore natural or near-natural contours.
4. Minimize disturbance of existing vegetation in ditches and at stream crossings.
5. Conduct activities during dry field conditions (generally May 15 to October 15) when the soil is more resistant to compaction and soil moisture is low.
6. When removing a culvert from a first- or second-order, non-fish-bearing stream, project specialists shall determine if culvert removal should include stream isolation and rerouting in project design. Culvert removal on fish-bearing streams shall adhere to the measures described in the “Fish Passage Restoration” section on page 56 and the culvert discussion on page 60 in the “Design Criteria” section.
7. For culvert removal projects, restore natural drainage patterns and channel morphology. Evaluate channel incision risk and construct in-channel grade control structures when necessary.

Appendix 2. Project Design Criteria Common to all 19 Aquatic Restoration Categories

Project design criteria common to all 19 proposed activities within this analysis are described here. These design criteria support the effects analysis and decision and therefore are not negotiable during implementation unless a supplemental review and appropriate analysis including documentation is completed.

A. Required Legal Compliance

Follow the land management plan for the relevant National Forest System unit, other relevant laws, policies, recovery plans, and conservation strategies. These include but are not limited to:

- Forest plan amendments (e.g. Eastside Screens)
- Forest plan revisions as they are completed
- Land allocation areas (e.g. Late Successional Reserves)
- Forest Service Manual and Handbook relevant direction
- All threatened and endangered species recovery plans
- Signed conservation agreements or current conservation strategies
- Current sage grouse conservation measures
- Inventoried roadless areas

Use best available science and established best management practices at all times.

B. Site Considerations

Site Assessment

In developed or previously developed sites, such as areas with past dredge mines, or sites with known or suspected contamination, a site assessment for contaminants will be conducted on projects that involve excavation of more than 20 cubic yards of material. The action agencies will complete a site assessment to identify the type, quantity, and extent of any potential contamination. The level of detail and resources committed to such an assessment will be commensurate with the level and type of past or current development at the site. The assessment may include the following:

- Review of readily available records, such as former site use, building plans, records of any prior contamination events
- Site visit to observe the areas used for various industrial processes and the condition of the property
- Interviews with knowledgeable people, such as site owners, operators, occupants, neighbors, and local government officials.
- Report that includes an assessment of the likelihood that contaminants are present at the site.

Site Preparation

1. Flag sensitive areas
    - Prior to construction, flag and avoid critical riparian vegetation areas, wetlands, and other sensitive sites to minimize ground disturbance and effects to such resources.
2. Minimize ground disturbance
    - Follow project design criteria for soils.

3. Staging areas
    - Establish staging areas for storage of vehicles, equipment, and fuels to minimize erosion into or contamination of streams and floodplains.
    - Follow project design criteria for soils and vegetation.
    - There are no topographical restrictions.
    - Place staging area 150 feet or more from any natural waterbody or wetland in areas where topography does not restrict such a distance.
    - Place staging area away from any natural waterbody or wetland to the greatest extent possible in areas with high topographical restriction, such as constricted valley types.
    - Avoid putting staging areas and other work areas in areas where there are high snag densities.
    - Avoid putting staging areas and other work areas in areas with unique vegetation or large diameter trees.
4. Temporary erosion controls
    - Place sediment barriers, such as straw bales and silt fencing, prior to construction around sites where potentially large levels of erosion may enter the stream directly or through road ditches. Temporary erosion controls will be in place before any major alteration of the action site occurs and will be removed once the site has been stabilized following construction activities.
5. Stockpile materials
    - Minimize clearing and grubbing activities when preparing staging, project, and or stockpile areas. Any large wood, topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration. Materials used for implementation of aquatic restoration categories (such as large wood, boulders, or fencing material) may be staged within the 100-year floodplain.

Site Restoration

1. Initiate rehabilitation
    - Upon project completion and prior to the normal heavy rainfall period, rehabilitate all disturbed areas in a manner that results in similar or better than pre-work conditions by removing project-related waste, spreading stockpiled materials (soil, large wood, trees, etc.), and seeding or planting with local native seed mixes or plants.
2. Waterbars
    - If necessary to prevent erosion and flow into stream channels, construct waterbars on travel routes and landings after use or before substantial rainfall.
3. Short-term stabilization
    - Measures may include the use of nonnative, nonpersistent sterile seed mix (when appropriate native seed sources are not available), weed-free certified straw, jute matting, and other similar techniques. Short-term stabilization measures will be maintained until permanent erosion control measures are effective. Stabilization measures will be instigated within 3 days of construction completion.

4. Revegetation

    - Replant each area requiring revegetation before or at the beginning of the first growing season following construction. Achieve reestablishment of vegetation in disturbed areas to at least 70 percent of pre-project levels within 3 years. Use an appropriate mix of species that will achieve establishment and erosion control objectives, preferably forb, grass, shrub, or tree species native to the project area or region and appropriate to the site. No nonnative species will be used for revegetation. Barriers will be installed as necessary to prevent access to revegetated sites by livestock or unauthorized people.

C. Heavy Equipment Use

Choice of Equipment

- Heavy equipment use will be commensurate with the project and operated in a manner that minimizes adverse effects to the environment (such as minimally sized, low pressure tires, minimal hard turn paths for tracked vehicles, or temporary mats or plates within wet areas or sensitive soils).
- Heavy equipment and temporary roads shall not be used in wilderness.

Fueling, Cleaning, and Inspection for Petroleum Products and Invasive Weeds

1. All equipment used for instream work will be cleaned for petroleum accumulations, dirt, plant material (to prevent the spread of noxious weeds), and leaks repaired prior to entering National Forest System lands and the project area. Such equipment includes large machinery, stationary power equipment (such as generators or canes), and gas-powered equipment with tanks larger than 5 gallons.
2. Store and fuel equipment in staging areas after daily use.
3. Inspect daily for fluid leaks before leaving the vehicle staging area for operation.
4. Thoroughly clean equipment before operation below ordinary high water or within 50 feet of any natural waterbody or area that drains directly to streams or wetlands and as often as necessary during operation to remain grease free.

Temporary Access Routes

- Flag temporary access routes. Existing roadways or travel paths will be used whenever possible. Minimize the number of temporary access roads to lessen soil disturbance and compaction and impacts to vegetation. Temporary access roads will not be built on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure. Temporary access roads will be decommissioned and/or revegetated as appropriate and necessary within 1 year after the route is no longer needed to complete the project. Construction of new permanent roads is not permitted.

Slope Limits

- Ground-based equipment will not operate on slopes greater than 30 percent unless approved by Forest Service staff.

Stream Crossings

- Minimize the number and length of stream crossings. Such crossings will be at right angles and avoid potential spawning areas to the greatest extent possible. Stream crossings shall not increase the risk of channel rerouting at low and high water conditions. After project completion, temporary stream crossings will be abandoned and the stream channel and banks restored.

Work from Top of Bank

- To the extent feasible, heavy equipment will work from the top of the bank, unless work from another location (instream) would result in less habitat disturbance, less floodplain disturbance, or better meet project design criteria. Operate heavy equipment in streams only when project specialists believe that such actions are the only reasonable alternative for implementation, or would result in less sediment in the stream channel or damage (short- or long-term) to the overall aquatic and riparian ecosystem relative to other alternative methods.

Timely Completion

- Minimize time heavy equipment is in stream channels, riparian areas and wetlands. Complete earthwork (including drilling, excavation, dredging, filling and compacting) as quickly as possible. During excavation, stockpile native streambed materials above the bankfull elevation, where it cannot reenter the stream, for later use.

D. Pollution and Erosion Control Measures

When heavy machinery will be used to complete a project, implement the following pollution and erosion control measures:

1. Identify a project contact (name, phone number, an address) who will be responsible for implementing pollution and erosion control measures.
2. List and describe any hazardous material that would be used at the project site, including procedures for inventory, storage, handling, and monitoring; notification procedures; specific clean up and disposal instructions for different products available on the site; proposed methods for disposal of spilled material; and employee training for spill containment.
3. Temporarily store any waste liquids generated at the staging areas under cover on an impervious surface, such as tarpaulins, until such time they can be properly transported to and treated at an approved facility for treatment of hazardous materials.
4. Use established best management practices to confine, remove, and dispose of construction waste, including every type of debris, discharge water, concrete, cement, grout, washout facility, welding slag, petroleum product, or other hazardous materials generated, used, or stored on site.
5. Use procedures and materials to contain and control a spill of any hazardous material generated, used or stored on site, including notification of proper authorities. Ensure that materials for emergency erosion and hazardous materials control are on site (such as silt fence, straw bales, or oil-absorbing floating boom whenever surface water is present).

6. Use best management practices to confine vegetation and soil disturbance to the minimum exclusion area and minimum length of time as necessary to complete the action, and otherwise prevent or minimize erosion associated with the action area.
7. Do not allow uncured concrete or form materials to enter the active stream channel.
8. Take steps to cease work under high flows, except for efforts to avoid or minimize resource damage.

E. Property Rights Including Water Rights

For stream restoration projects and projects involving relocation, replacement, removal or placement of new structures in streams and riparian areas:

1. Evaluate and identify existing valid water rights (both FS and third party water rights) that could be affected by the project.
2. Do so by coordinating with the Forest water rights data steward and the Forest special uses coordinator as well as the local watermaster (Forests in Oregon) or the WA Department of Ecology Regional Point-of-Contact (Forests in Washington).
    a. Oregon watermaster: https://www.oregon.gov/OWRD/aboutus/contactus/Pages/RegionalOfficesandWatermastersDirectory.aspx
    b. WA Department of Ecology Regional Point-of-Contact: https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-availability
3. Design and implement projects in a manner that prevents injury of a valid water right.

To protect private property rights, do not relocate, replace or remove structures unless they are:

1. Unauthorized or abandoned
2. Owned by the Forest Service; or
3. Owned by a third-party with whom coordination has occurred and agreement reached through the 5-step project implementation process and/or other applicable administrative procedures (e.g., special use permit).

Note: if the structure is unauthorized, but does not appear to be abandoned or unused, attempts must be made to identify the person(s) that built or are using the structure. If those person(s) are identified, communication/coordination should occur prior to removal of the structure. The line officer can make a decision whether to authorize or remove the structure in coordination with the relevant State's water resources agency, as appropriate.

F. Project Level Technical Skills, Qualifications, and Program Coordination

Ensure that experienced personnel are involved in the design of the restoration projects as appropriate.

1. Experienced means someone qualified at the journey level and classified under the professional series of their respective area (i.e. Botanist 0430, Wildlife 0486).

2. Interdisciplinary teams or project review teams would normally include a botanist, engineer, geneticist, geomorphologist, ecologist, fuels and fire staff, invasive species coordinator, recreation staff, range staff, silviculturist, and wildlife biologist.

G. Discipline-Specific Project Design Criteria

Botanist

1. All botany-related work will be completed by or at the direction of a GS-0430 botanist.
2. Pre-implementation surveys for sensitive plants will be completed for any ground-disturbing work if deemed necessary by the project botanist.
    - Botanists will use the Regional Forester sensitive species list in force at the time of the survey, and survey targets will be broadened to include Regional Forester sensitive species that are known from adjacent Forest Service units in similar habitats.
    - Surveys will occur in the project area or other areas that might be affected by the action, especially uplands.
3. The integrity of sensitive plant populations shall be maintained. Operational activities shall not be allowed in any documented sensitive plant sites unless it is for the demonstrated benefit or protection of the site. Short-term impacts followed by long-term benefits are acceptable. All sensitive plant populations—including those found during surveys or known from corporate or unit databases—shall be buffered to 100 feet and avoided unless other conservation measures are approved by the project botanist. Larger buffers may be required for species that are highly sensitive to changes in microclimate, and smaller buffers may be appropriate where habitat restoration is required for rare plant maintenance or recovery.
    - Rare plants or those of local concern that are not on the Regional Forester's sensitive species list should be protected to a practical extent. This may include strategic species or plants or fungi known to have limited distribution locally or globally.
4. Degraded habitat for sensitive or locally significant rare plants in the project area shall be restored to a practical extent during project activities in consultation with the project botanist.
5. Avoidance of sensitive botanical resources is the mitigation of choice. Rare plant transplantation or removal to offsite locations for subsequent reintroduction or reestablishment of affected populations from seeds, cuttings, plugs, or any other plant materials is strongly discouraged due to high risk of failure.
6. Mitigation considerations and evaluation of rare plant population persistence must consider and accommodate future project effects such as hydrological alteration, changes in microclimate and insolation, changes in upland or riparian ungulate utilization that may affect rare upland species, the competitive effects of revegetation and subsequent growth, changes in expected successional patterns, changed recreational use, and other similar contingencies.
7. The integrity of sensitive and unique habitats shall be maintained. Rare, unusual, sensitive, or special natural communities as defined in the forest plan or so assessed by the project botanist or ecologist—particularly including groundwater dependent ecosystems—will be fully protected or enhanced using best management practices.
    - Cutting or disturbance of legacy vegetation features (those developed over centuries) is prohibited.

- Spring development shall not occur if sensitive plants are present.
- Any modification of groundwater-dependent ecosystems shall be to return them to a more natural and properly functioning condition.

8. Disturbed ground, erosion-prone sites, or areas treated to remove invasive species shall be revegetated using best management practices according to prevailing regional native plant materials guidance.
    - All plant materials used in projects shall be native species from appropriate seed zones and elevations. Local material is preferred. The project botanist should be consulted to write a specific revegetation plan if one is needed.
    - The use of fish- and wildlife-friendly native plants for restoration is highly encouraged, especially those that support birds and other wildlife, pollinators and other invertebrates, and those that discourage the establishment of invasive species.
9. As part of post-project monitoring, the effectiveness of the above design criteria will be evaluated and results shall be used to improve future work authorized by this environmental assessment.

Hydrologist/Watershed Specialist and Fisheries Biologist

1. Follow relevant best management practices described in the National Best Management Practices for Water Quality Management on National Forest System Lands (USDA Forest Service 2012).
2. Consider and address, as needed, potential streamflow effects associated with individual actions. This would include, as appropriate, coordination with Oregon Department of Water Resources and Washington Department of Ecology.
3. Follow the appropriate State (ODFW 2008, WDFW 2010, CDFW 2013 or most recent) guidelines for timing of in-water work:
    - Oregon Department of Fish and Wildlife: (http://www.dfw.state.or.us/lands/inwater/Oregon_Guidelines_for_Timing_of_%20InWater_work2008.pdf)
    - Washington Department of Fish and Wildlife: (http://wdfw.wa.gov/licensing/hpa/freshwater_incubation_avoidance_times_28may2010.pdf)
    - California Department of Fish and Game: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=58055

Exceptions to in-water work windows must be requested and granted through Level I National Marine Fisheries Service and/or U.S. Fish and Wildlife Service representatives (for federally listed species only) as well as essential State agencies. For national forests in the state of Washington, the Forest Service will work with Washington Department of Fish and Wildlife to determine in-water work periods, using the process contained in the 2011 Memorandum of Understanding between the Washington Department of Fish and Wildlife and USDA Forest Service, Pacific Northwest Region regarding hydrologic permits. See also seasonal restriction timeline.

4. Climate change
    - Consider climate change information, such as predictive hydrographs for a given watershed or region or local assessments if completed when designing projects.

5. Fish passage
    - Fish passage will be provided for any adult or juvenile fish likely to be present in the action area during construction, unless passage did not exist before construction, stream isolation and dewatering is required during project implementation, or where the stream reach is naturally impassible at the time of construction. After construction, adult and juvenile passage that meets National Marine Fisheries Service fish passage criteria (NMFS 2011) will be provided for the life of the action.

6. Lamprey
    - To the extent possible, incorporate lamprey best management practices found in Best Management Practices to Minimize Adverse Effects to Pacific Lamprey, *Entosphenus tridentatus* (USFWS 2010).

7. Work area isolation and aquatic organism capture and release
    - Isolate the Construction Area: Remove fish, amphibians, and other aquatic organisms (such as mussels) from a project site for projects that include concentrated and major excavation at a single location within the stream channel. This condition will typically apply to the following aquatic restoration categories: fish passage restoration, small dam removal, and channel reconstruction/relocation.
    - Isolate Capture Area: Install block nets at up and downstream locations outside of the construction zone and leave in a secured position to exclude fish from entering the project area. Leave nets secured to the stream channel bed and banks until construction activities within the stream channel are complete. If block nets or traps remain in place more than one day, monitor the nets and or traps at least on a daily basis to ensure they are secured to the banks and free of organic accumulation and to minimize aquatic animal (fish and amphibian) predation in the trap.
    - Capture and Release: Fish and other aquatic organisms trapped within the isolated work area will be captured and released as prudent to minimize the risk of injury, then released at a safe release site, preferably upstream of the isolated reach in a pool or other area that provides cover and flow refuge. Collect animals (fish and amphibians) by seine or dip nets as the area is slowly dewatered, and place minnow traps overnight. Animals must be handled with extreme care and kept in water the maximum extent possible during transfer procedures. A healthy environment for the stressed animals shall be provided—large buckets (five-gallon minimum to prevent overcrowding) and minimal handling of organisms. Place large fish and amphibians in buckets separate from smaller prey-sized individuals. Monitor water temperature in buckets and well-being of captured animals. If buckets are not being immediately transported, use aerators to maintain water quality. As rapidly as possible (especially for temperature-sensitive bull trout), but after fish and amphibians have recovered, release individuals. In cases where the stream is intermittent upstream, release animals in downstream areas and away from the influence of the construction. Capture and release will be supervised by a fish or wildlife biologist experienced with work area isolation and safe handling of all captured animals.

8. Electrofishing

   - Use electrofishing only where other means of capture may not be feasible or effective. If electrofishing will be used to capture fish for salvage, National Marine Fisheries Service electrofishing guidelines will be followed (NMFS 2000 - http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf). Those guidelines are available from the National Marine Fisheries Service Northwest Region, Protected Resources Division in Portland, Oregon.
   - If fish are observed spawning during the in-water work period, electrofishing shall not be conducted in the vicinity of spawning adult fish or active redds. Electrofishing will not occur in areas where there is observed amphibian egg clusters or where there is observed amphibian egg laying.
   - Only direct current (DC) or pulsed direct current (PDC) shall be used.
   - For conductivity less than 100, use voltage ranges from 900 to 1100. For conductivity from 100 to 300, use voltage ranges from 500 to 800. For conductivity greater than 300, use voltage to 400.
   - Reasonable effort should be made to avoid handling fish and other aquatic animals in warm water temperatures, such as conducting fish evacuation first thing in the morning, when the water temperature would likely be coolest. No electrofishing should occur when water temperatures are above 20 degrees Celsius or are expected to rise above this temperature prior to concluding the fish capture.
   - Begin electrofishing with minimum pulse width and recommended voltage and then gradually increase to the point where animals (fish/amphibians) are immobilized and captured. Turn off current once animals are immobilized.
   - Do not allow fish or other aquatic organisms to come into contact with anode. Do not electrofish an area for an extended period of time. Remove animals immediately from water and handle as described below. Dark bands on the fish indicate injury, suggesting a reduction in voltage and pulse width and longer recovery time.
   - If mortality of fish and amphibians is occurring during salvage, immediately discontinue salvage operations, reevaluate the current procedures, and adjust or postpone procedures to reduce mortality.

9. Dewater construction site

   - When dewatering is necessary to protect species or critical habitat, divert flow around the construction site with a coffer dam (built with non-erosive materials) and an associated pump, a by-pass culvert, or a water-proof lined diversion ditch. Diversion sandbags can be filled with material mined from the floodplain as long as such material is replaced at end of project. Small amounts of instream material can be moved to help seal and secure diversion structures. Pumps must have fish screens and be operated in accordance with National Marine Fisheries Service fish screen criteria described in the next section. Dissipate flow energy at the bypass outflow to prevent damage to riparian vegetation or stream channel. If diversion allows for downstream fish passage, place diversion outlet in a location to promote safe reentry of fish into the stream channel, preferably into pool habitat with cover. When necessary, pump seepage water from the de-watered work area to a temporary storage and treatment site or into upland areas and allow water to filter through vegetation prior to reentering the stream channel.

10. Fish screens for dewatering - National Marine Fisheries Service hydro fish passage review and approve

    - When using fish screens for surface water that is diverted by gravity or by pumping at a rate that exceeds 3 cubic feet per second, ensure that the action is individually reviewed by the Portland office of the National Marine Fisheries Service Habitat Conservation Division for consistency with criteria in NOAA Fisheries Anadromous Salmonid Passage Facility Design (NMFS 2011), located at: http://www.nwr.noaa.gov/Salmon-Hydropower/FERC/upload/Fish-Passage-Design.pdf.
    - For the dewatering of a work site to remove or install culverts, bridge abutments, or other structures, a fish screen must be used on the pump intake to avoid juvenile fish entrainment that meets criteria specified by National Marine Fisheries Service (2011, or most recent version).
    - All other diversions will have a fish screen that meets the following specifications:

      (a) An automated cleaning device with a minimum effective surface area of 2.5 square feet per cubic feet per second, and a nominal maximum approach velocity of 0.4 feet per second, or no automated cleaning device, a minimum effective surface area of 1 square foot per cubic feet per second, and a nominal maximum approach rate of 0.2 feet per second; and

      (b) a round or square screen mesh that is no larger than 2.38 millimeters (0.094 inches) in the narrow dimension, or any other shape that is no larger than 1.75 millimeters (0.069 inches) in the narrow dimension.
    - Each fish screen will be installed, operated, and maintained according to National Marine Fisheries Service fish screen criteria (NMFS 2011, or most recent version). National Marine Fisheries Service fish screen criteria applies to federally listed salmonid species under their jurisdiction as well as bull trout, Oregon chub, shortnose sucker, Lahontan cutthroat trout, Lost River sucker, Modoc sucker, and Warner sucker under U.S. Fish and Wildlife Service jurisdiction.

11. Stream rewatering

    - Upon project completion, slowly rewater the construction site to prevent loss of surface water downstream as the construction site streambed absorbs water and to prevent a sudden increase in stream turbidity. Monitor downstream during re-watering to prevent stranding of aquatic organisms below the construction site.

12. Report fish salvage

    - If a sick, injured, or dead specimen of a threatened or endangered species is found in the project exclusion area, the finder must notify National Marine Fisheries Service through the contact person identified in the transmittal letter for this opinion, or through the National Marine Fisheries Service Office of Law Enforcement at 1-800-853-2064, and follow any instructions. If the proposed action may worsen the fish's condition before National Marine Fisheries Service can be contacted, the finder should attempt to move the fish to a suitable location near the capture site while keeping the fish in the water and reducing its stress as much as possible. Do not disturb the fish after it has been moved. If the fish is dead, or dies while being captured or moved, report the following information: (a) National Marine Fisheries Service consultation number; (b) the date, time, and

location of discovery; (c) a brief description of circumstances and any information that may show the cause of death; and (d) photographs of the fish and where it was found. The National Marine Fisheries Service also suggests that the finder coordinate with local biologists to recover any tags or other relevant research information. If the specimen is not needed by local biologists for tag recovery or by National Marine Fisheries Service for analysis, the specimen should be returned to the water in which it was found, or otherwise discarded.

Soil Scientist

1. Ground-based equipment will not operate on slopes greater than 30 percent unless approved by Forest Service staff.
2. To minimize project area disturbance, existing landings, temporary haul roads, and old primary skid roads will be used to the extent practicable.
3. Heavy equipment use will be commensurate with the project and operated in a manner that minimizes adverse effects to the environment (minimally sized, low pressure tires, minimal hard turn paths for tracked vehicles, temporary mats or plates within wet areas or sensitive soils).
4. Construction operations will be staged as needed to limit the extent of disturbed areas without installed stabilization measures.
5. Clearing and grubbing activities will be minimized when preparing staging, project, and or stockpile areas. Any large wood, topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration.
6. Compacted areas such as access routes and paths, stream crossings, staging, and stockpile areas will be loosened as necessary.
7. Fills will be properly compacted to avoid or minimize erosion.
8. No off-road, ground-based equipment will be used during wet soil conditions to limit the likelihood of detrimental soil conditions, limit surface erosion and sediment transport, and reduce the intensity and duration of anticipated short-term turbidity increases. This restriction may be waived with the concurrence of a soil scientist or watershed specialist, if periods of dry weather are anticipated.

Wildlife Biologist/Ecologist

1. All wildlife-related work will be completed by or at the direction of a GS-0486/0408 wildlife biologist/ecologist, including the identification of nesting trees, developing project maps and applying timing restrictions.
2. All food and garbage will be properly stored while working on-site to avoid attracting corvids and scavengers. It is highly recommended that bear proof containers be used especially if food and smelly refuse will be left over night. If the project lies within a known grizzly bear recovery area or if the project area has a food storage order in place, bear certified storage must be used.
3. If an active den, nest, roost, rendezvous site, or other important habitat feature is found near the treatment site, consult the project wildlife biologist for measures to protect the species or site.

4. The unit wildlife biologist may shorten or extend restricted seasons based on site-specific information, such as a late or recycle nesting attempt.
5. Blasting activities must be carefully evaluated and timed to avoid impacts to wildlife. All seasonal and timing restrictions will be observed. Consultation with the project wildlife biologist is required.
6. Amphibians/Reptiles
    - Avoid conducting projects in high gradient (6% gradient or more), head-water streams with known occurrences of sensitive amphibians (tailed frogs, torrent salamanders). If work is necessary to restore the headwater, then a supplemental analysis shall be completed for up-to-date and local information. This may include timing restrictions.
    - Avoid conducting projects in identified suitable habitat for foothill yellow-legged frog and western pond turtle during the breeding season. See table 5 for avoidance periods.

Table 5. Sensitive periods that should be avoided to the greatest extent possible

Species Affected	Breeding Season
Northern Spotted Owl	March 1 - July 15
Northern Spotted Owl (ORCPP)	March 1 - July 7
Marbled Murrelet	March 1 - August 5
Canada Lynx (denning)	May 1 - August 31
Gray wolf (active dens / rendevous sites)	April 15 - June 30
Grizzly bear (denning)	October 15 - May 15
Grizzly bear (early foraging habitat)	March 15 - July 15
Grizzly bear (late foraging habitat)	July 16 - November 15
Woodland Caribou	October 1 - March 1
Bald Eagle (winter roost)	November 1 - April 30
Great Blue Heron	March 1 - August 31
Great Gray Owl	March 1 - June 30
Northern Goshawk	March 1 - August 31
Landbirds	May 15 - July 5
Cavity Nesters	May 1 - July 15
Waterfowl	March 1 - August 31
Pollinators	March 15 - September 30
Amphibians (breeding)	March 1 - June 1
Amphibians (migration)	September 1 - November 1
Oregon Chub (no water work)	June 1 - August 31
Bull Trout (spawning)	May 1 - July 31

7. Butterflies/Terrestrial Invertebrates
    - Minimize impacts to host plants species of listed and sensitive invertebrates, and work with the project wildlife biologist and botanist to restore host plants and habitats. Protection may include timing restrictions to protect various life stages.

- Avoid prescribed burning in known sensitive invertebrate habitat when species is less mobile (when there are eggs, larvae, pupae, etc.)
- Minimize travel routes of heavy equipment over undisturbed forest and riparian areas to minimize soil compaction and crushing of invertebrates.

8. Birds
   - To the extent possible, avoid disturbance to nesting birds. See table 5.
   - If work needs to be done during nesting and rearing periods, consult a wildlife biologist for site-specific surveys and restrictions.
9. Federally Threatened, Endangered, or Proposed Wildlife
   - Federally listed species are fully addressed in ARBO II (U.S. Fish and Wildlife Service 2013; see appendix 1) and will not be considered further here.
   - If a recently proposed or listed threatened and endangered wildlife species is found in the project area (such as Oregon spotted frog, yellow-billed cuckoo, or wolverine), discontinue project work and consult the project wildlife biologist immediately.

Recreation

- Provide advanced notification and consultation with representatives of recreation user groups and outfitter-guides for projects occurring in/around developed and dispersed recreation sites.
- Post notification on-site of proposed projects at trailheads and river access sites.

H. Survey-and-Manage Species

- For four aquatic restoration activities (bull trout protection, fencing to protect aquatic restoration projects, juniper removal, and riparian vegetation treatment controlled burning), if suitable habitat for a survey and manage species occurs within the project area and the activity is considered to be habitat-disturbing, the activity or project must be modified or the project location moved to avoid the species' habitats. This design criterion then provides for a reasonable assurance of species persistence and eliminates actions that require pre-disturbance surveys, which are not covered in this analysis.

I. Diseases and Invasive Species

1. All project areas will be surveyed for invasive plant infestations prior to implementation.
2. A botanist or invasive plant specialist will be notified a minimum of two weeks prior to any project implementation in order to treat or properly flag infested areas during the field season.
3. All invasive nonnative plant infestations within the project area or along travel routes near the project area will be treated where feasible or "flagged and avoided" according to the species present and project constraints.
4. Invasive plant treatment must be consistent with existing unit's decisions on invasive plant treatment. For sites not covered by existing decisions, or for units without existing decisions, site-specific environmental analysis and a decision would need to be made prior to any invasive plant treatments.

5. Control weeds as necessary at project sites.
6. Grass seed will be certified by the states of Oregon or Washington as weed-free or grown under government-supervised contracts to assure noxious weed-free status.
7. Use State certified weed-free straw and mulch or material procured through government-supervised contracts. If State certified products are not available, straw and mulch from sources determined to be weed free can be used.
8. Disturbed areas will be revegetated to prevent the establishment or spread of invasive plants and noxious weeds.
9. Seed mixes must be approved by a botanist or revegetation specialist.
10. Landings or staging areas for equipment, materials, or crews will not be situated in invasive plant or noxious weed infested areas until they have been treated.
11. Soil moved from a site infested with noxious weeds should be disposed of at a designated site coordinated by a botanist or invasive plant coordinator.
12. Any new invasive plants found in the project area will be documented and a botanist or invasive plant coordinator will be notified of the infestation location.
13. Conduct post-project monitoring to address new invasions of invasive plants.
14. A qualified weed specialist will inspect active gravel, fill, sand stockpiles, quarry sites and borrow material for invasive plants before use and transport. Use only gravel, fill, sand, and rock that is judged to be weed free by a qualified weed specialist (including material from commercial sites) (Prevention Standard 7 - Regional Invasive Plants FEIS).
15. Wherever possible reestablish native plants on sites where weeds are removed as well as in areas where fallow ground provides optimal habitat for weeds to colonize.
16. Disturbed ground, erosion-prone sites, or areas treated to remove invasive species shall be revegetated using best management practices according to prevailing regional native plant materials guidance.
17. All equipment used for work that will be in or near water will be cleaned for dirt, plant material (to prevent the spread of noxious weeds), and leaks repaired prior to entering National Forest System lands and the project area. Such equipment includes large machinery, stationary power equipment (generators, canes, etc.), and gas-powered equipment with tanks larger than five gallons. If the equipment is coming from known aquatic invasive hot spots, there will be a full equipment inspection for invasives prior to entry into the project area, and equipment will be cleaned with pressure and heat for sterility.
18. All work that will be in or near water will use decontamination protocols for aquatic pathogens like whirling disease and chytrid fungus. Follow decontamination procedures in Northwest Partners in Amphibian and Reptile Conservation “Habitat management guidelines for amphibians and reptiles of the Northwestern United States and Western Canada. Technical Publication HMG-4. Appendix G “Disinfection Guidelines for individuals working in freshwater habitats. https://static1.squarespace.com/static/57e01f421b631ba91823f357/t/57ffc473bebafba9d1102029/1476379779446/NWPARC_habitat_management_guidelines.pdf

J. Vegetation, Snags, and Down Wood

1. Retain existing vegetative connectivity between upland and aquatic areas to facilitate animal movement.
2. To the extent possible, retain all unique riparian habitat features. For example, retain large diameter trees within riparian areas if these are rare or unique to the area.
3. Retain old growth or legacy vegetation and vegetation features (such as ancient moss mats).
4. Large woody debris in all stages of decay is important habitat for many organisms, especially fungi, amphibians and reptiles, and invertebrates; it shall be retained in the project area.
5. "Leave-trees" damaged during project operations will be left on the project site for future snag and down wood recruitment.

K. Monitoring

Implementation

1. Visually monitor during project implementation to ensure effects are not greater (amount, extent) than anticipated and to contact Level 1 representatives if problems arise.
2. Fix any problems that arise during project implementation.
3. Ensure regular biologist/hydrologist coordination with the contracting officer's representative if biologist/hydrologist is not always on site is necessary to ensure contractor is following all stipulations. To minimize short-term degradation to water quality during project implementation, follow current 401 certification provisions of the Federal Clean Water Act for maintenance or water quality standards described by the following: Oregon Department of Environmental Quality; Memorandum of Understanding between the Washington Department of Fish and Wildlife and Forest Service regarding Hydraulic Projects Conducted by Forest Service, Pacific Northwest Region; or California 401 Certification protocols.

Post-Project Review

1. A post-project review shall be conducted after winter and spring high flows.
2. For each project, conduct a walk through and visual observation to determine if there are post-project affects that were not considered during consultation.
3. When post-project monitoring determines that remedial actions are required, such actions are permitted without additional analysis if they use relevant project design criteria and the effects described in this environmental assessment are not exceeded.

Fish Passage Restoration Projects

- Note any problems with channel scour or bedload deposition, substrate, discontinuous flow, vegetation establishment, or invasive plant infestation.

Revegetation

- For all plant treatment projects, including site restoration, monitor for and remove invasive plants until native plants become established.

Appendix 3. Focus Watersheds and Priority Subwatersheds in the Pacific Northwest Region

Deschutes National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
Whychus Creek	1707030107	Upper Whychus Creek	170703010702
Upper Metolius River	1707030109	Lower Lake Creek	170703010904
Browns Creek-Deschutes River	1707030102	Not applicable	Not applicable

Fremont-Winema National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
Upper Sycan River	2001020201	Headwaters Sycan River	200102020103
Long Lake Valley-Upper Klamath Lake	2001020303	Not applicable	Not applicable
Middle Sycan River	2001020202	Not applicable	Not applicable
Not applicable	Not applicable	Sevenmile Creek	200102030104
Not applicable	Not applicable	Upper Thomas Creek	200200010205

Gifford Pinchot National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
Muddy River	1708000202	Lower Clear Creek	170800020204
Muddy River	1708000202	Lower Muddy River	170800020205
Wind River	1707010510	Trout Creek	170701051005
Wind River	1707010510	Trapper Creek-Wind River	170701051004
Lower Cispus River	1708000404	Not applicable	Not applicable
Not applicable	Not applicable	Slide Creek-East Fork Lewis River	170800020502

Malheur National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
Camp Creek-Middle Fork John Day River	1707020302	Lower Camp Creek	170702030207
Camp Creek-Middle Fork John Day River	1707020302	Upper Camp Creek	170702030205
Camp Creek-Middle Fork John Day River	1707020302	Lick Creek	170702030206
Bridge Creek-Middle Fork John Day River	1707020301	Not applicable	Not applicable
Reynolds Creek-John Day River	1707020105	Not applicable	Not applicable

Mt. Baker-Snoqualmie National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
Lower Suiattle River	1711000603	Circle Creek-Suiattle River	171100060303
Upper North Fork Nooksack River	1711000401	Not applicable	Not applicable
Upper White River	1711001403	Not applicable	Not applicable
Not applicable	Not applicable	Upper South Fork Skykomish River	171100090302

Mt. Hood National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
West Fork Hood River	1707010506	Upper West Fork Hood River	170701050601
Zigzag River	1708000102	Still Creek	170800010201
Fifteenmile Creek	1707010503	Not applicable	Not applicable

Ochoco National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
Deep Creek	1707030404	Crazy Creek-Deep Creek	170703040403
McKay Creek	1707030505	Upper McKay Creek	170703050501
Upper Trout Creek	1707030701	Not applicable	Not applicable

Olympic National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
Dungeness River	1711002003	Middle Dungeness River	171100200306
Calawah River	1710010104	Sitkum River	171001010401
South Fork Skokomish River	1711001701	Upper South Fork Skokomish River	171100170101
South Fork Skokomish River	1711001701	Lower South Fork Skokomish River	171100170102

Rogue River-Siskiyou National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
South Fork Coquille River	1710030502	Headwaters South Fork Coquille River	171003050201
Sucker Creek	1710031102	Grayback Creek	171003110203
Sucker Creek	1710031102	Middle Sucker Creek	171003110202
Upper Applegate River	1710030902	Not applicable	Not applicable
Not applicable	Not applicable	Sugarpine Creek	171003070503
Not applicable	Not applicable	Upper Elk River	171003060301
Not applicable	Not applicable	Dunn Creek	171003110302

Siuslaw National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
Nestucca River-Frontal Pacific Ocean	1710020302	Farmer Creek-Nestucca River	171002030209
Siltcoos River-Frontal Pacific Ocean	1710020701	Tahkenitch Lake-Frontal Pacific Ocean	171002070104
Drift Creek	1710020503	Lower Drift Creek	171002050303
Not applicable	Not applicable	Eckman Creek-Alsea River	171002050405
Not applicable	Not applicable	Upper North Fork Siuslaw River	171002060701

Umatilla National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
Wall Creek	1707020208	Upper Big Wall Creek	170702020805
Upper Tucannon River	1706010706	Cummings Creek	170601070604
Not applicable	Not applicable	Upper North Fork Touchet River	170701020301
Granite Creek	1707020202	Clear Creek	170702020204

Umpqua National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
Steamboat Creek	1710030107	Upper Steamboat Creek	171003010702
Steamboat Creek	1710030107	Middle Steamboat Creek	171003010704
Upper South Umpqua River	1710030201	Skillet Creek-South Umpqua River	171003020105
Upper South Umpqua River	1710030201	Black Rock Fork	171003020102
Jackson Creek	1710030202	Not applicable	Not applicable
Not applicable	Not applicable	Copeland Creek	171003010802

Wallowa Whitman National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
Upper Grande Ronde River	1706010401	Meadowbrook Creek-Grande Ronde River	170601040103
Upper Grande Ronde River	1706010401	Sheep Creek	170601040105
Upper Catherine Creek	1706010405	Lick Creek	170601020302
Upper Catherine Creek	1706010405	Lower Five Points Creek	170601040403
Granite Creek	1707020202	Bull Run Creek	170702020202

Okanogan-Wenatchee National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
Little Naches River	1703000201	Lower Little Naches River	170300020109
Little Naches River	1703000201	Upper Little Naches River	170300020102
Lower Chewuch River	1702000804	Eight Mile Creek	170200080404
Nason Creek	1702001102	Not applicable	Not applicable
Not applicable	Not applicable	Tillicum Creek	170200100102
Not applicable	Not applicable	Upper Peshastin Creek	170200110501

Willamette National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
South Fork McKenzie River	1709000403	Cougar Creek-South Fork McKenzie River	170900040308
Breitenbush River	1709000501	Not applicable	Not applicable
Hills Creek Reservoir-Middle Fork Willamette River	1709000105	Not applicable	Not applicable
Not applicable	Not applicable	Staley Creek	170900010105
Not applicable	Not applicable	Marion Creek	170900050203
Not applicable	Not applicable	Soda Fork	170900060203

Colville National Forest

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
Le Cleric Creek-Pend Oreille River	1701021603	East Branch Le Clerc Creek	170102160303
Not applicable	Not applicable	West Branch Le Clerc Creek	170102160302
Upper Sanpoil River	1702000401	Ninemile Creek	170200040107
Chewelah Creek-Colville River	1702000301	Not applicable	Not applicable

Columbia River Gorge National Scenic Area

Focus Watershed 5th-field	Hydrologic Unit Code	Priority Subwatershed 6th-field	Hydrologic Unit Code
City of Washougal-Columbia River	1708000108	Hamilton Creek-Columbia River	170800010802
City of Washougal-Columbia River	1708000108	Viento Creek-Columbia River	170800010803
City of Washougal-Columbia River	1708000108	Latourell Creek-Columbia River	170800010804
City of Washougal-Columbia River	1708000108	Tanner Creek-Columbia River	170800010801
Lower Klickitat River	1707010604	Not applicable	Not applicable

Appendix 4. Project Compliance Form

The intent of this compliance form is two-fold:

1. The interdisciplinary team members verify that they have read and incorporated necessary project design criteria listed in appendices 1 and 2 into the project and that the project conforms to relevant land management plan standards and guidelines, laws, regulations, and policies. To document this confirmation, interdisciplinary team members are required to sign the form.
2. The local official validates that they have been briefed about the project by the interdisciplinary team and that it conforms to their land management plan, project design criteria, and the effects are within the range and scope of the Pacific Northwest Region Aquatic Restoration decision.
3. If changes in conditions occur within the duration of the implementation of the environmental assessment, such as newly listed sensitive species, the local interdisciplinary team will determine if there is a need for additional analysis and contact the Regional Office for guidance.

A pdf version of the completed form shall be attached to the Aquatic Restoration Reporting System database pre-project notification.

There are several project design criteria highlighted below because they require additional consultation, analysis, and possibly a separate environmental analysis and decision prior to project implementation:

Heritage Resources

- For the national forests in the state of Oregon, comply with the *Programmatic Agreement Among the USDA Forest Service, Pacific Northwest Region, The Advisory Council of Historic Preservation and the Oregon State Historic Preservation Officer Regarding the Regional Aquatic Restoration Project,* which will outline the process to complete phased 106 for each project under this analysis. For the national forests in the state of Washington, comply with the *Programmatic Agreement Among the USDA Forest Service, Pacific Northwest Region, The Advisory Council of Historic Preservation and the Washington State Department of Archeology and Historic Preservation Regarding the Regional Aquatic Restoration Project*. If either PA is revised and replaced after the final decision was signed, the most current programmatic agreement for each state will be followed.
- National Historic Preservation Act Tribal consultation will take place prior to project implementation. Heritage or Tribal Relations staff will need as much notice as possible. Tribes have 30 days to respond.

Wilderness and Wild and Scenic Rivers

- If the project occurs within a designated Wilderness area, work with the wilderness manager(s) on your unit as early as possible to: (1) identify the relevant management direction from the forest plan and, if relevant, wilderness plan; (2) identify the delegation of authority for the activities proposed; and (3) prepare a Minimum Requirements Analysis using the Minimum Requirements Decision Guide.

- If the project is located within a designated Wild and Scenic River or Congressionally authorized 5(a) Wild and Scenic Study River corridor, or if there is potential for effects to an upstream or downstream Wild and Scenic River or 5(a) study river, contact the Pacific Northwest Region Wild & Scenic Rivers Program Manager to discuss whether a Section 7 analysis is required. Ensure projects proposed within designated Wild and Scenic River corridors comply with relevant direction in the Comprehensive River Management Plan (CRMP).

Large Wood Acquisition

- Aquatic organism passage and instream, floodplain and side-channel aquatic restoration activities may require large trees to be brought in from outside of the riparian areas or riparian habitat conservation areas. When large wood is not available on site in riparian areas, Forest Service units may need to conduct a separate environmental analysis and decision to acquire and transport trees from off-site areas for the aquatic restoration actions.

Invasive Plant Treatment

- Forest Service units with an existing decision on invasive plant treatment need to determine if the decision covers existing invasive plant infestations at the project site or invasive plants introduced from disturbance associated with the project. For sites not covered by existing invasive plant treatment decisions, or for Forest Service units without existing decisions, site-specific environmental analysis and a decision would need to be made prior to any invasive plant treatments.

Inventoried Roadless Areas

- The Regional Forester will review the cutting, sale, or removal of generally small diameter timber when needed to improve threatened, endangered, proposed, or sensitive species habitat. Contact the Regional Inventoried Roadless Area Coordinator for a briefing with the Regional Forester.

Forest Service Unit: **Project Contact:** **Project Name:**[49]

Project Number: **Activity Type:**

I reviewed this project and determined that it complies with all relevant land management plan standards and guidelines, project design criteria listed in appendices 1 and 2 and is within the realm of expected effects described in the Pacific Northwest Region Aquatic Restoration analysis and decision.

Resource[50]	Signature (print/signature)	Date	Comments
Botany	/		
Engineering	/		
Fire/Fuels	/		
Fish	/		
Heritage	/		
Hydrology	/		
Invasive Species	/		
Lands	/		
Range	/		
Recreation	/		
Silviculture	/		
Soils	/		
Wildlife	/		
Wild & Scenic	/		
Wilderness			
Other	/		

Line Officer Signature: _____ **Date: _____**

[49] Use name, number and activity type from Aquatic Restoration Reporting System database

[50] If a resource staff area is not required for the analysis of this project, place an NA in the signature and date columns and an explanation as to why this resource area was not necessary in the comment section.

Appendix 5. Proposed Projects and Predicted Impacts

This appendix displays the number of proposed projects to be implemented each year along with associated impacts and total proposed projects and impacts over 15 years. Projects and impacts are displayed under the four aquatic restoration categories.

Type of Project	Projects per Year	Acres Impacted per Year	Projects per 10 to 15 Years	Acres Impacted over 10 to 15 years	Impacts
Aquatic Organism Passage	35	4	350	40	• **Terrestrial:** An average of 4 acres of undisturbed soil and vegetation will be temporarily impacted each year across the Region, about 0.24 acres per Forest Service unit. These values include staging areas. The majority of aquatic organism passage actions are culvert removal or replacement projects at road-stream crossings. Work is typically conducted with excavators and dump trucks and is mainly confined to existing road prisms. On occasion, areas outside of the road prism are disturbed with resulting damage to vegetation and soils, thus the 4 acres per year. To date, small dam removal has occurred infrequently under the ARBO II, but when such projects occur, actions will occur within disturbed sites and result in minimal disturbance to existing vegetation and soils. • **Aquatic:** Turbidity plumes within the affected stream will occur during construction of water diversions (less than 2 hours) and reentry of water back into the stream channel (less than 2 hours) for culvert projects and up to 8 hours for small dam removal projects. Contractors must adhere to Clean Water Act 401 guidelines that minimize turbidity and subsequent effects to aquatic organisms. Further, aquatic organisms may be handled, injured or killed during fish relocation efforts. • **Noise:** Created through daily use of heavy machinery, such as excavators, front-end loaders and dump trucks. • **Work Period:** Work is conducted during in-water work periods, typically between 6/15-9/30 with some starting June 1. In-water work extensions through October can be granted by ODFW/WDFW/CDFW/USFWS/NMFS.[51] Additional timing constraints determined by interdisciplinary teams will apply.

[51] ODFW = Oregon Department of Fish and Wildlife; WDFW = Washington Department of Fish and Wildlife; CDFW = California Department of Fish and Wildlife; USFWS = U.S. Fish and Wildlife Service; NMFS = National Marine Fisheries Service

Type of Project	Projects per Year	Acres Impacted per Year	Projects per 10 to 15 Years	Acres Impacted over 10 to 15 years	Impacts
Instream, Side-channel and Floodplain Projects	76	204	760	2,040	• **Terrestrial:** An average of **204 acres** of undisturbed soils and vegetation will be temporarily impacted each year across the Region, 12 acres per Forest Service unit. These values include staging areas. All projects will use heavy equipment to place large woody debris, boulders, and gravel and to remove human-placed fill, while few (about 2% of all projects) are more intrusive and include stream channel reconstruction within the floodplain. Projects occur in and adjacent to stream-channels. Disturbance occurs when heavy machinery operates off National Forest System roads in riparian reserves and riparian habitat conservation areas, resulting in soil compaction and exposure and damage to vegetation. • **Aquatic:** Stream turbidity will increase during in-stream use of heavy equipment. Contractors must adhere to Clean Water Act 401 guidelines that minimize turbidity and subsequent effects to aquatic organisms. For channel reconstruction and relocation projects, aquatic organisms may be handled, injured or killed during fish relocation efforts. • **Noise:** Created through daily use of heavy machinery, such as excavators, front-end loaders and dump trucks. About ¼ of large woody debris projects use helicopters to place wood. • **Work Period:** Work is conducted during in-water work periods, typically after 6/15-9/30 with some starting June 1. In-water work extensions through October can be granted by ODFW/WDFW/CDFW/USFWS/NMFS. Additional timing constraints determined by interdisciplinary teams will apply.
Riparian Vegetation	21	3	210	30	• **Terrestrial:** An average of **3 acres** of undisturbed soils and vegetation will be temporarily impacted each year across the Region, about 0.18 acre per Forest Service unit. Most if not all work is conducted with hand tools, so adverse impacts to vegetation and soil is limited to staging areas. On occasion, juniper removal may rely on feller-buncher equipment to cut juniper, so impacted acres will increase when such practices are used. • **Aquatic:** Stream turbidity will increase when heavy equipment is used to plant large willows and sedge mats along stream channels. Contractors must adhere to Clean Water Act 401 guidelines that minimize turbidity and subsequent effects to aquatic organisms. • **Noise:** Noise may result from the use of chainsaws and less frequently heavy machinery during Juniper Removal, Riparian Vegetation (controlled burning) and Beaver Habitat Restoration projects. • **Work Period:** Instream work windows, described in the aquatic organism passage and instream, side-channel and floodplain sections above, may apply to willow plantings along stream channels. Otherwise, work periods are not constrained by ODFW/WDFW/CDFW in-water work windows because projects occur outside of stream channels. Additional timing constraints determined by interdisciplinary teams will apply.

Type of Project	Projects per Year	Acres Impacted per Year	Projects per 10 to 15 Years	Acres Impacted over 10 to 15 years	Impacts
Non-system Road Decommission -ing	48	8	480	75	• **Terrestrial:** An average of **8 acres** of undisturbed soils and vegetation will be temporarily disturbed each year across the Region, about 0.47 acres per Forest Service unit. To a great degree, projects will occur within existing road prisms, yet some disturbance to soil and vegetation outside of road prisms may occur through construction of staging areas. • **Aquatic:** Stream turbidity will increase when heavy equipment is used to decommission roads along stream channels. Contractors must adhere to Clean Water Act 401 guidelines that minimize turbidity and subsequent effects to aquatic organisms. • **Noise:** Created through daily use of heavy machinery, such as excavators, front-end loaders, and dump trucks. • **Work Period:** When work is conducted within the bankfull channel, projects will be conducted during in-water work periods.
Regional Totals	180	219	1,800	2,190	Not applicable
Forest Service Unit Totals	10.5 per unit	13 per unit	105 per unit	129 per unit	Not applicable

ODFW = Oregon Department of Fish and Wildlife
WDFW = Washington Department of Fish and Wildlife
CDFW = California Department of Fish and Wildlife
USFWS = U.S. Fish and Wildlife Service
NFMS = National Marine Fisheries Service